[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

MITSUBISHI MU-2 AIRPLANES; Availability of Special Certification Review

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of Availability of Documentation.

SUMMARY: The Director of the FAA, Central Region, has conducted a review of the issues involved in the Mitsubishi MU-2 Special Certification Review. He has also reviewed and discussed with his staff a document entitled "Mitsubishi MU-2 Special Certification Review, Final Report". Based on this review, the Director approves issuance of the Mitsubishi MU-2 Special Certification Review. A copy of this document is on file in the FAA Rules Docket and is available for examination and copying at the Rules Docket, and also may be obtained from the Office of the Regional Counsel, FAA, Central Region, 601 East 12th Street, Kansas City, Missouri 64106.

Issued in Kansas City, Missouri, on September 7, 1984.

Murray E. Smith

Murray E. Smith, Director
Central Region

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: ACTION: Mitsubishi MU-2 Special Certification Review (SCR) Program

Date: SEP 4 1984

From: Barry D. Clements
Manager, Aircraft Certification Division

Reply to Attn. of: ACE-107:Malir

To: Kenneth E. Geier
Regional Counsel, ACE-7

THRU: Murray E. Smith
Director, ACE-1

On September 14, 1983, a Special Certification Review (SCR) Team was formed to review the Mitsubishi MU-2 aircraft design in accordance with Handbook 8110.4. The review concentrated primarily on areas of concerns that were noted in National Transporation Safety Board (NTSB) Recommendation A-83-56. The result of the certification review were five recommendations which varied from developing new FAR 23 regulations to additional study of the MU-2 ice protection system, airspeed indicating system, electrical system, and air conditioning system. As result of the additional studies, four Airworthiness Directives (ADs) are presently being processed in the Aircraft Certification Division for release in September, 1984.

Nowithstanding the completion of the AD action, this completes the Aircraft Certification Division SCR effort. Please add this final report to your files and take the appropriate action to provide availability of the documentation.

Concurrence:

Barry D. Clements, Manager
Aircraft Certification Divsion,
ACE-100

Murray E. Smith
Director, ACE-1

SPECIAL CERTIFICATION REVIEW OF MITSUBISHI MU-2

FINAL REPORT

MITSUBISHI MU-2 FINAL REPORT INDEX

SPECIAL CERTIFICATION REIVEW

OF

MITSUBISHI MU-2

SUMMARY

In response to the National Transportation Safety Board's Safety Recommendation A-83-56, the Federal Aviation Administration Small Airplane Certification Directorate, ACE-100, conducted a limited Special Certification Review (SCR) of the Mitsubishi Model MU-2B airplane. The objective of the SCR was to review selected portions of the MU-2B design and the type certification programs that resulted in the issuance of Type Certificates A2PC and A10SW. The portions of the design selected for review were those recommended by the National Transportation Safety Board (NTSB) as supported by the overall accident/incident history and the service difficulty records. The review sought to establish whether or not the design was in compliance with the certificating regulations and if the service history revealed any unsafe features attributable to design.

This consolidated report of the SCR consists of a report from the SCR Team dated March 28, 1984, a follow-on report from the Aircraft Certification Division, ASW-100 dated May 31, 1984, and a reply from the Japan Civil Aviation Bureau (JCAB) dated July 24, 1984.

The FAA has concluded that all models of the MU-2B comply with the certificating regulations on which Type Certificates A2PC and A10SW were issued. Service history reports indicate a potential for two design changes: 1) to replace the current pitot heater with a higher wattage unit,

and 2) to replace the trim tab push rod clevis assembly. The pitot heater change will be included in a proposed Notice of Proposed Rulemaking (NPRM) and the trim tab push rod clevis assembly replacement is proposed in the revision of existing Airworthiness Directives (ADs) 77-04-07 and 77-13-19. Both of these proposed design changes are presently being considered by the Airworthiness Directive Review Board of the FAA Central Region and final mandatory action is expected to be completed prior to December 3, 1984. One Airworthiness Directive, AD 84-12-04, has been issued requiring safetying of the engine inlet bleed air line coupling nuts.

In addition to the proposed design changes, Mitsubishi has voluntarily proposed several changes to the airplane flight manuals, service bulletins, and maintenance manuals that should improve the operation and maintenance of all MU-2Bs.

The FAA Small Airplane Certification Directorate has proposed several regulatory changes as result of the SCR effort. Seven FAR 23 rules and one FAR 91 rule changes have been recommended and have been sent to the Regulations and Policy Office for their review.

In addition, General Aviation Alert (AC No. 43-16) has been submitted for operators to inspect their aircraft relative to certain models where field modifications may have rendered the alternate static selector inaccessible.

APPENDIX-A

JAPAN CIVIL AVIATION BUREAU RESPONSE

(JCAB)

CIVIL AVIATION BUREAU
MINISTRY OF TRANSPORT

2-1-3, Kasumigaseki, Chiyoda-ku,
TOKYO, JAPAN

July 24, 1984

KU-KEN-471

Mr. Barry D. Clements
Manager, Aircraft Certification Division
Central Region, Federal Aviation Administration
601E. 12th Street, Kansas City
Missouri 64106, U. S. A.

Dear Mr. Clements,

This is in reply to your letter dated June 21, 1984 concerning the FAA Special Certification Review of the Mitsubishi MU-2 with U.S. Type Certificate A10SW under FAR 21.21 and U.S. Type Certificate A2PC under FAR 21.29.

Since A2PC is the FAA Type Certificate issued based on Japanese type certification whereas A10SW is U.S. domestic Type Certificate, we have been concerned with the FAA Special Certification Review prompted by the NTSB recommendation. We reviewed the FAA SCR Team Report and also the FAA Southwest Region's response to it, and understood it was confirmed in these reports that the Mitsubishi MU-2 is in compliance with the applicable airworthiness regulations, CAR Part 3 including the special conditions, which is equivalent to the applicable Japanese airworthiness regulations at that time.

As to the FAA Southwest Region's conclusions which are responding to the SCR Team's recommendations, the actions proposed therein, which are based on the operational experiences in the United States, are considered to be those resulting in enhancement of the overall safety level of the MU-2, although we consider that most of them are applicable not only to the MU-2 but also to other small airplanes certified those days. The following are our comments on the eight items, which are requested in your letter.

1. S-1 Recommendation — Amend Airworthiness Directives 77-04-07 and 77-13-19 for all MU-2's to require compliance with the current optional provisions defined in paragraph (d) of AD 77-04-07 so as to reduce the potential for human error when using the current repetitive inspection and lubrication procedures.

Comment — There has been no report of such malfunction caused by human error in Japan. However, since it is much better that the old-type elevator trim tab bracket be replaced with the new-type in order to prevent possible faulty maintenance, we are planning to revise our airworthiness directive, TCD-1001B-1-82.

2. S-3 Recommendation No.2 — On all Model MU-2 airplanes, review the heating function of the pitot probes and static ports and determine if the level of heat is adequate for the required ice protection function.

Comment — There is no adverse service history regarding the icing of the static ports. As to the pitot probes, although there has been no report of erroneous airspeed indication due to the pitot icing in Japan, the possibility of moisture collection and freezing in the pitot with lower heating capacity cannot be totally denied from some reports of erroneous speed indications experienced in the United States. Since the number of MU-2s operated in Japan is far less than that in the United States and so is the service experience, we will take an appropriate action after reviewing comments forwarded to your NPRM and related engineering data.

3. S-4 Recommendation No. 1 — For all Model MU-2B's, review the present landing gear position versus throttle position warning system design and determine if an additional throttle position is required in order to provide a more positive warning when the landing gear is not extended and throttles are not fully closed during landing operations.

Comment — The design of landing gear is considered to be in compliance with the applicable airworthiness regulations. The manufacturer is planning to issue a Service Recommendation which will introduce a modification to activate landing gear warning at some advanced throttle position in order to enhance the safety level of the aircraft.

4. S-5 Recommendation No. 1 — On all Model MU-2 airplanes, review the pitot pressure and static pressure system designs to determine if the designs are vulnerable to moisture accumulation and entrapment which may cause system pressure blockage particularly when the moisture freezes.

Comment

There has been no report of erroneous airspeed indication in Japan. However, since draining the pitot/static system after flying through rain is considered to be necessary, the manufacturer will voluntarily revise the flight manual and the maintenance manual to amplify the importance of draining.

5. S-5 Recommendation No.3

Revise flight manuals to call attention to pitot/static system draining requirements in the maintenance manual. Review the flight manual procedures to prescribe the use of pitot heat in flight when visible moisture is present.

Comment

Since pitot/static system draining is required at specified intervals in the document, "Aircraft Inspection and Maintenance Requirements", for A2PC aircraft, and the operational procedure for pitot heat is prescribed in the flight manual, the minimum information necessary to ensure the safety of flight is provided to operators. The manufacturer will voluntarily revise the flight manuals to call pilots' attention to the use of pitot heat during flight in visible moisture and to draining the pitot/static system after flying in rain and washing aircraft.

6. S-7 Recommendation No.3

In all Model MU-2's, review all DC electrical power distribution system circuit breakers for proper marking and function grouping.

Comment

This problem is considered to be caused by the configuration changes approved under FAA Supplemental Type Certificates. The breakers of the A2PC type certification configurations are properly marked and grouped.

7. S-8 Recommendation

Location of the shutoff valve control in the cockpit would enhance the probability of having oxygen when needed in an emergency.

Comment

There are other airplanes certified in the configuration where the oxygen supply valve is not accessible to the pilot in flight. This configuration is in compliance with the applicable airworthiness regulations, and there is no adverse service history with respect to the valve location. The manufacturer is voluntarily planning to revise the flight manuals in order to prevent operational human errors.

8. Airplane Flight Manuals Changes Recommendations — The various flight manual revisions, or additions are recommended to enhance understanding and more consistent application of existing flight manual data.

Comment — The manufacturer is planning to incorporate the revisions and additions into the A2PC flight manu as well as the A10SW flight manuals by the end of 1985. It is considered that this item will be closed by these flight manual changes.

We are grateful to you for giving us an opportunity to express our position on this important review, and hope that the above comments will b of some assistance to you.

Sincerely yours,

Susumu Kato

Susumu Kato
Director, Airworthiness Divisi
Bureau of Civil Aviation

CC. Mr. Charles I. Blomer
Manager
Western Aircraft Certification Office, ANM-170W
Federal Aviation Administration
P. O. Box 92007, Worldway Postal Center
Hawthorne, California 90009-2007
U. S. A.

APPENDIX-B

SOUTHWEST REGION AIRCRAFT CERTIFICATION OFFICE RESPONSE

Memorandum

U.S. Department of Transportation
Federal Aviation Administration

Subject: Mitsubishi MU-2 Special Certification Review (SCR) Team Report.

Date: MAY 3 1 1984

From: Don P. Watson
Manager, Aircraft Certification Division, ASW-100

Reply to Attn of: ASW-150

To: ACE-100

The Southwest Region Aircraft Certification Office has reviewed the findings, conclusions, and recommendations of the subject report. The attached findings are the result of ASW-150 action on those recommendations. These findings address the systems and propulsion team's recommendations with respect to certification requirements only and do not address recommended regulatory changes. We also have addressed the adequacy of the turn and bank installation and the recommended flight manual changes.

After reviewing the MU-2 SCR team recommendations, we find no non-compliances. However, as a result of our review of service history reports, we propose to your office a revision to Airworthiness Directive (AD) 77-04-07 as recommended by the MU-2 SCR team and a notice of proposed rulemaking to adopt an AD requiring installation of improved pitot heads on the MU-2.

Attachment

#

Airplane Flight Manual Changes Recommendations

The following flight manual revisions, or additions, were recommended to enhance understanding and more consistent application of existing flight manual data:

(a) Amplified emergency procedures for trim aileron malfunctions.

(b) Insure there is consistency in all manuals for the requirement to perform an NTS check prior to the first flight of each day.

(c) Revise emergency smoke evacuation procedures to delete opening the emergency exit inflight and to add opening of the outflow valve and use of ram air.

(d) Revise the flight manuals to assure there is consistency in procedures for use of fuel anti-icing additive.

(e) Revise the flight manual takeoff performance data to more accurately reflect common pilot techniques. Add takeoff procedures to reflect sequence and technique used to obtain takeoff performance data.

(f) Add emergency takeoff transition procedures to reflect performance and process of transitioning from required flaps-down - takeoff to a flaps-up best-rate-of-climb speed.

(g) Add procedures for use of the windshield deicer system for those airplances using liquid (ethylene-glycol) as a means of deicing the pilot's windshield.

Discussion:

After Mitsubishi review of all MU-2B airplane flight manuals, as requested by the SCR team, the following revisions or additions (which include the above recommended changes) to MU-2B flight or pilot operating manuals are being considered for incorporation into their manuals:

(1) Amplified emergency procedures for trim aileron malfunctions.

(2) Insure there is consistency in all manuals for the requirement to perform an NTS check prior to the first flight of each day.

(3) Revise emergency smoke evacuation procedures to delete opening the emergency exit inflight and to add opening of the outflow valve and use of ram air.

(4) Revise the flight manuals to assure there is consistency in procedures for use of fuel anti-icing additive.

(5) Revise the flight manual takeoff performance data to more accurately reflect common pilot techniques. Add takeoff procedures to reflect sequence and technique used to obtain takeoff performance data.

(6) Add emergency takeoff transition procedures to reflect performance and process of transitioning from required flaps-down - takeoff to a flaps-up best-rate-of-climb speed.

(7) Add procedures for use of the windshield deicer system for those airplanes using liquid (ethylene-glycol) as a means of deicing the pilot's windshield.

(8) Editing of all MU-2 models' manuals in accordance with GAMA Specification No. 1.

(9) Add "zero flap landing" procedure.

(10) Improve and expand procedure for flight into known icing conditions.

(11) Add procedure for preflight check of oxygen bottle.

(12) Add requirement for pitot-static drain after certain flight conditions airplane washing, etc.

(13) Revise and add to landing procedure the confirmation of beta light illumination prior to use of reverse thrust.

(14) Add take-off and weight limitation chart to AFM's if not available.

(15) Ensure there is consistency in all manuals for the requirement to perform an overspeed governor check prior to the first flight of each day.

Conclusion:

The MU-2 airplane manufacturers (MHI and MAI) have stated to the Aircraft Certification Office that they intend to incorporate the above revisions or additions into the applicable manuals and that these changed/revisions should be completed by the end of 1985.

Turn and Bank Installation Recommendation

Recommendation

Determining the location of the turn-and-bank indicator to assure that the pilot's turn-and-bank is either air driven or has an acceptable emergency power source.

Discussion

All MU-2B models were reviewed with respect to whether the pilot's turn-and-bank indicator is located properly on the left side of the cockpit, whether each turn-and-bank instrument has an acceptable emergency power source, and if loss of adequate power to the instrument is annunciated. It was determined that even though some of the earlier MU-2B models have a single electrical DC bus or use a common ejector for supplying instrument vacuum, they still have two (2) independent sources of power, separate generators for electrical power and separate engine bleed air supplies for instrument vacuum power. The location of these instruments' instrument panel on the MU-2B fleet is considered satisfactory. Adequate electrical power is annunciated either by an internal flag in the instrument, by a turn-and-bank power fail light (MU-2B-25 and on), or both, depending on the model of airplane. The adequacy of vacuum power is indicated by the vacuum gage for earlier models, and in addition by an INST VAC FAIL indication on the annunciator panel for Models MU-2B-25 and on.

Conclusion

The turn-and-bank instruments on the MU-2B fleet comply with CAR 3.668 and have no adverse service history. These installations are considered airworthy.

S-1 Recommendation

Amend Airworthiness Directives (ADs) 77-04-07 and 77-13-19 for all MU-2s to require compliance with the current optional provisions defined in paragraph (d) of AD 77-04-07 so as to reduce the potential for wear induced error resulting in known incidents of flutter and/or separation of the elevator trim tab.

Discussion

Based on the SCR team recommendation stated on page S1-9 of the report, we have conducted an investigation of the accident and incident data surrounding the elevator trim tab flutter and/or separation problems encountered with the earlier, wear-sensitive clevis attachment design. This investigation has uncovered at least 13 incidents of elevator trim tab flutter and/or separation problems. The cause of this problem is the original design of the clevis attachments (as exhibited by assembly part numbers 010A-22119 or OXXA-22127). This design was wear deficient and results in flutter and/or separation because of excessive wear-related tolerance reductions in the bushing/clevis attachment area. The AD issued to correct this problem (AD 77-04-07 R1) provided the aircraft owners with an option to either help the old wear-sensitive design and perform mandatory, recurring 100-hour lubrication and 300-hour detail part dimensional inspection in accordance with MAI service data or replace the old assemblies with a redesigned assembly (035A-22128-1/-2) incorporating a nonwear sensitive clevis attachment design. Those owner/operators choosing to maintain their old wear sensitive designs are still experiencing wear related failures of the flutter/separation type.

Conclusion

Our investigation results dovetail with, those of the SCR team in this area; and, accordingly, we have prepared an AD revision requiring all owner/operators to adopt the new, superior clevis attachment assembly (P/N 035A-22188-1/-2) for the elevator trim tabs. This action is for all FAR 21.21 aircraft; however, we recommend similar action be taken on FAR 21.29 aircraft since a larger percentage of 21.29 units have the older assemblies.

S-3 Recommendation No. 1

Recommendation

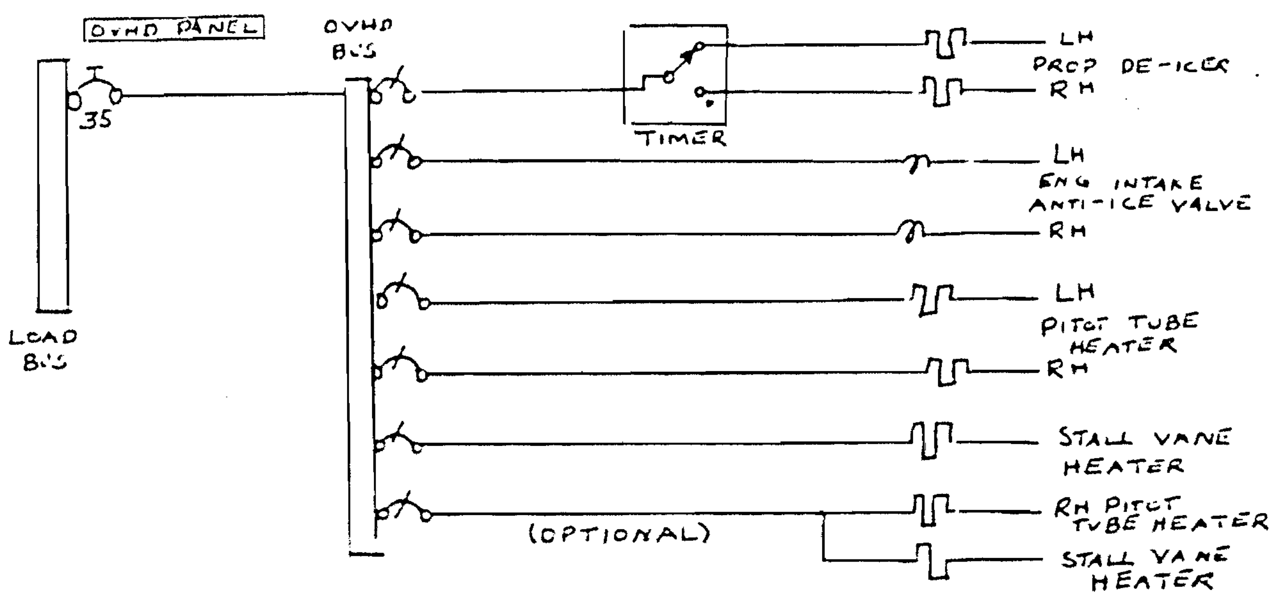
On all Model MU-2 airplanes, review, by a failure mode and effect analysis, the adequacy of the single circuit to provide reliable power to the systems powered by the overhead deice panel.

Discussion

A. The overhead deice system, which is powered by a single circuit breaker, is installed on FAR 21.29 MU-2 airplanes S/N 239 through 347 (excluding S/N 313, 321) for the short models and S/N 501 through 696 (excluding S/N 652, 661) for the long models. On these airplanes. this bus, designated OVHD, powers the following loads:

1. LH/RH propeller deicer heaters.
2. LH/RH engine intake anti-ice valves.
3. LH/RH pitot tube heaters.
4. Stall warning vane heater.

The following schematic diagram describes this specific installation:



B. A failure mode and effects analysis of the circuit follows:

1. OVHD circuit breaker fails open:

a. Electrical heat is not available for both pitot tubes, the stall warning system, both engine anti-ice systems and both propeller deicing systems.

b. If the above systems are not being operated, there will be no effect on the operation of the airplane (e.g., not in icing conditions) but the failure will not be annunciated to the pilot.

c. If the failure occurs during icing conditions while these systems are being operated, it can be detected by observing the absence of current on the PROP DEICER current meter and the extinguished ENG HEAT INTAKE lights on the overhead panel. Since these systems should be monitored when entering icing conditions and during icing conditions, their absence should alert the pilot to vacate the icing area as soon as possible.

2. OVHD circuit breaker fails closed.

Power is always supplied to the deice overhead panel circuits. Manually pulling the circuit breaker has no effect.

3. Individual switch/circuit breakers fail closed.

Power is always supplied to individual loads (LH/RH PROP DEICE, LH/RH PITOT TUBE HEATER, etc.) but may be removed by opening OVHD circuit breaker. Continual power can be detected for the PROP DEICER and LH/RH ENG INTAKE ANTI-ICE VALVE but not for the remaining loads.

4. Individual switch/circuit breakers fail open.

Power cannot be supplied to the affected load. Absence of power can be detected for the PROP DEICER and LH/RH ENG INTAKE HEAT circuits.

5. A short to ground occurs on the OVHD (35A) circuit breaker line.

a. OVHD (35A) circuit breaker opens.

b. Power is lost to all the above overhead panel DEICE Loads.

c. Power loss can be detected by loss of PROP DEICER current and LH/RH ENG INTAKE HEAT lights.

6. Individual switch/circuit breaker opens.

a. Individual switch/circuit breaker opens.

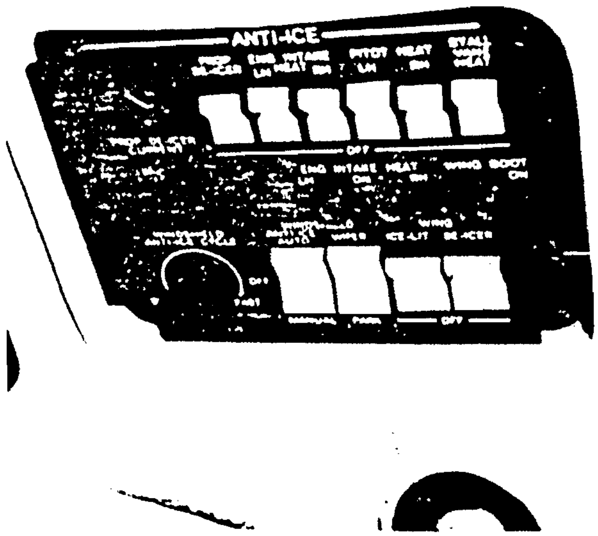
b. Power is lost to affected load.

c. Power loss can be detected if short occurs on PROP DEICER or LH/RH ENG INTAKE ANTI-ICE circuits only.

C. A single failure (a fault of the OVHD circuit breaker can cause a loss of all of the previously reviewed Deice loads. MIL HDBK 217D lists the Mean Time before Failure of a circuit breaker as 5×10^5 operating hours.

D. Conclusion:

The combination of circuit breaker reliability, circuit protection for each switch/circuit breaker controlled load and the power monitoring capability provided by the PROP DEICE current meter and ENG INTAKE heat lights were and are considered adequate in meeting the CAR 3.681, 3.690, and 3.691 requirements. In addition there is no adverse service history showing this installation to be unsafe. The power monitoring capability of this system is designated in the following photograph of the OVERHEAD PANEL.



S-3 Recommendation No. 2

Recommendation:

On all Model MU-2 airplanes, review the heating function of the pitot probes and static ports and determine if the level of heat is adequate for the required ice protection function.

Discussion:

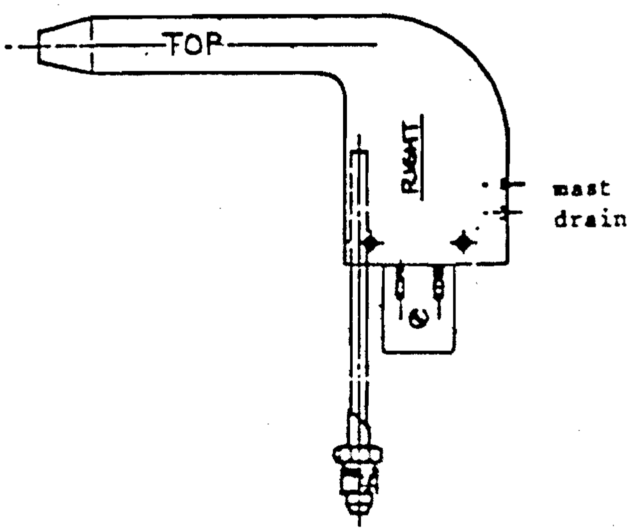
As discussed in S-3 Recommendation No. 4, there is no adverse service history regarding the icing of static ports. Therefore, we consider the question adequacy for the static ports closed.

On the other hand, reports have been received regarding erroneous airspeed indications during flight in icing conditions or during very cold temperatures. Mitsubishi, upon receipt of these reports, initiated changes to the pitot tube installation by way of Service Recommendation 053 dated January 19, 1979, for FAR 21.29 airplanes and Service Recommendation SR020/34-005 dated July 31, 1979, for FAR 21.21 airplanes. The two service recommendations offer an improved pitot head that incorporate a higher wattage heater as well as incorporating a mast heater. Mitsubishi recommended compliance with the service recommendation for aircraft operating in severe icing conditions.

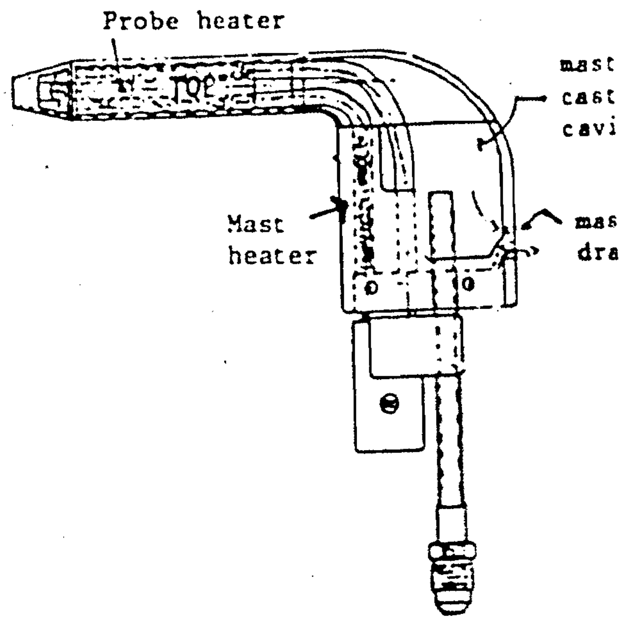
Since the Service Recommendations have been issued, there have been no reported incidents of pitot heads icing over. However, the level of compliance with the Service Recommendations cannot be determined.

Conclusion:

Subsequent investigation has revealed it is possible for moisture to collect and freeze within the pitot mast casting and not properly drain out of the mast drain.



PE 506 Pitot head



PH 1100 Pitot head

This is caused in part by the horizontal mounting of the pitot tube assembly. In addition, the lower heat (PH 506 L or R) pitot tubes do not incorporate a heater in the mast as does the higher heat pitot tube (PH 1100 R or L). Since the higher heat pitot tube utilizes a mast heater, the collected moisture does not have an opportunity to freeze and obstruct the pitot pressure.

We therefore will prepare and forward for issuance a notice of proposed rulemaking adopting an airworthiness directive requiring incorporation of Service Recommendation SR 020/34-005 on all FAR 21.21 airplanes. We also recommend that the Foreign Airplane Section of the Small Airplane Certification Directorate issue a similar NPRM for Service Recommendation 053 applicable to FAR 21.29 airplanes.

We will propose the NPRM to the Small Airplane Certification Directorate no later than August 1, 1984.

S-3 Recommendation No. 3

Recommendation

On all Model MU-2 airplanes, review the effect on the airspeed and altitude indicating system resulting from loss of electrical power that provides ice protection function and determine if a visual warning to the pilot is required.

Discussion

There are no heated static ports on the FAR 21.29 MU-2 airplanes; therefore, loss of electrical power to the static ports would not be a factor.

Loss of power to the static ports on the FAR 21.21 MU-2 airplanes would probably have no effect on the altimeter VSI and airspeed instruments. Static ports by design are located out of the airstream and as such do not accumulate ice or have moisture impinge upon them.

In addition, the SCR team flew on February 9, 1984, flight SCR-20-30 in moderate to heavy icing conditions for 45 minutes. The aircraft flown was S/N 183 which had an unheated static port. No anomolies were reported during flight test.

On both FAR 21.29 and 21.21 MU-2 airplanes, heated pitot tubes are used. Loss of electrical power that supplies the heating function and the effect it has quite obviously depends on the meteoroligical conditions in which the airplane is flying. Loss of electrical power during clear air flight or visible moisture conditions above freezing should have no deleterious effects on the airspeed indicating system.

On the other hand, loss of electrical power to the pitot tubes during icing conditions may cause the airspeed indicator to give erroneous readings. There are two failure modes. The airspeed could slowly drop to zero, caused by the nose of the pitot tube icing over, thus the trapped pitot pressure bleeds off through the pitot head moisture drain hole. The second failure mode would be for the indicator to stick at a fixed airspeed. This mode would be caused by the pitot head packing with ice so that the moisture drain hole as well as the pitot inlet would be frozen. The trapped pitot pressure would then cause the indicator to show the trapped pressure as a fixed airspeed.

Conclusions

SCR flights into icing conditions as well as service history for over 20 years has shown that the aircraft can be safely flown with unheated static ports.

There are no requirements in the certification basis for the MU-2 that would require a visual warning in the event of a pitot heat failure.

However, there are indirect indications to the pilot that power is available to the deice anti-ice circuits for the MU-2B, -10, -15, -20 by way of engine anti-ice lights. If any of the engine anti-ice lights are illuminated on the overhead deice/anti-ice panel then the pilot knows there is power on the bus, and it is available to the pitot heaters. The remainder of the FAR 21.29 airplanes incorporate a prop deice load meter on the overhead deice/anti-ice panel. Similarly, if a pilot notes that power is being supplied to the prop deice boots, then power is available to the pitot heaters.

On the FAR 21.21 airplanes, a separate heater current load meter was incorporated that is selectable for LH pitot and static, RH pitot and static, LH prop, RH prop, and stall vane so that current can be monitored by the pilot.

These methods of monitoring heater current go beyond the scope of the requirements of CAR 3.1956 and as such we find them adequate.

Finally, the reliability of the dual heated pitot tubes is based on the reliability of the circuit protection device in the circuit. The generally accepted reliability of a circuit breaker is one failure per 500,000 hours; therefore, loss of the ice protection circuit of the pitot tube is classed as an improbable event.

S-3 Recommendation #4

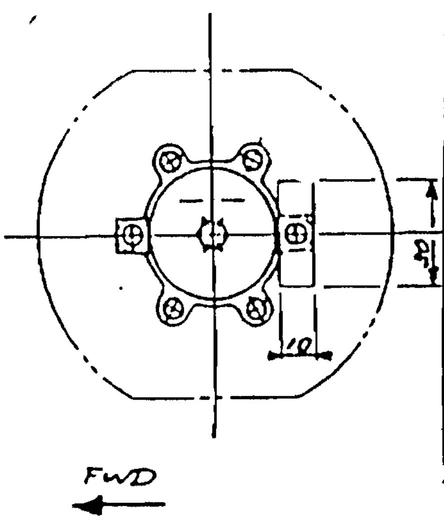
Recommendation:

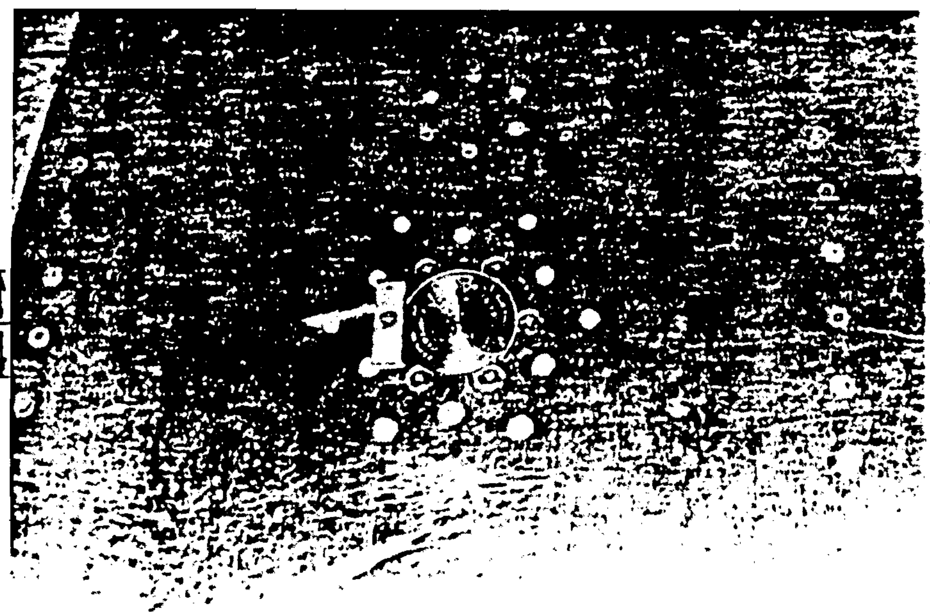
On all MU-2 airplanes, review any static pressure adjustment made by the method of attaching a metal spacer to the external surface of the airplane aft of the static port. Determine the adequacy of the static port ice protection system to prevent ice buildup as a result of the spacer.

Discussion:

The MU-2 airplanes utilizing the static port calibration ramp (metal spacer) are all short bodied MU-2 A10SW airplanes. MU-2B-25, S/N 313; MU-2B-26, S/N 349; MU-2B-26A, S/N 321, 348, 350 through 394; and MU-2B-40 395 and up.

A photo and sketch of the calibration ramp is shown below:





Use of a static port calibration ramp to calibrate an aircraft static system is not a new or novel idea. NA265-40, HS-125, and some Lear models, to name a few, utilize static port calibration ramps.

We know of no service difficulty reports due to static port calibration ramp installations or of ice accretions on the ramps. The MU-2 mounted ramp is attached with a screw that is connected directly to the heated port, and it is reasonable to believe that there is a level of thermal conductivity between the static port and the calibration ramp. In addition, the calibration ramp is within the boundary layer of the fuselage and, therefore, should be considered ice accretion free.

All service difficulty reports regarding pitot/static problems on the MU-2 deal with airspeed indicators. However, there are no reports on problems associated with altimeter or vertical speed indicator instruments which are exclusively static pressure indicators.

Conclusion:

The static port ramp installation is in compliance with the applicable CARs, and there is no adverse service history indicating that a safety hazard exists.

S-4 Recommendation No. 1

Recommendation:

For all Model MU-2B's review the present landing gear position versus throttle position warning system design and determine if an additional throttle position is required in order to provide a more positive warning when the landing gear is not extended and throttles are not fully closed during landing operations.

Discussion:

The design of the landing gear on the MU-2 models complies with CAR 3.359 requirements for a landing gear position warning device in that it is set to provide a warning "after the throttle is closed until the gear is down and locked." We are aware of a number of comments from pilots, however, who have indicated that they periodically make power-on-landings. For this type of operation, the landing gear warning system will not be armed.

Conclusion:

Mitsubishi engineering groups (MAI and MHI) are reviewing the MU-2B landing gear warning installation configuration in an attempt to arrive at a design change that would prevent landing with the gear retracted at some advanced throttle position. They have submitted a schedule showing completion of their engineering design analysis by July of 1984, Service Bulletin incorporation by August of 1984, and incorporation of flight manual changes by September of 1984.

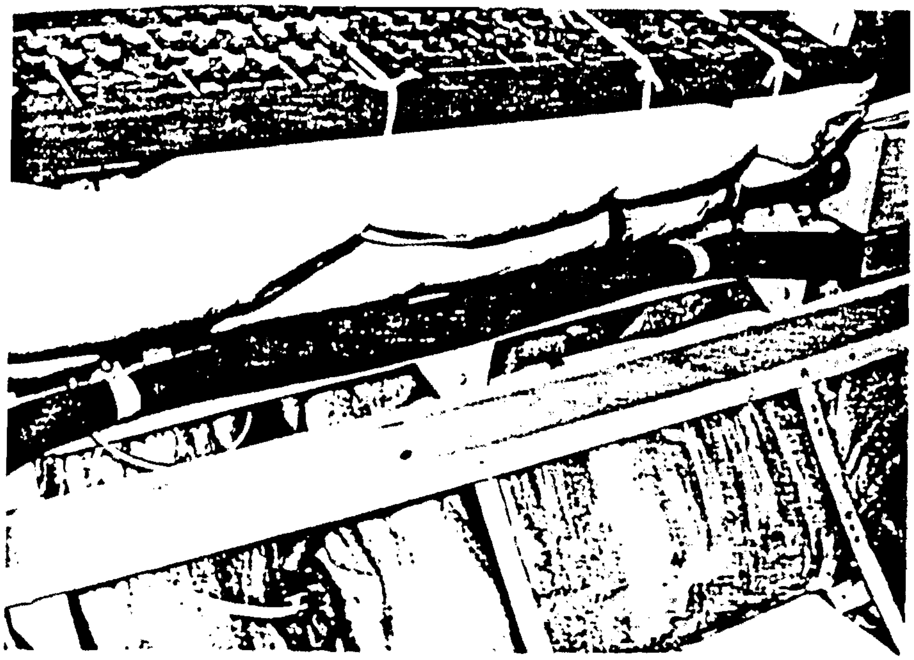
S-5 Recommendation #1

On all MU-2 airplanes, review the pitot pressure and static pressure system designs to determine if the designs are vulnerable to moisture accumulation and entrapment which may cause system pressure blockage particularly when the moisture freezes.

Discussion

Static system:

As can be seen on the photos below, all static system plumbing is located on the conditioned air (heated) side of the fuselage. In addition the plumbing for the static system is running "uphill" from the static port to the instrument panel. At the instrument panel, the static lines are routed, as necessary, with a moisture trap at the lowest point. The trap has a capacity of approximately 6.6 cc.



Static port left side of aircraft
Note: Plumbing run uphill (MU-2-40) (right side same)

Static pressure line running uphill to instrument panel left side MU-2-40
(right same same)

Static and pitot sumps and drains
Right side MU-2-40

Pitot system:

All pitot system plumbing is also located in the conditioned air (heated) side of the fuselage. As can be seen on the photos below, the pitot pressure line enters the fuselage and immediately goes "downhill" into a "T" fitting and into a moisture trap with a capacity of 6.6 cc for the RH trap and 6.3 cc for the LH trap.

Pitot head

Right pitot line showing line tee'd directly into sump and drain, MU-2-40 (left side same)

Pitot/Static details of sumps and drains MU-2-40

Conclusions:

The static system plumbing routing make's it very unlikely that moisture could be trapped during flight in rain. In addition, if moisture were trapped in the static lines, it is very unlikely that it would freeze due to the static lines located in the occupied (heated) spaces of the fuselage.

Moisture could enter the pitot system while flying in rain; however, there are drain holes in the pitot mast to drain water. The pitot head is to be turned on during flights in visible moisture to dry out the pitot tube, and there are pitot moisture sumps at the lowest point in the pitot plumbing.

During MEOT Flight SCR-20-30 on February 9, 1984, the aircraft was flown through moisture and through a moderate to heavy 45-minute icing encounter. Four-five inches of ice were accreted on unprotected surfaces. No anomalies in the pitot/static system were reported. After the flight, the system drains were opened and no moisture was detected. In addition, Mitsubishi conducted a random field study to determine if moisture was trapped in the pitot/static system. Out of 37 airplanes checked, only three were found to have trapped moisture in the sumps with six drops being the maximum found.

Finally, review of the pitot/static system reveals no design defects or unairworthy practices. There are no noncompliances noted.

Mitsubishi has voluntarily committed themselves to revising the Aircraft Maintenance Manual to amplify the importance of draining the pitot/static system after flying through rain and in addition to keep covers on the pitot/static ports when washing the airplane. They are also planning to add a note in the flight manual instructing the pilot to inform maintenance personnel when the aircraft has been flown through heavy rain.

No further action is planned.

S-3 Recommendation #2

Recommendation:

On all Model MU-2 airplanes, review the location and identification of the alternate static source controls. Determine if the alternate static source control is sufficiently accessible and properly identified to the pilot. Review must consider the loss of the primary static system or function during critical portions of a flight and the selection of the alternate static is required.

Discussion:

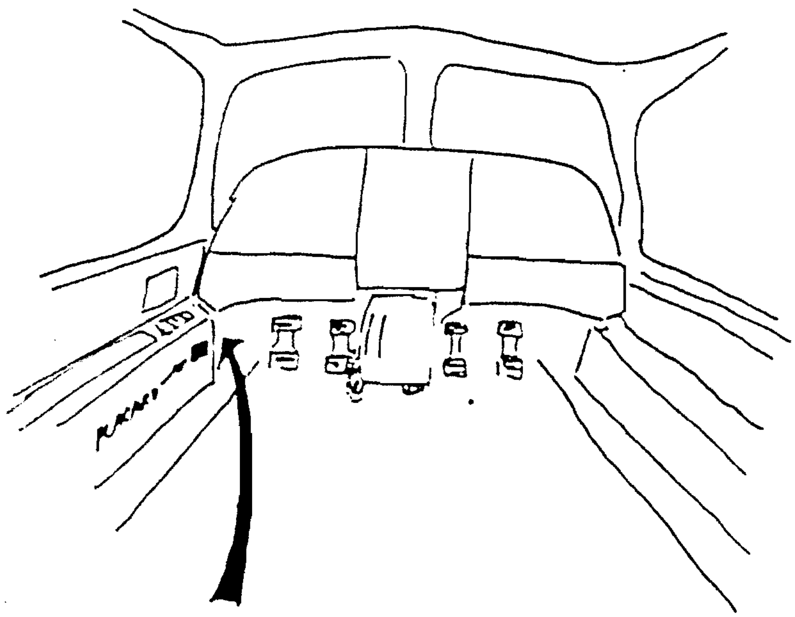
There are basically two types of alternate static source designs that were incorporated on MU-2 airplanes.

Starting with the MU2-25 (K) S/N 239 and subsequent for short bodied MU-2's and MU2-35 (J) S/N 548 and subsequent for long bodied MU-2s, an alternate static source selector was incorporated in type design data. The selector is located on the left side of the pilot's instrument panel and is clearly marked as shown in the photo below.

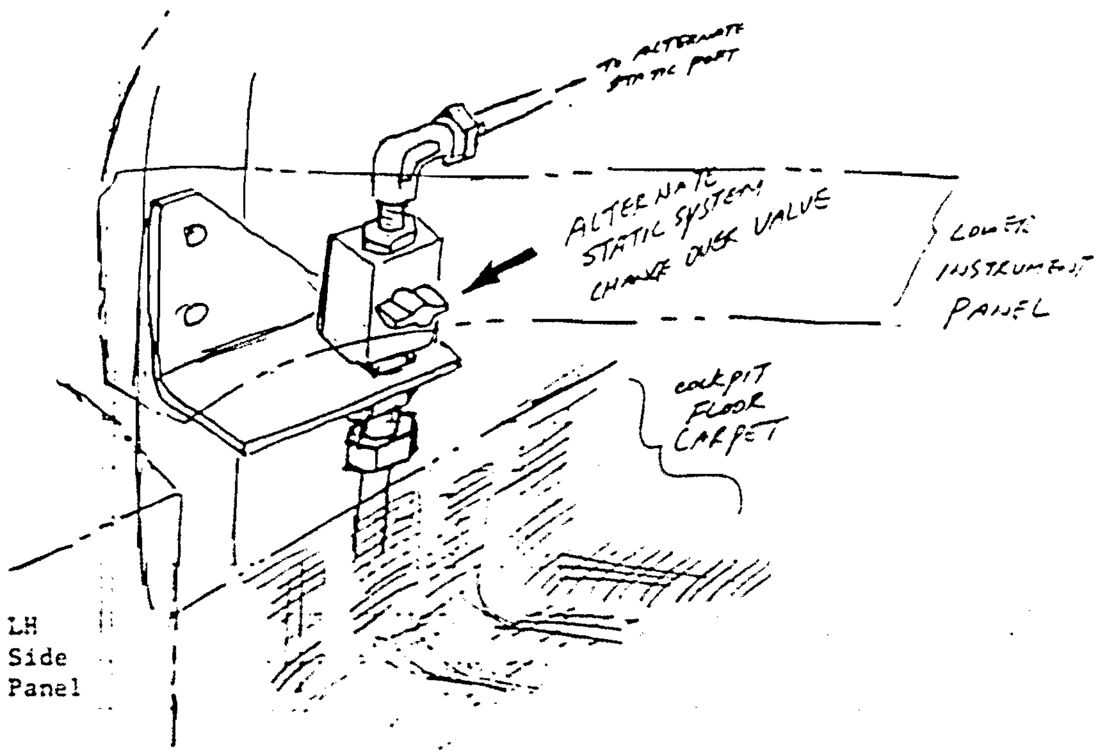
The location of the alternate static source selector may vary slightly from the location depicted; however, it is located on the front instrument panel in front of the pilot.

Alternate static source selector from Model 25 short bodies up to present and from Model 35 long bodies up to present.

The other alternate static system that may be installed on the MU-2 was a "field approved" installation. The location of this alternate static source selector is on the left side panel close to the left-hand corner of the lower instrument panel. See sketches of the installation.



Field Approved Alternate Static Source Selector Location



Additional Field Approved Alternate Static Source

The field approved alternate static source selector could possibly be installed on the following 21.29 MU-2s:

MU-2B	S/N 004 through 038
MU-2B-10	S/N 101 through 120
MU-2B-15	S/N 114 and 115
MU-2B-20	S/N 121 through 233
MU-2B-30	S/N 501 through 547

Both alternate static system designs have been reviewed and are found to be airworthy. However, during the SCR team review at least five airplanes with the field approved alternate static system with field approved interiors were found, after aircraft delivery, to have the alternate source selector covered with wire bundles or interior materials.

CAR 3 states that "each item of equipment which is essential to the safe operation of the airplane shall perform adequately the functions for which it is to be used, shall function properly when installed, and shall be adequately labeled. . . ."

Therefore, only equipment essential to the safe operation of an airplane must perform their intended functions. Equipment essential for safe operation is interpreted as equipment required by regulation. The certification basis of the MU-2 does not require an alternate static source selector; therefore, either the lack of the installation of an alternate static source or the nonvisibility of an installed static source selector is not considered a hazard.

Conclusion: The field approved and type design alternate static systems have been reviewed and determined to meet airworthy standards. However, information surfaced during the SCR investigation that points toward improper installations of interior or at least five airplanes subsequent to aircraft leaving the Mitsubishi factory.

Since this is a maintenance induced problem, on an FAR 21.29 airplane, we recommend that the Small Airplane Certification Directorate work with the appropriate Flight Standards Office to have the condition corrected.

S-5 Recommendation No. 3

Recommendation

Revise flight manuals to call attention to pitot/static system draining requirements that are specified in the maintenance manual. Review the flight manual procedures to prescribe the use of pitot heat in flight when visible moisture is present.

Discussion

There are currently two maintenance documents covering all MU-2 airplanes regarding the draining of pitot and static system sumps.

The first document is the Mitsubishi Aircraft Inspection and Maintenance Requirements Report MR 0179 for long body airplanes and MR 0178 for short body airplanes. These reports specify a requirement to drain the pitot and static system sumps at 100-hour intervals.

The second document is the Mitsubishi Maintenance Manual which specifies that after washing the airplane or after flight in rain the pitot sumps should be drained.

The flight manuals for the FAR 21.29 airplanes mention the anti-ice/deice items to be turned on at the discretion of the pilot. The flight manuals for the FAR 21.21 airplanes mention a pre-flight and inflight operational check prior to flight into known icing conditions.

Conclusion:

The maintenance manual and maintenance documents are adequate with regard to specifying when the pitot and static sumps should be drained. In addition, the flight manual requirements for use of pitot heat is adequate. There are no requirements for Mitsubishi to put in their flight manual that pitot heat should be used during flight in visible moisture. There are current production airplanes from other manufacturers which are of similar design that also do not specify turning on pitot heat in visible moisture. Mitsubishi is voluntarily planning to update the flight manuals to make them more consistent with each other and to also reference the need for informing maintenance personnel after flights into rain. In addition, Mitsubishi will review the maintenance information contained in the manual for clarity and consistency.

S-6 Recommendation No. 1 & 3

Recommendation

1. In all Model MU-2 airplanes, review the location and configuration of the autopilot and electrical trim disconnect or interrupt function. For all configurations identified to have the function or switch installed on the inboard horn of the control wheel, reevaluate the locations and determine if the switch location performs the disconnect or interrupt function in accordance with the normally accepted time delays/recognition times. Proper identification of the disconnect or interrupt switches shall be installed.

3. On all Model MU-2 airplanes, review the Airplane Flight Manuals to determine if opening a circuit breaker is provided as a procedure for disconnecting the autopilot and/or electrical trim in event of a system malfunction. Review the circuit breaker location and its accessibility for the purpose of disconnection.

Discussion

1. Bendix A/P and electric trim - All models have A/P and electric quick disconnects on the outboard control wheel horn. Not all installations have an electric trim quick disconnect switch installed. If not installed, the procedure calls for "A/P Master SW OFF" and Electric Trim C/B Pull." In all models, activation of the normal electric pitch trim button (up or down switch) will disconnect the autopilot. TIR's are not clear about whether appropriate time delays were observed during tests to account for the various electric trim or autopilot switch types and locations.

Switch legends for Bendix:

"TRIM DISC" and "AP DISC" (each separate switches)

2. Sperry (SPZ 200) - Similar to the Bendix Installations except for switch legends as follows:

"AP-TRIM DISC" or "RUD TRIM - AP DISC" depending on system installed. Both A/P and Electric Trim Disconnect functions are through a single switch.

3. Collins (AP 106) - Similar to Bendix with same disconnect switches as Sperry SPZ 200.

4. King (KFC-300) - Electric trim quick disconnect is similar to the Bendix system ("TRIM DISC" switch on outboard control wheel horns). However, when the "A/P DISC" quick disconnect switch was installed on the outboard control wheel horn, the same as the approved Bendix System Installation during FAA certification tests, MAI was told that this was not acceptable and that one switch could not be identical in design to another switch adjacent to it because of the identification confusion factor. They were directed by the FAA to either redesign the swtiches or they could relocate the A/P Disc switch to the inboard control wheel horn, which they elected to do (reference TIR for STC SA947CE and record of telecon between ACE-216 (Herron) and AFS-160 (Wilburn) dated September 14, 1973). Therefore, any requested design change would now require a retroactive restatement of FAA policy on this particular system approval before MAI would have to respond.

NOTE: It is significant to note that previous FAA policy and guidance on the proper installation and approval of "quick disconnect switches" have only been oriented to electric pitch trim systems (reference 8110.7). There is no stated policy on the location of A/P disconnect switches except as being currently proposed for AC 23.1329. Individual guidance appears to be oriented to the location of all quick disconnect switches on the outboard control wheel horn. This policy in effect forces the applicant to accept additional time delays which may not be acceptable and defeats the reason for the quick disconnect switch since multiple switches most likely will be installed on the outboard horn. There is a need for guidance of quick disconnect switches for integrated normal trim/autopilot trim/emergency trim systems.

Conclusions:

1. Only one installation approval does not require location of the quick disconnect switches on the outboard control wheel horn. The one exception (KFC 300) was directed and approved specifically by the FAA.

2. The optional installations where a "TRIM DISC" switch was not part of the trim/autopilot installation (Bendix) was not identified as a hazard in the TIR's reviewed. The system was evaluated under the alternate "fail-safe" guidance of FAA Order 8110.7 and found acceptable even though a system disconnect switch for the electric trim system alone was not provided. The use of the autopilot and radio master switches with associated circuit breakers were considered as an acceptable means of disconnect. Based on the TIR review, there does not appear to be adequate justification to reevaluate the need for a "TRIM DISC" on the control wheel switch.

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S-7 Recommendation No. 2

Recommendations:

In all Model MU-2's, review the DC electrical power distribution system by test or analysis and determine if the ground fault protection in the generator feeders to power distribution busses was considered in accordance with the requirements of CAR 3.690.

Discussion

A review of the DC power distribution system has been completed with the following results:

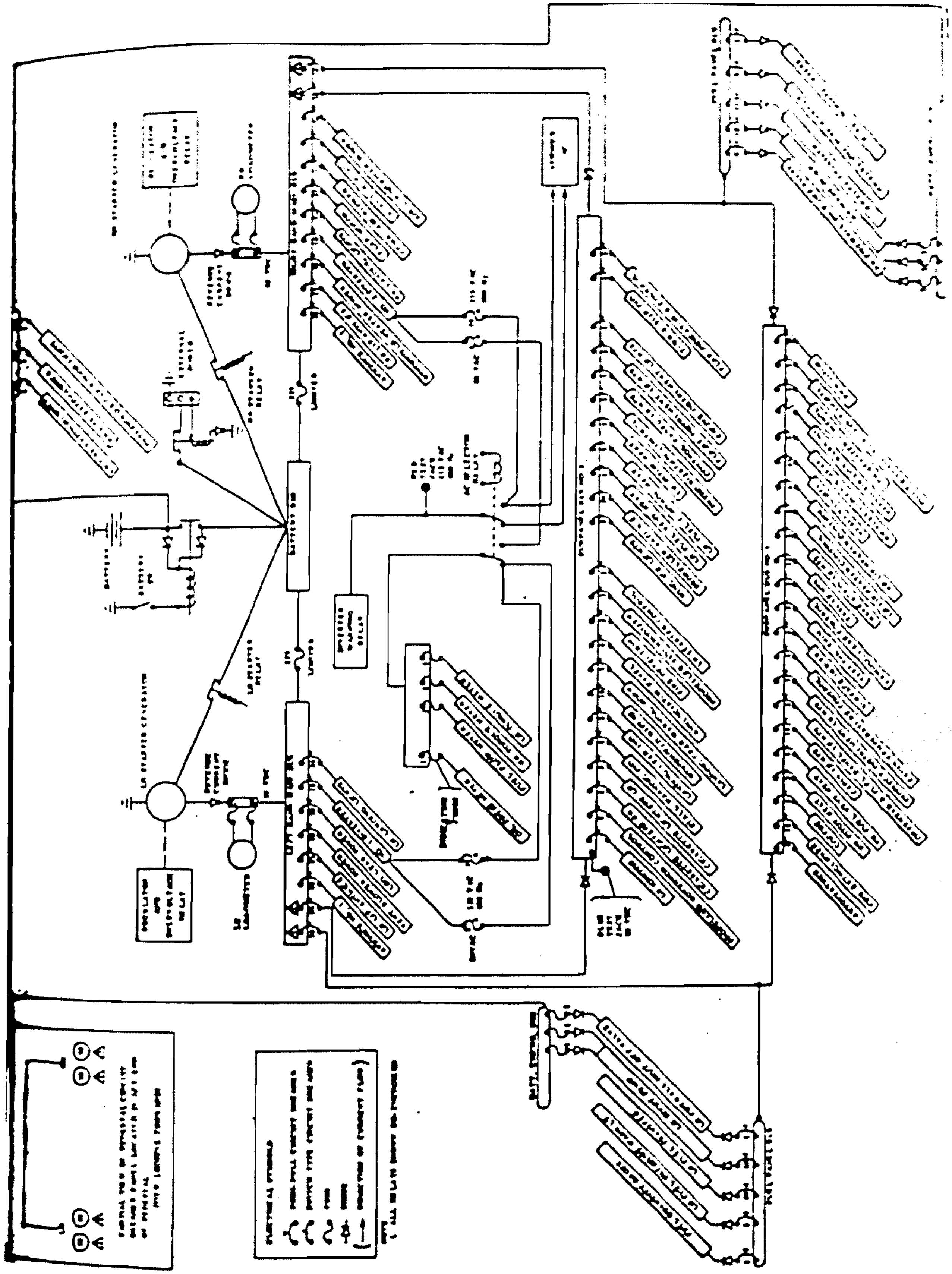
1. All MU-2 FAR 21.21 airplanes have a split bus and feeder fault protection. Of the A2PC airplanes, the MU2B-30, S/N 502 through 547, and the MU2B-35, S/N 586 and up, have a split bus and feeder current limiters and all the MU2B-36 airplanes have a split bus and feeder fault protection. The remainder of the A2PC airplanes have a single bus with no feeder fault protection. At the time these earlier airplanes were certificated, the single bus with no feeder fault protection concept, with the proper attention given to routing of cables, isolation from flammable fluid, and selection of quality insulation materials was a design accepted as airworthy. The Cessna 414 and Piper PA-31 are typical examples of this vintage airplane which have a single bus and no feeder fault protection. The Beech King Air C90 has a split bus but also does not have feeder fault protection. Copies of the schematics of these airplanes are attached.

To this date, the service history of the electrical systems on these airplanes has shown them to be safe and reliable. Evidently, the finding was made when they were FAR 21.29 type certificated that the method of insulation and isolation design which was used when installing these systems enabled them to come under the CAR 3.690 category where protective devices need not be installed "where no hazard is presented by their omission."

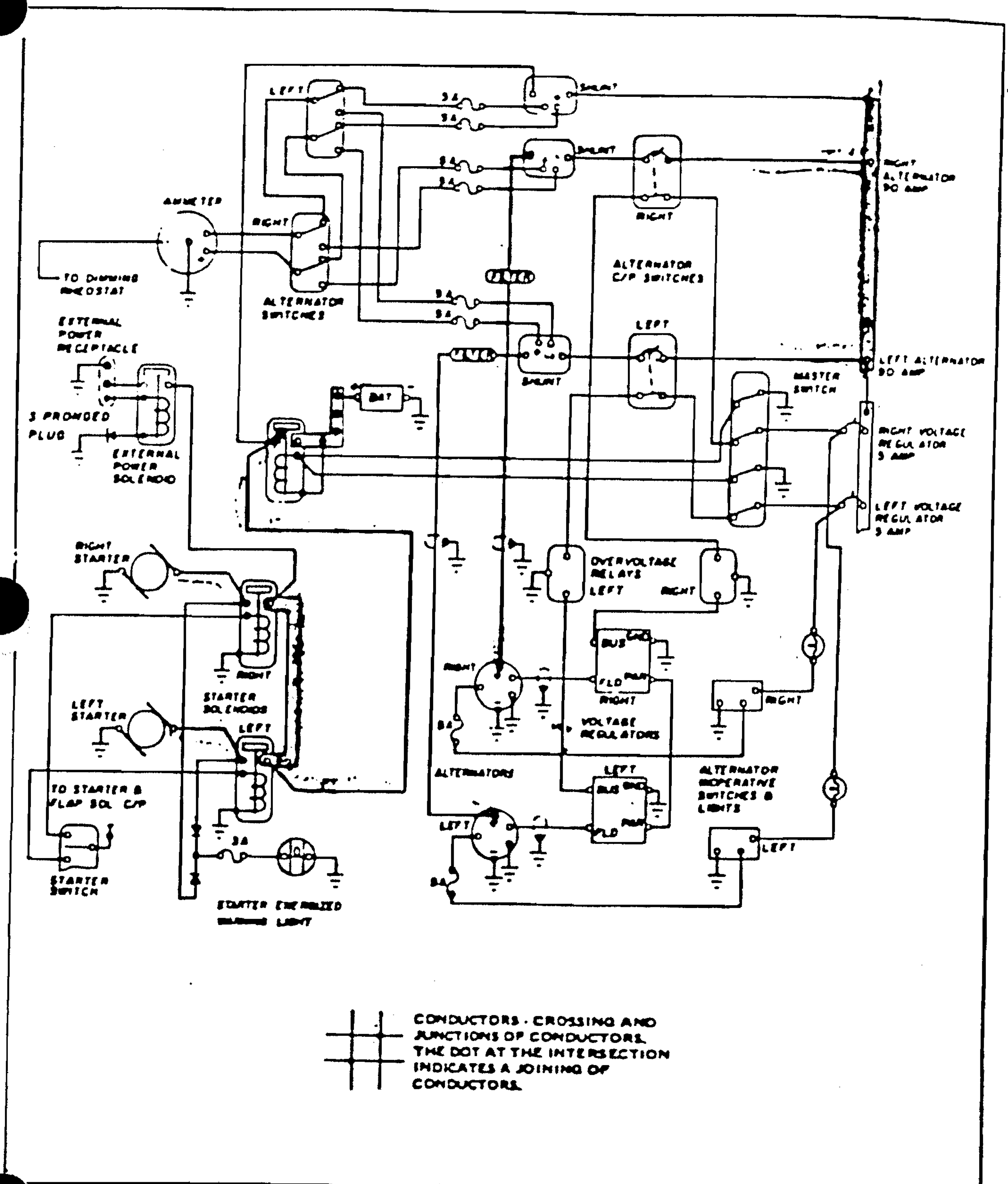
Conclusion

We see no reason, at this time, to challange the validity of that finding.

Photographs of the generator, battery, and feeder cables installation showing a part of the routing through the MU2B-40 and MU2B-60 airplanes are attached.



ELECTRICAL SYSTEM SCHEMATIC



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-19

ELECTRICAL SYSTEM SCHEMATIC

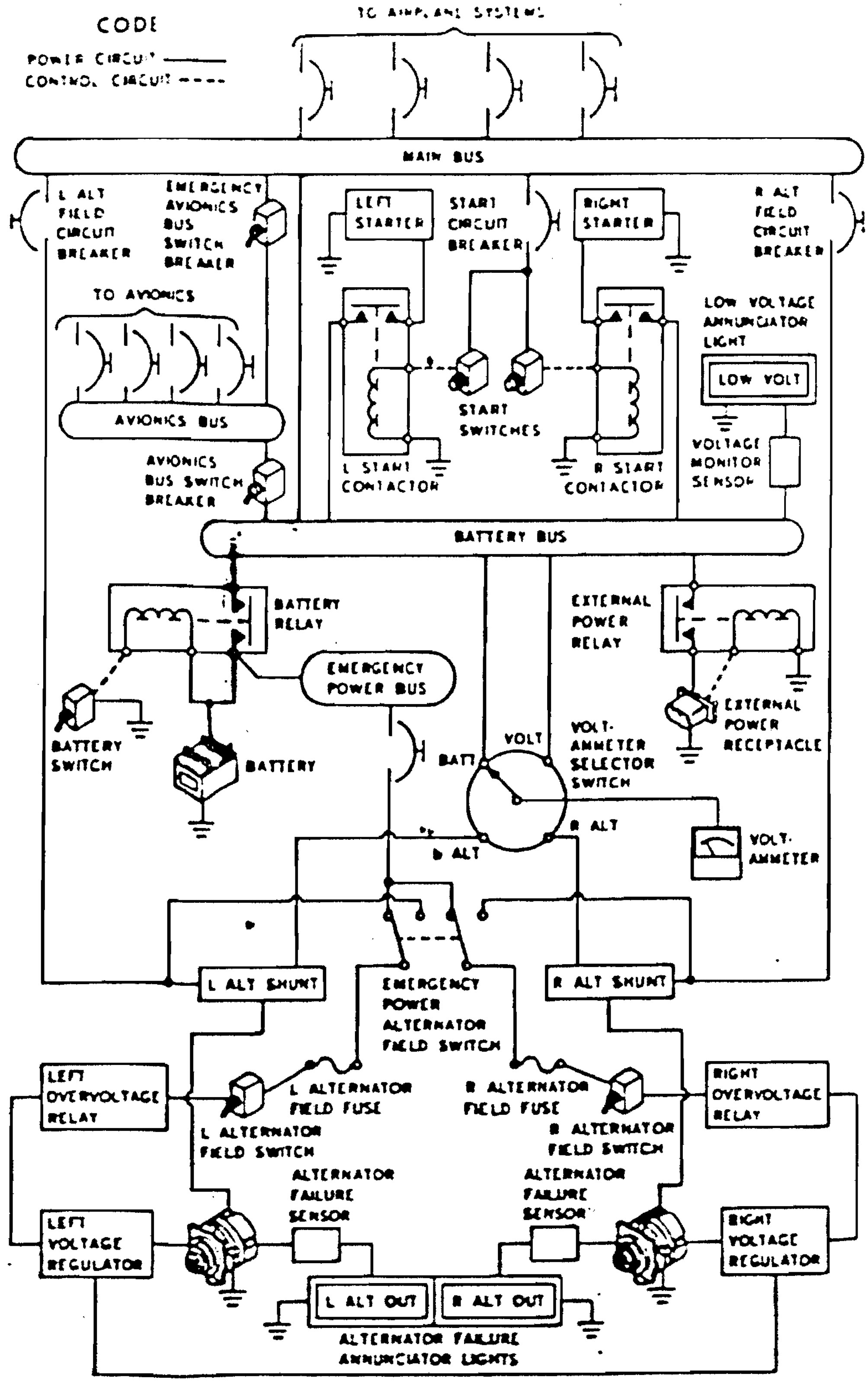
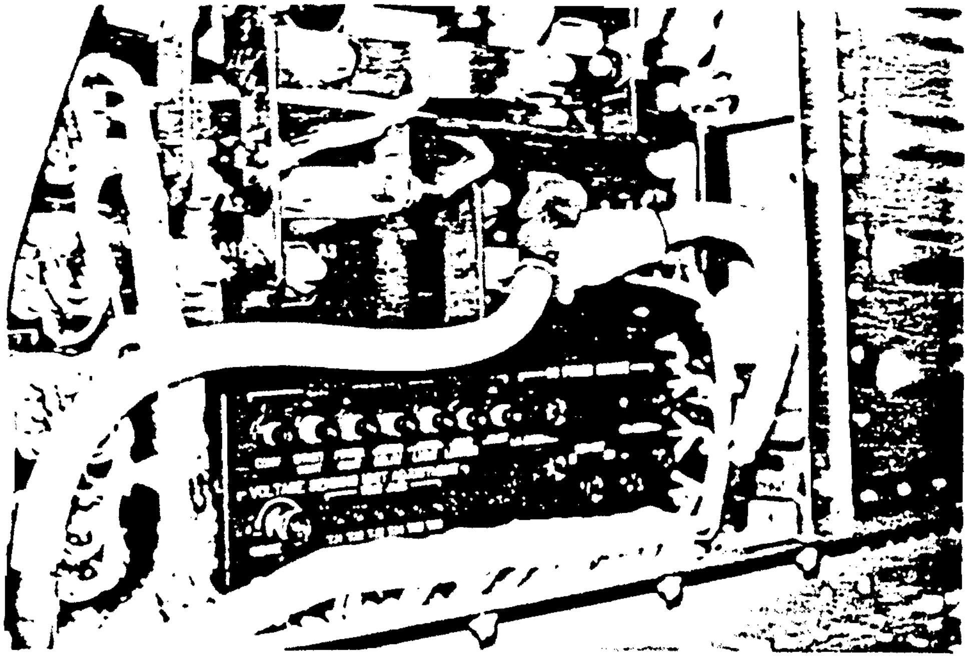


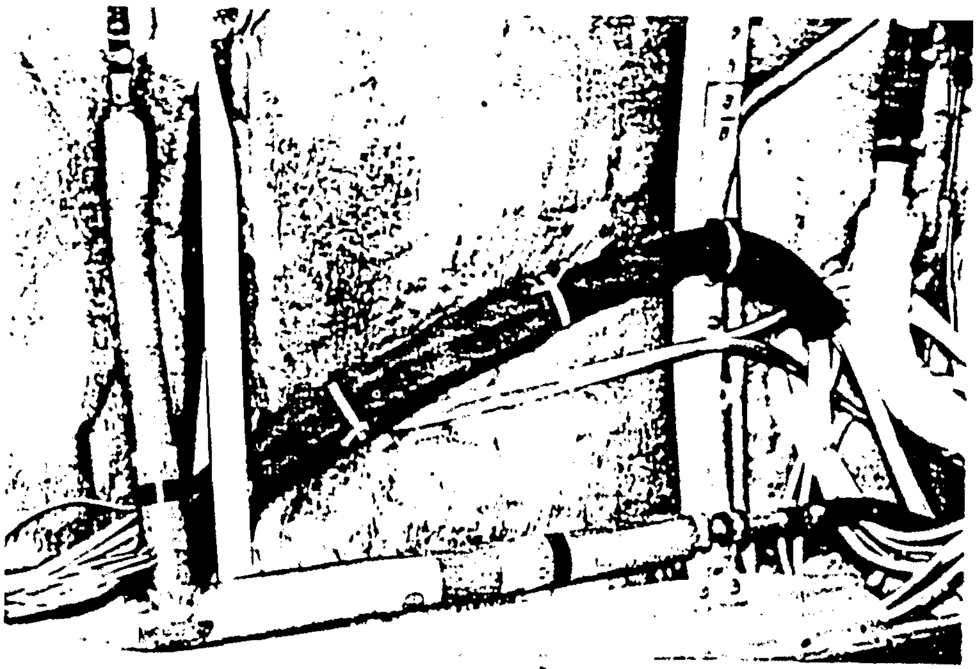
Figure 7-18



Rear Bulkhead From Back Side

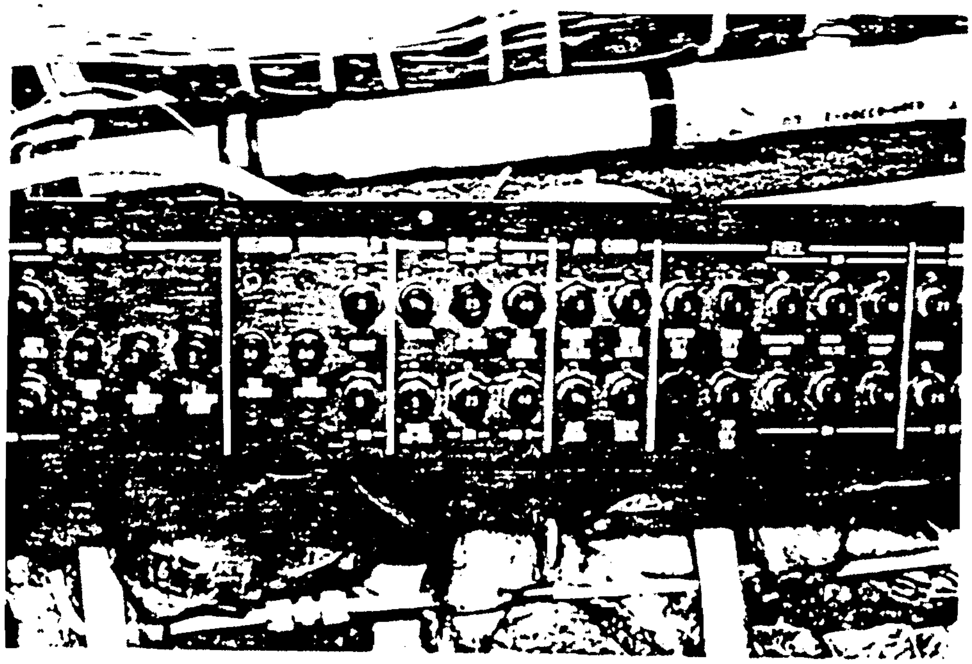
Rear Bulkhead From Back Side

MD15-40 Power Cable Routing

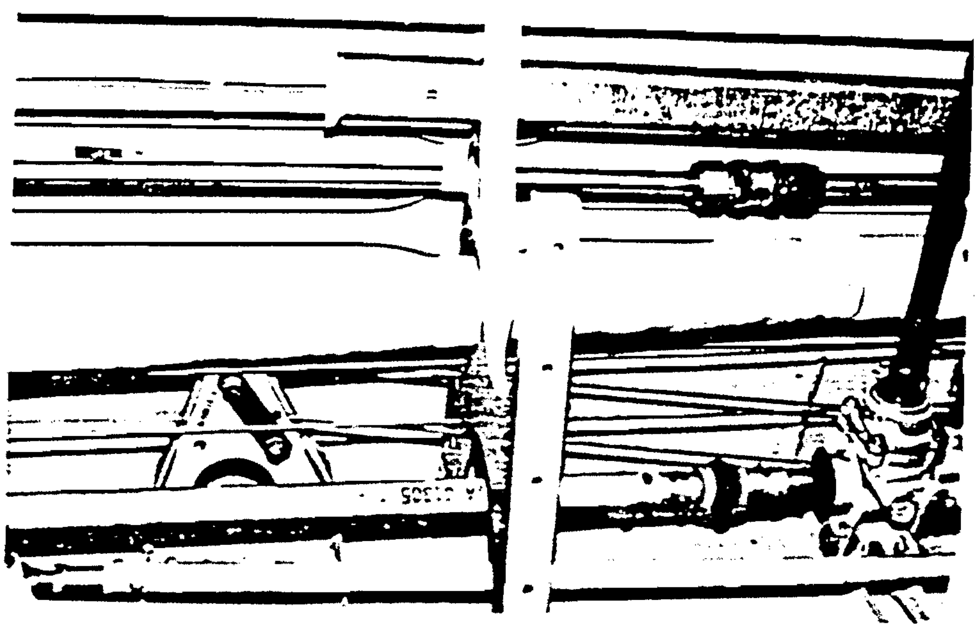


Power Feeders Going Forward

MU2B-40 Power Cable Routing

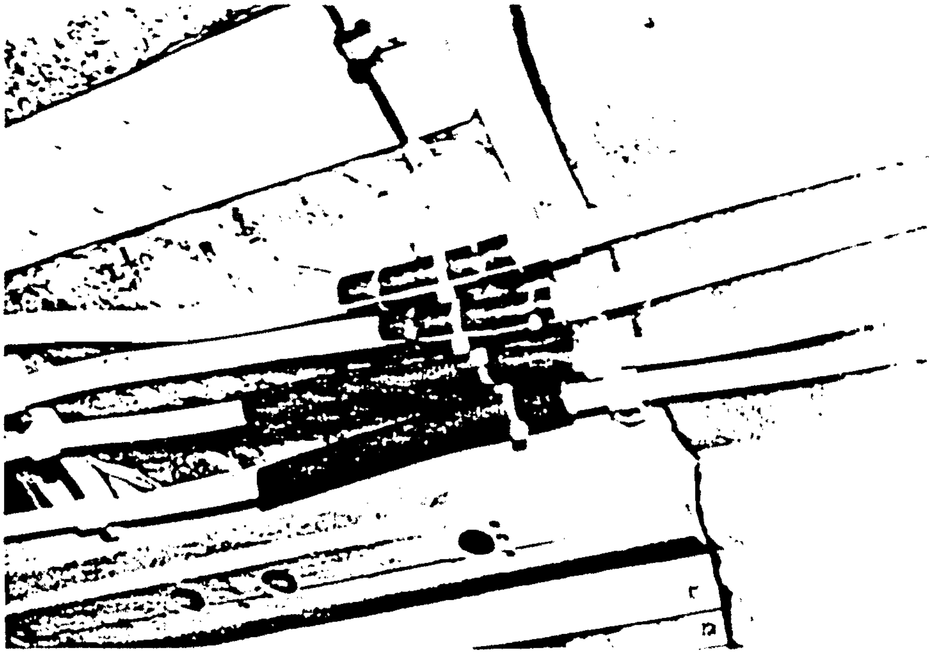


Forward Circuit Breaker Panel Area

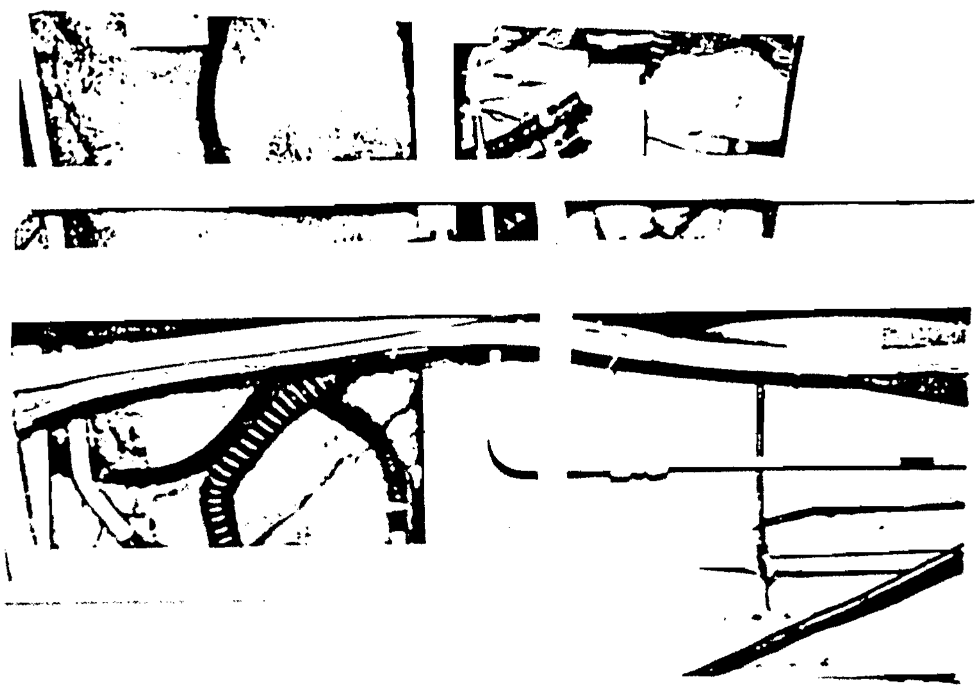


Wing Routing

MU2B-60 Power Cable Routing



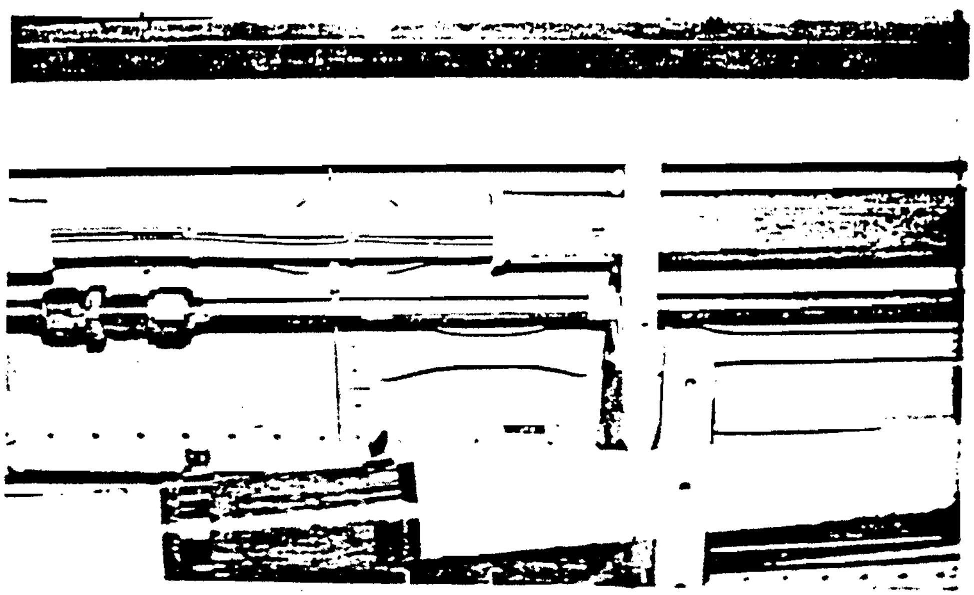
Center Fuselage Overhead



Left Side Feeders Routed Forwarded

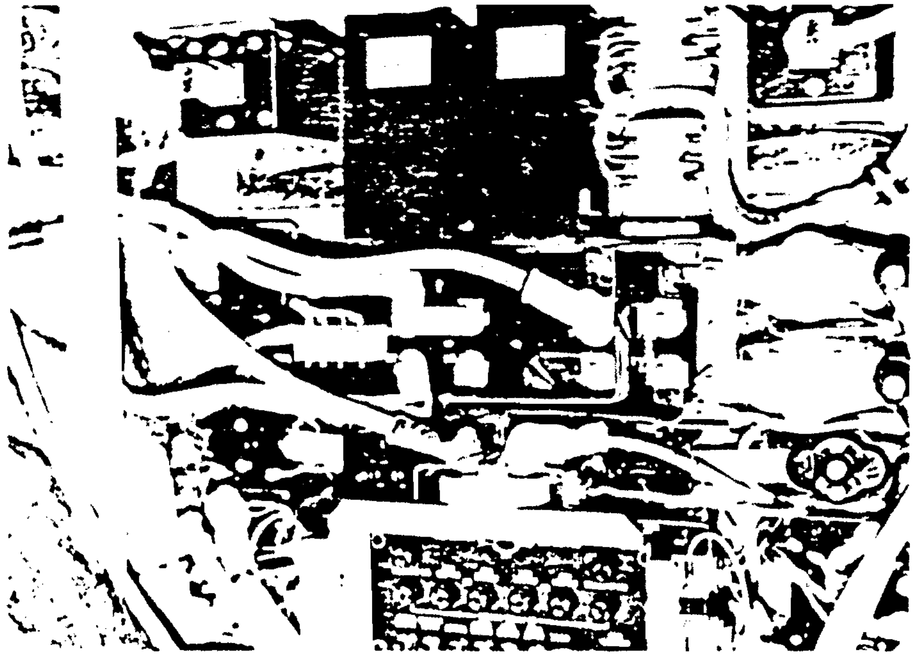
MU2B-60 Power Cable Routing

Left Side Door Area Routed Forward

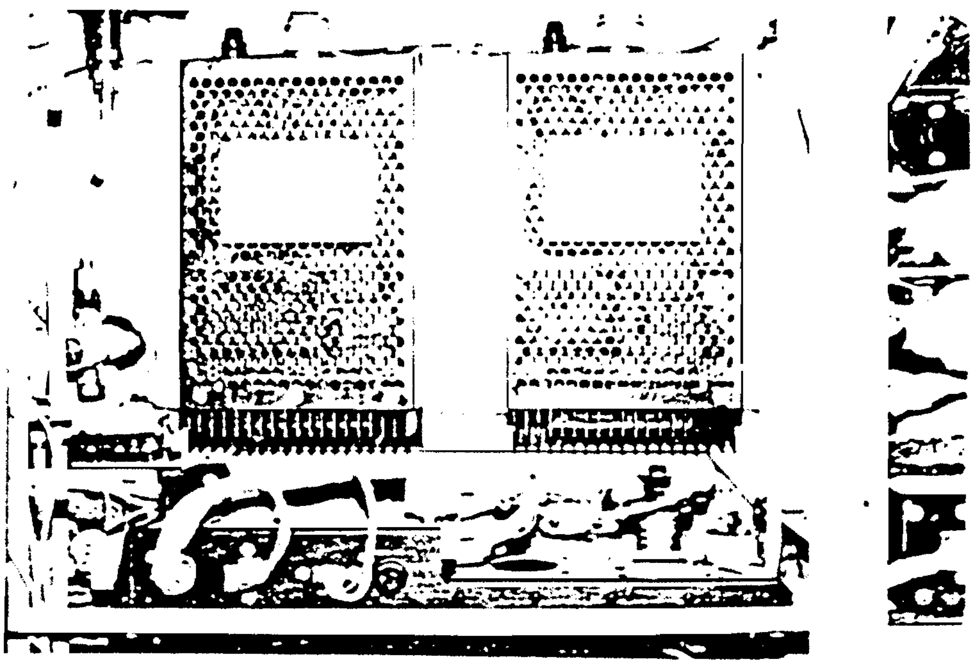


Wing Routing

MV-2B-60 Power Cable Routing



Rear Bulkhead Power Relays



Rear Bulkhead Inverters

S-7 Recommendation No. 3

Recommendation:

In all Model MU-2s, review all DC electrical power distribution system circuit breakers for proper marking and function grouping.

Discussion:

We have reviewed the MU-2 DC electrical system circuit breaker installations for proper marking and function grouping. The attached MHI Report No. MER-32068 describes the type certification configuration of all MU-2B models. In addition photographs of MU-2B-25, MU-2B-40, and MU-2B-60 circuit breaker and overhead panel installations are also attached for your reference. All appear to be properly marked and grouped except for the OVHD PANEL circuit breaker, which is clearly shown in the MU-2B-25 photographs. This circuit breaker was relocated from its DEICE block position to the LIGHTS section as a result of flight director STC Nos. SA1627SW, SA1785SW, and SA1793SW and is not clearly identifiable to the pilot as controlling a DEICE function.

Conclusion:

We have recommended to MAI that they issue service information changing the designation of this circuit breaker to clearly define its DEICE function and that the flight manual supplements affected by this change be revised to advise the pilot of the location of the circuit breaker. The airplane models affected are the MU-2B-25, -26, -35, and -36.

MAI/MHI has submitted an Airplane System Improvement Schedule which shows the Overhead Panel circuit breaker Service Bulletin issued by July of 1984, and Flight Manual Supplement revisions by August of 1984.

37-3 a)
Review all DC electrical power distribution circuit breakers for proper cockpit function marking and grouping.

Answer

As shown on following pages, all circuit breaker panels are proper marking and grouping.

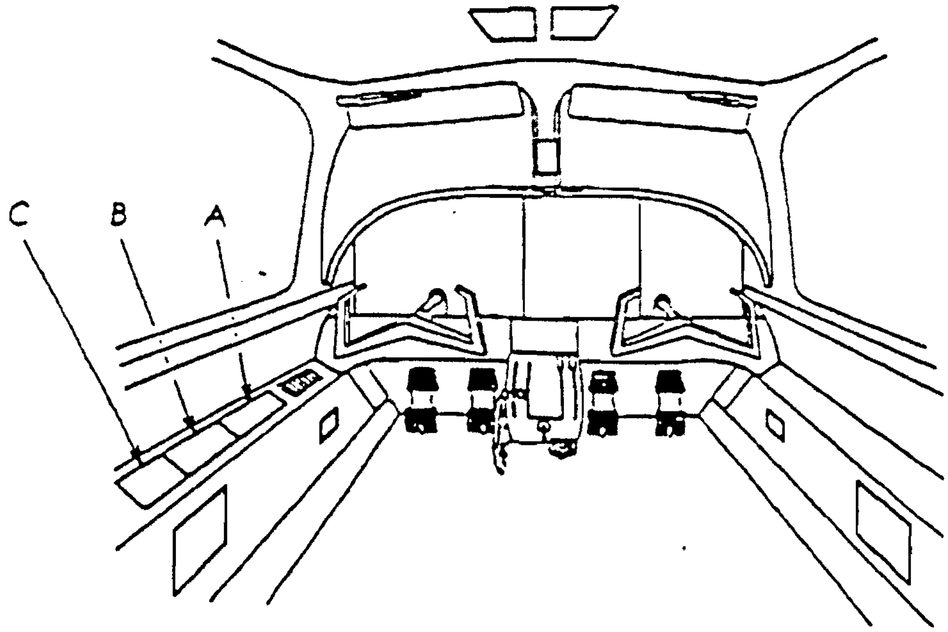
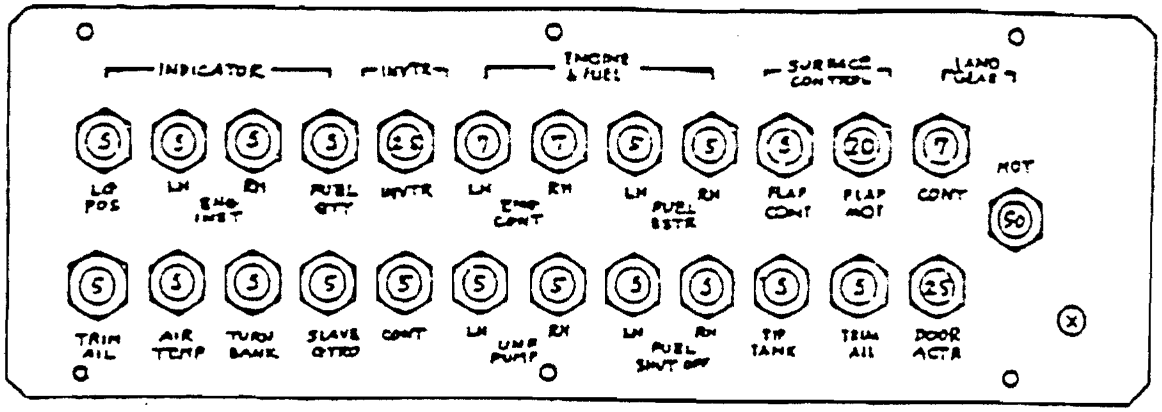


FIG 1. Circuit Breaker Panel Arrangement (See TABLE I)

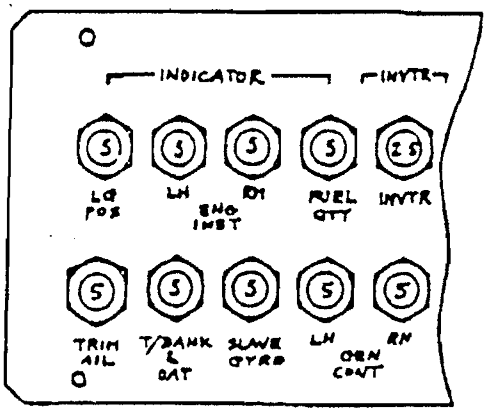
TABLE I

CORRESPONDING MODEL	MU-2B, MU-2B-10, -15, -20				
DETAIL	NOMENCLATURE	USED ON (S/N)	MARKING ARRANGE (See Detail)	PART NO. (Ref.)	REMARK
A	[illegible] Foward Circuit Breaker Panel	6 ~ 20	A-1	016A-88213	
		21 ~ 38	A-2	016A-88213	
		101 ~ 120 128, 147, 148	A-3	016A-88224	
		121 ~ 127 129 ~ 146 149 ~ 164	A-4	016A-88224	
		165 ~ 214	A-5	016A-88224-21	
		215 ~ 238	A-6	016A-88224-11	
B	Center Circuit Breaker Panel	6 ~ 38	B-1	016A-88214	
		101 ~ 164	B-2	016A-88222	
		165 ~ 189	B-3	016A-88222-21	
		190 ~ 238	B-4	016A-88222-31	

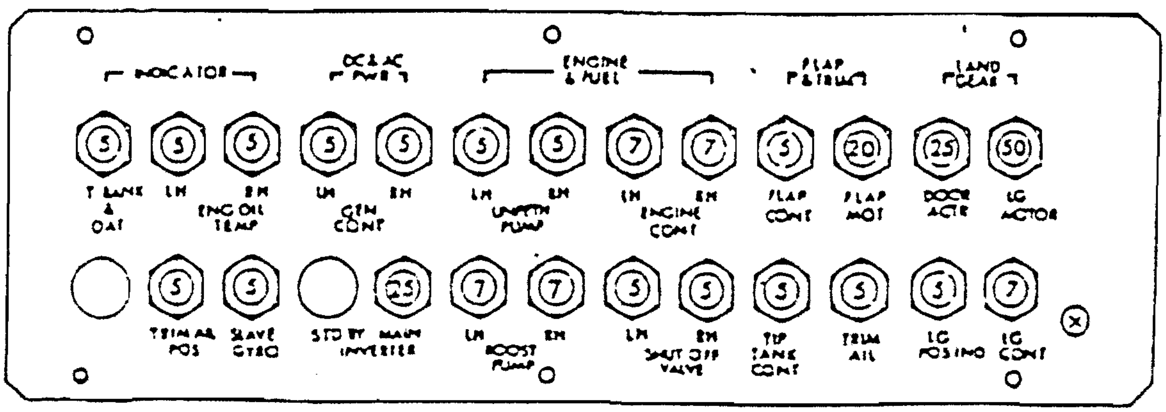
C	After Circuit Breaker Panel	6 ~ 38	C - 1	016A-88215	
		101 ~ 189	C - 2	016A-88215-21	
		190 ~ 214	C - 3	022A-88630	
		215 ~ 238	C - 4	022A-88230	



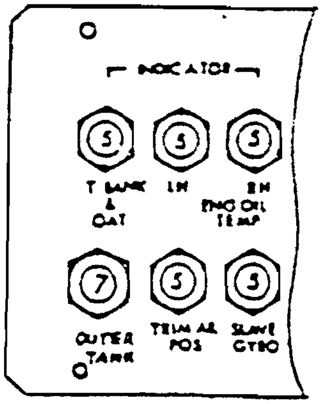
Detail A-1



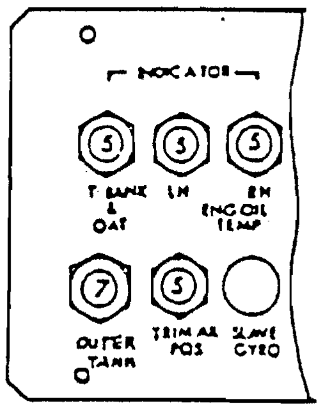
Detail A-2
(Same with Detail A-1 except as shown)



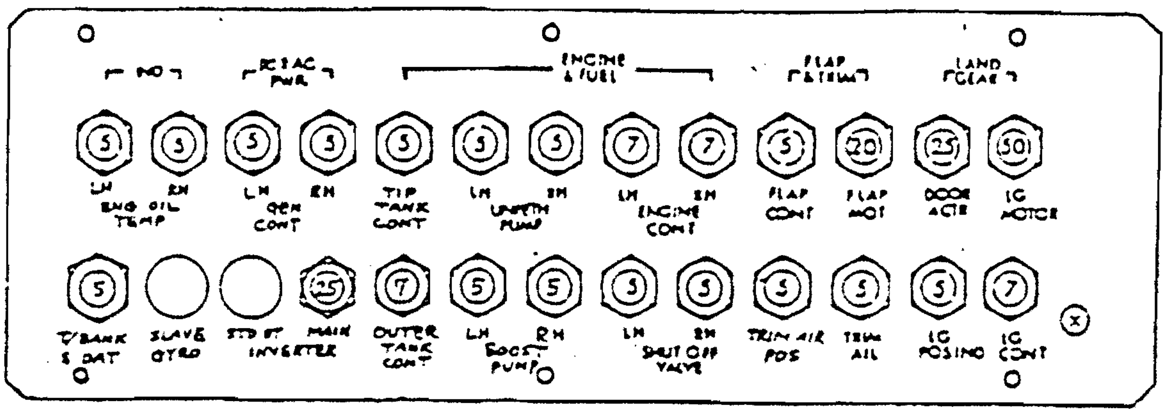
Detail A-3



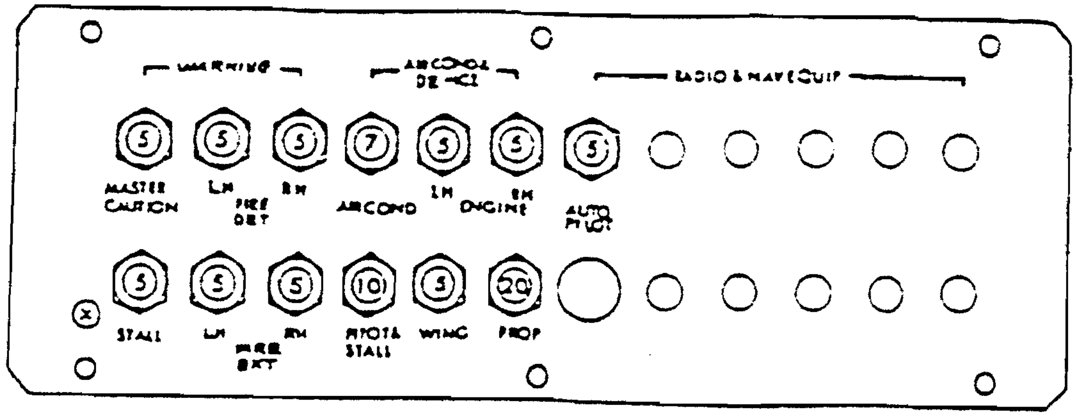
Detail A-4
(Same with Detail A-3 except as shown)



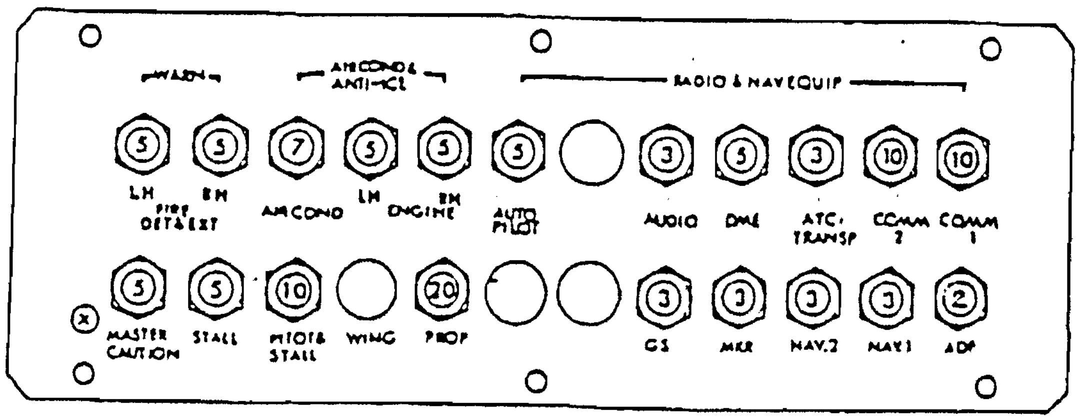
Detail A-5
(Same with Detail A-3 except as shown)



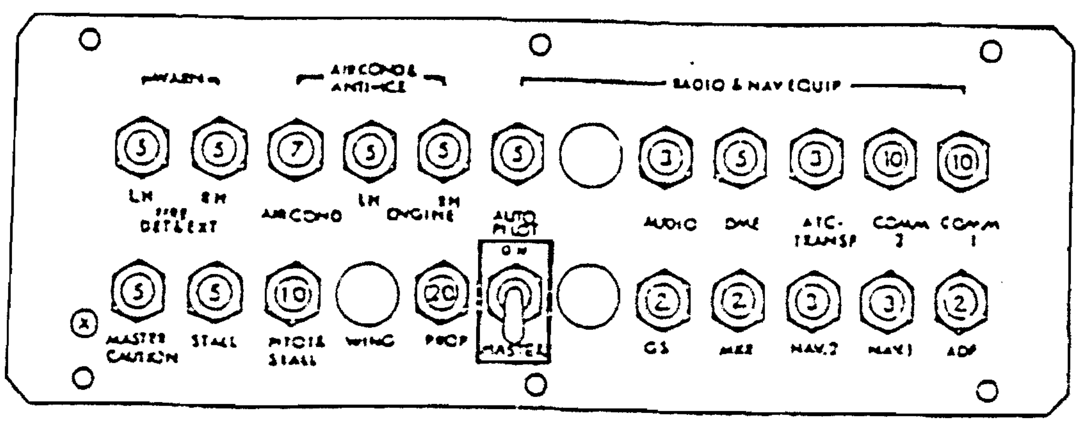
Detail A-6



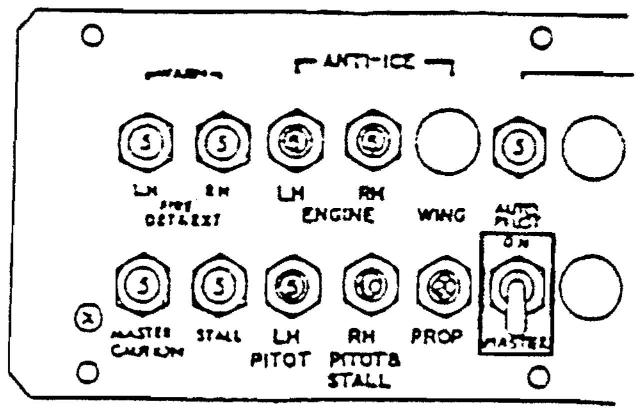
Detail B-1



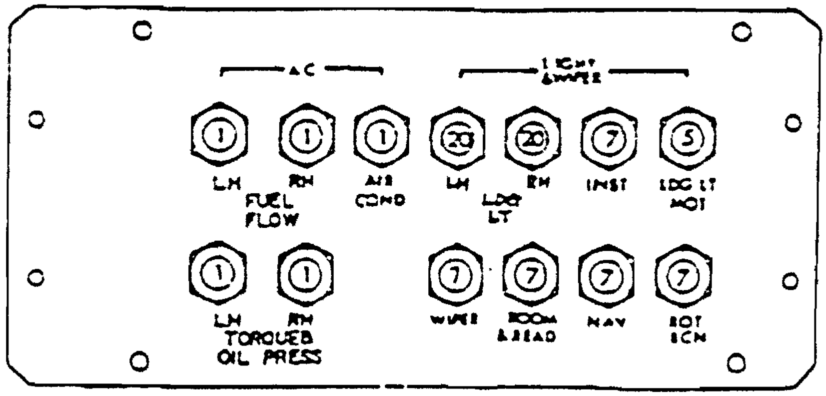
Detail B-2



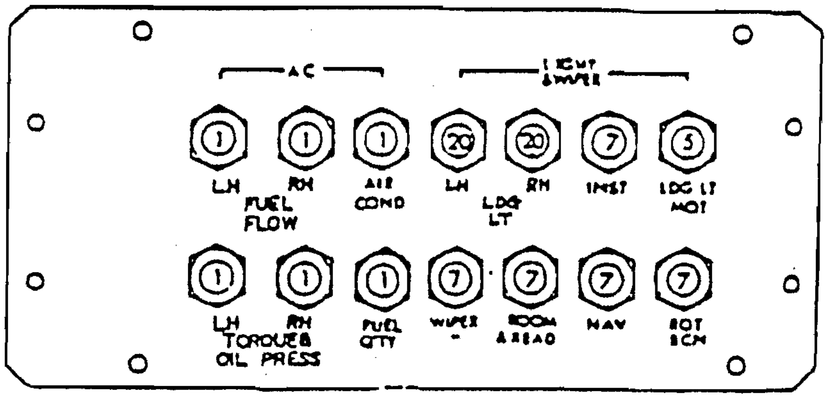
Detail B-3



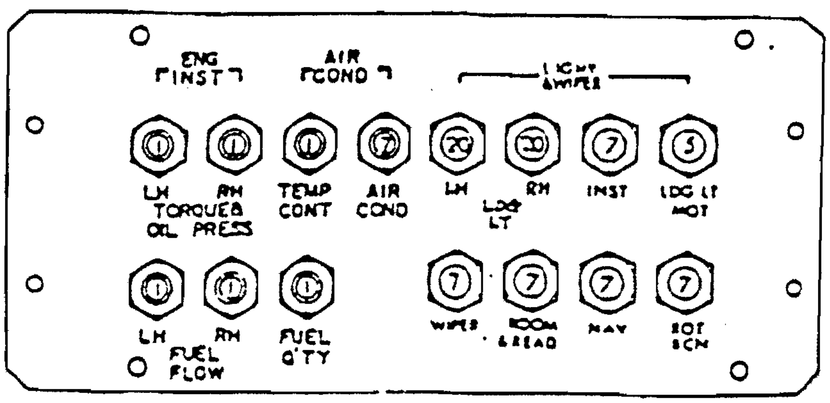
Detail B-4
(Same with Detail B-3 except as shown)



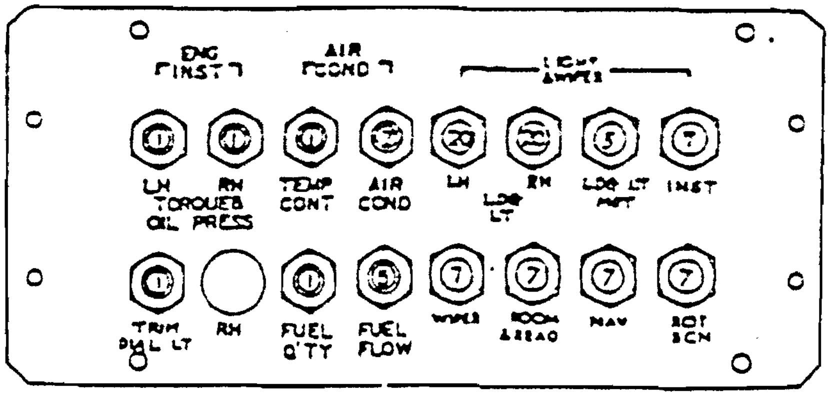
Detail C-1



Detail C-2



Detail C-3


ENG
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RH
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FUEL
Q'TY
FUEL
FLOW
NAV
ROT
BCN

Detail C-4

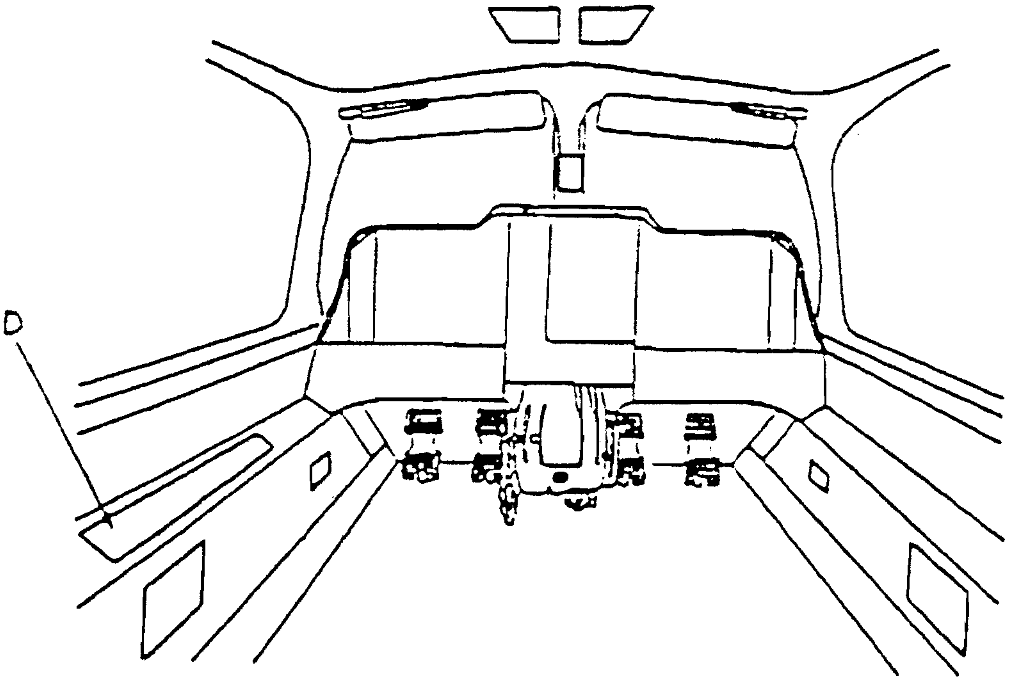
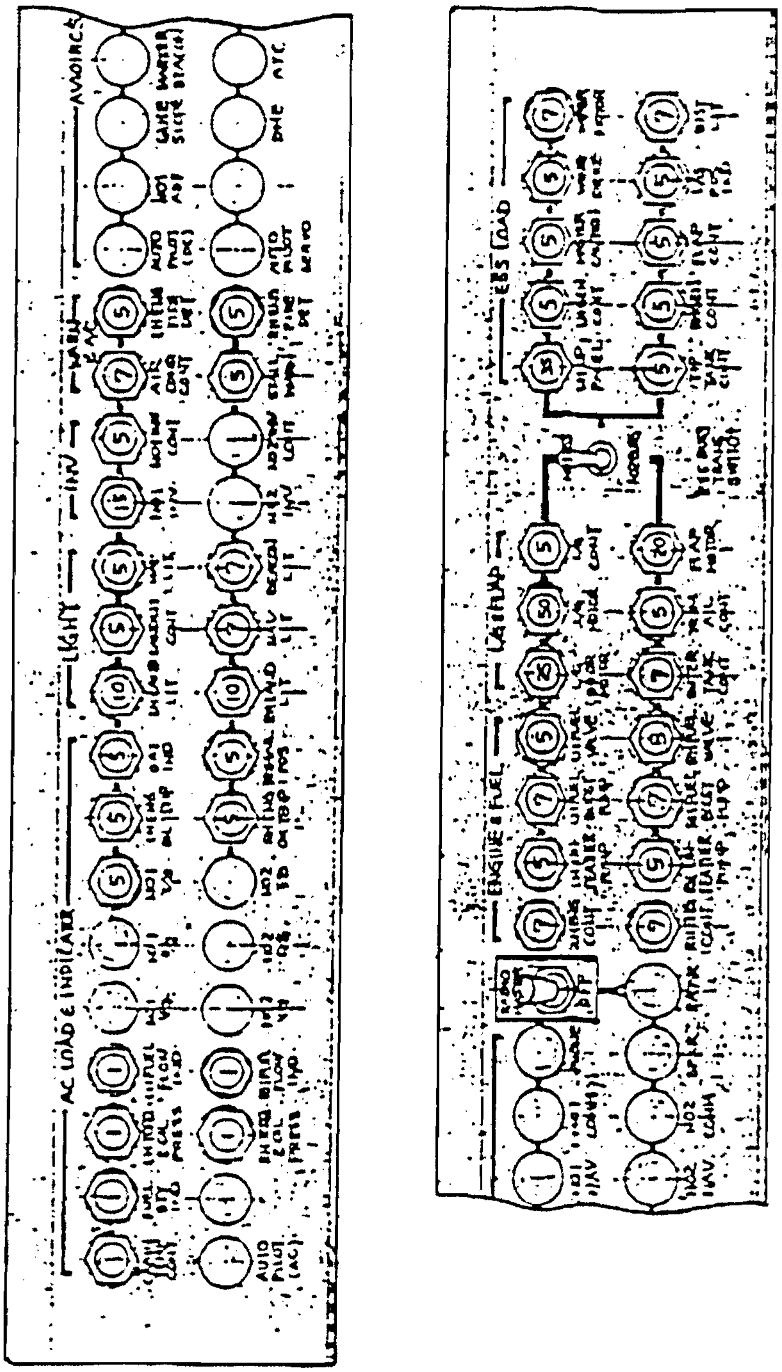


FIG. 2 Circuit Breaker Panel Arrangement (See TABLE 2)

TABLE 2

CORRESPONDING MODEL	MU-2B-30				
DETAIL	NOMEN-CLATURE	USED ON (S/N)	MARKING ARRANGE (See Detail)	PART NO. (Ref.)	REMARK
D	C/B Panel	502 . 503	D-1	030A-88215	



Detail D-1

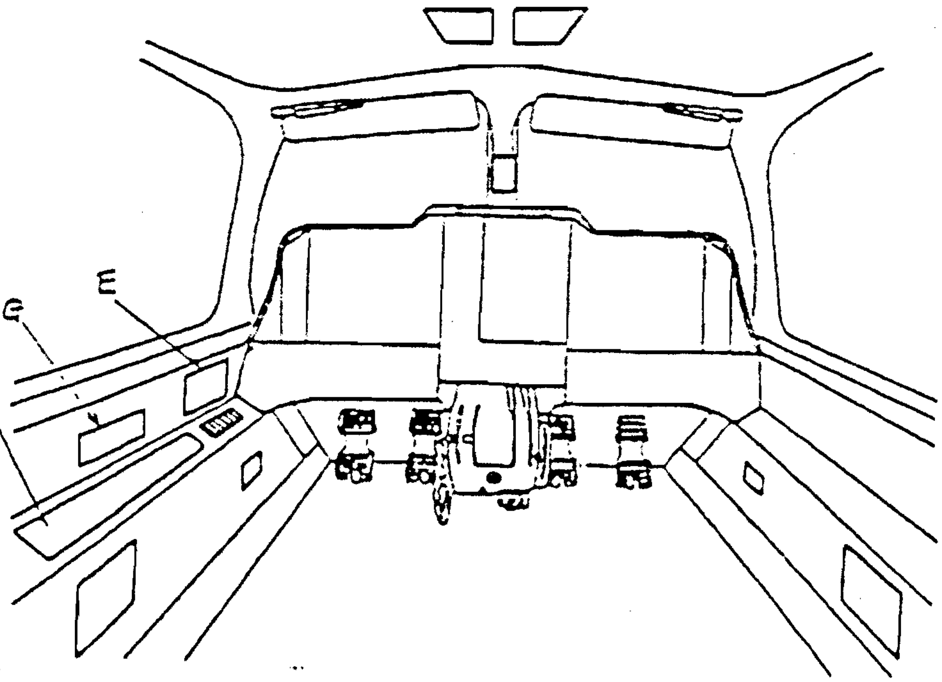
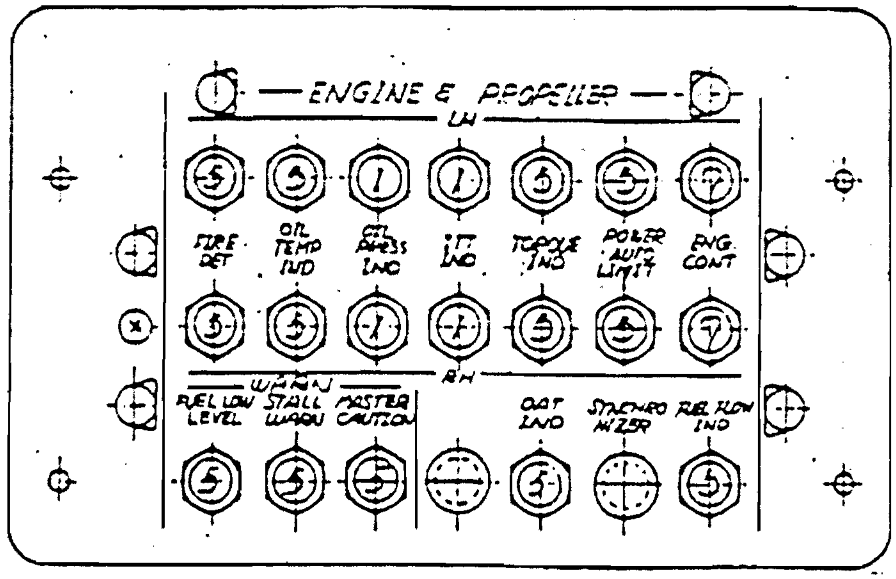


FIG. 3 Circuit Breaker Panel Arrangement (See TABLE 3)

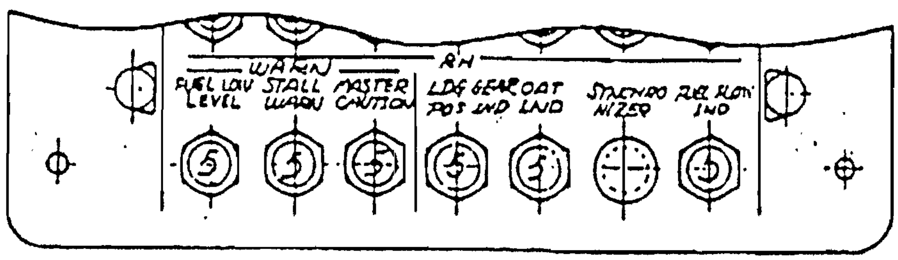
TABLE 3

CORRESPONDING MODEL		MU-2B-25, -26, -26A, -40 MU-2B-30, -35, -36, -36A, -60			
DETAIL	NOMEN-CLATURE	USED ON (S/N)	MARKING ARRANGE (See Detail)	PART NO. (Ref.)	REMARK
E	Foward Circuit Breaker Panel	237 ~ 263 548 ~ 585	E-1	035A-88233	
		264 ~ 347 586 ~ 713	E-2	035A-88233	
		504 ~ 525 527 ~ 532	E-3	030A-88282	
		533 ~ 545 547	E-4	030A-88282-11	
		526	E-5	030A-88282	
		546	E-6	030A-88282-11	
		348 ~ 394 714 ~ 730	E-7	035A-88222	
		395 ~ 399 731 ~ 741	E-8	035A-88222-11	
		400 ~ 742 ~	E-9	035A-88222-11	

F	After Circuit Breaker Panel	239 ~ 263	F - 1	037A-88222	
		264 ~ 289	F - 2	037A-88222-11	
		290 ~ 337	F - 3	037A-88222-21	
		338 ~ 347	F - 4	037A-88222-21	
		504 ~ 547	F - 5	030A-88224	
		548 ~ 570	F - 6	035A-88235	
		571 ~ 577	F - 7	035A-88235-21	
		578 ~ 615	F - 8	035A-88235-21	
		616 ~ 686	F - 9	035A-88235-31	
		687 ~ 713	F - 10	035A-88235-31	
		348 ~ 367 714 ~ 717	F - 11	035A-88224	
		368 ~ 394 718 ~ 730	F - 12	035A-88224-21	
		(OPTION) 348 ~ 714 ~	F - 13	035A-88224-11	
		395 ~ 445 731 ~ 799	F - 14	035A-88225	
		446 ~ 500 1001 ~ 1501 ~	F - 15	035A-88225-11	
G	Circuit Breaker and Switch Panel	348 ~ 367 714 ~ 717	G - 1	035A-88247	
		368 ~ 718 ~	G - 2	035A-88247-11	



Detail E-1



Detail E-2
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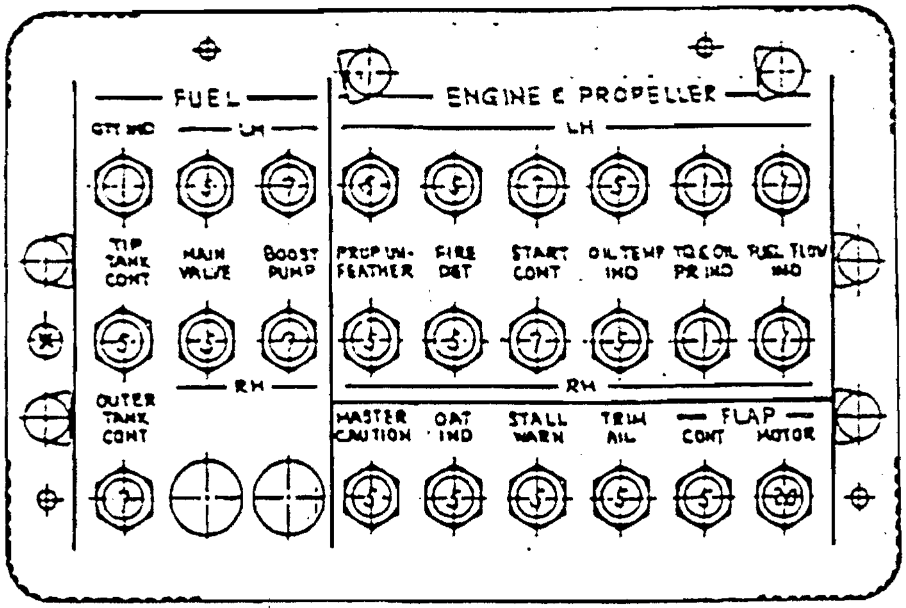
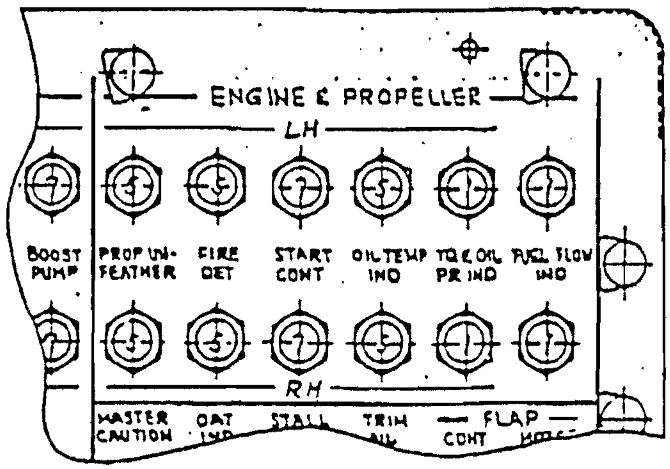


Detail E-3

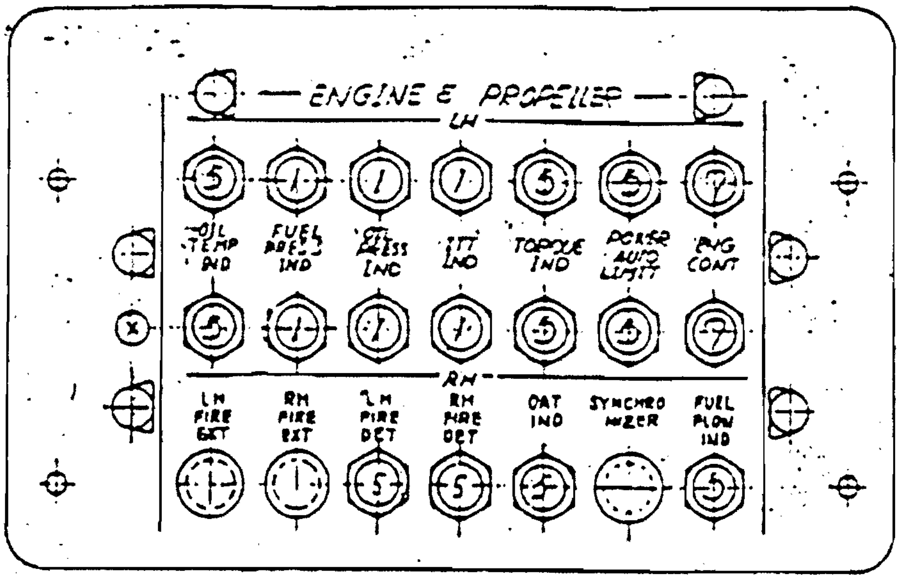
Detail E-4



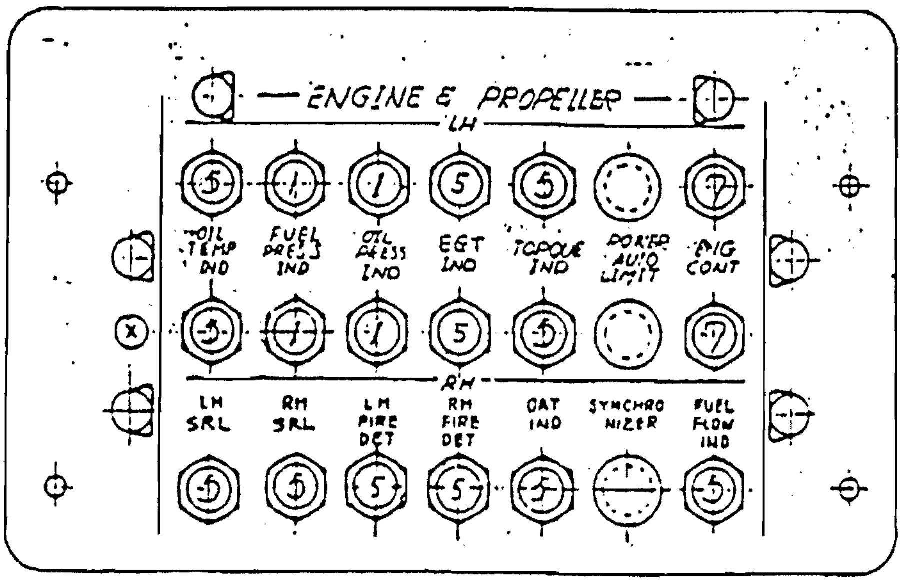
Detail E-5

Detail E-6

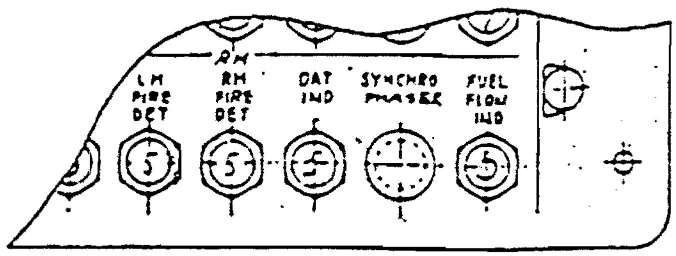
(Same with Detail E-3 & E-4 except as shown)



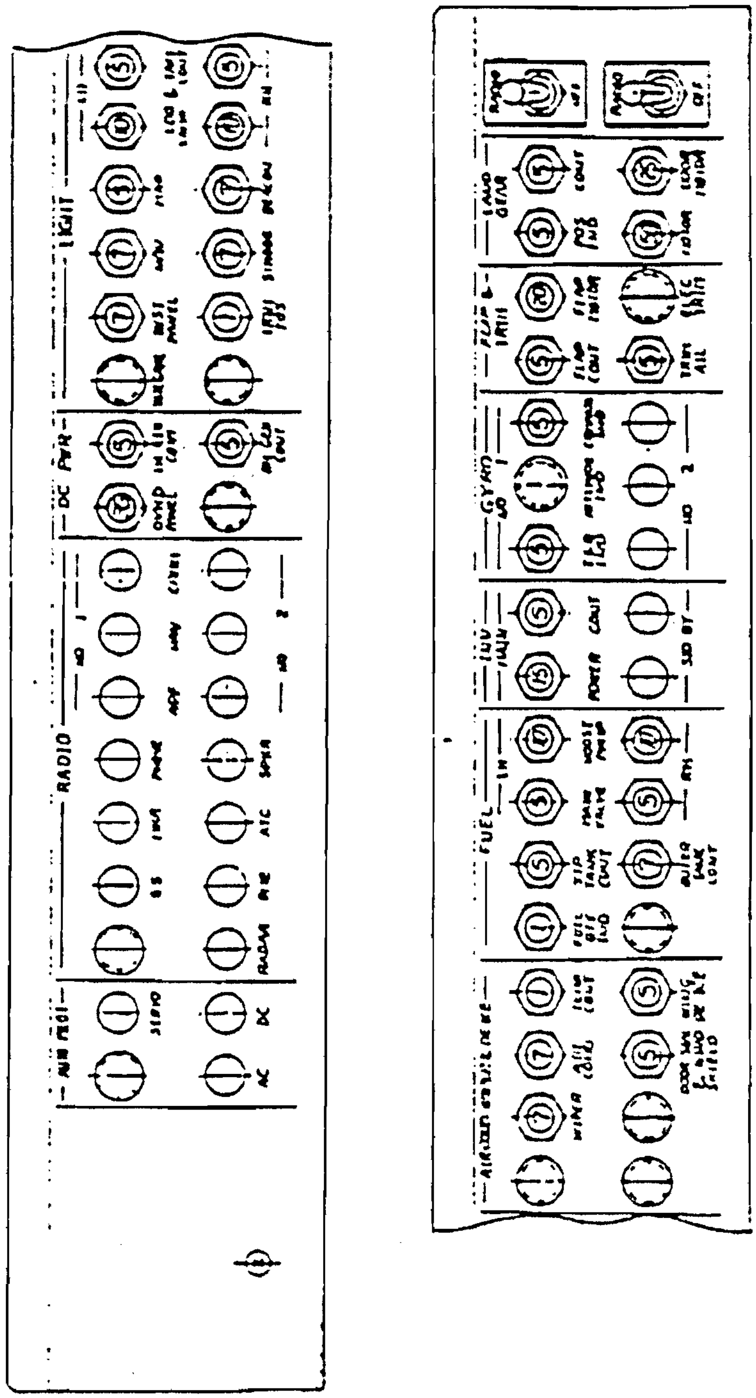
Detail E-7



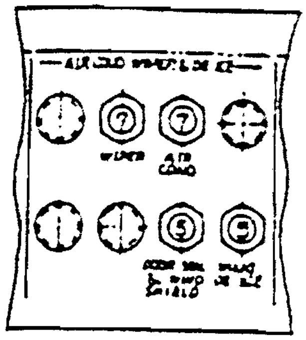
Detail E-8



Detail E-9
(Same with Detail E-8 except as shown)



Detail F-1



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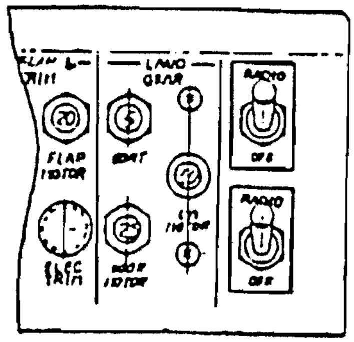

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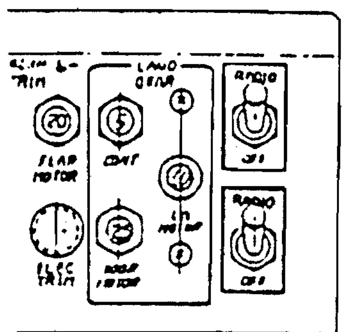

Detail F-4
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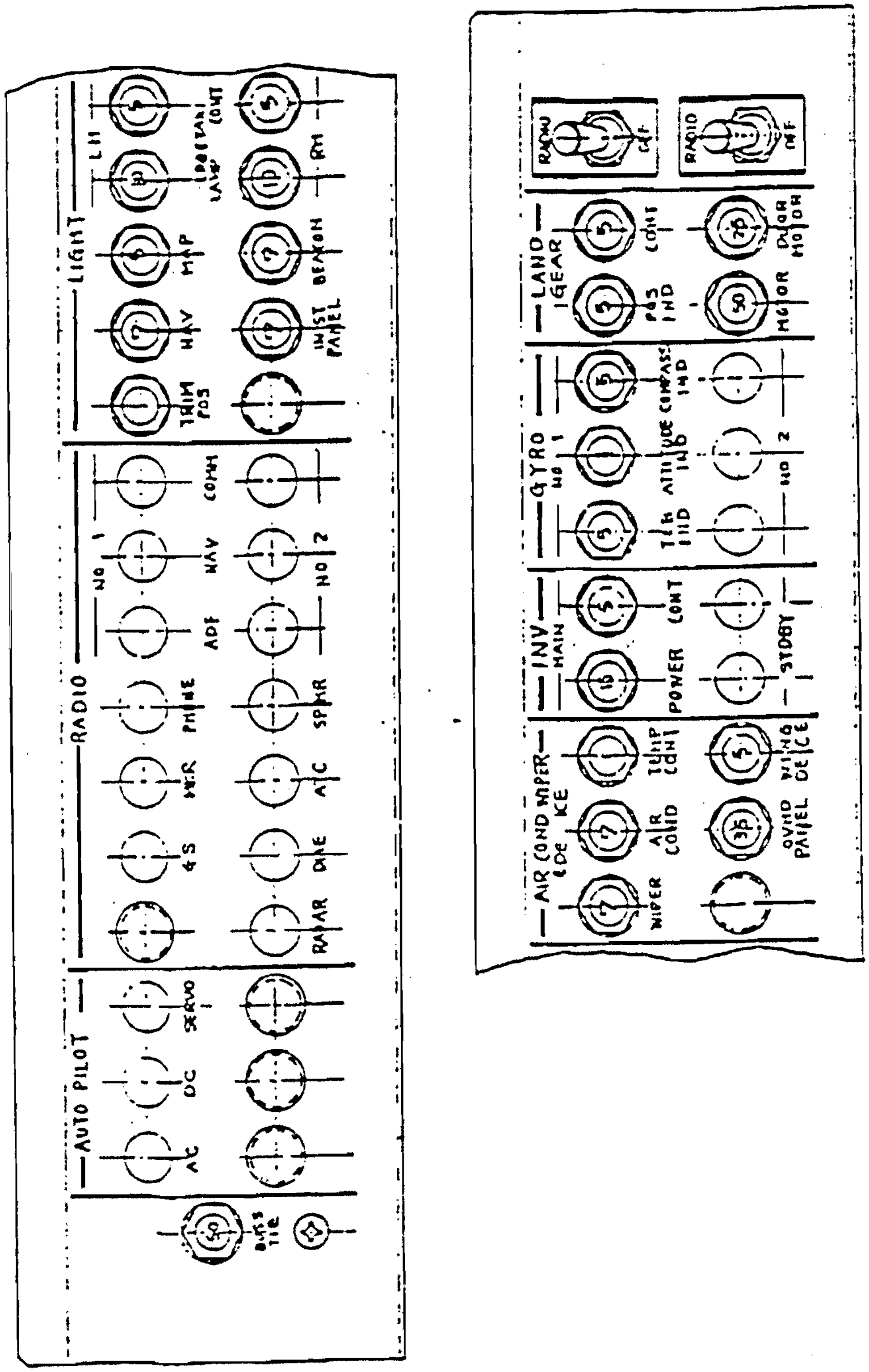
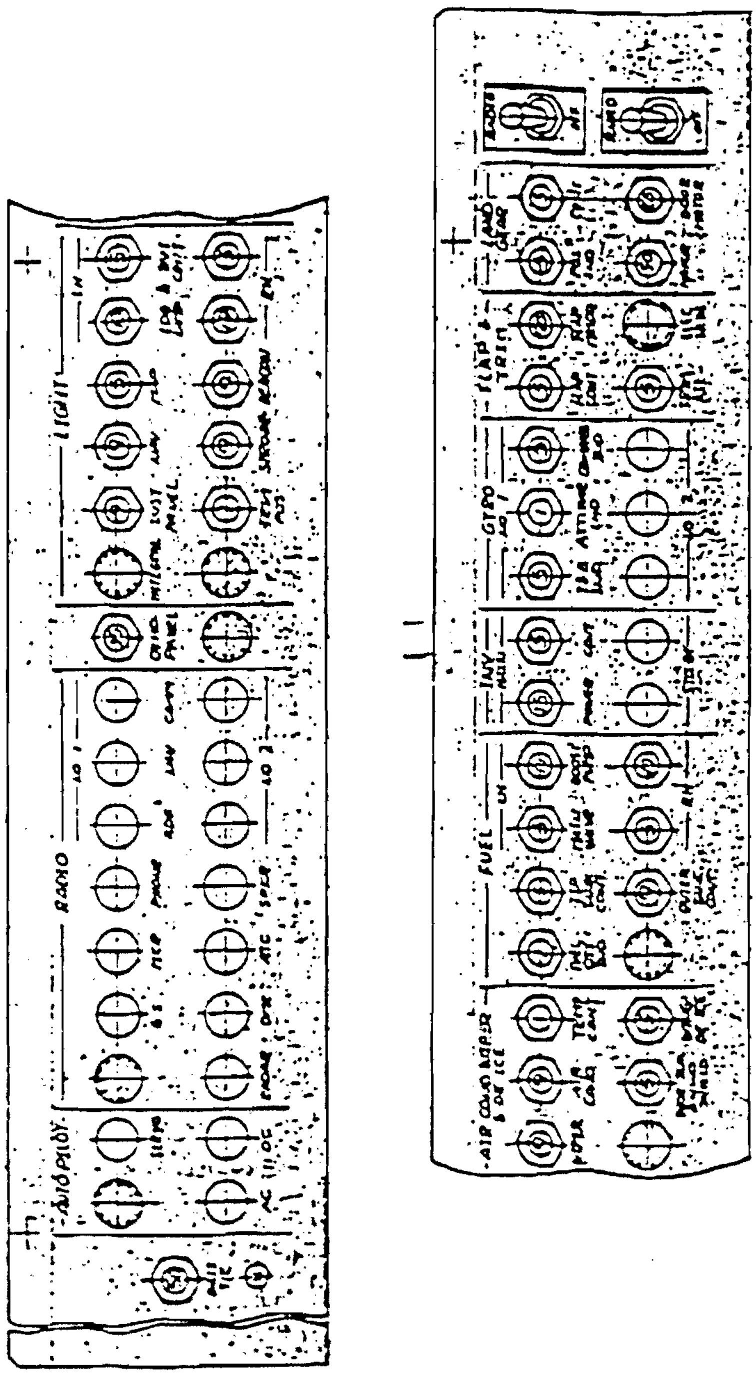
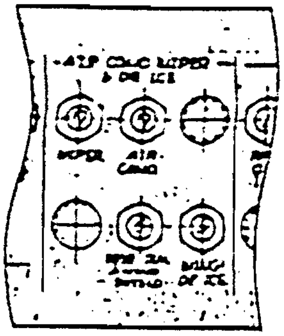

LIGHT
TRIM POS
NAV
MAP
LH
RH
BEACON
INST PANEL
RADIO
COMM
NAV
ADF
PHONE
SPKR
A/C
RADAR
AUTO PILOT
AC
DC
SERVO
BUSS TIE
LAND GEAR
CONT
POS IND
MOTOR
DOOR MOTOR
GYRO
NO 1
NO 2
ATTITUDE IND
COMPASS IND
INV
MAIN
POWER
CONT
STDBY
AIR COND
WIPER
AIR COND
TEMP CONT
OVHD PANEL
WING DE ICE
RADIO
OFF

Detail F-5



Detail F-6



Detail F-7
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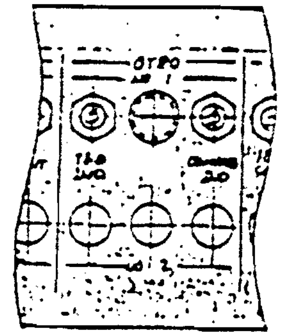
except as shown)



Detail F-8
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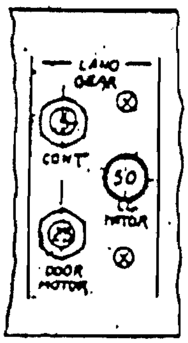
except as shown)



Detail F-9
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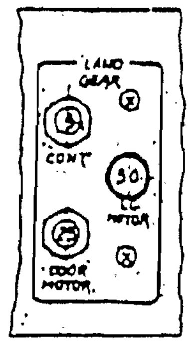
except as shown)



Detail F-10
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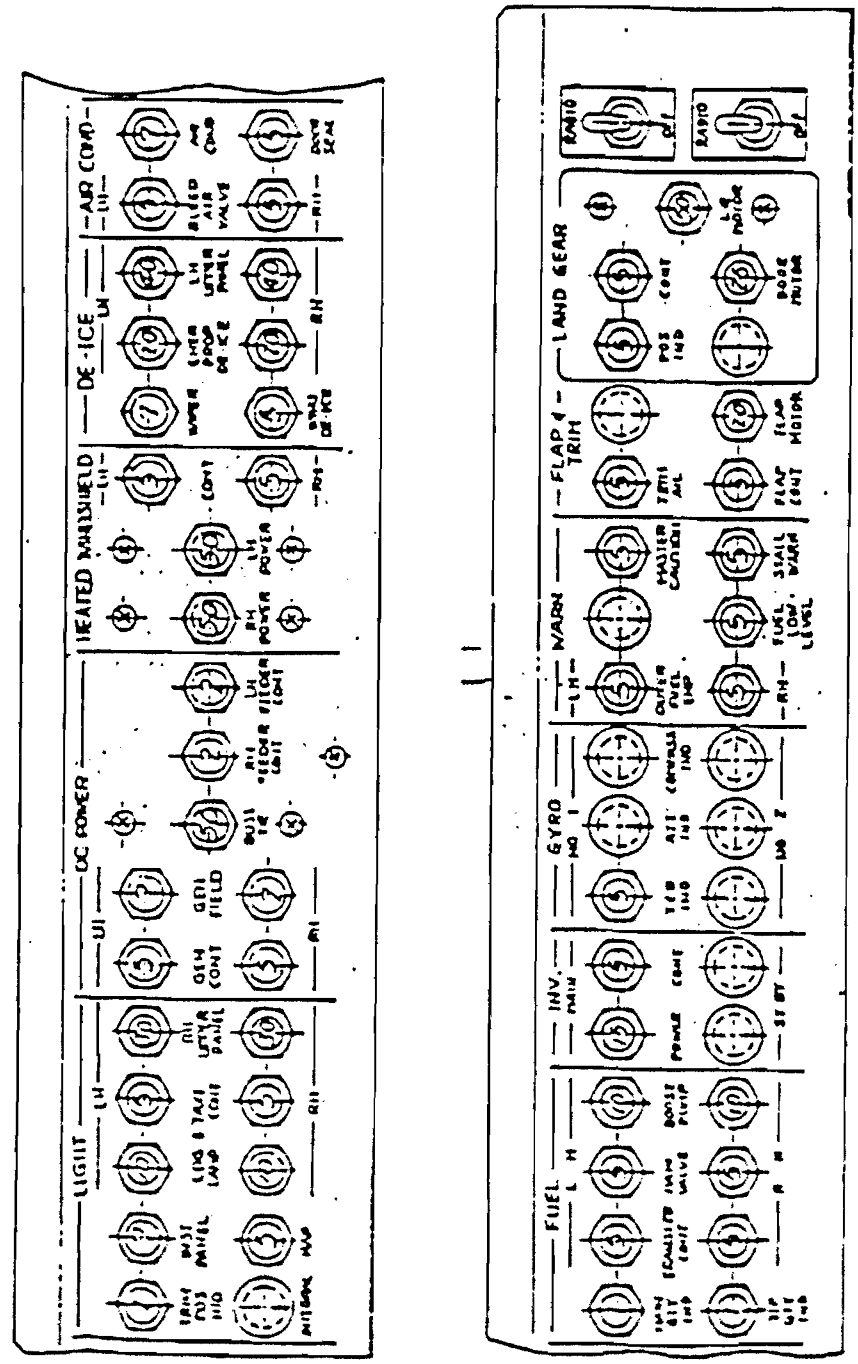
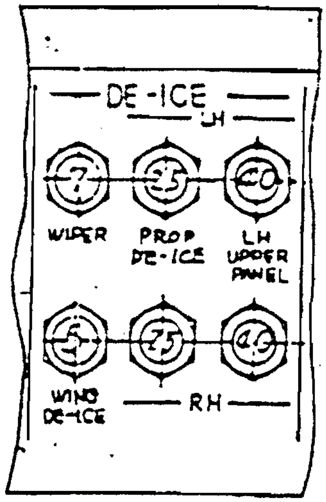
except as shown)


LIGHT
DC POWER
HEATED WINDSHIELD
DE-ICE
AIR COND
FUEL
INV.
GYRO
WARN
FLAP & TRIM
LAND GEAR
RADIO
RADIO

Detail F-11



Detail F-12
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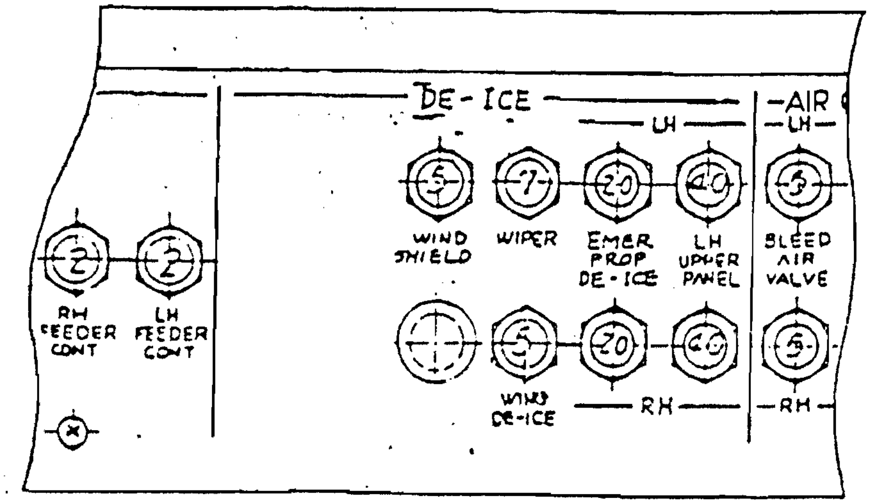

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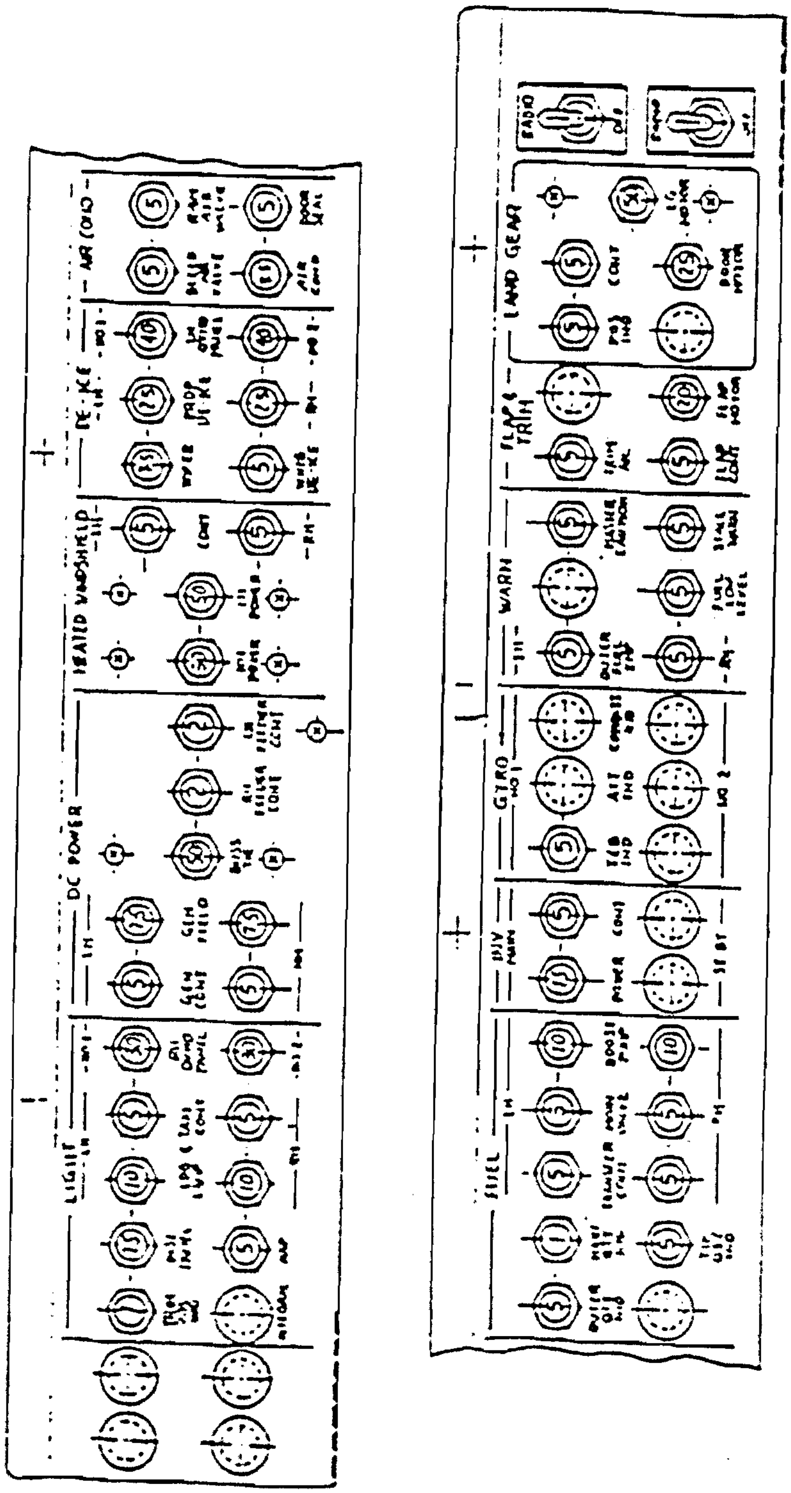
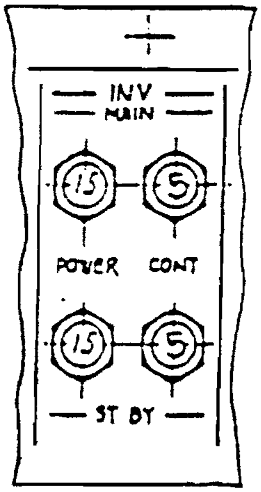

LIGHT
DC POWER
HEATED WINDSHIELD
DE-ICE
AIR COND
FUEL
GYRO
WARN
LAND GEAR

Detail F-14



Detail F-15
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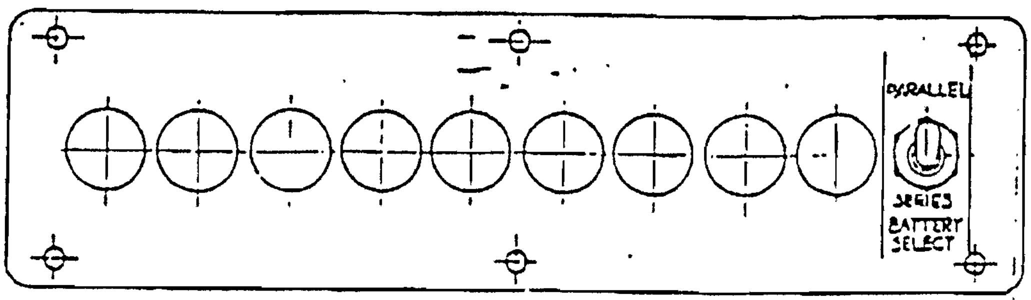
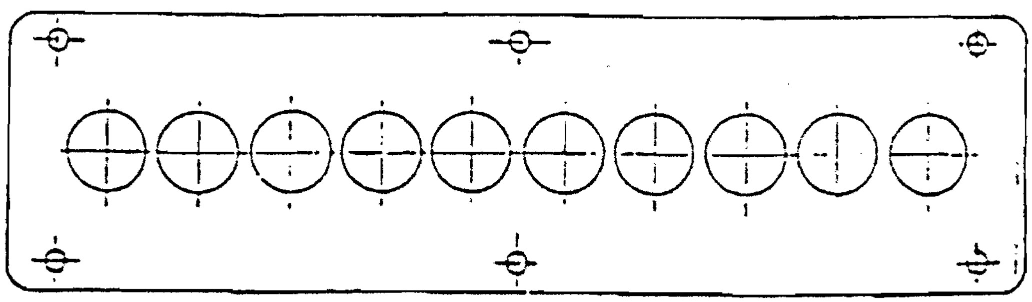
except as shown)

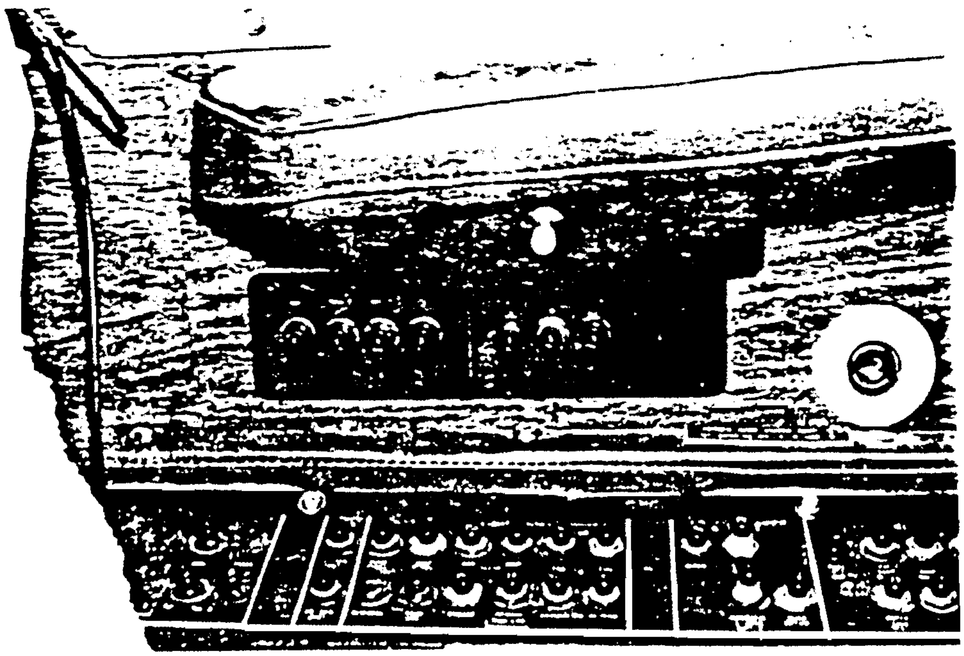


Detail G-1

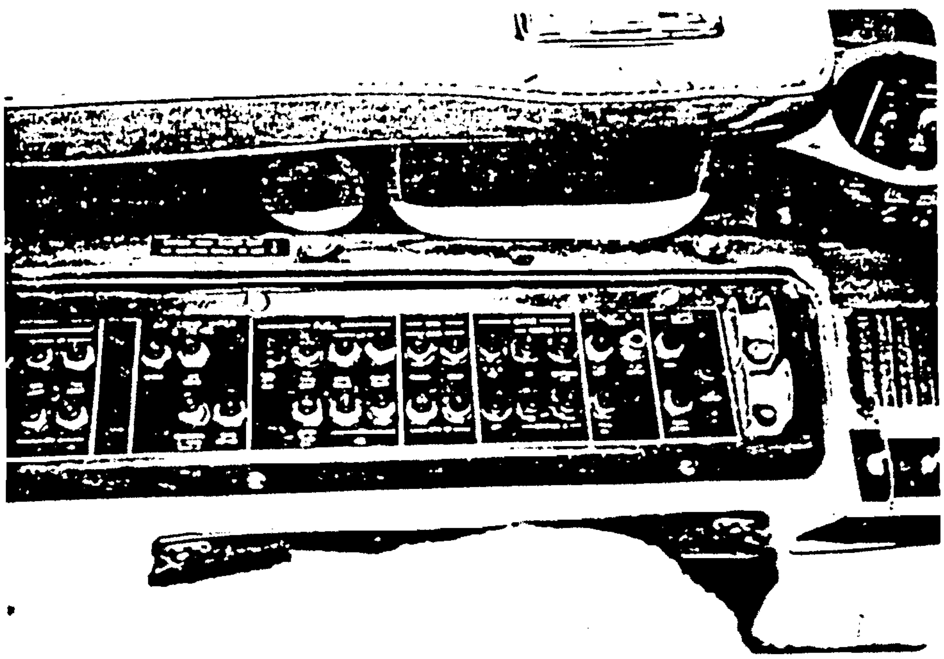


Detail G-2

MC2B-25 Circuit Breaker Grouping

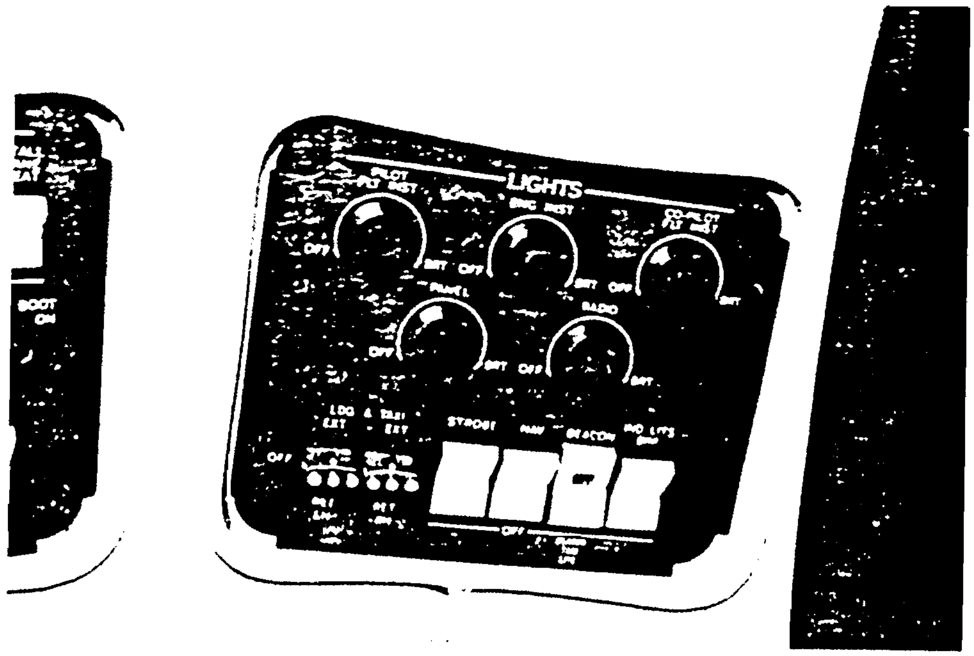


Center Circuit Breaker Panel

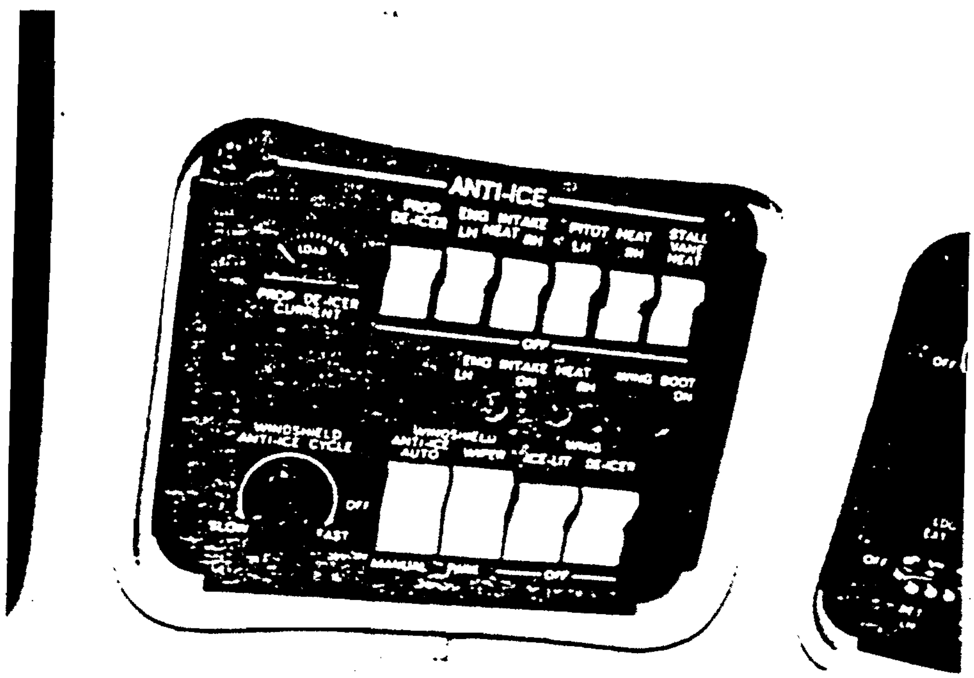


Forward Circuit Breaker Panel

MU2B-25 Overhead Switch Panel

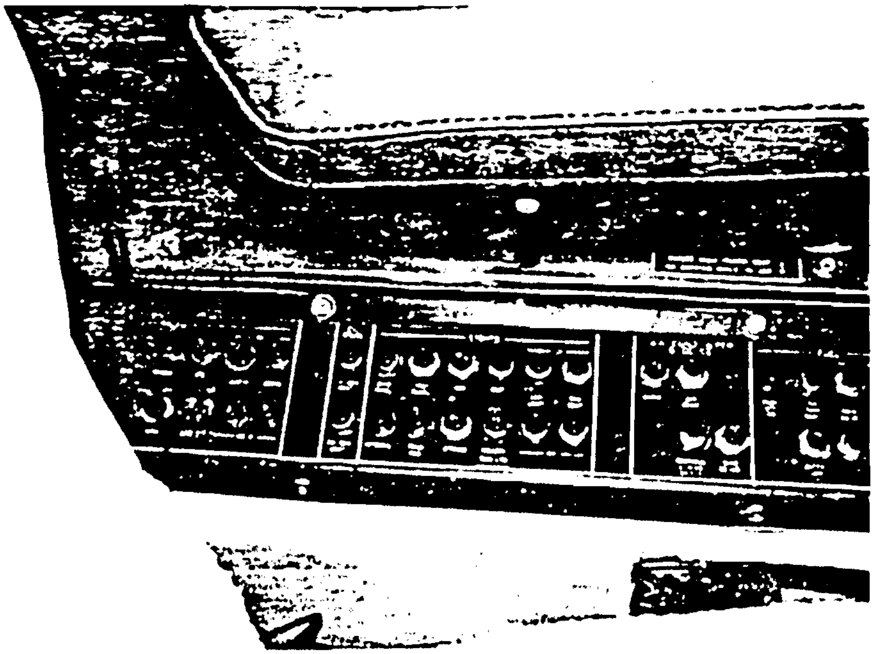


Lights Overhead Switch Panel

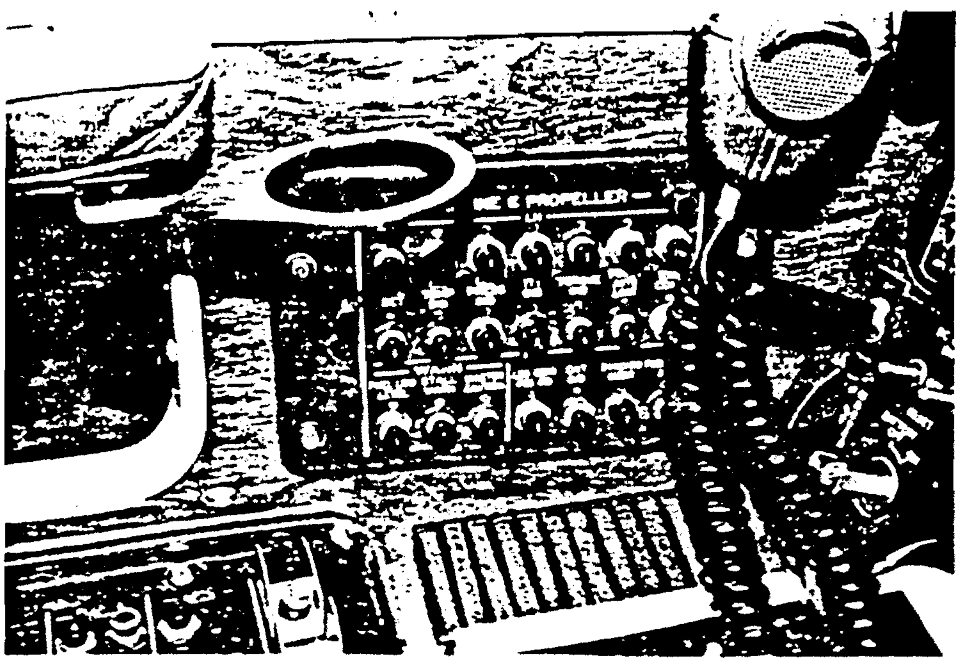


Anti-Ice Overhead Switch Panel

MU2B-25 Circuit Breakers Grouping

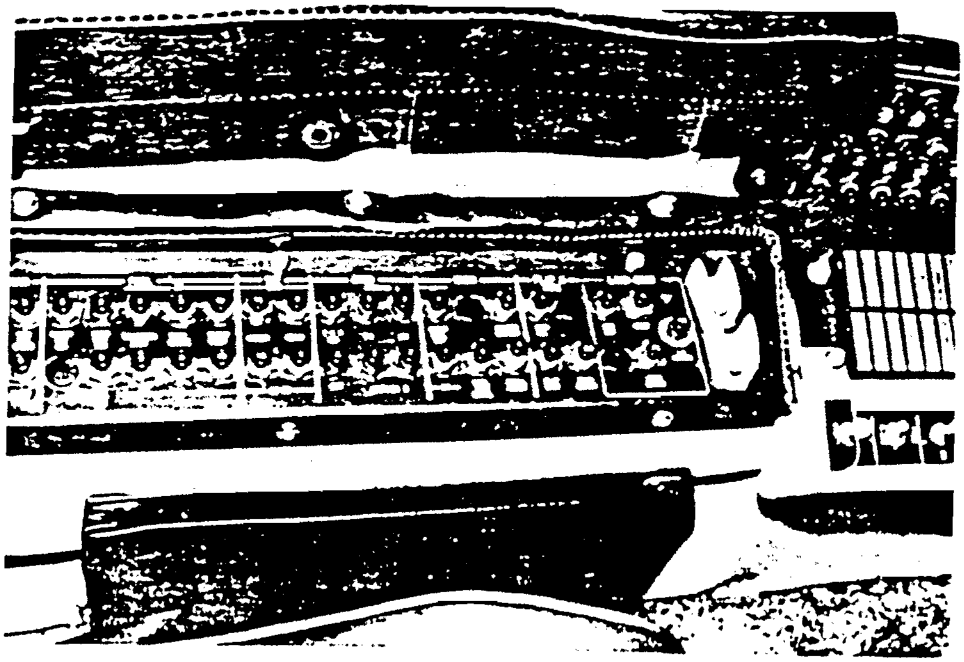


Rear Circuit Breaker Panel

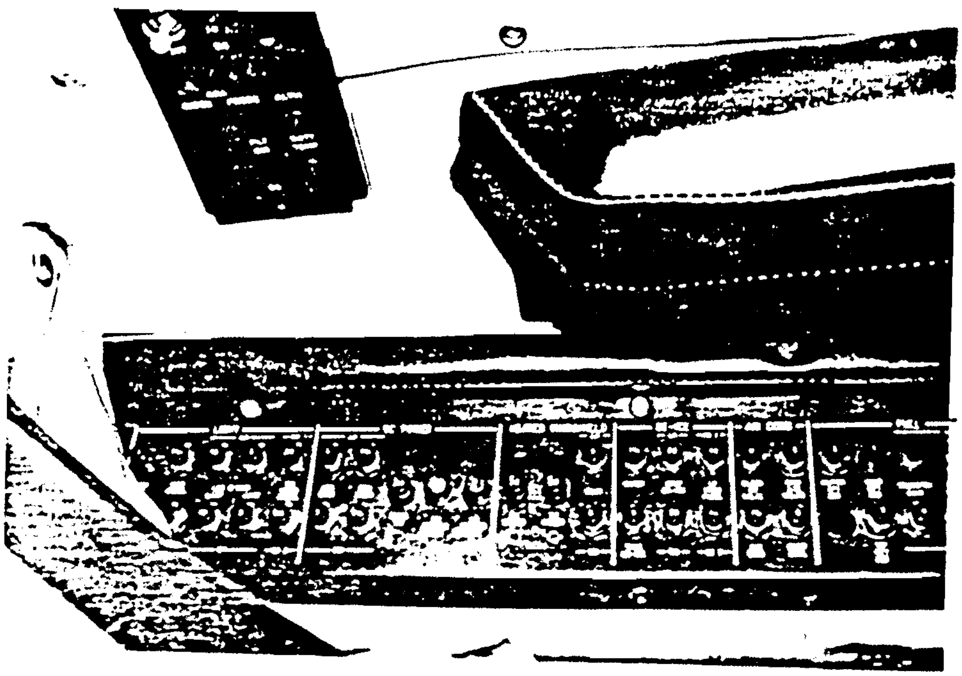


Engine & Propeller Circuit Breaker Panel

MU2B-40 Circuit Breaker Grouping

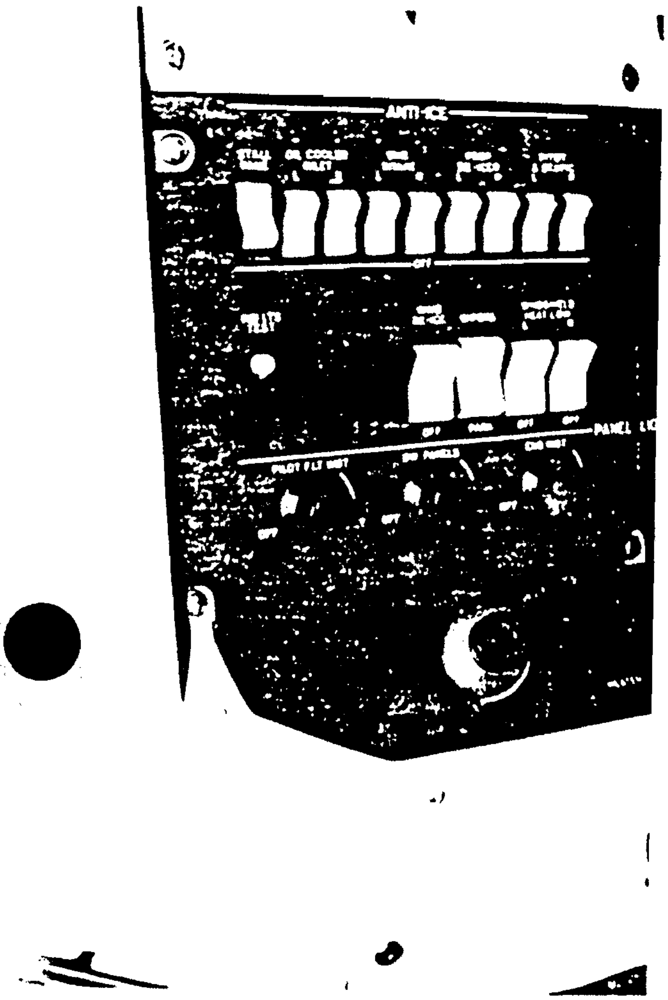


Forward Circuit Breaker Panel

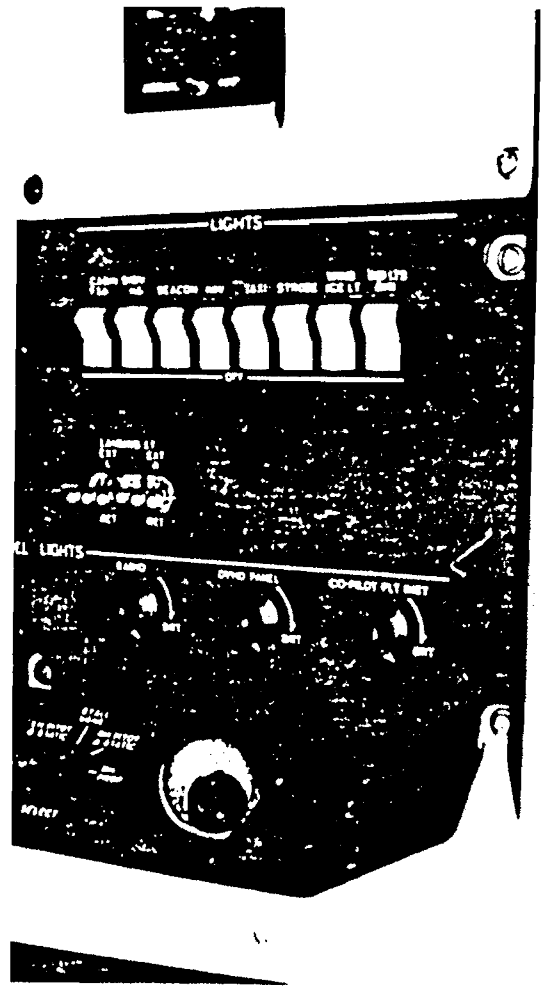


Rear Circuit Breaker Panel

MU2B-40 Overhead Switch Panel

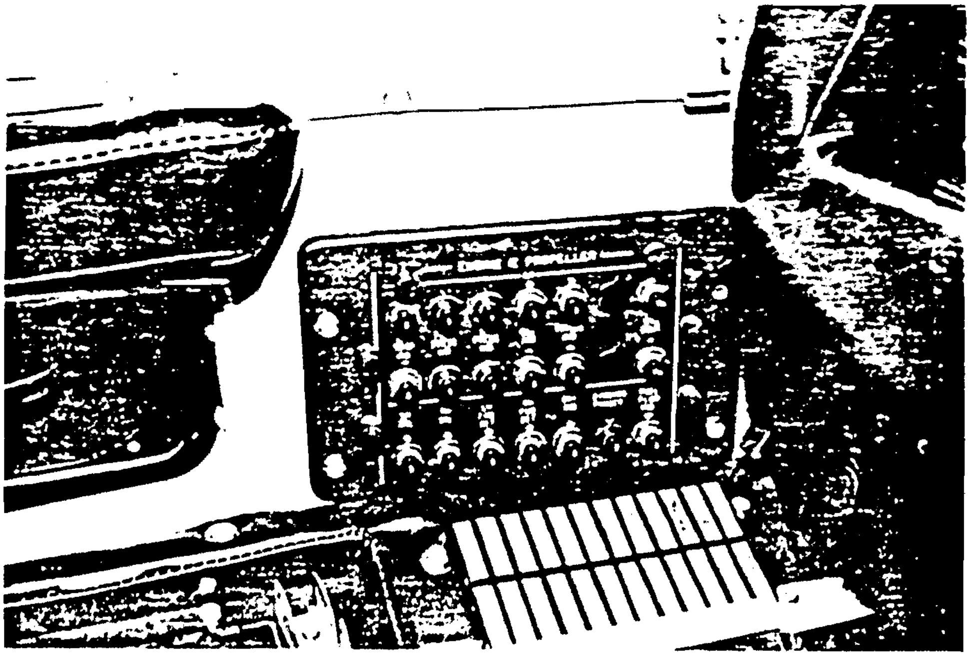


Anti-Ice Switch Panel

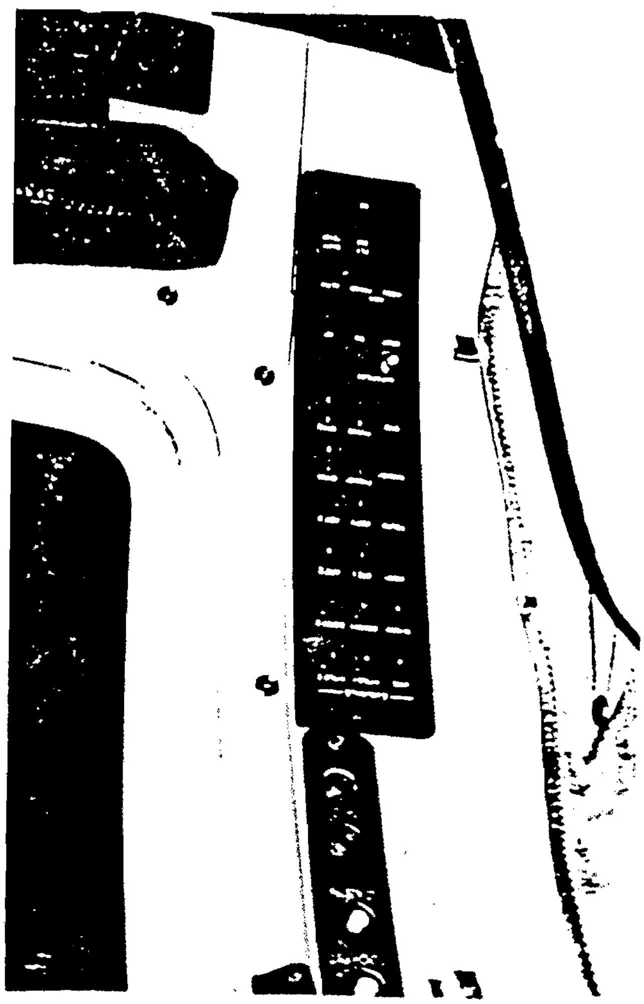


Lights Switch Panel

M22B-40 Circuit Breaker Grouping

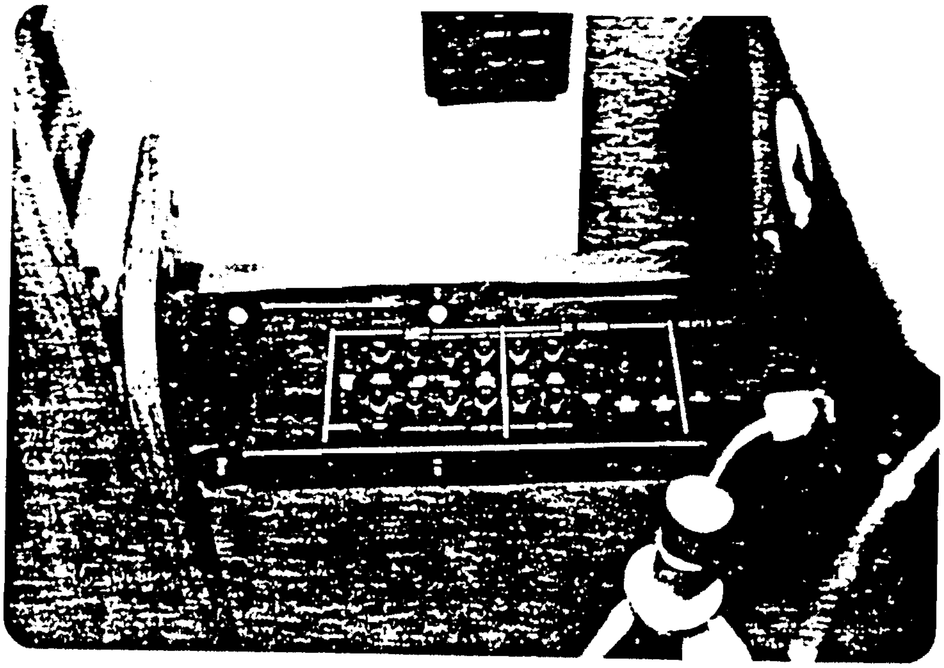


Engine & Propeller Circuit Breaker Panel

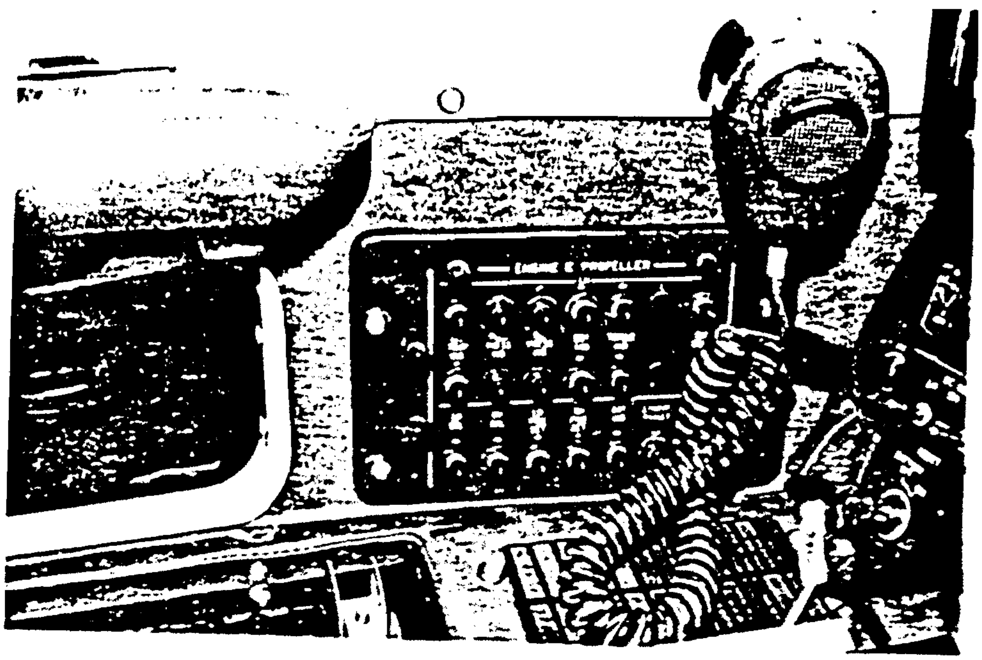


Avionics Circuit Breaker Panel

MC2B-60 Circuit Breaker Grouping

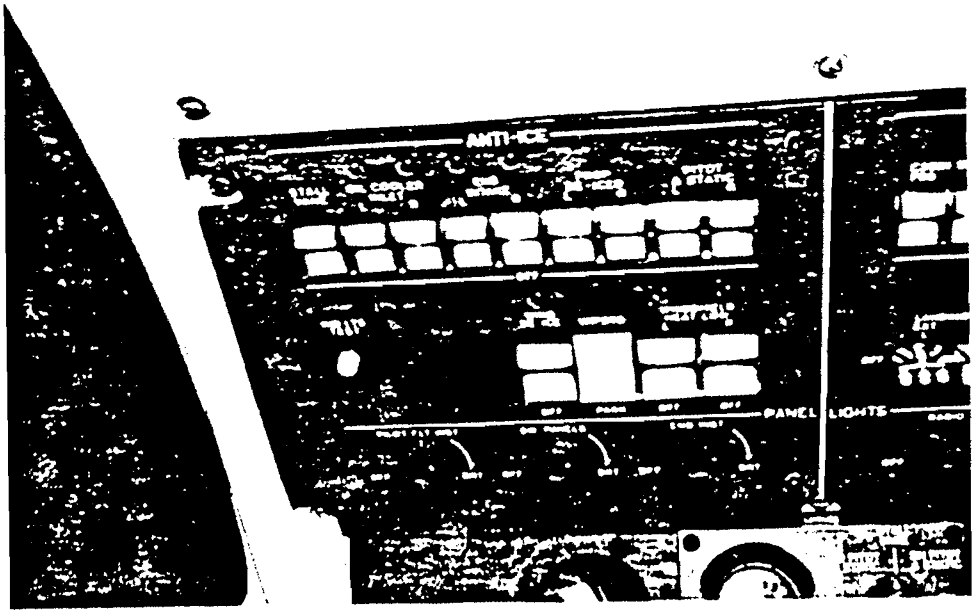


Rear Circuit Breaker Panel

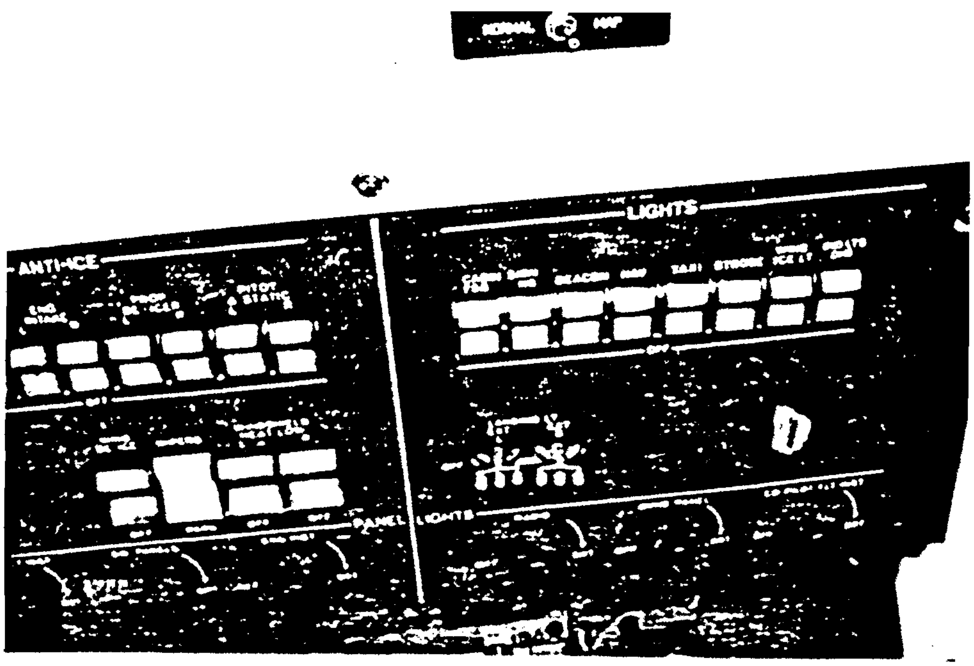


Engine & Propeller Circuit Breaker Panel

MU2B-60 Overhead Switch Panels

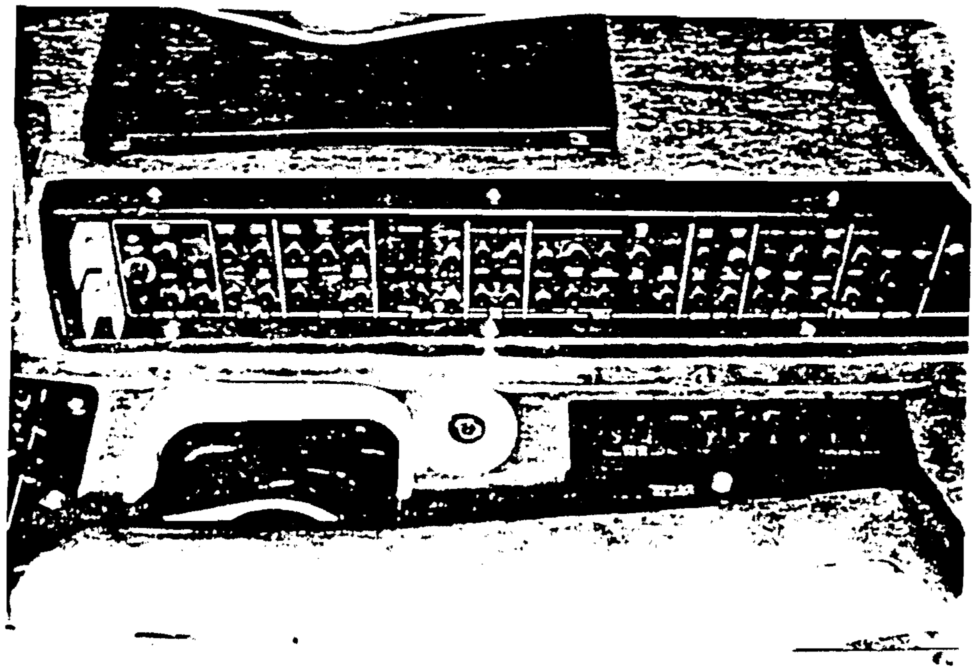


Anti-Ice Switch Panel

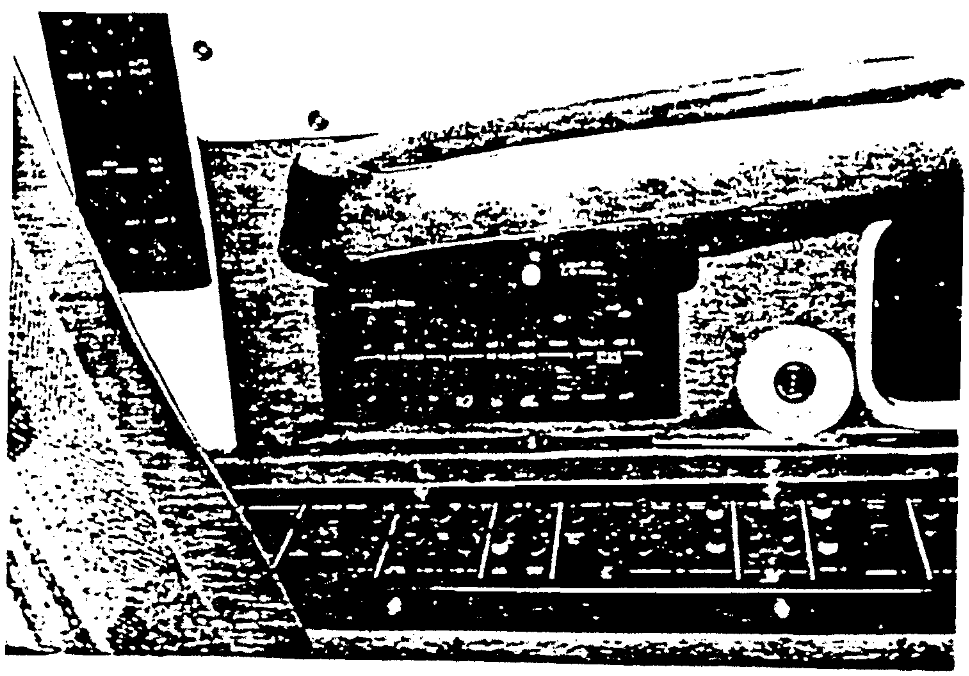


Lights Switch Panel

MU2B-60 Circuit Breaker Grouping

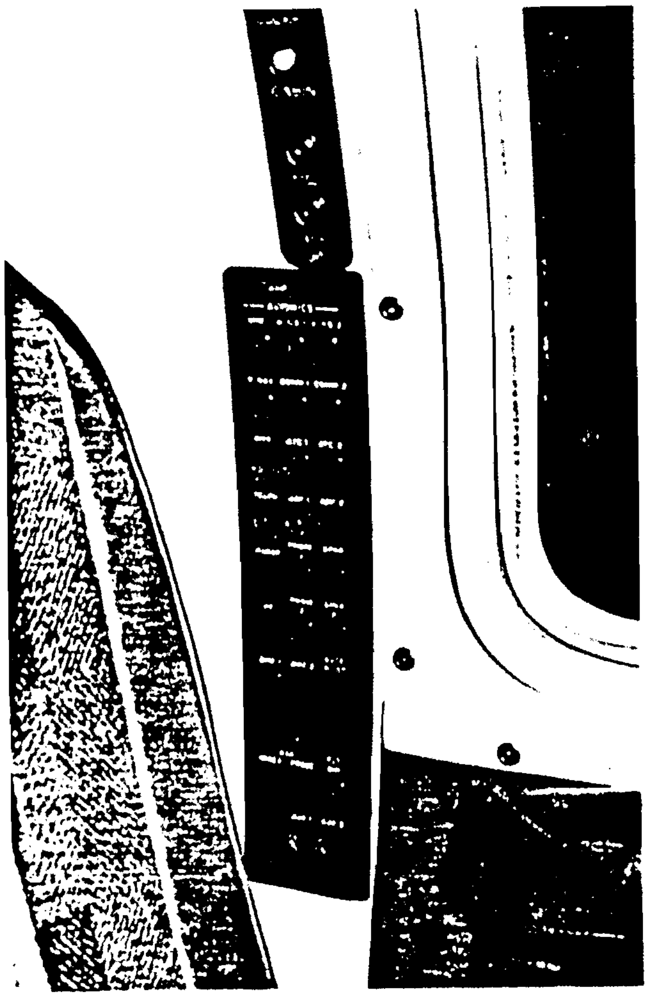


Forward Circuit Breaker Panel

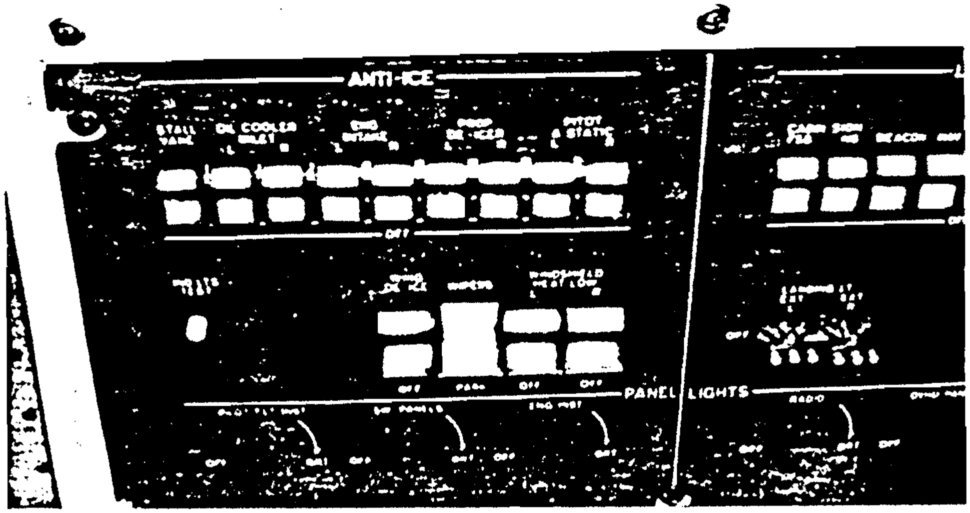


Center, AC Power Circuit Breaker Panels

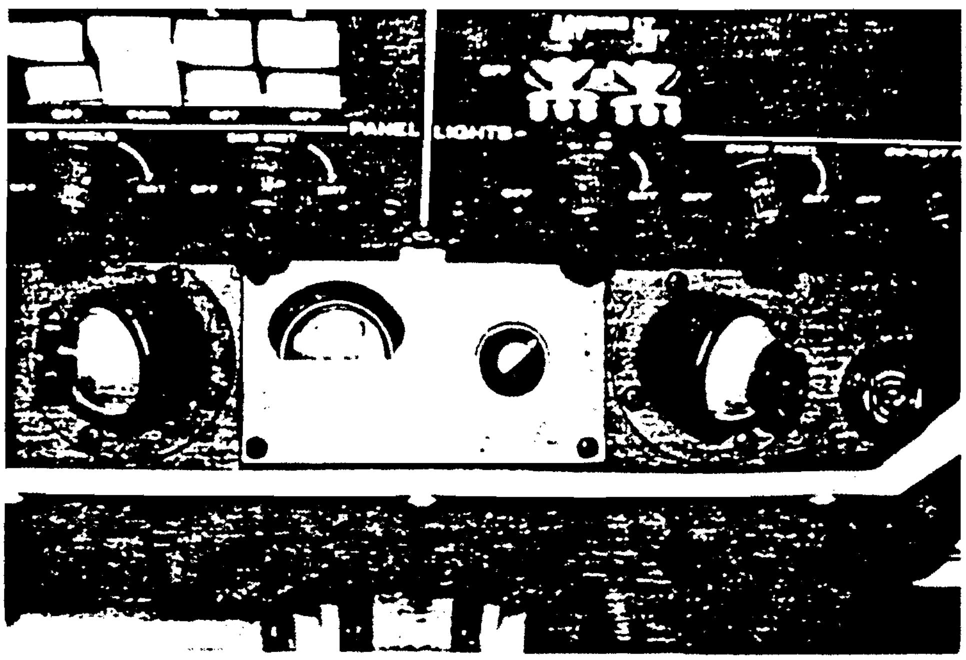
MU2B-60 Circuit Breaker Grouping



Avionics Circuit Breaker Panel



Anti-Ice Panel



De-Ice, Anti-Ice Monitor Panel

S-7 Recommendation No. 4

Recommendations:

In all Model MU-2's, review the DC electrical power load analysis and determine if the circuit protection for all distribution busses and auxiliary bus feeders is of the proper value to supply the required electrical voltage and current loads for the load on the busses.

Discussion

The electrical load analyses for the entire MU-2B fleet, with the exception of the -10, -15, and -20, which could not be made available as of this date, have been reviewed to verify that the power busses and distribution systems for these airplanes are adequate to safely supply the airplanes electrical loads. The standard interconnect wire used on these airplanes is MIL-W-5086 Type II and the wiring on sub-panels and inside boxes is equivalent to MIL-W-16878 Type B. The wire size and circuit breaker designs have been reviewed for all models to assure that the wire selected safely supplies the intended loads. We have no adverse service history to suspect its airworthiness.

Conclusion

The electrical power distribution system on the MU-2 fleet is considered airworthy and in compliance with the CAR 3.681, 3.690, and 3.692 regulations. No corrective action is planned in these areas.

S-8 Recommendation

Recommendation:

Location of the shutoff valve control in the cockpit would enhance the probability of having oxygen when needed in an emergency.

Discussion:

An oxygen system shutoff valve is located by the entrance door of the airplane. The flight manual presently contains instructions for the pilot to turn on oxygen and verify bottle contents prior to flight.

There are presently other airplanes certified where the oxygen supply valve is not accessible to the crew in flight. No inconsistency exists between the MU-2 oxygen system design and other certified aircraft designs.

Conclusion:

The existing MU-2 design of the oxygen shutoff valve, which is inaccessible to the pilot in flight, is in compliance with the applicable regulation, and there is no adverse service history indicating that a change to the design is warranted. Mitsubishi is voluntarily planning to change the flight manuals in order to amplify to the pilot that the oxygen valve should be turned on during preflight.

S-9 Recommendation

Recommendation:

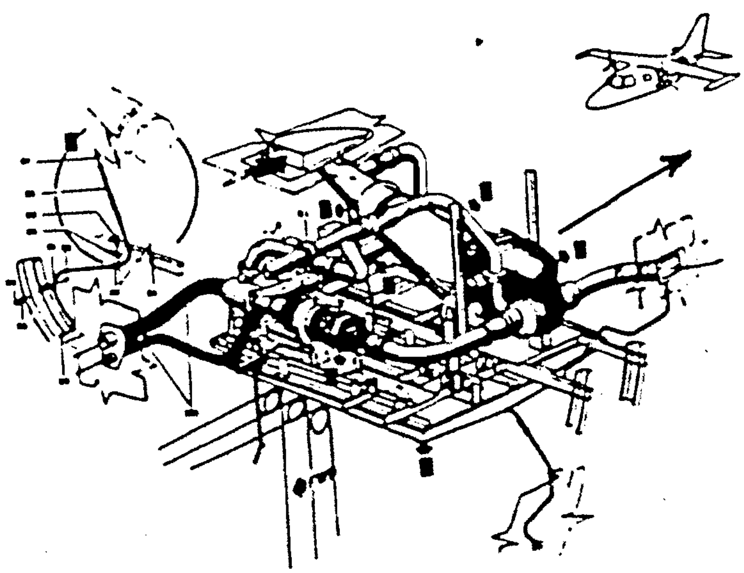
On all Model MU-2 airplanes, review the installation and service history of the environmental air cycle machines and determine if the containment of the high energy rotor is adequate to prevent damage to the adjacent control cables or other systems critical to safety of flight.

Discussion:

In over 2 million flight hours accumulated on MU-2 airplanes, there have been only four reported turbine burst failures on the air cycle machine. All four of the failures occurred on AiResearch cooling turbines.

The AiResearch cooling turbine is installed on 21.29 airplanes, Serial Number 4 through 263 for the short body airplanes and Serial Number 501 through 570 for the long body airplanes.

Three of the four failures resulted in pieces of the turbine damaging the aircraft skin, the fourth failure did no damage to the airplane. In all failures, damage to the airplane occurred quite some distance and in a direction opposite from components critical to safety of flight. Components critical to safety of flight are considered to be simultaneous failures of the elevator cable and elevator trim cable. Since the cables are well separated from each other and all previous failures have occurred in the direction opposite from the cables, there is little likelihood of a simultaneous failure due to uncontained rotor failure.



Direction of Failures

AiResearch Cooling Turbine Installation

Conclusion:

The certification basis of the MU-2 is CAR 3, 1956, and does not impose a rotor burst containment requirement. Part 23 does not require containment until 1977. In assessing the four failures in the 2 million plus hour service history of the airplane, no hazards were posed to the airplane, and we find that the turbine installation and its improbable failure is not critical to safety of flight.

Propulsion Team Recommendation

Recommendation:

All flight manuals should be reviewed and revised as necessary to require the pilot to perform a pre-takeoff negative torque systems (NTS) check prior to the first flight of each day.

Discussion:

This item is covered in the Airplane Flight Manual Change Recommendations.

Memorandum

U.S. Department of Transportation
Federal Aviation Administration

Subject: ACTION: Mitsubishi MU-2 Special Certification Review (SCR) Team Report

Date: MAR 29 1984

From: Barry D. Clements
Manager, Aircraft Certification Division, ACE-100

Reply to Attn. of: Arnold:ACE-106

To: Don Watson
Manager, Aircraft Certification Division, ASW-100

ATTN: ASW-150

Pursuant to the request of the National Transportation Safety Board on August 24, 1983, the Small Airplane Certification Directorate has conducted a limited Special Certification Review of the Mitsubishi Model MU-2B airplane. The review considered all MU-2B models certificated under Type Certificates A2PC and A10SW.

Attached is the report of the SCR Team, prepared as required by FAA Order 8110.4, and transmitted to you as the cognizant FAA Certificating Office.

Please review the attached report, particularly the conclusions and recommendations, and advise what actions will be taken to address each of the issues.

Attachment

#

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: ACTION: Mitsubishi MU-2 Special Certification Review (SCR) - Team Report

Date: MAR 28 1984

From: Charles E. Arnold
Team Chairman, MU-2 SCR Team

Reply to Attn. of: ACE-106:Arnold
8100-3; MU-2 SCR

To: Barry D. Clements
Manager, Aircraft Certification Division, ACE-100

This is in reply to your letter to me, dated September 14, 1983, which established the need for a Special Certification Review (SCR) of the Mitsubishi MU-2. You requested the preliminary team identify and outline the specific design and compliance areas to be reviewed and the organization of the full SCR team. The team organization and specific design and compliance areas were established by my memorandum to you dated September 26, 1983.

You also requested a report of the team's findings and specific recommended actions at the conclusion of the overall review. Attached is the team's report for your review and action as you deem appropriate.

Attachment

#

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Total Pages For Copying Purposes.......... 506

APPENDIX-C

SPECIAL CERTIFICATION REVIEW TEAM REPORT

Special Certification Review

of

Mitsubishi MU-2

Date: MAR 28 1984

I. Background

On August 24, 1983, the National Transportation Safety Board (NTSB) issued a Safety Recommendation, A-83-56, to the Federal Aviation Administration (FAA). Safety Recommendation A-83-56 cited certain Mitsubishi MU-2 accidents, because, "The puzzling circumstances of several of the accidents suggest that some of the causal circumstances may be design - related or design - induced." The NTSB further stated that, "In view of the continued involvement of the Mitsubishi MU-2 in fatal accidents involving engine failure or malfunction and sudden unexplained loss of control, the National Transportatin Safety Board recommends that the Federal Aviation Administration:

> Conduct a special certification review of Mitsubishi MU-2 airplanes relative to the engine, fuel system, autopilot, and flight control systems; flight in known icing condition; engine inoperative characteristics; and handling characteristics during IMC landing approaches; and take the appropriate action to corrct any deficiencies identified."

A copy of NTSB Safety Recommendation A-83-56 is enclosed as Appendix 1.

As a result of the NTSB recommendation, the FAA, consulted with the FAA certificating office, ASW-100, and Mitsubishi Aircraft International, Inc., and established a preliminary team to review the accident records of the MU-2 to determine the appropriate response to NTSB. The team was established by ACE-100 letter dated September 14, 1983. The preliminary team was requested to identify and outline the specific design and compliance areas to be reviewed and the organization and composition of the full team. The preliminary team reviewed all available accidents and statistical data and in a letter dated September 26, 1983, identified the following specific actions for the full SCR team:

1. Ask NTSB to provide the FAA the complete accident files for all accidents listed as "unknown cause."

2. Advise NTSB that the FAA wishes to be advised immediately of all MU-2 accidents and that the FAA will assign a technical assistance team to assist them in trying to determine the cause.

3. Advise NTSB that a Multiple Expert Opinion Team (MEOT) will be formed to evaluate pilot workload and cockpit arrangement to determine the need for the required crew, the need for pilot type rating, or any other pilot training or qualification processes. This evaluation will include handling qualities, single engine controllability, trimability, and pilot workload.

4. Advise NTSB that the FAA will conduct a design review of the fuel system, the landing gear warning system, the autopilot/trim

system, and icing protection to determine if system improvements are necessary.

The full SCR Team actions began with a briefing on October 12, 1983, for personnel from Mitsubishi Aircraft International, Inc. (MAI), Mitsubishi Heavy Industries, Ltd. (MHI), Japan Civil Aviation Bureau (JCAB), and FAA personnel from the cognizant Aircraft Certification Office, ASW-150. Team members were introduced and presented the team objectives and a proposed schedule. Mitsubishi agreed to fully support the proposed schedule and the team began with an orientation and overview of design details of the various models on October 24, 1983. Two airplanes were used for flight evaluations, an MU-2B-20(F) and an MU-2B-60 (Marquise). Both airplanes were given an inspection by FAA MIDO Inspectors to ensure they were in conformity with type design. Copies of the inspection records are enclosed in Appendix 6. Flight testing began with familiarization flights on October 27, 1983, and was completed on February 9, 1984. A total of 68.7 flight hours were flown during the SCR with 34.2 hours flown in the MU-2B-60 model and 34.5 hours flown in the MU-2B-20 model.

II. Certification Process of MU-2 Aircraft

The FAA certification of the Mitsubishi Model MU-2B was originally accomplished under the provisions of the Bilateral Airworthiness Agreement between the United States and Japan dated February 1, 1963. In accordance with Part 10 of the Civil Air Regulation (CAR), currently Section 21.29 of the Federal Aviation Regulations (FAR), FAA Type Certificate A2PC was issued for the MU-2B on November 4, 1965. The applicable regulations were cited as CAR Part 3 dated May 15, 1956, including Amendments 3-1 through 3-8, plus Special Conditions stated in FAA letter to JCAB dated May 14, 1965. The Special Conditions were later modified by FAA letters to JCAB, dated January 25, 1968 and May 12, 1971. The airplanes were shipped to the United States as completed airframe assemblies. Engines and other accessories were then added and the airplane test flown and released. Interior furnishings, additional avionics, and instruments were usually added after the airplane was released by Mitsubishi's U.S. representative, which was originally Mooney Aircraft Corporation. Mitsubishi Models MU-2B, MU-2B-10, -15, -20, -25, -26, -30, -35, and -36 were approved under the import criteria of Part 10 of the CAR.

On September 12, 1973, Mitsubishi Aircraft International, Inc. (MAI) submitted an application for type certification of the MU-2B under the provisions of Part 21.21 of the FAR. The effect of this process was to place control of the type design data with MAI at San Angelo, Texas, and to place direct responsibility for specific approval of type design, and changes thereto, with the FAA rather than through JCAB and bilateral agreements. Exemption Number 1951 was granted on February 4, 1974, to permit use of the same certificating regulations as were used for airplanes manufactured under Type Certificate A2PC. On January 20, 1976, FAA approval was granted for the MU-2B-25 and -35 models. Subsequent approval was granted for the -26, -26A, -36, -36A, -40, and -60 models as part of Type Certificate A10SW.

III. Summary of Accident History

The Special Certification Review Team began its activities by reviewing all available accident records maintained by FAA and NTSB. The majority of these data are only in summary form and consists of categorized data as established by the accident/incident investigating agency. In the SCR preliminary review, the SCR Team noted that six categories of accident classifications composed the reported accidents/incidents. These were:

A. Inadvertent gear-up landings (15%).

B. Fuel mismanagement causing engine flameout (10%).

C. Pilot mishandling of some form (53%).

D. Engine malfunction (7%).

E. Accidents of unknown cause.

F. Miscellaneous.

The combined accident and incident data file contained 183 reports as of September 12, 1983. Of the 183, 31 were discounted as being not related to aircraft design or germane to the certification process, leaving 152 for consideration by the team. Of the 152, the team selected 33 accidents where more information than that contained in the NTSB summaries was desired. The full reports were requested from the NTSB on September 27, 1983. The NTSB provided only 18 reports of the 33 requested. All accident reports were reviewed subjectively in conjunction with NTSB Safety Recommendation A-83-56 to establish the SCR Team tasks.

IV. <u>SCR Team Objectives</u>

The preliminary SCR Team met at the FAA Regional Headquarters at Fort Worth, Texas, on September 12 to 16, 1983. A preliminary review of the

MU-2 type design. NTSB accident summaries, FAA Accident/Incident Data System (AIDS) and statistical analysis provided by FAA National Safety Data Branch, AVN-120, was conducted. As a result of the preliminary team review, the team objectives as stated in Section I above were recommended to ACE-100 and approved. The preliminary SCR Team was augmented with additional engineering specialists. The list of the full SCR Team is included in Apendix 4. The team was further broken down into task discipline teams of Systems, Propulsion, Multiple Expert Opinion Team (MEOT), and Operations/Maintenance.

Each SCR Team objective was broken down into detailed requirements and these were defined in a memorandum to each team leader. Copies of these four memoranda are included in Appendix 5.

V. Findings

Each team leader was responsible for reviewing relevant accident data, service difficulty reports, type design data, and conducting the investigations and tests necessary to answer the questions presented in their task assignment memorandum. The individual team reports are enclosed in Appendices 7, 8, and 9. Consolidated conclusions and recommendataions are presented in Sections VI and VII below.

VI. Conclusions

A. Except for the items listed in "B" below, the status of which has not yet been determined, the SCR Team concludes there is no evidence of noncompliance with the certificating regulations established by the respective Type Certificates A2PC and A10SW or that an identifiable safety hazard exists.

B. The SCR Team concludes that although there is no evidence of noncompliance with certificating regulations or that an unsafe condition exists, there is sufficient evidence to warrant a more detailed review, analysis and tests of certain systems. These systems are:

1. Ice protection system.
2. Pitot and static system.
3. Electrical system.
4. Environmental system turbine.

C. Although full compliance with the certificating regulations and airworthiness standards have been shown, the SCR Team concludes that improvements in the following systems would possibly enhance the overall safety record of the airplane:

1. Elevator trim tab maintenance procedures.

2. Landing gear warning horn actuation at a power setting greater than the "throttle closed" position.

3. Locating the oxygen "on-off" control in the cockpit and readily accessible to the pilot.

4. Also conduct a review of all airplanes in service relative to:

   (a) Accessibility of alternate static source, MU-0039.

(b) Location of the autopilot/trim disconnect button to ensure it is on the outboard horn of the pilot's and copilot's control wheel.

(c) The labeling and location of the circuit breaker for the overhead deice/anti-ice panel.

(d) Location and power source of the pilot's turn-and-bank indicator.

D. The SCR team concludes that a minimum crew of one pilot, as required by the Airplane Flight Manual and as established under the provisions of Section 3.749 of the CAR, is adequate to safely operate the airplane.

E. The SCR team concludes that a type rating specifically for the MU-2 is not required.

F. The SCR team concludes that the existing flight manuals are adequate to show compliance with the certificating regulations. Certain revisions to the flight manual are requested where literal translations from Japanese to English make quick comprehension difficult. In addition, amplification of some normal and emergency procedures are requested to ensure more consistent understanding and application of information that is found in various other locations in the manual.

VII. Recommendations

A. It is recommended that the Regulations and Policy Office, ACE-110, review the detailed findings, conclusions, and recommendations of

Appendices 7, 8, and 9 to determine the need for regulatory review and updating of existing regulations.

B. It is recommended that the Aircraft Certification Office, ASW-150, review the findings, conclusions, and recommendations and establish a review process with a schedule for responding to each item. The following items should be reviewed and acted on as quickly as possible:

1. Recommendations of Systems, Item S3.
2. Recommendations of Systems, Item S5.
3. Recommendations of Systems, Item S7.
4. Recommendations of Systems, Item S9.

C. The following items should be reviewed and considered for the purpose of improving the overall safety record of the MU-2:

1. Elevator trim tab: amend Airworthiness Directives 77-04-07 and 77-13-19 for all MU-2s to require compliance with the current optional provisions defined in Paragraph (d) of AD 77-04-07 so as to reduce the potential for human error when using the current repetitive inspection and lubrication procedures.
2. Revise rigging procedures for the gear warning horn to provide an earlier warning more likely to cover all probable landing configurations.

3. Relocate the oxygen "on-off" control in the cockpit within easy reach of the pilot.

4. Conduct a review of all airplanes in service relative to:

   (a) Accessibility of the alternate static source for the MU-0039 system.

   (b) Location of the autopilot/trim disconnect switch to ensure it is located on the outboard horn of the pilot's and copilot's control wheel.

   (c) Determining the adequacy of the location and labeling of the circuit breaker for the overhead deice/anti-ice panel.

   (d) Determining the location of the turn-and-bank indicator to assure that the pilot's turn-and-bank is either air driven or has an acceptable emergency power source.

5. The following flight manual revisions, or additions, are recommended to enhance understanding and more consistent application of existing flight manual data:

   (a) Amplified emergency procedures for trim aileron malfunctions.

   (b) Ensure there is consistency in all manuals for the requirement to perform an NTS check prior to the first flight of each day.

(c) Revise emergency smoke evacuation procedures to delete opening the emergency exit in flight and to add opening of the outflow valve and use of ram air.

(d) Revise the flight manuals to assure there is consistency in procedures for use of fuel anti-icing additive.

(e) Revise the flight manual takeoff performance data to more accurately reflect common pilot techniques. Add takeoff procedures to reflect sequence and technique used to obtain takeoff performance data.

(f) Add emergency takeoff transition procedures to reflect performance and process of transitioning from required flaps-down takeoff to a flaps-up best-rate-of-climb speed.

(g) Add procedures for use of the windshield deicer system for those airplanes using liquid (ethylene-glycol) as a means of deicing the pilot's windshield.

Charles E. Arnold

Charles E. Arnold
SCR Team Chairman

Special Certification Review

Of

Mitsubishi MU-2

INDEX OF APPENDICES

Appendix 1

NTSB Safety Recommendation A-83-56

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: August 24, 1983

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-83-56

On March 24, 1983, a Mitsubishi airplane Model MU-2B-60, N72B, crashed near Jeffersonville, Georgia, killing all four persons aboard. The airplane, engaged in an air-taxi operation, disappeared from radar at an altitude of 18,000 feet shortly after the pilot had established initial contact with the Atlanta Air Route Traffic Control Center. Despite an intense and continuing investigation, the causal circumstances of the accident remain undetermined.

The Mitsubishi MU-2 twin-turboprop airplane has been involved in a series of fatal accidents in the past several years. These accidents, as indicated in the following summary for the period 1975 through 1983, relate primarily to (1) engine failure malfunction in various phases of flight; (2) uncontrolled collisions with the ground, often after rapid descent from relatively high altitudes; and (3) controlled collisions with the ground during cruise flight or instrument landing approaches. The puzzling circumstances of several of the accidents suggest that some of the causal circumstances may be design-related or design-induced.

Engine Failure/Malfunction

Several of the engine failure/malfunction accidents have involved flameout of one engine, while others have involved complete loss of power on both engines. The causes of some of these accidents are undetermined, while the causes of others involve fuel starvation, fuel exhaustion, and turbine or compressor rotor bearing failures. For example, on August 3, 1979, seven persons were killed in the engine failure/malfunction accident at Hays, Kansas, when the pilot of a Mitsubishi MU-2B attempted a go-around following a landing approach with an engine inoperative. (NTSB brief of accident, file 3-2769. 1/) Investigation disclosed that the forward compressor assembly rotor shaft bearing had failed. On November 22, 1981, the pilot of a Mitsubishi MU-2B was killed when he was forced to ditch the airplane following an engine failure/malfunction near Pago Pago, American Samoa (file 3-3415). The pilot radioed that he had experienced a complete loss of power on both engines and was unable to transfer fuel from the tip tanks to the main tanks. On September 13, 1982, at Hayden, Colorado, six persons aboard a

1/ NTSB file numbers are included for ordering purposes only.

MITSUBISHI MU-2 FATAL ACCIDENT SUMMARY
U.S. GENERAL AVIATION
1975 THROUGH 1983

DATE	LOCATION	TYPE OF ACCIDENT	PHASE OF FLIGHT	REMARKS
11/13/75	Jefferson City, TN	Engine Failure/Malfunction Stall	Landing: Traffic Pattern-Circling Landing	Engine Failure for undetermined reasons. Pilot diverted attention from operation of aircraft; operated engine controls improperly.
* 12/26/75	Nr. Rollinsville, CO	Controlled Collision With Ground	Normal Cruise	Continued VFR flight into adverse weather; high obstructions, low ceiling, snow.
2/8/76	Easton, MD	Engine Failure/Malfunction Stall/Spin	Landing-Final Approach Landing-Final Approach	Engine failure for undetermined reasons. Pilot diverted attention from operation of aircraft.
* 2/18/76	Argyle, NY	Stall	Landing-Initial Approach	Pilot not familiar with aircraft. Attempted operation beyond experience/ability level. IFR flight, icing conditions
1/7/77	Rochester, MN	Engine Failure/Malfunction Stall/Spin	Takeoff-Initial Climb Takeoff-Initial Climb	Engine failure for undetermined reasons. Improper flap position (full down). IFR flight, low ceiling, snow.
3/18/77	Nr. Austin, TX	Uncontrolled Collision With Ground	Uncontrolled Descent	Cause of accident undetermined.
* 4/5/77	Bronx, NY	Engine Failure/Malfunction Controlled Collision With Ground	Landing-Initial Approach Landing-Initial Approach	Fuel Exhaustion due to inadequate preflight planning. Erratic fuel quantity gauge. IFR flight, low ceiling, fog.

* Accidents not pertinent to the safety recommendation.

DATE	LOCATION	TYPE OF ACCIDENT	PHASE OF FLIGHT	REMARKS
* 8/25/78	Nr. Raton, New Mexico	Controlled Collision With Ground	Descending	Pilot's efficiency and judgement impaired by alcohol. Misjudged altitude and clearance.
8/28/78	Bedford, NH	Uncontrolled Collision With Ground	Uncontrolled Descent	Pilot diverted attention from operation of aircraft. Reported a compass problem.
* 6/18/79	New Orleans, LA	Propeller Struck Passenger	Static: Idling Engine(s)	Passenger impaired by alcohol
8/3/79	Hays, KS	Engine Failure/Malfunction Stall/Mush	Normal Cruise Landing-Go-Around	Engine failure due to failure of compressor assembly rotor shaft bearing
11/1/79	Nashville, TN	Undershoot Collided With Wires/Poles	Landing-Final Approach Landing-Final Approach	Inadequate supervision of copilot by pilot-in-command. Pilot fatigue. Ground fog.
11/26/79	Nr. Post Oak, TX	Uncontrolled Collision With Ground	Uncontrolled Descent	Pilot's efficiency and judgement impaired by alcohol and fatigue.
12/21/79	Provo, UT	Controlled Collision With Ground	Landing: Traffic Pattern-Circling	Improper preflight planning. Improper IFR operation (circling).
2/14/80	Nr. Houston, TX	Undershoot Collided With Trees	Landing-Final Approach Landing-Final Approach	Improper IFR operation. Incorrect altimeter setting. Wind shear, rain, fog, high obstructions, crashed during ILS approach about 5 miles behind Boeing 727.
2/23/80	New Orleans, LA	Controlled Collision With Water	Landing-Final Approach	Improper IFR operation, low ceiling, fog. Crashed 400 yards left of localizer, below glideslope.

DATE	LOCATION	TYPE OF ACCIDENT	PHASE OF FLIGHT	REMARKS
* 3/21/80	Cincinnati, OH	Propeller Struck Ground Crewman	Static: Starting Engines(s)	Line boy backed into rotating propeller
* 4/23/80	Henderson, NV	Stall/Spin	Landing: Traffic Pattern Circling	Pilot was attempting precautionary landing due to low fuel after initiating flight with known fuel system deficiencies.
12/6/80	Ramsey, MN	Uncontrolled Collision With Ground	Landing: Initial Approach	Pilot failed to maintain flying speed. Icing conditions present.
* 4/19/81	Lajitas, TX	Collided With Wires/Poles	Takeoff: Initial Climb	Pilot attempting downwind, upslope takeoff near maximum gross weight. Failed to use flaps. High density altitude.
4/23/81	Alpena, MI	Controlled Collision With Ground	Landing: Final Approach	Improper IFR operation. Crashed 1.6 miles short of runway during ILS approach. Low ceiling, rain, fog.
9/2/81	Nr. McLeod, TX	Stall/Spin	In-Flight: Other	Stall/Spin entered at about 21,000 feet. Airframe icing believed to be involved.
9/6/81	Nr. Riverton, WY	Uncontrolled Collision With Ground	In-Flight: Climb to Cruise	Pilot lost control while climbing through about 15,000 feet. Airframe icing believed to be involved.
11/5/81	Saratoga, WY	Uncontrolled Collision With Ground	Takeoff: Initial Climb	Cause of accident undetermined. Airplane crashed in a descending right turn shortly after takeoff.

DATE	LOCATION	TYPE OF ACCIDENT	PHASE OF FLIGHT	REMARKS
11/18/81	Nr. Eagle, CO	Controlled Collision With Ground	Decending	Improper IFR operating. Dark night with overcast ceiling.
11/19/81	Nr. Jacksonville, FL	Uncontrolled Collision With Water	Uncontrolled Descent	Cause of accident undetermined.
11/22/81	Nr. Pago Pago, American Samoa	Engine Failure/Malfunction Ditching	Normal Cruise Landing: Level off/Touchdown	Fuel starvation for undetermined reasons. Pilot stated he was unable to transfer fuel from tip tanks to main tanks.
* 4/20/82	La Fayette, GA	Controlled Collision With Ground	Normal Cruise	Pilot continued VFR flight into known adverse weather (haze, low ceiling) and crashed in mountainous/hilly terrain.
9/12/82	Hayden, CO	Engine Failure/Malfunction	Takeoff: Initial Climb	Following left engine failure, airplane rolled left and crashed. Rear turbine rotor shaft bearing improperly installed.
1/27/83	Scottsdale, AZ	Controlled Collision With Ground	VFR Approach-Base Turn	Attempting a night visual approach. Struck ground during descent about 2 miles from the runway. Rough, rainy weather
3/24/83	Jeffersonville, GA	Uncontrolled Collision With Ground	Normal Cruise	Airplane disappeared from radar at 18,000 feet shortly after pilot contact with Atlanta ARTC Center. Both wings, left engine and propeller, and empennage, separated in-flight.

Mitsubishi MU-2-25K were killed immediately after takeoff as a result of a failure/malfunction of the left engine. The airplane rolled to the left and crashed into the ground in a nosedown, inverted attitude. Investigation disclosed that the rear turbine rotor shaft bearing had been improperly installed. The causes of the engine failure/malfunction occurrences (see summary) at Jefferson City, Tennessee, on November 13, 1975 (file 3-4157); at Easton, Maryland, on February 8, 1976 (file 3-0685); and at Rochester, Minnesota, on January 7, 1977 (file 3-1406), remain undetermined.

The continued occurrence of these types of accidents, the Safety Board believes, warrants a certification review of the MU-2 engines, fuel system, and engine inoperative characteristics to determine whether the potential exists for any system design improvements; improved maintenance procedures; improved service or repair instructions; or changes in operational procedures relative to preflight inspection, engine inoperative procedures, or the in-flight management, expenditure, and transfer of fuel from the several fuel tanks aboard the airplane.

Uncontrolled Collisions With Ground/Water

In addition to the accident at Jeffersonville, Georgia, other uncontrolled collisions with the ground/water involving the MU-2 (see summary) include fatal accidents near Jacksonville, Florida, on November 19, 1981 (file 3-3605); at Saratoga, Wyoming, on November 5, 1981 (file 3-3668); at McLeod, Texas, on September 9, 1981 (file 3-3593); at Riverton, Wyoming, on September 6, 1981 (file 3-3667); at Ramsey, Minnesota, on December 6, 1980 (file 3-3798); at Bedford, New Hampshire, on August 28, 1978 (file 3-4348); and near Austin, Texas, on March 18, 1977 (file 3-0563).

The MU-2 which crashed near Jacksonville, Florida, had been operating normally in clear skies at approximately 12,000 feet just before plunging into the ocean. The MU-2 which crashed at Saratoga, Wyoming, rolled suddenly and dove to the ground immediately after takeoff. The MU-2 which crashed at Austin, Texas, was being flown by a Mitsubishi Aircraft International corporate-executive pilot and was observed to dive to the ground from an altitude of several thousand feet. The causes of these accidents, as well as the accident at Jeffersonville, Georgia, remain undetermined.

Airframe icing is believed to have contributed to the accidents at McLeod, Riverton, and Ramsey. In the McLeod accident, the airplane entered a stall/spin at 21,000 feet from which the pilot did not or could not recover. In the Riverton accident, the pilot lost control of the airplane while climbing through approximately 15,000 feet. Although the pneumatic deicer boots were known to be leaking, the airplane's encounter with ice would have lasted only a minute or two. At Ramsey, the pilot lost control of the airplane during the initial landing approach after a loss of flying speed for undetermined reasons. These accidents indicate the possibility that ice accumulation on the MU-2 airframe may be unusually critical to the airplane's performance. This characteristic may relate to the unusually high wing loading of the Mitsubishi MU-2 and the use of spoilers for lateral control, in relation to comparable airplanes that have lower wing loadings and use ailerons for lateral control. As a result, the Safety Board believes that a review of the airplane's icing certification should be conducted.

Controlled Collisions with Ground/Water

Controlled collisions with the ground/water involving the MU-2 included occurrences near Eagle, Colorado, on November 18, 1981 (file 3-3612); at Alpena, Michigan, on April 23, 1981 (file 3-1907); at New Orleans, Louisiana, on February 23, 1980 (file 3-0168); at Provo, Utah, on December 21, 1979 (file 3-3693); and several others as indicated in the accident summary. All of the aforementioned accidents occurred during the landing or landing approach phase of flight in instrument meteorological conditions (IMC) where precise trim, altitude, glidepath, speed, and directional control are critical. A pilot's workload under these conditions, or the ease with which he can control these factors, is strongly influenced by the airplane's handling characteristics in the landing configuration. Consequently, because of continued involvement of the MU-2 in the above types of accidents, the Safety Board believes that such handling characteristics should also be evaluated as an important, integral part of an MU-2 certification review program.

In view of the continued involvement of the Mitsubishi MU-2 in fatal accidents involving engine failure or malfunction and sudden unexplained loss of control, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Conduct a special certification review of Mitsubishi MU-2 airplanes relative to the engines, fuel system, autopilot, and flight control systems; flight in known icing conditions; engine inoperative characteristics; and handling characteristics during IMC landing approaches; and take the appropriate action to correct any deficiencies identified. (Class II, Priority Action) (A-83-56)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS and ENGEN, Members, concurred in this recommendation. BURSLEY, Member, did not participate.

Jim Burnett

By: Jim Burnett
Chairman

Appendix 2

FAA Letter, ACE-100, September 14, 1983

US Department of Transportation

Federal Aviation Administration

Memorandum

Subject: ACTION: Mitsubishi MU-2 Series Special Certification Review (SCR)

Date: SEP 14 1983

From: Barry D. Clements
Manager, Aircraft Certification Division, ACE-100

Reply to Attn of: Jake:X6937

To: Charles Arnold, ACE-106
THRU: Robert Stephens, ACE-105

As a result of questions raised about the MU-2 service history and accident history by ASW-100 during the past months, and NTSB Recommendation A-83-56, it is deemed appropriate for the FAA to review selected portions of the MU-2 design and the type certification programs that resulted in Type Certificates A2PC and A10SW. This will be accomplished via a Special Certification Review in accordance with Order 8110.4.

You are designated Team Leader for this SCR, and Billy Parker, ASW-150; Larry Malir, ACE-107; and Chuck Stauffer, ACE-270, have been named team members for the initial data gathering and preliminary review phase of the SCR. Upon completion of that phase, by approximately September 23, 1983, please identify to me those additional SCR team specialists for the necessary detailed review. It is also the responsibility of this initial team to identify and outline the specific design and compliance areas to be reviewed and the manner in which the team will be organized and is to function.

The team shall prepare a report of its findings with specific recommended actions at the conclusion of the overall review.

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105-3-786

Appendix 3

FAA Letter, SCR Team Chairman to ACE-100
September 26, 1983

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: ACTION: MU-2 Special Certification Review (SCR) Preliminary Review Report

Date: SEP 26 1983

From: Charles E. Arnold
Team Leader, MU-2 SCR Team

Reply to Attn. of:

To: Barry D. Clements
Manager, Aircraft Certification Division, ACE-100
Thru: Manager, Standardization & Evaluation Group, ACE-105

In response to your memorandum dated September 14, 1983, establishing the preliminary SCR Team and the objectives, this is to advise of the Team's preliminary findings and recommendations for further action.

On September 12, 1983, the preliminary Team met with ASW-100 personnel to make a limited review of the aircraft design and the certification process. A thorough analysis of the accident summaries provided by NTSB, the FAA Accident/Incident Data System (AIDS) and reports and analyses provided by the National Safety Data Branch, AVN-120, was conducted.

The Team found four major areas producing a significant portion of the accidents. These are: 1) inadvertent gear-up landings (15%); 2) fuel mismanagement causing engine flameout (10%); 3) pilot mishandling in situations where he would be expected to be able to manage the aircraft (53%); and 4) accidents of unknown causes.

A conference was held with ASW-100 personnel on Friday morning, September 16, 1983, to apprise them of the Team's findings and to seek their input into probable causes and/or courses of action. Subsequent to the meeting with ASW-100 personnel, the Team prepared a list of possible recommendations/courses of action. This list is attached as an enclosure.

In consideration of all factors, there still remains many unanswered questions regarding the acknowledged high rate of accidents with the MU-2 series of aircraft. There is also the serious concern that NTSB, Mitsubishi, and FAA has expressed about the number of catastrophic accidents with no established cause. It is the Team's conclusions that these factors can only be properly addressed by a full SCR evaluation of each questionable area to seek ways of improving the accident record and resolve design problems shown to be unsafe on the basis of service history.

The preliminary SCR Team makes the following recommendations:

1. Ask NTSB to provide us the complete accident files for all accidents listed as "unknown cause".

2. Advise NTSB that we wish to be advised immediately of all MU-2 accidents and that we will assign a technical assistance team to assist them in trying to determine the cause.

3. Advise NTSB that we will form a Multiple Expert Opinion Team (MEOT) to evaluate pilot workload and cockpit arrangement to determine the need for the required crew, the need for pilot type rating, or any other pilot training or qualification processes. This evaluation will include handling qualities, single engine controllability, trimability, and pilot workload.

4. Advise NTSB that we will conduct a design review of the fuel system, the landing gear warning system, the autopilot/trim system, and icing protection to determine if system improvements are necessary.

The full SCR Team complement has not yet been established, but will consist of augmentation of the existing team leaders in systems, propulsion, operations/maintenance, and a MEOT that we recommend become a standing team to evaluate all subsequent FAR 23 and SFAR 41 airplanes when crew complement is at issue. Approval of team augmentation will be requested by separate memorandum when members can be determined.

Attachment

#

Appendix 4

List of SCR Team Members

MU-2 SCR Team Members

1. Charles E. Arnold, FAA, ACE-106, Team Leader (Chairman)

2. Larry D. Malir, FAA, ACE-107, Systems Team Leader

   Donald E. Gonder, FAA, ANM-120S, Flight Control Systems

   Don Michal, FAA, ACE-130C, Electrical/Electronic

3. James S. Kishi, FAA, ACE-106, MEOT Team Leader

   George H. Meyers, FAA, ANM-170D, Test Pilot, Member

   David A. Robinson, FAA, ACE-270, Operational Pilot, Aircraft Evaluation Group Specialist

   Edward M. Boothe, FAA, ASO-205, Handling Qualities and Simulator Specialist

4. Bill Parker, FAA, ASW-150, Propulsion Specialist

   William Moring, FAA, ANM-174W, Propulsion Consultant

5. Charles R. Stauffer, FAA, ACE-270, Operational/Maintenance Specialist

6. Joseph Traybar, FAA, ACT-330, FAA Technical Center, Handling Qualities Consultant

7. Richard Adams, FAA, ACT-300N, National Resource Specialist, Flight Environmental Icing, Consultant

Revised: 10-20-83

Appendix 5

Memoranda, SCR Specific Task Assignments

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: Special Certification Review Team Specific Task assignment

Date: October 27, 1983

From: Charles E. Arnold
SCR Team Chairman

Reply to Attn. of: C. Arnold, ACE-106

To: Larry D. Malir
SCR Systems Team Leader

In accordance with the objectives established by ACE-100 letter dated Sept. 14, 1983, and my letter to ACE-100 dated Sept. 26, 1983, your team is requested to review the design details of the various models of the MU-2 aircraft to verify compliance with the certification basis of the airplane and to determine there are no unsafe features revealed by service history.

The following specific questions should be addressed:

1. Is the fuel system design adequate?

    a. Is the fuel feed design adequate?

    b. Is the unusable fuel quantity adequate?

    c. Is the fuel gauging system adequate to insure the pilot can adequately determine fuel status.
    d. Can malfunctions occur which would not be detectable by the crew under normal circumstances? If so, would these malfunctions compromise the ability to safely complete a flight once committed to flight?
    e. Are there changes required that are essential to safety of flight?
    f. Are there any recommended changes that could help improve the accident/incident record?

2. Is the landing gear warning system adequate?

    a. Is the design adequate?
    b. Does it perform its intended function?
    c. Are there changes required that are essential to safety of flight?
    d. Are there any recommended changes that could help improve the accident/incident record?

3. Is the autopilot/trim system adequate?

    a. Were the certification malfunction tests adequate?

b. Is the disconnect system adequate considering the malfunction tests?
c. Is failure identification/annunciation adequate?
d. Is the fault/failure analyses adequate?
e. Is the autopilot-trim interface and malfunction test adequate?

4. Is the manual trim system adequate?

   a. Is the indicator system adequate?
   b. Have mistrim considerations been adequately accounted for?
   c. Is the failure mode analyses/documentation adequate?

5. Are the cockpit controls, switches and displays adequate?

   a. Are the essential circuit breakers located within easy reach of the pilot?
   b. Are the essential switches located within easy reach, properly labeled, and oriented for proper sense of motion?
   c. Is the lighting of all switches, controls and instruments adequate?
   d. Are the circuit breakers of proper capacity and appropriate to the system protected?

6. Are the primary and secondary flight controls adequate?

   a. Is the flutter substantiation adequate?
   b. Is the design adequate to prevent jamming, binding or other obstructions that would inhibit safe flight?
   c. Are the design loads adequate?

7. Is there evidence of inadequate ice protection?

8. Define any other systems or features which service history indicates may present unsafe flight characteristics.

Please provide your team responses to these questions through review of the type design data, review of accident reports, special tests and flight demonstrations as necessary. If you need flight demonstrations to satisfactorily answer these questions, please submit the type of tests, type of aircraft and any special techniques necessary to obtain the test objectives as soon as possible.

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: Special Certification Review Team Specific Task Assignment

Date: October 27, 1983

From: Charles E. Arnold
SCR Team Chairman

Reply to Attn of: C. Arnold, ACE-106

To: Bill Parker
SCR Propulsion Team Leader

In accordance with the objectives established by ACE-100 letter dated Sept. 14, 1983, and my letter to ACE-100 dated Sept. 26, 1983, your team is requested to review the design details of the various MU-2 models to verify compliance with the certification basis of the airplane and to determine there are no unsafe features revealed by service history.

You are requested to review the following specific design areas:

1. Engines.
2. Propellors.
3. Fuel System.
4. Engine inoperative charateristics.
5. Define any other propulsion related systems or features which service history indicates may present unsafe flight characteristics.

Please provide your team responses to these items relative to recommended required design changes, limitations or operating procedures. Also provide any recommended improvements that would enhance the overall safety of the airplanes. If you need special flight tests or demonstrations to satisfactorily answer this memorandum, please submit the type of tests, type of aircraft and any special techniques necessary to obtain the test objectives to me as soon as possible.

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: Special Certification Review Team Specific Flight Task Assignment

Date: December 2, 1983

From: Charles E. Arnold
SCR Team Chairman

Reply to Attn. of: C. Arnold, ACE-106

To: Jim Kishi
MEOT Leader

In reference to my memorandum to you dated November 4, 1983, please delete engineering test item 1C for Bendix M4C autopilot/trim runaway tests.

After issuing my memorandum, MAI conducted a detailed analysis of the autopilot/trim malfunction possibilities. Their analysis, dated November 4, 1983 was reviewed by Mr. Larry Malir, SCR Systems Team Leader, and he concurs with MAI that a dual failure would be required and the likelyhood of an undetectable combined trim/autopilot fault is extremely improbable. Therefore, the need for this test is deleted.

US Department of Transportation
Federal Aviation Administration

Memorandum

Subject: Special Certification Review Team Specific Flight Task Assignment

Date: Nov. 04, 1983

From: Charles E. Arnold
SCR Team Chairman

Reply to Attn. of: C. Arnold, ACE-106

To: Jim Kishi
MEOT Leader

In accordance with the objective established by ACE-100 letter dated September 14, 1983, and my letter to ACE-100 dated September 26, 1983, your team is requested to review the design details and flight characteristics of the various MU-2 models to verify compliance with the certification basis of the airplane and to determine there are no unsafe features revealed by service history.

There are two models being made available by Mitsubishi Aircraft International, Inc.; an MU-2B-20 (F) and an MU-2B-60 (Marquise). These aircraft are representative of the two basic design styles and should be adequate for all flight characteristics by scheduling power and weight as appropriate for the design under consideration. It may be necessary to use other means to review appropriate cockpit design suitability. Tests may be limited to one model where criticality can be ascertained.

This memorandum defines two categories of tests to be conducted by your team; 1) engineering tests, and 2) Multiple Expert Opinion Team tests. For the engineering evaluations, you may use any appropriate process normally acceptable to FAA to make engineering findings. For the MEOT evaluations, you should use the full team to establish a consensus report.

You are requested to make specific evaluations and findings relative to the following items:

1. Engineering Evaluation:

   a) With the MU-2B-20, determine that the airplane is safely controllable under VFR and IFR conditions if all D.C. electrical power is lost.

   b) On the MU-2B-20, simulate loss of primary pitot static source by putting tape over the primary static port. Determine that the pilot can detect the malfunction and select the alternate source without hazard to safe operation.

   c) Using the most critical airplane model and the Bendix M4C autopilot, conduct the following malfunction tests:

Perform nose up and nose down elevator trim runaway tests. The tests are to be conducted with and without the autopilot connected. The tests should be conducted for the most critical conditions of speed, altitude, C.G., and approach configurations. Tests should be conducted in progressive increments of time delays until clear and distinct pilot recognition cues are indicated plus one second before disconnect. If a quick disconnect is not installed, procedures and time delays as prescribed in FAA Order 8110.7 are to be used. The airplane must be fully controllable without hazardous conditions as outlined by Advisory Circular AC 23.1329-1.

NOTE: All trim and autopilot malfunction tests are to be conducted with maximum torque settings on the servo clutches.

d) Conduct trim aileron runaway tests. The tests are to be conducted with and without the autopilot connected. The tests are to be conducted at the most critical airspeed and altitude. Tests should be conducted in increments of time delays until clear and distinct pilot recognition cues are indicated. Time delays will be those specified in FAA Order 8110.7, Change 5, and Change 12, pertaining to a disconnect switch. Because the trim-aileron select switch does not interrupt all movement of the trim-aileron, a total of four seconds should be used for disconnect after pilot recognition. This is the three seconds specified in Change 5, item 52 e and amended by Change 12, item 52 B. When conducting trim-aileron runaway tests with the autopilot connected, determine if satisfactory cues are available to ensure pilot recognition. If not, the trim runaway should be continued until recognition is assured.

e) Verify that the airplane can be safely controlled to a zero rate of descent by use of elevator trim and power only. Reference CAR 3.109 e.

f) Determine that if an elevator or rudder trim tab fails in the most adverse condition expected in flight that the airplane can be safely controlled and landed using any normally available flight control or power.

g) Verify that the established V_{MO} is satisfactory for compliance with Special Conditions, Flight Item 12. The need for an overspeed warning device and a yaw damper will be evaluated in accordance with special test criteria issued by ACE-110 letter dated Jan. 04, 1983. Insure that adequate safety and emergency egress capability is established and that adequate propeller oil pressure monitoring and airspeed calibration is established. The airplane considered most critical should be used.

h) Determine if a potential safety hazzard exists with the propeller start locks engaged. It should be determined if it would be possible to make a takeoff if improper cockpit procedure was used. Are the warning cues adequate to ensure the pilot would not make a takeoff with the start locks still engaged?

i) Using the airplane determined most critical, conduct evaluations with simulated ice shapes or natural residual ice on unprotected areas to ascertain that the airplane is safely controllable. Particular attention should be given to climb and approach speed schedules.

j) Using the MU-2B-20 aircraft, conduct flights in natural icing conditions to evaluate suitability of all icing protection systems under all normal conditions of flight; i.e., climb cruise, descent and approach. If possible, have a chase ship to obtain photographic coverage after exit from the icing cloud. If conditions permit, determine that stall warning margins are adequate and that stall warning is clear and distinct.

2. Multiple Expert Opinion Team Evaluations:

a) Determine if the fuel system operation and annunciation is adequate for operation as a sinle pilot airplane. Specific attention should be given to the location of gauges, annunciation and switches. Consider normal operation and the pilot's capability to ascertain fuel status, consumption and to detect faults in the process.

b) Determine if the landing gear warning system is adequate to assure the landing gear is down under all probable conditions of landing. The warning system is to be rigged in accordance with design specifications and the maintenance manual.

c) Determine if the landing gear position indicators are adequate to perform their intended functions for the average range of pilot sizes and under all probable conditions of flight.

d) Using the MU-2B-20 airplane, operate all anti-ice functions and evaluate pilot workload and capability of ascertaining status and proper functioning of all systems. Consider normal functioning annunciators and fault/failure annunciation.

e) Using both models of aircraft, determine if the airplane is safely controllable by a single pilot under all flight conditions normally expected in operation. Ensure that an evaluation is made in natural turbulence of at least moderate intensity. Particular attention should be given to yaw damping and dutch-roll characteristics. Particular attention should be given to speed schedules for takeoff, climb, and approach.

f) Determine the adequacy of the takeoff speed schedules and climb transition for both normal and emergency conditions. They are to be evaluated for a single pilot using average skill.

g) Determine the adequacy of the approach and landing procedures and speed schedules for both normal and emergency conditions. They are to be evaluated for a single pilot using average skill.

h) Using both models of aircraft, verify that CAR 3.109 (b) (6) can be accomplished with control forces appropriate to type and not exceeding maximum values or conditions of CAR 3.106.

i) Determine that stall warning is "clear and distinctive" under the following conditions at aft C.G.:

(1) All stall profiles - stright and climbing.

(2) Single engine stalls.

(3) With autopilot "on".

j) Determine that the airplane can be safely flown under instrument conditions using partial (emergency) panel instruments.

k) Determine crew workload under all probable conditions of flight for which the airplane is approved. Determine if a single pilot, non-type rated, and of average skill level is adequate to perform all required tasks in a safe manner. If not, determine what the minimum crew complement should be. Use the appropriate portions of FAR 25, Appendix D as guidelines for making recommendations for minimum crew complement.

l) Determine the minimum skill and knowledge requirements necessary to be demonstrated by the recommended minimum crew. Consider the minimum requirements of FAR 61.5, 61.57, 61.63, and Subparts D and E.

m) Conduct a cockpit evaluation of all models, either by hardware or design review, to determine the following:

(1) Adequacy of all emergency controls.

(2) Adequacy of all primary and secondary controls and switches.

(3) Adequacy of circuit breakers of fuses "essential to safe operation".

(4) Adequacy of caution, warning and advisory lights to include the master caution light.

n) Determine the adequacy of all flight manuals for appropriate limitations procedures, and performance. Consider the interface of pilot knowledge and skill requirements to be determined in item "l", above.

o) In conjunction with Mr. C. Stauffer, determine the adequacy of the total information system to include flight manuals, maintenance manuals, training manuals and service bulletins.

3. Define any other tests or evaluations considered essential to safety of flight.

Appendix 6

Conformity Inspection Records

Form Approved: OMB No. 04-R0

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STATEMENT OF CONFORMITY

SECTION I – AIRCRAFT

1. MAKE MITSUBISHI	2. MODEL MU-2B-60
3. SERIAL NO. 1560 S.A.	4. REGISTRATION NO. N486MA

SECTION II – ENGINE

1. MAKE	2. MODEL
3. SERIAL NO.	

SECTION III – PROPELLER

1. MAKE	2. HUB MODEL
3. BLADE MODEL	4. HUB SERIAL NO.
5. BLADE SERIAL NOS.	

SECTION IV – CERTIFICATION

I hereby certify that:

[X] A. I have complied with Section 21.33(a).

[X] B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on 7-16-82 (Date).

[ ] C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.

[ ] D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operational check on ________ (Date).

Deviations:

SIGNATURE OF CERTIFIER JOHN M. COAR	TITLE Manager, Quality Assurance Inspection
ORGANIZATION Mitsubishi Aircraft International, Inc.	DATE 7-19-82

FAA Form 8130-9 (2-74) FORMERLY FAA FORM 317

Form Approved
Budget Bureau No. 04-R00[illegible]

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

APPLICATION FOR AIRWORTHINESS CERTIFICATE

INSTRUCTIONS—Print or type. Do not write in shaded areas; these are for FAA use only. Submit original only to an authorized FAA Representative. If additional space is required, use an attachment. For special flight permits complete Sections II and VI or VII as applicable.

I. AIRCRAFT DESCRIPTION

1. REGISTRATION MARK: N486MA
2. AIRCRAFT BUILDER'S NAME (make): Mitsubishi
3. AIRCRAFT MODEL DESIGNATION: MU-2B-60
4. YR. MFG.: 1982
FAA CODING:
5. AIRCRAFT SERIAL NO.: 1560 S.A.
6. ENGINE BUILDER'S NAME (make): AiResearch
7. ENGINE MODEL DESIGNATION: TPE331-10-501M
8. NUMBER OF ENGINES: 2
9. PROPELLER BUILDER'S NAME (make): Hartzell
10. PROPELLER MODEL DESIGNATION: HCB4TN-5JL/LT10282B-5.3L
11. AIRCRAFT IS: ~~[illegible]~~ X IMPORT

II. CERTIFICATION REQUESTED

APPLICATION IS HEREBY MADE FOR: (Check applicable items)

- A 1 X STANDARD AIRWORTHINESS CERT. (Indicate category) X NORMAL — UTILITY — ACROBATIC — TRANSPORT — GLIDER — BALLOON
- B SPECIAL AIRWORTHINESS CERTIFICATE (Check appropriate items)
  - 2 LIMITED
  - 5 PROVISIONAL (Indicate class): 1 CLASS I; 2 CLASS II
  - 3 RESTRICTED (Indicate operation(s) to be conducted): 1 AGRICULTURE & PEST CONTROL; 2 AERIAL SURVEYING; 3 AERIAL ADVERTISING; 4 FOREST (Wild life conservation); 5 PATROLLING; 6 WEATHER CONTROL; 0 OTHER (Specify)
  - 4 EXPERIMENTAL (Indicate operation(s) to be conducted): 1 RESEARCH AND DEVELOPMENT; 2 AMATEUR BUILT; 3 EXHIBITION; 4 RACING; 5 CREW TRAINING; 6 MKT. SURVEY; 0 TO SHOW COMPLIANCE WITH FAR
  - 8 SPECIAL FLIGHT PERMIT (Indicate operation to be conducted then complete Section VI or VII as applicable on reverse side): 1 FERRY FLIGHT FOR REPAIRS, ALTERATIONS, MAINTENANCE OR STORAGE; 2 EVACUATE FROM AREA OF IMPENDING DANGER; 3 OPERATION IN EXCESS OF MAX. CERTIFICATED TAKE-OFF WEIGHT; 4 DELIVERING OR EXPORT; 5 PRODUCTION FLIGHT TESTING
- C 6 MULTIPLE AIRWORTHINESS CERTIFICATE (Check appropriate Restricted Operation and Standard or Limited as applicable above)

III. OWNER'S CERTIFICATION

A. REGISTERED OWNER (As shown on Certificate of Aircraft Registration) — IF DEALER, CHECK HERE →

NAME: Mitsubishi Aircraft International, Inc.

ADDRESS: One Lincoln Centre, Suite 1500
5400 LBJ Freeway, Dallas, TX 75240

B. AIRCRAFT CERTIFICATION BASIS (Check applicable blocks and complete items as indicated)

- X AIRCRAFT SPECIFICATION OR TYPE CERTIFICATION DATA SHEET (Give No. and Revision No.): A10SW Rev. 9 dated 3/1/81
- X AIRWORTHINESS DIRECTIVES (Check if all applicable AD's complied with and give latest AD No.): 82-12
- AIRCRAFT LISTING (Give page No(s).): N/A
- SUPPLEMENTAL TYPE CERTIFICATE (List number of each STC incorporated): N/A

C. AIRCRAFT OPERATION AND MAINTENANCE RECORDS

- X CHECK IF RECORDS IN COMPLIANCE WITH FAR 91.173
- TOTAL AIRFRAME HOURS ~~[illegible]~~: 8.8
- 3 EXPERIMENTAL ONLY—Enter hours flown since last certificate issued or renewed: N/A

D. CERTIFICATION—I hereby certify that I am the owner (or his agent) of the aircraft described above; that the aircraft is registered with the Federal Aviation Administration in accordance with Section 501 of the Federal Aviation Act of 1958, and applicable Federal Aviation Regulations; and that the aircraft has been inspected and is airworthy and eligible for the airworthiness certificate requested.

DATE OF APPLICATION: 7-19-82
NAME AND TITLE (Print or type): JOHN M. COAR, Mgr. Quality Assurance Inspection
SIGNATURE: [signature]

IV. INSPECTION AGENCY VERIFICATION

A. THE AIRCRAFT DESCRIBED ABOVE HAS BEEN INSPECTED AND FOUND AIRWORTHY BY: (Complete this section only if FAR 21.183 (d) applies)

- 2 FAR PART 121 OR 127 CERTIFICATE HOLDER (Give Certificate No.)
- 3 CERTIFICATED MECHANIC (Give Certificate No.)
- 6 CERTIFICATED REPAIR STATION (Give Certificate No.)
- 5 AIRCRAFT MANUFACTURER (Give Name of Firm)

DATE: — TITLE: — SIGNATURE:

V. FAA REPRESENTATIVE CERTIFICATION

(Check ALL applicable blocks) I find that the aircraft described in Section I or VII meets the requirements for: X The certification requested, or 4 Amendment or modification of its current airworthiness certificate. Inspection for a special flight permit under Section VII was conducted by: ☐ FAA Inspector, certificate holder under ☐ FAR 65, ☐ FAR 121 or 127, or ☐ FAR 145.

DATE: 7-19-82
DISTRICT OFFICE: ASW183
4 DESIGNEE'S SIGNATURE AND NO.: [signature] RAY R. ROBINSON DMIR SW-6075
FAA INSPECTOR'S SIGNATURE:

FAA Form 8130-6 (7-70)

VI. PRODUCTION FLIGHT TEST

A. MANUFACTURER

NAME	ADDRESS

B. PRODUCTION BASIS *(Check applicable item)*

- [ ] PRODUCTION CERTIFICATE *(Give production certificate number)*
- [ ] TYPE CERTIFICATE ONLY
- [ ] APPROVED PRODUCTION INSPECTION SYSTEM

C. GIVE QUANTITY OF CERTIFICATES REQUIRED FOR OPERATING NEEDS:

DATE OF APPLICATION	NAME AND TITLE *(Print or type)*	SIGNATURE

VII. SPECIAL FLIGHT PERMIT PURPOSES OTHER THAN PRODUCTION FLIGHT TEST

A. DESCRIPTION OF AIRCRAFT

REGISTERED OWNER	ADDRESS
BUILDER *(Make)*	MODEL
SERIAL NUMBER	REGISTRATION MARK

B. DESCRIPTION OF FLIGHT

FROM	TO	
VIA	DEPARTURE DATE	DURATION

C. CREW REQUIRED TO OPERATE THE AIRCRAFT AND ITS EQUIPMENT

- [ ] PILOT
- [ ] CO-PILOT
- [ ] NAVIGATOR
- [ ] OTHER *(Specify)*

D. THE AIRCRAFT DOES NOT MEET THE APPLICABLE AIRWORTHINESS REQUIREMENTS AS FOLLOWS:

E. THE FOLLOWING RESTRICTIONS ARE CONSIDERED NECESSARY FOR SAFE OPERATION *(Use attachment if necessary)*

F. **CERTIFICATION**—I hereby certify that I am the registered owner (or his agent) of the aircraft described above; that the aircraft is registered with the Federal Aviation Administration in accordance with Section 501 of the Federal Aviation Act of 1958, and applicable Federal Aviation Regulations; and that the aircraft has been inspected and is airworthy for the flight described.

DATE	NAME AND TITLE *(Print or type)*	SIGNATURE

AIRWORTHINESS DOCUMENTATION (FAA use only)

X	A. Operating Limitations and Markings in Compliance with FAR 91.31 as Applicable	X	G. Statement of Conformity, FAA Form 317 *(Attach when required)*
	B. Current Operating Limitations Attached		H. Foreign Airworthiness Certification for Import Aircraft *(Attach when required)*
	C. Data, Drawings, Photographs, etc. *(Attach when required)*		I. Previous Airworthiness Certificate Issued in Accordance with FAR ______ CAR ______ *(Original attached)*
X	D. Current Weight and Balance Information Available in Aircraft		
	E. Major Repair and Alteration, FAA 337 *(Attach when required)*	X	J. Current Airworthiness Certificate Issued in Accordance with FAR 21.183(b) *(Copy attached)*
X	F. This Inspection Recorded in Aircraft Records		

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO.: PA 206SW-D

2. MANUFACTURER: MITSUBISHI ACFT. INT'L.

3. MODEL: MU-2B-60 S/N 1560 N486MA

4. PERIOD COVERED BY THIS REPORT: FROM 10-18-83 TO

5. INSPECTED BY: Billy C. Gray SW-MIDO-41

INSTRUCTIONS

(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
PLACARDS & MARKINGS	PILOTS OPER. MANUAL	REV. 5-8-81 ORIG. 9-1-78	1		
SECTION II, P.O.M					
WEIGHT & BAL.			1		HIWAY LOADOMETER USED
					① S/N 11483 TYPE A
					CAL. DUE 12-20-83
					② S/N 11462 CAL DUE 12-20-83
					③ S/N 11484 CAL DUE 12-20-83
					COPY ATTACHED.

FAA Form 8100-1 (4-66) FORMERLY FAA FORM 1257

0052-039-3000

INSTRUCTIONS

(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

2. MANUFACTURER: MITSUBISHI ACFT. INT'L.

3. MODEL: MU-2B-60 S/N 1560 N486MA

4. PERIOD COVERED BY THIS REPORT: FROM 10-19-83 TO 10-20-83

5. INSPECTED BY: Billy C. Gray SW-MIDO-41

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
WING FLAP SETTINGS.	F.T.P. C-1114	3-1-82 REV. G 4-1-82 E.O. 51	1		NOTE: L/H OUTBD. JACKSCREW ADJ. FOR FLAP UP APPROX. 1/4 TURN BY PROD., PRIOR TO INSP. FLAPS CKD INBD & OUTBD @ 0°, 5°, 20°, 40° UP & DOWN, ALL WITHIN TOL.
PROP & ENG. TYPE & MDL.	A10SW T.C.D.S	3-1-81 REV. 9	1	+	T.C.D.S. CALLS PROPS HC84TN-5DL/ LT10282B-5.3R, INSTALLED ARE HCB4TN-5JL/LT10282B-5.3R. C/A SEE LTR. 4101-6422-0302 DTD 3-2-81 FROM M.A.I. TO ASW-214, & REPLY TO M.A.I. DTD. 3-12-81 FROM F.A.A.

FAA Form 8100-1 (4-66) FORMERLY FAA FORM 1257

0052-039-3000

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO.: PA206SW-D
2. MANUFACTURER: MITSUBISHI ACFT INT'L.
3. MODEL: MU 2B-60 S/N 1560 N486MA
4. PERIOD COVERED BY THIS REPORT: FROM 10-19-83 TO 10-21-83
5. INSPECTED BY: Billy C. Gray SW-MIDO-41

INSTRUCTIONS

(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
CONTROL SURFACE TRAVELS & CABLE TENSION.	935A-8190	thru E.O. A-8554, 2-4-80	1		ACTUAL TENSIONS & TRAVELS AVAILABLE IN M.A.I. Q.C. SECTIONS. (ACFT. WORKBOOK). THIS INSP. COVERS TRAVELS & TENSIONS ONLY.
	935A-8189	thru A-9236 5-29-80	1		
	935A-8191	12-14-79 D	1		
	FTP C-1102	2-29-80 E.O. A-8705 REV. D 9-8-77	1		
	FTP C-1103	3-1-82 E.O. A 8705 REV. E 3-1-82	1		
	FTP C-1105	1-31-79 E.O. A 7052 4-25-78 REV. H	1		
	FTP C-1201	6-24-82 E.I. 51 6-30-77 REV. C	1		

FAA Form 8100-1 (4-66) FORMERLY FAA FORM 1257

0052-039-3000

Eng'g
T. C. Data
Sheets

MITSUBISHI AIRCRAFT INTERNATIONAL, INC.

P.O. BOX 3848   SAN ANGELO, TEXAS 76902   915/944-1511   telex 73-9438

March 2, 1981

In Reply Please Refer To
4101-6422-0302

Mr. Don P. Watson, Chief
Engineering & Manufacturing Branch
Department of Transportation
Federal Aviation Administration
Southwest Region
P. O. Box 1689
Fort Worth, TX 76101

Attention: Mr. Al Backstrom, ASW-214

Subject: Requesting addition to Type Certificate Data Sheet A10SW

Dear Mr. Watson:

Our Mr. William Westphal is requesting that the below noted propeller models be added to the MU-2B Type Certificate Data Sheet No. A10SW:

To the propeller and Propeller Limits Sections, 2 Hartzell HC-B4TN-5GL/LT10282HB-5.3R with 4 blades each or 2 Hartzell HC-B4TN-5GL/LT10282-5.3R with 4 blades each or 2 Hartzell HC-B4TN-5JL/LT10282HB-5.3R with 4 blades each or 2 Hartzell HC-B4TN-5JL/LT10282-5.3R with 4 blades each.

These two propeller models (-5GL and -5JL) were previously submitted and subsequently approved on 79-CER-181 for the -5GL Model and 80-CER-258 for the -5JL Model.

If you should have any questions concerning this request, please contact our office.

Thank you.

Sincerely,

MITSUBISHI AIRCRAFT INTERNATIONAL, INC.

Charles E. Boettcher

Charles E. Boettcher
Director of Engineering

CEB/js

cc EMDO #43, W. Westphal, M. Schultz, T. Sangawa

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
SOUTHWEST REGION
P. O. BOX 1689
FORT WORTH, TEXAS 76101

MAR 1981
RECEIVED

March 12, 1981

Mr. Charles E. Boettcher
Director of Engineering
Mitsubishi Aircraft International
Post Office Box 3848
San Angelo, TX 76902

Dear Mr. Boettcher:

This is in reply to your letter (4101-6422-0302) dated March 2, 1981, which requested changes to Type Certificate Data Sheet (TCDS) A10SW for the MU-2B series airplanes. The additional propeller hub models will be added to TCDS A10SW at the next revision. The propeller TCDS indicates that these are minor changes not effecting eligibility of the propellers.

Sincerely,

Lawrence G. Kirkwood
Chief, Propulsion Section

cc:
Mr. John J. Miller
305 Foreman Avenue
Norman, OK 73069

Not Subject to OMB Clearance

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STATEMENT OF CONFORMITY

SECTION I – AIRCRAFT

1. MAKE Mitsubishi	2. MODEL MU-2B-20
3. SERIAL NO. 183	4. REGISTRATION NO. N967MA

SECTION II – ENGINE

1. MAKE	2. MODEL
3. SERIAL NO.	

SECTION III – PROPELLER

1. MAKE	2. HUB MODEL
3. BLADE MODEL	4. HUB SERIAL NO.
5. BLADE SERIAL NOS.	

SECTION IV – CERTIFICATION

I hereby certify that:

[X] A. I have complied with Section 21.33(a).

[ ] B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on ______________ (Date).

[ ] C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.

[ ] D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operational check on ______________ (Date).

~~XXXXXXX~~ Aircraft conforms to Type Design in accordance with A2PC Type Data Sheet and Log Book Listings showing compliance with applicable AD's and latest Bi-Weekly AD Listing Number 83-21.

SIGNATURE OF CERTIFIER John C. Reust *John C Reust*	TITLE Assistant Director Quality Assurance Department
ORGANIZATION Mitsubishi Aircraft International, Inc. - Certified Repair Station 207-4	DATE 11/8/83

FAA Form 8130-9 (9-78) USE PREVIOUS EDITION

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO. PA206SW-D
2. MANUFACTURER Mitsubishi Acft Int'l.
3. MODEL MU2B20
4. PERIOD COVERED BY THIS REPORT FROM 11/8/83 TO 11/10/83
5. INSPECTED BY William A. David SW-MIDO-42

INSTRUCTIONS
(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
INSTRUMENT Calib.	—	—	1		Pilots' ALTIMETER 10-26-83
			1		Co-Pilots' ALTIMETER 10-26-83
			2		TACH. INDICATORS 10-25-83
			2		TORQUE Indicators 10-25-83
			2		EGT 10-25-83
			2		Pilot & Co-Pilot A.S. 10-25-83
			1		OAT 10-25-83
FAA FORM 337	—	—	1		Copies of 337's Attached.
Aircraft Inspection Info.	—	—	1		Visually Spot Checked Aircraft. MAI to make Log Book Entry on Maintenance Performed Prior to FAA FLT. (27) Hours on A/c. Since LAST 100 Hr INSPECTIONS

005.

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO. PA 206 SW-D
2. MANUFACTURER Mitsubishi Acft. Int'l.
3. MODEL MU2-20 S/N 183
4. PERIOD COVERED BY THIS REPORT — FROM 11-8-83 TO 11/10/83
5. INSPECTED BY William A. Daniel SW-MIDO-42

INSTRUCTIONS
(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.
9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.
10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
Control Surface Travels	—	—	1		Travels Checked to maintenance manual dtd 4/1/68, Revised 11/1/77. – OK. Cable Tensions Checked to maintenance Manual – OK – Auto-Pilot Servo Cable Tension Checked to Mfg's Spec. – OK. –
Wt & Balance	—	—	1		Wt & Balance dated 10/30/83.
Pitot & Static Check	—	—	1		Changed Both Pitot Heads – OK

N967MA

CONFORMITY INSPECTION RECORD

1. TYPE OR PRODUCTION PROJECT NO. PA 206SW-D

2. MANUFACTURER Mitsubishi Aircraft Int'l.

3. MODEL MU2B-20 S/N 183

4. PERIOD COVERED BY THIS REPORT FROM 11/8/83 TO 11/10/83

5. INSPECTED BY William C. Daniel SW-MIDO-42

INSTRUCTIONS

(Items not listed are self-explanatory)

8. Indicate the latest drawing change number or letter noted on the drawing, together with the date. When pertinent, indicate the latest engineering change or change order and date of issuance.

9. Indicate the number of items inspected found to be satisfactory (in conformity and of acceptable workmanship) or unsatisfactory.

10. State the reasons for rejection and what corrective action was taken. Nonconformities in acceptable items will be noted when they are for the prototype product or a test article.

NOTE: Only those items passed by the manufacturer's inspection system should be inspected for conformity.

6. NOMENCLATURE OF PART INSPECTED	7. DRAWING NO.	8. DATE AND NO. OF LATEST CHANGE	9. NO. ITEMS FOUND SAT.	9. NO. ITEMS FOUND UNSAT.	10. UNACCEPTABLE CONDITION AND/OR CORRECTIVE ACTION TAKEN
Aircraft Info.	—	—	1		Aircraft Data Plate:
T.T 1919.1					T.C. A2PC
L/ENG. T.T. 2105.2					S/N 183
R/ENG. T.T. 1992.2			1		A.D's Accomplished Through
					83.21
					Engine Model: TPE 331-1-151A
					L/H S/N P92008, R/H S/N P92056
					Propeller Model: Hartzell
					H.C. B3TN-5E/T10173HB-11R.
					L/H S/N BV335, R/H S/N BV1784
Placards & Markings	— —	—	1		Checked Against Flt Manual

FAA 100-1 (4-66) FORMERLY FAA FORM 1257

00

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved Budget Bureau No. 04-R060.1
FOR FAA USE ONLY
OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE: Mitsubishi	MODEL: MU2B-20
	SERIAL NO.: 183	NATIONALITY AND REGISTRATION MARK: N711FR
2. OWNER	NAME (As shown on registration certificate): Florida Rock Industries, Inc.	ADDRESS (As shown on registration certificate): P. O. Box 4667 Jacksonville, Fla 32201

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION / **5. TYPE**

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE / MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
AiResearch Aviation Company Rt 3 Box 68 Augusta, GA 30906		U.S. CERTIFICATED MECHANIC	AirFrame Class III RS701-28
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
3/15/83	

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER	X	INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE		REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
3/15/83	1A1666941	

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

B. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

Installed oil access doors on both right cowl doors as follows:

Cut out section of cowl skin. Installed doublers, hinge and latch with original skin cut out.

Work accomplished per STC SA326L, drawing #2007 and AC43.13-1. Log entries made. Weight and balance change negligeble.

END

☐ ADDITIONAL SHEETS ARE ATTACHED

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE: Mitsubishi	MODEL: MU-2B-20
	SERIAL NO.: 183	NATIONALITY AND REGISTRATION MARK: N25JB
2. OWNER	NAME (As shown on registration certificate): Jay Bee Aviation, Inc.	ADDRESS (As shown on registration certificate): Suite 500, 1 Plymouth Meeting Plymouth Meeting, Pa. 19462

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION				5. TYPE	
UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE / MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY	C. CERTIFICATE NO.
Lancaster Aviation, Inc. R. D. #3 Lititz, Pa. 17543	U.S. CERTIFICATED MECHANIC FOREIGN CERTIFICATED MECHANIC X CERTIFICATED REPAIR STATION MANUFACTURER	161-4

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
April 17, 1980	Larry D. Miller

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is [X] APPROVED [ ] REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	X	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
4/17/80	161-4	Larry D. Miller

FAA Form 337 (7-67) (8320)

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

Installed second Wulfsberg WH-18 Cabin Control T. existing Flitefone III System.

Installation done in accordance with AC43:13-2 Chapters 2 and Wulfsberg Install Manual.

Equipment list revised, Weight and Balance computed.

☐ ADDITIONAL SHEETS ARE ATTACHED

U.S. GOVERNMENT PRINTING OFFICE : 1967 O—272-085

LANCASTER AVIATION
MUNICIPAL AIRPORT R.D.3 LITITZ, PA 17543 717-569-5341

April 17, 1980

Mitsubishi Model: MU-2B-20

N25JB Serial: 183

This Weight and Balance supercedes Weight and Balance dated 2/1/78.

Installed Wulfsberg WH-18 Cabin Control.

	Weight	Arm	Moment
Aircraft	6553.1	159.62	1046027.54
WH-18	2.9	97.2	282.
	6556.0	159.6	1046309.54

New Aircraft E.W.	6556. lbs.
New Aircraft E.W.C.G.	159.6 ins.
New Useful Load	3364. lbs.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY
OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE: Mitsubishi	MODEL: MU-2B-20
	SERIAL NO.: 183	NATIONALITY AND REGISTRATION MARK: N25JB
2. OWNER	NAME (As shown on registration certificate): Jay Bee Aviation, Inc.	ADDRESS (As shown on registration certificate): Suite 500, 1 Plymouth Meeting Plymouth, Meeting, Pa. 19462

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION / 5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
Lancaster Aviation Inc. R.D.#3 Lititz, Pa. 17543		U.S. CERTIFICATED MECHANIC	161-4
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
1 Feb. 78	[signature]

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is [X] APPROVED [ ] REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	XX	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
1 Feb. 78	161-4	[signature]

FAA Form 337 (7-67) (8320)

NOTICE

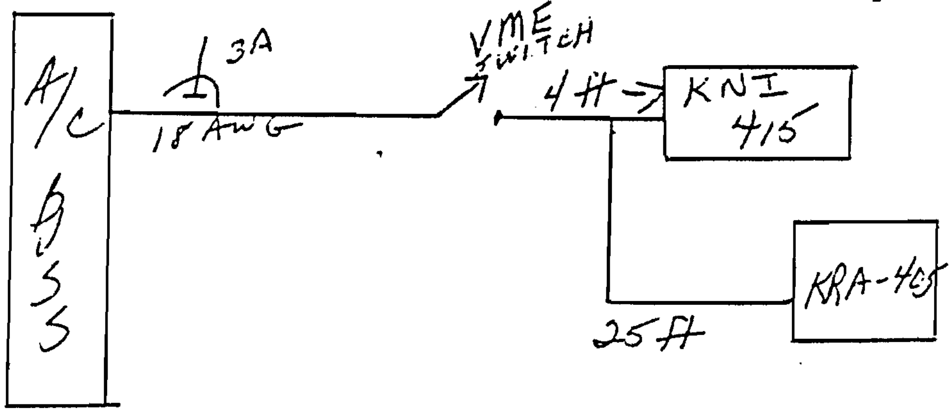
Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

Removed Bonzer Radar Altimeter System installed King KRA 405 Radar Altimeter System.

Installation done in accordance with AC 43:13-2 chapter 2 and 3 also King installation manual 006-0104-02.

Equipment list revised, weight and balance computed.



The installed equipment has been tested in flight and adequately performs its intended function with no adverse effects on other equipment in the aircraft.

Pilot

Date 7-2-1978

☐ ADDITIONAL SHEETS ARE ATTACHED

★1975-G.P.O.-1703-M/673-200/175

LANCASTER AVIATION INC.

LANCASTER MUNICIPAL AIRPORT

R.D. #3 LITITZ, PA. 17543 PHONE: 717 569-5341

AIRCRAFT SALES

AIRCRAFT MAINTENANCE

CHARTER FLIGHTS

INSTRUCTION

Febuary 1, 1978

Mitsubishi Model: MU-2B-20
N25JB S/N 183

This weight and balance supercedes weight and balance 10 Jan. 1975.

Removed Bonzer Radar Altimeter System.

Installed King KRA 405 Radar Altimeter System.

	weight	arm	moment
Aircraft empty wt.	6546.7	159.5	1,044,794.65
Bonzer AL-71 Ind.	-1.0	71.1	-71.10
Bonzer TRN-71 R/T unit	-2.5	305.9	-764.75
Radar Altimeter Antenna	-0.7	305.9	-214.13
King KRA 405 R/T unit	+6.3	286.8	+1806.84
King KNI 415 Ind.	+1.7	71.1	+120.87
KA 54 Ant.	+1.3	125.6	+163.28
KA 54 Ant.	+1.3	147.6	+191.88
	6553.1	159.62	1,046,027.54

New Empty wt. 6553.1 lbs.

New Empty Wt. C.G. 159.62 ins.

New Useful Load 3366.9 lbs.

SUPERCEDED
4-17-80

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE MITSUBISHI	MODEL MU-2B-20
	SERIAL NO. 183	NATIONALITY AND REGISTRATION MARK N 25JB
2. OWNER	NAME (As shown on registration certificate) Jay Bee Aviation Inc.	ADDRESS (As shown on registration certificate) Suite 500 One Plymouth Meeting Plymouth Meeting , PA. 19462

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION / 5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				x
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
Capitol Aviation Of Ga. Inc. Bushfield, Augusta, Ga. 30906		U.S. CERTIFICATED MECHANIC	Limited Airframe 701-28
		FOREIGN CERTIFICATED MECHANIC	
	x	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
1/16/75	AP 1981445

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

						OTHER (Specify)
	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER	x	INSPECTION AUTHORIZATION	
	FAA DESIGNEE		REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
1/16/75	A&P 1666941 I.A.	

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

Installed Tip Tank Taxi lights as per Capitol Aviation Inc. STC 39 GL and related installation instructions.

☐ ADDITIONAL SHEETS ARE ATTACHED

U.S. GOVERNMENT PRINTING OFFICE : 1967 OF—272-065

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE Mitsubishi	MODEL MU2B-20
	SERIAL NO. 183	NATIONALITY AND REGISTRATION MARK N25JB
2. OWNER	NAME (As shown on registration certificate) Jay Bee Aviation, Inc.	ADDRESS (As shown on registration certificate) Suite 500, 1 Plymouth Meeting, Plymouth, Meeting, Pa. 19462

3. FOR FAA USE ONLY

SUPERCEDED 1 Feb 79 AS

4. UNIT IDENTIFICATION				5. TYPE	
UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE / MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
Teterboro Aircraft Service 401 Industrial Avenue, Teterboro, N. J. 07608		U.S. CERTIFICATED MECHANIC	Limited Airframe 4395
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
1/10/75	Howard A. Geiler [signature]

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	X	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
1/10/75	4395	Howard A. Geiler [signature]

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

The following equipment change made:

Removed RCA A.V.Q. 55 Radar,
Installed Bendix RDR 1200 Radar.
Installed Flight Phone III, I.D.C. Encoding alt. with alerter & I.V.S.I.

All panel units installed in standard panel cut-outs, remote units secured to forward & aft radio shelves provided by aircraft manufacturer.

All cables fabricated in accordance with radio manufacturers manuals & in accordance with F.A.A. AC43-13-2 Chapter 2 & 3.

All work performed in accordance with A.C. 43-13-2 Chapter 1.

All antennas installed in accordance with F.A.A. AC 43-13-2 Chapter 3.

Aircraft equiped with two each 200 amp. generators total running load does not exceed 80% of alternator capacity.

Aircraft equipment list revised & weight & balance change noted in log book.

Aircraft test flown in accordance with F.A.R. 91.25 & AC 43-13-1, A Chapter 15.

Test flight satisfactory by: ________________

☐ ADDITIONAL SHEETS ARE ATTACHED

U.S. G.P.O. 1972/720-694/545/1303

SUPPLEMENTAL WEIGHT AND BALANCE DATA AND EQUIPMENT LIST

Make Mitsubichi Serial No. 183

Model M42B-20 Reg. No. N25JB

Prepared by: Teterboro Aircraft Co. Date Jan. 10,1975

ITEM DESCRIPTION	WEIGHT	ARM	MOMENT
OLD DATA:	6549.00	159.2	1,042,606.00
INSTALLED:			
Bendix RT 1201A	10.5	59.	619.5
IN 1202A	6.5	62.5	406.75
DA 1203A	8.0	5.0	40.0
Collins 332D12	3.8	22.5	85.50
Flite Phone III	7.0	270.0	1890.0
Hand Set	2.9	170.0	493.0
I.D.C. Encoding Alt.	3.5	56.00	196.0
" Alerter	2.0	56.00	112.0
IVSI	1.9	56.00	106.4
REMOVED			
R.C.A. AVQ55	-28.0	24.5	-686.0
Indicator	-15.0	68.5	-1027.5
Antenna	-5.4	5.	-27.0
	6546.7	159.5	1,044,794.65

SUPERCEDED 1 FEB 78 LJF

CATEGORY	EMPTY WEIGHT	CENTER OF GRAVITY	USEFUL LOAD
NORM	6546.7	159.5	3373.30

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE: Mitsubishi	MODEL: MU-2B-20
	SERIAL NO.: 183	NATIONALITY AND REGISTRATION MARK: N350MA
2. OWNER	NAME (As shown on registration certificate): MU-2 Corporation	ADDRESS (As shown on registration certificate): P.O. Box 3848, San Angelo, Texas 76901

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION				5. TYPE	
UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				XXX
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE / MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
MU-2 Corporation Box 3848 San Angelo, Texas 76901		U.S. CERTIFICATED MECHANIC	R.S. #207 Limited Airframe, Mitsubishi MU-2B Series
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
9-27-74	Glen L. Rodd *Glen L Rodd*

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is [X] APPROVED [ ] REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	X	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
9-27-74	R/S 207-4	Glen L. Rodd *Glen L Rodd*

FAA Form 337 (7-67) (8320)

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft r
An alteration must be compatible with all previous alterations to assure continued conformity wi
applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify witt craft nationality and registration mark and date work completed.)*

1. Installed Interior per STC SA1313SW.
2. Installed M4C Auto Pilot per STC SA955SW.
3. Installed Electric Pitch Trim per STC SA1354SW.
4. Installed Avionics Shelving per STC SA1488SW.
5. Installed Antennas per STC SA1489SW.
6. Aircraft Weighed & Balanced to above configuration on 9-26-74.

LAST ITEM:

☐ ADDITIONAL SHEETS ARE ATTACHED

U.S. GOVERNMENT PRINTING OFFICE : 1967 OF—

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE Mitsubishi	MODEL MU-2B-20
	SERIAL NO. 183	NATIONALITY AND REGISTRATION MARK N350MA
2. OWNER	NAME (As shown on registration certificate) MU-2 Corporation	ADDRESS (As shown on registration certificate) P.O. Box 3848 San Angelo, Texas 76901

3. FOR FAA USE ONLY

The alteration identified herein complies with the applicable airworthiness requirements and is approved for the above described aircraft, subject to conformity inspection by a person authorized in FAR 43, section 43.7.

9/27/74 (Date)

(Signature of FAA Inspector, SW CADO 7, Lubbock, Texas)

4. UNIT IDENTIFICATION / 5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE / MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
MU-2 Corporation Box 3848 San Angelo, Texas 76901		U.S. CERTIFICATED MECHANIC	R.S.#207-4 Limited Airframe, Mitsubishi MU-2B Series
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
September 27, 1974	Glen L. Rodd Glen L Rodd

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	X	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
September 27, 1974	R/S 207-4	Glen L. Rodd Glen L Rodd

FAA Form 337 (7-67) (8320)

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

1. Installed Basic King Package per dwg. 925A-0004 (Ref. STC SA1546SW on -25 model)
2. Installed AVQ-55 radar per dwg. 925A-0005 (Ref. STC SA1549SW -25 model)
3. Installed Bonzer radar altimeter per dwg. 925A-0014 (Ref. STC SA1563SW -25 model)
4. Installed Aerosonic encoding altimeter P/N 101435-01229 per dwg. 925A-0019. (Ref. STC SA1818SW -25 model)
5. Installed King Area NAV Sys. per dwg. 925A-0007 placarded VFR only. (Ref. STC SA1548SW -25 model)
6. Aircraft weighed & balanced to above configuration on 9-26-74.

LAST ITEM

☐ ADDITIONAL SHEETS ARE ATTACHED

U.S. GOVERNMENT PRINTING OFFICE : 1967 O—272-085

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY
OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE Mitsubishi	MODEL MU-2B-20
	SERIAL NO. 183	NATIONALITY AND REGISTRATION MARK N350MA
2. OWNER	NAME (As shown on registration certificate) MU-2 Corporation	ADDRESS (As shown on registration certificate) P.O. Box 3848, San Angelo, Texas 76901

3. FOR FAA USE ONLY

The alteration identified herein complies with applicable airworthiness requirements and is approved for the above described aircraft, subject to conformity inspection by a person authorized in FAR 43, section 43.7.

9/27/74 (Date)
(Signature of FAA Inspector, SWGADO 7, Lubbock, Texas)

4. UNIT IDENTIFICATION / 5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				XXX
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
MU-2 Corporation Box 3848 San Angelo, Texas 76901		U.S. CERTIFICATED MECHANIC	R.S. #207-4 Limited Airframe, Mitsubishi MU-2B Series
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
9-27-74	Glen L. Rodd *Glen L Rodd*

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	X	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
9-27-74	R/S 207-4	Glen L. Rodd *Glen L. Rodd*

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

1. Installed Curved Power Levers, P/NMU-01823 (to clear Radar Scope) per DWG MU-0183.
2. Relocated Aft Battery from R/H Wheel Well to Aft Fus Compartment per Dwgs 920A4007 & 920A4008.
3. Modified Battery Temp Warn Sys Wiring, Due to Relocation of Battery, per Dwg 925A4008 & Extending Wires From R/H Wheel Well into Aft Compartment along with Battery Cables.
4. Installed PC-15 Inverter per Dwg 920A-8007 & 925A4014.
5. Installed 2nd. Rotary Inverter per Dwg 920A-8301.
6. Acft Weighed & Balanced to above Configuration on 9-26-74.

LAST ITEM:

☐ ADDITIONAL SHEETS ARE ATTACHED

U.S. GOVERNMENT PRINTING OFFICE : 1967 OF—272-065

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE: Mitsubishi	MODEL: MU-2B-20
	SERIAL NO.: 183	NATIONALITY AND REGISTRATION MARK: N350MA
2. OWNER	NAME (As shown on registration certificate): MU-2 Corporation	ADDRESS (As shown on registration certificate): P. O. Box 3848, San Angelo, Texas 76901

3. FOR FAA USE ONLY

The alteration identified herein complies with the applicable airworthiness requirements and is approved for the above described aircraft, subject to conformity inspection by a person authorized in FAR 43, section 43.7.

9/27/74

(Date) (Signature of FAA Inspector, SWGADO-7, Lubbock, Texas)

4. UNIT IDENTIFICATION / 5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY	C. CERTIFICATE NO.
MU-2 Corporation Box 3848 San Angelo, Texas 76901	U.S. CERTIFICATED MECHANIC FOREIGN CERTIFICATED MECHANIC X CERTIFICATED REPAIR STATION MANUFACTURER	R.S. #207-4 Limited Airframe, Mitsubishi MU-2B Series

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
September 27, 1974	Glen L. Rodd

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is [X] APPROVED [ ] REJECTED

FAA FLT. STANDARDS INSPECTOR		MANUFACTURER	INSPECTION AUTHORIZATION	OTHER (Specify)
FAA DESIGNEE	X	REPAIR STATION	CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
September 27, 1974	R/S 207-4	Glen L. Rodd

FAA Form 337 (7-67) (8320)

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

1. Ref. FAA Form 337 dated 9-27-74. Item 5 RNAV Sys: System consists of King KNC-610, KDM-700A, KNR-661, and PN-101 indicator P-N 331A-3G.

2. System was installed in accordance with King reccomendation & MAI dwgs. & has been verified by the equipment mfg. as meeting accuracy specifications outlined in A.C. 90-45. Sys. has been bench checked and is approved for enroute terminal & approach IFR use.

3. RNAV light indicating RNAV operative placarded "RNAV Engaged."

LAST ITEM

☐ ADDITIONAL SHEETS ARE ATTACHED

U.S. GOVERNMENT PRINTING OFFICE : 1967 OF—272-665

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE: Mitsubishi	MODEL: MU-2B-20
	SERIAL NO.: 183	NATIONALITY AND REGISTRATION MARK: N350MA
2. OWNER	NAME (As shown on registration certificate): MU-2 Corporation	ADDRESS (As shown on registration certificate): P.O. Box 3848, San Angelo, Texas

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION / 5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				XXX
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE: / MANUFACTURER:				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
MU-2 Corporation Box 3848 San Angelo, Texas		U.S. CERTIFICATED MECHANIC	R.S.#207-4 Limited Airframe,Mitsubishi MU-2B Series
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
4/24/74	James A. Crosby

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is [X] APPROVED [ ] REJECTED

X	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE		REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
4/24/74	SW-EMDO 2-0-43	Francis C. Stouffer

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

1. Installed battery temperature warning system per STC SA1874SW.

Last Item

☐ ADDITIONAL SHEETS ARE ATTACHED

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY
OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE Mitsubishi	MODEL MU-2B-20
	SERIAL NO. 183	NATIONALITY AND REGISTRATION MARK N350MA
2. OWNER	NAME (As shown on registration certificate) MU-2 Corporation	ADDRESS (As shown on registration certificate) P.O. Box 3848 San Angelo, Texas

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION / 5. TYPE

UNIT	MAKE	MODEL	SERIAL NO.	REPAIR	ALTERATION
AIRFRAME	(As described in item 1 above)				XXX
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
MU-2 Corporation Box 3848 San Angelo, Texas		U.S. CERTIFICATED MECHANIC	R.S. #207-4 Limited Airframe,Mitsubishi MU-2B Series
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
10/15/73	Sanford D. Smith

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

	FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	X	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
10/15/73	R/S 207-4	Sanford D. Smith

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

1. Installed Pitot Tube Assy. per STC SA1029SW.
2. Installed Prop Syncronizer per STC SA250CE.
3. Installed Strobe Lights per STC SA800EA.
4. Installed Radome per STC SA588EA.
5. Installed Emergency Locator Transmitter RESCU/88 per STC SA1411SW.

Last Item

☐ ADDITIONAL SHEETS ARE ATTACHED

Appendix 7

System Team Report

SYSTEMS TEAM

EVALUATION OF THE MITSUBISHI MODEL MU-2 AIRPLANE

In accordance with paragraph 21 of FAA Order 8110.4 and guidance contained in the ACE-106 memorandum of October 4, 1983, a System Team was formed as a part of an overall Special Certification Review to review and evaluate the systems and equipment design of the MU-2 airplane. The Systems Team consisted of the following Federal Aviation Administration personnel:

Team Leader: Larry D. Malir
Standardization & Evaluation Group, ACE-105
Aircraft Certification Division
Kansas City, Missouri

Team Members: Donald Michal
Systems and Equipment Manager, ACE-130C
Aircraft Certification Office
Des Plaines, Illinois

Donald Gondor
Structure and Loads Section, ANM-120S
Aircraft Certification Office
Seattle, Washington

Larry D. Malir

S1 Statement of Problem/Question:

Are the primary and secondary flight controls adequate to show compliance with the certificating rules?

Facts Bearing on the Problem

The three basic concerns for which this review was conducted are:

a. Is the flutter substantiation adequate?

b. Is the design adequate to prevent jamming, binding, or other obstructions that would inhibit safe flight?

c. Are the design loads adequate?

These concerns were first reviewed to ensure that compliance with the applicable CAR's and special conditions had been shown in an acceptable manner. Secondly, the design of the manual flight control system was reviewed for any latent features which might result in an unsafe condition should a failure occur. Thirdly, the service history of the manual flight control system was reviewed for any known structural or mechanical failures which might result in an unsafe condition. Lastly, the accident reports of numerous unexplained accidents were reviewed to see if there is a connection between the accidents and possible failures in the controls system.

The manual flight control system consists of cable systems operating the elevator, rudder, elevator trim and rudder trim. Roll control is achieved by the use of spoilers actuated by a combination of cables and push rods.

Roll trim is accomplished by electrically powered trim ailerons. Flaps are driven by an electric motor through drive shafts.

Certification Process

The airworthiness standards which apply to the design of the MU-2 series flight control system are CAR 3, Subpart C, "Strength Requirements" and Subpart D, "Design and Construction."

Documentation for the MU-2B-26 showing compliance with these standards was reviewed. Additional documentation for other models in the MU-2B series of airplanes was given a cursory review to ensure that the practices of the earlier documents were carried over to the later ones.

CAR 3 allows the loads used in the design of the flight control system to be derived in one of two ways. These loads should be based on the aerodynamic loading of the flight control surfaces. However, these loads need not exceed those representative of maximum pilot effort. Aerodynamic loads for the MU-2B were shown to be less than those produced by the maximum pilot efforts listed in CAR 3.212, Figure 3-11 (Reference Report No. 5ET 65147). Therefore, Mitsubishi conservatively showed compliance with the strength requirements of Subpart C by designing the control system for the pilot effort loads listed in Figure 3-11 of CAR 3. There are two exceptions to this philosophy. The trim tab control surfaces and the flap surfaces are designed for the loading required by CAR 3.225, 3.223, and 3.234.

Flutter substantiation in accordance with CAR 3.311 and 3.347 was accomplished by a combination of ground vibration tests, analytical flutter analysis, and flight flutter tests (Reference Reports 5ET 65151, YET 66090). Since CAR 3 did not require it, freedom from tab flutter with a disconnect in the tab control system was not shown. Primary control surfaces (i.e. rudder and elevator) are balanced. Trim control surfaces are not balanced but have been shown to be sufficiently rigid to preclude flutter.

The reliability of spring devices used in the flight control system was established as required by CAR 3.347 by tests of three samples of each spring device to a life of 100,000 load cycles. The spring devices exhibited no adverse change in properties such as permanent deformation or loss of spring rate. With acceptable reliability, freedom from flutter due to a spring failure need not be demonstrated. Therefore, the flutter substantiation includes the effects of all applicable spring devices installed.

The various stress analyses for the flight control system structure were reviewed (Reference Reports 5ET 65169, -1, -2; 5ET 65168-1; 5ET 65149; YET 74170; YET 74171; YET 69121, -1; 5ET 65148; YET 66057). The criteria used to review these reports included proper application of the established loads, acceptable distribution of these loads into the structure, acceptable safety margins and the use of any special factors as may be required.

The design values used in these reports to establish margins of safety were referenced to an approved source (i.e., MIL-HDBK-5).

These reports established the proof of structure for the flight control system in accordance with CAR 3.171 - 3.174, 3.302 - 3.306, 3.329, and 3.330.

Finally, proof tests to limit load and operational tests were conducted on the entire flight control system (Reference Reports YET 65246; YET 66012; NR0774). Compliance with CAR 3.327, 3.328, 3.335, 3.342, and 3.343 was demonstrated by these tests.

As required by CAR 3.337 and 3.338, the tab and flap actuators were shown to be irreversible by the proof and operation tests and/or by analysis depending on the type of screw actuator used.

Design Layout Review

The review of the design of the manual flight control system revealed one deficiency which has the potential to affect safety of flight. CAR 3.339 requires that the extension of flaps be synchronized by a mechanical interconnect unless it is demonstrated that flight characteristics with an asymetrical flap configuration are not unsafe. The MU-2B flap system is designed with a flap drive system such that the flaps on either side of the airplane are driven in parallel off of the flap drive motor. Power to the flap jackscrews is transmitted by torque tube assemblies. A check of the drive system showed that there are certain failures which could cause an asymetric flap configuration. An example would be the torque tube failure at the flap drive motor left output shaft. Safe flight characteristics in this condition has not been demonstrated.

Inspections and flight tests conducted in conjunction with this review established that the design of the flight control system complies with CAR 3.337 requirement that the trim systems operate independently of the primary control system and the airplane is controllable with the trim systems only.

Service History Review

A review of service difficulty reports and incident data since 1972 showed negligible reports involving the mechanical flight control system except for four specific areas. Failures in these areas could either affect controllability or increase the susceptibility of the empennage to flutter. These four areas are the elevator tab actuator rod, the tab rod attach brackets, the flap outboard auxiliary drive shaft, and the elevator down springs.

There have been four malfunction reports of the elevator tab actuator rods separating from the tab while in flight. Two of these separations resulted in what was described as severe airplane vibration and one of these resulted in an uncontrolled loss of altitude (4,500 feet).

The actuator rod tab fittings have been the subject of numerous malfunction reports for worn bushings and excessive play.

The flap drive system has had numerous malfunction reports of auxiliary drive shaft failure. These drive shafts power the outboard flap actuators on each wing.

One of the two elevator down springs on one airplane was found broken. There was no pilot report of adverse airplane response due to the broken spring.

Accident History

Review of 23 unexplained MU-2B accidents did not indicate any discernable link between these accidents and the structural design of the flight control system.

Discussion of the Relevant Facts

The two tab rod separations which resulted in airplane vibration involved an MU-2B-36 and an MU-2B-35. Both airplanes had climbed to cruise altitude and were being trimmed out to cruise speed when the severe vibration started.

One of the airplanes, the -36 Model, went into an uncontrolled dive from 18,000 feet to 13,500 feet before a recovery could be made. Upon landing, the -36 was found to have the left elevator trim tab actuator rod failed which caused the tab to jam in the full-up position. The investigating authority believed that the rod end jam nut had not been properly tightened and this had allowed the rod end to strip its threads and pull out of the actuator rod. (Reference Iceland Directorate of Civil Aviation letter dated June 28, 1983).

Also, one MU-2 used for flight tests for this SCR was found to have a loose jam nut and to have considerable play in the threaded engagement.

In the second incident, power was reduced and the -35 landed without mishap. The right elevator trim tab rod was found disconnected. Further inspections showed that the left tab rod was still connnected but the bolt connecting it to the tab bracket was not safetied. Another possibly pertinent fact was the lubrication requirement of ADs 77-04-07 and 77-13-19 which calls for lubrication of the tab bracket bushings every 100 hours. A check of the airplane maintenance records showed that the lubrication had been accomplished five hours prior to the incident. (Reference SDR 120480058WP) It is possible that faulty maintenance resulted in the missing bolt not being properly secured and hence its loss in flight.

Another MU-2B-35 was involved in a missing tab rod attach bolt incident. In this case, there was no reported airplane vibration. The missing bolt was never found. (Reference SDR 122981029SW)

In 1976, it was reported that a pilot of MU-2B-25 had to reduce speed and use 5° of flaps in order to maintain altitude. Inspection revealed that the tab rod end fitting had failed.

The above malfunction reports indicate that it is possible the tab will flutter if the tab rod should become disconnected. The certification basis for the MU-2B, CAR 3.311, did not require that freedom from flutter be shown with a disconnect in the tab control system as is currently required by FAR 23.629(f).

The elevator uses two springs to maintain the elevator in the down position at zero airspeed. The flutter substantiation for the airplane empennage did not consider the loss of one or both of these springs because the reliability of these springs was established in accordance with CAR 3.347. Since these springs tend to increase the rotational stiffness of the elevator, loss of one or both of them could have an adverse effect on the flutter characterstics of the elevator. An additional analysis conducted by Mitsubishi, Engineering Report NA-36274, has shown that loss of both springs would have a negligible effect on critical flutter speeds.

AD 77-04-07 and AD 77-13-19 currently address the tab attach fittings by requiring periodic inspection for worn bushings and excessive play and by requiring periodic lubrication of the bushings. These ADs are considered to be adequate for the hinge cracking problem.

ADs 75-02-01 and 74-11-02 were issued to deal with the failure of the flexible flap drive shafts and are considered adequate for this problem.

Conclusion

This review has established that:

1. Flutter substantiation acceptably shows compliance with the applicable airworthiness standards. However, service experience has shown a likelihood of elevator trim tab disconnections that appear to be induced by maintenance error during servicing for compliance with AD 77-04-07 and 77-13-19. Tab flutter will possibly result if the tab actuator rod becomes disconnected.

2. Even though the flaps on either side of the airplane are

interconnected mechanically, there are failure modes which could cause the extension of flaps on one side of the airplane and not the other. This asymetric condition has not been demonstrated to be safe. Review of the service history of the flap drive system provides no indication that the reliabilty of the system is suspect. With acceptable reliability, an interlock to prevent an asymetric condition should a failure occur would not normally be required.

With the exception of the above comments on the trim tab, the manual primary and secondary flight controls are considered adequate.

Recommendation

Amend Airworthiness Directives 77-04-07 and 77-13-19 for all MU-2s to require compliance with the current optional provisions defined in Paragraph (d) of AC 77-04-07 so as to reduce the potential for human error when using the current repetitive inspection and lubrication procedures.

S2 Statement of Problem/Question:

Is the fuel quantity indication system adequate to properly show the volume of fuel aboard the airplane and to monitor the transfer of the fuel from tank to tank?

Facts Bearing On Problem

The Model MU-2 fuel system consists of five fuel tanks; one main tank, two outer tip tanks, and two outboard wing tanks. The fuel quantity indication system consists of the tank mounted transmitters with their panel mounted indicators. Some earlier models have only two indicators which monitors the main tank and the two outer tip tanks. The panel location for these indicators vary from model to model.

Certification Process

The Model MU-2 fuel system was certified in accordance with the requirements in CAR 3. A fuel quantity indication is required by Paragraphs 3.655(b)(i) and 3.672. The fuel system arrangement and operation is certified in accordance with Paragraphs 3.429 through 3.554. During the special certification review it was determined that the Model MU-2 fuel system did comply with the applicable CAR 3 requirements.

Service Experience

During the review it was noted that 10% of the accidents were attributed to fuel exhaustion by the NTSB. The team interviewed several pilots and no reports were recorded of inability to accurately monitor the fuel system operation and quantity of the fuel. Several cockpit configurations were reviewed and the indicator panel location was questioned. The MEOT flight test team was requested to evaluate the location of these indicators and no problems were noted (See MEOT portion of the report).

Accident History

Of the 152 MU-2 accidents reviewed, 16 involved the fuel system. The majority of the 16 incidents or accidents were attributed to fuel starvation.

Discussion Of Relative Facts

After reviewing the complete fuel system on the Model MU-2 airplane, the fuel quantity portion of the system was identified as an area for which further evaluation was required. Service history, accident reports, and interviews with pilots led the SCR Team to flight test the general fuel monitoring system. The fuel quantity indicators were reviewed during the MEOT flight test and the transfer function of the system was also monitored on all MEOT flights with no problems noted or recorded.

The fuel system is fairly complex for an airplane of the 1963 times but is straightforward in design. Single faults such as the loss of engine bleed air to the tip tank will prevent the use of the tip tank fuel but this is easily monitored by the pilot and adequate main tank fuel is available to provide sufficient range for an alternate course of action for normal over land flights.

Conclusion

From the information compiled during the review, it is the conclusion of the system portion of the SCR team that further invesitgation or reevaluation of the fuel quantity indicator system by the FAA is not warranted.

Recommendation

None

S3 Statement of Problem/Question

Is the ice protection system adequate to perform its intended function?

Facts Bearing on the Problem

The ice protection system of a Model MU-2 airplane consists of pneumatic rubber inflatable boots, installed on the leading edges of the wings, vertical and horizontal stabilizers. The boots are inflated by the engine bleed air and deflated by vacuum created by engine bleed air and an ejector system. An automatic and manual mode is provided to operate the boots. A pressure monitoring system is also provided. Windshield anti-ice system consists of an ethylene glycol fluid system on early models and dual electrically heated windshields with heavy duty windshield wipers on the later models. The propellers' blades are protected from ice accumulation by electrical heated elements. The pitot tubes, static ports, and stall warning vanes are also electrically heated to provide ice protection.

Certification Process

The ice protection system of the Model MU-2 was certified in accordance with requirements of CAR 3. Paragraphs 3.652 and 3.712 were the basis for ice protection system functional and installation requirements. The special conditions included in the May 14, 1965 letter, provided for propeller ice protection and required provisions for the prevention or removal of ice accumulation on propellers or accessories where ice accumulation would jeopardize engine performance.

No additional regulatory requirements were documented as necessary for certification of the MU-2B ice protection system. Prior to certification for Type Certificate A10SW, several pilots' testimonials of actual flights into icing conditions and their opinion of the system's peformance were obtained. These testimonials and Mitsubishi engineering reports were the major documentation that was reviewed in the Systems Team SCR effort. From this documentation the system team established that the MU-2B ice protection system did comply with the identified CAR 3 requirements and special condition.

Service History

During the review of the Model MU-2 accident reports it was determined that several of the unexplained accidents occurred during icing conditions and those icing conditions could have possibly contributed to the accidents. Review of documentation and field interviews were primarily directed toward the ice protection system and the possible problems that a failure of the system could create.

Accident History

The following accident or incident reports were reviewed with special attentions given to the ice protection system:

- MU-2B-35, N298MA - where both engines quit during approach to land.
- MU-2B, N930N - crashed during final approach during icing conditions.
- MU-2B, N969MA - crashed during initial approach during icing conditions.
- MU-2-25, N233MA - crashed during climb in icing conditions.
- MU-2B, N106MA - made hard landing during icing condition.

- MU-2B, N133MA - crashed during normal cruise in snow showers.

- MU-2B, N531MA - crashed during approach in icing conditions.

Discussion of Facts

Surface (Pneumatic) Deice System - The pneumatic deice system uses the engine bleed air for the vacuum and pressure for boot operation. Later Model MU-2's have a pressure monitoring system but no evidence of a similar warning system was noted in the earlier models. The source or pressures from engine bleed air is fairly reliable as compared to the mechanical and electrical driven vacuum pumps but the loss of the primary tail surface ice protection could go undetected.

Windshield Anti-ice or Deice - The earlier Model MU-2 s were equipped with an exterior fluid spray system. The fluid is basically ethylene glycol. The capacity of the fluid is 1.5 gallons with a discharge rate of 1.7 pint per minute. The total fluid capacity and the flight time it represents, creates some questions whether the capacity is adequate to be considered as the primary windshield ice protection for flight into known icing.

Pitot and Static Pressure Systems - The pitot and later model static ports are heated by electrical power. Continuous monitoring of an overhead control panel power meter is the major annuciation if a failure does occur. Failure of a pitot or static port heater would cause a very small power meter deflection which may not be detected by the pilot. The amount of heat generated by the imbedded electrical heaters is also questioned as whether the heater was adequate to control the ice and moisture in the pitot and static systems (See System Item S5).

Engine anti-ice system - On November 27, 1983, MU-2B-25, Serial Number 594, N298MA, was involved in an incident where both engines quit during approach to land in icing conditions.

The FAA inspector who investigated the incident concluded that the engines probably quit as a result of ice accumulation in the nose cowl lip area and around the airflow (P_2T_2) sensor. Further investigation revealed significant damage to both engines first stage compressor turbines and the engine inlet deicer lines to both engines were loose from the engine inlet deice valve. ASW-150 is reviewing the incident to determine the appropriate action which would require a positive means to secure the deice line fittings. The pilot also stated he had to reset the circuit breaker labeled "OVHD Panel" three times in flight. It was shortly after he had reset the circuit breaker the third time, on final approach, that the right engine quit followed shortly by the left engine. He managed to restart both engines and narrowly averted a crash landing. Further evaluation by investigators revealed the circuit breaker was located under the circuit breaker heading of "Lights" but in fact is the feeder circuit breaker for the overhead deice panel containing breaker-switches for propeller deice, left and right engine intake heat, both pitot heaters and stall warning vane heater. In response to this incident, the SCR team inspected six other -25 and -35 model aircraft that had the circuit breaker labeled "OVHD Panel" and located under the "Lights" section of the circuit breaker panel. Mitsubishi's drawing for the installation in the -35 model shows the underlining or bracket for "Lights" to stop short of the subject circuit breaker. The incident inspectors could find no reason why the circuit breaker kept popping.

The electrical power distribution design of the MU-2B was reviewed and it was noted the circuit breaker in question is the single electrical power source of the overhead anti-ice panel. This common point in the electrical design becomes critical to the ice protection of the MU-2B airplane. A single fault such as a broken wire supplying the overhead panel or faulty circuit breaker also becomes equally critical. A failure mode and effect analysis which would address the circuit breaker or any other single fault in the ice protection system was not found in any documentation reviewed by the system team. In the opinion of the system team, the MU-2B is a high performance airplane with the capability of exiting most ice conditions but if the above identified failure to the anti-ice electrical power goes undetected by the crew, a hazardous condition could occur.

Icing flight tests - The MEOT Team conducted a limited evaluation of the MU-2B-20 in icing conditions. There were three encounters and two flights were into moderate icing conditions. The objectives of the icing flights were to determine that handling qualities did not deteriorate with a reasonably expected residual ice accumulation and that all icing protection equipment performed its intended function. The MEOT Team found no discrepancies or items for concerns.

Conclusions

The documentation of the earlier Model MU-2B ice protection system would be considered inadequate for present day certification into known icing and the lack of documentation that addresses the consequences of an electrical failure or ice protection system reliability has motivated the system team of the SCR to recommend further investigation of the complete MU-2B ice protection. From the review of accident reports and the system design, the systems team of the

SCR have several questions pertaining to the adequacy of the overall ice protection system to properly perform its function.

1. Corrective action is necessary to ensure the engine inlet deice lines do not work loose. ASW-150's current action on this item may be adequate.

2. The overhead deice panel feeder circuit breaker is improperly labeled on some aircraft in service, and reliability of the single circuit to provide power to both engine anti-ice systems is questionable.

3. The adequacy of the pitot/static system to ensure freedom from contamination under all probable conditions is questionable.

Recommendations

1. On all Model MU-2 airplanes, review, by a failure mode and effect analysis, the adequacy of the single circuit to provide reliable power to the systems powered by the overhead deice panel.

2. On all Model MU-2 airplanes, review the heating function of the pitot probes and static ports and determine if the level of heat is adequate for the required ice protection function (See System Item S5).

3. On all Model MU-2 airplanes review the effect on the airspeed and altitude indicating systems and the loss of electrical power that provides the ice protection function for the probes in an event of a single electrical bus

system failure. Review the criticality of the loss of the pitot or static ice protection function and determine if a visual warning to the pilot is required (See System Item S5).

4. On all MU-2 airplanes review any static pressure adjustment made by the method of attaching a metal spacer to the external surface of the airplane aft of the static port. Determine, by test, the adequacy of the static port ice protection system to prevent ice build-up as result of the spacer (See System Item S5).

5. FAA review the requirements of FAR 23 for the purpose of providing regulatory requirements for a heated pitot probe for flight into known icing conditions on all FAR 23 airplanes.

6. FAA review the requirements of FAR 23.1323(e) for the purpose of providing regulatory requirements for a visual warning of loss of pitot probe ice protection on all FAR 23 airplanes (Reference FAR 25.1326).

S4 Statement of Problem/Question:

Does the aural warning for landing gear position and throttle lever position adequately warn the pilot of the failure to lower the landing gear during all probable landing operations?

Facts Bearing On The Problem:

Certification Process

The MU-2 landing gear monitor system was certified to the requirement of CAR 3, Paragraph 3.359, "Position indicator and warning." Paragraph 3.359 requires that an aural or equally effective warning device which shall function continuously when one or more throttles are closed until the gear is down and locked. The systems team of the SCR found the landing gear warning system to be in compliance with the applicable regulations as they are written.

Service History

During the review several maintenance personnel reported that the available information to service the landing gear monitoring system was adequate but found that worn switches have caused some problems in the field. It was the opinion of the systems team of the SCR that these service problems noted above did not contribute to any accident.

Accident History

The accident history of the MU-2 aircraft contained a number of gear-up landings or attempted landings. Approximately 23 accidents or 15% of the total 152 were landing gear extension related.

Discussion of Relative Facts

During the detail investigation it was noted that the landing gear warning system monitored the position of the engine power levers landing gear down and lock position switches. During certain landing operations the throttle setting could be above the throttle closed position and would not give the proper warning of the landing gear position. This was demonstrated during the special certification review flight test (See MEOT portion of the report).

Conclusion

The extension of the landing gear prior to the landing operation of any airplane is a fundamental action by the pilot and is a basic part of this flight training. The accident history indicated that fifteen percent (15%) of the reported accidents were landing gear-up related. The landing gear warning system complies with the applicable regulations for which the MU-2B was certified but may not perform its intended function under all probable conditions.

Recommendations

1. For all Model MU-2B's review the present landing gear position versus throttle position warning system design and determine if an additional throttle position is required in order to provide a more positive warning when the landing gear is not extended and throttles are not fully closed during landing operations.

2. FAA review the requirements of FAR 23.729 "Landing gear extension and retraction system" and provide regulatory requirements that would more accurately indicate or describe throttle position during landing in lieu of the "throttle is closed" position.

S5 Statement of Problem/Question:

Is the airspeed indicating system adequate to operate properly in flight under conditions varying from clear air and very cold to IFR in icing.

Facts Bearing on the Problem

With reference to an aircraft accident occurring at Elyria, Ohio, on January 11, 1974, the NTSB summary recounted the pilot experiencing "pitot system icing during descent from cruise altitude." This accident focused the SCR Team's attention on the pitot/static system. Subsequent interviews with a limited number of operators of MU-2 aircraft have revealed at least five reports of a loss of airspeed indications in flight. The issuance of Mitsubishi Service Recommendations Number 053, dated January 19, 1979, and Number SR020/34-005, dated July 31, 1979, provided for increased anti-ice capability with the installation of new pitot tubes with higher heat wattage. Optional compliance was recommended if the aircraft is presently or will be operated under severe icing conditions.

Pilots have reported two modes of failure: 1) the airspeed fluctuates and then drops to zero, or 2) the airspeed remains at a fixed speed regardless of changes to aircraft attitude or power. In all cases reported, the pilots said altimeter and vertical speed appeared to be working properly. In some cases, the pilots regained airspeed indications as they continued descent into warmer air. All the pilots were of the opinion the difficulty was because of ice developing in the pitot system. Their opinions were based on the airspeed functioning normally after a period of time or after flying into warmer conditions.

Design and installation review has also shown that the static system varies from a basic dual port system with no alternate source to heated static ports with an alternate static source. On the early airplanes, an alternate source was installed by Mooney and included as part of the design file through E.O. MU-0039.

The MU-2 maintenance manuals requires that the pitot/static moisture traps should be drained anytime the aircraft has been operated in rain or after washing the airplane. There is no information in the flight manual to advise the pilot of this draining requirement, nor instructions for the pilot to use pitot heat during flight in visible moisture.

Discussion:

The basic issue is that safe operation of the airplane can be affected by the pilot not having an accurate and reliable airspeed indication system as required by CAR 3.663 and 3.665. Without a usable airspeed indication system, the pilot may exceed certain airplane limitations and experience difficulty controlling the airplane. The airspeed indicator and other equipment, as is necessary, is required by CAR 3.651 for the specific type of operation, in this case IFR and icing approval, and by 3.652 is required to "perform adequately the functions for which it is to be used, shall function properly when installed, and shall be adequately labeled as to its identification, function, operational limitations, or any combination of these, whichever is applicable."

With the case history as documented above, we believe sufficient cause exists to investigate this matter thoroughly with Mitsubishi and to take appropriate action to rectify any problem found during the investigation. At this point in time, the SCR Team cannot say with certainty what is specifically causing the blockage. In one case, it was reported that in checking the system after the pilot reported the incident, the maintenance supervisor stated he found moisture in the pitot side of the airspeed indicator. An assured maintenance practice for removal of the entrapped moisture could alleviate this problem.

In examining several of the airplanes in the field with the Mooney installed alternate static system, the selector valve was located well under the instrument panel and next to the left-hand side wall. A majority of these selector valves were covered by wire bundles, interior furnishings and/or instruments protruding from behind the instrument panel such that it was difficult to reach the alternate static selector. The later version of the selector located on the pilot's side of the instrument panel was a more suitable design and not subject to being rendered unusable by field modifications.

Conclusion

1. From our review and analysis, the following sources of contamination appear likely: 1) through the pitot tube opening during washing of the airplane or while it is sitting on the ground during heavy, blowing rain; 2) operation of the aircraft in flight during conditions of visible moisture without using pitot heat; 3) inadequate heat of the pitot tube to assure melting of ice and/or evaporation of moisture; 4) ice or moisture shedding from accumulation on the nose of the aircraft may impact upon the pitot.

2. Some early models of MU-2B airplanes were not equipped with an alternate static system.

3. In several airplanes operating in the field, the MU-0039 alternate static system had been rendered ineffective because of interior furnishings and wire bundles behind the instrument panel.

Recommendations:

1. On all Model MU-2 airplanes, review the pitot pressure and static pressure system designs to determine if the designs are vulnerable to moisture accumulation and entrapment which may cause system pressure blockage particularly when the moisture freezes. The review must include an evaluation to determine the criticality of the system during IFR flights in event of the loss of airspeed and/or altitude indication systems during critical portions of a flight.
2. On all Model MU-2 airplanes, review the location and identification of the alternate static source controls. Determine if the alternate static source control is sufficiently accessible and properly identified to the pilot. Review must consider the loss of the primary static system or function during critical portions of a flight and the selection of the alternate static is required.
3. Revise flight manuals to call attention to pitot/static system draining requirements in the maintenance manual. Review the flight manual procedures to prescribe the use of pitot heat in flight when visible moisture is present.

S6 Statement of Problem/Question:

Is the autopilot/trim disconnect or interrupt function adequate to perform its intended function?

Facts Bearing on the Problem

The primary autopilot installed in the Model MU-2 airplane is the Bendix M-4 autopilot. Early MU-2 models were equipped with the Minneapolis Honeywell Regulator Model H-14 System No. YG391B2 adaptive autopilot. The servo actuators for the H-14 autopilot used bleed air pressure from the engine for primary power. Information pertaining to the certification of the Honeywell H-14 autopilot was not immediately available during the review because of the difficulty of obtaining past history of the earlier certification program. The Honeywell H-14 autopilot was not reviewed during this special certification review.

During the review, many configurations or combinations of autopilot and electrical trim systems were noted. Mitsubishi supplied a detail matrix of the different models and the autopilot and/or trim system applicable to those models. Model MU-2B and MU-2B-10 were equipped with Bendix M-4C autopilot with no electrical trim included. Model MU-2B-15 and Model MU-2B-20 were equipped with Bendix M-4C with an optional electrical trim. Some early serial numbers of Model MU-2B-25 were equipped with the M-4D. Some models MU-2B-30 and MU-2B-35 were also equipped with the M-4C autopilot with electrical trim. Later models of MU-2B were equipped with Bendix M-4D or Sperry autopilots.

All data that was available for the above Model MU-2B with M-4 autopilots were reviewed. A limited number of configurations were also reviewed during visits to operators in the field.

Certification Process

The review of the Mitsubishi matrix disclosed a number of approvals or certification methods for the Bendix M-2 autopilot. A majority of the autopilot certifications were approved by Mitsubishi under amended type certification procedures.

The electrical trim system installations were approved by both the amended type certification procedure and supplementary type certification. The following numbers identify some of the STC approvals but not all: SA1310WE, SA955SW, SA1354SW, SA561SO, SA1324SW, and SA1693SW.

All data for the above projects and approvals were reviewed and the autopilot and/or electrical trim system met the applicable requirements of CAR 3.667 "Automatic Pilot System". The electrical trim was certified in accordance with the requirements of CAR 3.337 and the Special Condition letter dated May 12, 1971. The Special Condition letter included requirements for a probable electrical trim tab runaway demonstration but the data showed that during the flight test for the supplementary type certification SA561SO (amended) no malfunction or trim runaways were performed because of the single-fault split-trim switch design. The MEOT of the SCR team was requested to perform a electrical trim runaway during their flight test evaluation. Results of flight test was reported to be satisfactory (See MEOT portion of report).

Service History

During the review of service history and field interviews of the Model MU-2, several comments were received pertaining to the autopilot servo. No other part or component of the Bendix M-4 autopilot was reported to have a service problem. The servo (Model 3013) of the M-4 autopilot has been used on many aircraft as listed in the Bendix Alert Service Bulletin M-4D-060 Revision 1. The service bulletin which required a modification to the clutch was included in an Airworthiness Directive (AD) 81-01-06 which was effective January 12, 1981.

A servo design similar to the Model 3013 servo has been installed as a component of a JET Electronic Technology, Inc., autopilot which was a major consideration in the Learjet special certification review in 1980. The clutch commonly referred to as a "pack powder" clutch was removed from some models of Learjet as a result of mandatory action in accordance with ADs 81-16-08R2 and 82-01-04R1.

Accident History

During the accident history review of the Model MU-2 no accidents could positively be identified as caused by an autopilot and electrical trim system servo malfunction. However from the past service history of the similar servo installations in high performance aircraft which have caused mandatory action in the past and the number of unexplained accidents noted in the Model MU-2, the systems team of the SCR did find cause for further investigation.

Discussion of Relative Facts

The Model 3013 servo design consists of a continuously rotating electrical motor and the torque transferring clutch of a ferrous material. The clutch of ferrous material may freeze up because of rust or other contaminations. This will cause the servo to move the control surface and require the pilot to immediately disconnect or interrupt electrical power to the servo or override the malfunctioning clutch. The ability to react in an accepted time delay to the malfunction, and exercise the proper action to override disconnect or override that malfunction, can be directly effected by the location of the disconnect or interrupt switch.

In reviewing a limited number of aircraft in the field, it was noted that the autopilot and electrical trim disconnect or interrupt switches were randomly located on the control wheels and in some cases were not identified. Some configurations include switches on both the inboard and outboard horns of the control wheels with some having two autopilot disconnect switches. The normally accepted location for an autopilot or electrical trim disconnect or interrupt switches is the outboard horn of the wheel adjacent to the trim control switch. This location enables the pilot to easily operate the switch when his inboard hand is controlling the throttles, as would be the case during landing or approach. If the switch was located on the inboard horn of the control wheel, the pilot would have to remove his hand from the throttles and transfer it to the inboard horn and then after locating the switch, operate it. This added motion would increase the delay time in disconnecting the servo during a suspected malfunction. In summary, the switch location is very important to minimize the delay time during critical portions of a flight.

All autopilot and trim flight test reports reviewed indicated that time delays performed were predicated on FAA Order 8110.7 guidelines for a "quick disconnect or interrupt". An electrical trim or autopilot disconnect or interrupt on the inboard side of the control wheel is not considered a "quick disconnect or interrupt" in present day certification of similar systems.

Conclusion

The team at this point cannot justify the total removal of the Model 3013 servo because of AD action that modified the questionable servo. The SCR system group could not find any adverse service history that indicated that the Airworthiness Directive (AD) 81-01-06 did not solve the identified unsafe condition that generated the mandatory action.

Field modifications or installations may have autopilot or trim disconnect/interrupt switches on the inboard side of the control wheel which is not consistent with type design data and the time delays/recognition times used for certification. However, there is no known service problem connected with these deviations from type design data.

Recommendations

1. In all Model MU-2 airplanes, review the location and configuration of the autopilot and electrical trim disconnect or interrupt function. For all configurations identified to have the function or switch installed on the inboard horn of the control wheel, reevaluate the locations and determine if the switch location performs the disconnect or interrupt function in accordance with the normally accepted time delays/recognition times. Proper identification of the disconnect or interrupt switches shall be installed.
2. FAA review the requirements of FARs 23.1329 and 23.677 to require all autopilot and/or trim disconnect or interrupt switches to be located on the outboard horn or handle of the control wheel.
3. On all Model MU-2 airplanes, review the Airplane Flight Manuals to determine if opening a circuit breaker is provided as a procedure for disconnecting the autopilot and/or electrical trim in event of a

system malfunction. Review the circuit breaker location and its accessibility for the purpose of disconnection.

S7 Statement of Problem/Question:

Is there lack of adequate circuit protection in the electrical DC power distribution system?

Facts Bearing on Problem:

The electrical DC power distribution system installed in the Model MU-2 aircraft, certified under Type Certificate (TC) A2PC, is of the single bus concept. The single bus consists of two engine mounted generators connected to a common bus with the ship's battery supply. From this common bus, several feeder cables are then routed to forward distribution busses and then to individual loads through circuit breakers. These feeder cables are routed forward the entire length of the cabin. The engine mounted generators feeder cables are routed to an aft cabin distribution panel. It was noted during the review that circuit protection for these cables and/or busses was not provided in the type design.

Certification Process:

The requirements for the Model MU-2B under A2PC type certification was CAR 3 which included paragraph 3.681 which required the electrical system in airplanes to be free from hazards in themself in their method of operations, and in their effect on other parts of the airplane. Also required was paragraph 3.690 which required protective devices except in the main circuits of starter motors or where no hazard is presented by their omission and paragraph 3.691 which provided for protective devices in circuits essential for safety in flight and so located that they may be replaced or reset readily in flight.

During the certification of the later Model MU-2B under A10SW type certificate which was also CAR 3, circuit protection was installed in circuits for all electrical equipment and "split" electrical DC power distribution system was provided.

Data for both type certificates were reviewed and it was found that both designs were generally in compliance except for the requirements of paragraph 3.690. Documentation that showed compliance with the portion of paragraph 3.690 that permitted omission of a protective device if no hazard is presented was not reviewed. Generator to bus circuit protection and the single bus design concept may have been certified as not presenting a hazard as required in paragraph 3.690 but no evidence of compliance was found in the design review or certification documentation.

It should be noted that during the special review, a flight test was performed with complete loss of DC power during VFR and IFR flight conditions and the results were satisfactory (See MEOT portion of report).

Accident History:

A review of the MU-2B accident reports have revealed several reported electrical and/or instrument malfunctions that occured before the accident. There was no evidence documented to connect or refute that these electrical and/or instrument malfunctions caused any of the reported accidents.

- Model MU-2B, N757Q, crashed after experiencing an electrical problem. Accident report listed a battery thermal runaway and fire as a probable cause for the accident. Pilot lost control for an undetermined reason.

- Model MU-2P, N765MA crashed after experiencing an electrical problem. The pilot reported having compass problems and during his communication reporting the problem, the transmissions ended. The transponder return was also lost at this time.

Discussion of Relative Facts:

During the review it was noted that the operation of the battery master switch to the emergency position will close the emergency relay and provide DC power to various components. Wire P122B20 supplies the battery power to the emergency relay but this wire does not include any circuit protection. During a fault to ship's structure or ground, the wire would be required to carry the total battery power. Due to the small size of the wire and the absence of a circuit protection, the wire will become overheated and create a possible ignition source for a fire. The common circuit of the emergency switch will also result in the loss of all DC electrical power if a single fault occurs.

The above observations of the general electrical design in the MU-2B is only one and in no way represents the result of a complete detail review.

The generator feeder to distribution bus circuit protection represents a major concern because of large current carrying cables and the installation close to fuel and critical structural members of the wing. The reverse current protection of the DC electrical power system will prevent the battery or the opposite generator power from adding to probable generator feeder fault but the generator on whose feeder the fault occurred, will be adequate to cause major damage.

Conclusion:

The certification documentation that was reviewed for all models of the MU-2B did not address the generator to power distribution bus fault protection. Further testing or a failure mode and effect analysis or submission of data including that analysis is warranted. A major design change was made to later MU-2B certification (A10SW) which provided for a split bus distribution system. This "split bus" concept is generally accepted by both FAA and FAR 23 airplane manufacturers in recent design approvals.

Recommendations:

1. FAA review the requirements of FAR 23 policy material that would provide regulatory requirements for a dual or "split" bus DC electrical power distribution system for airplanes certified under the FAR 23 regulations.

2. In all Model MU-2's review the DC electrical power distribution system by test or analysis, and determine if the ground fault protection in the generator feeders to power distribution busses was considered in accordance with the requirements of CAR 3.690.

3. In all Model MU-2's review all DC electrical power distribution system circuit breakers for proper marking and function grouping.

4. In all Model MU-2's review the DC electrical power load analysis and determine if the circuit protection for all distribution busses and auxiliary bus feeders is of the proper value to supply the required electrical voltage and current loads for the load on the busses.

OXYGEN SYSTEM

S8 Statement of Problem/Question

Can the oxygen pressure indication system, located in the cockpit, give an error or misleading oxygen pressure indication to the pilot?

Facts Bearing on the Problem

The oxygen bottle, which is the source of oxygen for the crew and/or passengers, is installed in the aft section of the aircraft. The pilot is required, by checklist, to open the oxygen shutoff valve during his walk around check prior to entering the cockpit.

Certification Process

The Model MU-2 oxygen system was certified in accordance with the requirements of the special conditions included in Attachment "A" of the letter dated May 14, 1965. The special conditions required oxygen be provided for the pilot and passengers with certain conditions.

The functional and installation requirements for the oxygen system are included in CAR 3.652.

Service History

During the special certification review, several operators stated their concern about the oxygen supply system and the
location of the shutoff valve.

Accident History

During the accident history review of the MU-2, no accident record indicated a loss or lack of oxygen.

Discussion of Relative Facts

The location of the oxygen supply shutoff valve is adjacent to the oxygen source or bottle in the rear of the aircraft. By opening the shutoff valve, oxygen pressure will be supplied by means of the forward routed tubing to a cockpit regulator panel which is easily accessible to the pilot in flight. A pressure indicator located at the regulator is also provided to monitor the available pressure.

With the source pressure turned off, the panel mounted indicator may show oxygen pressure that is trapped in the forward routed tubing and not the oxygen pressure available to the pilot. This trapped pressure will not be relieved and the indication on the panel mounted indicator will indicate pressure until the pilot or passengers use the system. If the pilot fails to open the supply valve and is airborne, it would be necessary for him/her to leave the pilot station and turn on the shutoff valve to supply oxygen to the cockpit and passengers.

Conclusion

The system complies with the certificating regulations.

Recommendation

Location of the shutoff valve control in the cockpit would enhance the probability of having oxygen when needed in an emergency.

S9 Statement of Problem/Question:

Is there a hazard associated with reported cooling turbine (air cycle machine) rotor burst?

Facts Bearing on Problems

The MU-2 aircraft is equipped with a complete air conditioning and pressurization system. The system consists of a refrigeration unit with heat exchanger and cooling turbine (air cycle machine), a water separator, a temperature control system, and a pressure control system. The refrigeration unit, heat exchanger and cooling turbine (air cycle machine) are located in the aft empennage area with the remaining equipment located forward.

Certification Process

The Model MU-2 certification requirements for the environmental system was CAR 3, Paragraphs 3.393, 3.651, and 3.652. The systems special review team found that the system did comply with the applicable regulations.

Accident History

The systems team review of the Model MU-2 accident history did not disclose any positive evidence that cooling turbine rotor burst caused any of the reported accidents. Most NTSB accident reports were not complete in this area and may not have included information related to rotor burst damage due to the similarity between crash impact damage and structural damage caused by a rotor burst. Further investigation of the malfunction and defect reports pertaining to MU-2B cooling turbine was performed and the following is a list of reports noted:

- MU-2B-30 serial 509 - Cooling turbine disintegrated in flight and part of turbine exited the outside skin.
- MU-2B-35 serial 557 - Cooling turbine disintegrated in flight and part of turbine penetrated the turbine housing.
- MU-2B-30 serial 508 - Cooling turbine disintegrated during climb and part of turbine penetrated a deice line and outside skin.
- MU-2B-30 serial 570 - Cooling turbine bearing failed.

These reports verified the field interview with maintenance personnel who had replaced cooling turbines after a rotor burst had occurred. As noted above, some repairs to the outer skin had to be performed. Of the two approved vendors for the cooling turbine installations (AiResearch and Hamilton Standard) one seems to be more reliable than the other.

Conclusion

The above incidents of rotor burst were not completely investigated in detail but the fact that they did happen and bearing failures are identified as probable failures, indicates a review of the cooling turbine installation is warranted. Later regulations in FAR 23, Paragraph 23.1461 provides a requirement that equipment containing high energy rotor must be located so a rotor failure will neither endanger the occupants nor adversely affect continued safe flight.

Recommendations

On all Model MU-2's, review the installation and service history of the environmental air cycle machines and determine if the containment of the high energy rotor is adequate to prevent damage to the adjacent control cables or other systems critical to safety of flight.

Appendix 9

MEOT Report

Consists Of:

MEOT Findings and Recommendations

MEOT References

MEOT Evaluations

Engineering Evaluations

Flight Test Plans and Reports:

Data Cards - MU-2B-20
Data Cards - MU-2B-60

MEOT FINDINGS AND RECOMMENDATIONS

MULTIPLE EXPERT OPINION TEAM

EVALUATION OF THE MITSUBISHI MODEL MU-2 AIRCRAFT

INTRODUCTION

In accordance with Paragraph 167 of 8110.4, and guidance contained in the ACE-106 memorandum of October 4, 1983, a Multiple Expert Opinion Team (MEOT) was formed to evaluate the MU-2 handling qualitites, pilot workload, and other items as tasked by the Special Certification Review (SCR) Team. The MEOT consisted of the following Federal Aviation Administration personnel:

Team Leader: James S. Kishi
Flight Test Section, ACE-106
Aircraft Certification Division
Kansas City, Missouri 64106

Team Members: David A. Robinson
Aircraft Evaluation Group, ACE-270
Flight Standards Division
Kansas City, Missouri 64106

George H. Meyers, III
Denver Aircraft Certification Field Office, ANM-170D
Denver, Colorado 80010

Edward M. Boothe (Stability & Control Consultant)
National Simulator Directorate
Southern Region
East Point, Georgia 30344

The MEOT received specific evaluation tasks from the SCR Team in a letter dated November 4, 1983, and revised by a second letter dated December 2, 1983. The MEOT tasks consisted of fifteen specific items. An additional ten tasks classified as engineering evaluations were also directed. A revision letter canceled one of the fifteen MEOT tasks.

Evaluation flights were conducted from October 27, 1983, through February 9, 1984. Two airplanes were used during the evaluation, an MU-2B-20 (Serial Number 183, Registration: N967MA), and a MU-2B-60 (Serial Number 1560SA, Registration: N486MA). For the evaluation, 34.5 hours and 29 flights were on the MU-2B-20, and 34.2 hours and 22 flights were flown on the MU-2B-60. The individual team members completed their reports on February 22, 1984.

The MEOT was assisted during the flight evaluation by C. E. Arnold, Manager, Flight Test Section, ACE-106, Kansas City, Missouri (and SCR Team Chairman), and the following Mitsubishi Aircraft International personnel:

R. Wentling, Director of Flight Test
E. Boehler, Test Pilot
J. Hunley, Test Pilot
H. Kawachi, Engineering
N. Kobayashi, Flight Test Engineer
T. Kawai, Flight Test Engineer
J. Hill, Flight Test Engineer
D. Thacker, Flight Test
R. Ellwanger, Flight Test

Assistance with maintenance and maintenance related problems was provided by Charles R. Stauffer, Aircraft Evaluation Group, ACE-270, Kansas City, Missouri.

DISCUSSION

The MEOT accomplished all of the tasks directed by the SCR Team. The flight test plans and flight test data and test pilot comments are attached. Additionally, the team members submitted findings and recommendations for each task that the individual evaluated. This information is also attached.

The team members were in general agreement concerning the major issues involving the airplane. The MEOT found the airplane suitable for single pilot operation.

The flying qualities of the MU-2B-20 and MU-2B-60 airplanes were adequate for single pilot operation. The pilot workload is comparable with similar twin-engine turbopropeller airplanes.

Though the landing gear warning system was in compliance with the regulations, instances were present when the warning system did not activate when it was required. The power levers were essentially against the flight idle stops in order for the system to be armed. The gear position indicator can be considered as a backup for the gear warning system.

Limited natural icing evaluations were conducted. The anti-ice/de-ice system functioned properly. The residual ice on the unprotected areas did not have an appreciable effect upon the airplane's handling qualities and stall characteristics.

The present takeoff schedule is adequate, but difficult to follow using takeoff procedures. The pilot's operating manual offers no information pertaining to this aspect of the takeoff.

Manuals for the earlier airplanes are adequate; however, an update with the type of information found in the later manuals has been suggested. Narrative information is particularly lacking.

CONCLUSIONS

1. The MEOT evaluation of the MU-2B-20 and MU-2B-60 airplanes did not reveal any major deficiencies that would reflect adversely upon normal operation of these airplanes.

2. The MEOT determined that the minimum skill and knowledge required for a single pilot to operate the MU-2B-20 and MU-2B-60 airplanes would be no greater than that required for a comparable twin-engine turbopropeller airplane.

James S. Kishi
JAMES S. KISHI
MEOT Team Leader
February 23, 1984

MULTIPLE EXPERT OPINION TEAM
SUMMARY OF FINDINGS AND RECOMMENDATIONS

QUESTION	FINDING	Robinson	Meyer	Kishi
ME-1	The fuel system operation and annunciation are suitable for single pilot operation of the airplane.	✓	✓	✓
ME-2	The landing gear warning system as rigged met the regulation, but would allow an approach to be flown with the landing gear up without giving the pilot an aural warning.	✓	✓	✓
ME-3	The landing gear position indicators are adequate to perform their intended function. (Meyers - that the gear position lights are not visible in the dash 60 airplane when the pilot's right hand is on the control wheel.)	✓	✓	✓
ME-4	The pilot workload was not adversely affected when operating the anti-ice/deice systems.	✓	✓	✓
ME-5	The airplane is safely controllable by a single pilot under flight conditions normally expected during operation. (Meyers - the pilot's proficiency would be an influencing factor.) (Kishi - the required pilot's experience and competence is no greater than requirements for comparable airplanes.)	✓	✓	✓
ME-6	The speed schedule is adequate for takeoff and climb transition. (Meyers - the schedule requires great anticipation and practice by the pilot...the initial climb angle required is high.) (Kishi - overshooting the rotation velocity makes the speed schedule difficult to maintain...this does not adversely affect the climb transition.)	✓	✓	✓
ME-7	The approach and landing procedures, and speed schedules for normal and emergency conditions were suitable for operational use.	✓	✓	✓
ME-8	The control forces are appropriate and acceptable for normal and emergency conditions.	✓	✓	✓
ME-9	The stall warning is clear and distinctive when conducting stalls.	✓	✓	✓

QUESTION	FINDING	Robinson	Meyer	Kishi
ME-10	The airplane can be safely flown in instrument conditions using partial panel instruments. (Meyers - the location of the turn and slip indicator on some aircraft causes the left hand on the control wheel to block pilot's view of the instrument) (Kishi - pilot workload is no greater than accomplishing the same task in a comparable airplane)	✓	✓	✓
ME-11	The crew workload under all probable conditions of flight is acceptable for single pilot operations.	✓	✓	✓
ME-12	The minimum skill and knowledge required for a single pilot to operate this airplane are no more than that required for a comparable airplane. (Meyers - some aircraft have awkward location of alternate static source selector, gear position lights obscured by pilot's right hand on control wheel, turn and slip indicator obscured by pilot's left hand on control wheel, seat height adjustment limited by cockpit shape which causes pilot to see windshield distortion during flare for touchdown, and pilot's shoe heel digging into the carpet when making large rudder displacements).	✓	✓	✓
ME-13	A cockpit evaluation determined that the crew station was adequate for single pilot operation.	✓	✓	✓
ME-14	The flight manuals for the aircraft are adequate for providing appropriate limitations, procedures, and performance information. (Meyers - JCAB approved flight manuals are minimally adequate. <u>Recommend</u> manuals be brought up to the quality of the latest revisions) (Kishi - many sections lacked information which would further assist the pilot. <u>Recommend</u> updating the older manuals to the same standard found in the later manuals) (Stauffer - MU-2B-26 manual requires NTS check at 50 hour periodic. It is not appropriate for the pilot to open the emergency exit door as cited for emergency in case of electrical fire. <u>Recommend</u> deletion of 50 hour NTS check, and revise electical fire emergency by replacing opening emergency exit door with opening outflow valves and use ram air).	✓	✓	✓

QUESTION	FINDING	Robinson	Meyers	Kishi
ME-15	(Stauffer - aircraft maintenance manual statement about draining pitot and static lines recommended for inclusion in the flight manual. Recommended consistent statements on use of MIL127686 anti-icing inhibitor in each maintenance manual.)	N/A	N/A	N/A

NOTE: ✓ Concur With Finding
X Do Not Concur With Finding
N/A Not Applicable (test was not conducted by individual)

ENGINEERING EVALUATION
SUMMARY OF FINDINGS AND RECOMMENDATIONS

QUESTION	INVESTIGATOR	FINDING
EE-1	Arnold	The airplane can be safely controlled under VFR or IFR if all electrical power is lost, provided an air-driven turn and bank indicator is available on the pilot's instrument panel. Recommends the ACO and MAI coordinate issuing an alert to assure an air-driven turn and bank, or other acceptable emergency system, is retained on the pilot's instrument panel.
EE-2	Kishi	The pilot can detect the loss of the primary static source, and select the alternate source without adversely affecting the safe operation of the airplane.
EE-3		Task was deleted.
EE-4	Arnold	The airplane is safely controllable with a malfunctioning (runaway) trim aileron throughout the approved flight envelope. Recommends adding amplified procedures for trim aileron tab malfunction.
EE-5	Kishi	The airplane can be safely controlled to a zero rate of descent using only elevator trim and power.
EE-6	Kishi	The airplane can be safely controlled and landed if the elevator or rudder trim fails in the most adverse flight condition, using power and the remaining flight controls.
EE-7	Kishi	The established maximum operating limit speed (V_{MO}) is satisfactory.
EE-8	Kishi	The airplane cannot takeoff with the propeller start locks engaged.
EE-9	Meyers	The airplane remained safely controllable with up to an estimated three inches of ice on the unprotected surfaces.
EE-10	Meyers	The ice protection system was successfully demonstrated during a flight involving 35 minutes in moderate icing conditions at minus one degree centrigrade.

MEOT REFERENCES

ACE

ACTION: Augmentation Members for MU-2 SCR Team
Original signed
by
C. E. Arnold

OCT JK
~~SEP~~ 04 1983

Charles E. Arnold
Team Leader, MU-2 SCR Team

ACE-106:Arnold

Barry D. Clements
Manager, Aircraft Certification Division, ACE-100

In accordance with my memorandum to you, dated September 26, 1983, containing the SCR preliminary review report, I am requesting the following personnel be designated to complete the augmentation of the present preliminary SCR Team:

1. A Multiple-Expert-Opinion Team be formed in accordance with Order 8110.4, Paragraph 167, as follows:

   Mr. James S. Kishi, ACE-106, Team Leader
   Mr. Dave Robinson, ACE-270, Operations
   Mr. George Meyers, ANM-170D, Member
   Mr. Ed Boothe, ASO-205, Handling Qualities Expert

   As a matter of information, Mr. Joseph Trabar, ACT-330, may also serve in a limited capacity as a handling qualities consultant.

2. The following systems engineers be designated to comprise the systems team:

   Larry D. Malir, ACE-107, Team Leader
   Robert R. Jackson, ACE-130W, Member
   W. H. Trammell, ASO-130A, Member

3. Mr. Billy Parker, ASW-150, remain as the propulsion specialist. If necessary, Mr. William Moring, ANM-174W, will asist on a limited basis.

4. Mr. Chuck Stauffer, ACE-270, remain as the maintenance/operations specialist.

It is requested that telegrams, copies attached, be issued by the Director, ACE-1, requesting attachment of the personnel as indicated.

Attachments

ACE-106:CArnold:X6932:pa:10/4/83:Augmentation:L
Rewritten:ACE-106:CArnold:X6932:pa:10/4/83:L

Memorandum

U.S. Department of Transportation
Federal Aviation Administration

Subject: ACTION: Mitsubishi MU-2 Series Special Certification Review (SCR)

Date: SEP 14 1983

From: Barry D. Clements
Manager, Aircraft Certification Division, ACE-100

Reply to Attn. of: Jake:X6937

To: Charles Arnold, ACE-106
THRU: Robert Stephens, ACE-105

As a result of questions raised about the MU-2 service history and accident history by ASW-100 during the past months, and NTSB Recommendation A-83-56, it is deemed appropriate for the FAA to review selected portions of the MU-2 design and the type certification programs that resulted in Type Certificates A2PC and A1OSW. This will be accomplished via a Special Certification Review in accordance with Order 8110.4.

You are designated Team Leader for this SCR, and Billy Parker, ASW-150; Larry Malir, ACE-107; and Chuck Stauffer, ACE-270, have been named team members for the initial data gathering and preliminary review phase of the SCR. Upon completion of that phase, by approximately September 23, 1983, please identify to me those additional SCR team specialists for the necessary detailed review. It is also the responsibility of this initial team to identify and outline the specific design and compliance areas to be reviewed and the manner in which the team will be organized and is to function.

The team shall prepare a report of its findings with specific recommended actions at the conclusion of the overall review.

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105-3-786

Memorandum

U.S. Department of Transportation
Federal Aviation Administration

Subject: ACTION: MU-2 Special Certification Review (SCR) Preliminary Review Report

Date: SEP 28 1983

From: Charles E. Arnold
Team Leader, MU-2 SCR Team

Reply to Attn. of:

To: Barry D. Clements
Manager, Aircraft Certification Division, ACE-100

Thru: Manager, Standardization & Evaluation Group, ACE-105

In response to your memorandum dated September 14, 1983, establishing the preliminary SCR Team and the objectives, this is to advise of the Team's preliminary findings and recommendations for further action.

On September 12, 1983, the preliminary Team met with ASW-100 personnel to make a limited review of the aircraft design and the certification process. A thorough analysis of the accident summaries provided by NTSB, the FAA Accident/Incident Data System (AIDS) and reports and analyses provided by the National Safety Data Branch, AVN-120, was conducted.

The Team found four major areas producing a significant portion of the accidents. These are: 1) inadvertent gear-up landings (15%); 2) fuel mismanagement causing engine flameout (10%); 3) pilot mishandling in situations where he would be expected to be able to manage the aircraft (53%); and 4) accidents of unknown causes.

A conference was held with ASW-100 personnel on Friday morning, September 16, 1983, to apprise them of the Team's findings and to seek their input into probable causes and/or courses of action. Subsequent to the meeting with ASW-100 personnel, the Team prepared a list of possible recommendations/courses of action. This list is attached as an enclosure.

In consideration of all factors, there still remains many unanswered questions regarding the acknowledged high rate of accidents with the MU-2 series of aircraft. There is also the serious concern that NTSB, Mitsubishi, and FAA has expressed about the number of catastrophic accidents with no established cause. It is the Team's conclusions that these factors can only be properly addressed by a full SCR evaluation of each questionable area to seek ways of improving the accident record and resolve design problems shown to be unsafe on the basis of service history.

The preliminary SCR Team makes the following recommendations:

1. Ask NTSB to provide us the complete accident files for all accidents listed as "unknown cause".

2. Advise NTSB that we wish to be advised immediately of all MU-2 accidents and that we will assign a technical assistance team to assist them in trying to determine the cause.

3. Advise NTSB that we will form a Multiple Expert Opinion Team (MEOT) to evaluate pilot workload and cockpit arrangement to determine the need for the required crew, the need for pilot type rating, or any other pilot training or qualification processes. This evaluation will include handling qualities, single engine controllability, trimability, and pilot workload.

4. Advise NTSB that we will conduct a design review of the fuel system, the landing gear warning system, the autopilot/trim system, and icing protection to determine if system improvements are necessary.

The full SCR Team complement has not yet been established, but will consist of augmentation of the existing team leaders in systems, propulsion, operations/maintenance, and a MEOT that we recommend become a standing team to evaluate all subsequent FAR 23 and SFAR 41 airplanes when crew complement is at issue. Approval of team augmentation will be requested by separate memorandum when members can be determined.

Attachment

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U.S. Department
of Transportation
Federal Aviation
Administration

Memorandum

Subject: Special Certification Review Team
Specific Flight Task Assignment

Date: Nov. 04, 1983

From: Charles E. Arnold
SCR Team Chairman

Reply to
Attn. of: C. Arnold, ACE-106

To: Jim Kishi
MEOT Leader

In accordance with the objective established by ACE-100 letter dated September 14, 1983, and my letter to ACE-100 dated September 26, 1983, your team is requested to review the design details and flight characteristics of the various MU-2 models to verify compliance with the certification basis of the airplane and to determine there are no unsafe features revealed by service history.

There are two models being made available by Mitsubishi Aircraft International, Inc.; an MU-2B-20 (F) and an MU-2B-60 (Marquise). These aircraft are representative of the two basic design styles and should be adequate for all flight characteristics by scheduling power and weight as appropriate for the design under consideration. It may be necessary to use other means to review appropriate cockpit design suitability. Tests may be limited to one model where criticality can be ascertained.

This memorandum defines two categories of tests to be conducted by your team; 1) engineering tests, and 2) Multiple Expert Opinion Team tests. For the engineering evaluations, you may use any appropriate process normally acceptable to FAA to make engineering findings. For the MEOT evaluations, you should use the full team to establish a consensus report.

You are requested to make specific evaluations and findings relative to the following items:

1. Engineering Evaluation:
   a) With the MU-2B-20, determine that the airplane is safely controllable under VFR and IFR conditions if all D.C. electrical power is lost.
   b) On the MU-2B-20, simulate loss of primary pitot static source by putting tape over the primary static port. Determine that the pilot can detect the malfunction and select the alternate source without hazard to safe operation.
   c) Using the most critical airplane model and the Bendix M4C autopilot, conduct the following malfunction tests:

KISHI
11-08-83

Perform nose up and nose down elevator trim runaway tests. The tests are to be conducted with and without the autopilot connected. The tests should be conducted for the most critical conditions of speed, altitude, C.G., and approach configurations. Tests should be conducted in progressive increments of time delays until clear and distinct pilot recognition cues are indicated plus one second before disconnect. If a quick disconnect is not installed, procedures and time delays as prescribed in FAA Order 8110.7 are to be used. The airplane must be fully controllable without hazardous conditions as outlined by Advisory Circular AC 23.1329-1.

NOTE: All trim and autopilot malfunction tests are to be conducted with maximum torque settings on the servo clutches.

d) Conduct trim aileron runaway tests. The tests are to be conducted with and without the autopilot connected. The tests are to be conducted at the most critical airspeed and altitude. Tests should be conducted in increments of time delays until clear and distinct pilot recognition cues are indicated. Time delays will be those specified in FAA Order 8110.7, Change 5, and Change 12, pertaining to a disconnect switch. Because the trim-aileron select switch does not interrupt all movement of the trim-aileron, a total of four seconds should be used for disconnect after pilot recognition. This is the three seconds specified in Change 5, item 52 e and amended by Change 12, item 52 B. When conducting trim-aileron runaway tests with the autopilot connected, determine if satisfactory cues are available to ensure pilot recognition. If not, the trim runaway should be continued until recognition is assured.

e) Verify that the airplane can be safely controlled to a zero rate of descent by use of elevator trim and power only. Reference CAR 3.109 e.

f) Determine that if an elevator or rudder trim tab fails in the most adverse condition expected in flight that the airplane can be safely controlled and landed using any normally available flight control or power.

g) Verify that the established V_{MO} is satisfactory for compliance with Special Conditions, Flight Item 12. The need for an overspeed warning device and a yaw damper will be evaluated in accordance with special test criteria issued by ACE-110 letter dated Jan. 04, 1983. Insure that adequate safety and emergency egress capability is established and that adequate propeller oil pressure monitoring and airspeed calibration is established. The airplane considered most critical should be used.

h) Determine if a potential safety hazzard exists with the propeller start locks engaged. It should be determined if it would be possible to make a takeoff if improper cockpit procedure was used. Are the warning cues adequate to ensure the pilot would not make a takeoff with the start locks still engaged?

i) Using the airplane determined most critical, conduct evaluations with simulated ice shapes or natural residual ice on unprotected areas to ascertain that the airplane is safely controllable. Particular attention should be given to climb and approach speed schedules.

j) Using the MU-2B-20 aircraft, conduct flights in natural icing conditions to evaluate suitability of all icing protection systems under all normal conditions of flight; i.e., climb cruise, descent and approach. If possible, have a chase ship to obtain photographic coverage after exit from the icing cloud. If conditions permit, determine that stall warning margins are adequate and that stall warning is clear and distinct.

2. Multiple Expert Opinion Team Evaluations:

a) Determine if the fuel system operation and annunciation is adequate for operation as a sinle pilot airplane. Specific attention should be given to the location of gauges, annunciation and switches. Consider normal operation and the pilot's capability to ascertain fuel status, consumption and to detect faults in the process.

b) Determine if the landing gear warning system is adequate to assure the landing gear is down under all probable conditions of landing. The warning system is to be rigged in accordance with design specifications and the maintenance manual.

c) Determine if the landing gear position indicators are adequate to perform their intended functions for the average range of pilot sizes and under all probable conditions of flight.

d) Using the MU-2B-20 airplane, operate all anti-ice functions and evaluate pilot workload and capability of ascertaining status and proper functioning of all systems. Consider normal functioning annunciators and fault/failure annunciation.

e) Using both models of aircraft, determine if the airplane is safely controllable by a single pilot under all flight conditions normally expected in operation. Ensure that an evaluation is made in natural turbulence of at least moderate intensity. Particular attention should be given to yaw damping and dutch-roll characteristics. Particular attention should be given to speed schedules for takeoff, climb, and approach.

f) Determine the adequacy of the takeoff speed schedules and climb transition for both normal and emergency conditions. They are to be evaluated for a single pilot using average skill.

g) Determine the adequacy of the approach and landing procedures and speed schedules for both normal and emergency conditions. They are to be evaluated for a single pilot using average skill.

h) Using both models of aircraft, verify that CAR 3.109 (b) (6) can be accomplished with control forces appropriate to type and not exceeding maximum values or conditions of CAR 3.106.

i) Determine that stall warning is "clear and distinctive" under the following conditions at aft C.G.:

(1) All stall profiles - stright and climbing.

(2) Single engine stalls.

(3) With autopilot "on".

j) Determine that the airplane can be safely flown under instrument conditions using partial (emergency) panel instruments.

k) Determine crew workload under all probable conditions of flight for which the airplane is approved. Determine if a single pilot, non-type rated, and of average skill level is adequate to perform all required tasks in a safe manner. If not, determine what the minimum crew complement should be. Use the appropriate portions of FAR 25, Appendix D as guidelines for making recommendations for minimum crew complement.

l) Determine the minimum skill and knowledge requirements necessary to be demonstrated by the recommended minimum crew. Consider the minimum requirements of FAR 61.5, 61.57, 61.63, and Subparts D and E.

m) Conduct a cockpit evaluation of all models, either by hardware or design review, to determine the following:

(1) Adequacy of all emergency controls.

(2) Adequacy of all primary and secondary controls and switches.

(3) Adequacy of circuit breakers of fuses "essential to safe operation".

(4) Adequacy of caution, warning and advisory lights to include the master caution light.

n) Determine the adequacy of all flight manuals for appropriate limitations procedures, and performance. Consider the interface of pilot knowledge and skill requirements to be determined in item "l", above.

o) In conjunction with Mr. C. Stauffer, determine the adequacy of the total information system to include flight manuals, maintenance manuals, training manuals and service bulletins.

3. Define any other tests or evaluations considered essential to safety of flight.

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: Special Certification Review Team Specific Flight Task Assignment

Date: December 2, 1983

From: Charles E. Arnold
SCR Team Chairman

Reply to Attn. of: C. Arnold, ACE-106

To: Jim Kishi
MEOT Leader

In reference to my memorandum to you dated November 4, 1983, please delete engineering test item 1C for Bendix M4C autopilot/trim runaway tests.

After issuing my memorandum, MAI conducted a detailed analysis of the autopilot/trim malfunction possibilities. Their analysis, dated November 4, 1983 was reviewed by Mr. Larry Malir, SCR Systems Team Leader, and he concurs with MAI that a dual failure would be required and the likelyhood of an undetectable combined trim/autopilot fault is extremely improbable. Therefore, the need for this test is deleted.

U.S. Department of Transportation

Federal Aviation Administration

Memorandum

Subject: INFORMATION: Mitsubishi MU-2 Special Certification Review; Multiple Expert Opinion Team (MEOT) Report

Date: December 16, 1983

From: David A. Robinson
David A. Robinson
MEOT Member, ACE-271A

Reply to Attn. of: ACE-271A

To: James S. Kishi
MEOT Chairman, ACE-106

It is my opinion that:

1. The minimum skill and knowledge required to operate the subject airplane is that specified by FAR Part 61.63(c).

   The aircraft appears to be no more demanding than other similar airplanes in which I have experience.

2. The airplane can be operated by one pilot.

#

MITSUBISHI AIRCRAFT INTERNATIONAL, INC.

P. O. BOX 3848 SAN ANGELO, TEXAS 76902 915/942-4200 TELEX 73-9438

16 February 1984

Mr. C. E. Arnold
Manager, Flight Test Section
Small Airplane Certification Directoriate
Federal Aviation Administration
601 East 12th Street
Kansas City, Missouri 64106

SJ: Flight Test Record Summary for MU-2 SCR

Dear Charlie:

We prepared the attached Flight Test Record Summary of both a short model (S/N 183) and a long model (S/N 1560). As I was asked to provide information of flight hours by Mr. J. Kishi, would you please give him this summary.

I hope this summary is enough for him.

Sincerely,

S. Nakagawa

S. Nakagawa
MAI MU-2 SCR Task Force Leader
Assistant Vice President,
Product Support

SN:ec

FLIGHT TEST RECORD SUMMARY
(MU-2 SCR)

(A) Short Model (S/N 183: MU-2B-20)

FLIGHT NO.	(HOURS)	DATE	LOCATION	CREWS	TEST ITEMS
SCR-20-1	(50 min)	11/17	SJT	G.M./E.B.	Familiarization Flight
SCR-20-2	(40 min)	11/17	SJT	D.R./E.B.	
SCR-20-3	(57 min)	11/18	SJT	C.A./E.B.	
SCR-20-4	(50 min)	11/18	SJT	J.K./E.B.	
SCR-20-5	(45 min)	11/18	SJT	D.R./E.B.	Item 2(a), 2(b), 2(c), 2(d), 2(e), and 2(j)
SCR-20-6	(38 min)	11/18	SJT	J.K./E.B.	
SCR-20-7	(40 min)	11/19	SJT	D.R./E.B.	Item 2(i)
SCR-20-8	(28 min)	11/19	SJT	J.K./E.B.	
SCR-20-9	(30 min)	11/19	SJT	D.R./E.B.	Item 2(f), 2(g), 2(h)
SCR-20-10	(25 min)	11/19	SJT	J.K./E.B.	
SCR-20-11	(1 hr. 8 min.)	11/21	SJT	C.A./E.B.	Item 1(a), 1(d), 1(h)
SCR-20-12	(37 min)	11/22	SJT	J.K./E.B.	Item 1(e), 1(f)
SCR-20-13	(50 min)	11/29	SJT	J.K./E.B.	Item 1(g)
SCR-20-14	(40 min)	11/29	SJT	J.K./E.B.	Item 1(b)
SCR-20-15	(40 min)	11/30	SJT	G.M./E.B.	Same with Flt. No. -5 & -6
SCR-20-16	(23 min)	11/30	SJT	G.M./E.B.	Same with Flt. No. -7 & -8
SCR-20-17	(18 min)	11/30	SJT	G.M./E.B.	Same with Flt. No. -9 & -10
SCR-20-18	(1 hr. 20 min)	12/06	SJT	E.B.	Alt. Static Source Cal.
SCR-20-19	(1 hr. 10 min)	12/06	SJT	E.B.	Alt. Static Source Cal.
SCR-20-20	(1 hr. 17 min)	12/13	SJT	R.W.	S.E. Appr. & Landing
SCR-20-21	(1 hr. 58 min)	12/19	SJT	C.A./R.W.	Additional tests
SCR-20-22	(2 hrs. 5 min.)	01/18	SJT →	R.W.	First Icing Trip
SCR-20-23	(2 hrs. 45 min)	01/18		G.M./R.W.	
SCR-20-24	(1 hr. 50 min)	01/19		G.M./R.W.	

FLIGHT NO.	(HOURS)	DATE	LOCATION	CREWS	TEST ITEMS
SCR-20-25	(3 hrs. 20 min)	01/19	→Lexington	G.M./R.W.	First Icing Test
SCR-20-26	(0)	01/20	Lexington	G.M./R.W.	
SCR-20-27	FOR MAINTENANCE OF S/N 183.				
SCR-20-28					
SCR-20-29	(2 hrs. 25 min)	02/09	SJT →	R.W.	Second Icing Test
SCR-20-30	(2 hrs. 40 min)	02/09		G.M./R.W.	
SCR-20-31	(2 hrs. 20 min)	02/09	→ SJT	R.W.	

(B) Long Model (S/N 1560: MU-2B-60)

FLIGHT NO.	(HOURS)	DATE	LOCATION	CREWS	TEST ITEMS
SCR-60-1	(1 hr. 6 min)	10/27	SJT	G.M./E.B.	Familiarization Flight
SCR-60-2	(1 hr. 0 min)	10/27	SJT	D.R./E.B.	Familiarization Flight
SCR-60-3	(1 hr. 5 min)	10/27	SJT	J.K./E.B.	Familiarization Flight
SCR-60-4	(1 hr. 40 min)	10/31	SJT	C.A./E.B.	Familiarization Flight
SCR-60-5	(57 min)	11/14	SJT	D.R./E.B.	Item 2(b), 2(c), 2(e), 2(j)
SCR-60-6	(53 min)	11/14	SJT	G.M./E.B.	Item 2(b), 2(c), 2(e), 2(j)
SCR-60-7	(1 hr. 0 min)	11/15	SJT	J.K./E.B.	Item 2(b), 2(c), 2(e), 2(j)
SCR-60-8	(1 hr. 18 min)	11/15	SJT	D.R./E.B.	Item 2(h) and 2(i)
SCR-60-9	(19 min)	11/16	SJT	G.M./E.B.	Item 2(h) and 2(i)
SCR-60-9-1	(30 min)	11/16	SJT	G.M./E.B.	Item 2(h) and 2(i)
SCR-60-10	(45 min)	11/16	SJT	J.K./E.B.	Item 2(h) and 2(i)
SCR-60-11	(1 hr. 0 min)	12/01	SJT	E.B./E.B.	General
SCR-60-12	NOT FOR SCR				
SCR-60-13	NOT FOR SCR				
SCR-60-14	NOT FOR SCR				
SCR-60-15	(1 hr. 20 min)	12/06	SJT	J.H.	Chase ship for S/N 183.
SCR-60-16	(1 hr. 10 min)	12/06	SJT	J.H.	Chase ship for S/N 183.
———	(1 hr. 54 min)	01/18	SJT →	J.H.	First Icing Trip (as chase ship).
———	(2 hr. 30 min)	01/18		J.H./J.K.	First Icing Trip (as chase ship).
———	(1 hr. 54 min)	01/19		J.H./J.K.	First Icing Trip (as chase ship).
———	(2 hrs. 12 min)	01/19		J.H./J.K.	First Icing Trip (as chase ship).

FLIGHT NO.	(HOURS)	DATE	LOCATION	CREWS	TEST ITEMS
________	(2 hrs. 24 min)	01/20		J.K./J.H.	
________	(2 hrs. 12 min)	01/20	→ SJT	R.W./J.H.	
________	(2 hrs. 6 min)	02/09	SJT →	J.H.	Second Icing Trip (as chase ship)
________	(2 hrs. 42 min)	02/09	SJT	J.K./J.H.	
________	(2 hrs. 12 min)	02/09	→ SJT	J.H.	

NOTE : FAA SCR TEAM ;

C.A. : C. Arnold , J.K. : J. Kishi , G.M. : G. Meyers

D.R. : D. Robinson , E.B. : E. Boothe

Company Pilot ;

R.W. : R. Wentling , E.B : E. Boehler, J.H. : J. Hunley

167. MULTIPLE-EXPERT-OPINION EVALUATIONS OF QUALITATIVE/SUBJECTIVE DESIGN FEATURES. (RIS: FS 8110-10)

a. Purpose. A multiple-expert-opinion evaluation may be used for determining compliance of controversial qualitative flight test certification design and operational features. This type of evaluation should be employed on an agency-wide basis whenever regional personnel feel that the issue is subject to controversy, precedent-setting, and/or transcends the local region's concern, for which specific guidelines and criteria have yet to be developed and issued.

(1) Determination of FAR compliance on an "equivalent level of safety basis" usually involves a qualitative analysis of an aircraft which possesses design features which do not meet the "letter of the regulation" or are not clearly covered in the applicable regulations.

(2) Determination of compliance in such instances is based on meeting the intent and objective of the applicable regulations and whether compensatory factors exist or operational limitations are applied which will result in an "equivalent" safe operation.

b. Responsibility. The responsibilities of the affected region are: first, to determine that the design feature in question involves the conditions of paragraph a. and warrants this type of evaluation; second, to initiate action to implement the procedure; and third, to include experts from Washington and from other regions which are likely to have or expect related features in its projects.

c. Procedure. The judgments of at least three expert persons should be used to make a determination of compliance with regulations involving qualitative/subjective standards when there appears to be a possible unsafe feature, a requirement application susceptible to nonstandard interregional administration, or when a marginal equivalent level of safety design feature is involved.

(1) Following determination that a multiple-expert-opinion compliance evaluation is necessary, a written request is to be forwarded by the regional branch chief to Washington and to the other regions which specifies the nature of the design feature and the details for the participation needed. In determining the participation needed, systemworthiness is to be considered. For example, Operations, Research/Development, Air Traffic, and Airports representatives should be invited to participate in the evaluation when the item in question may affect their areas of responsibility.

(2) The Chief of Flight Test for the region involved, or other team leader appointed by him, will direct and manage the team's activities while at the applicant's facility. He will be responsible for all meetings and discussions held between the applicant and FAA and for meetings held by FAA personnel only. He will be the spokesman for the FAA at the conclusion of the investigation and will initiate action to inform the applicant of the findings, in writing, as soon as possible.

(3) An initial meeting will be held with the applicant and all FAA participants to describe the purpose of the evaluation and to schedule the program.

(4) Each evaluator will be supplied with a checksheet prepared by the team leader. The format will include at least the following:

(a) Reference regulation.

(b) Problem.

(c) Findings.

(d) Recommendations.

(e) This checksheet will be completed, signed, and returned to the team leader. The consolidated report will then become a part of the TIR, Part II.

(5) After all FAA participants have independently reached a conclusion, the team leader shall convene the FAA personnel, independent of the applicant's personnel, to establish the conclusion(s) of the majority and minority, if any, of the members.

(6) The applicant may be orally informed of the team's findings and recommendations subject to written confirmation and higher approval.

d. Report.

(1) A written report of the team's findings, signed by the Chief of the Engineering and Manufacturing Branch, will be forwarded to: the applicant, the Chief, Engineering and Manufacturing Division in Washington, and to all regions. This report is to be forwarded not more than five working days after the conclusion of the evaluation.

(2) If the team has determined that, due to the results of the evaluation, guidance material and/or a regulation change is needed, such recommendations should be incorporated in the report and the Washington representative will initiate appropriate action.

168. TYPE INSPECTION REPORT (TIR).

a. Purpose.

(1) The purpose of the TIR is to provide an official record of the inspections and tests conducted to show compliance with the applicable regulations and provide a record of other information pertinent to each TC/STC project.

(2) A TIR consists of Part I, Ground Inspection - prepared by manufacturing inspection personnel; and Part II, Flight Test Report - prepared by flight test personnel.

b. Flight Test Report Preparation. A TIR should:

(1) Be prepared for each TC/STC project for which a TIA is issued.

(2) Be completed within 90 days after TC/STC issuance.

(3) Contain the results of all official TC inspections and tests.

(4) Contain a chronological list of all changes made to the prototype airplane and identified as made by the applicant <u>or</u> required by FAA as a result of type tests showing noncompliance.

(5) Be approved by the responsible supervisors.

(6) Be retained by the certificating region for reference purposes.

(7) On request, a copy prepared for the applicant provided all internal FAA and proprietary information is removed.

c. <u>Administrative Information</u>. The administrative information should be included in Section "0" of the flight test portion of each type inspection report.

(1) <u>Airmen Competency Maneuvers</u>. Include a statement and, if applicable, attach a copy of FAA Form 8420-3 or 8410-2 (ref. Par. 165.d(3)) which sets forth whether the type certification flight tests included all the airman competency and training maneuvers applicable to the type for the kind of operations approved.

(2) <u>Flight Operational Conditions</u>. Include a statement which describes those operational conditions and maneuver combinations experienced which would be representative of the more critical situations considered probable for the type. This will assure a record for future reference to show what was actually observed or encountered during official flight tests ". . . under all conditions of operation probable for the type . . ." (ref. general controllability requirements) that is not otherwise recorded. Specifically, the statement should include the environmental conditions, configurations, and the maneuvers performed such as:

(a) The degree of turbulence and/or precipitation involved (operationally severe, moderate, mild) with the type of maneuvers (turns, climbs, stalls, etc.), readability of instruments in turbulence.

(b) The runway and weight conditions (maximum landing weight, light weight, wet, slippery, slush, sod, etc.) with the type of landing or takeoff (maximum braking, crosswind velocity and angle, obstacle clearance, etc.).

FAA 21.21

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

A10SW
Mitsubishi
MU-2B-25
MU-2B-35
MU-2B-26
MU-2B-36
MU-2B-26A
MU-2B-36A
MU-2B-40
MU-2B-60
Revision 9
March 1, 1981

TYPE CERTIFICATE DATA SHEET NO. A10SW

This data sheet which is part of Type Certificate No. A10SW prescribes conditions and limitations under which the product for which the type certificate was issued meets the airworthiness requirements of the Civil Air Regulations.

Type Certificate Holder — Mitsubishi Aircraft International, Inc.
San Angelo, Texas

Model MU-2B-25, 6 to 9 PCLM (Normal Category) Approved January 20, 1976

Engines — 2 AiResearch TPE331-6-251M
Propeller-shaft to engine-rotor ratio 1 : 20.865

Fuel — Fuels as designated:

Aviation Turbine Fuel ASTM D1655-68T
Types Jet A, Jet A-1 and Jet B
MIL-T-5624G-1 Turbine Fuel: Grades JP-4 and JP-5
MIL-F-5616-1 Fuel; Grade JP-1
MIL-F--6005A (MR) -1; Type I and II
D. Eng. R.D. 2482; Issue No. 2
D. Eng. R.D. 2486; Issue No. 2
D. Eng. R.D. 2494; Issue No. 4
MIL-G-5572D; Grade 80/87 Octane Aviation
Gasoline (as emergency fuel only)
ASTM D910 Aviation Gasoline Grade 100LL (as an emergency fuel only)

Oil — Oils conforming to MIL-L-23699

Engine Limits — Static Sea Level Rating (I.S.A.)

	Shaft Horse-power (SHP)	Propeller Shaft Speed (%)*	Maximum Permissible Interstage Turbine Temperature (°C)
Takeoff (5 Min.)	665	100	923
Maximum Continuous	665	100	923
Starting Transient (1 Sec.)			1149

At low altitude and low ambient temperature, the engines may produce more power than that for which the aircraft has been certificated. Under these conditions, the placarded torque meter limitations shall not be exceeded.

*The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% continuous. 100% propeller shaft speed is defined as 2,000 RPM.

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Rev. No.	9	6	5	5	6	5	6	6	5	5	5	6	8	6	9

KISHI
10-11-83

Propeller and Propeller Limits

2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or 2 Hartzell HC-B3TN-5/T10178HB-11P with 3 blades each

Diameter: 90 3/8 inches

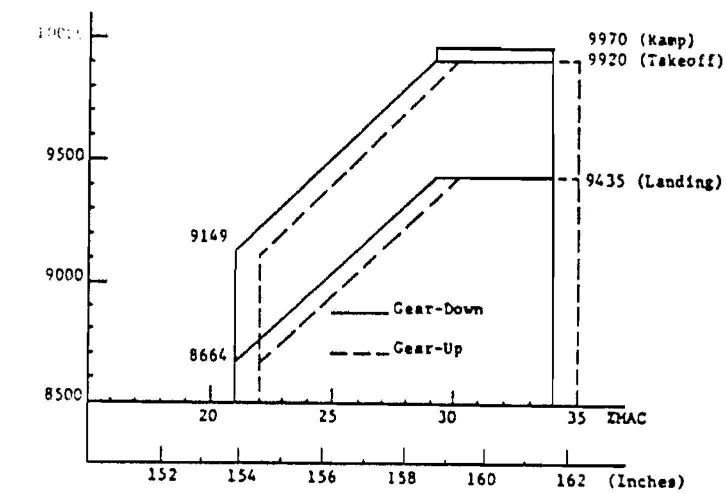
Pitch setting at 30 in. Station

Flight Idle	12°
Feathered	87° ± 0.5°
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum Operating) Decrease by 5 knots per 1,000 ft. above 21,300 ft. to account for Mmo = .57 M	:	250 knots (287 MPH)
Vp (Maneuvering)	:	181 knots (208 MPH)
Vfe (Flap Extended Flap 5°	:	175 knots (201 MPH)
Flap 20°, 40°	:	140 knots (161 MPH)
Vlo (Landing Gear Operating)	:	160 knots (184 MPH)
Vle (Landing Gear Extended)	:	162 knots (187 MPH)
Vmc (Minimum Control)	:	Flap 5° 100 knots (115 MPH) Flap 20° 93 knots (107 MPH)

C.G. Range.



Center of Gravity Range (MU-2B-25)

Ramp & Takeoff C.G. RANGES	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear Up	+154.3	22	+162.2	35	9149
Condition	+159.2	30	+162.2	35	9920
Gear	+153.8	21	+161.6	35	9149
Down	+158.6	29	+161.6	34	9920
Condition	+158.6	29	+161.6	34	9970

Landing C.G. Ranges	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear UP	+154.3	22	+162.2	35	8664
Condition	+159.2	30	+162.2	35	9435
Gear Down	+153.8	21	+161.6	34	8664
Condition	+158.6	29	+161.6	34	9435

Straight line variation between points given.
Moment change due to gear retraction is +6738 In-Lbs.
Maximum zero fuel weight - 9435 lbs.

Maximum Weight
Ramp: 9,977 lbs.
Takeoff: 9,920 lbs
Landing: 9,433 lbs.

No. of Seats
Maximum 9 (Pilot at +97.2)
See loading instructions for passenger loading.

Maximum Baggage
574 lbs. (200 lbs. at +205.1) (220 lbs. at +230.7)
(154 lbs. at +253.2)

Fuel Capacity

	Total CAP	USABLE
Wing Tank	159 gal. (+167.3)	154 gal.
Outer Tank	30 gal. (+163.4)	30 gal.
Tip Tank (2 at 93 gal. ea.)	186 gal. (+155.9)	180 gal.
Total	375 gal.	364 gal.

Fuel weights are based on 6.5 lbs/gal.

Fuel Usage Procedure
The fuel quantity of each tip tank must not be more than 55 gallons before landing.

Oil Capacity
Total 3.1 gal. (1.55 gal. each tank) (+138.7)

Maximum Operating Altitude
25,000 ft.

Control Surface Movements

Spoiler	Up 60°	
Aileron Trim	Up 20°	Down 20°
Elevator	Up 33°	Down 10°
Elevator Tab	Nose Up 30°	Nose Down 10°
Rudder	Right 25°	Left 22°
Rudder Tab	Right 25°	Left 25°
Flap Outboard		Down 40°
Flap Inboard		Down 40°

Serial Nos. Eligible
MU-2B-25 313 S.A.

Model MU-2B-35, 8 to 11 PCLM (Normal Category) Approved January 20, 1976

Engines
2 AiResearch TPE331-6-251M
Propeller-shaft to engine-rotor ratio 1 : 20.865

Fuel
Fuels as designated

Aviation Turbine Fuel ASTM D1655-68T
Types Jet A, Jet A-1, and Jet B
MIL-T-5624G-1 Turbine Fuel; Grades JP-4 and JP-5
MIL-F-5616-1 Fuel; Grade JP-1
MIL-F-46005A (MR) -1; Type I and II
D. Eng. R.D. 2482; Issue No. 2
D. Eng. R.D. 2486; Issue No. 2
D. Eng. R.D. 2494; Issue No. 4
MIL-G-5572D; Grade 80/87 Octane Aviation
Gasoline (as emergency fuel only)
ASTM D910 aviation gasoline Grade 100LL (as an emergency fuel only)

Oil
Oils conforming to MIL-L-23699

Engine Limits

	Shaft Horse-power (SHP)	Propeller Shaft Speed (%) *	Maximum Permissible Interstage Turbine Temperature (°C)
Takeoff (5 Min.)	665	100	923
Maximum Continuous	665	100	923
Starting Transient (1 Sec.)			1149

At low altitude and low ambient temperature, the engines may produce more power than that for which the aircraft has been certificated. Under these conditions, the placarded torque meter limitations shall not be exceeded.

*The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% continuous. 100% propeller shaft speed is defined as 2,000 RPM.

Propeller and Propeller Limits

2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each or 2 Hartzell HC-B3TN-5T10178HB-11R with 3 blades each.

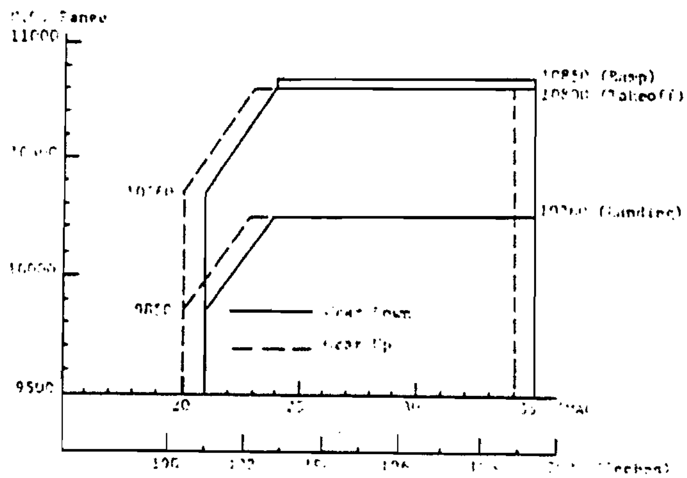
Diameter: 90 3/8 inches

Pitch setting at 30 in. Station

Flight Idle	12°
Feathered	$87^\circ \pm 0.5^\circ$
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum Operating) Decrease by 5 knots per 1, 000 ft. above 21,300 ft to account for Mmo = .57	:	250 knots (287 MPH)
Vp (Maneuvering	:	188 knots (216 MPH)
Vfe (Flap Extended)		
Flap 5°	:	175 knots (201 MPH)
Flap 20°, 40°	:	146 knots (168 MPH)
Vlo (Landing Gear Operating)		
Retract	:	170 knots (195 MPH)
Extend	:	170 knots (195 MPH)
Vle (Landing Gear Extended)	:	170 knots (195 MPH)
Vmc (Minimum Control)	:	90 knots (104 MPH)



(MU-2B-35.

Ramp & Takeoff Ranges	Forward		AFT		Weight
	In.	%MAC	In.	%MAC	Pounds
Gear Up	[illegible]	20	+196.8	34	[illegible]
Condition	[illegible]	22	[illegible]	34	[illegible]
Gear	+192.4	21	+199.4	35	[illegible]
Down	+192.8	24	+199.4	35	10800
Condition	+192.8	24	+199.4	35	10850

Landing Ranges	Forward		AFT		Weight
	In.	%MAC	In.	%MAC	Pounds
Gear Up	[illegible]	20	+198.8	34	9850
Condition	[illegible]	22	+196.8	34	10260
Gear Down	+192.4	21	+199.4	35	9850
Condition	+192.8	24	+199.4	35	10250

Straight line variation between points given.
Moment change due to gear retraction is -6555 In-Lbs.
Maximum zero fuel weight - 9950 lbs.

Maximum Weight	Ramp:	10,850 lbs.
	Takeoff:	10,800 lbs.
	Landing	10,260 lbs.

No. of Seats — Maximum 11 (Pilot at +97.2)
See loading instructions for passenger loading.

Maximum Baggage — 600 lbs. at +286.8

Fuel Capacity

	TOTAL CAP	USABLE
Wing Tank	159 gal. (+204.5)	154 gal.
Outer Tank	30 gal. (+201.0)	30 gal.
Tip Tank (2 at 93 gal. ea.)	186 gal. (+193.1)	180 gal.
Total	375 gal.	364 gal.

Fuel weights are based on 6.5 lbs/gal.

Fuel Usage Procedure — The fuel quantity of each tip tank must not be more Than 55 gallons before landing.

Oil Capacity — Total 3.1 gal. (1.55 gal. each tank) (+175.9)

Maximum Operating Altitude — 25,000 ft.

Control Surface Movements

Spoiler	Up 60°	
Aileron Trim	Up 20°	Down 20°
Elevator	Up 28°	Down 12°
Elevator Tab	Up 30°	Nose Down 10°
Rudder	Right 24°	Left 22°
Rudder Tab	Right 25°	Left 25°
Flap Outboard		Down 40°
Flap Inboard		Down 40°

Serial Nos. Eligible — MU-2B-35 652 S.A.

Model MU-2B-26, 6 to 9 PCLM (Normal Category) Approved March 9, 1976

Engines — 2 AiResearch TPE331-6-251M
Propeller-shaft to engine-rotor ratio 1 : 20.865

Fuel — Fuels as designated:

Aviation Turbine Fuel ASTM D1655-68T
Types Jet A, Jet A-1 and Jet B
MIL-T-5624G-1 Turbine Fuel: Grades JP-4 and JP-5
MIL-F-5616-1 Fuel; Grade JP-1
MIL-F-46005A (MR) -1; Type I and II
D. Eng. R.D. 2482; Issue No. 2
D. Eng. R.D. 2486; Issue No. 2
D. Eng. R.D. 2494; Issue No. 4
MIL-G-5572D; Grade 80/87 Octane Aviation
Gasoline (as emergency fuel only)
ASTM D910 Aviation Gasoline Grade 100LL (as emergency fuel only)

Oil — Oils conforming to MIL-L-23699

Engine Limits

Static Sea Level Rating (I.S.A.)

	Shaft Horse-power (SHP)	Propeller Shaft Speed (%)*	Maximum Permissible Interstage Turbine Temperature (°C)
Takeoff (5 Min.)	665	100	923
Maximum Continuous	665	100	923
Starting Transient (1 Sec.)			1149

At low altitude and low ambient temperature, the engines may produce more power than that for which the aircraft has been certificated. Under these conditions, the placarded torque meter limitations shall not be exceeded.

*The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% continuous. 100% propeller shaft speed is defined as 2,000 RPM.

Propeller and Propeller Limits

2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or 2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each

Diameter: 90 3/8 inches

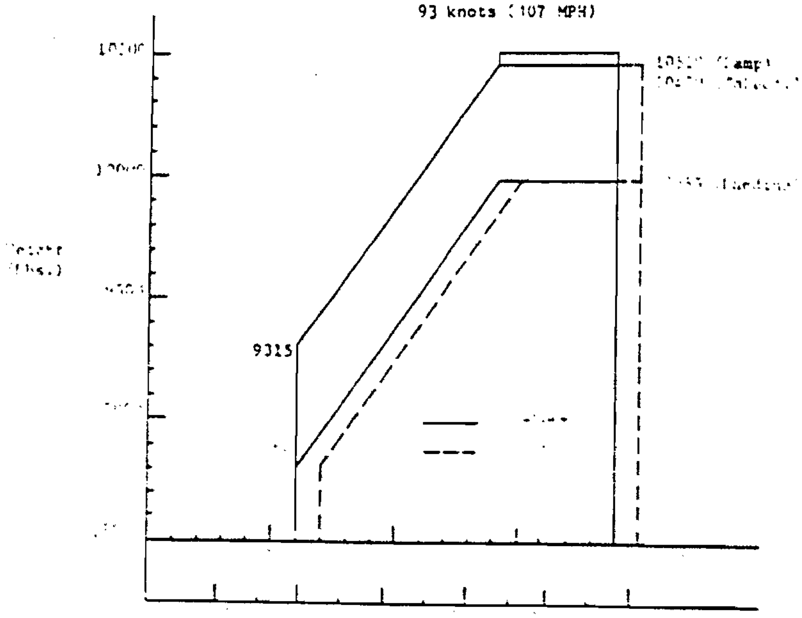
Pitch setting at 30 in. Station

Flight Idle	12°
Feathered	$87^\circ \pm 0.5^\circ$
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum Operating) : 250 knots (287 MPH)
Decrease by 5 knots per 1,000 ft. above 21,300 ft. to account for Mmo = .57

Vp	(Maneuvering)	:182 knots (209 MPH)
Vfe	(Flap Extended)	
	Flap 5°	:175 knots (201 MPH)
	Flap 20°, 40°	:155 knots (178 MPH)
Vlo	(Landing Gear Operating)	:170 knots (196 MPH)
Vle	(Landing Gear Extended)	:170 knots (196 MPH)
Vmc	(Minimum Control)	:Flap 5° 100 knots (115 MPH) Flap 20° 93 knots (107 MPH)



Ramp Takeoff C.G. RANGES	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear Up	+154.7	22	+162.2	35	9315
Condition	+155.2	30	+162.2	35	10470
Gear	+153.7	21	+161.6	34	9315
Down	+156.4	29	+161.6	34	10470
Condition	+155.9	29	+161.6	34	10520

Landing C.G. Ranges	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear UP	+154.7	22	+162.2	35	8800
Condition	+155.2	30	+162.2	35	9955
Gear Down	+153.7	21	+161.6	34	8800
Condition	+156.5	29	+161.6	34	9955

Straight line variation between points given.
Moment change due to gear retraction is +6733 IN-Lbs
Maximum zero fuel weight - 9700 lbs.

Maximum Weight	Ramp:	10,520 lbs.
	Takoff:	10,470 lbs.
	Landing:	9,955 lbs.

No. of Seats — Maximum 9 (maximum operating altitude 25,000 ft.) (pilot at + 97.2)
Maximum 7 (maximum operating altitude 28,000 ft.) (pilot at + 97.2)
See loading instructions for passenger loading

Maximum Baggage — 574 lbs. (200 lbs. at +205.1) (220 lbs. at +230.7)
(154 lbs. at +253.2)

Fuel Capacity		Total CAP		USABLE
	Wing Tank	159 gal.	(+167.3)	154
	Outer Tank	30 gal.	(+163.4)	30
	Tip Tank (2 at 93 gal. ea.)	186 gal.	(+155.9)	180
	Total	375 gal.		364

Fuel weights are based on 6.5 lbs/gal.

Fuel Usage Procedure — The fuel quantity of each tip tank must not be more than 55 gallons before landing.

Oil Capacity — Total 3.1 gal. (1.55 gal. each tank)
(+138.7)

Maximum Operating Altitude — 28,000 ft.

Control Surface Movements			
	Spoiler	Up 60°	
	Aileron Trim	Up 20°	Down 20°
	Elevator	Up 33°	Down 10°
	Elevator Tab	Nose Up 30°	Nose Down 10°
	Rudder	Right 25°	Left 22°
	Rudder Tab	Right 25°	Left 25°
	Flap Outboard		Down 40°
	Flap Inboard		Down 40°

Serial Nos. Eligible — MU-2B-26 321 S.A., 348 S.A. and up

<u>Model MU-2B-36, 6 to 9 PCLM (Normal Category) Approved March 9, 1976</u>

Engines — 2 AiResearch TPE331-6-251M
Propeller-shaft to engine-rotor ratio 1 : 20.865

Fuel — Fuels as designated:

Aviation Turbine Fuel ASTM D1655-68T
Types Jet A, Jet A-1 and Jet B
MIL-T-5624G-1 Turbine Fuel: Grades JP-4 and JP-5
MIL-F-5616-1 Fuel; Grade JP-1
MIL-F-46005A (MR) -1; Type I and II

(Fuel cont'd.)	D. Eng. R.D. 2482; Issue No. 2 D. Eng. R.D. 2486; Issue No. 2 D. Eng. R.D. 2494; Issue No. 4 MIL-G-5572D; Grade 80/87 Octane Aviation Gasoline (as emergency fuel only) ASTM D910 Aviation Gasoline Grade 100LL (as emergency fuel only)
Oil	Oils conforming to MIL-L-23699

Engine Limits

	Shaft Horse-power (SHP)	Propeller Shaft Speed (%)*	Maximum Permissible Interstage Turbine Temperature (°C)
Takeoff (5 Min.)	715	100	923
Maximum Continuous	715	100	923
Starting Transient (1 Sec.)			1149

At low altitude and low ambient temperature, the engines may produce more power than that for which the aircraft has been certificated. Under these conditions, the placarded torque meter limitations shall not be exceeded.

*The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% continuous . 100% propeller shaft speed is defined as 2,000 RPM.

Propeller and Propeller Limits

2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or 2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each

Diameter: 90 3/8 inches

Pitch setting at 30 in. Station

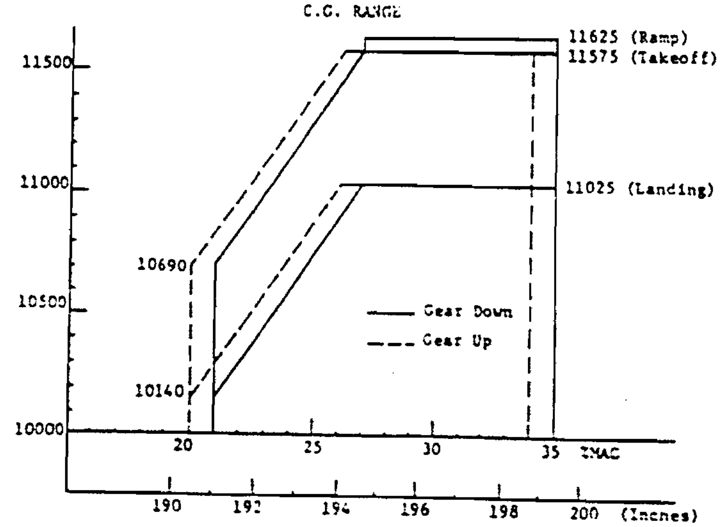
Flight Idle	12°
Feathered	87° ± 0.5°
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum Operating) : 250 knots (287 MPH)
Decrease by 5 knots per 1,000 ft. above 21,300 ft. to account for Mmo = .57

Vp	(Maneuvering)	: 191 knots (220 MPH)
Vfe	(Flap Extended	
	Flap 5°	: 175 knots (201 MPH)
	Flap 20°, 40°	: 155 knots (178 MPH)
Vlo	(Landing Gear Operating)	: 175 knots (201 MPH)
Vle	(Landing Gear Extended)	: 175 knots (196 MPH)
Vmc	(Minimum Control)	: 99 knots (114 MPH)

C.G. RANGE



Center of Gravity Range (MU-2B-36)

Ramp Takeoff C.G. RANGES	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear Up	+190.3	20	+198.8	34	[illegible]
Condition	+194.0	25	+198.8	34	[illegible]
Gear	+190.9	21	+199.4	35	10890
Down	+194.6	27	+199.4	35	11575
Condition	+194.6	27	+199.4	35	11625

Landing Ranges	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear UP	+190.3	20	+198.8	34	10140
Condition	+194.0	25	+196.6	34	11025
Gear Down	+190.3	21	+199.4	35	9140
Condition	+194.6	27	+199.4	35	11025

Straight line variation between points given.
Moment change due to gear retraction is -6555 In-Lbs
Maximum zero fuel weight -9950 lbs.

Maximum Weight — Ramp: 11,625 lbs.
Takoff: 11,575 lbs.
Landing: 11,025 lbs.

No. of Seats — Maximum 11 (Pilot at +97.2)

See loading instructions for passenger loading.

Maximum Baggage — 600 lbs. at +286.9

Fuel Capacity

	Total CAP	USABLE
Wing Tank	159 gal. (+204.5)	154
Outer Tank	30 gal. (+201.0)	30
Tip Tank (2 at 93 gal. ea.)	186 gal. (+193.1)	180
Total	375 gal.	364

Fuel weights are based on 5.5 lbs/gal.

Fuel Usage Procedure — The fuel quantity of each tip tank must not be more than 55 gallons before landing.

Oil Capacity — Total 3.1 gal. (1.55 gal. each tank) (+175.9)

Maximum Operating Altitude — 25,000 ft.

Control Surface Movements

Spoiler	Up 60°	
Aileron Trim	Up 20°	Down 20°
Elevator	Up 28°	Down 12°
Elevator Tab	Nose Up 30°	Nose Down 10°
Rudder	Right 24°	Left 22°
Rudder Tab	Right 25°	Left 25°
Flap Outboard		Down 40°
Flap Inboard		Down 40°

Serial Nos. Eligible — MU-2B-36 651 S.A., 697 S.A. and Up

Model MU-2B-26A, 6 to 9 PCLM (Normal Category) Approved January 12, 1977

Model MU-2B-40, 6 to 9 PCLM (Normal Category) Approved March 2, 1978

Engines
Model MU-2B-26A — 2 AiResearch TPE331-5-252M
Propeller-shaft to engine-rotor ratio 1 : 26.2287
Model MU-2B-40 — 2 AiResearch TPE331-10-501M
Propeller-shaft to engine-rotor ratio 1 : 26.2287

Fuel

Fuels as designated:

Aviation Turbine Fuel ASTM D1655-59T
Types Jet A, Jet A-1 and Jet B
MIL-T-5624G-1 Turbine Fuel; Grades JP-4 and JP-5
MIL-F-5616-1 Fuel; Grade JP-1
MIL-F-46005A (MR) -1; Type I and II
D. Eng. R.D. 2482; Issue No. 2
D. Eng R.D. 2486; Issue No. 2
D. Eng. R.D. 2494; Issue No. 4
MIL-G-5572D; Grade 80/87 Octane Aviation
Gasoline (as emergency fuel only)
ASTM D910 Aviation Gasoline Grade 100LL (As emergency fuel only)

Oil

Oils conforming to MIL-L-23699

Engine Limits

Static Sea Level Rating (I.S.A.)

	Shaft Horse-power (SHP)	Propeller Shaft Speed (%)*	Maximum Permissible Interstage Turbine Temperature (°C)	
			(-26A)	(-40)
Takeoff (5 Min.)	665	100	923	650
Maximum Continuous	665	100	923	650
Starting Transient (1 Sec.)			1149	770

At low altitude and low ambient temperature, the engines may produce more power than that for which the aircraft has been certificated. Under these conditions, the placarded torque meter limitations shall not be exceeded.

*The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% continuous. 100% propeller shaft speed is defined as 1,591 RPM.

Propeller and Propeller Limits

2 Hartzell HC-B4TN-5DL/LT10282HB-5.3R with 4 blades each, or
2 Hartzell HC-B4TN-5DL/LT10282B-5.3R
with 4 blades each

Diameter: 98 inches

Pitch setting at 30 in. Station

Flight Idle	16°	
Feathered	88.0°	$\pm$ .3°
Reverse	-5.5°	.7°

Airspeed Limits (CAS)

Vmo (Maximum Operating) : 250 knots (287 MPH)
Decrease by 5 knots per 1,000 ft. above 21,300 ft. to account for Mmo = .57

Vp	(Maneuvering)	: 182 knots (209 MPH)
Ffe	(Flap Extended	
	Flap 5°	: 175 knots (201 MPH)
	Flap 20°, 40°	: 155 knots (178 MPH)
Vlo	(Landing Gear Operating)	: 170 knots (196 MPH)
Vle	(Landing Gear Extended)	: 170 knots (196 MPH)
Vmc	(Minimum Control)	: Flaps 20° 93 knots (107 MPH)

Appendix 8

Propulsion Team Report

SCR Team Specific Findings - Powerplant

1. Statement of Question

The NTSB recommended a certification review of MU-2 airplanes relative to the engines to determine whether potential existed for system design improvements, improved maintenance procedures, improved service or repair instructions, and changes in operational procedures.

2. Facts Bearing on the Question

a. All MU-2B series aircraft are equipped with AiResearch Model TPE331 series engines. The TPE331 engine was issued FAA Type Certificate E2WE on February 25, 1965, under the certification basis of Civil Air Regulation (CAR) 13. For installation of the engine in the airframe, additional Special Conditions were issued by FAA letter to Japan Civil Aviation Bureau (JCAB) dated May 14, 1965.

b. The AiResearch Model TPE331 engine is widely used in a number of U.S. and foreign aircraft. The overall service history has been considered in evaluating engine related service and design needs.

c. In review of the specific MU-2 accident history as provided by NTSB, 7% were categorized as engine related.

3. Discussion of Relative Facts

The engines and associated propellers were reviewed in the following areas:

a. System design improvements--no design improvements were determined to be necessary for either the engines or propellers other than the ongoing product improvement changes resulting from service experience or manufacturer initiative.

b. Improved maintenance procedures--the existing procedures are considered to be satisfactory.

c. Improved service or repair instructions--the existing instructions are considered to be satisfactory.

d. Operation procedural changes--a review of the flight manuals for the various MU-2 models resulted in a disparity between both JCAB and FAA approved manuals for the Negative Torque System (NTS) preflight check. The disparity was that not all the manuals required an NTS check prior to the first flight of the day.

4. Conclusions

The existing system which solicits and recognizes field service problems which result in the issuance of airworthiness directives, service bulletins, and other corrective requirements is considered to be satisfactory in identifying and correcting engine related anomalies.

5. Recommendations

a. All flight manuals should be reviewed and revised as necessary to require the pilot to perform a pre-takeoff Negative Torque System (NTS) check prior to the first flight of each day.

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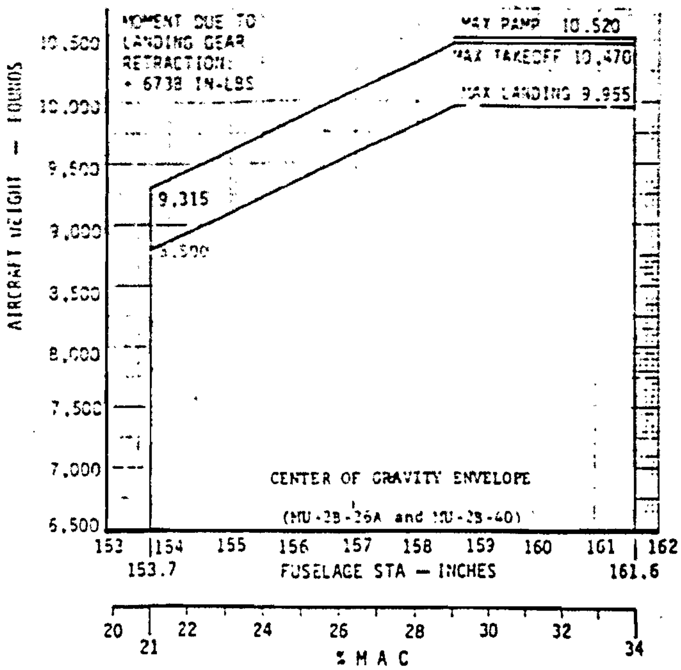


Ramp Takeoff C.G. Ranges	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear Up	+154.3	22	+162.2	35	9315
Condition	+159.2	30	+162.2	35	10470
Gear	+153.7	21	+161.6	34	9315
Down	+158.6	29	+161.6	34	10470
Condition	+158.6	29	+161.6	34	10520

Landing C.G. Ranges	Forward In.	Forward %MAC	AFT In.	AFT %MAC	Weight Pounds
Gear Up	+154.3	22	+162.2	35	8800
Condition	+159.2	30	+162.2	35	9955
Gear Down	+153.7	21	+161.6	34	8800
Condition	+158.5	29	+161.6	34	9955

Straight line variation between points given.
Moment change due to gear retraction is +6738 In-Lbs.
Maximum zero fuel weight 9700 lbs.

Maximum Weight	Ramp:	10,520 lbs.
	Takeoff:	10,470 lbs.
	Landing	9,955 lbs.

No. of Seats — Maximum 9 (maximum operating altitude 25,000 ft.) (pilot at +97.2)
Maximum 7 (maximum operating altitude 29,000 ft.) (pilot at +97.2) Model MU-2B-26A
Maximum 8 (maximum operating altitude 31,000 ft.) (pilot at +97.2) Model MU-2B-40
See loading instructions for passenger loading

Maximum Baggage — 574 lbs. (200 lbs. at +205.1) (220 lbs. at +230.7)
(154 lbs. at +253.2)

Fuel Capacity

	TOTAL CAP		USABLE
Wing Tank	159 gal.	(+167.3)	154
Outer Tank	* 30 gal.	(+163.4)	30
	** 70.6 gal.	(+163.4)	64
Tip Tank (2 at 93 gal. ea.)	186 gal.	(+155.9)	180
Total	*375 gal.		364 gal.
	**415.6 gal.		403.0 gal.

Fuel weights are based on 6.5 lbs/gal.

*MU-2B-26A, all S/N's, MU-2B-40, S/N 363S.A.
**MU-2B-40, S/N 395 S.A. and up

Fuel Usage Procedure — The fuel quantity of each tip tank must not be more than 65 gallons before landing.

Oil Capacity — Total — 3.1 gal. (1.55 gal. each tank) (+135.7)

Maximum Operating Altitude	Model MU-2B-26A	28,000 ft.	
	Model MU-2B-40	: 31,000 feet	
Control Surface Movements	Spoiler	Up 50°	
	Aileron Trim	Up 20°	Down 20°
	Elevator	Up 33°	Down 10°
	Elevator Tab	Nose Up 30°	Nose Down 10°
	Rudder	Right 22°	Left 25°
	Rudder Tab	Right 22°	Left 25°
	Flap Outboard		Down 40°
	Flap Inboard		Down 40°
Serial Nos. Eligible	MU-2B-26A	321 S.A.	348 S.A. and up
	MU-2B-40	365 S.A.	395 S.A. and up

<u>Model MU-2B-36A, 8 to 11 PCLM (Normal Category) Approved January 12, 1977</u>

<u>Model MU-2B-60, 8 to 11 PCLM (Normal Category) Approved March 2, 1978</u>

Engines
Model MU-2B-36A 2 AiResearch TPE331-5-252M
Propeller-shaft to engine-rotor ratio 1 : 26.2287

Model MU-2B-60 2 AiResearch TPE331-10-501M
Propeller-shaft to engine-rotor ratio 1 : 26.2287

Fuel Fuels as designated

Aviation Turbine Fuel ASTM D1655-68T
Types Jet A, Jet A-1, and Jet B
MIL-T-5624G-1 Turbine Fuel; Grades JP-4 and JP-5
MIL-F-5616-1 Fuel; Grade JP-1
MIL-F-46005A (MR) -1; Type I and II
D. Eng. R.D. 2482; Issue No. 2
D. Eng. R.D. 2486; Issue No. 2
D. Eng. R.D. 2494; Issue No. 4
MIL-G-5572D; Grade 80/87 Octane Aviation
Gaoline (as emerency fuel only)
ASTM D910 Aviation Gasoline Grade 100 LL (as emergency fuel only)

Oil Oils conforming to MIL-L-23699

Engine Limits

	Shaft Horse-power (SHP)	Propeller Shaft Speed (%) *	Maximum Permissible Interstage Turbine Temperature (°C) (-36A)	(-60)
Takeoff (5 Min.)	715	100	923	650
Maximum Continuous	715	100	923	650
Starting Transient (1 Sec.)			1149	770

At low altitude and low ambient temperature, the engines may produce more power than that for which the aircraft has been certificated. Under these conditions, the placarded torque meter limitations shall not be exceeded.

*The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% continuous. 100% propeller shaft speed is defined as 1,591 RPM.

Propeller and Propeller Limits	2 Hartzell HC-B4TN-5DL/LT10282HB-5.3P with 4 blades each or 2 Hartzell HC-B4TN-5DL/LT10282-5.3P with 4 blades each.

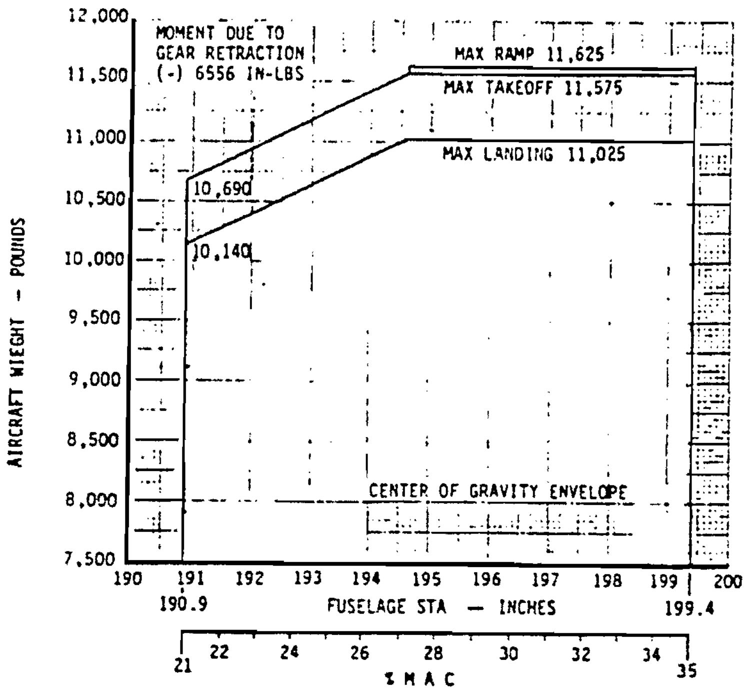
Diameter: 98 inches

Pitch setting at 30 in. Station

Flight Idle	12° $\pm$ .1° (See Note 3)
Feathered	88.0° $\pm$ .1°
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum Operating) Decrease by 5 knots per 1,000 ft. above 21,300 feet to account for Mmo = .57	: 250 knots (287 MPH)
Vp (Maneuvering	: 191 knots (220 MPH)
Vfe (Flap Extended)	
Flap 5°	: 175 knots (201 MPH)
Flap 20°, 40°	: 155 knots (178 MPH)
Vlo (Landing Gear Operating)	: 175 knots (201)
Vle (Landing Gear Extended)	: 175 knots (201 MPH)
Vmc (Minimum Control) (Flap Deflection 20°)	: 99 knots (114 MPH)



(MU-2B-36A and MU-2B-60)

Ramp Takeoff C.G. Ranges	Forward In.	Forward %MAC	Aft In.	Aft %MAC	Weight Pounds
Gear Up	+190.3	20	+195.8	34	10690
Condition	+194.0	26	+195.8	34	11575
Gear	+190.4	21	+199.4	35	10690
Down	+194.6	27	+199.4	35	11575
Condition	+194.6	27	+199.4	35	11625

Landing Ranges	Forward In.	Forward %MAC	Aft In.	Aft %MAC	Weight Pounds
Gear Up	+190.3	20	+195.8	34	10140
Condition	+194.6	26	+195.8	34	11025
Gear Down	+190.9	21	+199.4	35	10140
Condition	+194.0	27	+199.4	35	11025

Straight line variation between points given.
Moment change due to gear retraction is -6556 In-Lbs.
Maximum zero fuel weight - 9950 lbs.

Maximum Weight	Ramp:	11,625 lbs.
	Takeoff:	11,575 lbs.
	Landing	11,025 lbs.

No. of Seats — Maximum 11 (Pilot at +97.2)

See loading instructions for passenger loading.

Maximum Baggage — 600 lbs. at +296.8

Fuel Capacity		TOTAL CAP	USABLE
	Wing Tank	159 gal. (+204.5)	154
	Outer Tank	* 30 gal. (+201.0)	30
		** 70.6 gal. (+201.0)	69
	Tip Tank (2 at 93 gal. ea.)	186 gal. (+193.1)	180
	Total	*375 gal.	364 gal.
		**415.6 gal.	403.0 gal.

Fuel weights are based on 6.5 lbs/gal.

*MU-2B-36A, All S/N's, MU-2B-60, S/N 700 S.A.
**MU-2B-60, S/N 731 S.A. and up

Fuel Usage Procedure — The fuel quantity of each tip tank must not be more than 65 gallons before landing.

Oil Capacity — Total 3.1 gal. (1.55 gal. each tank) (+175.9)

Maximum Operating Altitude	Model MU-2B-36A	25,000 ft.
	Model MU-2B-60	31,000 feet

Control Surface Movements			
	Spoiler	Up 60°	
	Aileron Trim	Up 20°	Down 20°
	Elevator	Up 28°	Down 12°
	Elevator Tab	Nose Up 30°	Nose Down 10°
	Rudder	Right 22°	Left 24°
	Rudder Tab	Right 25°	Left 25°
	Flap Outboard		Down 40°
	Flap Inboard		Down 40°

Serial Nos. Eligible	MU-2B-36A	661 S.A.	697 S.A. and Up
	MU-2B-60	700 S.A.	731 S.A. and Up

DATA PERTINENT TO ALL MODELS

Datum — Nose of fuselage for Models MU-2B-25, MU-2B-26, MU-2B-26A, and MU-2B-40 (Forward 183.46 in. (4660 mm) from front plane of wing near spar fuselage connecting frame).

6.69 in. (170 mm) aft of nose for Models MU-2B-35, MU-2B-36, MU-2B-36A, and MU-2B-60 (Forward 220.67 in. (5605 mm) from front plane of wing rear spar fuselage connecting frame).

MAC — 62.55 in. (Leading edge of MAC is at +141.0 (MU-2B-25, MU-2B-26, MU-2B-26A, and MU-2B-40, and at +175.23 (MU-2B-35, MU-2B-36, MU-2B-36A, and MU-2B-60).

Leveling Means — Position spirit level on the R.H. bracket of keel (STA. 5509, STA. 5920) longitudinally, and on the channel of door actuator laterally for Models MU-2B-25, MU-2B-26, MU-2B-26A, and MU-2B-40.

A plumb bob suspension strip fitted to the channel of the pressure bulkhead (STA. 6035), and a leveling provision scale on the equipment floor in the electrical compartment for Models MU-2B-35, MU-2B-36, MU-2B-36A, and MU-2B-60.

Certification Basis — CAR 3 dated May 15, 1956, including Amendments 3-1 through 3-8 plus the Special Conditions stated in FAA letter to the JCAB dated May 14, 1965, modified by FAA letters to the JCAB dated January 25, 1966, and May 12, 1971. Exemption No. 1951, dated February 4, 1974, granted an exemption from Section 21.17.

Type Certification No. A10SW issued January 20, 1976.
Application for Type Certificate dated September 12, 1973.

Production Basis — None. Prior to original certification of each aircraft, an FAA representative must perform a detailed inspection for workmanship, materials, conformity with approved technical data, and a check of flight characteristics.

Export Eligibility — The Models MU-2B-26A, MU-2B-36A, MU-2B-40, and MU-2B-60 comply with French Certification requirements of the Secretariat General a l'Aviation Civile of France when modified in accordance with K940A-6006 Kit Installation.

Required Equipment — The basic required equipment as prescribed in the applicable airworthiness regulations (see Certification Basis) must be installed in the aircraft for type certification.

Mitsubishi Aircraft International Report MR0128 (MU-2B-25), MR0127 (MU-2B-35), MR0130 (MU-2B-26), MR0192 (MU-2B-26A), MR0269 (MU-2B-40), MR0129 (MU-2B-36), MR0193 (MU-2B-36A) and MR0270 (MU-2B-60) contain lists of all required equipment as well as optional equipment installations approved by the FAA.

Import Requirements — Spare parts and/or assemblies that are procured from MHI or its suppliers by MU-2 Corporation shall conform to type design data and reflect the applicable export airworthiness tags required by JCAB and FAA. Parts and equipment not requiring export airworthiness tag will be accompanied by MHI inspection tags.

Note 1:

(a) Current weight and balance report, including list of equipment included in certificated empty weight, and loading instructions when necessary, must be provided for each aircraft at the time of original airworthiness certification.

(b) The certificate empty weight and corresponding center of gravity location must include unusable fuel and undrainable oil as follows:

Unusable Fuel (MU-2B-25, MU-2B-26, MU-2B-26A, MU-2B-40, S/N 365) 71.5 lbs. at +161.1; (MU-2B-40, S/N 395 and up) 81.90 lbs. at +161.4.

Unusable Fuel (MU-2B-35, MU-2B-36, MU-2B-36A, MU-2B-60, S/N 700) 71.5 lbs. at +198.3; (MU-2B-60, S/N 731 and up) 81.90 lbs. at +198.6.

Note 2: This aircraft must be operated in accordance with the FAA approved Airplane Flight Manual.

Serial Numbers of Aircraft — The serial number under this certificate must include the letters S.A.

S.A. stands for San Angelo.
Example: S/N xxxS.A.

Note 3: MU-2B-26A/-40, S/N 321SA, 348SA, 350SA through 419SA, 421SA, 422SA, and 423SA; and MU-2B-36A/-60, S/N 661SA, 697SA through 747SA, 749SA through 757SA, and 759SA through 773SA are eligible for operation with 16° propeller flight idle pitch settings. Service Bulletin SB 016/61-001 dated March 18, 1980, covers changes for use of 12° setting. Both propellers must be set for the same pitch setting, either 12° or 16°.

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DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

A2PC
Revision 16
MITSUBISHI
MU-2B
MU-2B-10
MU-2B-20
MU-2B-15
MU-2B-30
MU-2B-35
MU-2B-25
MU-2B-36
MU-2B-26
June 30, 1975

TYPE CERTIFICATE DATA SHEET NO. A2PC

This data sheet, which is part of Type Certificate No. A2PC, prescribes conditions and limitations under which the product for which the type certificate was issued meets the airworthiness requirements of the Civil Air Regulations.

Type Certificate Holder — Mitsubishi Heavy Industries, Ltd.
5-1, Marunouchi 2 Chome, Chiyoda-ku
Tokyo, Japan

I - Model MU-2B, 6 to 9 PCLM (Normal Category), Approved November 4, 1965

Engines — 2 AiResearch TPE331-25A or TPE331-25AA or TPE331-25AB
Propeller shaft to engine rotor ratio 1 : 20.865

Fuel — Fuels conforming to AiResearch Specification SC-5605 or to subsequent revisions thereof.

Oil — Oils conforming to AiResearch Specification SC-5605 or to subsequent revisions thereof.

Engine Limits — Static Sea Level Ratings (I.S.A.)

	Shaft Horsepower (SHP)	Jet Thrust (lb.)	Equiv. Shaft Horsepower (ESHP)	Prop. Shaft Speed (%)*	Max. Permissible Exhaust Gas Temp. (°C)
Takeoff (5 min.)	575	75	605	100	571
Max. Continuous	500	73	529	100	530
Starting Transient (1 sec.)					815

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

*The maximum allowable propeller shaft speed is 105% for a transient period not to exceed 5 seconds. 100% propeller shaft speed is defined as 2,000 rpm.

Propeller and Propeller Limits

2 Hartzell HC-B3TN-5/T10176SB-5 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10176HSB-5 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HE-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.
(See Note 3 regarding intermixing propeller blades.)

Diameter: 96 in. (T10176-5)
90 in. (T10178-11)
(No reduction permitted)

Pitch setting at 30 in. station:
Flight idle 12°
Feathered 86°

Airspeed Limits (CAS)

Vmo (Maximum operating	250 knots (287 m.p.h.)
Vp (Maneuvering)	172 knots (197 m.p.h.)
Vfe (Flap extended)	140 knots (161 m.p.h.)
Vlo (Landing gear operating)	160 knots (184 m.p.h.)
Vle (landing gear extended)	160 knots (184 m.p.h.)

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	Vmc (Minimum Control) 92 knots (106 m.p.h.) S/N MU2-006, MU2-007 if not modified by SB No. 66. 91 knots (105 m.p.h.) S/N MU2-008, MU2-010, MU2-013 if not modified by SB No. 66 89 knots (102 m.p.h.) S/N MU2-004, MU2-009, MU2-011, MU2-012 MU2-014 through MU2-030, MU2-032 through MU2-042 if not modified by SB No. 66. Flap 5° 100 knots (115 m.p.h.) S/N MU2-006, MU2-007 if modified by Flap 20° 92 knots (106 m.p.h.) SB No. 66 Flap 5° 99 knots (114 m.p.h.) S/N MU2-008, MU2-010, MU2-013 if Flap 20° 91 knots (105 m.p.h.) modified by SB No. 66 Flap 5° 97 knots (112 m.p.h.) S/N MU2-004, MU2-009, MU2-011, MU2-012, Flap 20° 89 knots (102 m.p.h.) MU2-014 through MU2-030, MU2-032 through MU2-042 if modified by SB No. 66, and S/N MU2-031, MU2-043 and up.
C.G. Range (Landing Gear Extended)	see table below

Weight (lb.)	Forward	Aft
8;160 or less	+ 153.74 (21% MAC)	+ 161.60 (34% MAC)
8,930	+ 158.58 (29% MAC)	+ 161.60 (34% MAC)
(If not modified by SB Nos. 36 and 92)		
8,577 or less	+ 153.74 (21% MAC)	+ 161.60 (34% MAC)
9,350	+ 158.58 (29% MAC)	+ 161.60 (34% MAC)
(If modified by SB Nos. 36 and 92)		

Straight line variation between points given
Moment change due to gear retraction is +6,738 in.lb.

Maximum Weight	Takeoff 8,930 lb. Landing 8,490 lb. (If not modified by SB Nos. 36 and 92) Takeoff 9,350 lb. Landing 8,930 lb. (If modified by SB Nos. 36 and 92)
No. of Seats	9 (Pilot and Copilot at +97.2)
Maximum Baggage	420 lb. (200 lb. at +205.1) (220 lb. at +230.7) (S/N MU2-008, through MU2-024 if not modified by SB No. 10, and S/N MU2-004, MU2-006, MU2-007) 574 lb. (200 lb. at +205.1) (220 lb. at +230.7) (154 lb. at +253.2) (S/N MU2-008 through MU2-024 if modified by SB No. 10, and S/N MU2-025 and up)
Fuel Capacity	Wing tank 165 gal. (+167.3) Tip Tank (2 at 65 gal. ea.)* 130 gal. (+155.9) Total 295 gal. Usable 285 gal. Fuel weights are based on 6.5 lb./gal. *See NOTE 1(c) for required fuel usage procedure.
Oil Capacity	Total 3.7 gal. (1.85 gal. each tank) (+139.4)
Maximum Operating Altitude	23,000 ft. (S/N MU2-004 and MU2-006 through MU2-042, if not modified by SB No. 69) 25,000 ft. (S/N MU2-004 and MU2-006 through MU2-042, if modified by SB No. 69, and S/N MU2-043 and up)

Control Surface Movements	Spoiler	Up 58°	
	Aileron Trim	Up 20°	Down 20°
	Elevator	Up 33°	Down 17°
		(If not modified by SB No. 60)	
		Up 33°	Down 10°
		(If modified by SB No. 60)	
	Elevator Tab	Nose Up 30°	Nose Down 20°
		(S/N MU2-004 through MU2-042)	
		Nose Up 30°	Nose Down 10°
		(S/N MU2-043 and up)	
	Rudder	Right 25°	Left 25°
	Rudder Tab	Right 25°	Left 25°
	Flap outboard		Down 40°
	Flap inboard		Down 40°

Serial Nos. Eligible — The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

II. MU-2B-10, 6 to 9 PCLM (Normal Category), Approved January 20, 1967

(See Note 4 for conversion to MU-2B-15)

Engines — 2 AiResearch TPE331-25A or TPE331-25AA or TPE331-25AB
Propeller-shaft to engine-rotor ratio 1 : 20.865

Fuel — Fuels conforming to AiResearch Specification SC-5605 or to subsequent revisions thereof.

Oil — Oils conforming to AiResearch Specification SC-5605 or to subsequent revisions thereof.

Engine Limits

Static Sea Level Ratings (I.S.A.)

	Shaft Horse-power (SHP)	Jet Thrust (lb.)	Equiv. Shaft Horsepower (ESHP)	Prop.Shaft Speed % *	Max.Permissible Exhaust Gas Temp. (°C)
Takeoff (5 min.)	575	75	605	100	571
Maximum Continuous	500	73	529	100	530
Starting Transient (1 sec.)					815

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

* The maximum allowable propeller shaft speed is 105% for a transient period not to exceed 5 seconds. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits — 2 Hartzell HC-B3TN-5/T10176SB-5 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10176HSB-5 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HE-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.
(See Note 3 regarding intermixing propeller blades.)

Diameter: 96 in. (T10176-5)
90 in. (T10178-11)
(no reduction permitted)

Pitch Setting at 30 in. station: Flight idle 12°
Feathered 86°

Airspeed Limits (CAS)

Vmo (Maximum operating	250 knots	(287 m.p.h.)
Vp (Maneuvering)	172 knots	(197 m.p.h.)
Vfe (Flap extended)	140 knots	(161 m.p.h.)
Vlo (Landing gear operating)	160 knots	(184 m.p.h.)
Vle (Landing gear extended)	160 knots	(184 m.p.h.)

Vmc (Minimum Control)

89 knots (102 m.p.h.) — S/N MU2-101 through MU2-115 if not modified by SB No. 66

Flap 5° 97 knots (112 m.p.h.) — S/N MU2-101 through MU2-115 if modified by SB No. 66, and S/N MU2-116 and up.

Flap 20° 89 knots (102 m.p.h.)

C.G. Range (Landing Gear Extended)

Weight (lb.)	Forward	Aft
8,577 or less	+ 153.74 (21% MAC)	+ 161.60 (34% MAC)
9,350	+ 158.58 (29% MAC)	+ 161.60 (34% MAC)

Straight line variation between points given
Moment change due to gear retraction is + 6,738 in.lb.

Maximum Weight — Takeoff 9,350 lb.; Landing 8,930 lb.

No. of Seats — 9 (Pilot and Copilot at +97.2)

Maximum Baggage — 574 lb. (200 lb. at +205.1) (220 lb. at +230.7) (154 lb. at +253.2)

Fuel Capacity

Outer Tanks / Tip Tanks	Without		With		F.STA
	Standard	Extended Range	Standard	Extended Range	
Wing Tanks	159 gal.	159 gal.	159 gal.	159 gal.	+167.3
Outer Tanks	-	-	30	30	+163.4
Tip Tanks	130	186 *	130	186 *	+155.9
Total	289	345	319	375	
Usable	286	336	316	366	

Fuel weights are based on 6.5 lb./gal.

* See Note 1(c) for required fuel usage procedure

Oil Capacity — Total 3.7 gal. (1.85 gal. each tank) (+139.4)

Maximum Operating Altitude

23,000 ft. (S/N MU2-101 and MU2-103 through MU2-120 if not modified by SB No. 69)
25,000 ft. (S/N MU2-101 and MU2-103 through MU2-120 if modified by S.B No. 69, and S/N MU2-102, MU2-121 and up)

Control Surface Movements

Spoiler	Up 60°	
Aileron trim	Up 20°	Down 20°
Elevator	Up 33°	Down 17°
(S/N MU2-101 through MU2-108 if not modified by SB No. 66)		
	Up 33°	Down 10°
(S/N MU2-101 through MU2-108 if modified by SB No. 66, and S/N MU2-109 and up)		
Elevator tab	Nose Up 30°	Nose Down 20°
(S/N MU2-101 through MU2-164)		
	Nose Up 30°	Nose Down 10°
(S/N MU2-165 and up)		
Rudder	Right 25°	Left 25°
Rudder tab	Right 25°	Left 25°
Flap outboard		Down 40°
Flap inboard		Down 40°

Serial Nos. Eligible — The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

III - Model MU-2B-20, 6 to 9 PCLM (Normal Category), Approved May 16, 1968

Engines — 2 AiResearch TPE331-1-151A
Propeller-shaft to engine-rotor ratio 1: 20.865

Fuel — Fuels conforming to AiResearch Specification SC-5802 or to subsequent revisions thereof.

Oil — Oils conforming to AiResearch Specification SC-5802 or to subsequent revisions thereof.

Engine Limits — Static Sea Level Rating (I.S.A.)

	Shaft Horse-power (SHP)	Jet Thrust (lb.)	Equiv. Shaft Horsepower (ESHP)	Prop. Shaft Speed % *	Max. Permissible Exhaust Gas Temp. (°C)
Takeoff (5 min.)	665	100	705	100	572
Max. Continuous	665	100	705	100	550
Starting Transient (1 sec.)					815

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

* The maximum allowable propeller shaft speed is 105% for a transient period not to exceed 5 seconds, and 101% for 5 minutes. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits — 2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HE-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.
(See Note 3 regarding intermixing propeller blades.)

Diameter: 90 in. (No reduction permitted)

Pitch setting at 30 in. Station:
Flight idle 12°
Feathered 86°
Reverse -6.5°

Airspeed Limits (CAS)

Vmo (Maximum operating)	250 knots (287 m.p.h.)
Vp (Maneuvering)	181 knots (208 m.p.h.)
Vfe (Flap extended) 140 knots (161 m.p.h.)	(S/N MU2-102, MU2-121 through MU2-279 if not modified by S/R No. 010)
Flap 5°	: 175 knots (201 m.p.h.)
Flap 20°, 40°	: 140 knots (161 m.p.h.)
	(S/N MU2-280 and up S/N MU2-102, MU2-121 through MU2-279 if modified by S/R No. 010)
Vlo (Landing gear operating)	160 knots (184 m.p.h.)
Vle (Landing gear extended)	162 knots (187 m.p.h.)
Vmc (Minimum control)	Flap 5° 100 knots (115 m.p.h.) Flap 20° 93 knots (107 m.p.h.)

C.G. Range (Landing Gear Extended)

Weight (lb.)	Forward	Aft
9,149 or less	+ 153.74 (21% MAC)	+ 161.60 (34% MAC)
9,920	+ 158.58 (29% MAC)	+ 161.60 (34% MAC)

Straight line variation between points given
Moment change due to gear retraction is +6,738 in.lb.

Maximum Weight	Takeoff 9,920 lb.	
	Landing 9,435 lb.	
No. of Seats	9 (Pilot and Copilot at +97.2)	
Maximum Baggage	574 lb. (200 lb. at +205.1) (220 lb. at +230.7) (154 lb. at +253.2)	
Fuel Capacity	Wing tank	159 gal. (+167.3)
	Outer tank	30 gal. (+163.4)
	Tip tank (2 at 93 gal. ea.)*	186 gal. (+155.9)
	Total	375 gal.
	Usable	366 gal.
	Without Outer Tank	
	Wing tank	159 gal. (+167.3)
	Tip tank (2 at 93 gal. ea.)*	186 gal. (+155.9)
	Total	345 gal.
	Usable	336 gal.
	Fuel weights are based on 6.5 lb./gal.	
	* See Note 1(c) for required fuel usage procedure.	
Oil Capacity	Total 3.1 gal. (1.55 gal. each tank) (+138.7)	
Maximum Operating Altitude	25,000 ft.	

Control Surface

Spoiler	Up 60°	
Aileron trim	Up 20°	Down 20°
Elevator	Up 33°	Down 10°
Elevator tab	Nose Up 30°	Nose Down 20°
(S/N MU2-102, MU2-121 through MU2-164)		
	Nose Up 30°	Nose Down 10°
(S/N MU2-165 and up)		
Rudder	Right 25°	Left 22°
Rudder tab	Right 25°	Left 25°
Flap outboard		Down 40°
Flap inboard		Down 40°

Serial Nos. Eligible — The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

IV. Model MU-2B-15, 6 to 9 PCLM (Normal Category), Approved August 26, 1968

Engines — 2 AiResearch TPE331-1-151A
Propeller shaft to engine rotor ratio 1: 20.865

Fuel — Fuels conforming to AiResearch Specification SC-5802 or to subsequent revisions thereof.

Oil — Oils conforming to AiResearch Specification SC-5802 or to subsequent revisions thereof.

Engine Limits — Static Sea Level Rating (I.S.A.)

	Shaft Horsepower (SHP)	Jet Thrust (lb.)	Equiv. Shaft Horsepower (ESHP)	Prop Shaft Speed % *	Max. Permissible Exhaust Gas Temp. (°C)
Takeoff (5 min.)	665	100	705	100	572
Maximum Continuous	665	100	705	100	550
Starting Transient (1 sec.)					815

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

* The maximum allowable propeller shaft speed is 105% for a transient period not to exceed 5 seconds, and 101% for 5 minutes. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits

2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HE-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.

(See Note 3 regarding intermixing propeller blades.)

Diameter: 90 in. (No reduction permitted)

Pitch setting at 30 in. Station

Flight idle	12°
Feathered	86°
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum Operating)	250 knots (287 m.p.h.)
Vp (Maneuvering)	172 knots (197 m.p.h.)
Vfe (flap extended)	140 knots (161 m.p.h.)
Vlo (Landing gear operating)	160 knots (184 m.p.h.)
Vle (Landing gear extended)	160 knots (184 m.p.h.)
Vmc (Minimum control)	93 knots (107 m.p.h.) (S/N MU2-101, MU2-103 through MU2-115 if not modified by S/B No. 66)
Flap 5° 100 knots (115 m.p.h.)	(S/N MU2-101, MU2-103 through MU2-115 if modified by S/B No. 66, and S/N MU2-116 through MU2-120)
Flap 20° 93 knots (107 m.p.h.	

C.G. Range (Landing Gear Extended)

Weight (lb.)	Forward	Aft
8,577 or less	+153.74 (21% MAC)	+161.60 (34% MAC)
9,350	+158.58 (29% MAC)	+161.60 (34% MAC)

Straight line variation between points given
Moment change due to gear retraction is +6,738 in.lb.

Maximum Weight

Takeoff	9,350 lb.
Landing	8,930 lb.

No. of Seats

9 (Pilot and Copilot at +97.2)

Maximum Baggage

574 lb. (200 lb. at +205.1) (220 lb. at +230.7)
(154 lb. at +253.2)

Fuel Capacity

Wing tank	159 gal.	(+167.3)
Tip tank (2 at 93 gal. ea.)*	186 gal.	(+155.9)
Total	345 gal.	
Usable	336 gal.	

With outer tank

Wing tank	159 gal.	(+167.3)
Outer tank	30 gal.	(+163.4)
Tip tank (2 at 93 gal.ea.)*	186 gal.	(+155.9)
Total	375 gal.	
Usable	366 gal.	

Fuel weights are based on 6.5 lb./gal.

* See note 1(c) for required fuel usage procedure

Oil Capacity

Total 3.1 gal. (1.55 gal. each tank) (+138.7)

Maximum Operating Altitude — 23,000 ft. (If not modified by SB No. 69)
25,000 ft. (If modified by SB No. 69)

Control Surface Movements

Spoiler	Up 60°	
Aileron trim	Up 20°	Down 20°
Elevator	Up 33°	Down 17°
(S/N MU2-101, MU2-103 through MU2-108 if not modified by SB No. 60)		
	Up 33°	Down 10°
(S/N MU2-101, MU2-103 through MU2-108 if modified by SB No. 60, and S/N MU2-109 through MU2-120)		
Elevator tab	Nose Up 30°	Nose Down 20°
Rudder	Right 25°	Left 22°
Rudder tab	Right 25°	Left 25°
Flap outboard		Down 40°
Flap inboard		Down 40°

Serial Nos. Eligible — The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

V. Model MU-2B-30, 10 PCLM (Normal Category), Approved July 14, 1969

Engines — 2 AiResearch TPE331-1-151A
Propeller shaft to engine rotor ratio 1: 20.865

Fuel — Fuels conforming to AiResearch Specification SC-5802 or to subsequent revisions thereof.

Oil — Oils conforming to AiResearch Specification SC-5802 or to subsequent revisions thereof.

Engine Limits — Static Sea Level Rating (I.S.A.)

	Shaft Horse-power (SHP)	Jet Thrust (lb)	Equiv. Shaft Horsepower (ESHP)	Prop. Shaft Speed %*	Max. Permissible Exhaust Gas Temp. (°C)
Takeoff (5 min.)	665	100	705	100	572
Max. Continuous	665	100	705	100	550
Starting Transient (1 sec.)					815

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

* The maximum allowable propeller shaft speed is 105% for a transient period not to exceed 5 seconds, and 101% for 5 minutes. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits — 2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HE-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.
(See Note 3 regarding intermixing propeller blades.)

Diameter 90 in. (No reduction permitted)

Pitch setting at 30 in. Station
Flight idle 12°
Feathered 86°
Reverse -6.5°

Airspeed Limits (CAS)

Vmo (Maximum Operating) 250 knots (287 m.p.h.)
Vp (Maneuvering) 188 knots (216 m.p.h.)
Vfe (Flap extended) 145 knots (167 m.p.h.)
(S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if not modified by S/B 113.)

146 knots (168 m.p.h.)
(S/N MU2-505, MU2-520, MU2-524 and up if not modified by S/R No. 010.)
(S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if modified by S/B No. 113 and not modified by S/R No. 010.)

Flap 5° 175 knots (201 m.p.h.)
Flap 20°, 40° 146 knots (168 m.p.h.)
(S/N MU2-505, MU2-520, MU2-524 and up if modified by S/R No. 010. S/N MU2-502 through MU2-504. MU2-506 through MU2-519, MU2-521 through MU2-523 if modified by S/B No. 113 and S/R No. 010.)

Vlo (Landing gear operating)

Retract:	160 knots (184 m.p.h.)	(S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if not modified by S/B No.113)
Extend:	170 knots (195 m.p.h.)	
Retract:	170 knots (195 m.p.h.)	(S/N MU2-505, MU2-520, MU2-524 and up. S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if modified by S/B No. 113)
Extend:	170 knots (195 m.p.h.)	

Vle (Landing gear extended) 170 knots (195 m.p.h.)
Vmc (Minimum control) 90 knots (104 m.p.h.)

C.G. Range (Landing Gear Extended)

Weight (lb.)	Forward	Aft
10,360	+190.93 (21% MAC)	+199.41 (35% MAC)

(S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if not modified by S/B No. 113.)

Weight (lb.)	Forward	Aft
10,360	+190.93 (21% MAC)	+199.41 (35% MAC)
10,800	+192.75 (24% MAC)	+199.41 (35% MAC)

(S/N MU2-505, MU2-520, MU2-524 and up. S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if modified by S/B No. 113.)

Straight line variation between points given.
Moment change due to gear retraction is -6556 in. lb.

Maximum Weight

Takeoff 10,360 lb.
Landing 9,850 lb.
S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if not modified by S/B No. 113.)

Takeoff 10,800 lb.
Landing 10,260 lb.
S/N MU2-505, MU2-520, MU2-524 and up.
S/N MU2-502 through MU2-504, MU2-506 through MU2-519, MU2-521 through MU2-523 if modified by S/B No. 113.)

No. of Seats

Maximum 10 (Pilot at +97.2)
See loading instructions for passenger loading

Maximum Baggage

600 lbs. at +286.8

Fuel Capacity

Wing tank	159 gal.	(+204.5)
Outer tank	30 gal.	(+201.0)
Tip tank (2 at 93 gal.ea)*	186 gal.	(+193.1)
Total	375 gal.	
Usable	366 gal.	

Fuel weights are based on 6.5 lb./gal.

* See Note 1(c) for required fuel usage procedure

Oil Capacity

Total (2 at 1.55 gal. each tank) 3.1 gal. (+175.9)

Maximum Operating Altitude

25,000 ft.

Control Surface Movements	Spoiler	Up 60°	
	Aileron trim	Up 20°	Down 20°
	Elevator	Up 28°	Down 12°
	Elevator tab	Nose Up 30°	Nose Down 10°
	Rudder	Right 24°	Left 22°
	Rudder tab	Right 25°	Left 25°
	Flap Outboard		Down 40°
	Flap Inboard		Down 40°

Serial Nos. Eligible — The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

VI. Model MU-2B-35, 10 PCLM (Normal Category), Approved May 28, 1971

[Engines — 2 AiResearch TPE331-6-251M
Propeller shaft to engine rotor ratio 1: 20.865

Fuel — Fuels conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.

Oil — Oils conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.

Engine Limits — Static Sea Level Rating (I.S.A.)

	Shaft Horse-power (SHP)	Jet Thrust (lb.)	Equiv. Shaft Horsepower (ESHP)	Prop Shaft Speed %*	Max. Permissible Interstage Turbine Temp. (°C)
Takeoff (5 min.)	665	148	724	100	923
Max. Continuous	665	148	724	100	923
Starting Transient (1 sec)					1149

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

[* The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% for 5 minutes. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits — 2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or
2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.

Diameter: 90 in. (No reduction permitted)

Pitch setting at 30 in. Station
- Flight idle 12°
- Feathered 86°
- Reverse -6.5°

Airspeed Limits CAS

Vmo (Maximum Operating)	250 knots (287 m.p.h.)
Vp (Maneuvering)	188 knots (216 m.p.h.)
Vfe (Flap extended)	S/N MU2-548 through MU2-609 if not modified by SR No. 010
(146 knots, 168 m.p.h.)	
Flap 5°	175 knots (201 m.p.h.)
Flap 20°, 40°	146 knots (168 m.p.h.)
	S/N MU2-610 and up. S/N MU2-548 through MU2-609 if modified by SR No. 010
Vlo (Landing gear operating)	
Retract	170 knots (195 m.p.h.)
Extend	170 knots (195 m.p.h.)
Vle (Landing Gear Extended)	170 knots (195 m.p.h.)
Vmc (Minimum control)	90 knots (104 m.p.h.)

C.G. Range (Landing Gear Extended)

Weight (lb.)	Forward	Aft
10,360 or less	+190.93 (21% MAC)	+199.41 (35% MAC)
10,800	+192.75 (24% MAC)	+199.41 (35% MAC)
10,850	+192.75 (24% MAC)	+199.41 (35% MAC)

	Straight line variation between points given. Moment change due to gear retraction is -6556 in. lb.
Maximum Weight	Ramp 10,850 lbs. Takeoff 10,800 lbs. Landing 10,260 lbs.
No. of Seats	Maximum 10 (Pilot at +97.2) See loading instructions for passenger loading
Maximum Baggage	600 lbs. at +286.8
Fuel Capacity	Wing tank 159 gal. (+204.5) Outer tank 30 gal. (+201.0) Tip tank (2 at 93 gal. ea.)* 186 gal. (+193.1) Total 375 gal. Usable 366 gal. Fuel weights are based on 6.5 lb./gal. * See Note 1(c) for required fuel usage procedure.
Oil Capacity	Total (2 at 1.55 gal. each tank) 3.1 gal. (+175.9)
Maximum Operating Altitude	25,000 ft.

Control Surface Movements

Spoiler	Up 60°	
Aileron trim	Up 20°	Down 20°
Elevator	Up 28°	Down 12°
Elevator tab	Nose Up 30°	Nose Down 10°
Rudder	Right 24°	Left 22°
Rudder tab	Right 25°	Left 25°
Flap outboard		Down 40°
Flap inboard		Down 40°

Serial Numbers Eligible: The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

VII. Model MU-2B-25, 6 to 9 PCLM (Normal Category), Approved June 16, 1972

[Engines: 2 AiResearch TPE 331-6-251M
Propeller shaft to engine rotor ratio 1:20.865

Fuel: Fuels conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.

Oil: Oils conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.

Engine Limits: Static Sea Level Rating (I.S.A.)

	Shaft Horse-power (SHP)	Jet Thrust (lb.)	Equiv. Shaft Horsepower (ESHP)	Prop Shaft Speed %*	Max. Permissible Interstage Turbine Temp. (°C)
Takeoff (5 min)	665	148	724	100	923
Max. Continuous	665	148	724	100	923
Starting Transient (1 sec)					1149

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

[* The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% for 5 minutes. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits	2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or 2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each. Diameter: 90 in. (No reduction permitted) Pitch setting at 30 in. Station: Flight idle 12° Feathered 86° Reverse -6.5°
Airspeed Limits (CAS)	Vmo (Maximum operating) 250 knots (287 m.p.h.) Vp (Maneuvering) 181 knots (208 m.p.h.) Vfe (Flap extended) Flap 5, 20, 40° 140 knots (161 m.p.h.) *Flap 5° 175 knots (201 m.p.h.) *(S/N 280 and up) (S/N 239 through 279 provided provisions of MU-2 Service Recommendation No. 010A are incorporated) Vlo (Landing gear operating) 160 knots (184 m.p.h.) Vle (Landing gear extended) 162 knots (187 m.p.h.) Vmc (Minimum control) Flap 5° 100 knots (115 m.p.h.) Flap 20° 93 knots (107 m.p.h.)

C.G. Range (Landing gear extended)

Weight (lb.)	Forward	Aft
9,149 or less	+153.74 (21% MAC)	+161.60 (34% MAC)
9,920	+158.58 (29% MAC)	+161.60 (34% MAC)
9,970	+158.58 (29% MAC)	+161.60 (34% MAC)

Straight line variation between points given.

Moment change due to gear retraction is +6,738 in.lb.

Maximum Weight	Ramp 9,970 lbs. Takeoff 9,920 lbs. Landing 9,435 lbs.
Number of Seats	Maximum 9 (Pilot and Copilot at +97.2) for aircraft with cabin differential pressure of 5 psi nominal Maximum 7 (Pilot and Copilot at +97.2) for aircraft with cabin differential pressure of 6 psi nominal
Maximum Baggage	574 lb. (200 lb. at +205.1) (220 lb. at +230.7) (154 lb. at +253.2)
Fuel Capacity	Wing tank 159 gal. (+167.3) Outer tank 30 gal. (+163.4) Tip tank (2 at 93 gal. ea.)* 186 gal. (+155.9) Total 375 gal. Usable 366 gal. Fuel weights are based on 6.5 lb./gal. * See Note 1(c) for required fuel usage procedure
Oil Capacity	Total 3.1 gal. (1.55 gal. each tank) (+138.7)
Maximum Operating Altitude	25,000 ft. for aircraft with cabin differential pressure of 5 psi nominal. 28,000 ft. for aircraft with cabin differential pressure of 6 psi nominal.

Control Surface Movements

Spoiler	Up 60°	
Aileron trim	Up 20°	Down 20°
Elevator	Up 33°	Down 10°
Elevator tab	Nose Up 30°	Nose Down 10°
Rudder	Right 25°	Left 22°
Rudder tab	Right 25°	Left 25°
Flap outboard		Down 40°
Flap inboard		Down 40°

Serial Numbers Eligible — The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

VIII - Model MU-2B-36, 10 PCLM (Normal Category) Approved July 23, 1974

Engines — 2 AiResearch TPE331-6-251M
Propeller shaft to engine rotor ratio 1:20.865

Fuel — Fuels conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.

Oil — Oils conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.

Engine Limits — Static Sea Level Rating (I.S.A.)

	Shaft Horsepower (SHP)	Jet Thrust(lb.)	Equiv. Shaft Horsepower (ESHP)	Prop. Shaft Speed %*	Max. Permissible Interstage Turbine Temp. (°C)
Takeoff (5 min.)	715	153	776	100	923
Max. Continuous	715	153	776	100	923
Starting Transient (1 sec.)					1149

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions, the placarded torque meter limitations shall not be exceeded.

* The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% for 5 minutes. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits — 2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each or 2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.

Diameter: 90 in. (No reduction permitted)

Pitch setting at 30 in. station

Flight idle	12°
Feathered	86°
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum operating)	250 knots (287 m.p.h.)
Vp (Maneuvering)	191 knots (220 m.p.h.)
Vfe (Flap extended)	
Flap 5°	175 knots (201 m.p.h.)
Flap 20°, 40°	155 knots (178 m.p.h.)
Vlo (Landing gear Operating)	
Retract	175 knots (201 m.p.h.)
Extend	175 knots (201 m.p.h.)
Vle (Landing gear extended)	175 knots (201 m.p.h.)
Vmc (Minimum control)	99 knots (114 m.p.h.)

C.G. Range (Landing Gear Extended)

Weight (lb.)	Forward		Aft
10,690 or less	+190.93 (21% MAC)	to	+199.41 (35% MAC)
11,575	+194.56 (27% MAC)	to	+199.41 (35% MAC)
11,625	+194.56 (27% MAC)	to	+199.41 (35% MAC)

Straight line variation between points given.

Moment change due to gear retraction is -6,556 in.lb.

Maximum Weight	Ramp 11,625 lbs. Takeoff 11,575 lbs. Landing 11,025 lbs.
Number of Seats	Maximum 10 (Pilot at +97.2) See loading instructions for passenger loading.
Maximum Baggage	600 lb. at +286.8
Fuel Capacity	Wing tank 159 gal. (+204.5) Outer tank 30 gal. (+201.0) Tip tank (2 at 93 gal. ea.)* 186 gal. (+193.1) Total 375 gal. Usable 366 gal. Fuel weights are based on 6.5 lb./gal. * See Note 1(c) for required fuel usage procedure.
Oil Capacity	Total (2 at 1.55 gal. each tank) 3.1 gal. (+175.9)
Maximum Operating Altitude	25,000 ft.

Control Surface Movements

Spoiler	Up 60°	
Aileron trim	Up 20°	Down 20°
Elevator	Up 28°	Down 12°
Elevator tab	Nose Up 30°	Nose Down 10°
Rudder	Right 24°	Left 22°
Rudder tab	Right 25°	Left 25°
Flap outboard		Down 40°
Flap inboard		Down 40°

Serial Numbers Eligible: The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

IX - Model MU-2B-26, 6 to 9 PCLM (Normal Category) Approved July 23, 1974

Engines	2 AiResearch TPE 331-6-251M Propeller shaft to engine rotor ratio 1 : 20.865
Fuel	Fuels conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.
Oil	Oils conforming to AiResearch Specification SC-8006 or to subsequent revisions thereof.

Engine Limits — Static Sea Level Rating (I.S.A.)

	Shaft Horsepower (SHP)	Jet Thrust (lb.)	Equiv. Shaft Horsepower (ESHP)	Prop. Shaft Speed %*	Max. Permissible Interstage Turbine Temp. (°C)
Takeoff (5 min.)	665	148	724	100	923
Max. Continuous	665	148	724	100	923
Starting Transient (1 sec.)					1149

At low altitude and low ambient temperature the engines may produce more power than that for which the aircraft has been certificated. Under these conditions the placarded torque meter limitations shall not be exceeded.

* The maximum allowable propeller shaft speed is 106% for a transient period not to exceed 5 seconds, and 101% for 5 minutes. 100% propeller shaft speed is defined as 2,000 r.p.m.

Propeller and Propeller Limits	2 Hartzell HC-B3TN-5/T10178HB-11 with 3 blades each, or 2 Hartzell HC-B3TN-5/T10178HB-11R with 3 blades each.

Diameter: 90 in. (No reduction permitted)

Pitch setting at 30 in. Station

Flight idle	12°
Feathered	86°
Reverse	-6.5°

Airspeed Limits (CAS)

Vmo (Maximum operating)	250 knots (287 m.p.h.)
Vp (Maneuvering)	182 knots (209 m.p.h.)
Vfe (Flap extended)	
Flap 5°	175 knots (201 m.p.h.)
Flap 20°, 40°	155 knots (178 m.p.h.)
Vlo (Landing gear Operating)	170 knots (196 m.p.h.)
Vle (Landing gear extended)	170 knots (196 m.p.h.)
Vmc (Minimum Control)	
Flap 5°	100 knots (115 m.p.h.)
Flap 20°	93 knots (107 m.p.h.)

C.G. Range (Landing gear extended)

Weight (lb.)	Forward	Aft
9,315 or less	+153.74 (21% MAC)	+ 161.60 (34% MAC)
10,470	+158.58 (29% MAC)	+ 161.60 (34% MAC)
10,520	+158.58 (29% MAC)	+ 161.60 (34% MAC)

Straight line variation between points given.

Moment change due to gear retraction is +6,738 in. lb.

Maximum Weight

Ramp	10,520 lbs.
Takeoff	10,470 lbs.
Landing	9,955 lbs.

Number of Seats

Maximum 9 (Pilot and Copilot at +97.2)(for aircraft with cabin differential pressure of 5 psi nominal)
Maximum 7 (Pilot and Copilot at +97.2) (for aircraft with cabin differential pressure of 6 psi nominal)

Maximum Baggage

574 lbs. (200 lb. at +205.1) (220 lb. at +230.7) (154 lb. at +253.2)

Fuel Capacity

Wing tank	159 gal. (+167.3)
Outer tank	30 gal. (+163.4)
Tip tank (2 at 93 gal. ea)*	186 gal. (+155.9)
Total	375 gal.
Usable	366 gal.

Fuel weights are based on 6.5 lb./gal.

* See Note 1(c) for required fuel usage procedure.

Oil Capacity

Total 3.1 gal. (1.55 gal. each tank) (+138.7)

Max. Operating Altitude

25,000 ft. (for aircraft with cabin differential pressure of 5 psi nominal)
28,000 ft. (for aircraft with cabin differential pressure of 6 psi nominal)

Control Surface Movements

Spoiler	Up 60°	
Aileron trim	Up 20°	Down 20°
Elevator	Up 33°	Down 10°
Elevator tab	Nose Up 30°	Nose Down 10°
Rudder	Right 25°	Left 22°
Rudder tab	Right 25°	Left 25°
Flap outboard		Down 40°
Flap inboard		Down 40°

Serial Numbers Eligible — The Government of Japan Certificate of Airworthiness for Export endorsed as noted under "Import Requirements" must be submitted for each individual aircraft for which application for certification is made.

DATA PERTINENT TO ALL MODELS

Datum — Nose of fuselage for Models MU-2B, MU-2B-10, MU-2B-20, MU-2B-15, MU-2B-25, MU-2B-26 (Forward 183.46 in. (4660 mm) from front plane of wing rear spar fuselage connecting frame).

6.69 in. (170 mm) aft of nose for Models MU-2B-30, MU-2B-35, MU-2B-36 (Forward 220.67 in. (5605 mm) from front plane of wing rear spar fuselage connecting frame).

MAC — 60.55 in. (Leading edge of MAC is at +141.03 (MU-2B, MU-2B-10, MU-2B-20, MU-2B-15, MU-2B-25, and MU-2B-26), and at +178.23 (MU-2B-30, MU-2B-35, and MU-2B-36).

Leveling Means — Position spirit level on the R.H. bracket of keel (STA. 5809, STA. 6020) longitudinally, and on the channel of door actuator laterally, for Models MU-2B, MU-2B-10, MU-2B-20, MU-2B-15, MU-2B-25 and MU-2B-26.

A plumb bob suspension crip fitted to the channel of the pressure bulkhead (STA. 8035), and a leveling provision scale on the equipment floor in the electrical compartment for Models MU-2B-30, MU-2B-35, and MU-2B-36.

Certification Basis — CAR 10 dated March 28, 1955. (Applicable regulations are CAR 3 dated May 15, 1956 including Amendments 3-1 through 3-8, plus the Special Conditions stated in FAA letter to the JCAB dated May 14, 1965, modified by FAA letters to the JCAB dated January 25, 1968, and May 12, 1971.

Type Certificate No. A2PC issued November 4, 1965.

Application for Type Certificate dated November 25, 1964.

Required Equipment — The basic required equipment as prescribed in the applicable airworthiness regulations (See Certification Basis) must be installed in the aircraft for type certification. Mitsubishi Reports SET65196 (MU-2B), YET 66131 (MU-2B-10), YET 68004 (MU-2B-20), YET 68027 (MU-2B-15), YET 69069 (MU-2B-30), YET 70176 (MU-2B-35), YET 71354 (MU-2B-25), YET 74194 (MU-2B-26) and YET 74196 (MU-2B-36), contain lists of all required equipment as well as optional equipment installations approved by the JCAB.

Import Requirements — Each aircraft and any replacement parts manufactured in Japan and exported to the United States must be designated as "Import" and clearly labeled as such in accordance with CAR 10.30. A U.S. certificate of Airworthiness may be issued on the basis of a Japanese Certificate of Airworthiness for export signed by a representative of the JCAB containing the following notation:

"The aircraft covered by this certificate has been found to conform to Type Certificate Number A2PC and is in a condition for safe operation."

Note 1: (a) Current weight and balance report, including list of equipment included in certificated empty weight, and loading instructions when necessary, must be provided for each aircraft at the time of original airworthiness certification.

(b) The certificated empty weight and corresponding center of gravity location must include unusable fuel and undrainable oil as follows:

Unusable Fuel (MU-2B)	65.0 lbs. at (+167.3)	
Unusable Fuel (MU-2B-10)	19.5 lbs. at (+167.3)	(Standard)
	58.5 lbs. at (+159.7)	(Extended Range)
Unusable Fuel (MU-2B-20)	58.5 lbs. at (+159.7)	
Unusable Fuel (MU-2B-15)	58.5 lbs. at (+159.7)	
Unusable Fuel (MU-2B-30)	58.5 lbs. at (+196.9)	
Unusable Fuel (MU-2B-35)	58.5 lbs. at (+196.9)	
Unusable Fuel (MU-2B-25)	58.5 lbs. at (+159.7)	
Unusable Fuel (MU-2B-26)	58.5 lbs. at (+159.7)	
Unusable Fuel (MU-2B-36)	58.5 lbs. at (+196.9)	

Undrainable oil (All Models) 0 lb.

(c) The fuel quantity of each tip tank must not be more than 45 gallons, Model MU-2B, and not more than 65 gallons, Models MU-2B-10 (Extended Range), MU-2B-20, MU-2B-15, MU-2B-30, MU-2B-35, MU-2B-25, MU-2B-26, and MU-2B-36, before landing.

Note 2: This aircraft must be operated in accordance with the JCAB approved Airplane Flight Manual.

Note 3: This series aircraft may intermix the following propeller blades in the combination.

(a) T10176SB-5 and T10176HSB-5
(b) T10178HB-11 and T10178HE-11

Note 4: (a) Model MU-2B-10 can be converted to Model MU-2B-15 by complying with the provisions of Service Bulletin No. 86.

(b) Model MU-2B-25 can be converted to Model MU-2B-20 by complying with the provisions of Service Recommendation No. 013.

(c) Model MU-2B-35 can be converted to Model MU-2B-36 by complying with the provisions of Service Recommendation No. 020.

(d) Model MU-2B-25 can be converted to Model MU-2B-26 by complying with the provisions of Service Recommendation No. 021.

* * * END * * *

MEOT EVALUATIONS

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2a)

QUESTION: Determine if the fuel system operation and annunciation are adequate for operation as a single pilot airplane. Question ME-1

FINDINGS: The fuel system annunciation and operation are adequate for single pilot operation. The fuel gauges and tank empty lights, depending on the aircraft, are not always in the pilot's normal line-of-sight. The locations require only minimum pilot effort to monitor fuel system status.

RECOMMENDATIONS: None

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2a)

QUESTION: Determine if the fuel system operation and annunciation are adequate for operation as a single pilot airplane. Question ME-1

FINDINGS: The fuel system operation and annunciation are adequate for operation as a single pilot airplane. Question ME-1.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2a)

QUESTION: Determine if the fuel system operation and annunciation are adequate for operation as a single pilot airplane. Question ME-1

FINDINGS: The fuel system operation and annunciation are adequate for single pilot operation of the airplane.

RECOMMENDATIONS: None

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2b)

QUESTION: Determine if the landing gear warning system is adequate to assure the landing gear is down under all probable conditions of landing. Question ME-2.

FINDINGS: The landing gear warning system can be rigged in a manner that would allow an approach to be flown with the landing gear up and no aural warning to the pilot. Although the system meets the regulation, it does not perform its intended function.

RECOMMENDATIONS: Change the rigging on the gear warning system to activate the audio gear warning at a higher throttle angle than flight idle.

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2b)

QUESTION: Determine if the landing gear warning system is adequate to assure the landing gear is down under all probable conditions of landing. Question ME-2.

FINDINGS: When headwinds require additional power to maintain an approach glideslope, it is possible to complete an approach without activiating the "Landing-Gear-Up" warning tone.

No other discrepancies in this system were noted.

RECOMMENDATIONS: None

SIGNATURE: David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2b)

QUESTION: Determine if the landing gear warning system is adequate to assure the landing gear is down under all probable conditions of landing. Question ME-2.

FINDINGS: The landing gear warning system (warning horn) is not adequate to assure the landing gear is extended for all probable conditions for landing. This is due to the adjustment of the warning system. However, this adjustment does comply with the requirements in the regulation. The landing gear position indicators provide a supplementary means of determining if the gear is extended.

RECOMMENDATIONS: The power levers should be rigged so that the aural landing gear warning will become armed at some position forward of the flight idle stops.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2c)

QUESTION: Determine if the landing gear position indicators are adequate to perform intended function. Question ME-3

FINDINGS: The landing gear position indicators are adequate to perform their intended function but are in a poor location on the -60 aircraft. The gear position lights are not visible in the -60 aircraft when the pilot has his right hand on the control wheel. The pilot must move his head to observe the position lights.

RECOMMENDATIONS: None

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2c)

QUESTION: Determine if the landing gear position indicators are adequate to perform intended function. Question ME-3

FINDINGS: The landing gear position indicators are adequate to perform intended function.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2c)

QUESTION: Determine if the landing gear position indicators are adequate to perform intended function. Question ME-3

FINDINGS: The landing gear position indicators operated without any problems, and provided information about the position of the landing gear.

RECOMMENDATIONS: None

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2d)

QUESTION: Determine if the pilot workload in operating all anti-ice/de-ice systems, and ascertain the status and the proper function of these systems. Question ME-4

FINDINGS: The pilot workload while operating the anti-ice/de-ice systems is tolerable for single pilot operations. The switch locations on the overhead panel are not the most desirable since a large head movement is required to view the switch and labels.

RECOMMENDATIONS: None

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2d)

QUESTION: Determine if the pilot workload in operating all anti-ice/de-ice systems, and ascertain the status and the proper function of these systems. Question ME-4

FINDINGS: The pilot workload in operating all anti-ice/de-ice systems is acceptable. All systems functioned as per flight manual description.

RECOMMENDATIONS:

SIGNATURE: David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2d)

QUESTION: Determine if the pilot workload in operating all anti-ice/de-ice systems, and ascertain the status and the proper function of these systems. Question ME-4

FINDINGS: The pilot workload was not adversely affected when operating the anti-ice/de-ice system.

RECOMMENDATIONS: None

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2e)

QUESTION: Determine if the airplane is safely controllable by a single pilot under all flight conditions normally expected during operation. Question ME-5

FINDINGS: The aircraft is safely controllable by a single pilot under all flight conditions normally expected during operation. The proficiency level of the pilot would be an influencing factor in this determination as it would be with any aircraft of comparable complexity (light turbopropeller).

RECOMMENDATIONS:

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2e)

QUESTION: Determine if the airplane is safely controllable by a single pilot under all flight conditions normally expected during operation. Question ME-5

FINDINGS: The airplane is safely controllable by a single pilot under all flight conditions normally expected during operation.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2e)

QUESTION: Determine if the airplane is safely controllable by a single pilot under all flight conditions normally expected during operation. Question ME-5

FINDINGS: The airplane is safely controllable by a single pilot under flight conditions normally expected during operation. The experience and level of competence of the pilot would not have to be any greater than that which is required for any twin-engine turbopropeller airplane of comparable power, weight, and performance.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2f)

QUESTION: Determine the adequacy of the takeoff speed schedules and climb transition for normal and emergency conditions. Question ME-6

FINDINGS: The normal takeoff speed schedules are difficult to achieve. The published speeds that are required to achieve the takeoff performance require great anticipation and practice on the part of the pilot. The initial climb angle required to achieve the published performance is high!

The recommended climb angle for climb out after an engine failure was presented in the Flight Safety Ground School but did not appear in the AFM. Transition to any climb schedule is easily accomplished.

RECOMMENDATIONS: Publish more data on procedures in the AFM.

Establish performance using normal pilot skills.

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2f)

QUESTION: Determine the adequacy of the takeoff speed schedules and climb transition for normal and emergency conditions. Question ME-6

FINDINGS: Speed schedules for a normal takeoff are adequate. Actual emergency takeoff conditions were not observed.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2f)

QUESTION: Determine the adequacy of the takeoff speed schedules and climb transition for normal and emergency conditions. Question ME-6

FINDINGS: The takeoff speed schedule and climb transition are adequate. Initially, the speed schedule for the takeoff is difficult to maintain; however, overshooting the rotation velocity does not adversely affect climb transition, nor detract from safe operation. With increased familiarity operating the airplane, conformance should no longer be a problem. Transition to the climb presented no difficulties.

RECOMMENDATIONS: Amplify takeoff procedures and data in the pilot's operating manual.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2g)

QUESTION: Determine the adequacy of the approach and landing procedures, and speed schedules for both normal and emergency conditions. Question ME-7

FINDINGS: Approach and landing speed schedules and procedures during normal and emergency conditions are adequate.

RECOMMENDATIONS:

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2g)

QUESTION: Determine the adequacy of the approach and landing procedures, and speed schedules for both normal and emergency conditions. Question ME-7

FINDINGS: The approach and landing procedures, and speed schedules for both normal and emergency conditions are adequate.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2g)

QUESTION: Determine the adequacy of the approach and landing procedures, and speed schedules for both normal and emergency conditions. Question ME-7

FINDINGS: The approach and landing procedures and speed schedules for normal emergency conditions were evaluated and found to be suitable for operational use.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2h)

QUESTION: Determine under prescribed conditions, the control forces are appropriate for the type and do not exceed the predetermined values. Question ME-8

FINDINGS: Control forces were acceptable during all operations, normal and emergency. Forces were not objectionable and did not approach any maximum limit.

RECOMMENDATIONS:

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2h)

QUESTION: Determine under prescribed conditions, the control forces are appropriate for the type and do not exceed the predetermined values. Question ME-8

FINDINGS: The control forces are appropriate for the type and do not exceed the predetermined values.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2h)

QUESTION: Determine under prescribed conditions, the control forces are appropriate for the type and do not exceed the predetermined values. Question ME-8

FINDINGS: The control forces are appropriate for normal and emergency flight conditions.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2i)

QUESTION: Determine that the stall warning is clear and distinctive when conducting stalls under the predetermined conditions. Question ME-9

FINDINGS: The stall warning was clear and distinctive during all stall configurations single and multi-engine. There were no unusual stall characteristics.

RECOMMENDATIONS:

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2i)

QUESTION: Determine that the stall warning is clear and distinctive when conducting stalls under the predetermined conditions. Question ME-9

FINDINGS: The stall warning is clear and distinctive when conducting stalls under the predetermined conditions.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2i)

QUESTION: Determine that the stall warning is clear and distinctive when conducting stalls under the predetermined conditions. Question ME-9

FINDINGS: The stall warning (stick shaker) is clear and distinct when conducting stalls. Stalls were conducted in various configurations cited in the flight test plan, including single and multi-engine stalls.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2j)

QUESTION: Determine if the airplane can be safety flown in instrument conditions using partial panel (emergency) instruments. Question ME-10

FINDINGS: The aircraft can be safely flown using partial panel instruments with a pilot that has the proper instrument proficiency. The location of the turn and slip indicator on some aircraft makes the task more difficult since the left hand on the control wheel blocks the view of this instrument. The pilot's head must be moved excessively to view this instrument.

RECOMMENDATIONS: Standardize the location of the turn and slip indicator.

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2j)

QUESTION: Determine if the airplane can be safety flown in instrument conditions using partial panel (emergency) instruments. Question ME-10

FINDINGS: The airplane can be safely flown in instrument conditions using partial panel (emergency) instruments.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2j)

QUESTION: Determine if the airplane can be safety flown in instrument conditions using partial panel (emergency) instruments. Question ME-10

FINDINGS: The airplane can be safely flown in instrument conditions using partial instrument panel. The pilot workload is no greater than that required to accomplish the same task in a comparable airplane.

RECOMMENDATIONS: None

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2k)

QUESTION: Determine crew workload under all probable conditions of flight for which the airplane is approved. Question ME-11

FINDINGS: The crew workload under all probable conditions of flight was evaluated as acceptable for single pilot operations.

RECOMMENDATIONS:

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2k)

QUESTION: Determine crew workload under all probable conditions of flight for which the airplane is approved. Question ME-11

FINDINGS: Crew workload under all probable conditions of flight for which the airplane is approved is acceptable.

RECOMMENDATIONS:

SIGNATURE: David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2k)

QUESTION: Determine crew workload under all probable conditions of flight for which the airplane is approved. Question ME-11

FINDINGS: The crew workload under all probable conditions of flight for which the airplane is approved is within the capability of a single pilot.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 21)

QUESTION: Determine the minimum skill and knowledge required for demonstration by the minimum crew recommended. Question ME-12

FINDINGS: The minimum skill and knowledge required for demonstration by a single pilot for this aircraft is no greater than for other similar airplanes.

RECOMMENDATIONS: None

SIGNATURE:

George Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 21)

QUESTION: Determine the minimum skill and knowledge required for demonstration by the minimum crew recommended. Question ME-12

FINDINGS: The minimum skill and knowledge required for demonstration by the minimum crew recommended for this aircraft is no greater than for other similar airplanes with which I have experience.

RECOMMENDATIONS:

SIGNATURE: David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 21)

QUESTION: Determine the minimum skill and knowledge required for demonstration by the minimum crew recommended. Question ME-12

FINDINGS: The minimum skill and knowledge required for a single pilot to operate this airplane are no more than that which are required for a comparable airplane.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2m)

QUESTION: Determine the adequacy of the crew station by conducting a cockpit evaluation. Question ME-13

FINDINGS: The crew station was adequate for single pilot operations. The following items were considered cumbersome and although not unacceptable, are noted:

1. Some aircraft have alternate static source selector in an awkward place.

2. Some aircraft, the gear position lights are obscured by the pilot's right hand on the control wheel.

3. Some aircraft, the turn and slip indicator is obscured by the pilot's left hand on the control wheel.

4. The cockpit shape requires that the pilot seat be adjusted lower than normally desired to allow clearance between the left side of the aircraft and the pilot's head. In this position, when a heated windshield is installed, the pilot sees considerable distortion in the lower portion of the windshield which is the area through which he is viewing the runway during the flare for touchdown.

5. The area under the rudder pedals where the pilot's heels are required to slide when the rudder is displaced, is covered with a carpet. This configuration occasionally causes the pilot's heel to dig in on the retreating pedal side when making large rudder displacements.

RECOMMENDATIONS:

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2m)

QUESTION: Determine the adequacy of the crew station by conducting a cockpit evaluation. Question ME-13

FINDINGS: The crew station is adequate.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2m)

QUESTION: Determine the adequacy of the crew station by conducting a cockpit evaluation. Question ME-13

FINDINGS: The cockpit evaluation determined that the aircrew station was adequate for single pilot operation. The evaluation was a difficult task since the manufacturer stated that each new airplane is flown stripped and "green" to a modification center and outfitted to suit the customer. This was very apparent when viewing a collection of cockpit photographs provided by the manufacturer. The crew seats are comfortable. Cockpit switches and controls are accessible to the single pilot. The seat adjustments provided the evaluation pilot (upper 98th percentile) with ample room and a good view of the essential instruments.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2n)

QUESTION: Determine the adequacy of all flight manuals for appropriate limitations, procedures, and performance. Question ME-14

FINDINGS: The flight manuals for the JCAB approved aircraft were minimumly adequate. There is a need to expand the normal and emergency procedure sections to explain the techniques required to achieve the performance presented in the manuals, i.e., what is the proper takeoff technique?

RECOMMENDATIONS: Generally, the manual should be brought up to the quality of the latest revisions of the flight manual.

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2n)

QUESTION: Determine the adequacy of all flight manuals for appropriate limitations, procedures, and performance. Question ME-14

FINDINGS: The flight manuals are adequate.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2n)

QUESTION: Determine the adequacy of all flight manuals for appropriate limitations, procedures, and performance. Question ME-14

FINDINGS: The flight manual for the MU-2B-20 airplane provided enough information to operate the airplane. However, many sections lacked information which would further assist the pilot. This became very apparent when the MU-2B-40 flight manual was reviewed.

RECOMMENDATIONS: Updating the older model flight manuals to the standard used in the later manuals.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2n)

QUESTION: Determine the adequacy of all flight manuals for appropriate limitations, procedures, and performance. Question ME-14

FINDINGS:

1. MU 2B-26, Chapter 11, page 3, of the flight manual requires NTS check to be done at 50 hour periodic.

2. Emergency procedures for an electric fire in flight manual MU 2B-26 items:

   h. Open instruction door.

   i. Emergency exit door open.

   It does not appear to be appropriate for a pilot to open the emergency exit door in flight.

RECOMMENDATIONS:

1. It is recommended that Item 1 be revised to require NTS check be required at each engine start and MU 2B-26 flight manual delete reference to the non-existing 50 periodic check of NTS.

2. It is recommended that this procedure be revised to delete opening emergency exit in flight and add open outflow valves and go to ram air.

SIGNATURE:

Charles R. Stauffer

Charles R. Stauffer/

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2o)

QUESTION: Determine the adequacy of the total aircraft information system. Question ME-15

FINDINGS:

1. MU 2 maintenance manual states, "After aircraft washing or flight in rain, drain pitot and static lines."

2. Review of landing gear warning system maintenance procedures are adequate.

3. MU 2-26 maintenance manual has statement "Use MIL 127686 jet fuel anti-icing additive to fuel in auxiliary tanks."

   MU 2-60 maintenance manual has statement, "Fuel not containing anti-icing inhibitor must have MIL 127686 fuel system inhibitor added."

RECOMMENDATIONS:

1. If Item 1 is necessary, this information should be in the flight manual and the system modified to add quick drains. Draining then could be accomplished on preflight per 19.171(a)(2).

2. Item 3 of findings, manuals should be revised to be the same for all MU-2's since fuel system is basically the same on all MU 2 aircraft.

SIGNATURE:

Charles R. Stauffer

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2o)

QUESTION: Determine the adequacy of the total aircraft information system. Question ME-15

FINDINGS: The total aircraft information system is adequate.

RECOMMENDATIONS:

SIGNATURE: David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 2o)

QUESTION: Determine the adequacy of the total aircraft information system. Question ME-15

FINDINGS:

(Evaluation conducted by C. Stauffer)

RECOMMENDATIONS:

SIGNATURE:
James S. Kishi

ENGINEERING EVALUATIONS

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1a)

QUESTION: Determine if the airplane is safely controllable under VFR and IFR conditions if all electrical power is lost. Question EE-1

FINDINGS: See data card for SCR-20-011 dated November 21, 1983.

The airplane can be safety controlled under VFR or under IFR using partial (emergency) panel instruments provided there is an air-driven turn-and-bank indicator on the pilot's instrument panel. The type design specifies an air-driven T&B; however, many variations of instrument panels have been noted where field modifications may have abrogated the type design. Instruments relying solely on electrical power would not provide an emergency source of airplane attitude control.

RECOMMENDATIONS: That the ACO and Mitsubishi coordinate on issuing an alert to operators in the field to review their particular aircraft configuration to assure that an air-driven turn-and-bank (or other acceptable emergency system) is retained on the pilot's instrument panel.

SIGNATURE:

Charles E. Arnold

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1a)

QUESTION: Determine if the airplane is safely controllable under VFR and IFR conditions if all electrical power is lost. Question EE-1

FINDINGS: The airplane is safely controllable under VFR and IFR conditions if all electrical power is lost. Question EE-1

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1a)

QUESTION: Determine if the airplane is safely controllable under VFR and IFR conditions if all electrical power is lost. Question EE-1

FINDINGS:

Flight evaluation conducted by C.E. Arnold

RECOMMENDATIONS:

SIGNATURE:

James Y. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1b)

QUESTION: Determine if the pilot can detect loss of primary static source, and select the alternate source without hazard to safe operation. Question EE-2

FINDINGS: The pilot is capable of detecting the loss of the primary static source. The alternate static source can be selected without difficulty by the pilot, and this action does not adversely affect the safe operation of the airplane. It was noted that care should be taken to avoid covering the selector valve with sidewall upholstery and wire bundles behind the instrument panel. Placards should indicate the location of the selector valve.

RECOMMENDATIONS: None

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1c)

QUESTION: Determine if the airplane is fully controllable without hazardous conditions if the Bendix M4C autopilot experiences a malfunction. Question EE-3

FINDINGS: This evaluation was deleted by Memorandum, Subject: Special Certification Review Team Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold, SCR Team Chairman, Dated: December 2, 1983

RECOMMENDATIONS:

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1d)

QUESTION: Determine if the airplane is fully controllable without hazardous conditions if a trim aileron runaway is experienced. Question EE-4

FINDINGS: See data card for SCR-20-011 dated November 21, 1983.

The airplane is safely controllable with a malfunctioning (runaway) trim aileron throughout the approved flight envelope. Tests were conducted with maximum tab deflections up to V_{MO}/M_{MO}. The flight manual emergency procedures could be amplified to better explain details of isolating a malfunctioning trim aileron and that significant airspeed loss may result if both tabs are fully deflected (both tabs up or down) to balance roll control forces.

RECOMMENDATIONS: Add amplified emergency procedures for trim aileron tab failure.

SIGNATURE:

Charles E. Arnold

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1d)

QUESTION: Determine if the airplane is fully controllable without hazardous conditions if a trim aileron runaway is experienced. Question EE-4

FINDINGS:

(Flight evaluation conducted by C.E. Arnold)

RECOMMENDATIONS:

SIGNATURE:

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1e)

QUESTION: Determine if the airplane can be safely controlled to a zero rate of descent using elevator trim and engine power only. Question EE-5

FINDINGS: The evaluation determined that the airplane can be safety controlled to a zero rate of descent using elevator trim and engine power only.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1f)

QUESTION: Determine if the airplane can be safely controlled and landed if the elevator or rudder trim fails in the most adverse flight condition using the remaining flight controls, or power. Question EE-6

FINDINGS: The airplane can be safety controlled and landed if the elevator or rudder trim fails in the most adverse flight condition, using the remaining flight controls and power.

RECOMMENDATIONS: None

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1g)

QUESTION: Determine if the established V_{MO} is satisfactory. Question EE-7

FINDINGS: The established maximum operating limit speed (V_{MO}) is satisfactory.

RECOMMENDATIONS: None

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1g)

QUESTION: Determine if the established V_{MO} is satisfactory. Question EE-7

FINDINGS: The established V_{MO} is satisfactory.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1h)

QUESTION: Determine if the airplane can takeoff with the propeller start locks engaged. Question EE-8

FINDINGS: The airplane cannot take off with the propeller start locks engaged.

RECOMMENDATIONS:

SIGNATURE:

David A. Robinson

David A. Robinson

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1h)

QUESTION: Determine if the airplane can takeoff with the propeller start locks engaged. Question EE-8

FINDINGS: The airplane cannot takeoff with the propeller start locks engaged.

RECOMMENDATIONS: None.

SIGNATURE:

James S. Kishi

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1i)

QUESTION: Determine if the airplane is safely controllable with simulated ice shapes or residual natural ice on the unprotected areas of the airplane. Question EE-9

FINDINGS: The aircraft remained safely controllable with up to an estimated three inches of ice on the unprotected surfaces. Other than a noticeable weight/drag increase, the accumulated ice had no detectable effect on the aircraft's handling qualities.

RECOMMENDATIONS:

SIGNATURE:

George Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1i)

QUESTION: Determine if the airplane is safely controllable with simulated ice shapes or residual natural ice on the unprotected areas of the airplane. Question EE-9

FINDINGS:

(Flight evaluation conducted by G. Meyers)

RECOMMENDATIONS:

SIGNATURE:

James S. Kishi

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1j)

QUESTION: Determine the suitability of the ice protection systems during flight in natural icing conditions. Question EE-10

FINDINGS: The ice protection system demonstrated adequacy during a 35 minute encounter at minus one degree centigrade in moderate icing conditions.

RECOMMENDATIONS:

SIGNATURE:

George H Meyers

George Meyers

REFERENCE: Memorandum, Subject: Special Certification Review Team Specific Flight Task Assignment, To: J. Kishi, MEOT Team Leader, From: Charles E. Arnold - SCR Team Chairman, November 4, 1983, paragraph 1j)

QUESTION: Determine the suitability of the ice protection systems during flight in natural icing conditions. Question EE-10

FINDINGS:

(Flight evaluation conducted by G. Meyers)

RECOMMENDATIONS:

SIGNATURE:

James S. Kishi

FLIGHT TEST PLANS AND REPORTS

(Data Cards)

MU-2B-20
MU-2B-60

DATA CARDS - MU-2B-20

DATE: 11/17/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boettger Meyers	TEST: SCR-20-1	S.E. 1315 T.O. 1325 LDG. 1415 TOTAL 0:50 FUEL USED 85 gal

RAMP WT: 8392.0	C.G. %MAC.... 27.97	TIA REF:
ZFW..... 7159.2	ZFW C.G. %MAC 25.47	R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

5° TAKEOFF - Normal climb to 12,500. Slow flight with 40° flap & clean. Stalls with 40° flap & clean. One clean S/E stall. Dynamic Vmc check at 5° flaps.

3 Normal landings - one @ F.I 1.5 Vso from 50';
1 with 20° flap. 1 S/E landing with reverse to full stop

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

187 Pages ①

SCR-20-1 (MEYERS)

FLIGHT TEST PLAN

11-17-83

PREPARED BY D. Tucker	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT E. Buehler	TEST CREW	TEST CREW	TEST CREW
COPILOT G. Meyers	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT 2392.0 LBS

CENTER OF GRAVITY 27.97 %MAC

FUEL LOADING MAIN 1031.8 LBS

OUTER 201.0 LBS

TIP ——— LBS

TEST ITEMS

FAMILARIZATION FLIGHT

NOTE: SEE ATTACHED SHEET FOR OPEN SQUAWKS ON A/C

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

REMARKS

LIMITATIONS

DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

FUEL AT LANDING: ________ LBS

TEST CONDITION					
Engine					
Gear					
Flap					
Airspeed (KIAS)					
Altitude (FT)					
TEST ITEM					
Cond NO					

2

[illegible] 153 [illegible]

1. ALTERNATE STATIC SYSTEM INOP.

2. R NAV OUT FOR REPAIR

3. No. 2 COMPASS SYSTEM INOP.

4 DME INTERMITTENT.

5. NAV 1 LOC INOP.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: ______

AIRCRAFT SN: 183 AIRCRAFT "N": 96717A

$\frac{157.92 - 154.3}{60.6} \times 100 \div 22.0 = 27.9$

FLIGHT NO.: SCD-20- (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VIII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (C) G MEYERS	190 0	97.2	18,468.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600.0	
ZERO FUEL WEIGHT	7,159.2	156.4	1,119,726.3	25.47 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ______ %MAC
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ______
Tip Tanks / Gal	—	155.9	—	
TOTAL FUEL O/B 184 Gal	1232.8	XXXXXX	XXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8191.0	157.78	1,292,346.4	27.74 %MAC
GWT MAINS/OUTERS (ONLY)	8392.0	157.92	1,325,270.2	27.97 %MAC
GWT MAINS/OUTERS/TIPS	—	—	—	______ %MAC

*Includes oil and unusable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-17-83

PILOT: E. BOEHLER CO-PILOT: G. MEYERS

FLIGHT TEST (Additional Crew Members): — 2. —

3. — 4. — 5. — 6. —

DATE OF FLIGHT: 11-17-83 Q.C. (Stamp & Initials): 32 / [illegible]

4

DATE: 11/17/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehler Robinson	TEST: SCR-20-2	S.E. 1550 T.O. 1600 LDG. 1640 TOTAL 0.6 FUEL USED 50 gal

RAMP WT: 8347.0	C.G. %MAC.... 28.52	TIA REF: R0394
ZFW..... 7114.2	ZFW C.G. %MAC 26.09	

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

5° Flap T.O. & climb to 12,500. Turns, Clean & Dirty stalls, one clean S/E stall. Pattern work

2 Normal T.O. 20° Flap.
1 Normal T.O. 5° Flap
2 40° Flap Landings
1 20° Flap S/E Landing with Reverse
1 No Flap Landing to Full Stop

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

FLIGHT TEST PLAN 11-17-83 SCR-20-002

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
D. THACKER			
PILOT E. BOEHLER	TEST CREW	TEST CREW	TEST CREW
COPILOT D. ROBINSON	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT	8347.0	LBS
CENTER OF GRAVITY	28.52	%MAC
FUEL LOADING MAIN	1031.8	LBS
OUTER	201.0	LBS
TIP	———	LBS

TEST ITEMS

FAMILARIZATION FLIGHT

NOTE: SEE ATTACHED SHEET FOR OPEN SQUAWKS ON A/C

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

REMARKS

LIMITATIONS

DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

FUEL AT LANDING: ________ LBS

TEST CONDITION																											
	Engine																										
	Gear																										
	Flap																										
	Airspeed (KIAS)																										
	Altitude (FT)																										
TEST ITEM																											
Cond No																											6

[illegible] 183 OPEN SQUAWKS 11-17-83

1. ALTERNATE STATIC SYSTEM INOP.
2. R NAV OUT FOR REPAIR
3. NO. 2 COMPASS SYSTEM INOP.
4. DME INTERMITTENT.
5. NAV 1 LOC INOP.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967 MA

$\frac{158.25 - 154.3}{60.6} \times 100. + 22.0 = 28.52$

FLIGHT NO.: SCR-20-002 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) D. ROBINSON	145.0	97.2	14,094.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600	
ZERO FUEL WEIGHT	7114.2	156.78	1,115,352.3	26.09 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %MAC
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks — / — Gal	—	155.9	—	
TOTAL FUEL O/B Gal		XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8146.0	158.1	1,287,972.4	28.29 %MAC
GWT MAINS/OUTERS (ONLY)	8347.0	158.25	1,320,896.2	28.52 %MAC
GWT MAINS/OUTERS/TIPS	—	—	—	— %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-17-83

PILOT: E. BOEHLER CO-PILOT: D. ROBINSON

FLIGHT TEST (Additional Crew Members): ______ 2. ______

3. ______ 4. ______ 5. ______ 6. ______

DATE OF FLIGHT: 11-17-83 Q.C. (Stamp & Initials): 32

SCR 20-2 11-17-83 ROBINSON

FAMILIARIZATION FLIGHT

(1) FLIGHT CONDUCTED AS PLANNED

(2) I MADE NO OBSERVATIONS WHICH WARRENT FURTHER COMMENT.

David A. Robinson

DATE: 11/18/83
MODEL: MU2B20

MITSUBISHI AIRCRAFT INTERNATIONAL
FLIGHT RESULTS REPORT

PAGE 1 OF
FLT. NO.

CREW: Boehler
Arnold

TEST: SCR-20-3

S.E. 0915
T.O. 0928
LDG. 1025
TOTAL .9
FUEL USED 80 gal

RAMP WT: 8387.0 C.G. %MAC.... 28.03
ZFW..... 7154.2 ZFW C.G. %MAC 25.53
TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

5° Takeoff and normal climb to 12,500. Alternate static checked on climb. Stability checks in all 3 axies. slow flight clean & dirty. stalls clean & dirty with and without power.

Pattern Work.

2-5° Takeoff
2-20° Takeoff

1-20° Flap landing
1-40° Flap landing
1-No Flap landing
1-S/E landing with reverse to full stop

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

SCR-20-003 Arnold

FLIGHT TEST PLAN

11-18-83 | SCR-20-003

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
D. THACKER			
PILOT	TEST CREW	TEST CREW	TEST CREW
E. BOEHLER			
COPILOT	TEST CREW	TEST CREW	TEST CREW
C. ARNOLD			

AIRPLANE CONDITION

TAKEOFF WEIGHT		8327.0	LBS
CENTER OF GRAVITY		28.05	%MAC
FUEL LOADING	MAIN	1031.8	LBS
	OUTER	201.0	LBS
	TIP	—	LBS

TEST ITEMS

FAMILARIZATION FLIGHT

NOTE: SEE ATTACHED SHEET FOR OPEN SQUAWKS ON A/C

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

REMARKS

LIMITATIONS

DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.

FUEL AT LANDING: ________ LBS

TEST CONDITION: Engine, Gear, Flap, Airspeed (KIAS), Altitude (FT)

TEST ITEM

Cond NO

16

MU-2B-20, S/N 183 OPEN SQUAWKS 11-17-83

1. ALTERNATE STATIC SYSTEM INOP.
2. R NAV OUT FOR REPAIR
3. NO. 2 COMPASS SYSTEM INOP.
4 DME INTERMITTENT.
5. NAV 1 LOC INOP.

17

WEIGHT & BALANCE

CENTER OF GRAVITY

$\dfrac{\_\_\_\_ - 154.3}{60.6} \times 100 \div 22.0 = \_\_\_\_$

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

FLIGHT NO.: SCR-20-003 (Initial) (C of A) (R & D) (Prod)

NOTE. SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6624.2	158.9	1,052,644.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) C. ARNOLD	185.0	97.2	17,982.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600.0	
ZERO FUEL WEIGHT	7154.2	156.44	1,119,240.3	25.53 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %MAC
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks — / — Gal	—	155.9	—	
TOTAL FUEL O/B 184 Gal	1232.8	XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8186.0	157.8	1,291,860.4	27.80 %MAC
GWT MAINS/OUTERS (ONLY)	8387.0	157.96	1,324,784.2	28.03 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-17-83

PILOT: E. BOEHLER CO-PILOT: C. ARNOLD

FLIGHT TEST (Additional Crew Members): ——— 2. ———

3. ——— 4. ——— 5. ——— 6. ———

DATE OF FLIGHT: 11-18-83 Q.C. (Stamp & Initials): 32 / [illegible]

DATE: 11/18/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHLER KISHI	TEST: SCR-20-4	S.E. 1115 T.O. 1125 LDG. 1225 TOTAL 0.8 FUEL USED .600

RAMP WT: 8422.0	C.G. %MAC.... 27.62	TIA REF: PD394
ZFW..... 7189.2	ZFW C.G. %MAC 25.06	

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

5° FLAP TAKEOFF WITH NORMAL CLIMB to 12,500. TURNS,
FLAP & GEAR EXTENSIONS & RETRACTIONS, STALLS.
PATTERN WORK

5° TAKEOFFS - 2
20° TAKEOFFS - 2

40° FLAP LANDING
20° FLAP LANDINGS
0° FLAP LANDINGS
S/E LANDINGS W/REVERSE to STOP

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

FLIGHT TEST PLAN | 11-[illegible]-83 | SCR-20-004

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
D. THACKER	S. [illegible]	[illegible]	[illegible]
PILOT E. BOEHLER	TEST CREW	TEST CREW	TEST CREW
COPILOT J. KISHI	TEST CREW	TEST CREW JK	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT		8422.0	LBS
CENTER OF GRAVITY		27.62	%MAC
FUEL LOADING	MAIN	1031.8	LBS
	OUTER	201.0	LBS
	TIP	—	LBS

TEST ITEMS

FAMILARIZATION FLIGHT

NOTE: SEE ATTACHED SHEET FOR OPEN SQUAWKS ON A/C

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

REMARKS

LIMITATIONS

DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.

FUEL AT LANDING: ________ LBS

TEST CONDITION																										
Engine																										
Gear																										
Flap																										
Airspeed (KIAS)																										
Altitude (FT)																										
TEST ITEM																										
Cond No																									24	

MU-2B-70, S/N 183 OPEN SQUAWKS 11-17-83

1. ALTERNATE STATIC SYSTEM INOP.
2. R NAV OUT FOR REPAIR
3. No. 2 COMPASS SYSTEM INOP.
4 DME INTERMITTENT.
5. NAV 1 LOC INOP.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{157.70 - 154.3}{60.6} \times 100 \div 22.0 = 27.6$

FLIGHT NO.: SCR-20-CC4 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) J. KISHI	220.0	97.2	21,384.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600.0	
ZERO FUEL WEIGHT	7189.2	156.16	1,122,642.3	25.06 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %M
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks — / — Gal		155.9		
TOTAL FUEL O/B 184 Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8221.0	157.55	1,295,262.4	27.37 %MAC
GWT MAINS/OUTERS (ONLY)	8422.0	157.70	1,328,186.2	27.62 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-17-83

PILOT: E. BOEHLER CO-PILOT: J. KISHI

FLIGHT TEST (Additional Crew Members): — 2. —

3. — 4. — 5. — 6. —

DATE OF FLIGHT: 11-18-83 Q.C. (Stamp & Initials): 32) / Field

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FLIGHT NUMBER: SCR-20-004

DATE: NOVEMBER, 18, 1983

LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS

CREW: BOEHLER / KISHI

AIRCRAFT: MU-2B-20-183 (N967MA) [Ramp Weight: 8422 lbs.]

FLIGHT TIME: 0.8 hours.

PURPOSE: ORIENTATION/FAMILIARIZATION - (MU-2B-20)

GENERAL:

This was my first flight in the MITSUBISHI MU-2B-20 airplane. The (-20) is also known by the manufacturer's model designation MU-2E. The (-20) is the short body model.

DISCUSSION:

1. Ernie Boehler took me through a preflight. Particular attention was given to the main gear door microswitch, and the engine shaft alinement and warp.

2. The starting engines portion of the checklist was followed to start the engines. The negative torque sensor (NTS) check was skipped since the airplane had a previous flight on that day. Starting procedure

3. The propellers were disengaged from the start locks prior to releasing the parking brake and taxiing. The steerable nose gear is linked to the rudder pedals. Taxiing the airplane presented no difficulties. With the condition levers in the taxi position and the power levers in ground idle there is sufficient thrust to propel the aircraft at a very brisk taxi speed. However, the beta range is available to slow the airplane so that the wheel brakes need not be used. Differential engine thrust is available for assistance with the steering if needed.

4. For takeoff, the flaps were lowered to the 5° down position. The condition levers are moved forward to the takeoff and land position. The rotation airspeed was predetermined as 93 KIAS. The best rate of climb speed (V_y) from the charts was 140 KIAS. Directional control is easy to maintain. The spoilers are very effective during the takeoff run.

5. A climb was made to 12,500 feet. During the climb, turns were made with varying bank angles. Using the 140 KIAS climb speed produces about 2600 feet per minute climb rate. The nose up angle is relatively steep and reduces forward visibility. Since this was a familiarization flight, my attention was directed away from numbers and concentrated on the operational aspect of the airplane.

6. At 12,500 feet, turns were made in both directions with varying bank angles. Stalls were conducted in all combinations of configurations. All stalls were preceded by aerodynamic buffet followed by activation of the stick shaker and finally the stall itself. The stalls were controllable with the longitudinal control against the aft stop. In each case, the roll control was effectively maintained by using the spoilers.

7. A descent was made from the test area toward MATHIS FIELD. Four full stop landings were made, including a no flap (0°), a 20° flap setting, a 40° flap setting, and a single engine with reverse thrust. A total of four takeoffs were made. Two takeoffs were made with 5° flaps, and two takeoffs were made with 20° flaps.

8. The engine shut-downs are very simple and involves placing the crank-run-stop switch to stop and hold until the engine rpm reaches 50 percent rpm. at this point the propeller start locks are engaged.

CONCLUSION:

1. The familiarization flight in the MU-2B-20 was successfully Completed.
2. The test airplane did not display any characteristics which could be considered as adverse to normal operation

James S. Kishi.

DATE: 11/18/83 MODEL: MU26-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOGUGE ROBINSON	TEST: SCR 20-5	S.E. 1430 T.O. 1440 LDG. 1525 TOTAL .7 FUEL USED 800

RAMP WT: 8481.0 ZFW..... 7114.2	C.G. %MAC.... 28.45 ZFW C.G. %MAC 26.09	TIA REF: P0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

5° TAKEOFF. ALL ITEMS ON ATTACHED FLIGHT CARD

Accomplished - to BE REPORTED BY TEAM.

40° FLAP LANDINS -

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU2E-20 183 | FLIGHT TEST PLAN 1/2 | 11-18-83 | SCR-22-005

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
S. NAKAGAWA	S. Nakagawa	[illegible]	[illegible]
PILOT E. TEEHLER	TEST CREW	TEST CREW	TEST CREW
COPILOT D. ROBINSON	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT	SEE W/B SHT	LBS
CENTER OF GRAVITY	OPTIONAL	%MAC
FUEL LOADING L.W.	SEE W/B SHT	LBS
R.W.	"	LBS
FUS	"	LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE
2. SEE ATTACHED SHEET FOR OPEN SQWKS ON A/C

TEST ITEMS

(1) fuel system operation and annunciation (item 2(g))
(2) anti-ice functions (item 2(d))
(3) to determine if the airplane is safely controllable by a single pilot (item 2(e))
(4) flight using partial panel instrument (item 2(j))
(5) landing gear warning system (item 2(b))

ESTIMATED FLIGHT TIME: ___ HR ___ MIN FUEL AT LANDING: ___ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	FUEL SYSTEM OPERATION & ANNUNCIATION	~	~	~	~	~
2	ANTI-ICE FUNCTIONS	~	~	~	~	~
3	SINGLE PILOT CONTROL	~	~	~	~	~
3a	SINGLE PILOT CONTROL IN NATURAL TURBULENCE OF AT LEAST MODERATE INTENSITY	~	~	~	~	~
4	PARTIAL PANEL INSTR.	~	~	~	~	~
5	L/G WARNING SYS & POSITION INDICATORS	~	BELOW 140	20°	RET → EXT	~
5a	L/G WARNING SYS & POSITION INDICATORS	~	BELOW 120	40°	RET → EXT	~

28

MU28-20 | 183 | FLIGHT TEST PLAN 2/2 | 11-18-8[illegible] | [illegible]

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT	TEST CREW	TEST CREW	TEST CREW
COPILOT	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT ______ LBS

CENTER OF GRAVITY OPTIONAL %MAC

FUEL LOADING ______ ______ LBS

______ ______ LBS

TEST ITEMS ______ LBS

(6) landing gear position indicators (item 2(e))

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ______ LBS

TEST CONDITION																										
Engine																										
Gear																										
Flap																										
Airspeed (KIAS)																										
Altitude (FT)																										
TEST ITEM																										
Cond NO																									29	

TEST PROCEDURES

I. Fuel System Operation and Annunciation (item 2.(a))

1. Check the following items during a normal flight.
   - the location of gauges, annunciation and switches
   - the pilot's capability to ascertain fuel status, consumption and to detect faults in the process

   (1) Determine if the fuel system operation and annunciation is adequate for operation as a single pilot airplane.

II. Anti-ice Functions (item 2 (d))

1. Operate all anti-ice functions listed below during a normal flight.
   - Propeller de-icing system
   - Engine air intake anti-icing system
   - Pitot & stall warning anti-icing system
   - Surface de-icing system
   - Windshield anti-icing system

   (1) Evaluate the following items.
   - pilot workload
   - capability of ascertaining status and proper
   - functioning of all systems
   - normal functioning annunciators
   - fault/failure annunciation

TEST PROCEDURES

III. Single Pilot Control (item 2.(e))

1. Perform takeoff, climb, level flight, turning, descent, approach and landing normally.
   (1) Give particular attention to the following items during the flight.
   - yaw damping characteristics
   - dutch-roll characteristics
   - takeoff speed schedule
   - climb speed schedule
   - approach speed schedule

IV. Partial Panel Instruments (item 2.(j))

1. Put covers on panel instruments excepts pilot's side turn & bank, airspeed and altitude indicators during a level flight.
2. Conduct climb, level flight, turn, descent and simulated landing.
   (1) Assure that the airplane can be safely flown.
3. Remove covers put on panel instruments.

TEST PROCEDURES

V. Landing Gear Warning System (item 2 (b)) &
VI. Landing Gear Position Indicators (item 2 (c))

1. Obtain an airspeed below 140 KCAS.
2. Extend flaps and set them at 20° position.
   (1) Check adequacy of the landing gear warning.
3. Operate the landing gear warning cut out switch.
   (1) Assure that landing gear warning does not stop.
4. Extend landing gears.
   (1) Assure that landing gear warning stops.
   (2) Determine if the landing gear position indicators are adequate to perform their intended functions.
5. Retract landing gears.
6. Retract flaps.
   (1) Assure that landing gear warning is silent.
7. Obtain an airspeed below 120 KCAS.
8. Extend flaps and set them at 40° position.
   (1) Check adequacy of the landing gear warning.
9. Follow the above procedures 3 thru 6.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{158.21 - 154.3}{60.6} \times 100 + 22.0 = 28.45$

FLIGHT NO.: SCR-20-005 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) D. ROBINSON	145.0	97.2	14 094.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600.0	
ZERO FUEL WEIGHT	7114.2	156.78	1,115,352.3	26.09 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %MAC
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks 10 / 10 Gal	134.0	155.9	20,890.6	
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8146.0	158.11	1,287,972.4	28.29 %MAC
GWT MAINS/OUTERS (ONLY)	8347.0	158.25	1,320,896.2	28.50 %MAC
GWT MAINS/OUTERS/TIPS	8481.0	158.21	1,341,786.8	28.45 %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-18-83

PILOT: E. BOEHLER CO-PILOT: D. ROBINSON

FLIGHT TEST (Additional Crew Members): —— 2. ——

3. —— 4. —— 5. —— 6. ——

DATE OF FLIGHT: 11-18-83 Q.C. (Stamp & Initials): 32

83

MU-2B-60

FLT. NO SCR-60-5
(11/14/83)

SE 14:04
TC
LD

RUN	CONDITION	TIME	Hp (FT)	V (KTS)	RAT		COMMENT	
1	GND CHECK	14:07	29.76 1520				Ground check	
		14:14		45, 09			100%	
	Climb	14:17						
		14:21	15000		10	160		
		14:24	14200	170	8	157		
	Flaps							
	20°			120				
	20°			135				
	40°			120				
		15:05				550	GO-	
		15:12				505		
		15:15				601		

SCR-20-5 11-18-83 Robinson

I. Fuel System Operation and Annunciation

(1) The fuel system operation and annunciation is adequate for operation as a single pilot airplane. Note: placement of the red "outer-tank-not-feeding lights" is such that they cannot be seen without a change in the pilots normal position.

II Operation of all anti-icing functions during normal flight

(1) A. Pilot Workload: Not significant. The switches for all functions are clearly labeled and easily reached. Lights which indicate operation of functions are easily seen.

B. Capability of ascertaining the status and proper functioning of all systems:

1. Propeller, engine air intake and surface deicing function operations are clearly indicated by amber lights.

2. Windshied anti icing is a liquid system for which the function is obvious.

3. PITOT AND STALL WARNING HEAT OPERATION MAY BE NOTED BY OBSERVING AND INCREASE IN AMPERAGE ON THE VOLT/AMMETERS.

C. <u>FUNCTIONING OF ALL SYSTEMS</u>: ALL SYSTEMS FUNCTIONED IN NON-ICING CONDITIONS.

D. <u>NORMAL FUNCTIONING OF ANNUNCIATORS</u>: ALL ANNUNCIATORS FUNCTIONED IN ACCORDANCE WITH THE FLIGHT MANUAL.

E. <u>FAULT / FAILURE ANNUNCIATION</u>: THIS POINT WOULD BE MANIFESTED BY THE FAILURE OF A ANNUNCIATOR LIGHT TO ILLUMINATE OR THE ACTIVATION OF A CIRCUIT BREAKER. NO SUCH MANIFESTATIONS WERE OBSERVED.

III SINGLE PILOT CONTROL

(1) A. <u>YAW DAMPING CHARACTERISTICS</u>: YAW WAS STABALIZED WITHIN ONE HALF (1/2) TO (1 1/2) ONE AND ONE HALF OSCILLATIONS USING APPROXIMATELY A TWO (2) INCH RUDDER PEDDLE DEFLECTION AT SPEEDS FROM 120 TO 240 KIAS. NO YAW DAMPER IS INSTALLED.

B. <u>DUTCH ROLL CHARACTERISTICS</u>: DUTCH ROLL WAS INDUCED AS IN "A" ABOVE AND BY APPLYING OPPOSITE SPOILER. THE ROLL WAS LESS EASILY INDUCED AS COMPARED WITH -60 MODEL AND DAMPED AS IN "A." ABOVE. IN ADDITION, THE MAGNITUDE OF THE

OSCILLATIONS WAS LESS AND THE PERIOD OF THE OSCILLATIONS WAS SHORTER WHEN COMPARED WITH THE -60 MODEL.

(C) SPEED SCHEDULES SPEED SCHEDULES FOR NORMAL TAKEOFF, CLIMB, AND APPROACH WERE ADEQUATE.

IV PARTIAL PANEL INSTRUMENTS

1) THIS ITEM PERFORMED AS DIRECTED

2) THE AIRPLANE CAN BE SAFELY FLOWN

V LANDING GEAR WARNING SYSTEM

(1) THE LANDING GEAR WARNING SYSTEM IS ADEQUATE AND FUNCTIONS IN ACCORDANCE WITH THE AFM SYSTEM DESCRIPTION.

VI LANDING GEAR POSITION INDICATORS.

(1) THE LANDING GEAR POSITION INDICATORS ARE ADEQUATE TO PERFORM THEIR INTENDED FUNCTION.

David A. Robinson

DATE: 11/18/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHLER KISH	TEST: SCR-20-6	S.E. 1615 T.O. 1622 LDG. 1702 TOTAL .6 FUEL USED 60 gal

RAMP WT: 8552.0	C.G. %MAC.... 27.57	TIA REF:
ZFW..... 7189.2	ZFW C.G. %MAC 25.06	R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

5° FLAP TAKEOFF & CLIMB OUT. ALL ITEMS ON ATTACHED FLIGHT CARD ACCOMPLISHED AND WILL BE REPORTED BY TEAM.

40° FLAP NORMAL LANDING accomplished

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU2B-20 183 | FLIGHT TEST PLAN 1/2 | 11-18-83 | 2CE-20-006

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
S. NAKAGAWA	S. Nakagawa		
PILOT E. KOEHLER	TEST CREW	TEST CREW	TEST CREW
COPILOT J. KISHI	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT		SEE W/B SHT	LBS
CENTER OF GRAVITY		OPTIONAL	%MAC
FUEL LOADING	L.W.	SEE W/B SHT	LBS
	R.W.	"	LBS
	FUS	"	LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE
2. SEE ATTACHED SHEET FOR OPEN SQWKS ON A/C

TEST ITEMS

(1) fuel system operation and annunciation (item 2(a))
(2) anti-ice functions (item 2(d))
(3) to determine if the airplane is safely controllable by a single pilot (item 2(e))
(4) flight using partial panel instrument (item 2(j))
(5) landing gear warning system (item 2(b))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN   FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	FUEL SYSTEM OPERATION & ANNUNCIATION	~	~	~	~	~
2	ANTI-ICE FUNCTIONS	~	~	~	~	~
3	SINGLE PILOT CONTROL	~	~	~	~	~
3a	SINGLE PILOT CONTROL IN NATURAL TURBULENCE OF AT LEAST MODERATE INTENSITY	~	~	~	~	~
4	PARTIAL PANEL INSTR.	~	~	~	~	~
5 ~ 6	L/G WARNING SYS & POSITION INDICATORS	~	BELOW 140	20°	RET → EXT	~
5a ~ 6a	L/G WARNING SYS & POSITION INDICATORS	~	BELOW 120	40°	RET → EXT	~

MU2B-20	183	FLIGHT TEST PLAN 2/2		11-18-83	SCR-20-002

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT	TEST CREW	TEST CREW	TEST CREW
COPILOT	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT ________ LBS

CENTER OF GRAVITY OPTIONAL %MAC

FUEL LOADING ________ ________ LBS

________ ________ LBS

TEST ITEMS ________ LBS

(6) landing gear position indicators (item 2(c))

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

TEST CONDITION																										
	Engine																									
	Gear																									
	Flap																									
	Airspeed (KIAS)																									
	Altitude (FT)																									
TEST ITEM																										
Cond NO																										

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TEST PROCEDURES

I. Fuel System Operation and Annunciation (item 2.(a))

1. Check the following items during a normal flight.
   - the location of gauges, annunciation and switches
   - the pilot's capability to ascertain fuel status, consumption and to detect faults in the process

(1) Determine if the fuel system operation and annunciation is adequate for operation as a single pilot airplane.

II. Anti-ice Functions (item 2 (d))

1. Operate all anti-ice functions listed below during a normal flight.
   - Propeller de-icing system
   - Engine air intake anti-icing system
   - Pitot & stall warning anti-icing system
   - Surface de-icing system
   - Windshield anti-icing system

(1) Evaluate the following items.
   - pilot workload
   - capability of ascertaining status and proper
   - functioning of all systems
   - normal functioning annunciators
   - fault/failure annunciation

TEST PROCEDURES

III. Single Pilot Control (item 2.(e))

1. Perform takeoff, climb, level flight, turning, descent, approach and landing normally.
   (1) Give particular attention to the following items during the flight.
      - yaw damping characteristics
      - dutch-roll characteristics
      - takeoff speed schedule
      - climb speed schedule
      - approach speed schedule

IV. Partial Panel Instruments (item 2.(j))

1. Put covers on panel instruments excepts pilot's side turn & bank, airspeed and altitude indicators during a level flight.
2. Conduct climb, level flight, turn, descent and simulated landing.
   (1) Assure that the airplane can be safely flown.
3. Remove covers put on panel instruments.

TEST PROCEDURES

V. Landing Gear Warning System (item 2 (b)) &

VI. Landing Gear Position Indicators (item 2 (c))

1. Obtain an airspeed below 140 KCAS.
2. Extend flaps and set them at 20° position.
   (1) Check adequacy of the landing gear warning.
3. Operate the landing gear warning cut out switch.
   (1) Assure that landing gear warning does not stop.
4. Extend landing gears.
   (1) Assure that landing gear warning stops.
   (2) Determine if the landing gear position indicators are adequate to perform their intended functions.
5. Retract landing gears.
6. Retract flaps.
   (1) Assure that landing gear warning is silent.
7. Obtain an airspeed below 120 KCAS.
8. Extend flaps and set them at 40° position.
   (1) Check adequacy of the landing gear warning.
9. Follow the above procedures 3 thru 6.

WEIGHT & BALANCE

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

FLIGHT NO.: SCR-20-006 (Initial) (C of A) (R & D) (Prod)

CENTER OF GRAVITY

$\frac{157.68 - 154.3}{60.6} \times 100 \div 22.0 = 27.57$

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) J. KISHI	220.0	97.2	21,384.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600.0	
ZERO FUEL WEIGHT	7189.2	156.16	1,122,642.3	25.06 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ______ %MAC
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ______
Tip Tanks 10 / 10 Gal	134.0	155.9	20,890.0	
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8221.0	157.55	1,295,262.4	27.37 %MAC
GWT MAINS/OUTERS (ONLY)	8422.0	157.70	1,328,186.2	27.62 %MAC
GWT MAINS/OUTERS/TIPS	8556.0	157.68	1,349,076.2	27.57 %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-18-83

PILOT: E. BOEHLER CO-PILOT: J. KISHI

FLIGHT TEST (Additional Crew Members): ——— 2. ———

3. ——— 4. ——— 5. ——— 6. ———

DATE OF FLIGHT: 11-18-83 Q.C. (Stamp & Initials): 32 [illegible]

FLIGHT NUMBER: SCR-20-006
DATE: NOVEMBER 18, 1983
LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS
AIRCRAFT: MU-2B-20-183 (N967MA)
CREW: KISHI / BOEHLER
FLIGHT TIME: 0.6 hours
PURPOSE: Evaluate:

1. fuel system operation and annunciation
2. anti-ice functions
3. single pilot operation
4. instrument flight using partial panel
5. landing gear warning system and position indicators

COMMENTS:

1. FUEL SYSTEM OPERATION AND ANNUNCIATION. The fuel quantity indicators and fuel selector switches are located on the pilots' side of the instrument panel under the control wheel assembly. Therefore, the pilot must move his head to see the indicators. However, this also holds true for some airplanes that have indicators and selectors mounted on the sidewall, or other remote locations. A light to signal that the outer tank is depleted is located with the indicators. This light also requires the pilot to move his head in order to see it. Since illumination of the light requires no action on the part of the pilot, the light should be classed as an advisory device. Therefore, the lights red lense should be exchanged for an amber lens. The fuel system operation and annunciation is simple, and should be suitable for single pilot operation.

2. ANTI-ICE FUNCTIONS. A functional check was successfully completed for the airplane's anti-ice and deice systems including engine anti-ice, propeller anti-ice/de-ice, surface de-ice, windshield anti-ice/de-ice, pitot heat, and stall warning vane heat. The system annunciators functioned properly. An overhead panel grouped all of the system switches. Each switch was clearly marked and operated satisfactorily. Operation of the switches revealed no problems, and would not adversely affect single pilot operation.

3. SINGLE PILOT OPERATION. The various maneuvers predetermined by the test plan were successfully completed. Specifically, the yaw damping and dutch roll characteristics were acceptable. The airplane was not equipped with a yaw damper. The takeoff speed schedule is adequate. Some difficulty was experienced in precisely rotating the airplane at the rotation velocity. During one takeoff, leading the rotation velocity resulted in the airplane rotating 5-6 KIAS under the target velocity. Familiarity with the airplane should resolve this problem. In any case, due to the rapid acceleration of the airplane this situation has no bearing on safety. The climb speed schedule is easy to maintain and results in good performance up to 12,500 feet. However, the angle of climb restricts to an extent the over-the-nose visibility. The approach speed schedule is adequate and easy to follow. However maintaining the specified airspeed over the threshold resulted in substantial

floating during the landing flare. Single pilot operation of the airplane should not incur any more workload than the amount required for comparable turbo-propeller aircraft.

3. INSTRUMENT FLIGHT USING PARTIAL PANEL. Instrument flight using a partial panel required no greater effort than for comparable aircraft. The airplane requires frequent use of trim. However, when in proper trim the airplane is easy to control. The prime trim axes are for yaw and roll.

4. LANDING GEAR WARNING SYSTEM AND POSITION INDICATORS. The landing gear warning horn is not adequate. The airplane warning horn will not sound during an approach with the gear up and the flaps at 20° down if the power levers are not against the flight idle stop. The landing gear position lights operated in the proper manner and the landing gear position was easily determined.

James S. Kishi

DATE: 11/19/83 MODEL: MU2B20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHLGE ROBINSON KALLIM	TEST: SCR-20-17	S.E. 0928 T.O. 0945 LDG. 1023 TOTAL .7 FUEL USED -80

RAMP WT: 9072.0 C.G. %MAC.... 34.0 ZFW..... 7839.2 ZFW C.G. %MAC 33.02	TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

WINDS 270° 18+25 KTS -

5° FLAP TAKEOFF. CLIMB TO 8500 where FLIGHT CARD ITEMS ACCOMPLISHED. ONE other TEST Performed NOT ON FLIGHT CARD: Simulated ENGINE FAILURE AT 50', T.O. Speed. GEAR DOWN, FLAPS 20°.

NORMAL 40° FLAP LANDING

B/DR

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

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SCR-20-007

(11/19/83)

SE 9:27

TO 9:45

LP 10:25

T. V[illegible]

RUN	COND		FLAPS	GEAR	FUEL BURN	VTRIM (1.5 VS)	VSHAKER	VSTALL	COMMENTS	
		Takeoff 9:45	5	↓						
		Simulated T/O	20	↓		102			up @ 7500	
	8	AP ON Power ON	0	↑		144	92	12° Nose up Trim	75% Power. 18° pitch	
	9	AP ON power OFF	0	↑		144	101	12° Nose up Trim	7° pitch.	idle.
	10	AP ON power ON	40	↓		108	81	6° Nose up Trim	9° pitch.	
	11	AP ON power off	40	↓		108	74	10° Nose up Trim	level pitch	
	2	Power ON	0	↑		144	93	8° Nose up Trim.	14° pitch	
	3	Power OFF	0	↑		144	98	6° Trim.	6° pitch.	
	5 ~~4~~	Power OFF	40	↓		107	72	9° trim.	2° Nose Down.	
	4	Power ON	40	↓		107	69	8° trim	7° Nose up.	
	6	S/E	0	↑		143	95	7° Trim	L/E Shut Down. Wings Level.	
	7	↓	40	↓		107	—	6° Trim.	No shaker. [illegible]	80 KTS
		10:27	E/G Shut Down.							

MU-2B-20 | #183 | FLIGHT TEST PLAN | 10-19-83 | SCR-20-007

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
S. NAKAGAWA	S. Nakagawa	[illegible]	[illegible]
PILOT E. BOEHLER	TEST CREW KAWAI	TEST CREW	TEST CREW
COPILOT L. ROBINSON	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT 9072.0 LBS

CENTER OF GRAVITY (aft) %MAC

FUEL LOADING MAIN 1031.8 LBS

OUTER 201.0 LBS

TIP ——— LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.
2. SEE ATTACHED SHEET FOR OPEN SQWKS ON A/C.

TEST ITEMS

SN

~~(1) to obtain and maintain airspeeds within the range of 1.1 Vs1 to 1.7 Vs1 or Vf, whichever is the lesser (item 2.(h)) CAR 3.109(b)(6)~~

(2) Stall warning (item 2.(i))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	Test Item	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	~~CAR 3.109 (b)(6)~~ SN	~~10,000~~	~~Trim 1.5 Vso~~	~~40°~~	~~Ext.~~	~~Flight Idle~~
	STALL WARNING — AUTOPILOT OFF					
2	straight (climbing)	10,000	Trim 1.5 Vs1	Ret.	Ret.	MCP
3	straight	"	"	"	"	Flight Idle
4	straight (climbing)	"	"	40°	Ext.	MCP
5	straight	"	"	"	"	Flight Idle
6	single engine (straight)	"	~	Ret.	Ret.	Feather / MCP
7	single engine (straight)	"	~	40°	Ext.	" "
	STALL WARNING — AUTOPILOT ON					
8	Straight (climbing)	10,000	Trim 1.5 Vs1	Ret.	Ret.	MCP
9	straight	"	"	"	"	Flight Idle
10	Straight (climbing)	"	"	40°	Ext.	MCP
11	Straight	"	"	"	"	Flight Idle
12	~~Single engine~~ SN	~~"~~	~~~~~	~~Ret.~~	~~Ret.~~	~~Feather / MCP~~
13	~~Single engine~~ SN	~~"~~	~~~~~	~~40°~~	~~Ext.~~	~~"~~

TEST PROCEDURES

~~I. To obtain and maintain airspeeds within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f, whichever is the lesser (item 2. (h)) — CAR 3.109 (b)(6)~~

GH

~~1. Trim the airplane at the specified conditions.~~

~~2. Obtain and maintain 1.1 V_{S1} using primary control systems without changing trim. (with one hand)~~

~~3. Obtain and maintain 1.7 V_{S1} using primary control systems without changing trim. (with one hand)~~

II Stall Warning. (item 2 (i))

— For cond. NO. 2 thru 5 and 8 thru 11.

1. Trim the airplane at the specified conditions.
2. Reduce airspeed by means of the elevator control until stall warning starts.
   (1) Assure that the stall warning is clear and distinctive.
3. The elevator control shall be pulled back at a rate such that the airplane speed reduction does not exceed 1 mph/sec until a stall is produced.
   (1) Assure that a clear and distinctive stall warning continues until the stall occurs.
4. Recover from the stall using normal elevator control.

TEST PROCEDURES

II Stall Warning. (item 2ω) continued

- For cond. NO 6, 7. ~~12 and 13~~ SN.

1. ~~Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank towards the inoperative engine.~~
2. Increase steadily angle of attack with the elevator control until a stall occurs.
   (1) Assure that a clear and distinctive stall warning is available until the stall occurs.
3. Recover from the stall by normal use of the controls, reducing power on the operating engines if desired.
4. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank away from the inoperative engine.
5. Repeat above procedures 2 and 3.

WEIGHT & BALANCE

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

FLIGHT NO.: SCR-20-007 (Initial) (C of A) (R & D) (Prod)

CENTER OF GRAVITY

$\frac{161.6 - 154.3}{60.6} \times 100 + 22.0 = 34.0$

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) D. ROBINSON	145.0	97.2	14,094.0	
2nd ROW KAWAI	125.0	133.9	16,737.5	
2nd ROW		133.9		
COUCH	125	183.5	22,937.5	
CABIN BAGGAGE COMPT	200.0	204.7	40,940.0	
BAGGAGE COMPT. **	220.0	230.7	50,754.0	
AFT BAGGAGE COMPT. **	155.0	246.0	38,130.0	
ZERO FUEL WEIGHT	7829.2	160.8	1,260,251.3	33.0 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.14	W/800lbs ____ %MAC
Outer Tanks 15 / 15 Gal	201	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8871.0	161.5	1,432,871.4	33.9 %MAC
GWT MAINS/OUTERS (ONLY)	9072.0	161.6	1,465,795.2	34.0 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-18-83

PILOT: E. BOEHLER CO-PILOT: D. ROBINSON

FLIGHT TEST (Additional Crew Members): KAWAI 2. ____

3. ____ 4. ____ 5. ____ 6. ____

DATE OF FLIGHT: 11-19-83 Q.C. (Stamp & Initials): 32

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SCR-20-007
(11/19/83)

SE 9:27
TO 9:45
LP 10:25

T. V[illegible]

RUN	COND		FLAPS	GEAR	FUEL BURN	VTRIM (1.5 VS)	VSHAKER	VSTALL	COMMENTS	
		Takeoff 9:45	5	↓						
		simulator T/O	20	↓		102			wp=7300	
	8	AP ON. Power ON	0	↑		144	92	12° Nose up Trim	75% Power. 18° pitch	
	9	AP ON power OFF	0	↑		144	101	12° Nose up Trim	7° pitch.	Idle.
	10	AP ON power ON	40	↓		108	71	6° Nose up Trim	9° pitch.	
	11	AP ON power off	40	↓		108	74	10° Nose up Trim	level pitch	
	2	Power ON	0	↑		144	93	8° Nose up Trim.	14° pitch	
	3	Power OFF	0	↑		144	98	6° Trim.	6° pitch.	
	5	Power OFF	40	↓		107	72	9° trim.	2° Nose Down.	
	4	Power ON	40	↓		107	69	8° trim	7° Nose up.	
	6	S/E	0	↑		143	95	7° Trim	L/E Shut Down. Wings Level	
	7	↓	40	↓		107	—	6° Trim	No shaker before	80 FTS
		10:27	E/G Shut Down.							

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CR-20-7 10-19-83 ROBINSON

I STALL WARNING - AUTO PILOT OFF - TWO ENGINES

(1) STALL WARNING WAS CLEAR AND DISTINCTIVE.

NOTE: BY VERBAL AGREEMENT, A CHANGE TO THE FLIGHT CARD RESULTED IN RECOVERY JUST PRIOR TO AN ACTUAL STALL.

II STALL WARNING - AUTO PILOT ON - TWO ENGINES

(1) STALL WARNING IS CLEAR AND DISTINCTIVE.

NOTE: USE OF THE AUTO PILOT FOR AIRCRAFT CONTROL TO ACTIVATE THE STALL WARNING HAD NO EFFECT. RECOVERY WAS ACCOMPLISHED AS THE AUTOPILOT WAS DISCONNECTED JUST ABOVE STAL

III STALL WARNING AUTO PILOT OFF - ONE ENGINE.

(1) WITH GEAR AND FLAPS RETRACTED: STALL WARNING WAS CLEAR AND DISTINCTIVE.

(2) WITH GEAR DOWN, FLAPS 40°: THE STALL WARNING COULD NOT BE ACTIVATED BECAUSE MAXIMUM SPOILER AND RUDDER DEFLECTIONS WERE ACHIEVED PRIOR TO PROBABLE ACTIVATION SPEED.

IV ADDITIONAL ITEM

(1) DONE AT MY REQUEST.

(2) MANEUVER: SIMULATED TOTAL LOSS OF LEFT (CRITICAL) ENGINE POWER, GEAR DOWN, FLAPS 20°, 93 KIAS (V_{mc}), APPROXIMATELY 8920 POUNDS (1000 POUNDS LESS THAN MTOGW), 6500 FEET MSL, OAT APPROXIMATELY 12°C, RIGHT ENGINE AT MAXIMUM TAKEOFF POWER.

(3) I WAS FULLY AWARE OF HOW AND WHEN THE POWER LOSS WOULD OCCUR AND WHAT CORRECTIVE ACTION WOULD BE REQUIRED.

(4) RESULTS INDICATED THAT: HAD THE ACTUAL ALTITUDE FOR THE MANEUVER BEEN FIFTY (50) FEET AGL, AN IMMEDIATE AND UNSUCCESSFUL RETURN TO EARTH WOULD HAVE OCCURED.

David A. Robinson

SDN

DATE: 11/19/83 MODEL: MU 2B 20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehler Kisha Thacker	TEST: SCR-20-8	S.E. 1103 T.O. 1112 LDG. 1140 TOTAL .3 FUEL USED -50

RAMP WT: 9432.0	C.G. %MAC.... 33.9	TIA REF: R0394
ZFW..... 8199.2	ZFW C.G. %MAC 32.7	

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

WIND 270 18G25 - 5° FLAP T.O. CLIMB TO 5500.
ALL ITEM ON ATTACHED FLIGHT CARD Accomplished.
ONE ADDITIONAL TEST: SIMULATED ENGINE FAILURE
ON TAKEOFF AT 50'.

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU-2B-20 | #183 | FLIGHT TEST PLAN | 11-19-83 | SCR-20-002

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
S. NAKAGAWA	S. Nakagawa	B	[signature]
PILOT E. BOEHLER	TEST CREW D. THACKEE	TEST CREW	TEST CREW
COPILOT J. KISHI	TEST CREW	TEST CREW JSK	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT		9382.0	LBS
CENTER OF GRAVITY		34.0	%MAC
FUEL LOADING	MAIN	1031.8	LBS
	OUTER	201.0	LBS
	TIP	——	LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.
2. SEE ATTACHED SHEET FOR OPEN SQWKS ON A/C.

TEST ITEMS

~~(1) to obtain and maintain airspeeds within the range of 1.1 Vs1 to 1.7 Vs1 or Vf, whichever is the lesser (item 2.(h)) CAR 3.109(b)(6)~~ (2)

(2) Stall warning (item 2.(i))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
~~1~~	~~CAR 3.109 (b)(6)~~ SL	~~10,000~~	~~Trim 1.5 Vs0~~	~~40°~~	~~Ext.~~	~~Flight Idle~~
	STALL WARNING —	AUTOPILOT OFF				
2	straight (climbing)	10,000	Trim 1.5 Vs1	Ret.	Ret.	MCP
3	straight	"	"	"	"	Flight Idle
4	straight (climbing)	"	"	40°	Ext.	MCP
5	straight	"	"	"	"	Flight Idle
6	single engine	"	~	Ret.	Ret.	Feather/MCP
7	single engine	"	~	40°	Ext.	"
	STALL WARNING —	AUTOPILOT ON				
8	straight (climbing)	10,000	Trim 1.5 Vs1	Ret.	Ret.	MCP
9	straight	"	"	"	"	Flight Idle
10	straight (climbing)	"	"	40°	Ext.	MCP
11	straight	"	"	"	"	Flight Idle
12	~~single engine~~ SL	"	~	Ret.	Ret.	~~Feather/MCP~~
13	single engine SL	"	~	40°	Ext.	~~"~~
67						

TEST PROCEDURES

~~I. To obtain and maintain airspeeds within the range of 1.1 V_{s1} to 1.7 V_{s1} or V_t, whichever is the lesser (item 2. (h)) — CAR 3. 109 (b) (6)~~

~~1. Trim the airplane at the specified conditions.~~
~~2. Obtain and maintain 1.1 V_{s1} using primary control systems without changing trim. (with one hand)~~
~~3. Obtain and maintain 1.7 V_{s1} using primary control systems without changing trim. (with one hand)~~

II Stall Warning. (item 2 (i))

— For cond. NO. 2 thru 5 and 8 thru 11.

1. Trim the airplane at the specified conditions.
2. Reduce airspeed by means of the elevator control until stall warning starts.
   (1) Assure that the stall warning is clear and distinctive.
3. The elevator control shall be pulled back at a rate such that the airplane speed reduction does not exceed 1 mph/sec until a stall is produced.
   (1) Assure that a clear and distinctive stall warning continues until the stall occurs.
4. Recover from the stall using normal elevator control.

TEST PROCEDURES

II Stall Warning. (item 2(i)) Continued

- For cond. NO 6, 7. ~~12 and 13~~ SN.

1. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank towards the inoperative engine.
2. Increase steadily angle of attack with the elevator control until a stall occurs.
   (1) Assure that a clear and distinctive stall warning is available until the stall occurs.
3. Recover from the stall by normal use of the controls, reducing power on the operating engines if desired.
4. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank away from the inoperative engine.
5. Repeat above procedures 2 and 3.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{-154.3}{60.6} \times 100 \div 22.0 =$ ____

FLIGHT NO.: SCR-20-008 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) J. KISHI	220 0	97.2	21,384.0	
2nd ROW D. THACKER	160.0	133.9	21,424.0	
2nd ROW		133.9		
COUCH	375.0	183.5	68,812.5	
CABIN BAGGAGE COMPT	200.0	204.7	40,940.0	
BAGGAGE COMPT. **	220.0	230.7	50,754.0	
AFT BAGGAGE COMPT. **	155.0	246.0	38,130.0	
ZERO FUEL WEIGHT	8199.2	160.8	1,318,102.8	32.7 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ #
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9231.0	161.5	1,490,722.9	33.9 %MAC
GWT MAINS/OUTERS (ONLY)	9432.0	161.5	1,523,646.7	33.9 %MAC
GWT MAINS/OUTERS/TIPS	——	——	——	____ %MAC

*Includes oil and unusable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-19-83

PILOT: E. BOEHLER CO-PILOT: J. KISHI

FLIGHT TEST (Additional Crew Members): D. THACKER 2. ____

3. ____ 4. ____ 5. ____ 6. ____

DATE OF FLIGHT: 11-19-83 Q.C. (Stamp & Initials): / [illegible]

[illegible]

SCR-~~60~~ 20-008
(11/19/83)

SE 11:05
TO 11:10
LP 11:[illegible]

RUN	COND	11:10	FLAPS	GEAR	FUEL BURN	VTRIM (1.5 Vs)	VSHAKER	VSTALL	COMMENTS	
1	2	11:18	↑	↑	140	141	96	76	6° TRIM	
2	3	11:23	↑	↑	145	141	101	90	7° TRIM	
3	4	11:25	40	40	140	111	70	51	5° TRIM	
4	5	11:28	40	↓	135	111	74	63	7° TRIM	
5	6	11:31	↑	↑	130	144	98	—	7° TRIM	
6	7	11:32	40	↓	125	144	75	—	6° TRIM	
7										
8										
9										
10										
		11:39	landing							

FLIGHT NUMBER: SCR-20-008

DATE: NOVEMBER 19, 1983

LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS

AIRCRAFT: MU-2B-20-183 (N967MA)

CREW: KISHI / BOEHLER

FLIGHT TIME: 0.3 hours

PURPOSE: EVALUATE THE STALL WARNING WITH THE AUTOPILOT OFF

COMMENTS: The stall warning was evaluated under the test conditions cited in the flight test plan. Every stall was preceded by aerodynamic buffet followed by the stick shaker. Using 40° down wing flaps, the aerodynamic buffet is more pronounced than with the wing flaps in the 0° position. This stick shaker provided a distinct and unmistakable warning.

James S. Kishi

DATE: 11/19/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehler Robinson Kawai	TEST: SCR-20-9	S.E. 1400 T.O. 1410 LDG. 1440 TOTAL :30 FUEL USED -50

RAMP WT: 8747.0	C.G. %MAC.... 24.1	TIA REF:
ZFW..... 7514.2	ZFW C.G. %MAC 21.1	R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All ITEMS ON ATTACHED FLIGHT CARD Accomplished with some DEVIATIONS TO BE REPORTED ON BY TEAM PILOT.

B. [signature]

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU-2B-20 #183	FLIGHT TEST PLAN		11-19-83	SCR-20-009
PREPARED BY D. THACKER	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT) D	APPROVED BY	
PILOT E. BOEHLER	TEST CREW KAWAI	TEST CREW	TEST CREW	
COPILOT D. ROBINSON	TEST CREW	TEST CREW	TEST CREW	

AIRPLANE CONDITION

TAKEOFF WEIGHT		8747.0	LBS
CENTER OF GRAVITY		24.1 (Forward)	%MAC
FUEL LOADING	MAIN	8541.0	LBS
	OUTER	8747.0	LBS
	TIP	—	LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE
2. SEE ATTACHED SHEET FOR OPEN SQUAKS ON A/C.

TEST ITEMS

(1) take off speed schedules and climb transition (item 2.(f))

(2) approach and landing procedures and speed schedules (item 2.(g))

(3) to obtain and maintain airspeed within the range of 1.1 Vs1 to 1.7 Vs1 or Vf whichever is the lesser (item 2.(h)) — CAR 3.109(b)(6)

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ____________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
		TEST CONDITION				
1a	TAKEOFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKEOFF → CLIMB	5°	Ext. → Ret	TOP → MCP
1b	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKE OFF → CLIMB	20°	Ext. → Ret	TOP → MCP
1c	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKE OFF → CLIMB	5° → 0	Ext. → Ret	TOP → FI/MCP
1d	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKE OFF → CLIMB	20° → 0°	Ext. → Ret	TOP → FI/MCP
2a	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE.	~	APPROACH → LANDING	20°	Ext.	~
2b	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE.	~	APPROACH → LANDING	40°	Ext.	~
2c	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE	~	APPROACH → LANDING	20°	Ext.	FI/~
2d	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE	~	APPROACH → LANDING	40°	Ext.	FI/~
3	CAR 3.109(b)(6)	10,000	Trim 1.5 Vso	40°	Ext.	Flight Idle.
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TEST PROCEDURES

I. Takeoff Speed Schedule and Climb Transition (item 2.(f))

1. Conduct a takeoff and a climb transition in accordance with the airplane flight manual procedures.

   (1) Determine the adequacy of the takeoff speed schedules and climb transition considering a single pilot using average skill.

   (2) Evaluate for both two engine and single engine takeoff.

II. Approach and Landing Procedures and Speed Schedules (item 2.(g))

1. Perform an approach and a landing in accordance with the airplane flight manual procedures.

   (1) Determine the adequacy of the approach and landing procedures and speed schedules considering a single pilot using average skill.

   (2) Evaluate for both two engine and single engine approarches.

TEST PROCEDURES.

III To obtain and maintain airspeed within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f, whichever is the lesser (item 2.(h)) — CAR 3.109 (b)(6)

1. Trim the airplane at the specified conditions.
2. Obtain and maintain 1.1 V_{S1} using primary control systems without changing trim. (with one hand)
3. Obtain and maintain 1.7 V_{S1} using primary control systems without changing trim. (with one hand)

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{155.6 - 154.3}{60.6} \times 100. + 22.0 = 24$

FLIGHT NO.: SCR-20-009 (Initial) (C of A) (R & D) (Prod)

NOTE. SEE P.O.M. -SECTION VIII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) D. ROBINSON	145.0	97.2	21,384.0	
2nd ROW KAWAI	125.0	133.9	16,737.5	
2nd ROW		133.9		
COUCH		183.5		
BALLAST	375.0	109.0	40,875.0	
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **		246.0		
ZERO FUEL WEIGHT	7514.2	153.8	1,155,654.8	21.1 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %
Outer Tanks 15/15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8546.0	155.4	1,328,274.9	23.8 %MAC
GWT MAINS/OUTERS (ONLY)	8747.0	155.6	1,361,198.7	24.1 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-19-83

PILOT: E BOEHLER CO-PILOT: D. ROBINSON

FLIGHT TEST (Additional Crew Members): KAWAI 2. ____

3. ____ 4. ____ 5. ____ 6. ____

DATE OF FLIGHT: 11-19-83 Q.C. (Stamp & Initials): 32

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SCR-20-CCP
(11/17/83)

T. Vanwe

ST 14:00
TO 14:15
LD 14:47

RUN	CMF		FLAPS	GEAR		TIME	COMMENTS		
1	1c	Takeoff RWY 27	5	↓			Trim.		
2	2a	Trim	40	↓	102 Trim		18° Trim		
3	2a	Land	20	↓	120	14:23	80/30K WIND	20° Trim	
		T/O.	20	↓	110 LOF	14:29			
		Land	40	↓	108	14:32	108 / TD 85K approx		23° trim
		T/O	20	↓	110	14:36			
		S/E Land	20	↓			Missed.	overshoot	
		↓	20	↓	50FT ≃ 120K	14:41	100 Touch Down.		L/E idle
		T/O.	20	↓	105 LOF	14:43.	27%/20K wind.		
		S/E Land	20	↓	78K T/D	14:47	20° → 40° at 350FT.		
			↓ 40						
		E/G shutDown				14:49			

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SCR-20-9   11-19-83   ROBINSON

I TAKEOFF SPEED SCHEDULE AND CLIMB TRANSITION - TWO ENGINES ONLY.

(1) SPEED SCHEDULES WERE ADEQUATE

II APPROACH AND LANDING PROCEDURES AND SPEED SCHEDULES

(1) APPROACH AND LANDING PROCEDURES AND SPEED SCHEDULES APPEARED ADEQUATE FOR BOTH ONE AND TWO ENGINE OPERATIONS.

III OBTAIN AND MAINTAIN AN AIRSPEED OF 1.1 TO 1.7 VS, WITH ONE HAND.

(1) NO DIFFICULTY WAS ENCOUNTERED. CONTROL PRESSURES WERE ESTIMATED TO BE EIGHT TO TEN POUNDS.

NOTE: ENGINE CUTS AT 50' FEET, AT MAXIMUM TAKEOFF GROSS WEIGHT AS REQUIRED BY THIS FLIGHT CARD WERE NOT DONE. PLEASE REFER TO SCR 20-7, ITEM IV.

David A. Robinson

DATE: 11/19/83 MODEL: MU2B20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehuer, Kishi, Kawai	TEST: SCR-20 TO	S.E. 1520 T.O. 1532 LDG. 1555 TOTAL :25 FUEL USED -50

RAMP WT: 8532.0 C.G. %MAC.... 24.5 TIA REF: R0394

ZFW..... 7299.2 ZFW C.G. %MAC 21.3

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All Items on attached flight card completed.
Deviations to be covered by Team Pilot.

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU-2B-20 | #183

FLIGHT TEST PLAN

11-19-83

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
J. THACKER	S. [illegible]	[illegible]	[illegible]
PILOT	~~TEST CREW~~	TEST CREW	TEST CREW
E. BOEHLER			
COPILOT	TEST CREW	TEST CREW	TEST CREW
J. KISHI			

AIRPLANE CONDITION

TAKEOFF WEIGHT 8532 LBS

CENTER OF GRAVITY 24.5 %MAC

FUEL LOADING MAIN 1051.8 LBS

OUTER 201 LBS

TIP — LBS

TEST ITEMS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE
2. SEE ATTACHED SHEET FOR OPEN SQUAKS ON A/C.

(1) take off speed schedules and climb transition (item 2.(f))

(2) approach and landing procedures and speed schedules (item 2.(g))

(3) to obtain and maintain airspeed within the range of 1.1 Vs1 to 1.7 Vs1 or Vf whichever is the lesser (item 2.(h)) — CAR 3.109(b)(6)

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
		TEST CONDITION				
1a	TAKEOFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKE OFF → CLIMB	5°	Ext. → Ret	TOP → MCP
1b	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKE OFF → CLIMB	20°	Ext. → Ret	TOP → MCP
1c	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKE OFF → CLIMB	5° → 0°	Ext. → Ret	TOP → FI/MCP
1d	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	~	TAKE OFF → CLIMB	20° → 0°	Ext. → Ret	TOP → FI/MCP
2a	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE.	~	APPROACH → LANDING	20°	Ext.	~
2b	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE.	~	APPROACH → LANDING	40°	Ext.	~
2c	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE	~	APPROACH → LANDING	20°	Ext.	FI/~
2d	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE	~	APPROACH → LANDING	40°	Ext.	FI/~
3	CAR 3.109(b)(6)	10,000	Trim 1.5 Vso	40°	Ext.	Flight Idle
8b						

SCR-20-007

(11/19/83)

SE 9:27

TO 9:45

LP 10:25

T. Vc[illegible]

RUN	COND		FLAPS	GEAR	FUEL BURN	VTRIM (1.5Vs)	VSHAKER	VSTALL	COMMENTS	
		Takeoff 9:45	5	↓						
		simulated T/O	20	↓		102			up @ 7500	
	8	AP ON. Power ON	0	↑.		144	92	12° Nose up Trim	75% Power. 18° pitch	
	9	AP ON power OFF	0	↑		144	101	12° Nose up Trim	7° pitch.	·1 d/c.
	10	AP ON power ON	40	↓		108	71	6° Nose up Trim	9° pitch.	
	11	AP ON power off	40	↓		108	74	10° Nose up Trim	level pitch	
	2	Power ON	0	↑		144	93	8° Nose up Trim.	14° pitch	
	3	Power OFF	0	↑		144	98	6° Trim.	6° pitch.	
	5*	Power OFF	40	↓		107	72	9° trim:	2° Nose Down.	
	4	Power ON	40	↓		107	69.	8° trim	7° Nose up.	
	6	S/E	0	↑		143	95	7° Trim	4E Shut Down. Wings Level.	
	7	↓	40	↓		107	—	6° Trim.	No shaker [illegible] 80 FTS	
		10:27	E/G Shut Down.							

TEST PROCEDURES

I. Takeoff Speed Schedule and Climb Transition (item 2.(f.

1. Conduct a takeoff and a climb transition in accordance with the airplane flight manual procedures.

   (1) Determine the adequacy of the takeoff speed schedules and climb transition considering a single pilot using average skill.

   (2) Evaluate for both two engine and single engine takeoff.

II. Approach and Landing Procedures and Speed Schedules (item 2.(g))

1. Perform an approach and a landing in accordance with the airplane flight manual procedures.

   (1) Determine the adequacy of the approach and landing procedures and speed schedules considering a single pilot using average skill.

   (2) Evaluate for both two engine and single engine approarches.

TEST PROCEDURES.

III To obtain and maintain airspeed within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f, whichever is the lesser (item 2.(h)) — CAR 3.109 (b)(6)

1. Trim the airplane at the specified conditions.
2. Obtain and maintain 1.1 V_{S1} using primary control systems without changing trim. (with one hand)
3. Obtain and maintain 1.7 V_{S1} using primary control systems without changing trim. (with one hand)

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-3-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{155.8 - 154.3}{60.6} \times 100 + 22.0 = 24.$

FLIGHT NO.: SCR-20-010 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VIII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) J. KISHI	220.0	97.2	21,384.0	
2nd ROW KAWAI	125.0	133.9	16,737.5	
2nd ROW		133.9		
COUCH		183.5		
BALLAST	35	109.0		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **		246.0		
ZERO FUEL WEIGHT	7299.2	153.9	1,124,044.8	21.3 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %
Outer Tanks 15/15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8331.0	155.6	1,296,664.9	24.1 %MAC
GWT MAINS/OUTERS (ONLY)	8532.0	155.8	1,329,588.7	24.5 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-19-83

PILOT: E. BOEHLER CO-PILOT: J. KISHI

FLIGHT TEST (Additional Crew Members): KAWAI 2. ______

3. ______ 4. ______ 5. ______ 6. ______

DATE OF FLIGHT: 11-19-83 Q.C. (Stamp & Initials): (QC 32) / MOL

89

SCR-20-010
(11/19/83)

W_{TO} = 8532 #

ES 15:21
TO 15:31
LD 16:10

RUN	No.	FLAPS	GEAR	TIME	V	COMMENTS		
1	Takeoff	5	↓	15:31.				
2	Trim	20	↓	15:38	$1.5 V_S$ = 106	$1.1 V_S$ = 78 15° trim No Problem	$1.7 V_S$ = 120	
3	Land	20	↓	15:43.	V_{TD} = 100^K	RWY 36	300/25 WIND	
4	T/O	20	↓	15.48	V_{LOF} = 98^K	RWY 36		
5	Land	40	↓	15:52	V_{APP} = 110^K	RWY 36		
6	T/O	20	↓	15:57	V_{LOF} = 90^K ~ 95^K		RWY 27	
7	Land	20	↓	16:00		L/H IDLE. (S/E Land) RWY 27		
8	T/O.	20	↓	16:07	V_{LOF} = 93^K		RWY 27	
9	Land	40	↓	16:10.		L/H IDLE (S/E Landing) Flaps 40° set at final approach. RWY 27		
	E/G Shut Down			16:14				

FLIGHT NUMBER: SCR-20-010
DATE: NOVEMBER 19, 1983
LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS
AIRCRAFT: MU-2B-20-183 (N967MA)
CREW: KISHI/BOEHLER
FLIGHT TIME: 0.4 hours
PURPOSE: Evaluate:
1. takeoff speed schedule and climb transition
2. approach and landing procedures and speed schedule.
3. CAR 3.109 (b)(6)

COMMENTS: The takeoff speed schedule and climb transition were evaluated using the test conditions cited in the flight test plan. The takeoff speed schedule was used without experiencing any difficulties. As mentioned previously, a tendency to overshoot the rotation velocity was prevalent due to inexperience in leading the target speed. Naturally, the slight excess speed did not adversely affect the takeoff, nor the climb transition. The approach and landing procedures, and the associated speed schedules were evaluated using the test conditions on the flight test plan. The approach speed schedule is easy to conform with. It was noted that maintaining the specified airspeed over the runway threshold resulted in substantial floating during the landing flare. Single engine approaches to a landing were conducted. Reverse thrust available was used on each single engine landing. Difficulties during the approaches and landings were not experienced. For the evaluation of CAR 3.109(b)(6), a trim speed of 106 KIAS (1.5 V_s) was used. To maintain 78 KIAS (1.1 V_s), a pull on the control wheel of about 10 pounds was required. For an airspeed of 120 KIAS (1.7 V_s), a push on the control wheel of approximately 5 pounds was required. A pilot would be able to control the airplane for the airspeeds evaluated using one hand on the control wheel.

CONCLUSION: Evaluation of the takeoff speed schedule, climb-transition, approach procedures, landing procedures, landing speed schedule, and the provisions of CAR 3.109(b)(6) did not surface any findings which would adversely affect single pilot operation.

James S. Kishi

DATE: 11/21/83 MODEL: MU2B20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHLER HEROLD THACKER	TEST: SCR-20-011	S.E. 1305 T.O. 1317 LDG. 1425 TOTAL 1.1 FUEL USED 1305

RAMP WT: 7314.2 ZFW..... 9753.0	C.G. %MAC.... 24.7 ZFW C.G. %MAC 27.0	TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All ITEMS ON ATTACHED FLIGHT CARD Accomplished WITH ADDITION OF Simulated T.O. with Engine Failure at 50' DONE At ALTITUDE.

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

90

DOUG THACKER HAL KAWACHI

[illegible]

TRIM AILERON RUNAWAY TESTS:

1. BASIC TRIM / CONTROLLABILITY TESTS:

   a. STABILIZE AIRPLANE AT 140 K IAS - CLEAN.

   b. RUN TRIM AILERON TO MAXIMUM LEFT DEFLECTI

   c. HOLD WINGS LEVEL WITH SPOILER.

   d. ~~ESTIMATE~~ MEASURED FORCE REQUIRED TO HOLD LEVEL AND PERCENTAGE OF CONTROL TRAVEL.
   16 lb. at 140K, 26 lb. at 195K, 27½ lb. at 250K.

   e. IN INCREMENTS OF 20K each, INCREASE SPEED TO VMO OR UNTIL FULL SPOILER IS REQUIRED. RECORD SPEED + FORCE.

2. BASIC TRIM / RUNAWAY TESTS:

   a. STABILIZE AIRPLANE AT CRUISE + MCP - CLEAN

   b. COPILOT INITIATE TRIM AILERON (LEFT OR RIGH

   c. PILOT ANNOUNCES "MARK" WHEN HE IS AWARE OF NEED FOR CORRECTIVE ACTION. FTE BEGINS TIMING WITH STOPWATCH AT PILOTS "MARK".

   92

   d. FTE ANNOUNCES "STOP" AT 4 SECONDS.

2d CONT'D:

(1) RECORD AIRPLANE ROLL ATTITUDE AT END OF 4 SECONDS UNRESTRAINED. (62° Left roll)

(2) RECORD ~~ESTIMATED~~ MEASURED MAXIMUM FORCE REQUIRED TO RETURN THE AIRPLANE TO LEVEL FLIGHT. 22 lb. (.7 of 1 to left)

e. REPEAT ITEMS a, b, + c ABOVE. AFTER PILOT RECOGNIZES NEED FOR CORRECTIVE ACTION, "MARK" USE CONTROL WHEEL (SPOILER) TO RETURN TO LEVEL OR CONTROLLED FLIGHT. USE TRIM - AILERON DISCONNECT SWITCH TO ISOLATE MALFUNCTION. PILOT ANNOUNCES "STOP" WHENEVER HE IS ASSURED HE HAS STOPPED ALL TRIM MOVEMENT. FTE STOPS STOPWATCH. COPILOT RELEASES TRIM SWITCH.

(1) RECORD TIME REQUIRED TO ISOLATE TRIM RUNAWAY. THE LONGER OF 4 SECONDS OR ACTUAL TIME WILL BE USED FOR ALL SUBSEQUENT RUNAWAY TESTS. (7.54 seconds + .9 of 1 to left) 225K from 2/D

(2) RECORD ESTIMATED MAXIMUM FORCE REQUIRED TO HOLD THE AIRPLANE LEVEL. 26 lb.

f. REPEAT TESTS OF 2 a, b, c + d AT VMO EXCEPT USE TIME DELAY ESTABLISHED UNDER 2 e(1) ABOVE. 250K + 7.54 sec. .6 to left + 26 lb to recover, 55° bank after 4 seconds before pilot takes control and returns A/C to level flight while also trim isolation.

(1) RECORD ROLL ATTITUDES, MAXIMUM AIRSPEEDS + FORCE

3. TRIM AILERON RUNAWAYS WITH AUTOPILOT COUPLED:
IN PROGRESSIVE INCREMENTS FROM 140K TO
a. THE MAXIMUM CONTROLLABLE SPEED ESTABLISHED UNDER 1e ABOVE, INITIATE A TRIM RUNAWAY. THE COPILOT WILL INITIATE EITHER LEFT OR RIGHT WITHO ANNOUNCING TO THE PILOT.

b. WHENEVER THE PILOT RECOGNIZES CLEARLY OBVIOUS SIGNS OF THE NEED FOR CORRECTIVE ACTION, HE ANNOUNCES "MARK", TAKES A ONE SECOND DELAY AND DISCONNECTS THE AUTOPILOT. THE TRIM RUNAWAY WILL BE CONTINUE UNTIL THE PILOT ISOLATES THE TRIM OR FOR 4 SECONDS, WHICHEVER IS LONGER.

(1) RECORD ROLL ATTITUDES, MAXIMUM AIRSPEED CONTROL FORCES AND "g" LOADS.

at 215K, 7.54 SEC. 1.0 (100%) to right + 22° 4
31 lb to maintain wings level.

at 250K, 7.54 sec., 1.0 (100%) to Right + 20° 4
34 lb. to maintain wings level.

Control wheel moves to about 135°/315° (Q)
position then forces overcome autopilot and airpl. begins to roll in direction of wheel. Autopilot disconnected at 22°+20° bank and wings leveled. Trim

(over)

runaway continued for 7.54 seconds after pilot recognition. Autopilot was not disconnected until approx. 1 second after pilot recognition. Forces continued to build until end of 7.54 seconds which was full travel - or near full travel - of aileron trim. Wheel could be held by one hand for brief period of time while trim selector was repositioned for isolation.

CONCLUSION: The autopilot and trim failures were not considered hazardous, the cues were obvious that a malfunction of some sort was occurring. If wheel is grasped before pushing autopilot/trim disconnect, there are no large or abrupt discontinu of force or wheel position.

MAX ROLL rates were not as fast at V_{MO} As at V_H - ? - Air loads on trim aileron causes slower rate of trim movement ??

Also forces with right trim runaway were consistently higher than for left trim runaway

NOTE: the isolation is really a moot point since trim goes to 95-100% any way.

Worst Case is a straight trim runaway at about V_H for 7.5 seconds with controls unrestrained. This assumes pilot takes no action to restrain A/c roll until after 4 seconds then restores level flight while isolating trim.

Aircraft Type MU-2B-20 FAA Flt. No. ______ Surface Cond:

S.N. 153 T.O. ______ H ______ OAT ______

Reg. No. N 467 MA Land ______ Wind ______

Date T.T. ______ Pilot ______

Raw Data Sheet

Pro. No.

ALL D.C. POWER FAILURE:

TASK: DETERMINE IF THE AIRPLANE CAN BE SAFELY CONTROLLED & LANDED UNDER VFR OR IFR AFTER FAILURE OF THE MAIN D.C. BUSS.

1. TURN OFF BOTH GENERATORS - NOTE WHAT ANNUNCIATORS ARE "ON":
   L DC GEN OUT, R DC GEN OUT, MC, U. 26 "O" Amp. FUEL IND. TIP "FULL" STBY. Oil T. "O" O Pres
   ? DOES ALL EQUIPMENT CONTINUE TO OPERATE? TQ "O" W/P STBY. EGT & TACK OK
   CP. ALT + VSI T+B BOTH SIDE
2. TURN OFF KEY SWITCH - NOTE WHAT ANNUNCIATORS OR WARNING LIGHTS ARE "ON":
   Pres Loss FLAGS HSI ALT. RAD ALT.

a. WHAT EQUIPMENT + INSTRUMENTS ARE STILL OPERATING:

b. TURN "ON" "MASTER - EMERGENCY" SWITCH - WHAT ADDITIONAL EQUIPMENT IS NOW OPERATING? Fire detectors and fire bottles.

c. IS THERE SUFFICIENT EQUIPMENT OPERATING FOR A SINGLE PILOT TO CONTROL THE AIRPLANE UNDER DAY/NIGHT + IFR CONDITIONS & MANEUVER INTO A VFR AIRPORT FOR LANDING? yes.

SCR-~~60~~ 20 -11

SE

TO

LP

RUN	COND		FLAPS	GEAR	FUEL BURN	VTRIM (1.5 Vs)	~~Vstall~~ IAS	~~[illegible]~~ FORCE	COMMENTS 103.5	103.5
	1									
	2									
1	3		↑	↑	—	—	140 Kt	16#		
			"	"						
			"	"			Vh 195Kt	26#	10.5 ft	MCR 530
			"	"						
			"	"			VMO 250Kt	27½#	"	" "
			"	"						
2	3		↑	↑	—	—	210/240	22#	.7L	62°
							225	26#	.9L	7.54Sec
							250	26#	.6L	7.54 Sec
3	3		↑	↑			215	31#	1.0 L/22°	7.54 Sec
							250	34#	1.0/20°	7.54 Sec

DATE: 11/22/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHLER KISH THACKER	TEST: SCR 20-012	S.E. 1115 T.O. 1123 LDG. 1210 TOTAL .5 FUEL USED -30

RAMP WT: 8597.0	C.G. %MAC.... 24.1	TIA REF: R0394
ZFW..... 7364.2	ZFW C.G. %MAC 21.0	

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All ITEMS ON ATTACHED FLIGHT CARD Accomplished.

RESULTS ATTACHED

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU2B-20 #183	FLIGHT TEST PLAN	11/22/83	SCR-20-012
PREPARED BY D. THACKER	CHECKED BY (ENG'G) [illegible signature]	CHECKED BY (FLIGHT) [illegible signature]	APPROVED BY [illegible signature]
PILOT E. BOEHLER	TEST CREW D. THACKER	TEST CREW	TEST CREW
COPILOT J. KISHI	TEST CREW	TEST CREW	TEST CREW

SCR-20-012
1930.4 N 1930.9

AIRPLANE CONDITION

TAKEOFF WEIGHT ______ LBS

CENTER OF GRAVITY FORWARD %MAC

FUEL LOADING ______ ______ LBS

______ ______ LBS

TEST ITEMS ______ LBS
(ENG'G EVAL.)

REMARKS

1-LDG
1-SE LDG

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.
2. SEE ATTACHED SHEET FOR OPEN SQWKS ON A/C.

(1) LONGITUDINAL CONTROL BY USE OF ELEVATOR TRIM AND POWER ONLY (ITEM 1(e)) CAM 3.109 e)

(2) Elevator or rudder Trim tab fails (item 1(f))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN   FUEL AT LANDING: ______ LBS

Cond No	TEST ITEM	TEST CONDITION: Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1.	LONGITUDINAL CONTROL CAM 3.109 e	~	~	40°	EXT	~
2a.	ELEVATOR TRIM TAB FAILS	≈ 15,000	V_{MO}	Ret.	Ret.	MCP
2b.	RUDDER TRIM TAB FAILS	10,000	V_H	Ret	Ret	Feather / MCP

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Aircraft Type [illegible] FAA Flt. No. ______ Surface Cond:
S.N. [illegible] T.O. ______ IL ______ OAT ______
Reg. No. [illegible] Land ______ Wind ______
Date ______ T.T. ______ Pilot ______

Raw Data Sheet

Pro. No. ______

TRIM CONTROL WITH LOSS OF PRIMARY LONG. CONT

TASK: CAN THE AIRPLANE BE SAFELY CONTROLLED TO A ZERO RATE OF DESCENT WITH ONLY LONGITUDINAL TRIM & POWER IN LANDING CONFIGURATION (40° FLAPS). CAR 3.109 B.

1. ESTABLISH TRIM CONDITION AT 1.5 V_{S1}, GEAR DOWN + FLAPS 40° POWER FOR APPROXIMATELY 3° ANGLE OF APPROACH.

2. USING ONLY LONG TRIM & POWER AS REQUIRED, ESTABLISH LEVEL FLIGHT AND ZERO RATE OF DESCENT. RECORD CONDITIONS AND MINIMUM CONTROLLABLE AIRSPEED AND PITCH ATTITUDE:

AIRSPEED:
POWER: RPM- TORQUE:
PITCH ATTITUDE:

4

Aircraft Type LJ 2B-20 FAA Flt. No. ______ Surface Cond:

S.N. 1?3 T.O. ______ H_p ______ OAT ______

Reg. No. N4?7MA Land ______ Wind ______

Date T.T. ______ Pilot ______

Raw Data Sheet

Pro. No.

ELEVATOR + RUDDER TRIM TAB FAILURE (STUCK):

TASK: IF A RUDDER OR ELEVATOR TRIM TAB SHOULD FAIL OR STICK AT ANY CONDITION NORMALLY EXPECTED IN FLIGHT CAN THE AIRPLANE BE SAFELY MANEUVERED AND LANDED UNDER VFR OR IFR CONDITIONS BY A SINGLE PILOT.

1. DETERMINE EXTREME CONDITIONS OF TRIM FOR:

	LONG	RUDDER
TAKE OFF:		
CLIMB:		
CRUISE:		
DESCENT:		
APPROACH:		
LANDING		

2. FOR THE WORST CASE OF NOSE UP AND NOSE DOWN TRIM, MANEUVER THE AIRCRAFT AND LAND. VARIATIONS OF CONFIGURATION AND POWER MAY BE USED TO AID IN CONTROL. RECORD CONDITIONS + EASE OR DIFFICULTY:

3. FOR THE WORST CASE OF LEFT OR RIGHT RUDDER TRIM, PERFORM A SINGLE ENGINE LANDING - USING THE MOST ADVERSE ENGINE OUT. RECORD CONDITIONS + EASE OR DIFFICULTY:

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-30-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{155.6 - 154.3}{60.6} \times 100 + 22.0 = 24.$

FLIGHT NO.: SCR-20-012 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) J. KISHI	220.0	97.2	21,384.0	
2nd ROW D. THACKER	160.0	133.9	21,424.0	
2nd ROW		133.9		
COUCH		183.5		
BALLAST	115.0	109.0	12,535.0	
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **		246.0		
ZERO FUEL WEIGHT	7364.2	153.7	1,132,001.3	21.0 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GRT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GRT MAINS (ONLY)	8396.0	155.4	1,304,621.4	23.8 %MAC
GRT MAINS/OUTERS (ONLY)	8597.0	155.6	1,337,545.2	24.1 %MAC
GRT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: ____________

PILOT: E. BOEHLER CO-PILOT: J. KISHI

FLIGHT TEST (Additional Crew Members): D. THACKER 2. ——

3. —— 4. —— 5. —— 6. ——

DATE OF FLIGHT: 11-22-83 Q.C. (Stamp & Initials): 32 [illegible]

101

SCR -

SE 11:16
TO 11:20
LP 12:15

RUN	COND	TRIM	FLAP	L/G	1.5 VSI	TQ	EGT	RPM	ATTIT	IVSI
1	1	12 ↑	40	↓	103	PSI 30/30	410 °C	100 %	LEVEL	0
2	1	12 ↑	40	↓	103	PSI 40/40	500	100 %		100 FPM
						LONG.	RUDDER	IAS		
1	2	T/O				6° ↑	1° R	93 Kt		
2	2	TURNING CLIMB				10° ↑	4° R	140 Kt		
3	2	CLIMB				10° ↑	2½ R	140 Kt		
4	2	CRUISE				4° ↑	0	225 Kt		
5	2	DESCENT				4° ↑	0	250 Kt		
6	2	APPROACH & LANDING				4° ↑	0		25 # FORCE	
						LONG	RUDDER			
1	3	LH ENG F/I				8° ↑	13° R		≈ 25 #	

FLIGHT NUMBER: SCR-20-012

DATE: NOVEMBER 22, 1983

LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS

CREW: KISHI/BOEHLER/THACKER

FLIGHT TIME: 0.5 hours

PURPOSE: Evaluate:

1. longitudinal control (CAR 3.109 e)
2. elevator trim tab failure
3. rudder trim tab failure

COMMENTS: The evaluation of the longitudinal control provision of the CAR 3.109e was conducted using the test conditions cited on the flight test plan. After establishing trim at 103 KIAS (1.5 V_S) with the airplane in the landing configuration and power for maintaining a 3° descent, the descent was arrested and level flight was established using longitudinal trim control and power. The elevator and rudder trim tab failures were simulated using the most adverse trim positions in opposite directions. In all cases, the airplane was maneuvered without difficulty and landed. The findings from this evaluation did not reflect any conditions which would adversely affect single pilot operation.

James S. Kishi

DATE: 11/29/83 MODEL: MU-26-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Buehler Thacker	TEST: SCR-20C006 SR-20-0013	S.E. 1032 T.O. 1040 LDG. 1122 TOTAL .7 FUEL USED -55

RAMP WT: 8837.0 ZFW..... 7604.2	C.G. %MAC.... 34.0 ZFW C.G. %MAC 32.6	TIA REF: R0394

CONFIGURATION: See attached W&B

TEST EQUIPMENT:

SUMMARY OF RESULTS:

V_{MO} Upsets accomplished IAW A/C 25,253-1A

5 departures accomplished (data attached)

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

102

WEIGHT & BALANCE

CENTER OF GRAVITY

$\frac{161.54 - 154.3}{60.6} \times 100 + 22.0 = 34.0$

MODEL: MU-2B-20   DATE OF W & B: 10-30-83

AIRCRAFT SN: 183   AIRCRAFT "N": 967 MA

FLIGHT NO.: SCR-20-C006 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VIII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) D. THACKER	160.0	97.2	15,552.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT	200.0	204.7	40,940.0	
BAGGAGE COMPT. **	220.0	230.7	50,754.0	
AFT BAGGAGE COMPT. **	155.0	246.0	38,130.0	
ZERO FUEL WEIGHT	7604.2	160.7	1,222,034.3	32.6 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %MAC
Outer Tanks 15/15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8636.0	161.5	1,394,654.4	33.9 %MAC
GWT MAINS/OUTERS (ONLY)	8837.0	161.54	1,427,578.2	34.0 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids   ** Location of Ballast When Installed

Prepared By: D. THACKER   Date Prepared: 11-28-83

PILOT: E. BOEHLER   CO-PILOT: D. THACKER

FLIGHT TEST (Additional Crew Members): ____ 2. ____

3. ____ 4. ____ 5. ____ 6. ____

DATE OF FLIGHT: ____   Q.C. (Stamp & Initials): ____

113

SCR 20-C006

V_{mo} upset

① V_{mo} : 0.5 g upset for 5 sec ⊗ at V_{mo} + 6 : T+3 sec
initiate Recovery

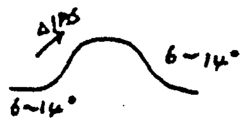
Record ⊗ 5 sec or V_{mo}+6

1. Pitch ∡ 3.5° -.5 g T+3 sec.
2. IAS at T+3 266
3. RPM 100.3/100.3 T_r = 7 sec
4. IAS at level flt. 272 1.5 g

② V_H : 60° bank upset for 3 sec. at V_{mo}+6 ; T+3 sec.
initiate Recovery

Record. V_h = 210

1. Pitch ∡ ↑Nose .5 g
2. Bank ∡ 31 1.5 g
3. IAS 228
4. RPM 100.2
5. IAS on level flight. 190

③ V_H 

at V_{mo}+6 : T+3 Initiate recovery

VH 193

Record

1. Pitch ∡ 10°
2. IAS start 193
3. RPM 100.3
4. IAS completion 258

Come back
Wings level
Cycle 170 ~ 220

---

④ V_H Δ pitch -7.5° ~~at~~ hold to V_{mo}
at V_{mo} T+20 sec. (not to exceed 315 kt) 103

Record

1. IAS at T+20 sec 288
or 2. T+ ? ~~#~~ at 315 kt ~~sec~~ 288
3. RPM at Recovery 100.7/100.8

DATE: 4/29/83 MODEL: ~~MU-300~~ 2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehler Kishi Thacker	TEST: SCR-20-013 TIA REF: RD394	S.E. 1330 T.O. 1338 LDG. 1428 TOTAL .50 FUEL USED 60

RAMP WT: 9207 C.G. 33.1 %MAC ZFW 7974.2 ZFW C.G. 31.6 %MAC

CONFIGURATION: See attached W&B

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All items on attached flight card completed. An additional Spiral Stability test was performed at gear down, Flaps 40, 1.5 V_{S0} (110). Results positive

B

JSK

MAINT. & ENGR. ITEMS:

RECOMMENDATIONS & CONCLUSIONS:

SCR 20-013.

1. At Vmo. conduct 0.5g upset to reach Vmo + 6 kt. T+3 sec. or 5 sec. whichever longer. and then initiate recovery with 1.5g.

Record 1. pitch angle - 4   4. IAS at level flight 275

2. IAS at T+3 266

3. Rpm 100.3 / 100.3

2. Trim at Vh. conduct 60° bank upset for 3 sec. abandon for 10 sec. or until the airplane reaches Vmo + 6 kt. T+3 sec. whichever sooner. then initiate recovery.

Record. 1. pitch angle ↑ ≈ 8°   4. Rpm 100.3/100.3

2 Bank angle 60 → 35   5. IAS in level flight. 220

3. IAS 230

3. Trim at Vh. conduct pitch up 6° ~ 14°, then pitch down 6° ~ 14° to reach Vmo + 6, T+3 sec. Then initiate recovery

Record. 1. Pitch angle 14   4. IAS completion 230 level

2. IAS start 175

3. Rpm 100.3 / 100.3

4. Trim at Vmo, conduct combination of 2 and 3 above using 30° bank.

Record 1. pitch angle 10°   4. ~~IA~~ RPM 100.3 / 100.3

2. Bank angle 30°   5. IAS finish.

3. IAS start 170 Kt   234 Kt

192 MARK

5. Trim at V_H. pitch down 7.5° and hold ~~[illegible]~~ T+20 sec, provided (after reaching V_{MO}) that not to exceed 315 KT.

Record 1. IAS at T+20 sec 289 @ 20 sec

or 2. T + ? at 315 KT

3. RPM at Recovery. 288 recovery
100.4/100.4

---

6. Evaluate approach speed in turbulence

MU-2B-20	#123	FLIGHT TEST PLAN	11-29-83	[illegible]

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
[signature]	[signature]	[signature]	S. [signature]
PILOT E BOEHLER	TEST CREW D THACKER	TEST CREW	TEST CREW
COPILOT J. KISHI	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT ______ LBS

CENTER OF GRAVITY ______ %MAC

FUEL LOADING ______ ______ LBS

______ ______ LBS

TEST ITEMS ______ ______ LBS

ENG'G EVAL

(1) VMO (item 1(g))

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE EXCEPT UP SET TEST

2. G-METER IS INSTALLD ON GLARESHIELD.

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ______ LBS

Cond No	1a	1b	1c	1d	1e	2
TEST CONDITION: Engine	MCP	"	"	"	"	~
TEST CONDITION: Gear	Ret	"	"	"	"	~
TEST CONDITION: Flap	Ret	"	"	"	"	~
TEST CONDITION: Airspeed (KIAS)	VMO	VH	VH	VMO	VMO→	~
TEST CONDITION: Altitude (FT)	≈ 20,000	"	"	"		~
TEST ITEM	VMO UPSET	"	"	"	"	EVALUATION APPROACH SPEED IN TURBULANCE

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-30-87

AIRCRAFT SN: 183 AIRCRAFT "N": 967 MA

$\frac{161.0 - 154.3}{60.6} \times 100 + 22.0 = 33$

FLIGHT NO.: SCR-20-013 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) J. KISHI	220.0	97.2	21,384.0	
2nd ROW D. THACKER	160.0	133.9	21,424.0	
2nd ROW		133.9		
COUCH BALLAST	150.0	183.5	27,525.0	
CABIN BAGGAGE COMPT	200.0	204.7	40,940.0	
BAGGAGE COMPT. **	220.0	230.7	50,754.0	
AFT BAGGAGE COMPT. **	155.0	246.0	38,130.0	
ZERO FUEL WEIGHT	7974.2	160.1	1,276,815.3	31.6 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,626.1	W/800lbs ___ %
Outer Tanks 15/15 Gal	201.0	163.8	32,923.8	GWT W/800# ___
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9006.0	160.9	1,449,435.4	32.9 %MAC
GWT MAINS/OUTERS (ONLY)	9207.0	161.0	1,482,359.2	33.1 %MAC
GWT MAINS/OUTERS/TIPS				___ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: ______________ Date Prepared: ______________

PILOT: ______________ CO-PILOT: ______________

FLIGHT TEST (Additional Crew Members): ______________ 2. ______________

3. ______________ 4. ______________ 5. ______________ 6. ______________

DATE OF FLIGHT: ______________ Q.C. (Stamp & Initials): 32 / [illegible]

110

ILS ± ...

⑤ Climb, level

⑥ ILS

WKLOAD =

SCR 20-C006

V_{mo} upset $V_{MO} = 253$

V_{MO}, 0.5g, $V_{MO}^{M}+6$, T+3, recover

① V_{mo} : 0.5 g upset for 5 sec ⊗ at $V_{mo}+6$: T+3 sec initiate Recovery

Record ⊗ 5 sec or $V_{mo}+6$ T+3 sec.

1. Pitch ∠ -3.5°
2. IAS at T+3 266
3. RPM 100.3/100.3
4. IAS at level flt. 272

V_H = 210 KIAS

0.5 ~ 1.5

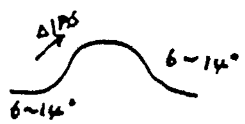
V_H, 60° Bank, $V_{MO}+6$, T+3, RECOVER

② V_H : 60° bank upset for 3 sec. 10 sec at $V_{mo}+6$; T+3 sec. initiate Recovery

→ V_H, 60° Bank, T+10, RECOVER

Record.

1. Pitch ∠ ↑
2. Bank ∠ 31
3. IAS 228
4. RPM 100.2/100.2
5. IAS on level flight. 191

③ V_H 

V_H, (6°-14°) UP, (6°-14°) DN, $V_{MO}^{M}+6$, T+3, RECOVER

at $V_{mo}+6$: T+3 Initiate recovery

Record

1. Pitch ∠
2. IAS start 220 ~ 175
3. RPM 100.3
4. IAS completion

3A Combine ② and ③ V_H, (6°-14°) UP, (6°-14°) DN, 15°-25° (M 30°) BANK, T+3, RECOVER

④ V_H Δ pitch -7.5° ~~at~~ hold to V_{mo} at V_{mo}^{M} T+20 sec. (not to exceed 315 kt)

Record

1. IAS at T+20 sec 252 ~~sk~~ 258
or 2. T+ ? ~~at~~ at 315 kt
3. RPM at Recovery 100.5/100.8

112

FLIGHT NUMBER: SCR-20-013
DATE: NOVEMBER 29, 1983
LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS
CREW: KISHI/BOEHLER/THACKER
FLIGHT TIME: 0.9 hours
PURPOSE: Evaluate:
1. V_{MO} Upset
2. Approach speed in turbulence
3. Spiral stability, landing configuration, approach speed.
4. ILS workload

COMMENTS: Through mutual agreement, the manufacture verified the V_{MO} upset data by conducting the test. The evaluation was conducted using the test conditions cited in the flight test plan. The V_{MO} upset was accomplished, and the results were essentially the same as the manufacturer's data. The established V_{MO} is satisfactory. Operating in turbulent atmosphere, at speeds from 110KIAS to 130KIAS in various configurations, did not reveal any characteristics which would indicate added workload for the pilot. The spiral stability was evaluated in the landing configuration (gear down, flaps 40° down), and an airspeed of 110KIAS (1.5V_{SO}). The spiral stability was positive. An ILS approach was made to a landing to evaluate the pilot workload. Though a spoiler effectiveness dead-band was noted, the pilot workload can not be considered in excess to that experienced during a similar approach in a comparable airplane.

The findings from this evaluation does not indicate any characteristics which would adversely affect single pilot operation.

James D. Kishe

DATE: 11/29/83 MODEL: ~~MU-300~~ 2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boenke Fish	TEST: SCR 20-014 TIA REF: R0394	S.E. 1556 T.O. 1605 LDG. 1645 TOTAL .6 FUEL USED —

RAMP WT: 8422.0 C.G. 27.6 %MAC ZFW 7189.2 ZFW C.G. 25.1 %MAC

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

	NORMAL	ALT
	8500'/182 KTS	8450/180
gear	8500/150	8600/159
gear 20	8500/140	8620/142
V_s	78	82

T.O. w/ Ports Taped in Normal Pos
A/S reading with draconian altimeter.
T.O. w/ Ports taped in alt Pos
A/S readings and alt climb to 2100' before T.O. A/P worked ok but did not see ALT.

ITEM 3B NCW

JK

B

MAINT. & ENGR. ITEMS:

RECOMMENDATIONS & CONCLUSIONS:

MODEL MU-2B-20	SERIAL NO. #183	FLIGHT TEST PLAN	FLIGHT DATE 11-29-83	FLIGHT NO SCR 20-01
PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY	
PILOT E BOEHLER	TEST CREW	TEST CREW	TEST CREW	
COPILOT J. KISHI	TEST CREW	TEST CREW	TEST CREW	

AIRPLANE CONDITION

TAKEOFF WEIGHT		LBS
CENTER OF GRAVITY	opt	%MAC
FUEL LOADING L.W.		LBS
R.W.		LBS
FUS		LBS

TEST ITEMS

ENG'G EVAL.

(1) LOSS OF PRIMARY PITOT STATIC SOURCE (ITEM 1 (b))

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST CONDITION: Engine	Gear	Flap	Airspeed (KIAS)	Altitude (FT)	TEST ITEM
1	~	~	~	~	~	LOSS OF PPIMARY STATIC SYSTEM SEE ATTACHED SHEET.

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SCR20-014

1. FLIGHT WITHOUT TAPE ON NORMAL & AUTOPILOT PORTS.

   a. ~~SEE~~ CHECK ACCESSIBILITY OF THE VALVE.

   b. CHECK INDICATION CHANGE WITH ALTERNATE STATIC SYSTEM TURNS ON AND OFF IN DIFFERENT ALTITUDE, SPEEDS AND CONFIGURATION

2. WITH TAPES ON NORMAL AND AUTOPILOT STATIC PORTS.

   GROUND TAKE-OFF RUN AND STOP AND SEE INDICATION OF A/S. ALT VSI.

3. WITH TAPES ON NORMAL AND AUTOPILOT STATIC PORTS

   a. TAKE OFF WITH THE VALVE IN "ALTERNATE" ~~NORMAL~~ POSITION (ADD 10 K TO T/O S
   AND SEE INDICATION OF INSTRUMENTS AND SEE IF ANY APPARENT C

   b. CHECK INDICATION CHANGE WITH ALTERNATE SYSTEM TURNS ON AND OFF, IN DIFFERENT ALTITUDE, SPEED AND CONFIGURATION.

   c. AT THE ALTITUDE. ENGAGE AUTOPILOT.
   DURING CLIMB. SET "ALT HOLD", "ATT. HOLD" ETC AND SEE WHAT MAY HAPPEN.

100N

11'2

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-30-83

AIRCRAFT SN: 189 AIRCRAFT "N": 967 MA

$\frac{157.7 - 154.3}{60.6} \times 100 \div 22.0 = 27.$

FLIGHT NO.: SCE-20-014 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) J. KISHI	220	97.2	21,384	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600	
ZERO FUEL WEIGHT	7189.2	156.2	1,122,642.3	25.1 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %
Outer Tanks / Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8221.0	157.5	1,295,262.4	27.4 %MAC
GWT MAINS/OUTERS (ONLY)	8422.0	157.7	1,328,186.2	27.6 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-29-83

PILOT: E. BOEHLER CO-PILOT: ~~C. Arnold~~ J. KISHI

FLIGHT TEST (Additional Crew Members): 1. ____ 2. ____

3. ____ 4. ____ 5. ____ 6. ____

DATE OF FLIGHT: 11-29-83 Q.C. (Stamp & Initials): 52 [illegible]

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FLIGHT NUMBER: SCR-20-014
DATE: NOVEMBER 29, 1983
LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS
AIRCRAFT: MU-2B-20-183 (N967MA)
CREW: KISHI/BOEHLER
FLIGHT TIME: 0.6 hours
PURPOSE: Evaluate the loss of the primary static system

COMMENTS: The loss of the primary static system was accomplished in accordance with the flight test plan with attachment. The alternate system selector valve was acessible to the pilot. However, the placard pointing out the location of the selector valve was missing. The results of the evaluation show that a cue is apparent. A delta velocity and a delta altitude was recorded. Prior to the takeoff with the static ports taped and the selector in the alternate source position the altimeter climbed to 2100 feet. The auto pilot functioned properly except for sensing the preset altitude.

James D. Kishi

DATE: 1/30/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehler Nkyces	TEST: SCR 20-015	S.E. 102 T.O. 103 LDG. 111 TOTAL .7 FUEL USED -52

RAMP WT: 8526	C.G. %MAC.... 28.0	TIA REF:
ZFW..... 7159.2	ZFW C.G. %MAC 25.5	R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All items on attached flight card completed.

B

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU2B-20 183	FLIGHT TEST PLAN 1/2		11- -83	209-20-015
PREPARED BY S. NAKAGAWA	CHECKED BY (ENG'G) S. Nakagawa	CHECKED BY (FLIGHT)	APPROVED BY	
PILOT E. TUEHLER	TEST CREW	TEST CREW	TEST CREW	
COPILOT G. MEYERS	TEST CREW	TEST CREW	TEST CREW	

AIRPLANE CONDITION

TAKEOFF WEIGHT ________ LBS

CENTER OF GRAVITY ________ %MAC

FUEL LOADING L.W. ________ LBS

R.W. ________ LBS

FUS ________ LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE
2. SEE ATTACHED SHEET FOR OPEN SQWKS on A/C

TEST ITEMS

(1) fuel system operation and annunciation (item 2(a))
(2) anti-ice functions (item 2(d))
(3) to determine if the airplane is safely controllable by a single pilot (item 2(e))
(4) flight using partial panel instrument (item 2(j))
(5) landing gear warning system (item 2(b))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	FUEL SYSTEM OPERATION & ANNUNCIATION	~	~	~	~	~
2	ANTI-ICE FUNCTIONS	~	~	~	~	~
3	SINGLE PILOT CONTROL	~	~	~	~	~
3a	SINGLE PILOT CONTROL IN NATURAL TURBULENCE OF AT LEAST MODERATE INTENSITY	~	~	~	~	~
4	PARTIAL PANEL INSTR.	~	~	~	~	~
5	L/G WARNING SYS & POSITION INDICATORS	~	BELOW 140	20°	RET → EXT	~
5a	L/G WARNING SYS & POSITION INDICATORS	~	BELOW 120	40°	RET → EXT	~

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MU2B-20 | 183 | FLIGHT TEST PLAN 2/2 | 11-18-83 | SCR-20-OC-

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT	TEST CREW	TEST CREW	TEST CREW
COPILOT	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT ______ LBS

CENTER OF GRAVITY OPTIONAL %MAC

FUEL LOADING ______ ______ LBS

______ ______ LBS

TEST ITEMS ______ LBS

(6) landing gear position indicators (item 2(c))

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ______ LBS

TEST CONDITION																													
Engine																													
Gear																													
Flap																													
Airspeed (KIAS)																													
Altitude (FT)																													
TEST ITEM																													
Cond No																													120

TEST PROCEDURES

I. Fuel System Operation and Annunciation (item 2.(a))

1. Check the following items during a normal flight.
   - the location of gauges, annunciation and switches
   - the pilot's capability to ascertain fuel status, consumption and to detect faults in the process

   (1) Determine if the fuel system operation and annunciation is adequate for operation as a single pilot airplane.

II. Anti-ice Functions (item 2 (d))

1. Operate all anti-ice functions listed below during a normal flight.
   - Propeller de-icing system
   - Engine air intake anti-icing system
   - Pitot & stall warning anti-icing system
   - Surface de-icing system
   - Windshield anti-icing system

   (1) Evaluate the following items.
   - pilot workload
   - capability of ascertaining status and proper
   - functioning of all systems
   - normal functioning annunciators
   - fault/failure annunciation

TEST PROCEDURES

III. Single Pilot Control (item 2.(e))

1. Perform takeoff, climb, level flight, turning, descent, approach and landing normally.
   (1) Give particular attention to the following items during the flight.
   - yaw damping characteristics
   - dutch-roll characteristics
   - takeoff speed schedule
   - climb speed schedule
   - approach speed schedule

IV. Partial Panel Instruments (item 2.(j))

1. Put covers on panel instruments excepts pilot's side turn & bank, airspeed and altitude indicators during a level flight.
2. Conduct climb, level flight, turn, descent and simulated landing.
   (1) Assure that the airplane can be safely flown.
3. Remove covers put on panel instruments.

TEST PROCEDURES

V. Landing Gear Warning System (item 2 (b)) &

VI. Landing Gear Position Indicators (item 2 (c))

1. Obtain an airspeed below 140 KCAS.
2. Extend flaps and set them at 20° position.
   (1) Check adequacy of the landing gear warning.
3. Operate the landing gear warning cut out switch.
   (1) Assure that landing gear warning does not stop.
4. Extend landing gears.
   (1) Assure that landing gear warning stops.
   (2) Determine if the landing gear position indicators are adequate to perform their intended functions.
5. Retract landing gears.
6. Retract flaps.
   (1) Assure that landing gear warning is silent.
7. Obtain an airspeed below 120 KCAS.
8. Extend flaps and set them at 40° position.
   (1) Check adequacy of the landing gear warning.
9. Follow the above procedures 3 thru 6.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20   DATE OF W & B: 10-30-83

$\frac{157.9 - 154.3}{60.6} \times 100 \div 22.0 = 28.$

AIRCRAFT SN: 183   AIRCRAFT "N": 967 MA

FLIGHT NO.: SCR-20-015 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) G. MEYERS	190.0	97.2	18,468.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH		183.5		
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **	100.0	246.0	24,600.0	
ZERO FUEL WEIGHT	7159.2	156.4	1,119,726.3	25.5 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks 10 / 10 Gal	134.0	155.9	20,890.6	
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8191.0	157.8	1,292,346.4	27.7 %MAC
GWT MAINS/OUTERS (ONLY)	8392.0	157.9	1,325,270.2	28.0 %MAC
GWT MAINS/OUTERS/TIPS	8526.0	157.9	1,346,160.8	28.0 %MAC

*Includes oil and unuseable fluids   ** Location of Ballast When Installed

Prepared By: D. THACKER   Date Prepared: 11-28-83

PILOT: E. BOEHLER.   CO-PILOT: G. MEYERS

FLIGHT TEST (Additional Crew Members): ——— 2. ———

3. ——— 4. ——— 5. ——— 6. ———

DATE OF FLIGHT: ________ Q.C. (Stamp & Initials): 32

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Flight Test Report SCR 20-015 MU2B-20 11/30/83
Boehler / Meyers

I. Fuel ~~gsan~~ System operation, Annunciation.

Fuel gauges ~~and~~ for the center tank groups, and tip tanks are located behind the control wheel as are the control switches and tank empty lights for the out board wing fuel. Operation of the fuel system for transfer of outboard wing and Tip fuel is manual and is adequately annunciated although visual inspection requires head or head and body movement to see beyond the control wheel. The low level indicator that is part of the master caution system was not evaluated. ~~although if it was operates as~~

~~I believe single pilot operation is not not hampered by the fuel system~~
~~Pilot workload for single pilot operation is not~~
I do not believe that the fuel system would contribute to an ~~single pilot overload~~ excessive workload for single pilot operations

II Anti-ice functions.

All anti-ice systems are activated and annunciated from the overhead left panel.

Their operation is not significantly different from any other aircraft of this category. The switch panel location is awkward in the sense it is too close to the pilots head to permit just eye scan to view the annunciators and switches. Any action that must be accomplished on this panel, selection or monitoring, requires a head movement that will direct the pilots attention from his primary instrument group. Although this location is not ideal I could not say it would cause an additional work load that would prohibit single pilot operation.

II Single Pilot Control.

All of the requested maneuvers were accomplished T.O, Climbs, etc. -

The yaw damping characteristics of the aircraft are acceptable. Yaw disturbances result in several overshoots for recovery but the amplitude of these overshoots ~~are~~ is small. The accompanying dutch-roll is not objectionable. Lateral and directional trim are sensative to power and airspeed changes and do require attention for coordinated flight. The amount of attention although higher than other aircraft of this category is not excessive for single pilot operations.

The Take off speed schedule appeared reasonable and is not difficult to achieve if rotation is initiated at the recomended Take-off speed. This results in a higher than desired take off speed. If it were imperative that the aircraft ~~be~~ lifted off at the take off speed, considerable pilot experience and effort would be required.

The Climb speed schedule is easy to achieve There is a tendency to Climb higher than the recomended speeds because of ~~the~~ reduced over the-nose visability at the recomended climb speeds

The approach speed schedule is easy to achieve. It is however fast enough to cause a longer than desired float when transitioning to the landing flare at a flight idle power setting. A considerable amount of pilot experience would be required for a pilot to accurately predict touch down points using the recomended airspeeds.

IV Partial Panel Instruments

Flying this aircraft with a partial instrument panel is no more difficult than any other aircraft of this category. Aircraft lateral and directional trim are especially important during partial panel operations.

V Landing gear Warning System.

The landing gear warning system is deficient in that an approach can bee flown with the gear up and the flaps in the 20° position with the throttles slightly in front of the flight idle stop and no gear warning horn will sound.

VI The landing gear ~~warning~~ Position indicators are adequate to determine gear position. (safe up and down).

VII. The postion of the engine oil temperature gauges behind the control wheel and low on the instrument panel renders their usefulness extremely low. In-flight considerable more than eye movement is required to make use of these gauges. If an impending engine problem was indicated on either one of these gauges Chances are more than even the pilot would not notice an abnormal reading until other engine parameters changed.

DATE: 11/30/83 MODEL: MU2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boghez Meyers	TEST: SCR 20-016	S.E. 133 T.O. 133 LDG. 140 TOTAL .(FUEL USED -3

RAMP WT: 9277.0 ZFW..... 8094.2	C.G. %MAC.... 338 ZFW C.G. %MAC 32.5	TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All items on attached flight card completed except 6 & 7

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MU-2B-20 | #183

FLIGHT TEST PLAN

11-?-83 SCR-20 C16

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
S. NAKAGAWA	S. Nakagawa	B	[signature]
PILOT E. BOEHLER	TEST CREW D. THACKER	TEST CREW	TEST CREW
COPILOT G. MEYERS	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT		9277.0	LBS
CENTER OF GRAVITY		33.8	%MAC
FUEL LOADING	MAIN	1031.8	LBS
	OUTER	201.0	LBS
	TIP	———	LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.
2. SEE ATTACHED SHEET FOR OPEN SQWKS ON A/C.

TEST ITEMS

~~(1) to obtain and maintain airspeeds within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f, whichever is the lesser (item 2.(h)) CAR 3.109(b)(6)~~ SN

(2) Stall warning (item 2.(i))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
~~1~~	~~CAR 3.109 (b)(6)~~ SN	~~10,000~~	~~Trim 1.5 V_{S0}~~	~~40°~~	~~Ext.~~	~~Flight Idle~~
	STALL WARNING — AUTOPILOT OFF					
2	straight (climbing)	10,000	Trim 1.5 V_{S1}	Ret.	Ret.	MCP
3	straight	"	"	"	"	Flight Idle
4	straight (climbing)	"	"	40°	Ext.	MCP
5	straight	"	"	"	"	Flight Idle
6	single engine	"	~	Ret.	Ret.	Feather/MCP
7	single engine	"	~	40°	Ext.	" "
	STALL WARNING — AUTOPILOT ON					
8	Straight (climbing)	10,000	Trim 1.5 V_{S1}	Ret.	Ret.	MCP
9	straight	"	"	"	"	Flight Idle
10	straight (climbing)	"	"	40°	Ext.	MCP
11	straight	"	"	"	"	Flight Idle
~~12~~	~~single engine~~ SN	~~"~~	~~~~~	~~Ret.~~	~~Ret.~~	~~Feather/MCP~~
~~13~~	~~single engine~~ SN	~~"~~	~~~~~	~~40°~~	~~Ext.~~	~~" "~~

TEST PROCEDURES

~~I. To obtain and maintain airspeed: within the range of 1.1 V_{s1} to 1.7 V_{s1} or V_t, whichever is the lesser (item 2. (h)) — CAR 3. 109 (b) (6).~~

GH

~~1. Trim the airplane at the specified conditions.~~
~~2. Obtain and maintain 1.1 V_{s1} using primary control systems without changing trim. (with one hand)~~
~~3. Obtain and maintain 1.7 V_{s1} using primary control systems without changing trim. (with one hand)~~

II Stall Warning. (item 2 (i))

— For cond. NO. 2 thru 5 and 8 thru 11.

1. Trim the airplane at the specified conditions.
2. Reduce airspeed by means of the elevator control until stall warning starts.
   (1) Assure that the stall warning is clear and distinctive.
3. The elevator control shall be pulled back at a rate such that the airplane speed reduction does not exceed 1 mph/sec until a stall is produced.
   (1) Assure that a clear and distinctive stall warning continues until the stall occurs.
4. Recover from the stall using normal elevator control.

TEST PROCEDURES

II Stall Warning. (item 2(i)) Continued

- For cond. NO 6, 7. ~~2 and 9~~ SN.

1. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank towards the inoperative engine.
2. Increase steadily angle of attack with the elevator control until a stall occurs.
   (1) Assure that a clear and distinctive stall warning is available until the stall occurs.
3. Recover from the stall by normal use of the controls, reducing power on the operating engines if desired.
4. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank away from the inoperative engine.
5. Repeat above procedures 2 and 3.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-30-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{161.5 - 154.3}{60.6} \times 100 \div 22.0 =$ 33

FLIGHT NO.: SCP-20-016 (Initial) (C of A) (R & D) (Prod)

NOTE. SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	1539	1,052,844.3	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) G. MEYERS	190.0	97.2	18,468.0	
2nd ROW D. THACKER	160.0	133.9	21,424.0	
2nd ROW		133.9		
COUCH	250	183.5	45,875.0	
CABIN BAGGAGE COMPT	200.0	204.7	40,940.0	
BAGGAGE COMPT. **	220.0	230.7	50,754.0	
AFT BAGGAGE COMPT. **	155.0	246.0	38,130.0	
ZERO FUEL WEIGHT	8044.2	160.6	1,292,249.3	32.5 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %
Outer Tanks 15 / 15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9076.0	161.4	1,464,869.4	33.7 %MAC
GWT MAINS/OUTERS (ONLY)	9277.0	161.5	1,497,793.2	33.8 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-28-83

PILOT: E. BOEHLER CO-PILOT: G. MEYERS

FLIGHT TEST (Additional Crew Members): D. THACKER 2. ——

3. —— 4. —— 5. —— 6. ——

DATE OF FLIGHT: ________ Q.C. (Stamp & Initials): 32 / [illegible]

SCR-20-016

SE
TO 13:37
LP

	Item	hp			Vs	1.5 Vs1	[illegible]	[illegible]		
	2	MCP			94	141	93	73		
	3	F/I			94	141	100	85		
	4	MCP			74	111	69	52		
	5	F/I			74	111	7[illegible]	66		

Flight test Report SCR 20-016 MU-2B-20 11/30/83
Boehler / Meyers

STall Warning

Stall warning was evaluated using the recomended procedures on the test card.

The stall warning as provided by the wheel shaker is adequate in all configurations and power settings. The warning came on at a higher than normal airspeed i.e. greater than 10 knots above the stall but this was not considered to be the intent of the investigation.

There is considerable airframe buffet when the flaps are at 40°. This buffet does not mask the wheel shaker.

DATE: 11/20/85
MODEL: MU2B20

MITSUBISHI AIRCRAFT INTERNATIONAL
FLIGHT RESULTS REPORT

PAGE 1 OF
FLT. NO.

CREW:

TEST: SCR-20-017

S.E. 1508
T.O. 1513
LDG. 1531
TOTAL .3
FUEL USED -30

RAMP WT: 8582.0 C.G. %MAC.... 24.3
ZFW..... 7349.2 ZFW C.G. %MAC 21.3

TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

All ITEMS on ATTACHED FLIGHT CARD Completed
except 1C & 1D

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

135

FLIGHT TEST PLAN

MU-2B-20 #183			11-[illegible]-83 [illegible]
PREPARED BY D. THACKER	CHECKED BY (ENG'G) [illegible]	CHECKED BY (FLIGHT) [illegible]	APPROVED BY [illegible]
PILOT E. BOEHLER	~~TEST CREW~~ D. THACKER	TEST CREW	TEST CREW
COPILOT G. MEYERS	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT 8582.0 LBS

CENTER OF GRAVITY 24.3 %MAC

FUEL LOADING MAIN 1031.8 LBS

OUTER 201.0 LBS

TIP — LBS

REMARKS

LIMITATIONS

1. DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

2. SEE ATTACHED SHEET FOR OPEN SQUAKS ON A/C.

TEST ITEMS

(1) take off speed schedules and climb transition (item 2.(f))

(2) approach and landing procedures and speed schedules (item 2.(g))

(3) to obtain and maintain airspeed within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f, whichever is the lesser (item 2.(h)) — CAR 3.109(b)(6)

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Engine	Gear	Flap	Airspeed (KIAS)	Altitude (FT)
1a	TAKEOFF SPEED SCHEDULE & CLIMB TRANSITION	TOP → MCP	Ext. → Ret	5°	TAKEOFF → CLIMB	~
1b	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	TOP → MCP	Ext. → Ret	20°	TAKE OFF → CLIMB	~
1c	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	TOP → FI/MCP	Ext. → Ret	5° → 0°	TAKE OFF → CLIMB	~
1d	TAKE OFF SPEED SCHEDULE & CLIMB TRANSITION	TOP → FI/MCP	Ext. → Ret	20° → 0°	TAKE OFF → CLIMB	~
2a	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE.	~	Ext.	20°	APPROACH → LANDING	~
2b	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE.	~	Ext.	40°	APPROACH → LANDING	~
2c	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE	FI/~	Ext.	20°	APPROACH → LANDING	~
2d	APPROACH AND LANDING PROCEDURES & SPEED SCHEDULE	FI/~	Ext.	40°	APPROACH → LANDING	~
3	CAR 3.109(b)(6)	Flight Idle	Ext.	40°	Trim 1.5 V_{S0}	10,000

TEST PROCEDURES

I. Takeoff Speed Schedule and Climb Transition (item 2.(f).

1. Conduct a takeoff and a climb transition in accordance with the airplane flight manual procedures.

   (1) Determine the adequacy of the takeoff speed schedules and climb transition considering a single pilot using average skill.

   (2) Evaluate for both two engine and single engine takeoff.

II. Approach and Landing Procedures and Speed Schedules (item 2. (g))

1. Perform an approach and a landing in accordance with the airplane flight manual procedures.

   (1) Determine the adequacy of the approach and landing procedures and speed schedules considering a single pilot using average skill.

   (2) Evaluate for both two engine and single engine approarches.

TEST PROCEDURES.

III To obtain and maintain airspeed within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_T, whichever is the lesser (item 2.(h)) — CAR 3.109 (b)(6)

1. Trim the airplane at the specified conditions.
2. Obtain and maintain 1.1 V_{S1} using primary control systems without changing trim. (with one hand)
3. Obtain and maintain 1.7 V_{S1} using primary control systems without changing trim. (with one hand)

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-30-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{155.7 - 154.3}{60.6} \times 100 + 22.0 = 24$

FLIGHT NO.: SCR-20-017 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) E BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) G. MEYERS	190.0	97.2	18,468.0	
2nd ROW D. THACKER	160.0	133.9	21,424.0	
2nd ROW		133.9		
COUCH		183.5		
BALLAST	130.0	109.0	14,170.0	
CABIN BAGGAGE COMPT		204.7		
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **		246.0		
ZERO FUEL WEIGHT	7249.2	153.9	1,130,720.3	21.3 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	167.3	172,620.1	W/800lbs ____ %
Outer Tanks 15/15 Gal	201.0	163.8	32,923.8	GWT W/800# ____
Tip Tanks / Gal		155.9		
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8381.0	155.5	1,303,340.4	24.0 %MAC
GWT MAINS/OUTERS (ONLY)	8582.0	155.7	1,336,264.2	24.3 %MAC
GWT MAINS/OUTERS/TIPS				____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-28-83

PILOT: E. BOEHLER CO-PILOT: G. MEYERS

FLIGHT TEST (Additional Crew Members): D. THACKER 2. ——

3. —— 4. —— 5. —— 6. ——

DATE OF FLIGHT: ________ Q.C. (Stamp & Initials): 32

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Flight Test Report   SCR 20-017   MU2B-20   11/30/83
Boehler / Meyers.

The card was flown as specified.

Take off and Climb.
The aircraft transitions easily from the take off attitude to the climb schedule in either Take off configuration. (5° or 20° flaps down.)
Take off at the intended airspeed requires considerable pilot effort. Normal pilot techniques results in take offs at speeds above those intended.

approach and landing.

~~When~~ Flying at the recomended approach airspeeds results in a long float that makes prediction of touchdown point difficult.

Single engine (simulated) landings are not difficult if gear and 40° flaps are held until the landing area is assured. 20° flap landings single and multi-engine are easy to accomplish with float as described above.

Single engine reverse does not cause directional control problems when the nose wheel is on the runway prior to application of reverse thrust. Reverse was applied as soon as ~~possible~~ after the

Beta lights were illuminated.

Cross wind landings were not attempted during this flight but based on previous landings in crosswinds the following comments are offered.

Because the nose wheel steering is connected directly to the rudder pedals and the nose is hard to keep up during a normal landing, cross wind ~~landings~~ can result in the nose wheel touching down with a considerable angle to the flight/ground path. ~~Cross wind landings on wet or icey runways would be~~ control on wet or icey runways would be affected by this conditions.

~~[illegible]~~ When flying ~~[illegible]~~ on final approach with gear and flaps down at and below recomended airspeeds, lateral control is diminished to a point where slightly larger than normally anticipated roll control inputs are required to maintain desired roll attitudes. a mild lateral P.I.O. results the first few ~~[illegible]~~ times this pheonomiena occurs. After several flights in the aircraft this tendenc ~~[illegible]~~ diminishes

111 When Trimmed to 1.5 Vs, it required 4 pounds of push to obtain 1.7 V_{s0} and 8 to 10 pounds of pull to obtain 1.1 V_{s0} (119 and 77 KIAS)

SCR-20-018

DATE: 1/11/83 MODEL: MU-2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: [illegible] SILVANSEN NAKAGAWA KAWAI	TEST: CONTROLLABILITY AT TAKEOFF ENGINE FAILURE	S.E. T.O. LDG. TOTAL FUEL USED

RAMP WT: 9,635 LBS C.G. %MAC.... TIA REF:

ZFW..... ZFW C.G. %MAC

CONFIGURATION:

TEST EQUIPMENT: CAMERA, MANUAL NOTES

SUMMARY OF RESULTS:

Five takeoff/landing runs with simulated engine failure at 50ft were conducted at Roswell, NM.

Left engine was cut to idle for the first three runs investigating the airspeed effect to the controllability.

Two actual fuel flow cut runs were conducted.

During these tests winds are virtually calm (3kts).

Runway used for these test were almost 10,000ft from takeoff roll to full stop.

Kawai

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

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DATE: [illegible] MODEL: MU-[illegible]-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO. [illegible]
CREW: ARNOLD WENTLING ELLWANGER KAWAI	TEST:	S.E. [illegible] T.O. [illegible] LDG. [illegible] TOTAL [illegible] FUEL USED

RAMP WT: 9.880	C.G. %MAC....	TIA REF:
ZFW.....	ZFW C.G. %MAC	

CONFIGURATION:

TEST EQUIPMENT: CAMERA (E/G start) & MANUAL NOTES.

SUMMARY OF RESULTS:

All test were conducted according to FLIGHT TEST PLAN.
except

1. Trim aileron runaway without using autopilot, and
2. Measured rate of descent in flaps 20°, L/G ↓ configuration.

All tests were conducted satisfactory.

R. Wentling C. Arnold

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MODEL	SERIAL NO.	FLIGHT TEST PLAN	FLIGHT DATE	FLIGHT NO.

PREPARED BY	CHECKED BY (ENG'G) S. Wiggins	CHECKED BY (FLIGHT)	APPROVED BY
PILOT R. JEWLING	TEST CREW T KAWAI	TEST CREW	TEST CREW
COPILOT C ARNOLD	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT 9435 LBS

CENTER OF GRAVITY (aft) %MAC

FUEL LOADING Main Tank ______ LBS

Outer Tank ______ LBS

Tip Tank 65/65 gal LBS

TEST ITEMS

ENG'G EVAL

(1) Circle to Land with Single Engine

REMARKS

LIMITATIONS

(1) DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

ESTIMATED FLIGHT TIME: ____ HR ____ MIN FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1.	Circle to Land with Single Engine (SEE ATTACHED SHEET)		~	40	Ext.	Feathered as Required

TEST - PROCEDURE

NOTE : Max. Landing Wt : 9435 lbs

Max. Fuel in Tip Tanks : 65 / 65 gal

(1) Take off with Two engine operative

(2) Shut down one engine (LH) to feather prop. at 150.

(3) Circle to land from about 300 ft AGL with single engine.

[illegible]	[illegible]	FLIGHT TEST PLAN	[illegible]	[illegible]

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
[illegible]	[illegible]		
PILOT: ? WENTLING	TEST CREW: D THACKER	TEST CREW	TEST CREW
COPILOT: C ARNOLD	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT 9920 (max TO) LBS

CENTER OF GRAVITY aft %MAC

FUEL LOADING Main Tank ______ LBS

Outer Tanks (171/171 gal) LBS

Tip Tanks (90/90 gal) LBS

REMARKS

LIMITATIONS

(1) DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.

TEST ITEMS

Engineering Evaluation

(1) Trim-Aileron Runaway with Auto-pilot. (item 1(d) Re-Test)

(2) Air Start

(3) Check of Engine Flight Idle Setting

(4) Two Engine ILS Approach

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1.	Trim-Aileron Runaway with Auto-pilot.	15,000	V_{MO}	Ret	Ret.	As Required
2.	Air Start	15,000	100	Ret	Ret.	As Required
3	Check of Eng Flight Idle Setting	5,000	120	20	Ret.	F.I.
4	Two Eng. ILS Approach	~	~	20°	Ext.	As Required

Column group heading over Altitude through Engine: TEST CONDITION

1. TRIM-AILERON RUNAWAY WITH AUTO-PILOT:

Repeat trim-aileron runaway with auto-pilot engaged and trimmed to VMO. Record force to recover and acceptability of cues.

2. AIR-START:

Do an engine restart at 15,000 ft & 100 kt
Determine adequacy of restart envelope.

3. CHECK OF ENG. FLIGHT IDLE SETTING:

At 5000 ft check engine flight idle setting per maintenance requirement manual procedure (page 54)

4 TWO ENG ILS APPROACH:

Conduct two ILS approaches with 20° and 40° flap

MODEL	SERIAL NO.	FLIGHT TEST PLAN 5(?)-20-020
[illegible]	[illegible]	

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
[illegible]	S. [illegible]		
PILOT F. WENTLING	**TEST CREW.** T. R.	**TEST CREW**	**TEST CREW**
COPILOT C. ARNOLD	**TEST CREW**	**TEST CREW**	**TEST CREW**

AIRPLANE CONDITION

TAKEOFF WEIGHT 9925 [illegible] LBS

CENTER OF GRAVITY aft %MAC

FUEL LOADING Main Tank ______ LBS

Outer Tanks ______ LBS

Tip Tanks ______ LBS

REMARKS

LIMITATIONS

(1) DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE.

TEST ITEMS

ENG'G EVAL

(1) Climb test on speed schedule.

(2) Emergency Descent.

(3) ILS Approach with Single Engine

ESTIMATED FLIGHT TIME: ____ HR ____ MIN FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	Climb test on speed schedule.	~ 2[illegible]	[illegible]	Ret	Ret	MCP
2	Emergency Descent	[illegible]	V_{MO}	Ret	Ret	F.I.
		[illegible]	140	Ext.	Ext.	F.I.
3	ILS Approach with S/E	[illegible]	[illegible]	20	Ext.	F.I / Required

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1. CLIMB TEST ON SPEED SCHEDULE :

At max. T.O. weight, climb on speed schedule to max. altitude (25000 ft). Evaluate suitability of stability on schedule and stall speed margins.

EST wt (lbs)	Alt (ft)	IAS (kt)	V_s	Δ BROC/V_s
9,900	1,000	152	102	50
9,900	5,000	148	102	46
9,850	10,000	143	101	42
9,800	15,000	138	100	38
9,700	20,000	131	99	32
9,600	22,000	129	98	31
9,500	24,000	128	98	30
9,400	25,000	126	97	29

2 EMERGENCY DESCENT :

Do a simulated emergency descent to 15,000 ft.
From 25,000 ft to 20,000 ft – Use V_{MO} & 45° bank with F/I.
From 20,000 ft to 15,000 ft – Use gear & flap extended and 140 kt with F/I

(Don O_2 mask befor descent)

Record Rate of Descent.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 10-30-83

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$$\frac{-154.3}{60.6} \times 100 \div 22.0 = \_\_\_$$

FLIGHT NO.: SCR-20-21 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VIII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P)	170.0	97.2	16,524.0	
1st Row (CP)	185.0	97.2	17,982.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH	335.0	183.5	61,472.5	
CABIN BAGGAGE COMPT	220.0	204.7	45,034.0	
BAGGAGE COMPT. **	242.0	230.7	55,829.4	
AFT BAGGAGE COMPT. **	—	246.0	—	
ZERO FUEL WEIGHT	7776.2	160.7	1,429,686.2	32.6 %MAC
Main Tank 6.7 lb/gal 154 Gal	1,031.8	167.3	172,620.1	W/800lbs ___
Outer Tanks 15/15 Gal	201.0	163.8	32,925.6	GWT W/800# ___
Tip Tanks 65/65 Gal	871.0	155.9	135,788.9	
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8808.0	161.47	1,422,306.3	33.8 %MAC
GWT MAINS/OUTERS (ONLY)	9009.0	161.53	1,455,230.1	33.9 %MAC
GWT MAINS/OUTERS/TIPS	9880.0	161.0	1,591,019.0	33.1 %MAC

*Includes oil and unusable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 12-19-83

PILOT: R WENTLING CO-PILOT: C. HENOLD

FLIGHT TEST (Additional Crew Members): B. ELLWANGER 2. KANIKI

3. — 4. — 5. — 6. —

DATE OF FLIGHT: ______ Q.C. (Stamp & Initials): [illegible] 12-14-1983

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SCR 20-?/ (1/2) (11/1?/83)

SE 10:48
TO 10:57
LF 12:55

RUN		PILOT Hp	PILOT VIAS	TIME		
1	CLIMB	5,000	150	10:59	ROC = 2000 fpm	
		6,500	150		checked Windshield Deice Fluid OK	
		10,000	130	11:01		
		13,000	138	11:04	ROC ≈ 1000 fpm	
					TQ 39 psi / 41 psi ITT	510/510
		15,000	135	11:06	ROC ≈ 1000 fpm	
		17,000	135	11:08	ROC ≈ 1000 fpm (	ALT. SET = 30.82)
	ALT SET 29.92 → @ 18,000 ft.				θ ≈ 10° (pilot gyro)	
		20,000	132	11:13	θ ≈ 12° (pilot gyro)	
		21,000	130	11:16	ROC ≈ 400 fpm	
					checked stability	
		22,000	128	11:18	ROC = 400 fpm	θ = 12°
		23,000	126	11:21	ROC = 200 fpm	θ = 12°
					check stability	
		24,000	125	11:25		
		24,600	120	11:27	slow down to 120K. ROC = 300 fpm	θ = 12°
		25000	120	11:30		
	shaker check	25300	100	11:33	(shaker 98K.)	Power ON
					← Put oxygen mask	
2	Emergency Descent	25000	150	11:41:45	1'43"	
		22000	190	42:35		
		20000	190	43:06		
		20000	140	44:15		
	FLAPS 20°	18000	135	44:36	77"	
	L/G	16000		45:08		
		15000	130	45:31		

SCR 20-21 (5/2)
(12/19/7?)

		Hp	Vi	TIME		
3	Airstart.	15000	170	11:48	E/G shut Down	(Left)
		15000	100	11:54	E/G start	
4	Trim Runaway	13600	250.	11:59:	9LBS / 2sec	
					12LBS	
				12:01	14LBS / 4sec +	
5.	Flight Idle.	7000	120.	12:15:34		
	Flaps 20°	6500		12:15:49	] 19.5"	
	4G ↓	6000		12:16:08		] 36.5"
		5500		12:16:25		] 49.8
		5000				
6	ILS					
7	S/E circle. & Land			12:48.	L/E shut Down.	
					Flaps 0°, L/G ↑	
				12:52	S/E GO AROUND	
				12:55	Flaps 40°. Landing.	
9	L/H Engine start on ground			12:58		
	E/G shut Down.			13:02		

TIP TANKS FULL, MAX GROSS WT, NEAR AFT C.G.

Aircraft Type MU-2B-20 FAA Flt. No. SCR 20-21 Surface [illegible]
S/N. 103 T.O. 10:57 / 10:48 H. ___ OAT ___
Reg. No. 967MA Land 12:55 / 13:02 Wind ___
Date 12-19-93 T.T. 1+58 Pilot WINTLINGER HANDED

Raw Data Sheet

Pro. No.

CEA MISCELLANEOUS TESTS:

1. AT MAX T.O. WT CLIMB TO MAX ALT. ON SPEED SCHED. EVAL STABILITY, TRIMABILITY, CONTROLLABILITY + STALL SPEED MARGINS

VSI		EST. WT	ALT	IAS	CAS	VS1	Δ VS	POWER PER
2000+	10:59	9900	1000'	152		102	50	TQ or ITT SC
		9850	10,000'	143		101	42	
1000'+	11:07	9800	15,000'	138	135	100	38	
500'+	11:14	9700	20M'	131		99	32	
400'+	11:19	9600	22M	129	128	98	31	
300'+	11:26	9500	24M	128	125K	98	30	525°
300±	11:31	9400	25M	126	(ACTUAL 120K)	97	29	525°

CRUISE 140K IAS @ 510° ITT @ 25M'
VS CHECK SHAKER ON ≈ 100K - SLOWED TO ≈ 99K
STABILITY CHECK 120 - 140 + 100K.

2. DO A SIMULATED EMERGENCY DESCENT TO 15,000'; O2 MASK -
25M TO 20M @ VMO, 45° BANK + FLT. IDLE. 25 → 20M = 1'.4
20M TO 15M @ VFE, GEAR DOWN + FLT. IDLE: LEVEL & RECONFIGURE
(DON O2 MASK BEFORE DESCENT)
MAX A/S ONLY 200 TO 210K θ ≈ 30° DOWN 20M → 15M' = 1'+

3 DO ENGINE RESTART AT 15M' + 100K DETERMINE ADEQUACY OF ENGINE RESTART ENVELOPE. Left engine feather.
A lot of yaw oscillations, but no problem - just a lot of transient conditions.

4. AT ≈ 8000' DO FLT. IDLE SETTING CHECK PER MAINT. MANUAL (Pg. 54) FLAPS 20° + L.G. DOWN. Not a good stable check due to clouds at 5200'. 6500 to 5500 = 1600 FPM, WITHIN Δ

5. DO ILS APPROACH W/20° FLAPS - GO AROUND - ENGINE CUT AT VY. FEATHER & RETURN FOR ENGINE-OUT ILS + CIRCLE TO LAND. FULL STOP LANDING.
NO PROBLEM, had to do a S.E. go around on S.E. circle due to traffic conflict. From ≈ 300' AGL, 20° F
G.W. ≈ 9000 lb + GEAR DOWN. NO PROBLEM. GEAR UP + F20° ↗ 130 → 140, F0°

6. DO ELEVATOR TRIM RUNAWAY TEST. MEASURE FORCE/TIME AT VMO. (250KMS)
at 1 sec. nothing noticeable. 2 seconds = 9 lbs. at 3 sec = 12 lbs. at 4 sec = 14 lbs.

GENERAL COMMENTS:

① On climb-out, cloud tops ≈ 6500', light coat of ice ≈ 1/8"
Temp inversion above until about 15000'.

② Above 20 M' aero damping is less and controllability becomes more difficult "seems to be like balancing a stick on finger". Interface of trim and spoiler interaction becomes more pronounced. Spoiler dead-band (speed 130K or less) becomes noticeable when trim becomes more responsive due to lower damping ratio. Once trimmed, it's OK – provided nothing (power or airspeed) changes. Rudder can be used to control if wish. A/C is not difficult to control – just "busy work". Classed as "annoyance".

③. Speed schedule, as published in AFM, is not "right-on" for the test-day conditions flown. Schedule (at 24M) was for 128K IAS, but 120K was definitely better, and speed stability "sensing" showed it; eg, when you pulled back more, ROC increased, thus natural tendency was to keep going off speed schedule to lower speed to get better RC. This of course gave less margin between climb and stall, also, though not checked precisely, static margins (Fe) from 120K to 100K not very much (light Fe) thus giving less cue for speed stability.

④. Engine restart is no problem at 15M + 100K. A lot of yaw perturbations causing bicycling of rudder, but control was adequate.

⑤ Flight idle check was not done correctly – put gear down. but ROD was within tolerance when considering nominal 300' for.

7. ILS approach – no evidence of pitch dead-band or response lag. Raw data approach was "no sweat". S.E. was no problem to include climb out, maneuver and circle and a S.E. go-around; Clean up and go could have been done from 100' AGL. (EST. G.W. n

6 cont'd: On single engine go around, flaps at 20° and gear down at about 300' AGL, applied power (speed about 130K), leveled, gear up. Established positive rate of climb. At ≈140K retracted flaps to 0° and accelerated to 148K and about 500' ROC. Flew pattern after climbing to 1000' AGL came back and landed. Only problem is the normal one of one-engine-out landing – deceleration rate is slower and thus is easy to overshoot because of reluctance to bleed off speed early and get full flaps sooner. Did moderate S.E. reverse with not problem other than initial yaw perturbations.

7. Did check of elevator trim runaway for 1, 2, 3 and 4 seconds (1 second reaction and 3 seconds recognition). After trimming at VMO (250KIAS) one second was not even noticeable. 2 seconds gave 9 lbs of Fe to hold 250, 3 seconds gave 12 lbs and 4 seconds gave 14 lbs. Trim rate and forces mild. rate is very slow.

DATE: 1-18-84 MODEL: MU-2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO. SCR 20-23
CREW: G. Meyers R. Wentling J. Hill	TEST:	S.E. 1630 T.O. 1640 LDG. 1925 TOTAL 2+45 FUEL USED

RAMP WT: 9,573.0	C.G. %MAC.... 29.1	TIA REF:
ZFW..... 7,134.2	ZFW C.G. %MAC 27.53	MU-2 S.C.R. Team

CONFIGURATION:

Same as SCR-20-22

TEST EQUIPMENT:

Same as SCR-20-22

SUMMARY OF RESULTS:

X-country uneventful until approach into HAB at which time moderate rime ice was encountered at approx. 5,000~6,000 ft. Exposure time was about 15 minutes and accumulations of up to 1 1/2 inches were noted on the unprotected surfaces. Aircraft icing systems worked normally and there were no difficulties on landing. After landing, the remaining ice was documented by photograph.

NOTE: Further testing (i.e., handling qualities) was not attempted due to darkness.

J. Hill FLT. TEST ENG'R

Raymond P. Wentling CO. PROJECT PILOT

George H. Meyers III ANM 176D

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

/lr

DATE: 2-9-84 MODEL: MU-2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO SCR-20-
CREW: G. Meyers R. Wentling J. Hill	TEST: NATURAL ICING	S.E. 1145 T.O. 1200 LDG. 1440 TOTAL 2+40 FUEL USED

RAMP WT: 9,763.0 ZFW..... 7,324.2	C.G. %MAC.... 28.85 ZFW C.G. %MAC 27.25	TIA REF: MU-2 SCR TEAM

CONFIGURATION:

SAME AS SCR-20-22

TEST EQUIPMENT:

SAME AS SCR-20-22

SUMMARY OF RESULTS:

SEE ATTACHED.

Jack Hill FLT. TEST ENG'R

Raymond E. Wentling CO. PROJECT PILOT

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

:/mf

MODEL	SERIAL NO.	FLIGHT TEST PLAN	FLIGHT DATE	FLIGHT NO.
MU2B-20	183		1-18-94	SCR-20-23

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
J. Hill	J. Hill		R. Weatling
PILOT	**TEST CREW**	**TEST CREW**	**TEST CREW**
G. Meyers	J. Hill		
COPILOT	**TEST CREW**	**TEST CREW**	**TEST CREW**
R. Weatling			

AIRPLANE CONDITION

TAKEOFF WEIGHT	9,763.0	LBS
CENTER OF GRAVITY	29.9	%MAC
FUEL LOADING ~~L.W.Mains~~	1031.8	LBS
R.W.Mains	201.0	LBS
FUS.Tips	1206.0	LBS

TEST ITEMS

Natural Icing

* See ATTACHED TEST PLAN

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

TEST CONDITION

Engine																									
Gear																									
Flap																									
Airspeed (KIAS)																									
Altitude (FT)																									
TEST ITEM																									
Cond No																									

Raw Data Sheet

Pro. No.

Aircraft Type MU-2B-20 (F) FAA Flt. No. ________ Surface Cond:

S.N. 183 T.O. ________ H ________ OAT ________

Reg. No. N 967MA Land ________ Wind ________

Date T.T. ________ Pilot

1. FLY IN ICING CONDITIONS: (~~RECORD TEMP. AND ICE BUILD~~ UP RATES, TOTAL TIME IN ICE.
   a. HOLD AT LEAST 45 MINS. VARY SPEED FROM MAX
   b. CRUISE TO ≤ 140K (GEAR + FLAPS UP)
   c. TURN ON ALL ANTI-ICING EQUIPMENT.
   d. ACTIVATE BOOTS AT 1/4" TO 1/2" ICE.
   e. ACTIVATE WINDSHIELD DE-ICE AT ≈ 1/4" ICE.

2. PHOTOGRAPH (FROM INSIDE A/C):
   a. WINDSHIELD DE-ICE CYCLE.
   b. BOOT DE-ICE CYCLE.
   C. ICE BUILD UP ON UNPROTECTED AREAS:
      TIP TANK & FILLET
      UNDERSIDE OF WING AT BOOT/WING JUNCTION
      HORIZONTAL STABILIZER BOOT & TIP
      ENGINE OIL COOLER INLET

3. EXIT FROM ICE CLOUD. HOLD IN CLEAR FOR CHASE.
   a. PHOTOGRAPHS FROM CHASE:
      UPPER SURFACE OF WING + TAIL (HORIZ + VERT)
      UNDERNEATH SIDE OF A/C (FROM FWD + BELOW)

   B. AT AIRSPEEDS FROM MINIMUM TO MAXIMUM
      CHECK STABILITY, LATERAL, DIRECTIONAL + LONGITUDINAL
      NOTE: PERIOD, DAMPING, DIVERGENCE + FORCE GRADIENT
      NOTE SPOILER EFFECTIVENESS (PARTICULARLY AT 110-120

   C. CHECK CONTROLLABILITY AND STALL WNG MARGINS.

NOTE STABILITY AT SLOWER SPEEDS

   CLEAN - A/S AT WNG - OTHER BUFFETT.
   APPROACH (20° + GEAR DOWN)
   LANDING CONFIG: (40° + GEAR DOWN)

4. IF ICE STILL ON - LAND SOFTLY FOR GROUND PICTURES.

9970 MWT.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-20 DATE OF W & B: 1-18-84

AIRCRAFT SN: 183 AIRCRAFT "N": 967MA

$\frac{158.45 - 154.3}{60.6} \times 100 + 22.0 = 28$

FLIGHT NO.: 522-20-073 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. -SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6624.2	158.9	1,052,844.3	
1st Row (P) Meyers	190.0	97.2	18,468.0	
1st Row (CP) Wentling	170.0	97.2	16,524.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH Hill	190.0	183.5	34,865.0	
CABIN BAGGAGE COMPT	150.0	204.7	30,705.0	
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **		246.0		
ZERO FUEL WEIGHT	7324.2	157.48	1,153,406.3	27.25 %MAC
Main Tank— Lb/Gal 154 Gal	1031.8	167.3	172,620.14	W/800lbs ____
Outer Tanks 15 115 Gal	201.0	163.8	32,923.8	GRT W/800# ____
Tip Tanks 90 190 Gal	1206.0	155.9	188,015.4	
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GRT MAINS (ONLY)	8,356.0	158.69	1,326,026.44	29.25 %MAC
GRT MAINS/OUTERS (ONLY)	8,557.0	158.81	1,358,950.24	29.44 %MAC
GRT MAINS/OUTERS/TIPS	9763.0	158.45	1,546,965.64	28.85 %MAC

*Includes oil and unusable fluids ** Location of Ballast When Installed

Prepared By: [signature] Date Prepared: 1-18-84

PILOT: G Meyers CO-PILOT: R. Wentling

FLIGHT TEST (Additional Crew Members): 1. J. Hill 2.____

3.____ 4.____ 5.____ 6.____

DATE OF FLIGHT: 1-18-84 Q.C. (Stamp & Initials): 32 / MDS

FLT DATE 2-4-84
SC P-20-30

Run No.	Time	HDG	hp	OAT	Q	RPM	EGT	F/F	T OIL	IAS	Ice Thick
1	IN 1245	105	6700	0	30/30	97/97	400/390	220/210	70/72	162	1/8~1/4
2	1250	260	7,00	-1	30/30	97/97	400/400	220/220	73/72	140	1/4~1/2
3 (Note Speed Runs)	1255	285	7000	-1	35/35	97/97	430/420	250/230	80/75	155	1/2~3/4
4	1305	265	7500	-2	38/38	97/97	500/480	260/250	70/75	160	1 1/2~2"
5	1310	150	7500	-2	36/36	97/97	460/440	250/235	70/80	140	2~2 1/2
6	1320	Tank → Climb Out									~3~3 1/2 4" ON TOP
7	OUT 1330 → ON TOP										
8	1340										

Note: θ = 10°~12°

STABILITY — 140 Kts TRIM

1345 11220 -5 30/30 99/99 470/420 210/200 80/80

Push 160 - 6 lbs push Return → 146

Pull 130 6 lbs pull

120 - 8~10 pull Return → 142

Left sideslip — at Rudder
Side slip → positive

Spiral stab — Good

Ice still ON

Stall warning — Trim same i.e. 142
Clean V_{buff} ~ 100 } Good
V_{SKR} ~ 90
V_s ~ 85 Stick: Full Left

Spoiler eff: 120 kts Good!
100 kts Good all the way into stall warning

Speed stab → Max PwR
Trim - 125 kts
110 Kts ~ 4 lbs pull
150 Kts ~ 6 lbs push

STABILITY Appr Config Gear dwn S_F 20° - 9400' hp
Trim for 3° slide @ 120 kts
Side slip - rudder return positive / lateral positive
Damping Good

MITSUBISHI AIRCRAFT INTERNATIONAL, INC.

P. O. BOX 3848 SAN ANGELO, TEXAS 76902 915/942-4200 TWX 73-9438

15 February 1984

Mr. C. E. Arnold
Manager, Flight Test Section
Small Airplane Certification Directoriate
Federal Aviation Administration
601 East 12th Street
Kansas City, Missouri 64106

SJ: MU-2 Flight Results Report of Icing Evaluation

Dear Charlie:

We have prepared Flight Results Report of MU-2 Icing Evaluation flight tests, which were conducted with S/N 183 test airplane on February 09, 1984.

Enclosed are:
1) A copy of Flight Results Report of Flight No. SCR 20-30 (02/09/84), including photographs.
2) Original of Flight Results Report of Flight No. SCR 20-30 (first page only).
3) Original of Flight Results Report of Flight No. SCR 20-23 (first page only).

Regarding the above items (2) and (3), we would like to have the FAA SCR's pilot (Mr. G. Meyers) signature for future record.

Please review Flight Results Reports and sign on both original sheets if you concur. Then, would you please return both original sheets to us.

If you any questions, please contact me.

Sincerely,

S. Nakagawa

S. Nakagawa
MAI MU-2 SCR Task Force Leader
Asst. Vice President,
Product Support

Encl:
SN:ec

DATE: 2-9-84 MODEL: MU-2B-20	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO SCR-20-
CREW: G. Meyers R. Wentling J. Hill	TEST: NATURAL ICING	S.E. 1145 T.O. 1200 LDG. 1440 TOTAL 2+40 FUEL USED

RAMP WT: 9,763.0 ZFW..... 7,324.2	C.G. %MAC.... 28.85 ZFW C.G. %MAC 27.25	TIA REF: MU-2 SCR TEAM

CONFIGURATION:

SAME AS SCR-20-22

TEST EQUIPMENT:

SAME AS SCR-20-22

SUMMARY OF RESULTS:

SEE ATTACHED.

FLT. TEST ENG'R

CO. PROJECT PILOT

ANM 176T

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

FLIGHT RESULTS REPORT

FLT. NO. SCR-20-30

DATE 2-9-84

Flight tests were conducted in natural icing to make a general assessment of the overall icing characteristics of the total aircraft, aircraft systems, and power plants. Moderate to heavy "rime" ice was encountered between 6,900 ft. and 7,500 ft. with ram air temperatures ranging from 0° C to -2°C (or -3.3°C ~ -5.3°C OAT). The aircraft remained in the icing environment for a total of 45 minutes (35 min. run plus 10 min. climb out) and accumulated up to 4~5 inches on the unprotected surfaces.

After exiting icing conditions the aircraft was evaluated satisfactory for handling qualities as follows:

STABILITY - CLEAN CONFIGURATION - SATISFACTORY

The aircraft was trimmed for 144 kts at 11,220 ft., -5°C RAT and evaluated for overall control and stability. Stick force was estimated at:

160 kts: approximately 6 lbs. of push return speed = 146 kts.
130 kts: approximately 6 lbs. of pull
120 kts: approximately 8 10 lbs. of pull return speed = 142 kts.

Spiral stability was also evaluated and found satisfactory.
Speed stability at maximum power was found satisfactory. The aircraft was trimmed at 125 kts and stick forces were estimated to be approximately 4 lbs. pull at 110 kts and 6 lbs. push at 150 kts.

STABILITY - APPROACH CONFIGURATION - SATISFACTORY

The aircraft was trimmed for a 3° glide at 120 kts (gear dwn-δ_f 20° - 9,400 ft.) and evaluated satisfactory for overall stability and controllability. Lateral stability and rudder return (side slip) were found to be positive. Short period dynamics and longitudinal static stability and damping were also found satisfactory.

STALL WARNING AND SPOILER EFFECTIVENESS - SATISFACTORY

Stall warning in the clean configuration was evaluated at 11,000 ft. (prior to any significant errosion or shedding of accumulated ice). The aircraft was trimmed at 142 kts. and entered the stall at 1~2 kts/sec. V_{Buff} occurred at around 100 kts with the shaker at 90 kts. and V_s at 85 kts. The spoilers were found to be effective and providing good roll response all the way down to and including stall speeds. Aircraft stall characteristics, stall warning, stall recognition, and spoiler effectiveness were evaluated and found satisfactory.

FLIGHT RESULTS REPORT

FLT. NO. SCR-20-30

DATE 2-9-84

ICING CHARACTERISTICS (Cont'd)

SUMMARY

The aircraft icing characteristics were documented by photographs from inside the test vehicle and from a chase airplane. These and manual notes of the instrument panel are presented herein.

WING DE-ICE SYSTEM - SATISFACTORY

The wing de-ice system was activated at 1/4 to 1/2 inches of ice accumulation and functioned normally throughout the flight. The complete de-ice cycle is illustrated in the attached photographs.

ENGINE ANTI-ICE SYSTEM - SATISFACTORY

The engine anti-ice system functioned satisfactorily throughout flight. The protected areas remained free of ice as shown and engine operation was normal. Post-flight inspection revealed no anomalies.

ENGINE; UNPROTECTED AREAS - SATISFACTORY

A. Oil Cooler Inlet

The icing characteristics of the oil cooler inlets are such that although a significant horn may develop, the inlets remain open. This is shown in Run 5 Photo 3 for the LH INBD inlet and Run 4 Photo 10 for the RH INBD inlet. It should be noted that even though the ice propagated inside the inlet, effectively reducing inlet area, the highest oil temperature recorded was 80°C for both engines. This provides a margin in excess of 40°C.* While the INBD inlets established a build/shed cycle (Ref.: Run 5/6 Photo 9/1), the OUTBD inlets were observed not to shed; however, Photo C-1 from the chase airplane shows the inlet to be open.

B. Generator Cooling

The generator cooling inlet remained clear of ice throughout the flight as shown.

*NOTE: Engine oil used meets the requirement of MIL-L-23699. The maximum operational temp. limit is 127°C.

FLIGHT RESULTS REPORT

FLT. NO. SCR-20-30

DATE 2-9-84

ICING CHARACTERISTICS (Cont'd)

WINDSHIELD DE-ICE SYSTEM - SATISFACTORY

The windshield de-ice system was not activated during the run. Ice was allowed to accumulate until the end of the encounter, at which time the windshield was cleared without difficulty. (Ref.: Run 7 Photo 4/5)

PITOT/STATIC SYSTEM - SATISFACTORY

The pitot/static system was monitored closely throughout the flight and was observed to function normally at all times. The pitot masts collected ice in the typical horn fashion, but the heated portion of the head remained clear. All results were evaluated and found satisfactory.*

RADOME - SATISFACTORY

The icing characteristics of the radome were found to be satisfactory in that the ice accumulated symmetrically about the stagnation point and did not shed in hazardous quantities, but merely eroded. Radar operation was also unaffected by the ice build-up.

OTHER - SATISFACTORY

Other aircraft systems, such as avionics, COMM, NAV, etc., were monitored through the flight by their normal use, and no abnormal operation was observed. Flap, gear, and gear door operation were also normal.

*NOTE: After return to San Angelo the pitot and static system was checked and found to be free of moisture.

FLIGHT RESULTS REPORT

FLT. NO. SCR-20-30

DATE 2-9-84

MANUAL NOTES

Run No.	Time	Hdg	hp	RAT	TQ	RPM	EGT	F/F	Toil	IAS	Est. Ice Thickness .
1	In 12:45	105	6900	0	30/30	97/97	400/390	220/210	70/72	162	1/8~1/4 inch
2	12:50	260	7100	-1	30/30	97/97	400/400	220/200	73/72	140	1/4~1/2 inch
3	12:55	285	7000	-1	35/35	97/97	430/420	250/230	80/75	155	1/2~3/4 inch
4	13:05	265	7500	-2	38/38	97/97	500/480	260/250	70/75	160	1-1/2~2 inches
5	13:10	150	7500	-2	36/36	97/97	460/440	250/235	70/80	140	2~2-1/2 inches
6	13:20	→ START CLIMB OUT									3~3-1/2 inches 4" on wing tip fillet
7	Out 13:30	→ ON TOP	11,220	-5	NOTE: ~~0~~ 10°~12° 30/30	99/99	440/420	210/200	80/80	140	Wipers~ 5 inch Wing Tip fillet ~ 4 inch Other 3-1/2~4 in
8	13:40	→ START HANDLING EVALUATIONS									

/mf

MODEL	SERIAL NO.	FLIGHT TEST PLAN		FLIGHT DATE	FLIGHT NO.
MU-2B-20	183			2-9-84	SCR-20-30

PREPARED BY J. HILL	CHECKED BY (ENG'G) [illegible signature]	CHECKED BY (FLIGHT)	APPROVED BY
PILOT G. MEYERS	TEST CREW J. Hill	TEST CREW	TEST CREW
COPILOT R. WENTLING	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT 9,763.0 LBS

CENTER OF GRAVITY 28.85 %MAC

FUEL LOADING ~~L.H~~ MAINS 1031.8 LBS

~~R.H~~ OUTERS 201.0 LBS

~~FUS~~ TIPS 1,206.0 LBS

TEST ITEMS

NATURAL ICING TESTS

⊳ SEE ATTACHED TEST PLAN

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

REMARKS

LIMITATIONS

FUEL AT LANDING: ________ LBS

TEST CONDITION																												
Engine																												
Gear																												
Flap																												
Airspeed (KIAS)																												
Altitude (FT)																												
TEST ITEM																												
Cond No																												

Raw Data Sheet

Pro. No.

Aircraft Type MU-2B-20(F)
S.N. 183
Reg. No. N967MA
Date

FAA Flt. No.
T.O.
Land
T.T.

Surface Cond:
H_p OAT
Wind
Pilot

1. FLY IN ICING CONDITIONS: (~~RECORD TEMP. AN ICE BUIL~~ UP RATES, TOTAL TIME IN ICE.
 a. HOLD AT LEAST 45 MINS. VARY SPEED FROM MAX
 b. CRUISE TO ≤ 140K (GEAR + FLAPS UP)
 c. TURN ON ALL ANTI-ICING EQUIPMENT.
 d. ACTIVATE BOOTS AT 1/4" to 1/2" ICE.
 e. ACTIVATE WINDSHIELD DE-ICE AT ≈ 1/4" ICE.

2. PHOTOGRAPH (FROM INSIDE A/C):
 a. WINDSHIELD DE-ICE CYCLE.
 b. BOOT DE-ICE CYCLE.
 c. ICE BUILD UP ON UNPROTECTED AREAS:
 TIP TANK + FILLET
 UNDERSIDE OF WING AT BOOT/WING JUNCTION
 HORIZONTAL STABILIZER BOOT + TIP
 ENGINE OIL COOLER INLET

3. EXIT FROM ICE CLOUD. HOLD IN CLEAR FOR CHASE.
 a. PHOTOGRAPHS FROM CHASE:
 UPPER SURFACE OF WING + TAIL (HORIZ + VERT)
 UNDERNEATH SIDE OF A/C (FROM FWD + BELOW)

 B. AT AIRSPEEDS FROM MINIMUM TO MAXIMUM
 CHECK STABILITY, LATERAL, DIRECTIONAL + LONGITUDIN.
 NOTE: PERIOD, DAMPING, DIVERGENCE + FORCE GRADIENT
 NOTE SPOILER EFFECTIVENESS (PARTICULARLY AT 110-12

 C. CHECK CONTROLLABILITY AND STALL WNG MARGINS
 CLEAN - A/S AT WNG - OTHER BUFFETT.
 APPROACH (20° + GEAR DOWN)
 LANDING CONFIG: (40° + GEAR DOWN)

NOTE STABILITY AT SLOWER SPEEDS

4. IF ICE STILL ON - LAND SOFTLY FOR GROUND PICTURES.

WEIGHT & BALANCE

CENTER OF GRAVITY

$$\frac{158.45 - 154.3}{60.6} \times 100 + 22.0 = 28.9$$

MODEL: MU-2B-20   DATE OF W & B: 2-9-84

AIRCRAFT SN: 123   AIRCRAFT "N": 967MA

FLIGHT NO.: SSR-20-030 (Initial) (C of A) (R & D) (Prod)

NOTE. SEE P.O.M. -SECTION VIII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	6,624.2	158.9	1,052,844.3	
1st Row (P) Meyers	190.0	97.2	18,468.0	
1st Row (CP) Wentling	170.0	97.2	16,524.0	
2nd ROW		133.9		
2nd ROW		133.9		
COUCH Hill	190.0	183.5	34,865.0	
CABIN BAGGAGE COMPT	150.0	204.7	30,705.0	
BAGGAGE COMPT. **		230.7		
AFT BAGGAGE COMPT. **		246.0		
ZERO FUEL WEIGHT	7,324.2	157.48	1,153,406.3	27.25 %MAC
Main Tank — lb/gal Gal	1,031.8	167.3	172,620.14	W/800lbs ______ %M
Outer Tanks / Gal	201.0	163.8	32,923.8	GWT W/800# ______
Tip Tanks / Gal	1,206.0	155.9	188,015.4	
TOTAL FUEL O/B Gal		XXXXXX	XXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	8,356.0	158.69	1,326,026.44	29.25 %MAC
GWT MAINS/OUTERS (ONLY)	8,557.0	158.81	1,358,950.24	29.44 %MAC
GWT MAINS/OUTERS/TIPS	9,763.0	158.45	1,546,965.64	28.85 %MAC

*Includes oil and unuseable fluids   ** Location of Ballast When Installed

Prepared By: T. Hill   Date Prepared: 2-9-84

PILOT: G. Meyers   CO-PILOT: R Wentling

FLIGHT TEST (Additional Crew Members): T. Hill 2.________

3.________ 4.________ 5.________ 6.________

DATE OF FLIGHT: 2-9-84   Q.C. (Stamp & Initials): [illegible] /________

Raw Data Sheet

Pro. No.

Aircraft Type MU-2B-20 (F)
S.N. 183
Reg. No. N 967MA
Date

FAA Flt. No.
T.O.
Land
T.T.

Surface Cond:
H_p OAT
Wind
Pilot

1. FLY IN ICING CONDITIONS: (RECORD TEMP. ... UP RATES, TOTAL TIME IN ...

a. HOLD AT LEAST 45 MINS. VARY SPEED FROM MAX. CRUISE TO ≤ 140K (GEAR + FLAPS UP).
b.
c. TURN ON ALL ANTI-ICING EQUIPMENT.
d. ACTIVATE BOOTS AT 1/4" to 1/2" ICE.
e. ACTIVATE WINDSHIELD DE-ICE AT ≈ 1/4" ICE.

2. PHOTOGRAPH (FROM INSIDE A/C):
   a. WINDSHIELD DE-ICE CYCLE.
   b. BOOT DE-ICE CYCLE.
   c. ICE BUILD UP ON UNPROTECTED AREAS:
      TIP TANK + FILLET
      UNDERSIDE OF WING AT BOOT/WING JUNCTION
      HORIZONTAL STABILIZER BOOT + TIP
      ENGINE OIL COOLER INLET

3. EXIT FROM ICE CLOUD. HOLD IN CLEAR FOR CHASE.
   a. PHOTOGRAPHS FROM CHASE:
      UPPER SURFACE OF WING + TAIL (HORIZ + VERT)
      UNDERNEATH SIDE OF A/C (FROM FWD + BELOW)

   B. AT AIRSPEEDS FROM MINIMUM TO MAXIMUM
      CHECK STABILITY, LATERAL, DIRECTIONAL + LONGITUDINA.
      NOTE: PERIOD, DAMPING, DIVERGENCE + FORCE GRADIENT
      NOTE SPOILER EFFECTIVENESS (PARTICULARLY AT 110-120.

   C. CHECK CONTROLLABILITY AND STALL WNG MARGINS.
      ... STABILITY / CLEAN - A/S AT WNG - OTHER BUFFETT.
      ... LOWER / APPROACH (20° + GEAR DOWN)
      ...
      LANDING CONFIG: (40° + GEAR DOWN)

4. IF ICE STILL ON - LAND SOFTLY FOR GROUND PICTURES.

[illegible] KC Z KC 3.1

No.	Time	HDG	Hp	OAT	Q	RPM	EGT	[illegible]	Toil	IAS	[illegible]
1	IN [illegible]	105	6700	0	31/30	97/97	[illegible]00/7[illegible]0	[illegible]	[illegible]/72	162	[illegible]
2	1750	[illegible]	7100	-1	30/30	97/97	[illegible]	[illegible]	[illegible]/72	140	[illegible]
3	[illegible]	285	7000	-1	37/35	[illegible]/97	430/420	230/230	80/75	155	[illegible]
4	1755	[illegible]	7500	-2	38/38	97/97	[illegible]/480	[illegible]	70/75	160	[illegible]
5	[illegible]	[illegible]	7500	-2	36/36	[illegible]	400/[illegible]	[illegible]/235	70/80	140	[illegible]
6	[illegible]	[illegible] → Climb Out									[illegible] 4'[illegible]
7	OUT [illegible] → ON TOP				Note: θ = 10~12°						
8	1710										

STABILITY — 140 Kts TRIM

11220 -5 30/30 99/99 470/920 210/[illegible] 80/80

1745

PUSH 160 6 lbs push Return → 146

PULL 130 6 lbs pull

→ 120 3~10 pull Return → 142

Left side slip — Rt Rudder
[illegible] slip → positive

Spiral stab — Good

Stall warning — TRIM [illegible]

[illegible] ON →

Clean $V_{[illegible]}$ ~ 100 } Good
V_{SKR} ~ 90
V_{STALL} — 85 STK FULL AFT

Spoiler eff: 120 Kts Good
100 Kts Good roll [illegible]

Spiral STAB → [illegible] PWR
TRIM — 125 Kts
110 Kts ~ 4 lbs pull
150 Kts ~ 6 lbs push

STABILITY Appr Config Gear dwn δ_F 20° — 9400' hp
TRIM for 3° slide @ 130 Kts
Side slip — rudder return positive lateral positive
Damping Good

FLIGHT REPORT

On February 9, 1984, Flight number SCR 20-30 was conducted from Kansas City Missouri toward Springfield Missouri. The intended purpose of the flight is oulined in the attached flight test card.

Icing conditions were encountered about 7000 to 7500 feet, 30 miles northwest of Springfield. A 10 mile long right hand holding pattern was set up at 7500 feet at airspeeds between 160 and 140 KIAS. Occasionally airspeeds of 120 to 130 were maintained to determine the effect of the ice buildup and low airspeed holding.

The ice encounter lasted 35 minutes and was terminated because the protrusions of ice on the tanks and wing fillets approached an estimated three inches. It was felt that continuation would have resulted in partial ice break off that would have resulted in a less severe condition as time progressed.

General comments about the conditions and aircraft reaction to the ice are as follows:

Prop deice, pitot heat, and lip deice were on continuously. Boots were cycled after an estimated one-quarter inch or more of ice was noted on the protected surfaces. The boots were activated three to four times during the encounter.

Each time the boots were cycled, the aircraft increased airspeed approximately 10 KIAS.

Ice built up below the wing on the rubber boot behind the inflatible sections. The ice was extremely irregular and ragged and would break off after an inch or inch and a half buildup. It was the opinion of the crew that if airspeeds would have been maintained at a higher value that this buildup would have broken off sooner. Holding airspeeds low during the encounter seemed to subject the aircraft to the worst case condition. (High deck angle, most exposed unprotected area.)

Ice buildup on the unprotected surfaces was estimated to be three inches. There was an extrememly irregular accumulation of ice on the windshield wiper that protruded approximately five inches in front of the wiper.

Windshield deice (alcohol) was effective in removing ice after the encounter using only two to three short applications

It was apparent that the weight of the aircraft was increasing significatly as indicated by the increase in airspeed after each boot activation and a small (400 fpm) rate of climb out of the ice after the termination of the test.

The oil cooler air inlets appeared to be almost completely blocked and the oil temperature remained well within limits. The oil cooler inlets cleared themselves during the encounter.

Flight Report (cont.)

Other than the feeling of increased weight, the aircraft exhibited normal handling characteristics during the hold at low airspeeds while encountering the ice build-up.

After the encounter, a climb was made to 12,000 feet to get on top of the clouds and to present the aircraft for picture taking by a chase aircraft. After the picture taking, handling qualities were investigated with most of the accumulated ice remaining on the unprotected surfaces.

At a trim airspeed of 140 KIAS, static longitudinal stability was positive, static directional stability was positive and static lateral stability was positive. Spiral stability was neutral.

Stalls were demonstrated clean power off. Airframe buffet began about 100 KIAS and the artifical stall warning began at 90 KIAS. The stick reached its full aft stop at 85 KIAS. Stall characteristcs were normal and the spoilers remained effective into the stall.

Static longitudinal stability was checked at maximum continuous power and a trim airspeed of 125 KIAS. It remained positive.

In the approach configuration at 120 KIAS with power to maintain a three degree glide slope lateral and directional stability remained positive.

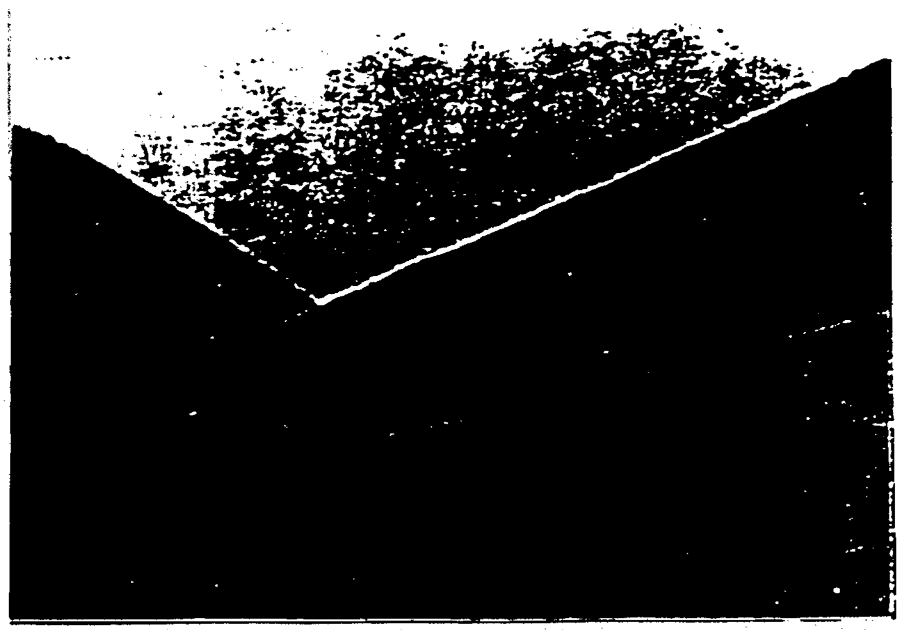
Photographs were taken from the cabin of the test aircraft to record the ice accumulations.

There were no unusual characteristics exhibited during or after the encounter and the aircraft deice/anti-ice systems performed their intended function.

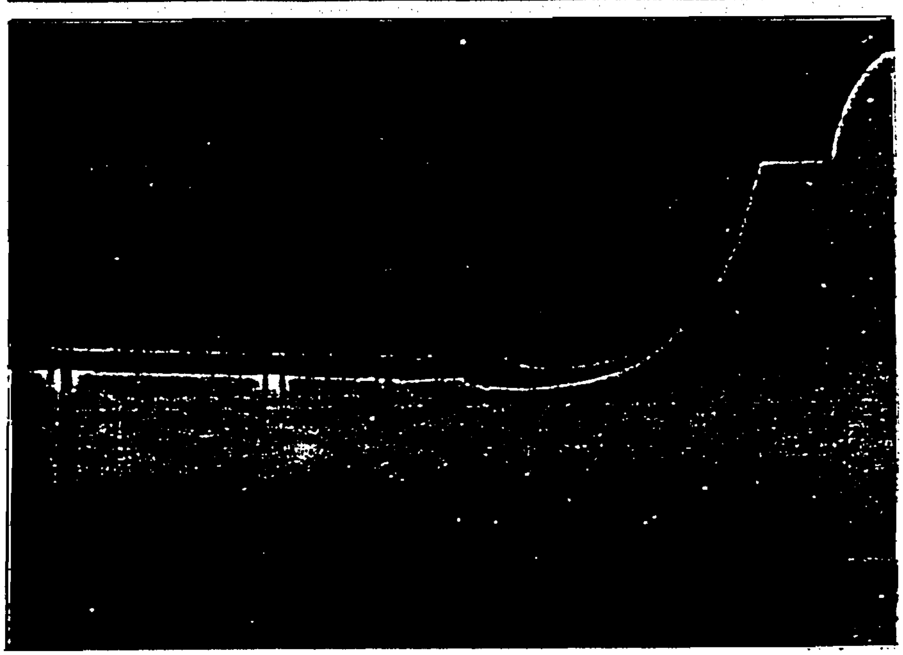
George H. Meyers III

George H. Meyers, III
ANM-176D

FLT No. SC2-20-30
RUN No 1
TIME 12:45



1-1



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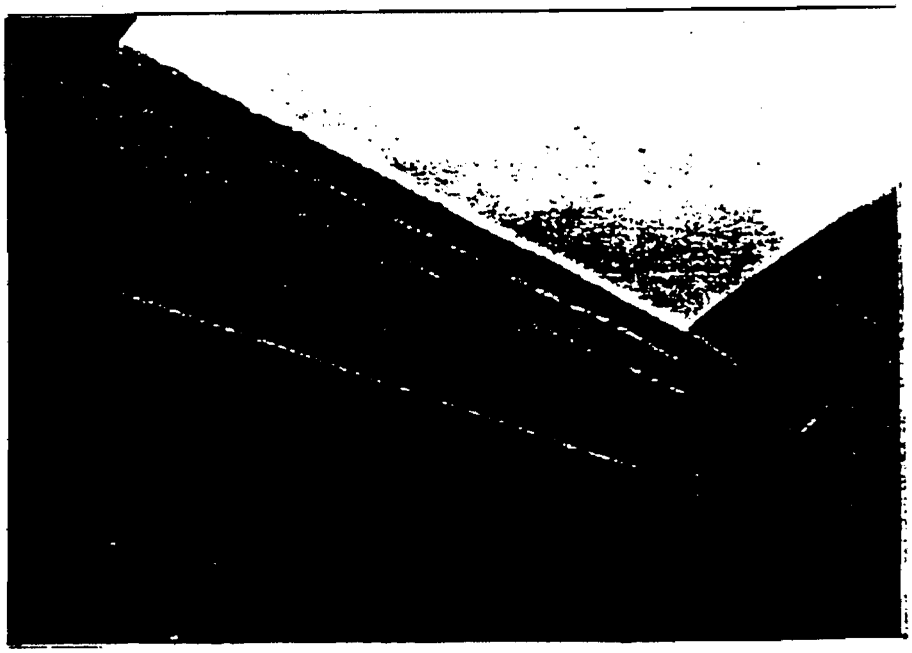
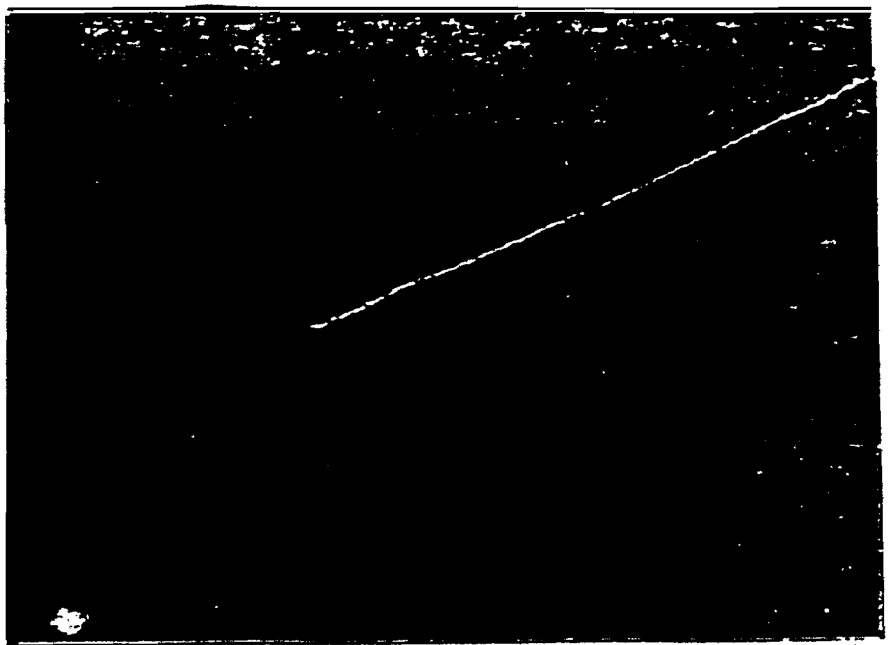


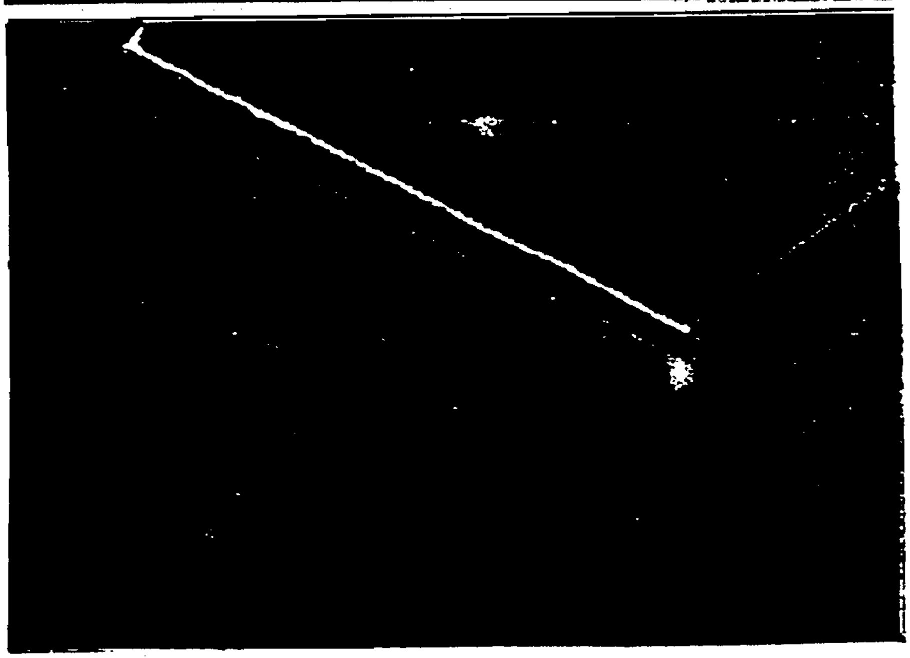
1-3

FLT No. SC2-20-30
RUN No 1
TIME 12:45



1-1

1-2



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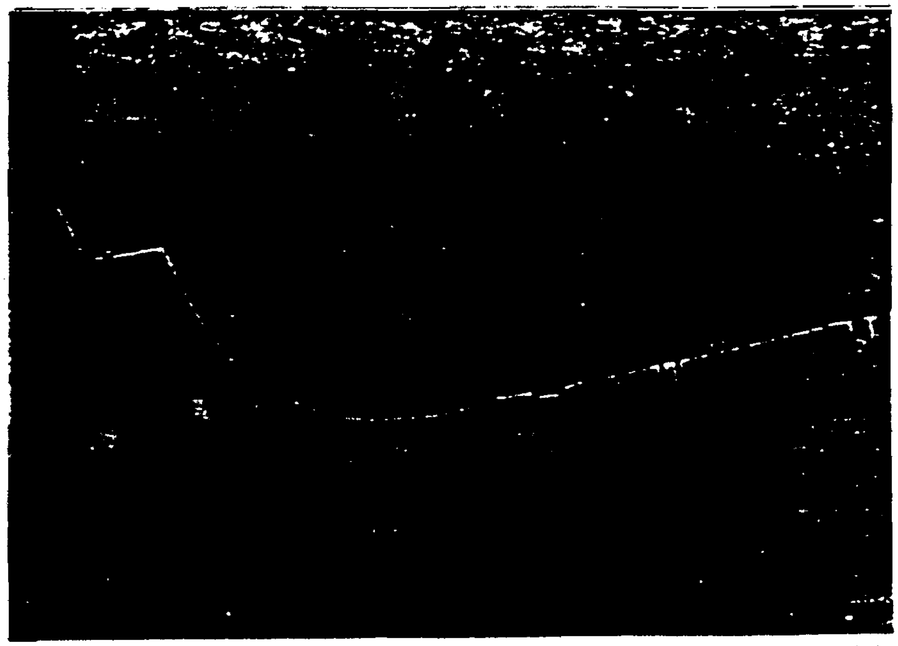
FLT No SCE-20-30
RUN No. 1
TIME 12:45



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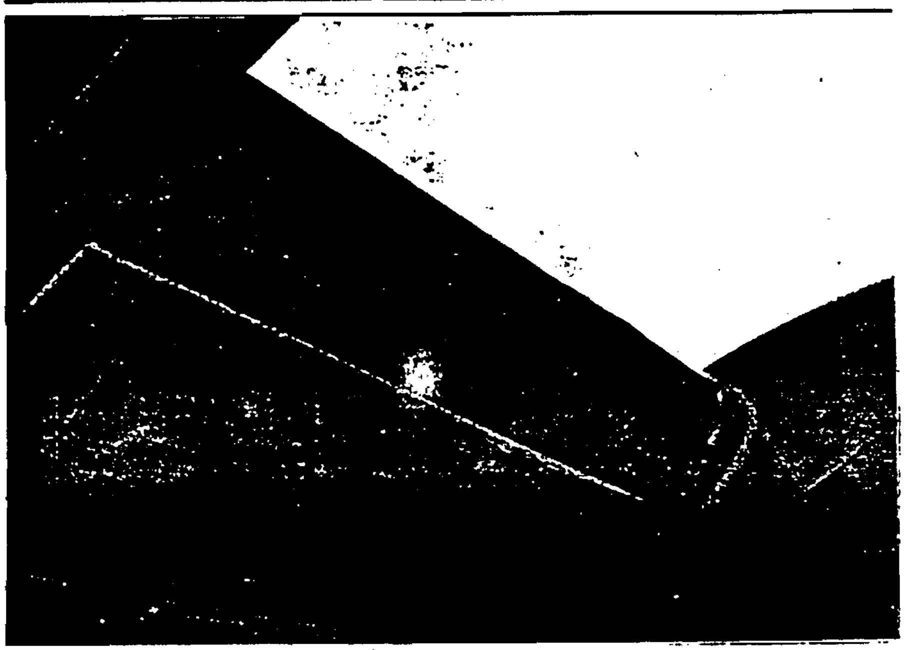

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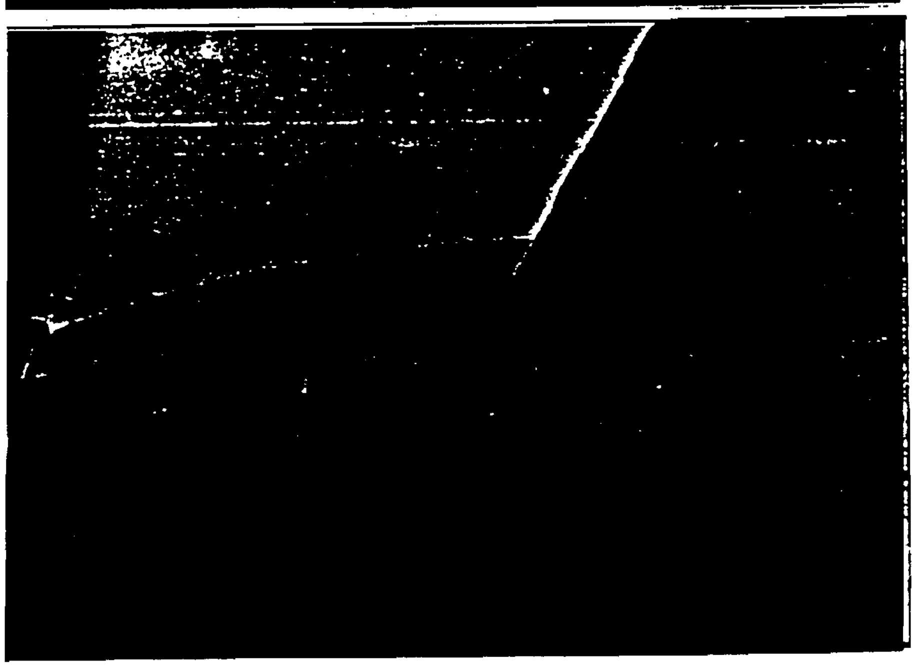
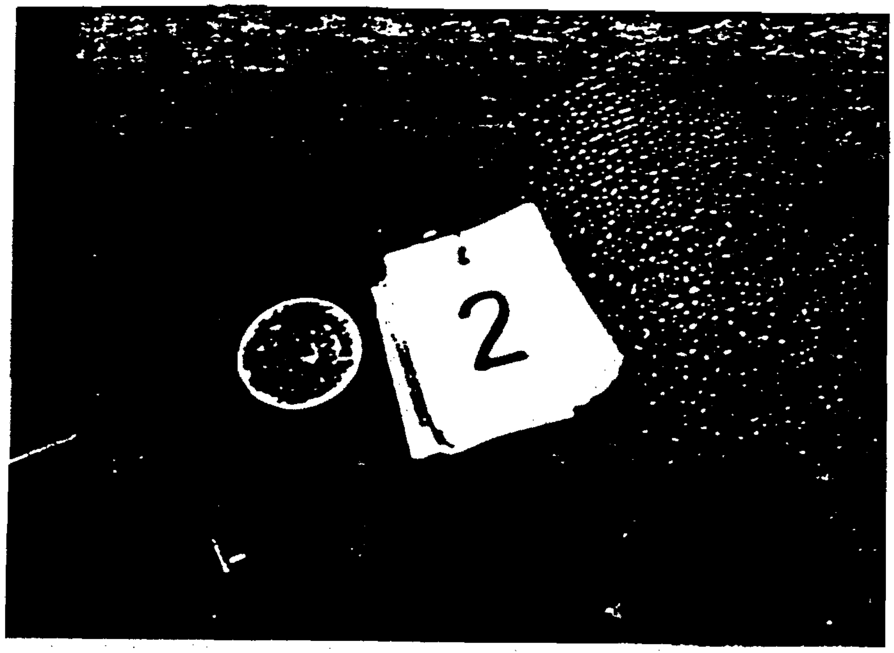


1-6

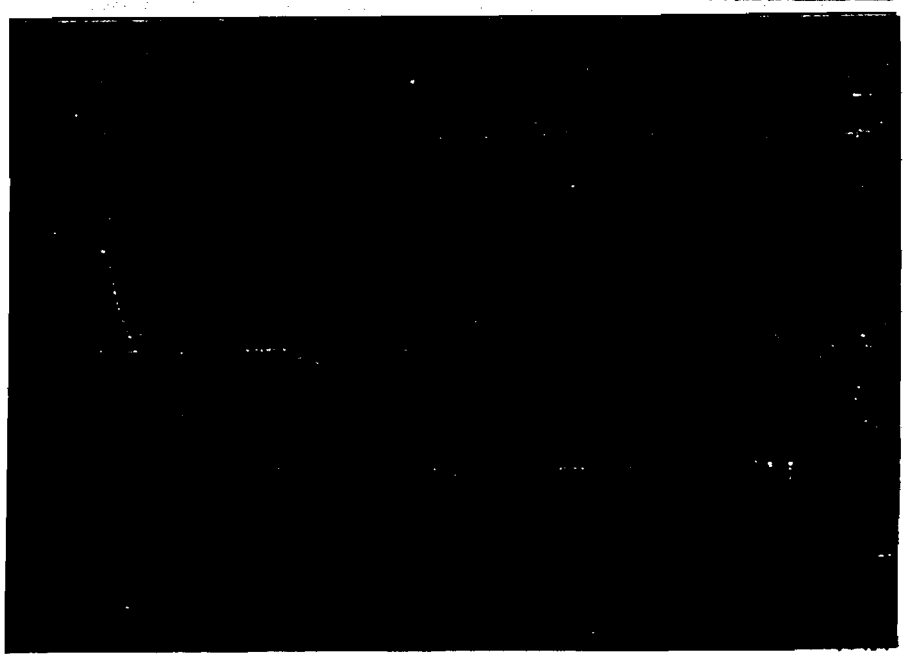
FLT No. SCR 20-30
RUN No. 2
TIME 12:50

2

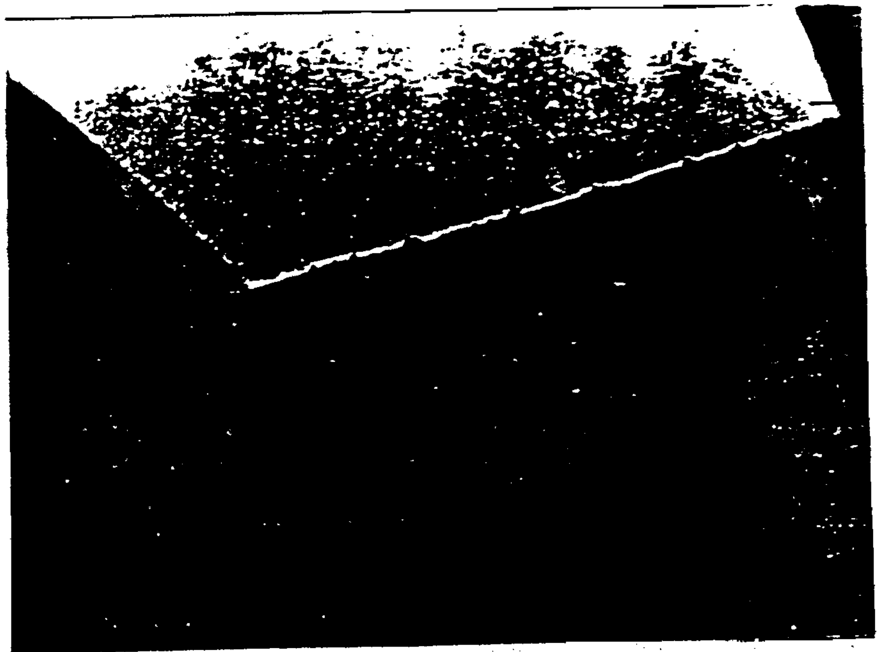


2-1

2-2



Flt No. SCR 20-30
Run No 2
Time 12.50



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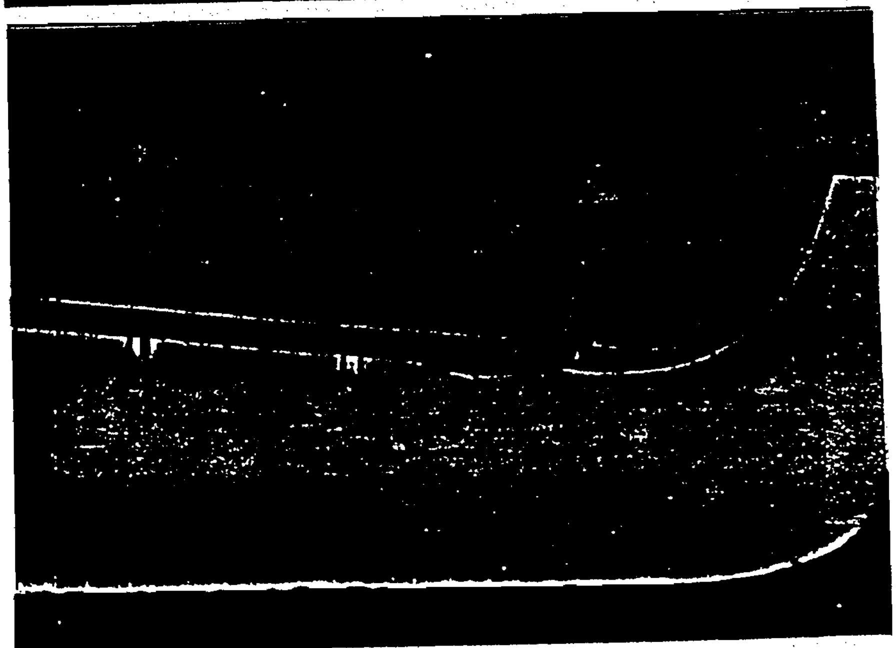
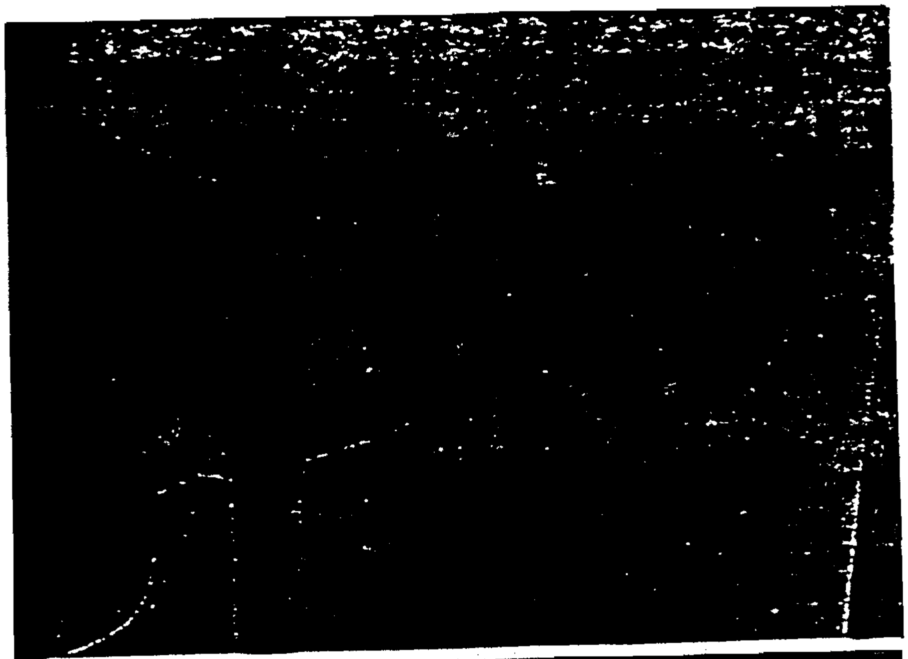


2-4

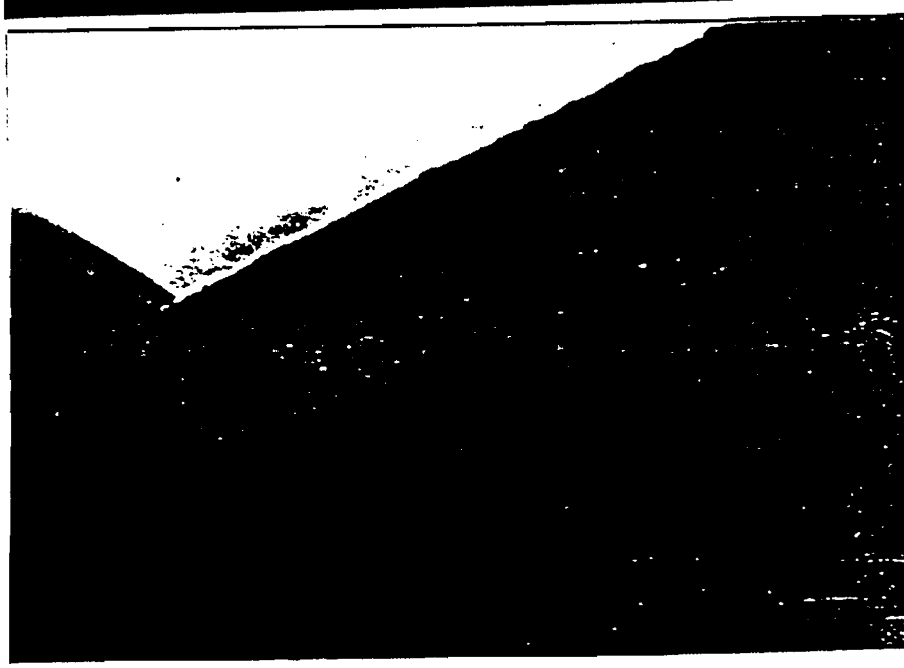
2-5

2-6



2-7

2-8



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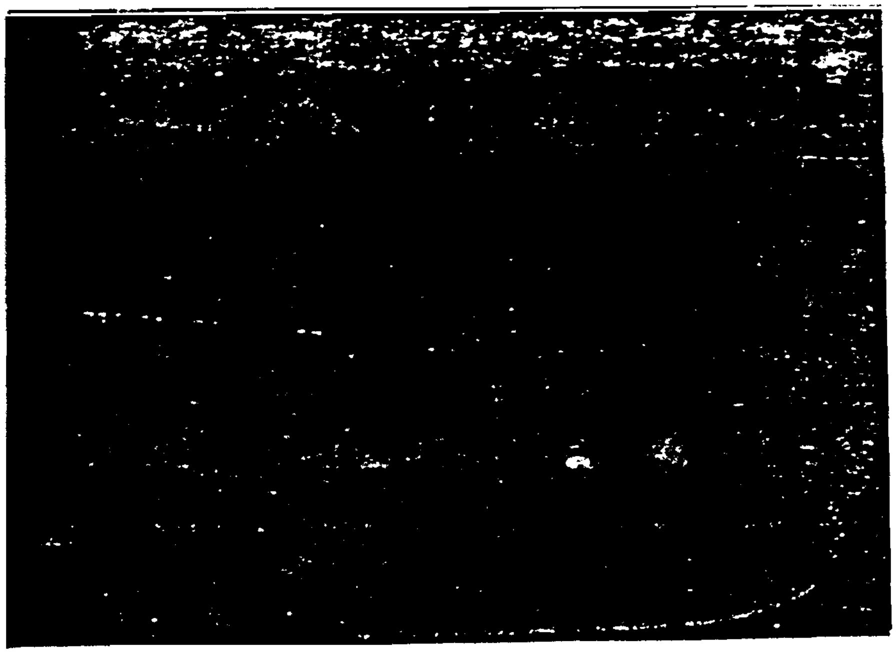
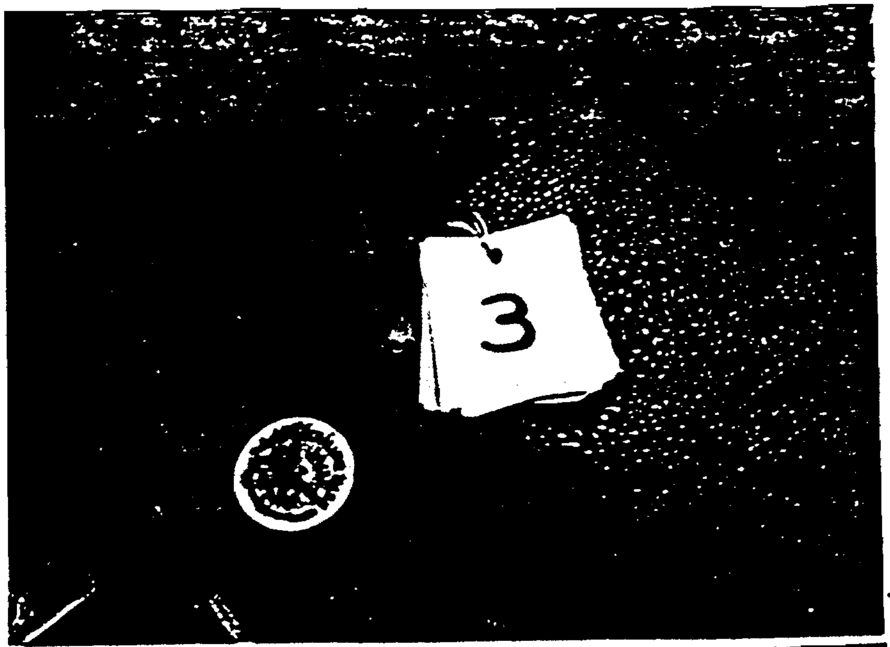


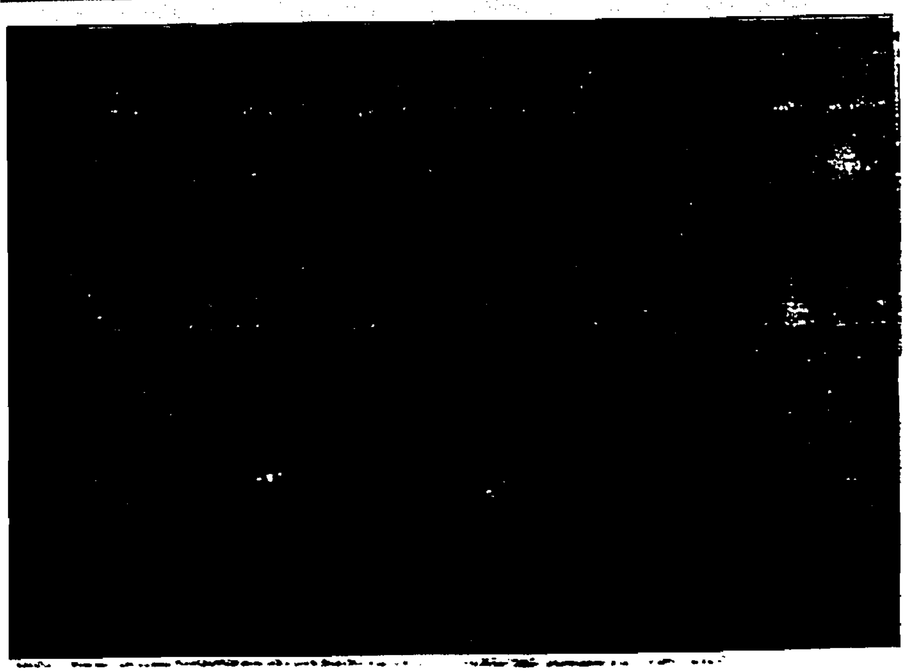
FLT No. SCR-20-30
RUN No. 3
TIME 12:55

3



3-1

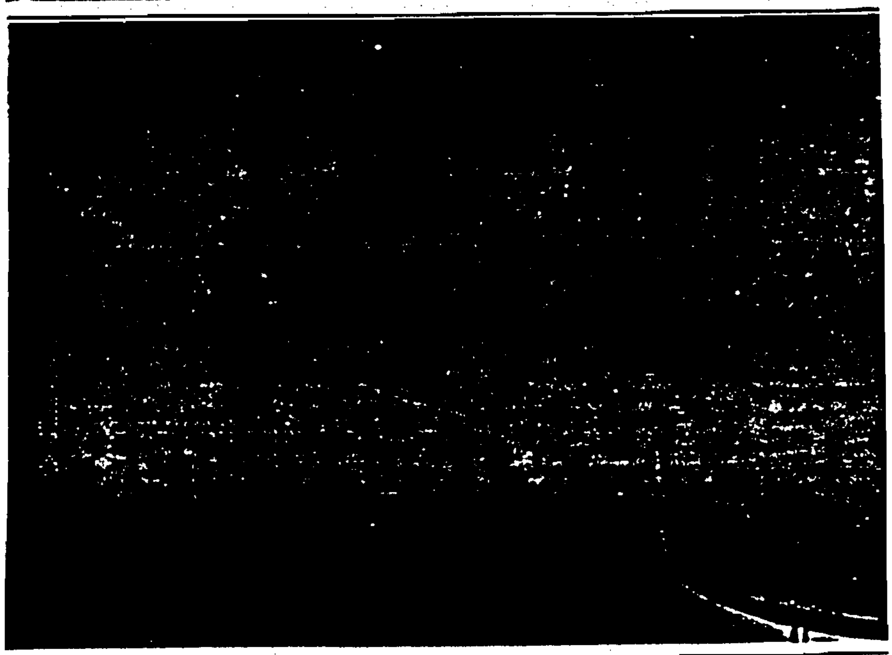
3-2



FLT No. SCR-20-30
RUN No. 3
TIME 12:55

3-3

3-4



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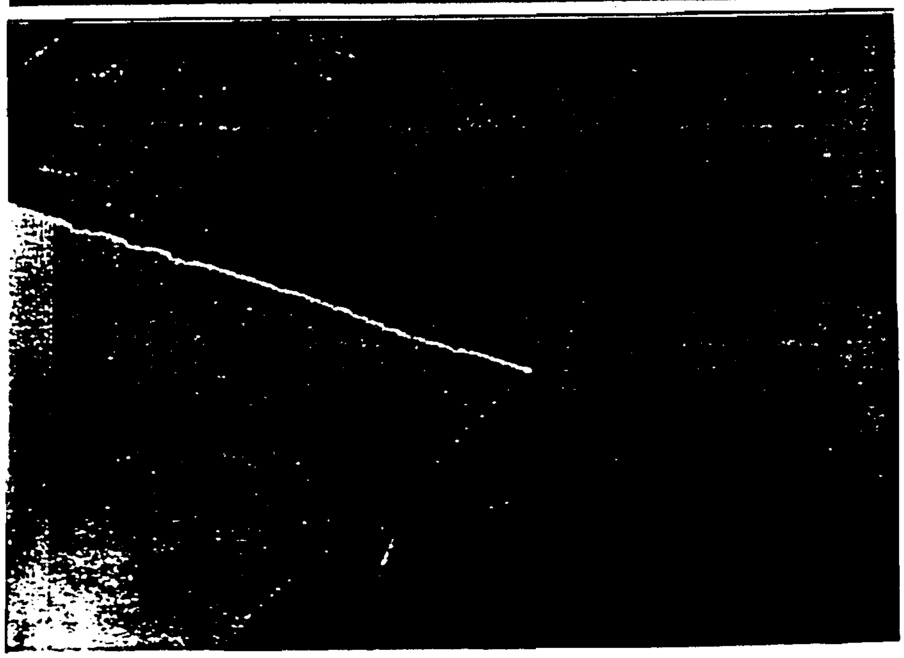
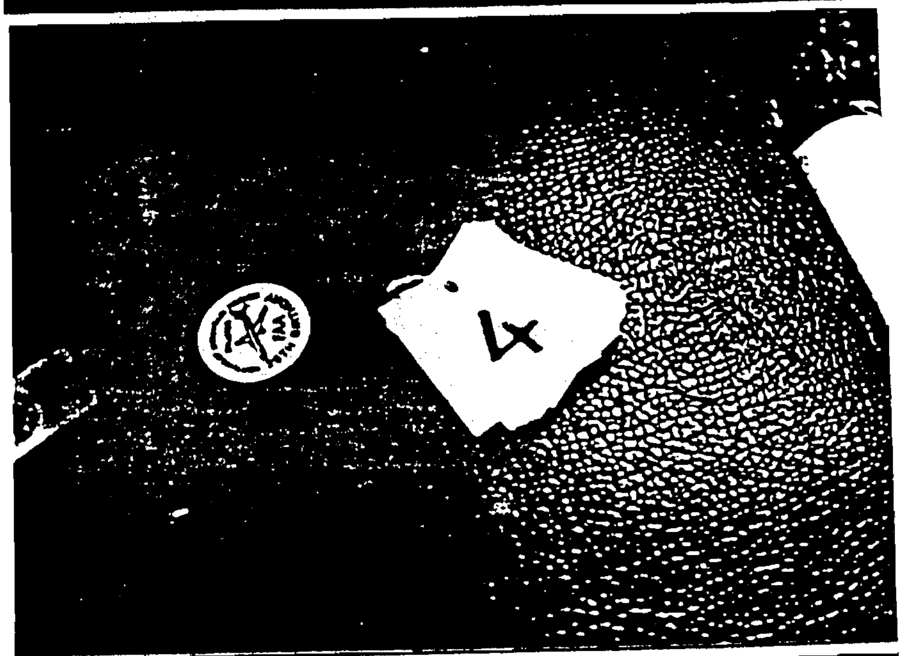


FLT No. SCR-20-30
RUN No. 3
TIME 12:55

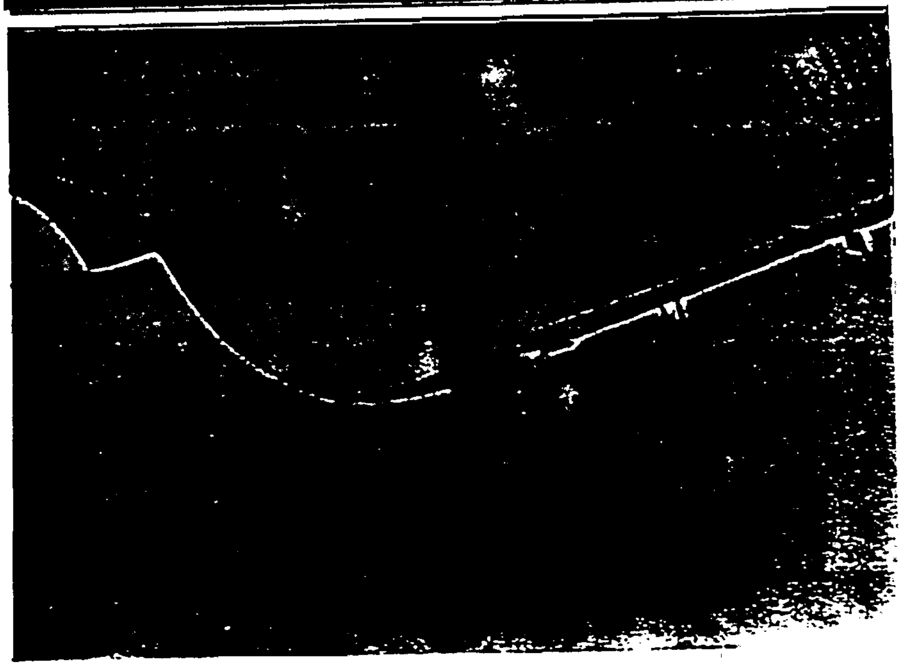
3-6

FLT No. SCR-20-30
RUN No. 4
TIME 13:05

4

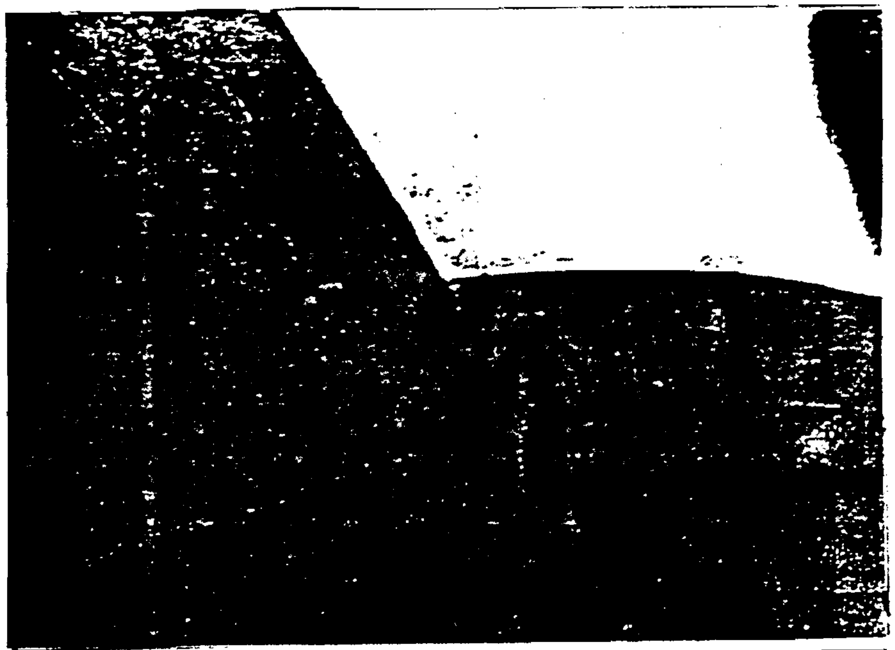


4-1



Flt No ICE-20-30
Run No. 4
Time 13 05

4-2



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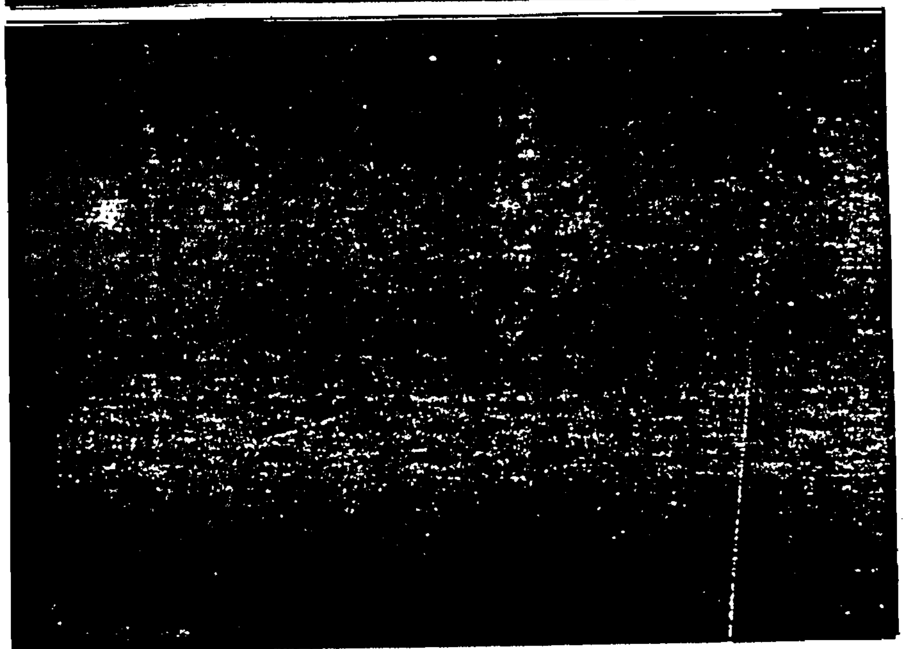

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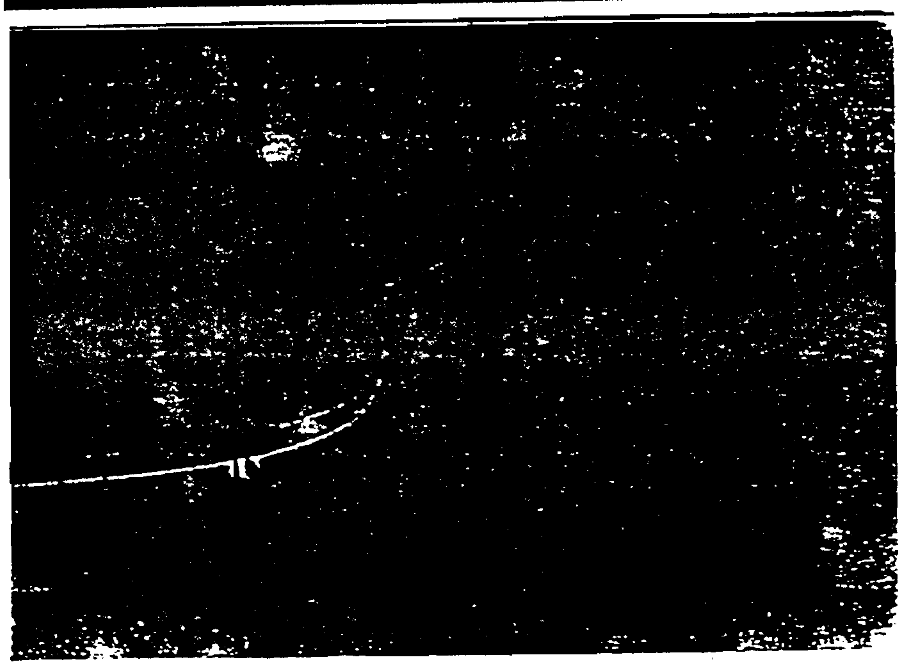
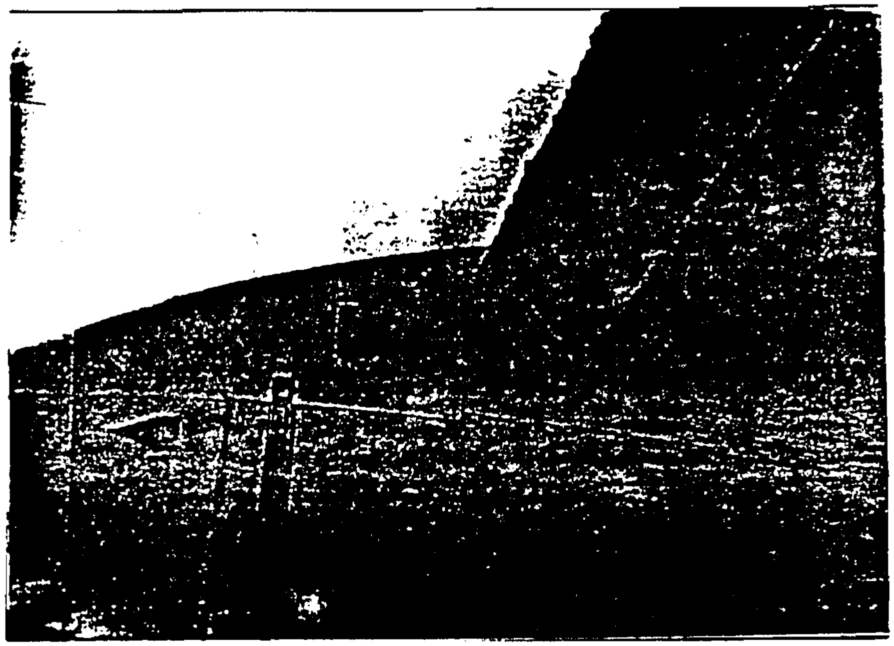


[illegible] No 552-20-30
Run No. 4
Time 13.05

4-5

4-6



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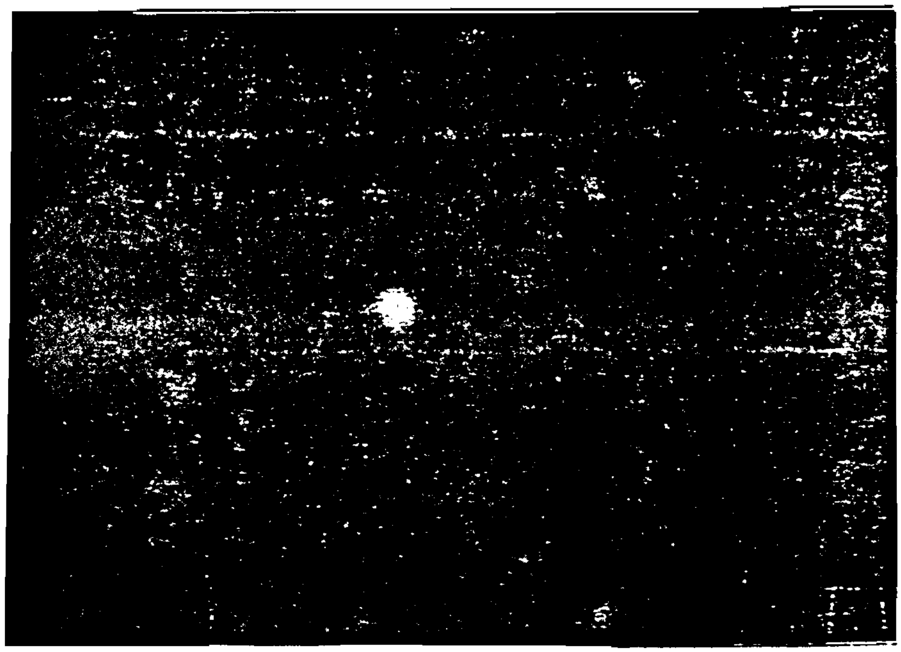
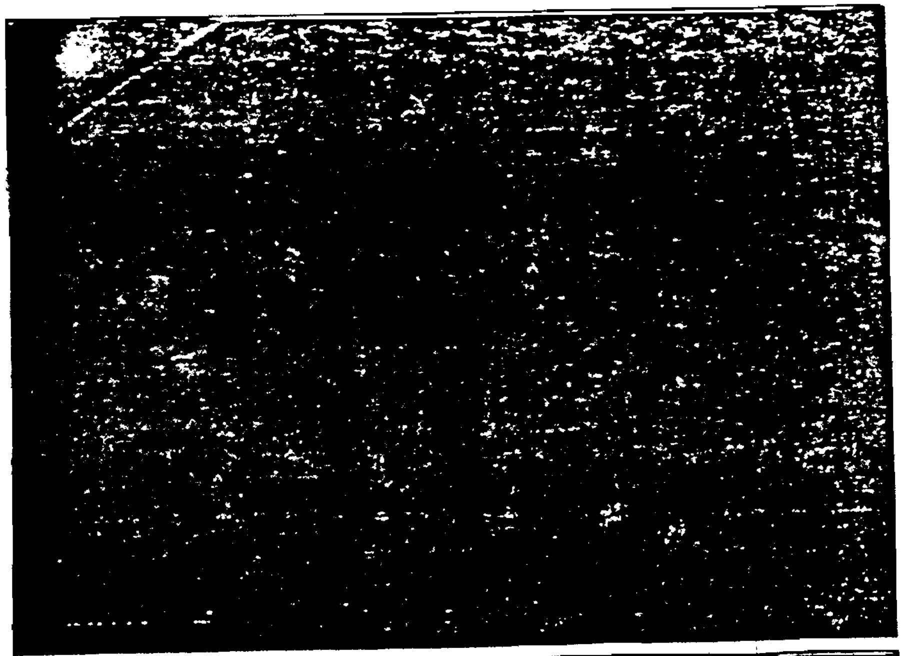
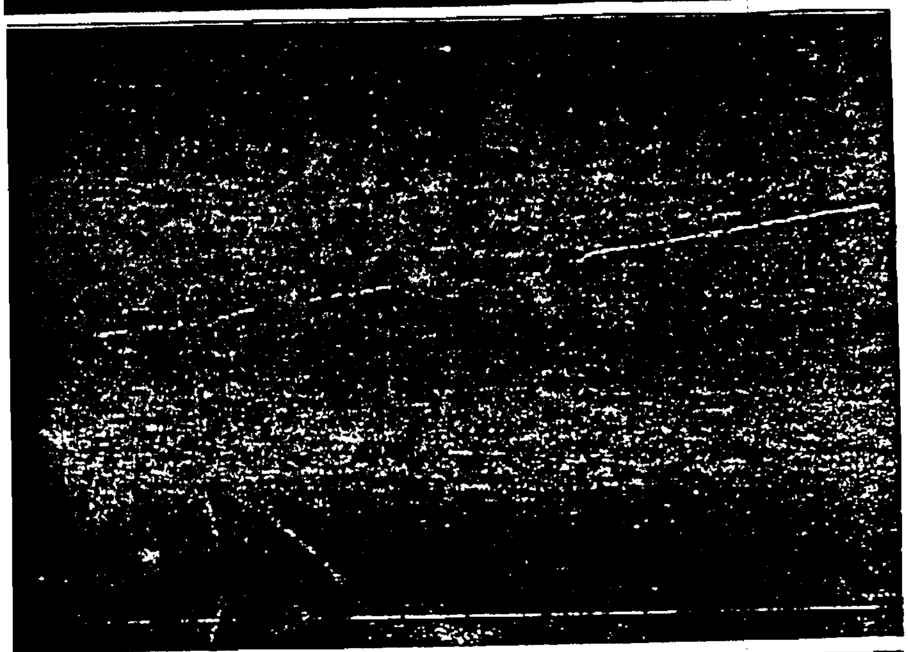


Fit No. 572 10-30
Run No. 4
Time 13:05

4-8



4-9



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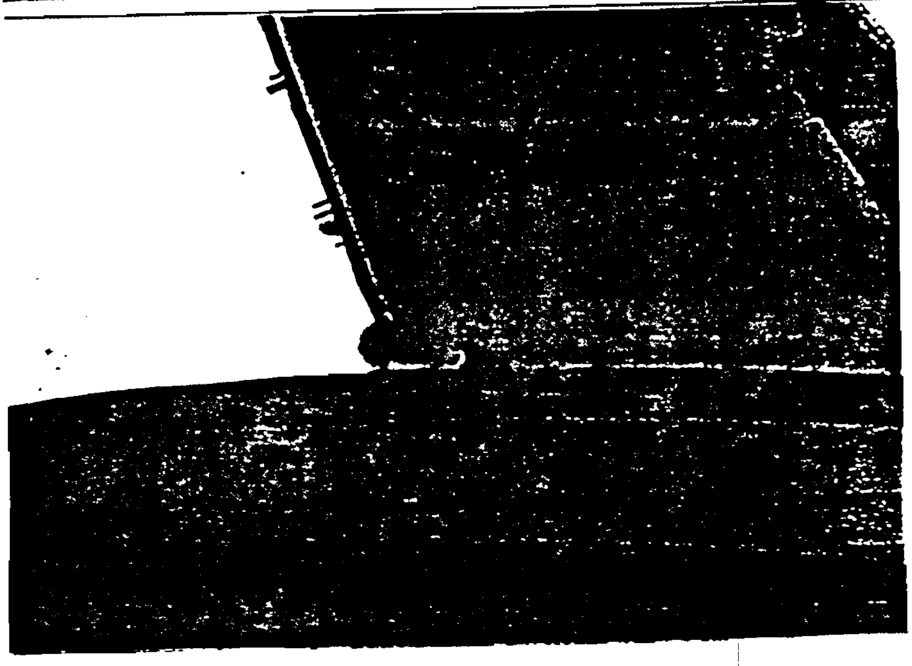
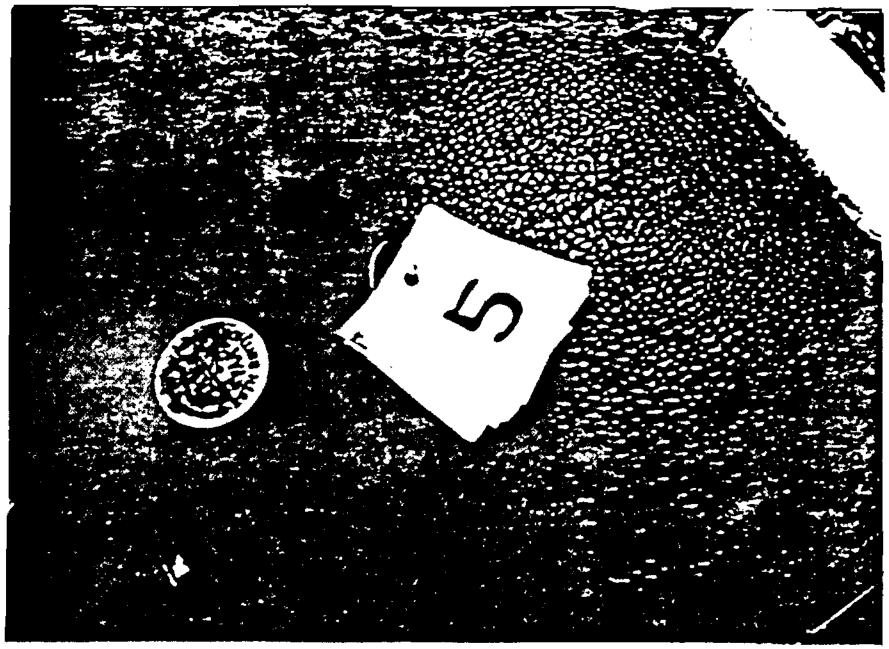
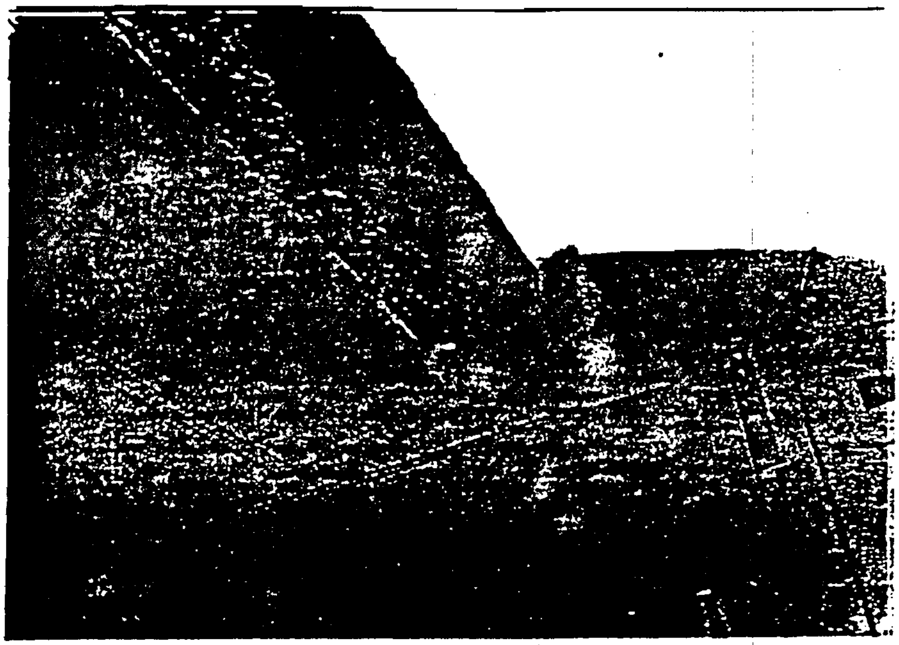


T- No 552-20-30
Run No 5
Time 1310

5



5-1



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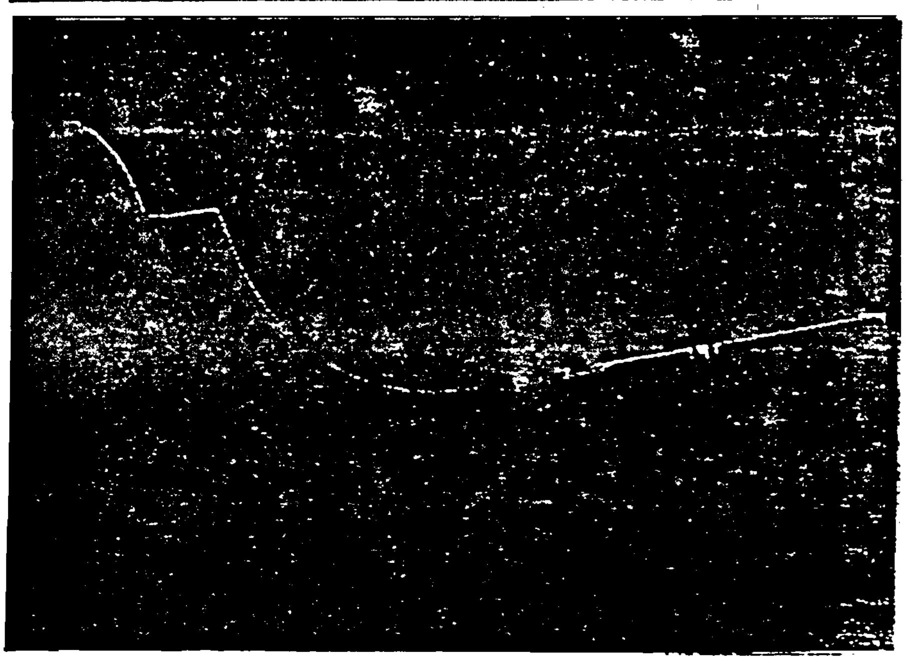
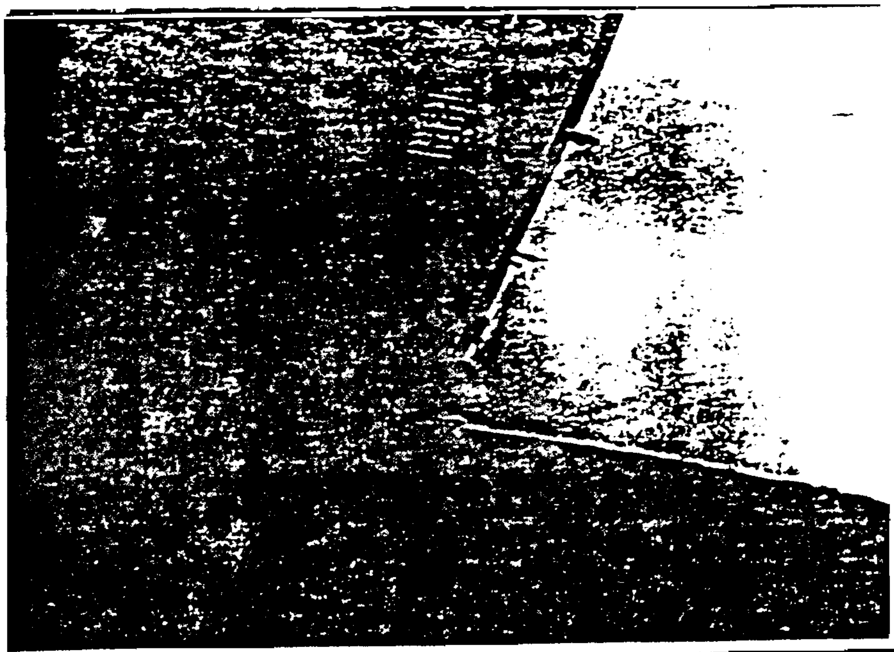


Test No SER-20-30
Run No 5
Time 13:10

5-3



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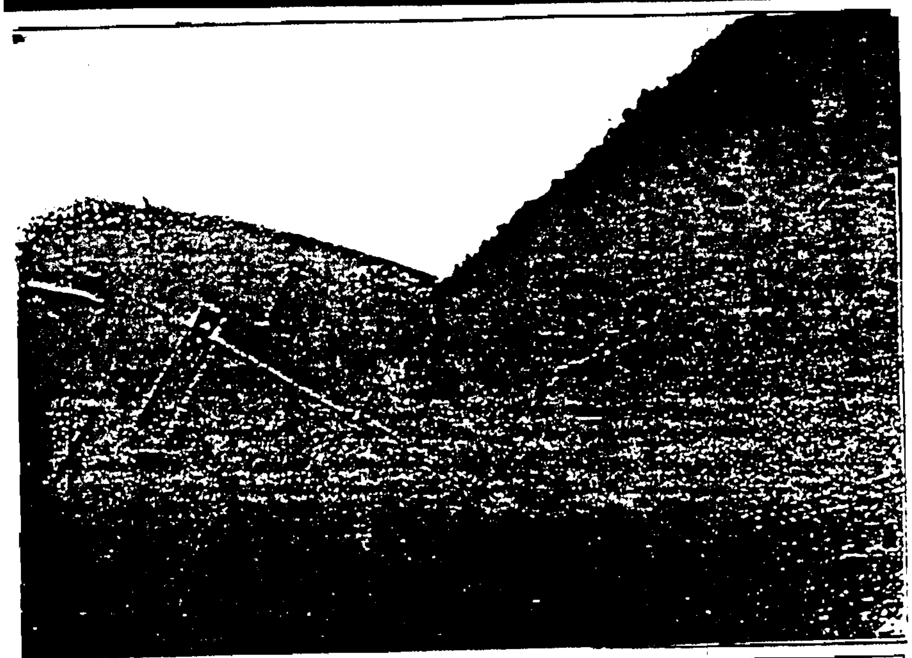

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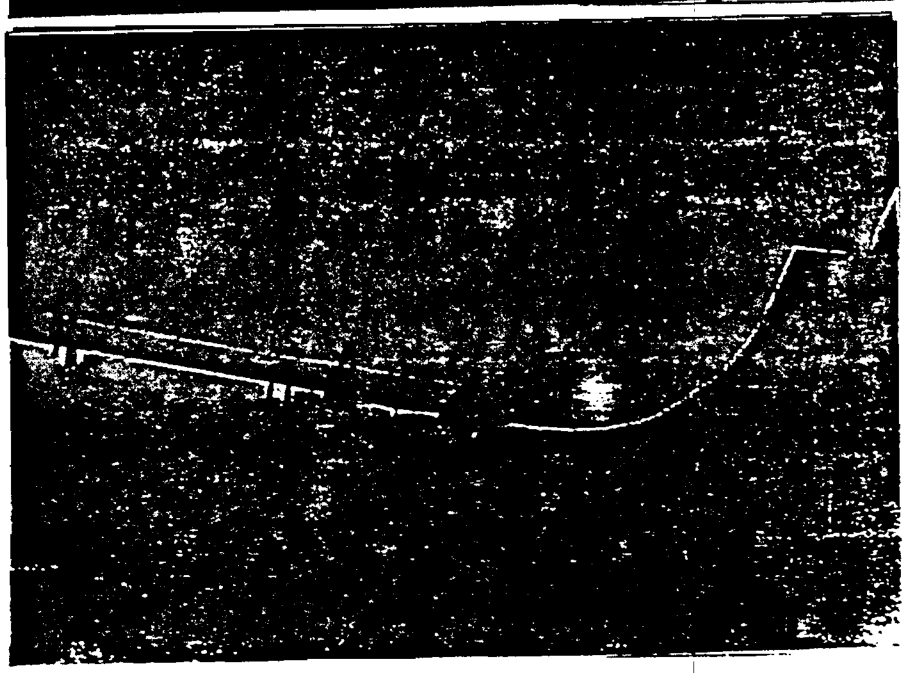
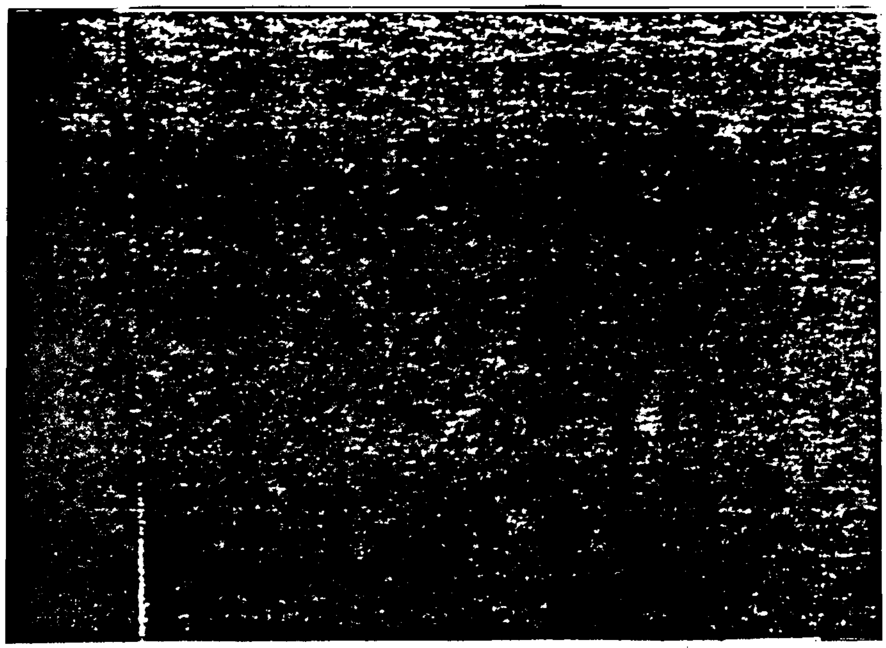


Flt No. SEE 20-30
Run No 5
Time 13:10

5-6



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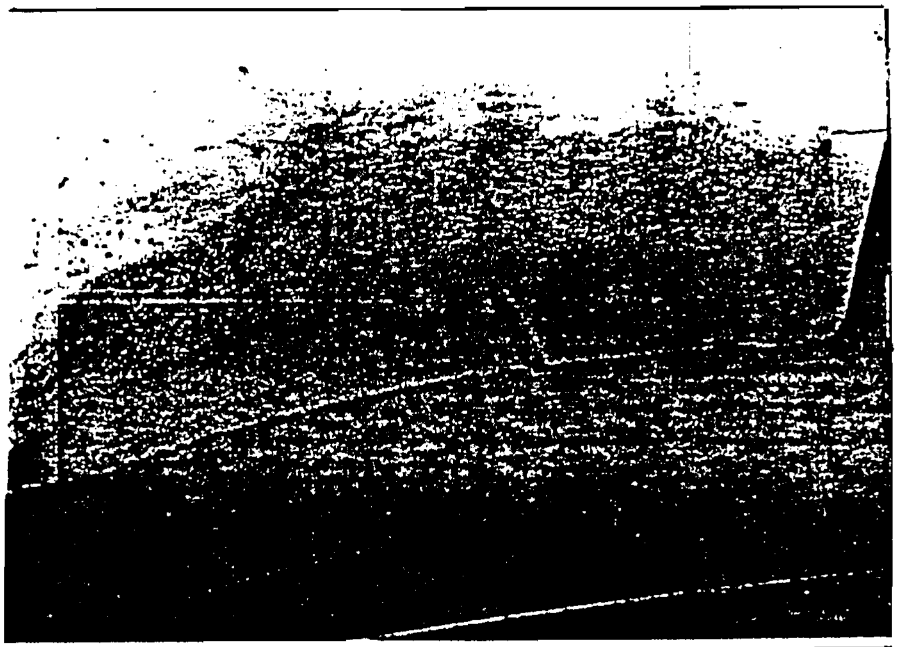
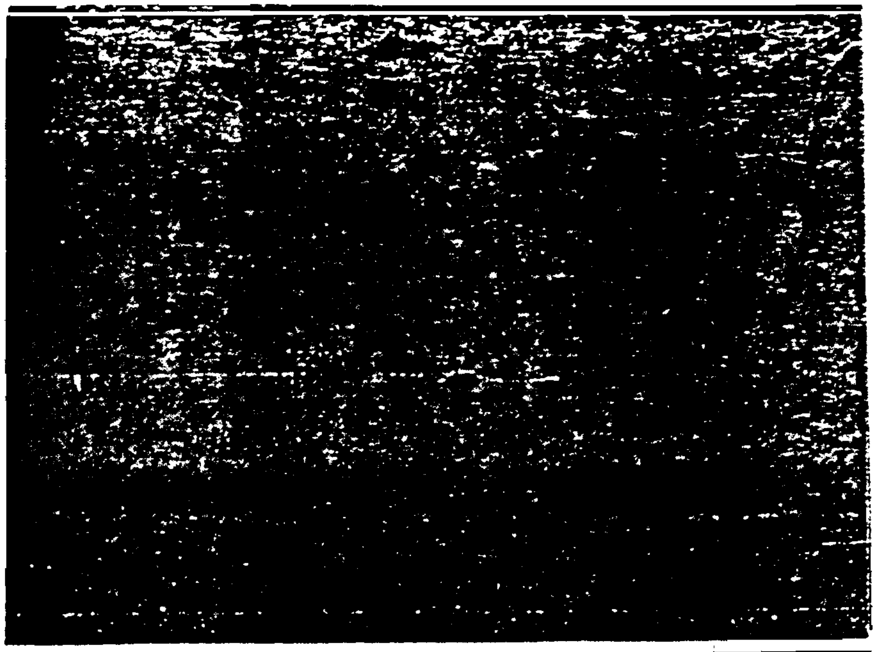


5-8

Test No 5CR-20-30
Run No 5
Time 13:10

5-9



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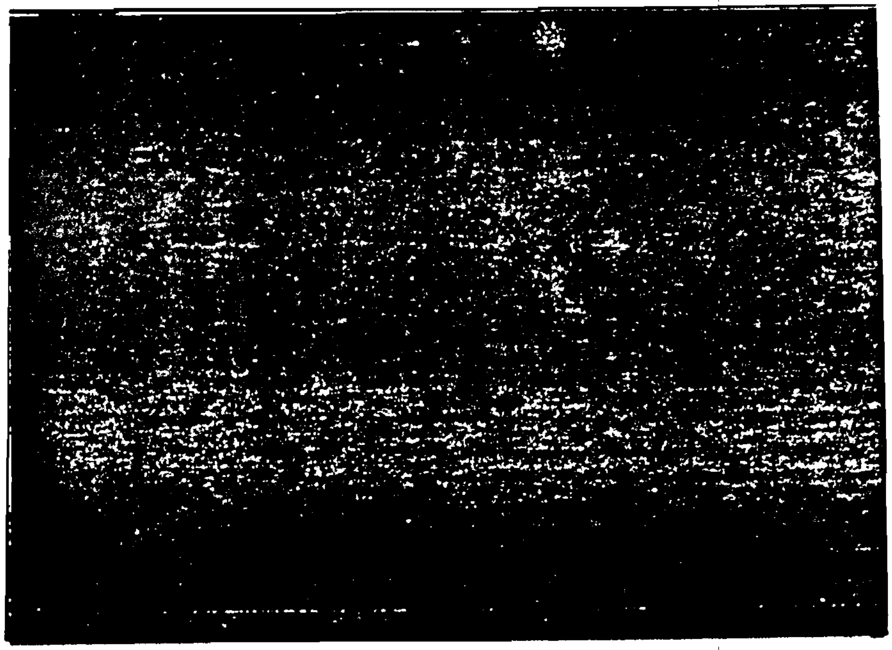

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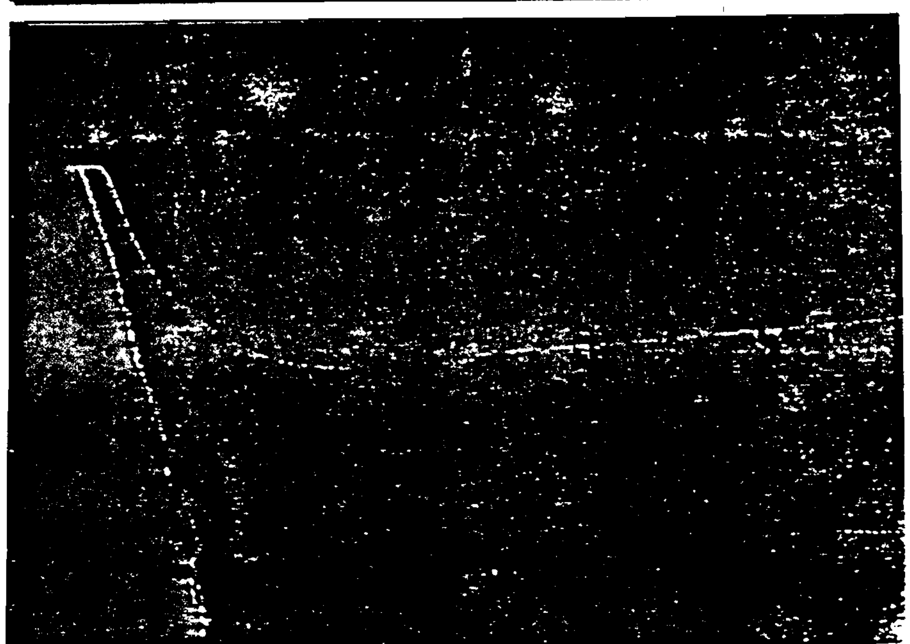
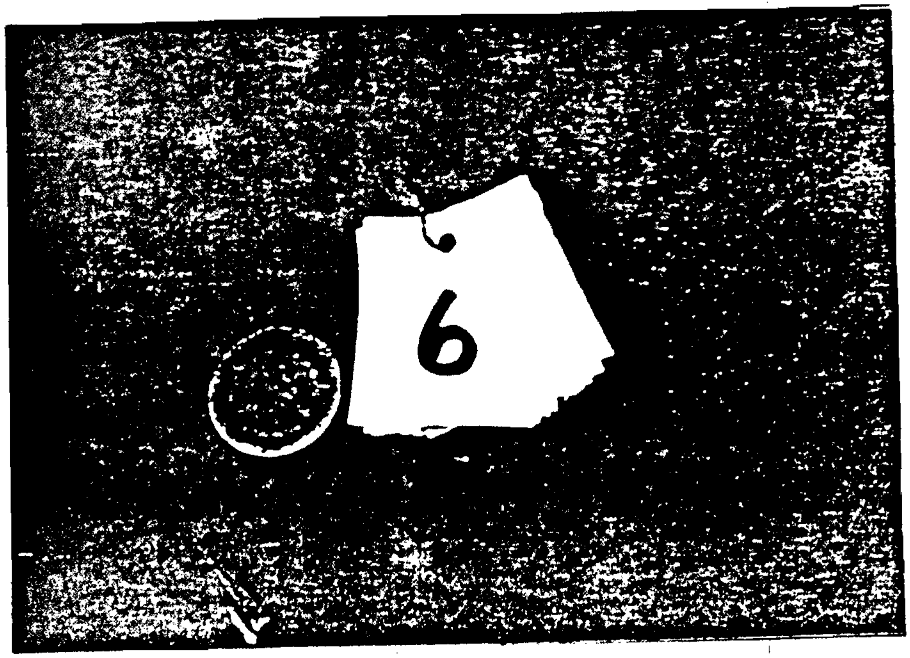


Fit No SCR-20-30
Run No 6
Time 13:20

6



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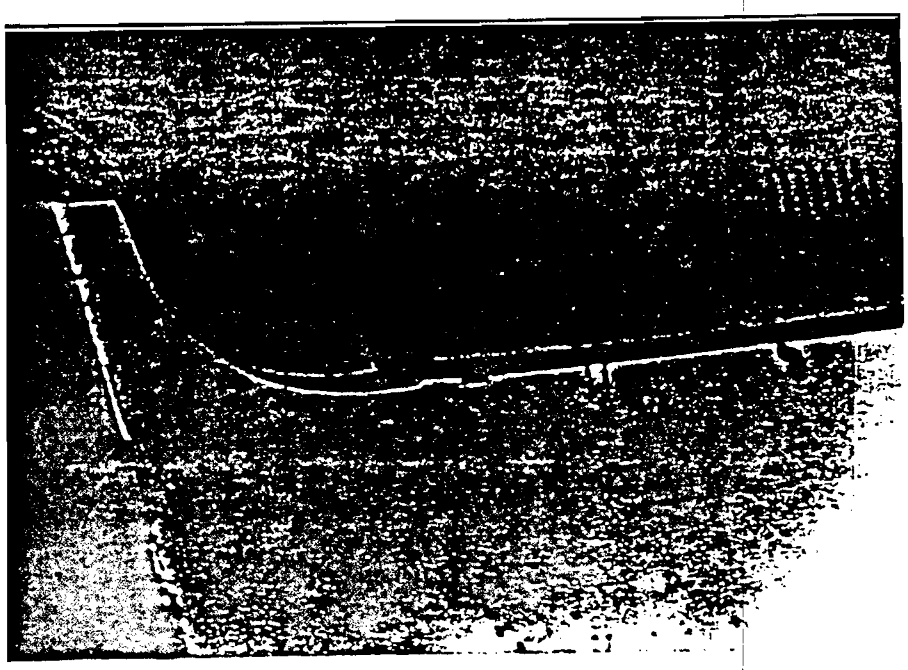
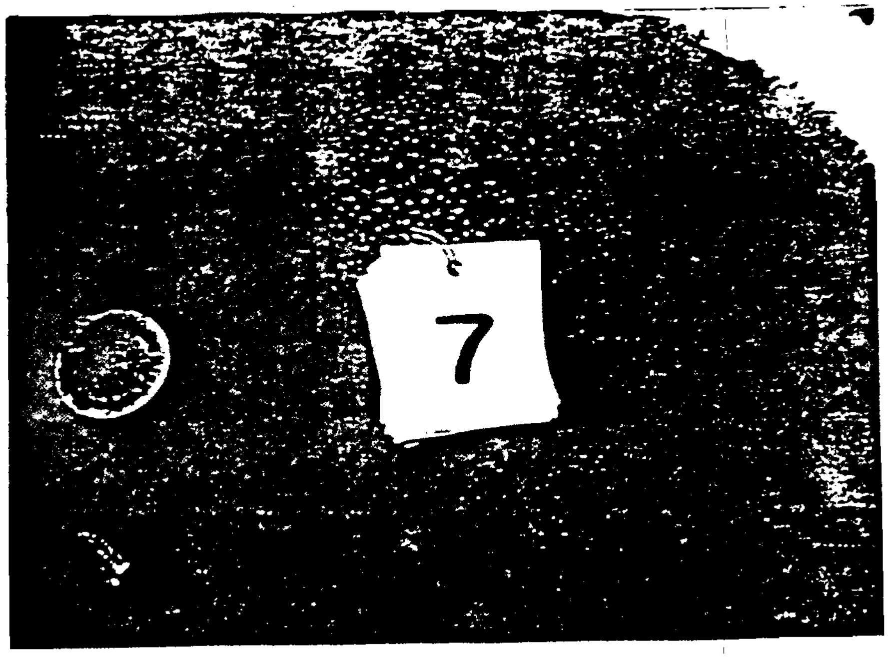
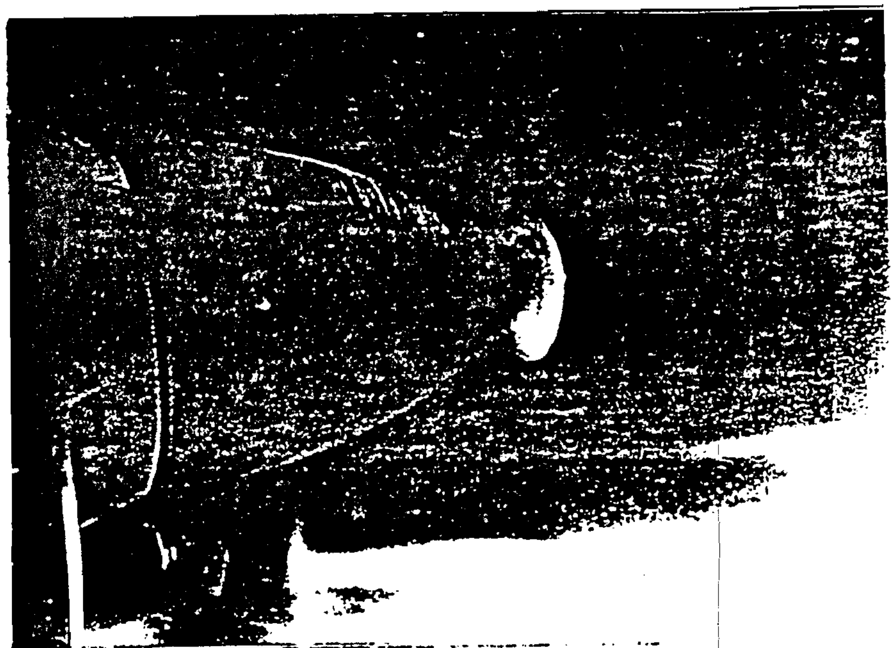


Flt No. SCR 20·30
Run No. 7
Time 13:30

7



7-1



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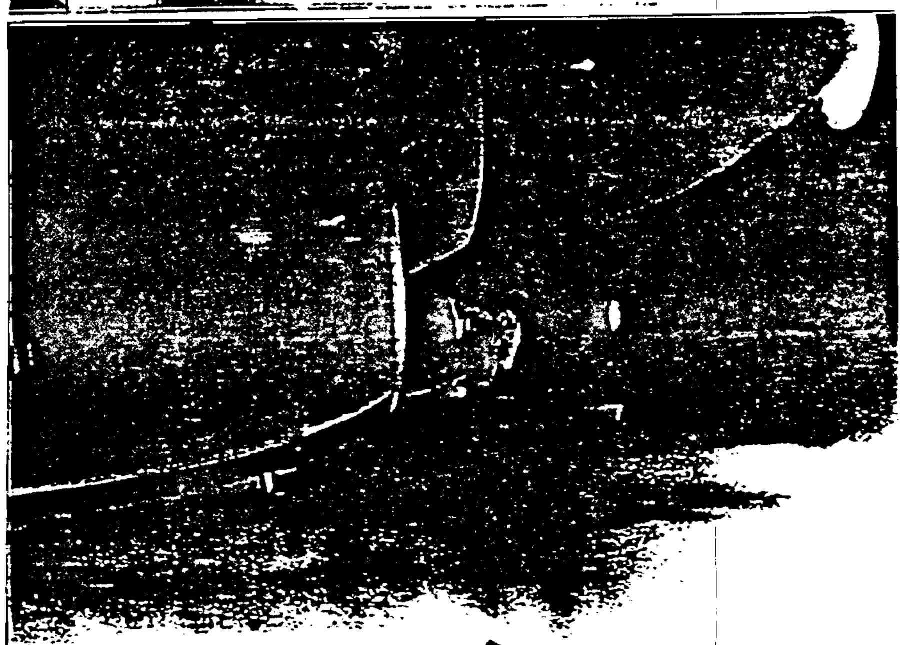
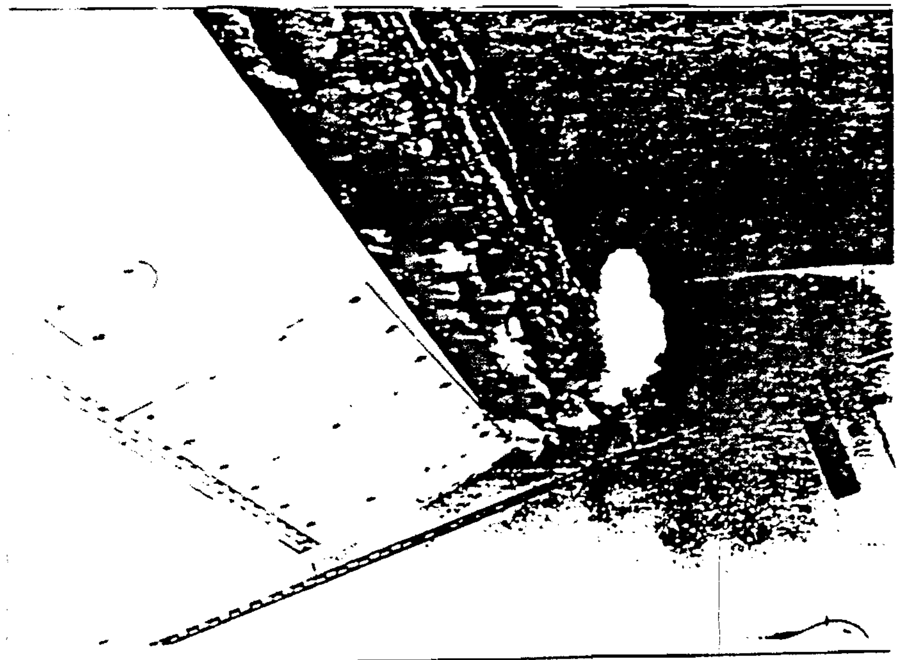


[illegible] 50% 20-30
Run No. 7
Time 12 30

7-3



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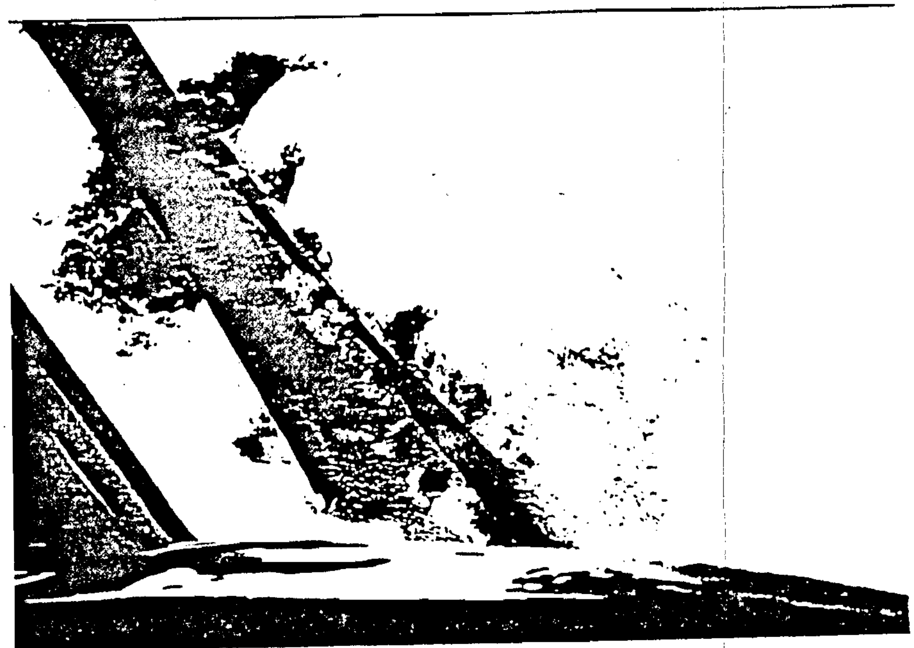

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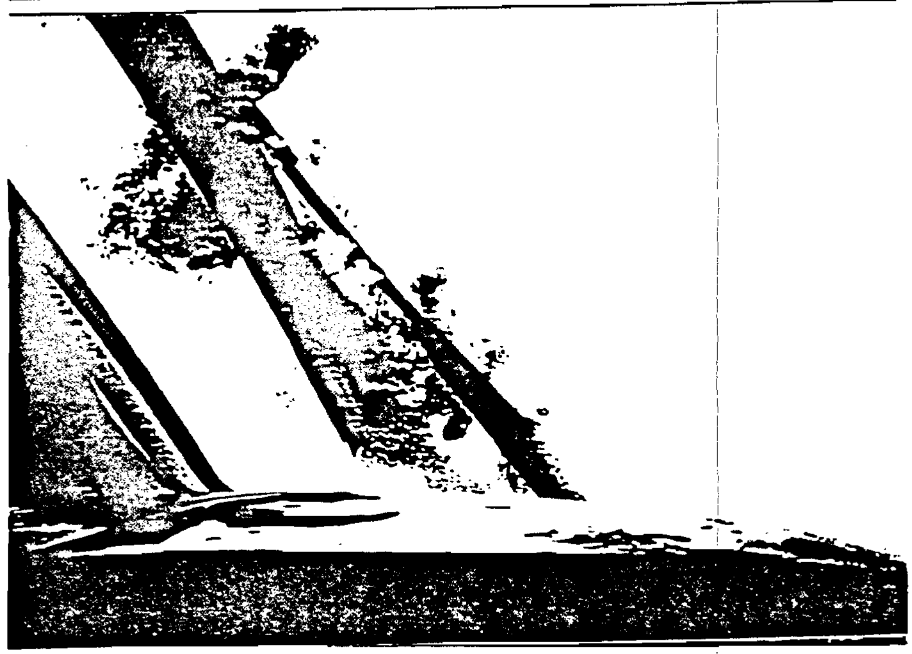
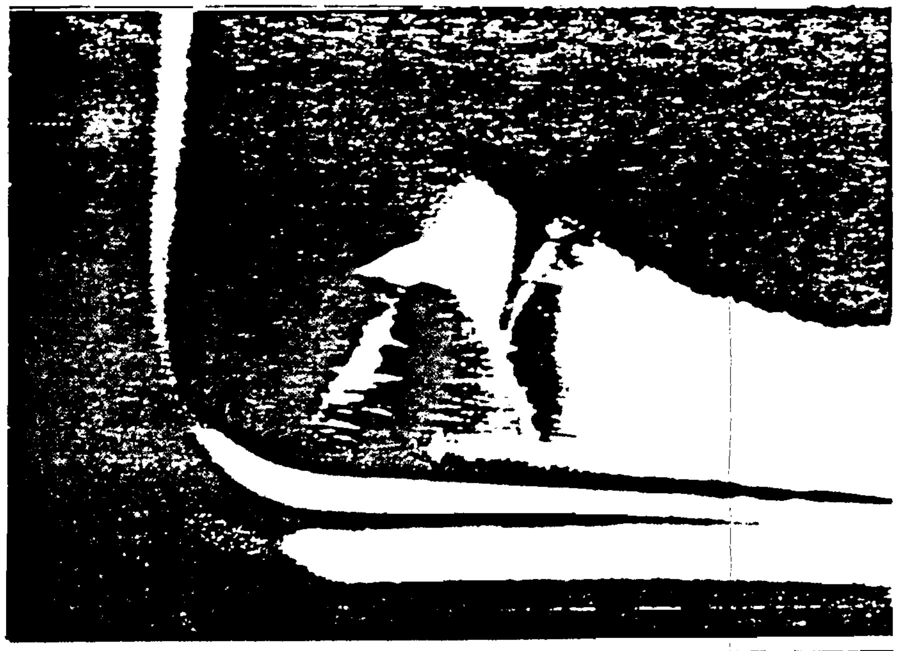


Test No 502 20-30
Run No 7
Time 1330

7-6



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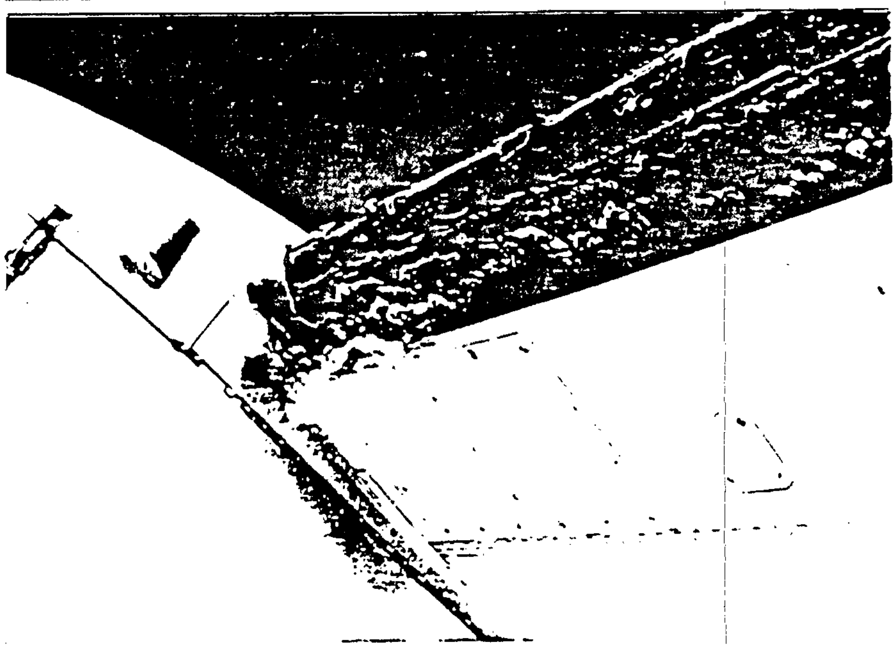

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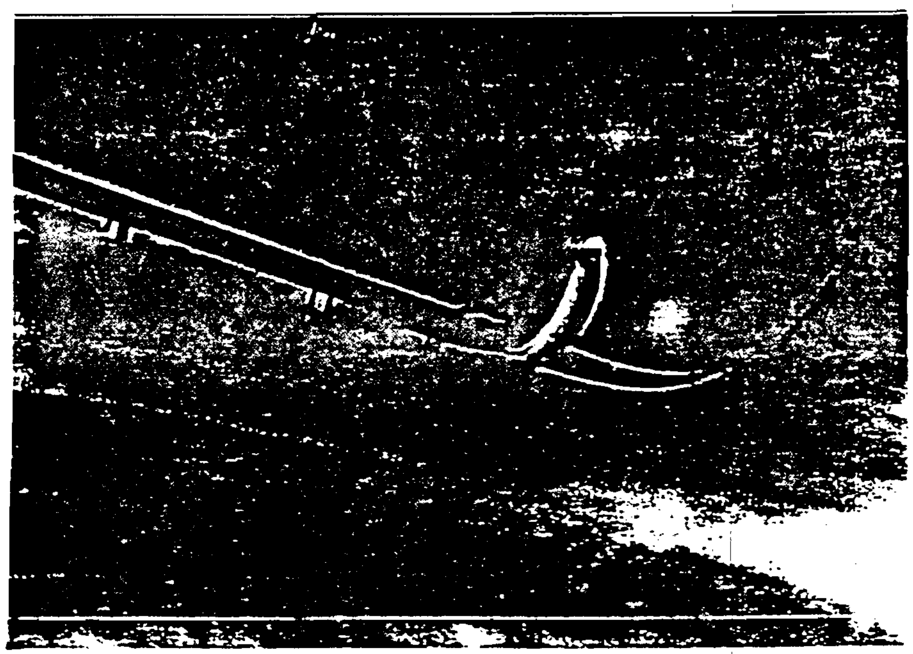
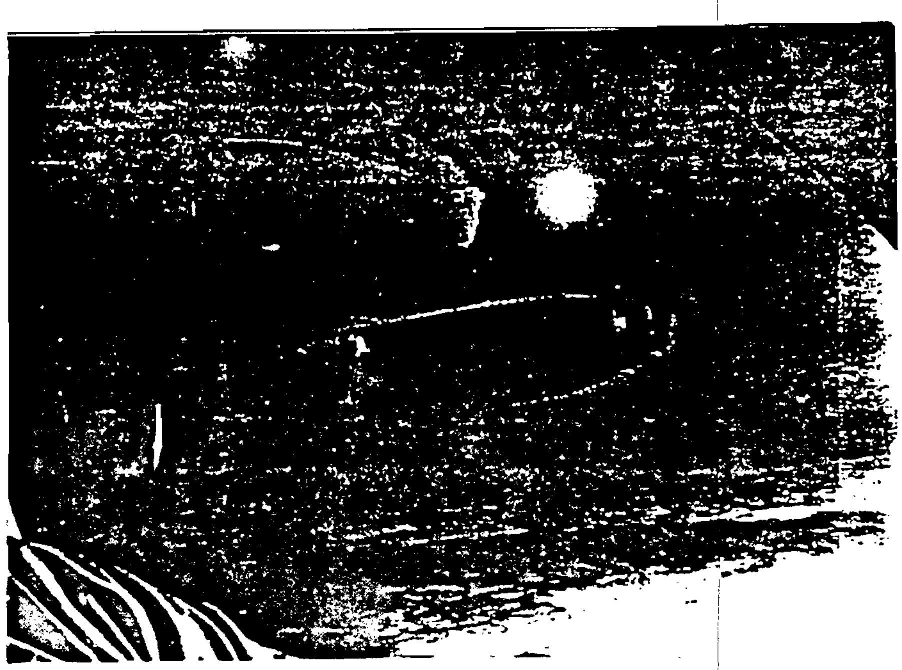


Fr No [illegible]
Run No 7
Time 13:30

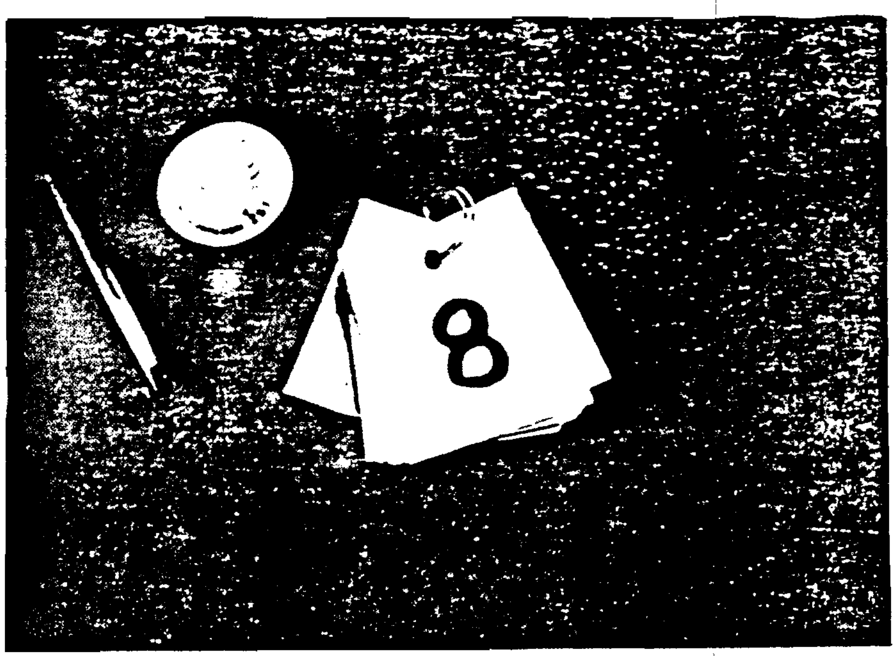
7-9

7-10



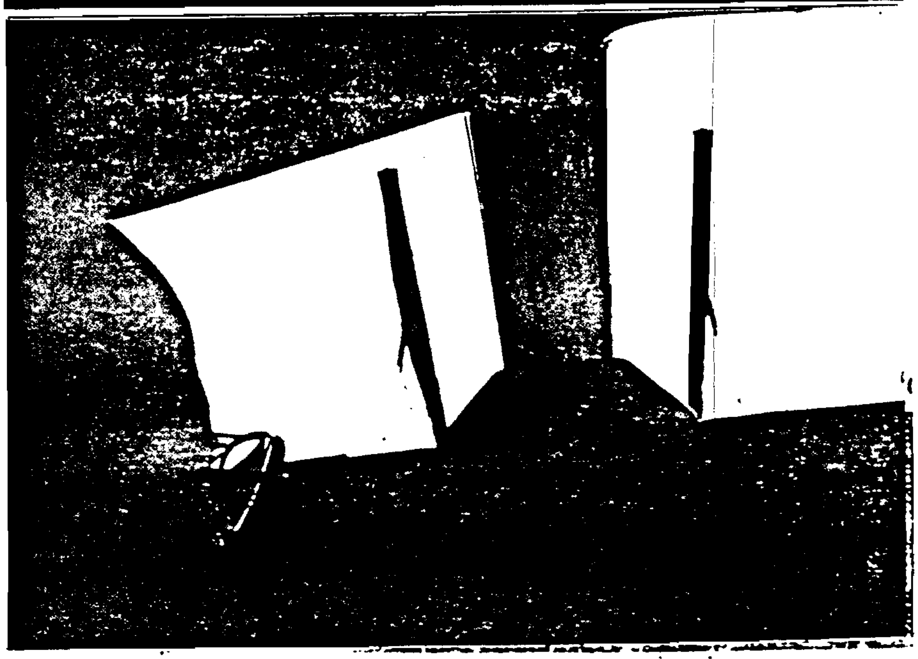
F.- No. 012-0030
Run No. 8
Time 13.40

8



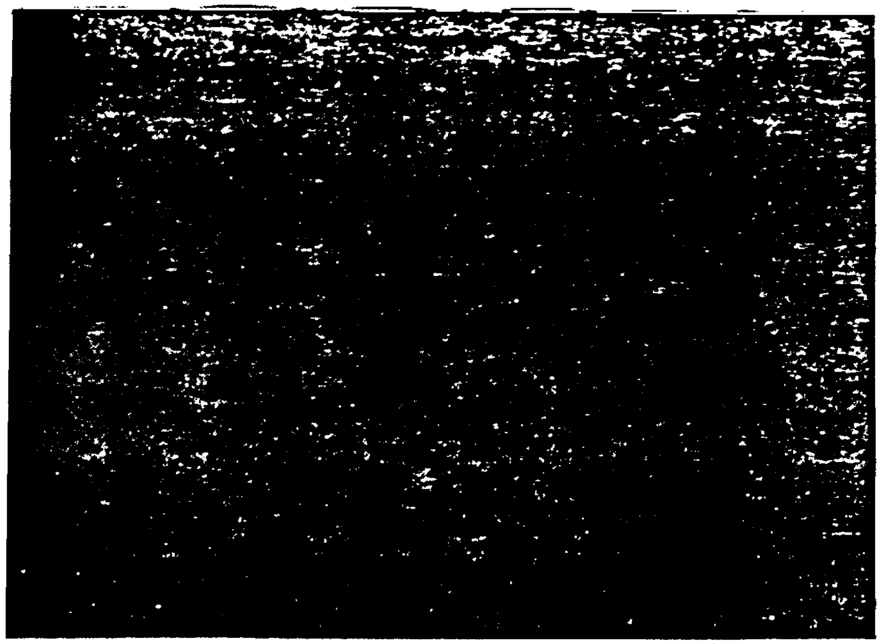
8-1

8-2



CHASE
PHOTOGRAPHS

C-1



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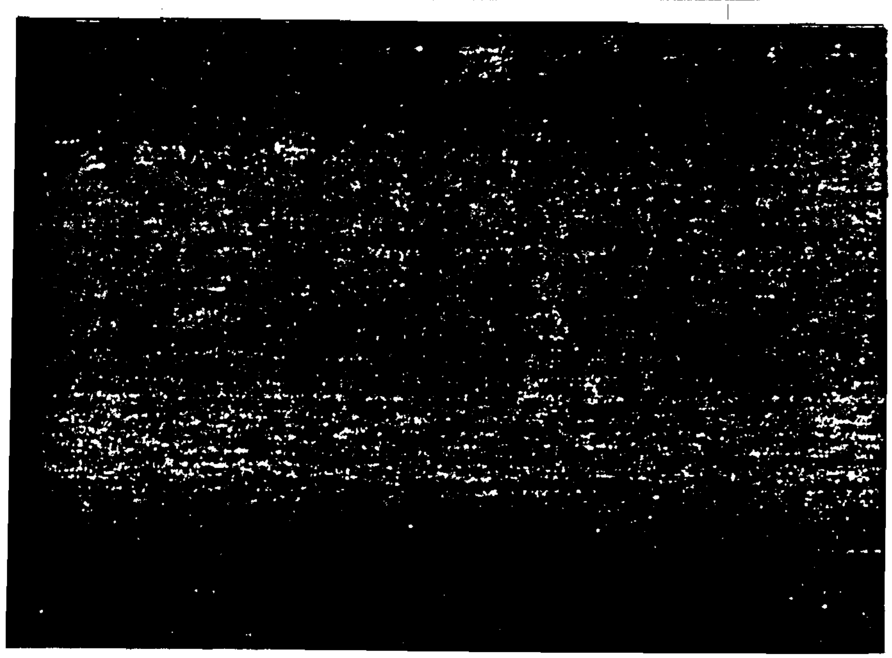

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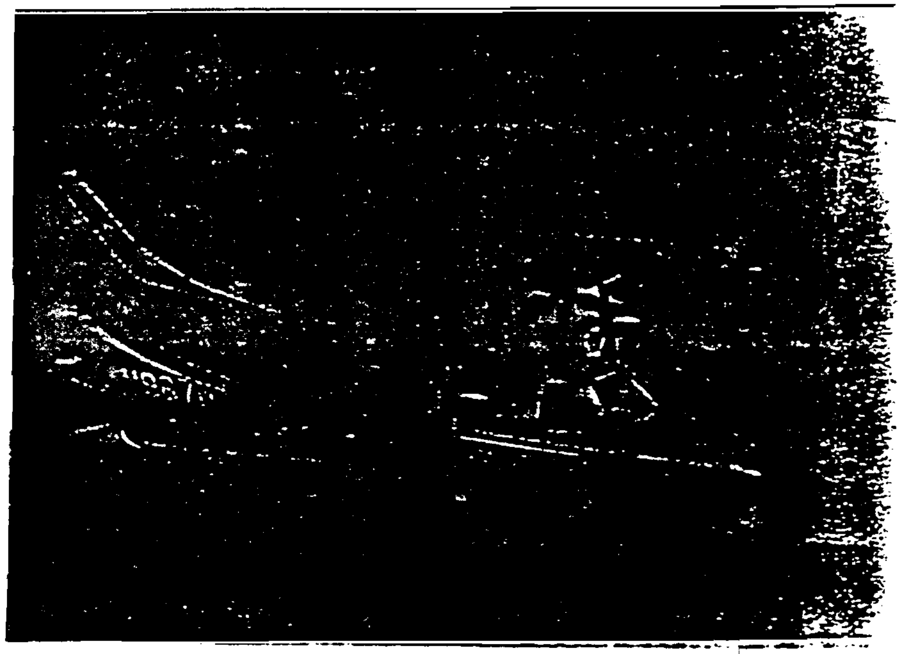

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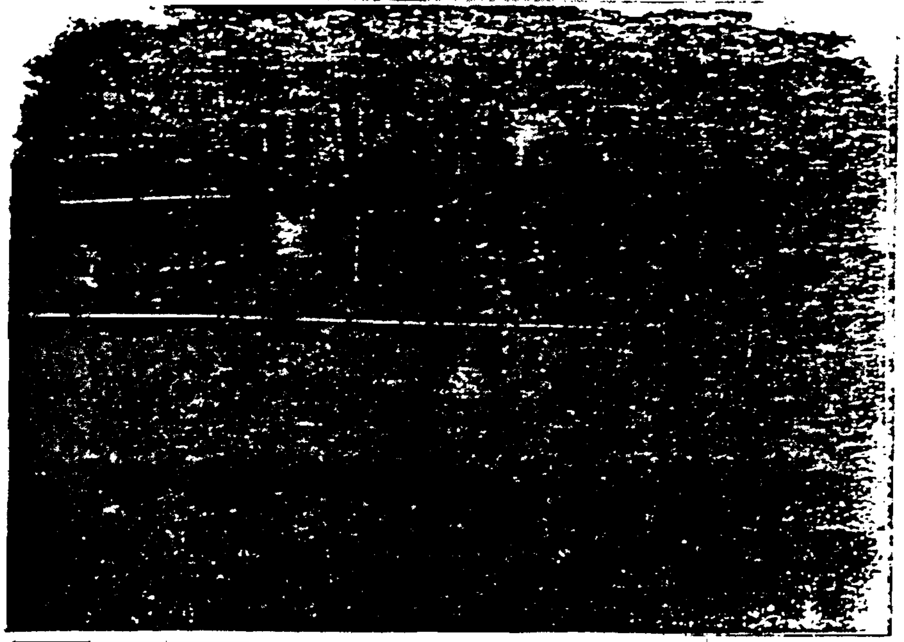

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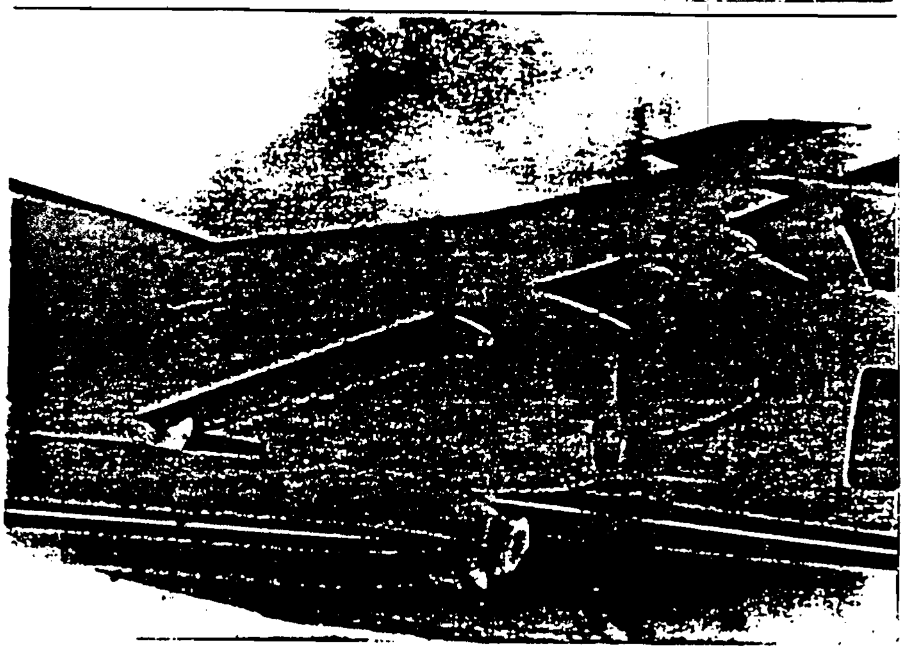

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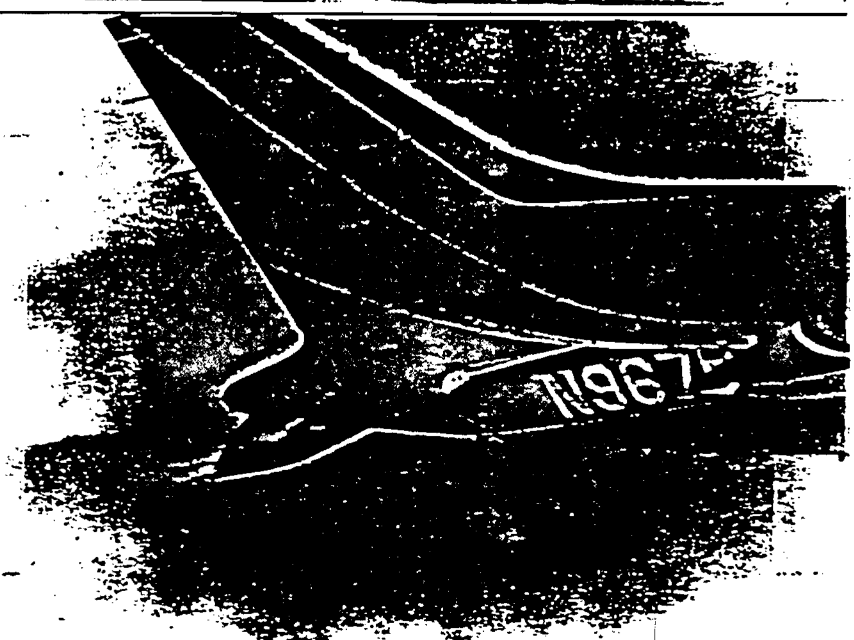

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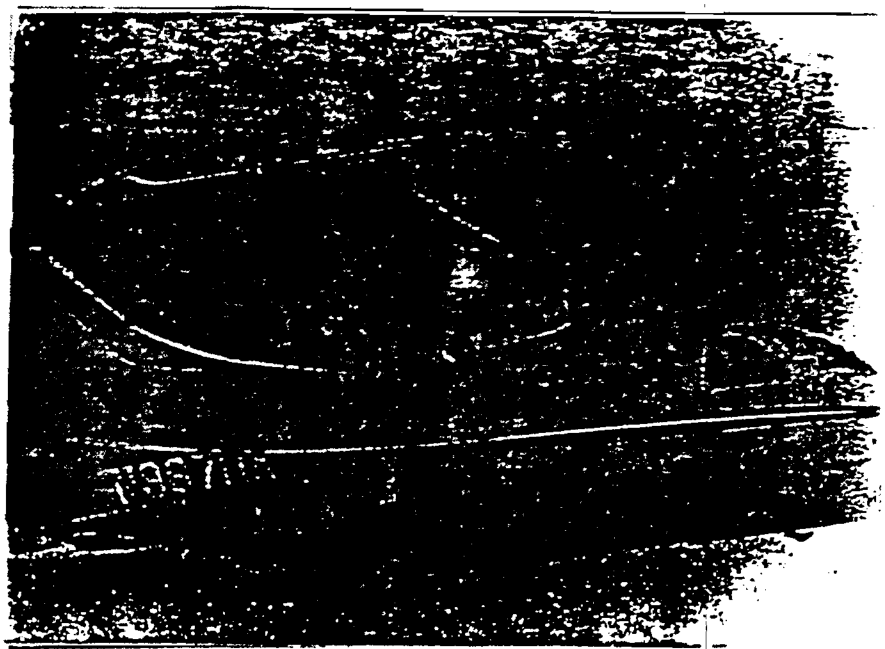

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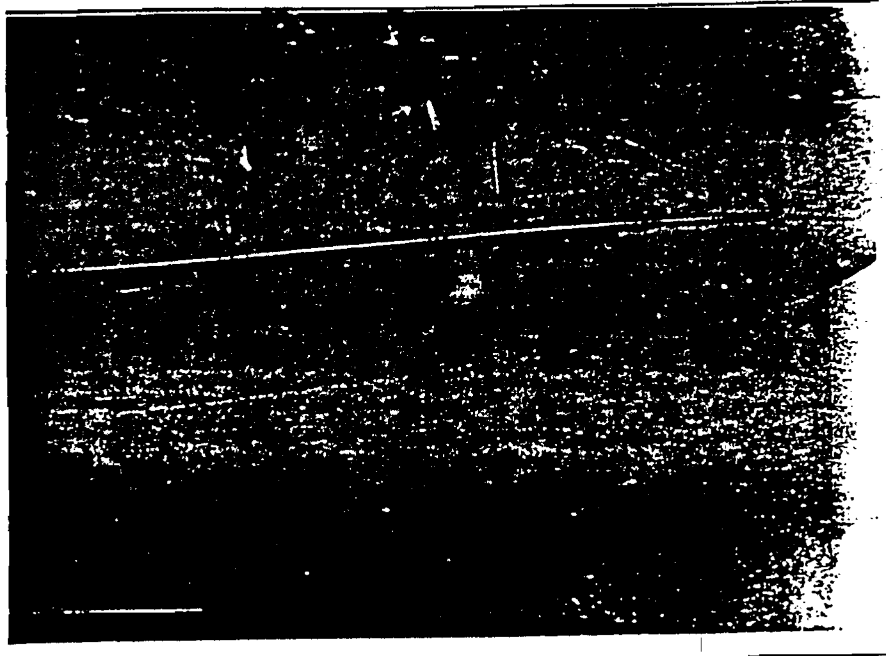

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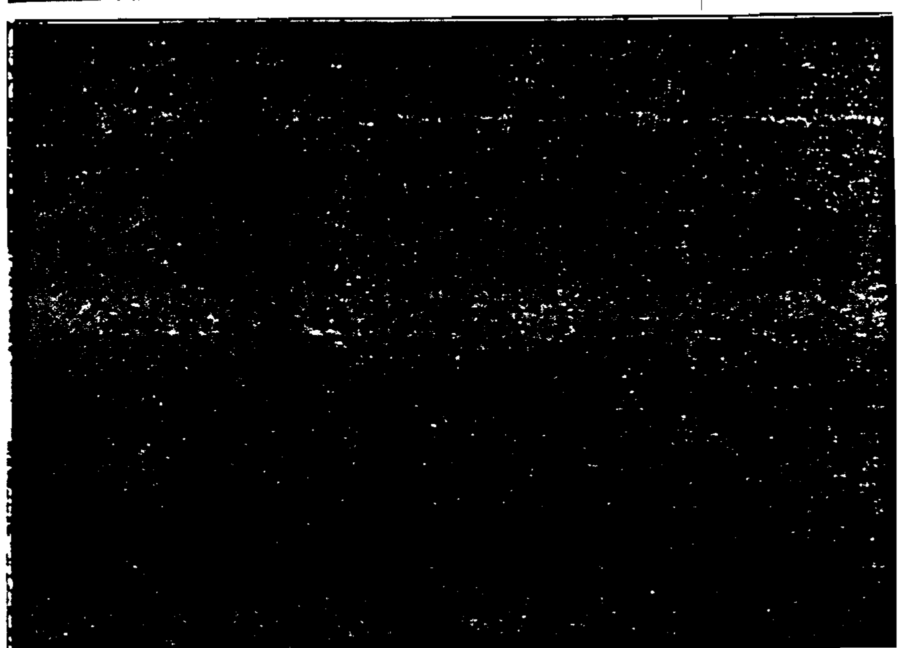

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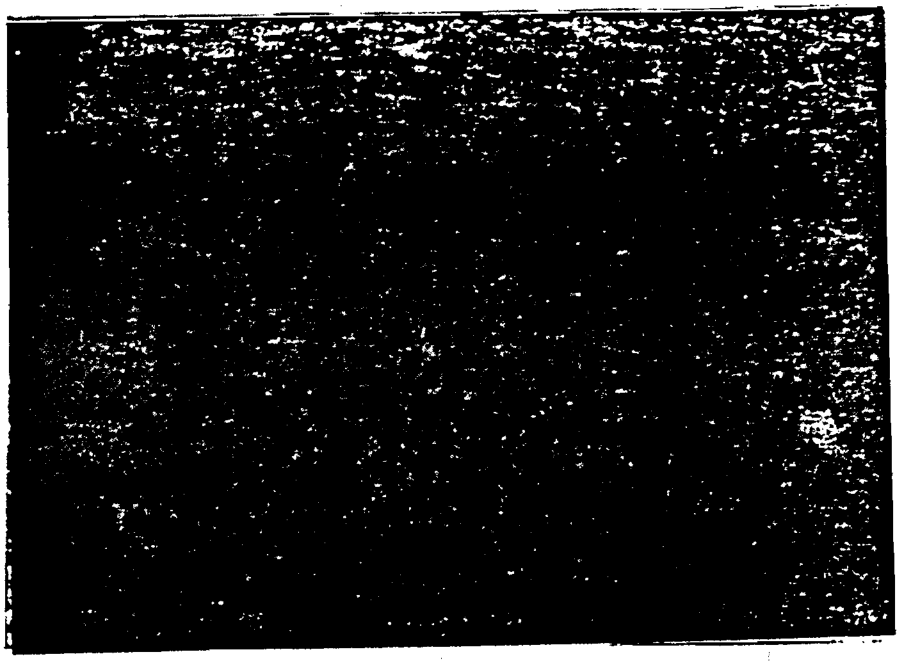
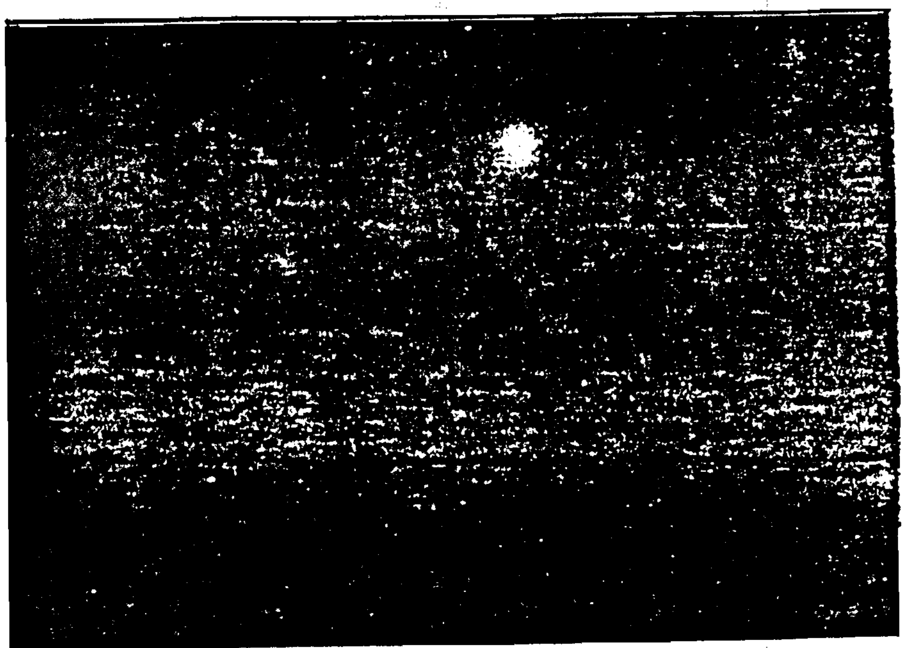


C-11



DATA CARDS - MU-2B-60

MODEL	SERIAL NO.	FLIGHT TEST PLAN	10-27-93	SCR-60-...
MU-2B-60	1566SA			

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT BOEHLER	TEST CREW ROBINSON	TEST CREW	TEST CREW
COPILOT MEYERS	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION SCR-60-001

TAKEOFF WEIGHT ________ LBS

CENTER OF GRAVITY ________ %MAC

FUEL LOADING L.W. ________ LBS

R.W. ________ LBS

FUS ________ LBS

TEST ITEMS

(-60) ORIENTATION

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

TEST CONDITION																										
	Engine																									
	Gear																									
	Flap																									
	Airspeed (KIAS)																									
	Altitude (FT)																									
TEST ITEM																										
Cond No																										

Ch Pilots

1

MODEL MU-2B-60	SERIAL NO. 1566SA	FLIGHT TEST PLAN	10-27-83	SCR-60

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT BOEHLER	TEST CREW KISH!	TEST CREW	TEST CREW
COPILOT ROBINSON	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION SCR-60-002

TAKEOFF WEIGHT ______ LBS

CENTER OF GRAVITY ______ %MAC

FUEL LOADING L.W. ______ LBS

R.W. ______ LBS

FUS ______ LBS

TEST ITEMS

1-60) ORIENTATION

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

TEST CONDITION																										
Engine																										
Gear																										
Flap																										
Airspeed (KIAS)																										
Altitude (FT)																										
TEST ITEM																										
Cond No																										

MODEL MU-2B-66	SERIAL NO. 1566 SA	FLIGHT TEST PLAN	10-27-83	SCR-60-02

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT BOEHLER	TEST CREW ROBINSON	TEST CREW	TEST CREW
COPILOT KISHI	TEST CREW	TEST CREW	TEST CREW

SCR-60-003

AIRPLANE CONDITION

TAKEOFF WEIGHT	______	LBS
CENTER OF GRAVITY	______	%MAC
FUEL LOADING L.W.	______	LBS
R.W.	______	LBS
FUS	______	LBS

TEST ITEMS

(-60 ORIENTATION)

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ______ LBS

TEST CONDITION: Engine																									
TEST CONDITION: Gear																									
TEST CONDITION: Flap																									
TEST CONDITION: Airspeed (KIAS)																									
TEST CONDITION: Altitude (FT)																									
TEST ITEM																									
Cond No																									

FLIGHT NUMBER: SCR-60-003

DATE: OCTOBER 27, 1983

LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS

AIRCRAFT: MU-2B-60-1560SA (N486MA)

CREW: KISHI/BOEHLER

FLIGHT TIME: 1.1 hours

PURPOSE: MU-2B-60 FAMILIARIZATION

COMMENTS: This was the initial flight in the long body MU-2B-60 airplane. Though this was not the first flight of the day, the overspeed governor check and negative torque sensor check were conducted for familiarization. Before removing the propeller start locks, an attempt was made to taxi the airplane. Insufficient thrust was generated to even move the airplane. The engine starting and after starting engines procedures were simple to follow. Since the nose gear steering is linked to the rudder pedals, taxiing the airplane is simple. The taxi speed may be regulated by using the power levers in the beta range. Differential power may be used to augment nosewheel steering. The use of wheel brakes can be easily minimized through judicious use of the power levers. During the takeoff run, the pilot was advised to place the controls mid-way aft and left wing down. The takeoff and transition to a climb was conducted without any undue difficulties. The climb speed of 155 KIAS was easily maintained to 10,000 feet. The climb speed from 10,000 feet to 12,500 feet was 156 KIAS. Using these climb speed the angle of climb is quite steep and the over-the-nose visibility is reduced. The importance of using trim and the effectiveness of the trim about the three axes are immediately apparent. Power changes necessitate making trim changes. Rudder trim appears to be the prime trim followed by the roll trim. When the airplane is properly trimmed the airplane is stable and flies very well without using hands and feet. Various maneuvers including slow flight and stalls were conducted using various flap settings and with the landing gear down and retracted. A descent was made to the airport. A series of landings with different flap settings were made. The final landing was a single engine landing using reverse thrust. By properly manipulating the engine producing thrust the aircraft is slowed while maintaining directional control during the landing roll. The engine shut-down procedure is simple. Airplane transition in the MU-2B-60 should not be any different than transition into comparable airplanes.

James S. Kishi

MODEL	SERIAL NO.	FLIGHT TEST PLAN		
MU-2B-60	1560SA			SCR-60-00

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
PILOT BOEHLER	TEST CREW	TEST CREW	TEST CREW
COPILOT ARNOLD	TEST CREW	TEST CREW	TEST CREW

AIRPLANE CONDITION SCR-60-004

TAKEOFF WEIGHT ________ LBS

CENTER OF GRAVITY ________ %MAC

FUEL LOADING L.W. ________ LBS

R.W. ________ LBS

FUS ________ LBS

TEST ITEMS

(-60) ORIENTATION

REMARKS

LIMITATIONS

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

TEST CONDITION																										
	Engine																									
	Gear																									
	Flap																									
	Airspeed (KIAS)																									
	Altitude (FT)																									
TEST ITEM																										
Cond No																										

4

DATE: 11/14/83 MODEL: MU-2B-60 [redacted]	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHLER ROBINSON KAWAI	TEST: SCR-60-5 TIA REF: RO 394	S.E. 1404 T.O. 1415 LDG. 1412 TOTAL 7100 FUEL USED -621

RAMP WT: 11403.2 C.G. 29.4 %MAC 2 · ZFW 8703.1 ZFW C.G. 27.9 %MAC

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

T.O. SPEED 109 KTS. NORMAL CLIMB TO 14,500 WITH TURNS. YAW DAMPER EVAL IN CLIMB. LANDING GEAR WARNING SYSTEM TESTED IAW FLIGHT CARD PROCEDURE. PARTIAL PANEL FLOWN MAKING TURNS to HEADINGS & CLIMBS AND DESCENTS TO VARIOUS ALTITUDES. AIRSPEED CHANGES MADE AT LOW ALTITUDE IN TURBULENT AIR THROUGH VARIOUS FLAP SETTINGS. RAW DATA ILS FLOWN IN 20° FLAP POSITION. GO-AROUND AND NORMAL 40° FLAP LANDING ACCOMPLISHED. ALL ITEMS ON FLIGHT CARD (ATTACHED) ACCOMPLISHED.

MAINT. & ENGR. ITEMS:

RECOMMENDATIONS & CONCLUSIONS:

MODEL	SERIAL NO.	FLIGHT TEST PLAN	FLIGHT DATE	FLIGHT NO.
MU-2B-60	1560 S.A.		11-14-83	SCR-66-3

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
N. KOBAYASHI	S Nakazawa		R. Wainberg
PILOT BOEHLER	~~TEST CREW~~ PILOT : ROBINSON	TEST CREW KAWAI	TEST CREW
PILOT KISHI	~~TEST CREW~~ PILOT : MEYERS	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT ________ LBS

CENTER OF GRAVITY optional %MAC

FUEL LOADING Outer Tanks ________ LBS

Main Tanks ________ LBS

Tip Tanks ________ LBS

REMARKS

LIMITATIONS

DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

TEST ITEMS

(1) landing gear warning system (item 2.(b))

(2) landing gear position indications (item 2.(c))

(3) to determine if the airplane is safely controllable by a single pilot (item 2.(e))

(4) Flight using partial panel instruments (item 2.(j))

(5) [illegible]

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1.	1/2 GEAR WARNING SYS	〃	below 140	20°	RET.→EXT.	〃
	& POSITION INDICATORS					
2.	1/2 GEAR WARNING SYS	〃	below 120	40°	RET.→EXT	〃
	& POSITION INDICATORS					
3.	SINGLE PILOT CONTROL	〃	〃	〃	〃	〃
4.	SINGLE PILOT CONTROL IN NATURAL TURBULENCE OF AT LEAST MODERATE INTENSITY	〃	〃	〃	〃	〃
5.	PARTIAL PANEL INSTRUMENTS	〃	〃	〃	〃	〃
6	ILS Apch	〃	As req	20°	Ext	As req

TEST PROCEDURES

I. Landing Gear Warning System & Landing Gear Position Indicators ;

1. Obtain an airspeed below 140 KCAS.
2. Extend flaps and set them at 20° position.
   (1) Check adequacy of the landing gear warning.
3. Operate the landing gear warning cut out switch.
   (1) Assure that landing gear warning does not stop.
4. Extend landing gears.
   (1) Assure that landing gear warning stops.
   (2) Determine if the landing gear position indicators are adequate to perform their intended function.
5. Retract landing gears.
6. Retract flaps.
   (1) Assure that landing gear warning is silent.
7. Obtain an airspeed below 120 KCAS.
8. Extend flaps and set them at 40° position.
   (1) Check adequacy of the landing gear warning.
9. Follow the above procedures 3 thru 6.

Add: Make an ILS approach using only 20° of flaps. Is it possible to make the approach without getting ~~at~~ a gear warning?
Add a rigging check - make sure horn does not come on until throttles are <u>in flight idle</u> per MAINT MAN.

TEST PROCEDURES

II. Single Pilot Control

1. Perform takeoff, climb, level flight, turning, descent, approach and landing normally.
   (1) Give particular attention to the following items during the flight.
   - yaw damping characteristics
   - dutch-roll characteristics
   - takeoff speed schedule
   - climb speed schedule
   - approach speed schedule

III. Partial Panel Instruments

1. Put covers on panel instruments except pilot's side turn & bank, airspeed and altitude indicators during a level flight.
2. Conduct climb, level flight, turn, descent and simulated landing.
   (1) Assure that the airplane can be safely flown.
3. Remove covers put on panel instruments.

Raw Data Sheet

Pro. No.

Aircraft Type MU-2B-60 FAA Flt. No. Surface Cond:
S.N. 1560 T.O. H_p OAT
Reg. No. N 486 MA Land Wind
Date T.T. Pilot

PURPOSE OF TEST: SCR EVAL. 1(h) PROP START LOCKS
DETERMINE IF IT IS POSSIBLE TO MAKE A
TAKEOFF WITH START LOCKS STILL ENGAGED.

1. NORMAL ENGINE START - EXCEPT DO NOT UNLOCK
START LOCKS.

2. ADVANCE POWER FOR TAXI:

WHAT IS MAX TORQUE ATTAINABLE W/COND. LEVER:
IN TAXI:
MIN CRUISE:
TO + LAND:

ARE THERE ANY UNUSUAL VIBS OR NOISE:

ARE WARNINGS OBVIOUS:

WOULD IT BE AT ALL POSSIBLE TO
MAKE A TAKEOFF:

T.O. 109

SCR-60-5 (11-14-83)

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-60 S.A. DATE OF W & B: 10/15/83

AIRCRAFT SN: 1566SA AIRCRAFT "N": 486 MA

$\frac{\quad - 191.5}{60.6} \times 100 + 22.0 =$ ___

FLIGHT NO.: SCR-60-5 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	7888.1	197.2	1,555,591.7	
1st Row (P) BOEHLER	245	97.2	23,814.0	
1st Row (CP) ROBINSON	145	97.2	14,094.0	
KAWAI	125	130.5	16,312.5	
Baggage Compt. **	300	293.7	88,110.0	
ZERO FUEL WEIGHT	8703.1	195.1	1,697,927.2	27.9 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	204.5	211,003.1	W/800lbs ___ %
Outer Tanks 34.5/34.5 Gal	462.3	201.0	92,922.3	GWT W/800# ___
Tip Tanks 90 / 90 Gal	1206.0	193.1	232,878.6	
TOTAL FUEL O/B Gal	2700.1	XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9734.9	196.1	1,908,930.3	29.6 %MAC
GWT MAINS/OUTERS (ONLY)	10,197.2	196.3	2,001,852.6	29.9 %MAC
GWT MAINS/OUTERS/TIPS	11,403.2	196.0	2,234,731.2	29.4 %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: R Thacker Date Prepared: 11-14-83

PILOT: BOEHLER CO-PILOT: ROBINSON

FLIGHT TEST (Additional Crew Members): KAWAI 2. —

3. — 4. — 5. — 6. —

DATE OF FLIGHT: 11-14-83 Q.C. (Stamp & Initials): 32 / MDL

9

MU-2B-60

FLT NO SCR-60-5
(11/14/83)

CE [illegible]
TC
LD

RUN	CONDITION	TIME	Hp (FT)	V (KTS)	RAT		COMMENT	
1	[illegible]	[illegible]	[illegible]				[illegible]	
[illegible]	– –	10:14		[illegible]			[illegible]	
[illegible]	[illegible]	[illegible]	–			[illegible]	[illegible]	
		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
	Flaps [illegible]							
	[illegible]0°			[illegible]				
	[illegible]			1[illegible]			[illegible]	
	[illegible]			1[illegible]			[illegible]	[illegible]
								–
	[illegible]	[illegible]				[illegible]	[illegible]	
	[illegible]	15 12				[illegible]		
	[illegible]	[illegible] 15				[illegible]		

6

SCR 60-5. 11-14-83 ROBINSON

1(h) DETERMINE IF IT IS POSSIBLE TO MAKE A TAKEOFF WITH THE START LOCKS STILL ENGAGED.

1. TORQUE AVAILABLE = NONE.

2. NO UNUSUAL VIBRATIONS OR NOISE

3 WARNINGS ARE OBVIOUS

a. NO TORQUE INDICATION

b NO INCREASE IN FUEL FLOW OR TEMPERATURE WITH POWER LEVER ADVANCEMENT

c. THE AIRPLANE COULD NOT BE MOVED FROM THE PARKED POSITION (IE) LEVEL SMOOTH SURFACE, TAILW. OF 12 KNOTS.

4 NEITHER TAXI NOR TAKEOFF WOULD HF BEEN POSSIBLE IN AIRCRAFT N486MA AS IT WAS RIGGED ON THIS DATE.

2CR-60-5 11-14-83 ROBINSON

I LANDING GEAR WARNING SYSTEM AND LANDING GEAR POSITION INDICATORS

1. LANDING GEAR WARNING ACTIVATED APPROXIMATELY ONE EIGHTH (1/8) INCH ABOVE FLIGHT IDLE AND WAS ADEQUATE

2 LANDING GEAR WARNING CUT-OUT CONSISTANTLY STOPPED THE WARNING SOUND WHEN ACTIVATED WITH FLAPS 20°

3 THE LANDING GEAR WARNING SOUND STOPPED WHEN THE GEAR LOCKED DOWN.

4 THE LANDING GEAR INDICATORS WERE ADEQUATE TO PERFORM THEIR INTENDED FUNCTION.

5 AFTER LANDING GEAR AND FLAP RETRACTION, THE WARNING SOUND REMAINED SILENT.

6 WITH THE FLAPS AT THE 40° POSITION AND THE LANDING GEAR UP, THE GEAR WARNING SYSTEM COULD NOT BE SILENCED BY USING THE GEAR WARNING CUT-OUT SWITCH.

7. WITH THE FLAPS AT 40°, THE GEAR UNSAFE WARNING SOUND STOPPED WHEN THE LANDING GEAR LOCKED DOWN.

I SINGLE PILOT CONTROL

1. YAW DAMPING CHARACTERISTICS

a. WITHOUT YAW DAMPER ENGAGED

1. POSITIVE DYNAMIC STABILITY EVIDENT STABILITY INCREASES WITH INCREASING SPEED (140 to 200 K) TWO (2) to SIX (6) OSCILLATIONS

b WITH YAW DAMPER ENGAGED - OSCILLATIONS STOPPED WITH 1/2 TO 1 1/2 CYCLES.

2. DUTCH ROLL CHARACTERISTICS - TIP TANKS 2/3 full OR MORE - SPEEDS 140 TO 200 K

a DUTCH ROLL CAN BE EASILY INDUCED

b POSITIVE DYNAMIC STABILITY IS EVIDENT OSCILLATIONS STOP WITHIN TWO (2) TO SIX (6) CYCLES.

c. THE YAW DAMPER HAS A POSITIVE EFFECT LIMITING CYCLES TO APPROXIMATELY ONE (1) TO TWO (2) CYCLES.

3, 4 AND 5 – TAKEOFF, CLIMB AND APPROACH SPEED SCHEDULES

a. THE SPEEDS WERE EASILY DETERMINED FROM THE CHECK LIST

b. SPEEDS WERE NOT DIFFICULT TO MAINTAIN

c. MODERATE TURBULANCE HAD NO SIGNIFICANT EFFECT ON MAINTENANCE OF SPEEDS.

III PARTIAL PANEL INSTRUMENTS

NO DIFFICULTY WAS NOTED IN FLYING PARTIAL PANEL

NOTE: THE PILOT MUST REMEMBER TO COMPLY WITH THE CHECKLIST NOTATION WHICH REQUIRES TURNING THE WINDSHIELD HEAT OFF BEFORE USING THE STANDBY MAGNETIC COMPASS

IV AN ILS WITH FLAPS 20° WAS FLOWN TO DETERMINE IF THE APPROACH COULD BE FLOWN TO COMPLETION WITHOUT ACTIVATING THE GEAR WARNING HORN. ONCE THE GLIDE PATH WAS INITIATED AT 126 K. AND GEAR UP, IT WAS NECESSARY TO RETARD THE POWER LEVERS TO A POSITION WHICH ACTIVATED THE GEAR WARNING HORN.

DATE: MODEL: MU-2B-60 [redacted]	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHMER MEYERS KAUAI	TEST: SCR-60-6 TIA REF: R0394	S.E. 1600 T.O. 1612 LDG. 1705 TOTAL 0.9 FUEL USED -1002

RAMP WT: 11438.2 C.G. 19.57 %MAC | ZFW 8738.1 | ZFW C.G. 27.3 %MAC

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

ONE NORMAL T.O @ 109 KTS. CLIMB SPEED & DUTCH ROLL CHECKS ENROUTE TO 14500. YAW DAMPER TRIED DURING CLIMB. GEAR WARNING CHECK ACCOMPLISHED IAW ATTACHED FLIGHT CARD. PARTIAL PANEL TURNS, CHANGES OF AIRSPEED, AND SIMULATED LANDING EVALUATED. A FLIGHT DIRECTOR ILS WITH 20° FLAPS FLOWN to 200' AND GO-AROUND ACCOMPLISHED. STRAIGHT IN LANDING WITH 20° FLAPS 10 KT XWIND completed FLIGHT. ALL ITEMS ON FLIGHT CARD ACCOMPLISHED.

[illegible signature]

MAINT. & ENGR. ITEMS:

RECOMMENDATIONS & CONCLUSIONS:

MODEL	SERIAL NO.	FLIGHT TEST PLAN	FLIGHT DATE	FLIGHT NO.
MU-2B-60	1560 S.A.		11-14-83	SCR-60-3

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
N. KOBAYASHI	S Nakagawa	[illegible]	R. Wainberg
PILOT BOEHLER	~~TEST CREW~~ PILOT : ROBINSON	TEST CREW KAWAI	TEST CREW
PILOT ~~Kishi~~ Robinson	~~TEST CREW~~ PILOT : MEYERS	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT ______ LBS

CENTER OF GRAVITY *optional* %MAC

FUEL LOADING *Outer Tanks* ______ LBS

Main Tanks ______ LBS

Tip Tanks ______ LBS

REMARKS

LIMITATIONS

DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

TEST ITEMS

(1) *landing gear warning system (item 2.(b))*

(2) *landing gear position indications (item 2.(c))*

(3) *to determine if the airplane is safely controllable by a single pilot (item 2.(e))*

(4) *flight using partial panel instruments (item 2.(j))*

(5) *prop start locks for takeoff*

ESTIMATED FLIGHT TIME: ____ HR ____ MIN FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1.	L/G GEAR WARNING SYS	~	below 140	20°	RET. → EXT.	~
	& POSITION INDICATORS					
2.	L/G GEAR WARNING SYS	~	below 120	40°	RET. → EXT.	~
	& POSITION INDICATORS					
3.	SINGLE PILOT CONTROL	~	~	~	~	~
4.	SINGLE PILOT CONTROL IN NATURAL TURBULENCE OF AT LEAST MODERATE INTENSITY	~	~	~	~	~
5.	PARTIAL PANEL INSTRUMENTS	~	~	~	~	~
6	ILS Apch	—	As Req	20°	Ext	As Req

TEST PROCEDURES

I. Landing Gear Warning System & Landing Gear Position Indicators ;

1. Obtain an airspeed below 140 KCAS.
2. Extend flaps and set them at 20° position.
   (1) Check adequacy of the landing gear warning.
3. Operate the landing gear warning cut out switch.
   (1) Assure that landing gear warning does not stop.
4. Extend landing gears.
   (1) Assure that landing gear warning stops.
   (2) Determine if the landing gear position indicators are adequate to perform their intended functions LOCATI[illegible]
5. Retract landing gears.
6. Retract flaps.
   (1) Assure that landing gear warning is silent.
7. Obtain an airspeed below 120 KCAS. when horn works & is ade[illegible]
8. Extend flaps and set them at 40° position.
   (1) Check adequacy of the landing gear warning.
9. Follow the above procedures 3 thru 6.

Add: Make an ILS approach using only 20° of flaps. Is it possible to make the approach without getting ~~at~~ a gear warning? yes

add a rigging check - make sure horn does not come on until throttles are <u>in flight idle</u> per MAINT MAN. slightly Above F.Idle ?

Partial Panel T&B under left hand must reposition hand
To fly good ins.

Gear indicator under Right hand during approach
at heavier wt it is possible to fly App w/20° Fl.
and not get horn -
with power in idle horn always blows with
20° Flaps - 22% Torque jus above F/idle

Heel Caught in carpet or well of Rudder pedal
on landing.
(10 knot)
20° Flap landing with Left X wind no
particular problem

TEST PROCEDURES

II. Single Pilot Control

1. Perform takeoff, climb, level flight, turning, descent, approach and landing normally.
   (1) Give particular attention to the following items during the flight.
      - yaw damping characteristics
      - dutch-roll characteristics
      - takeoff speed schedule
      - climb speed schedule
      - approach speed schedule

III. Partial Panel Instruments

1. Put covers on panel instruments except pilot's side turn & bank, airspeed and altitude indicators during a level flight.
2. Conduct climb, level flight, turn, descent and simulated landing.
   (1) Assure that the airplane can be safely flown.
3. Remove covers put on panel instruments.

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-60 S.A. DATE OF W & B: 10-15-83

AIRCRAFT SN: 1560SA AIRCRAFT "N": 456MA

$$\frac{195.7 - 191.5}{60.6} \times 100 + 22.0 = 2\text{[illegible]}$$

FLIGHT NO.: SCR-60-6 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	7888.1	197.2	1,555,596.7	
1st Row (P) BOEHLER	245	97.2	23,814.0	
1st Row (CP) MEYERS	180	97.2	17,496.0	
KAWAI	125	130.5	16,312.5	
Baggage Compt. **	300	293.7	88,110.0	
ZERO FUEL WEIGHT	8738.1	194.7	1,701,329.2	27.3 %MAC
Main Tank — lb/gal 154 Gal	1031.8	204.5	211,003.1	W/800lbs ____ %
Outer Tanks 34.5/34.5 Gal	462.3	201.0	92,922.3	GWT W/800# ____
Tip Tanks 90 / 90 Gal	1206.0	193.1	232,878.6	
TOTAL FUEL O/B Gal	2700.1	XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9769.9	195.7	1,912,332.3	29.0 %MAC
GWT MAINS/OUTERS (ONLY)	10,232.2	196.0	2,005,254.6	29.4 %MAC
GWT MAINS/OUTERS/TIPS	11,438.2	195.7	2,238,133.2	28.9 %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: R. Flacker Date Prepared: 11-14-83

PILOT: BOEHLER CO-PILOT: MEYERS

FLIGHT TEST (Additional Crew Members): KAWAI 2. —

3. — 4. — 5. — 6. —

DATE OF FLIGHT: 11-14-83 Q.C. (Stamp & Initials): KJ 32 [illegible]

SCR-60-6.

[illegible]

SE

TO

LDG

Run	CONDITION	TIME	Hp (FT)	V(KTS)	OAT	Fuel Flow	COMMENTS	
		[illegible]	[illegible]					
[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	
[illegible]			[illegible]		10			
[illegible]	[illegible]	[illegible] 31	[illegible]	[illegible]			[illegible]	
				[illegible] UP			[illegible]	
				[illegible]			[illegible]	
				FLAPS [illegible]			[illegible]	
	[illegible]	[illegible]		[illegible]	[illegible]	151	[illegible]	
[illegible]	[illegible]	[illegible]				[illegible]		
7	[illegible]	17:56					[illegible]	
7	[illegible]	17:59				[illegible]		

Flight Test Report

SCR-60-6

GEORGE MEYERS .9

I LANDING GEAR WARNING SYSTEM

1. THE LOCATION OF THE GEAR INDICATOR LIGHTS IS SUCH THAT THE RIGHT HAND HOLD OF THE LEFT CONTROL WHEEL BLOCKS OUT THE PILOTS VIEW OF THE GEAR INDICATOR LIGHTS. WHEN THE PILOT FLYS WITH BOTH HANDS ON THE WHEEL IT MAKES THE SITUATION WORSE. TO VIEW THE LIGHTS A CONCERTED EFFORT MUST BE MADE TO MOVE YOUR HEAD TO THE RIGHT OF ITS NORMAL POSITION TO VIEW THE LIGHTS

2. THE WARNING HORN IS ADEQUATE WHEN IT IS ACTUATED BUT THE RED LIGHT IS USELESS IN ITS CURRENT LOCATION.

3. WHEN THE POWER IS REDUCED TO FLIGHT IDLE THE Audio GEAR WARNING SYSTEM IS ADEQUATE. WHEN THE FLAPS ARE SET TO 20° IT IS POSSIBLE TO FLY AN ILS ~~AP~~ WITH THE GEAR UP AND NOT RECEIVE A GEAR WARNING WHILE FLYING ON SPEED BECAUSE THE POWER LEVERS ARE NOT BACK ON THE FLIGHT IDLE STOP.

II SINGLE PILOT CONTROL

1. THE ~~YAW~~ NATURAL YAW DAMPING OF THE AIRCRAFT IS WEAK. THE AUTO PILOT YAW DAMPER IS ADEQUATE

2. COORDINATED (BALL CENTERED) FLIGHT IS POSSIBLE WITH A CONSIDERABLE AMOUNT OF PILOT EFFORT. LACK OF COORDINATED FLIGHT DOES NOT SERIOUSLY EFFECT THE CONTROL OF THE AIRCRAFT BUT WOULD EFFECT THE QUALITY OF THE PASSENGER RIDE.

3. THE TAKEOFF, CLIMB, AND APPROACH SPEED SCHEDULES APPEAR TO BE ADEQUATE. THE DECK ANGLE FOR ENROUTE CLIMB AT 150 KT. IS HIGH FROM A VISABILITY STAND POINT

III PARTIAL PANEL INSTRUMENTS

THE LOCATION OF THE PRIMARY BANK INSTRUME WHILE ON PARTIAL PANEL, THE TURN & SLIP ~~BANK~~ INDICATOR IS DEFICIENT BECAUSE THE LEFT HAND YOKE HANDLE ON THE PILOTS ~~CO~~ CONTROL WHEEL BLOCKS DIRECT VIEW OF THE TURN & SLIP INDICATOR. A HEAD MOVE MENT TO THE LEFT IS REQUIRED TO VIEW THE INSTRUMENT. ~~THIS~~ IT WOULD ~~BE~~ REQUIRE A A CONSIDERABLE AMOUNT OF ADDITIONAL PILOT EFFORT TO FLY PARTIAL PANEL IN THIS AIRCRAFT VS. OTHER AIRCRAFT OF THIS CATEGORY.

IV OTHER COMMENTS

1. WHEN PILOT SEATING POSITION IS SELECTED

THE MOST COMFORTABLE POSITION FROM A CONTROL AND VISABILITY STAND POINT PUTS MY HEAD TOO CLOSE TO THE LEFT HAND COCK PIT STRUCTURE AT THE TOP OF THE LEFT SIDE WINDOW. WHEN THE SEAT IS ADJUSTED TO PROVIDE ADEQUATE HEAD CLEARENCE VISABILITY OVER THE NOSE DURING CLIMBS IS REDUCED.

DURING LANDINGS WITH 20° FLAPS ~~THIS~~ THE LOW SEATING POSITION CAUSES THE PILOT TO VIEW THE RUNWAY ~~during~~ ~~THE~~ THROUGH THE LOWER PORTN. OF THE WIND SHIELD. THIS PORTION OF THE WIND SHIED ~~IS~~ ~~SEVERELY~~ ~~DISTORTED~~ CAUSES A SEVERELY DISTORTED VIEW WHEN THE WNDSHE ANTI ICE IS ON

2. DURING LANDING ROLL OUT AND TAXI THE CARPET ON THE FLOOR behind THE RUDDER PEDAL CAUGHT THE HEEL OF MY SHOE AND ALTHOUGH IT DID NOT CAUSE LOSS OF CONTROL

3. FLIGHT MANUAL DOES NOT COVER GEAR WARNING ADEQUATELY —

DATE: 11/15/83 MODEL: MU-2B 60	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehler Kishi Kaneki	TEST: SCR-60-7	S.E. 0915 T.O. 0925 LDG. 1027 TOTAL 1.0 FUEL USED 711

RAMP WT: 11,478.2	C.G. %MAC.... 28.3	TIA REF: R039d
ZFW..... 8778.1	ZFW C.G. %MAC 26.6	

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

Normal T.O. & climb schedule to 4500 msl. General 'Feeling out' of aircraft including turns & 'Dutch Rolls'. Thorough Partial Panel Evaluation including turns, climbs/descents, simulated landing approach. Evaluation of Gear Warning System. A ILS Flown on Flight Director with 20° Flaps only, followed by a circling approach to a normal 40° Flap full stop landing

B

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

SCR-60-7 (11-15-83) Kishi

MODEL	SERIAL NO.	FLIGHT TEST PLAN	FLIGHT DATE	FLIGHT NO
MU-2B-60	1560 S.A.		11-15-83	SCR-60 7

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
N. KOBAYASHI	S. Nakagawa		R. Wauchope
PILOT	~~TEST CREW~~	TEST CREW	TEST CREW
BOEHLER	PILOT : ROBINSON	KAWAI	
PILOT	~~TEST CREW~~	TEST CREW	TEST CREW
KISHI	PILOT : MEYERS		

AIRPLANE CONDITION

TAKEOFF WEIGHT ________ LBS

CENTER OF GRAVITY optional %MAC

FUEL LOADING Outer Tanks ________ LBS

Main Tanks ________ LBS

Tip Tanks ________ LBS

REMARKS

LIMITATIONS

DO NOT FLY AIRCRAFT OUTSIDE CERTIFIED ENVELOPE

TEST ITEMS

(1) landing gear warning system (item 2.(b))

(2) landing gear position indications (item 2.(c))

(3) to determine if the airplane is safely controllable by a single pilot (item 2.(e))

(4) flight using partial panel instruments (item 2.(j))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	TEST CONDITION: Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1.	L/G GEAR WARNING SYS & POSITION INDICATORS	~	below 140	20°	RET. → EXT.	~
2.	L/G GEAR WARNING SYS & POSITION INDICATORS	~	below 120	40°	RET. → EXT.	~
3.	SINGLE PILOT CONTROL	~	~	~	~	~
4.	SINGLE PILOT CONTROL IN NATURAL TURBULENCE OF AT LEAST MODERATE INTENSITY	~	~	~	~	~
5.	PARTIAL PANEL INSTRUMENTS	~	~	~	~	~
6	ILS Appr	|	As Req	20°	Ext	As Req

33

TEST PROCEDURES

I. Landing Gear Warning System & Landing Gear Position Indicators ;

1. Obtain an airspeed below 140 KCAS.
2. Extend flaps and set them at 20° position.
   (1) Check adequacy of the landing gear warning.
3. Operate the landing gear warning cut out switch.
   (1) Assure that landing gear warning does not stop.
4. Extend landing gears.
   (1) Assure that landing gear warning stops.
   (2) Determine if the landing gear position indicators are adequate to perform their intended functions
5. Retract landing gears.
6. Retract flaps.
   (1) Assure that landing gear warning is silent.
7. Obtain an airspeed below 120 KCAS.
8. Extend flaps and set them at 40° position.
   (1) Check adequacy of the landing gear warning.
9. Follow the above procedures 3 thru 6.

Add: Make an ILS approach using only 20° of flaps. Is it possible to make the approach without getting a gear warning?

V = 126 KIAS

add a rigging check - make sure horn does not come on until throttles are <u>in flight idle</u> per MAINT MAN.

smut locks.

TEST PROCEDURES

II. Single Pilot Control

1. Perform takeoff, climb, level flight, turning, descent, approach and landing normally.
   (1) Give particular attention to the following items during the flight.
      - yaw damping characteristics
      - dutch-roll characteristics
      - takeoff speed schedule
      - climb speed schedule
      - approach speed schedule

III. Partial Panel Instruments

1. Put covers on panel instruments except pilot's side turn & bank, airspeed and altitude indicators during a level flight.
2. Conduct climb, level flight, turn, descent and simulated landing.
   (1) Assure that the airplane can be safely flown.
3. Remove covers put on panel instruments.

WEIGHT & BALANCE

CENTER OF GRAVITY

$$\frac{195.3 - 191.5}{50.6} \times 100 + 22.0 = 2[illegible]$$

MODEL: MU-2B-60 S.A. DATE OF W & B: 10-15-83

AIRCRAFT SN: 1560 SA AIRCRAFT "N": 486 MA

FLIGHT NO.: SCR-60-7 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	7888.1	197.2	1,555,596.7	
1st Row (P) BOEHLER	245	97.2	23,814.0	
1st Row (CP) KISHI	220	97.2	21,384.0	
KAWAI	125	130.5	16,312.5	
Baggage Compt. **	300	293.7	88,110.0	
ZERO FUEL WEIGHT	8778.1	194.3	1,705,217.2	26.6 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	204.5	211,003.1	W/800lbs ____ %
Outer Tanks 34.5/34.5 Gal	462.3	201.0	92,922.3	GWT W/800# ____
Tip Tanks 90 / 90 Gal	1206.0	193.1	232,878.6	
TOTAL FUEL O/B Gal	2700.1	XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9809.9	195.3	1,916,220.3	28.3 %MAC
GWT MAINS/OUTERS (ONLY)	10,272.2	195.6	2,009,142.6	28.8 %MAC
GWT MAINS/OUTERS/TIPS	11,478.2	195.3	2,242,021.2	28.3 %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. Hacker Date Prepared: 11-14-83

PILOT: BOEHLER CO-PILOT: KISHI

FLIGHT TEST (Additional Crew Members): KAWAI 2. —

3. — 4. — 5. — 6. —

DATE OF FLIGHT: 11-~~14~~ 15-83 Q.C. (Stamp & Initials): 32 / [illegible]

SCR-60-7
(11/15/83)

SE 9:13
TO [illegible]
LD 10:30

RUN	CONDITION	TIME	Hp (FT)	V (KTS)	RAT	FUEL FLOW	COMMENTS
1	NTS Check	9.15	30.32 1900				
2	Start Lock	9.18					
3	Takeoff	9.28		108		94	Set Power, FF Falling
	Climb			≈150 K			15° pilot gyro
		9:36	14,500				Level off.
	Cruise	9.39	14500	225 pilot	8	232	100% → 96% RPM
4	Partial Panel	9:51					
5	Gear Horn	10:14	≈10000			565	
6	ILS Approach						
7	Land	10:30					
8	E/S Shut Down	10:33				711	

FLIGHT NUMBER: SCR-60-007

DATE: NOVEMBER 15, 1983

LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS

AIRCRAFT: MU-2B-60-1560SA (N486MA)

CREW: KISHI / BOEHLER / KAWAL

FLIGHT TIME: 1.0 hours

PURPOSE: Evaluate:

1. landing gear warning system and indicators
2. single pilot operation
3. single pilot operation in turbulence
4. instrument flight using partial panel
5. ILS approach

COMMENTS: The evaluations were conducted under the test conditions cited in the flight test plan.

1. LANDING GEAR WARNING SYSTEM AND INDICATORS. The landing gear warning horn system is not adequate. While conducting ILS approaches, if the approach was made into the wind, it was possible to make the approach without receiving warning that the landing gear was not down. The warning horn would sound when the power levers were against the flight idle stops. The landing gear position lights functioned properly, and the position of the landing gear was easily determined.

2. SINGLE PILOT OPERATION. The maneuvers in the flight test plan were successfully completed without any difficulties. The pilot workload was not excessive and is comparable to the workload required to operate similar airplanes. Consideration was given

to the pilots' unfamiliarity with the airplane. The yaw damping characteristics are weak, however the airplane is equipped with an effective yaw damper. Proper trim is very important. Any changes in the power setting usually requires some adjustments with trim. The takeoff speed schedule was followed. Using the accepted takeoff techniques result in overshooting the rotation velocity. This overshoot is minimal numerically and has no adverse effect relative to the climb schedule. This problem will be resolved through familiarity operating the airplane. The climb schedule calls for 155 KIAS from sea level to 10,000 feet and 150 KIAS from 10,000 feet to the test area cap of 12,500 feet. The angle of climb at these climb speeds is steep enough to cause some limitation to the pilot's over-the-nose visibility. The approach speed schedule is sufficient and provides a comfortable margin. In maintaining the specified airspeed over the runway threshold resulted in substantial floating during the landing flare. A single engine approach and landing was accomplished without difficulty. The landing included braking using reverse thrust from the active engine. The evaluation did not reveal any characteristics which would adversely affect operating the airplane with a single pilot.

3. SINGLE PILOT OPERATION IN TURBULENCE. This part was not evaluated due to the lack of turbulence.

4. INSTRUMENT FLIGHT USING PARTIAL PANEL. The maneuvers required by the flight test plan were completed

successfully referring to the instruments available in a partial panel. With the airplane properly trimmed, stable flight is easily maintained.

5. Two ILS approaches were made with the landing gear up and 20° of flaps down to see if the approaches could be made without obtaining a warning that the landing gear was not down. For the first ILS, intercept of the localizer was very close-in. As a result, the aircraft had to descend to intercept the glide slope. To maintain the proper approach airspeed, the power levers were retarded to the flight idle stops. At this point, the landing gear warning horn was activated. The second ILS was different, and conformed with normal procedures. Intercepting the glide slope using power to maintain the proper speed, the power levers were forward of the flight idle stops. The airplane descended down the glide slope into the wind with the power levers still forward of the flight idle stops. The approach was made without sounding the warning horn.

James D. [illegible]

DATE: 11/15/83 MODEL: MU-2B-60	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehme Pierson	TEST: SCR 60-8	S.E. 1401 T.O. 1455 LDG. 1615 TOTAL 1:17 FUEL USED -752

RAMP WT: 9962.2 ZFW..... 8468.1	C.G. %MAC.... 24.14 ZFW C.G. %MAC 21.08	TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

Normal Takeoff and Climb to 10.500. Items 1-12 on Flight Card Accomplished (See Attached Data) with No Unusual Results. A 20° Flap ILS Flown to Full stop on Return.

ME-9

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

MODEL	SERIAL NO.	FLIGHT TEST PLAN		FLIGHT DATE	FLIGHT NO
MU-2B-60	1560SA			11/15/83	SCR-60-8
PREPARED BY		CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY	
PILOT: BOEHLER		~~TEST CREW~~ PILOT: ROBINSON	TEST CREW: KAWAI	TEST CREW	
COPILOT: KISHI		~~TEST CREW~~ PILOT: MEYERS	TEST CREW	TEST CREW	

AIRPLANE CONDITION

TAKEOFF WEIGHT	11,162.2	LBS
CENTER OF GRAVITY	FWD	%MAC
FUEL LOADING L.W.		LBS
R.W.		LBS
FUS		LBS

REMARKS

LIMITATIONS

Do not fly aircraft outside certified envelope

TEST ITEMS

(1) To obtain and maintain airspeeds with the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f whichever is the lower (item 2 (h)) — CAR 3.109 (b) (6)

(2) stall warning (item 2 (i))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN FUEL AT LANDING: ________ LBS

TEST CONDITION

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	CAR 3.109 (b) (6)	10,000	Trim 1.5 V_{S0}	40°	DN	Flt Idle
	STALL WARNING (AUTO PILOT OFF)					
2	Straight (climbing)	10,000	Trim 1.5 V_{S0}	0°	UP	As Req'd
3	Straight	→	→	→	→	Flt Idle
4	Straight (climbing)	→	→	40°	DN	As Req'd
5	Straight	→	→	→	→	Flt Idle
6	Single Engine	→	~	0°	UP	~~As Req'd~~ Feather
7	Single Engine	→	~	40°	DN	→
	STALL WARNING (AUTO PILOT ON)					
8	Straight (climbing)	10,000	Trim 1.5 V_{S0}	0°	UP	As Req'd
9	Straight	→	→	→	→	Flt Idle
10	Straight (climbing)	→	→	40°	DN	As Req'd
11	Straight	→	→	→	→	Flt Idle
12	accel.					

TEST PROCEDURES

I. To obtain and maintain airspeeds within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f, whichever is the lesser $\longrightarrow$ Cond. No. 1.

1. Trim the airplane at the specified conditions.
2. Obtain and maintain 1.1 V_{S1} using primary control systems without changing trim. (with one hand)
3. Obtain and maintain 1.7 V_{S1} using primary control systems without changing trim. (with one hand)

II. Stall Warning $\longrightarrow$ Cond. No. 2 thru 5 and 8 thru 11.

1. Trim the airplane at the specified conditions.
2. Reduce airspeed by means of the elevator control until stall warning starts.
   (1) Assure that the stall warning is clear and distinctive.
3. The elevator control shall be pulled back at a rate such that the airplane speed reduction does not exceed 1 mph/sec until a stall is produced.
   (1) Assure that a clear and distinctive stall warning continues until the stall occurs.
4. Recover from the stall using normal elevator control.

TEST PROCEDURES

III. Stall Warning ⟶ Cond. No. 6, 7, 12 and 13

1. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank towards the inoperative engine.
2. Increase steadily angle of attack with the elevator control until a stall occurs.
   (1) Assure that a clear and distinctive stall warning is available until the stall occurs.
3. Recover from the stall by normal use of the controls reducing power on the operating engines if desired.
4. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank away from the inoperative engine.
5. Repeat above procedures 2 and 3.

We would also want to
look at accelerated rate entries
(approx 4K/sec)
to insure that warning occurs.
Not necessarily at 4-9 K, but
at least to be sure that it
does come on prior to stall.
B. R.

clean and power OFF

WEIGHT & BALANCE

CENTER OF GRAVITY

$$\frac{192.8 - 191.5}{60.6} \times 100 + 22.0 = 2.$$

MODEL: MU-2B-60 S.A. DATE OF W & B: 10/15/83

AIRCRAFT SN: 1560SA AIRCRAFT "N": 486 MA

FLIGHT NO.: SCR-60-8 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	7.882.1	197.2	1.555.294.7	
1st Row (P) BOEHLER	245.0	97.2	23.814.0	
1st Row (CP) ROBINSON	145.0	97.2	14.094.0	
KAWAI	125	130.5	16,312.5	
BALLAST	65	109	7,0850	
Baggage Compt. **		293.7		
ZERO FUEL WEIGHT	8468.1	190.9	1,616,902.2	21.08 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	204.5	211,003.1	W/800lbs ___ %
Outer Tanks 34.5/34.5 Gal	462.3	201.0	92,922.3	GWT W/800# ___
Tip Tanks 90 / 90 Gal	1206.0	193.1	232,878.6	
TOTAL FUEL O/B Gal	2700.1	XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9499.9	192.4	1,827,905.3	23.51 %MAC
GWT MAINS/OUTERS (ONLY)	9962.2	192.8	1,920,827.6	24.14 %MAC
GWT MAINS/OUTERS/TIPS	11168.2	192.8	2,153,706.2	24.14 %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-15-83

PILOT: E BOEHLER CO-PILOT: ROBINSON

FLIGHT TEST (Additional Crew Members): KAWAI 2. —

3. — 4. — 5. — 6. —

DATE OF FLIGHT: 11-15-83 Q.C. (Stamp & Initials): 32 / [illegible]

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SCR-60-8 (11/15/83)

SE 14.47
TO 14 55
LD 16 13

W_{TO} = 9,962 LBS

RUN	H_P (FT)	V_{TRIM}	V_{SHAKER}	V_{BUF}	Fuel Burn	COMMENT	
		1.5 V_S		(V_S)			
1	T/O 15:15 1010						
1	15:00 9940	112				1.1 V_s = 82	
		trim = 13°.				1.7 = 127	
2	15 03	146	101	91	145	Power ON	
				V_s=97		Flaps 0°	G↑
3	15:07	146	105	99	171	Idle	
						Flaps 0°	G↑
4	15 09	112	72	50		V_s = 74.5	
8						Power ON	40° G↓
5	15 11	112.	77	73	240.	Power OFF	40° G↓
	15:15	111			260	V_{SPEC} = 74	
				NO SHAKER			
8	COND 7	145	NO STALL 105 KTS at full Nose up			V_{SPEC} = 96.5	TRIM 1 FK
	COND 8						
		145	100	20° Nose up stall. Full Nose up 30°	360	75% TQ/	75% TQ.
	COND 11						
		110	80K NO shaker		400	IDLE	
			No stall. Full Nose up trim				
	COND 10	110	70K shaker. No stall obtained			80% TQ	
	COND 7	110	15° trim.			1.1 V_s = 80 KTS	7~8%
						1.7 V_s = 124 KTS	6~7%
	S/E STALL	143	110.		553	Idle	
	S/E STALL	110	No stall obtained		590	Power ON	
	S/E shut Down	16 · 18			← Full Rudder, Full spoiler		

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SCR-60-8 11-15-83 Robinson

I. To obtain and maintain airspeeds within the range of 1.1 to 1.7 Vs1 or Vf, whichever is the lesser.

Result: No difficulty was encountered. Maximum positive and negative applied pressures were approximately (5) five and (8) eight pounds, respectively.

II Stall Warning

A. Items 2 through 5

(1) Accomplished in accordance with instructio[n]. Stall warning was clear and distinctive and continued until the stall occured

B. Items 8 through 11

(1) Accomplished in accordance with instructions

(a) Climbing with 75% power
Results as per A.(1) above except Autopil[ot] was disengaged two (2) knots prior to stall.

(b) Flight idle power
Aircraft stabalized at trimed speed of 1.5 Vso, -800 FPM.

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(2) NOTE: BOTH THE POWER-AS-REQUIRED AND FLIGHT IDLE MANEUVERS RESULTED IN FULL TRAVEL OF THE PITCH TRIM (UP OR DOWN AS APPROPRIATE). THE POWER AS REQUIRED MANEUVERS (75%) RESULTED IN FULL TRAVEL OF THE RUDDER TRIM THROUGH TORQUE COMPENSATION.

C. ITEMS 6 AND 7

(1) ATTEMPTED IN ACCORDANCE WITH INSTRUCTIO...

(a) BANKED TOWARD THE OPERATIVE ENGINE (LEFT). RESULT AS PER II. A (1) FLAP 0°, GEAR UP)

(b) BANKED TOWARD THE INOPERATIVE ENGINE (RIGHT). RESULT WAS NOT OBTAINABLE. MAXIMUM DEFLECTION OF RUDDER AND SPOILER CONTROL WAS OBTAINED ABOV... STALL WARNING ACTIVATION SPEED. (FLAP 40°, GEAR DOWN)

D. ITEM 12

(1) ACCOMPLISHED IN ACCORDANCE WITH INSTRUCTIONS. AN ACCELERATED ENTRY OF APPROXIMATELY FOUR (4) KNOT PER SECOND PRODUCED RESULTS AS PER II. A. (1)

DATE: 11/16/83 MODEL: MU-2B-60	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Buehler Meyers Kawan	TEST: SCR 60-9	S.E. 0855 T.O. 0905 LDG. 0927 TOTAL 0.3 FUEL USED 247#

RAMP WT: 9957.2 ZFW..... 8463.1	C.G. %MAC.... 24.16 ZFW C.G. %MAC 21.07	TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

Normal Takeoff & Climb to 10.500. Flight Card Item #1 completed when Main Gear Doors Failed to close. Gear Extension did not close Doors – Aborted and Returned

Broken wire of terminal board.

Terminal broken on door control circuit. Repaired.

B

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

SCR-60-9 (11-16-83) Meyers

MODEL	SERIAL NO.	FLIGHT TEST PLAN	FLIGHT DATE	FLIGHT NO.
MU-2B-60	1560 SA		11/16/83	SCR-60-9

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
[illegible]	[illegible]	[illegible]	[illegible]
PILOT BOEHLER	~~TEST CREW~~ PILOT ~~[illegible]~~	TEST CREW KATDA	TEST CREW
COPILOT ~~[illegible]~~	~~TEST CREW~~ PILOT MEYERS	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT		11,162 2	LBS
CENTER OF GRAVITY		FWD	%MAC
FUEL LOADING	L.W.		LBS
	R.W.		LBS
	FUS		LBS

REMARKS

LIMITATIONS

Do not fly aircraft outside certified envelope

TEST ITEMS

(1) To obtain and maintain airspeeds with the range of 1.1 Vs1 to 1.7 Vs1 or Vx whichever is the lower (item 2 (h)) — CAR 3.109 (h) (6)

(2) stall warning (item 2 (i))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	Test Item	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	CAR 3.109 (h) (6)	10,000	Trim 1.5 Vs0	40°	DN	Flt Idle
	STALL WARNING (AUTO PILOT OFF)					
2	Straight (climbing)	10,000	Trim 1.5 Vs0	0°	UP	As Req'd
3	Straight	→	→	→	→	Flt Idle
4	Straight (climbing)			40°	DN	As Req'd
5	Straight			→	→	Flt Idle
6	Single Engine 15° L & R		~	0°	UP	As Req'd / feather
7	Single Engine 15° L & R	→	~	40°	DN	→
	STALL WARNING (AUTO PILOT ON)					
8	~~Straight (climbing)~~	10,000	Trim 1.5 Vs0	0°	UP	As Req'd
9	~~Straight~~	→	→	→	→	Flt Idle
10	~~Straight (climbing)~~			40°	DN	As Req'd
11	~~Straight~~			→	→	Flt Idle
12	Accel. 4 K/sec			40°	DN	Flt Idle
13	ILS			20°		

ABORT DUE TO GEAR DOOR

TEST PROCEDURES

I. To obtain and maintain airspeeds within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_F, whichever is the lesser $\longrightarrow$ Cond. No. 1.

1. Trim the airplane at the specified conditions.
2. Obtain and maintain 1.1 V_{S1} using primary control systems without changing trim. (with one hand)
3. Obtain and maintain 1.7 V_{S1} using primary control systems without changing trim. (with one hand)

II. Stall Warning $\longrightarrow$ Cond. No. 2 thru 5 and 8 thru 11.

1. Trim the airplane at the specified conditions.
2. Reduce airspeed by means of the elevator control until stall warning starts.
   (1) Assure that the stall warning is clear and distinctive.
3. The elevator control shall be pulled back at a rate such that the airplane speed reduction does not exceed 1 mph/sec until a stall is produced.
   (1) Assure that a clear and distinctive stall warning continues until the stall occurs.
4. Recover from the stall using normal elevator control.

TEST PROCEDURES

III. Stall Warning ⟶ Cond. No. 6, 7, 12 and 13

1. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank towards the inoperative engine.
2. Increase steadily angle of attack with the elevator control until a stall occurs.
   (1) Assure that a clear and distinctive stall warning is available until the stall occurs.
3. Recover from the stall by normal use of the controls reducing power on the operating engines if desired.
4. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank away from the inoperative engine.
5. Repeat above procedures 2 and 3.

We would also want to look at accelerated rate entries (approx 4K/sec) to insure that warning occurs. Not necessarily at 4-9 K, but at least to be sure that it does come on prior to stall.

G. A.

WEIGHT & BALANCE

CENTER OF GRAVITY

$\frac{- 191.5}{60.6} \times 100 + 22.0 =$ ____

MODEL: MU-2B-60 S.A. DATE OF W & B: 10-15-83

AIRCRAFT SN: 1560SA AIRCRAFT "N": 486 MA

FLIGHT NO.: SCR-60-9 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	7888.1	197.2	1,555,596.7	
1st Row (P) BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) MEYERS	180.0	97.2	17,496.0	
KAWAI	125.0	130.5	16.312.5	
BALLAST	25.0	109.0	2725	
Baggage Compt. **		293.7		
ZERO FUEL WEIGHT	8463.1	190.9	1,615,944.2	21.07 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	204.5	211,003.1	W/800lbs ____ %
Outer Tanks 34.5/34.5 Gal	462.3	201.0	92,922.3	GWT W/800# ____
Tip Tanks — / — Gal	—	193.1	—	
TOTAL FUEL O/B Gal	1494.1	XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9494.9	192.4	1,826,947.3	23.51 %MAC
GWT MAINS/OUTERS (ONLY)	9957.2	192.8	1,919,869.6	24.16 %MAC
GWT MAINS/OUTERS/TIPS	—	—	—	____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-15-83

PILOT: BOEHLER CO-PILOT: MEYERS

FLIGHT TEST (Additional Crew Members): KAWAI 2. ——

3. —— 4. —— 5. —— 6. ——

DATE OF FLIGHT: 11/16/83 Q.C. (Stamp & Initials): 32 [signature]

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S 0900
TO 0909
L 0927

S 1130 9-1
T.O. 1134
L 1204

1. WARNING & STALLS AS NOTED

2. TURNING into bad ENGINE SHAKER COMES ON 1 to 2 Knots of STALL but ATTITUDE of A/C and CONTROL deflection Required to maintain coordinated Flight is so FOREIGN THAT This should indicate to A pilot THAT doom is impending

3. ILS w/ 20° FLAPS gear up horn did not COME ON until 1 MILE ON SHORT FINAL

4. Right Shoe heel hung up during Attempt To Push Left Rudder pedal during ENGINE

SCR - 60 - 9
(11/16/83)

W_{TO} = [illegible]

RUN	COND	TIME	FLAPS	GEAR	Fuel Burn	1.5V	[illegible]	Vs	[illegible]
1	1	9:16	40	↓	120	112		7[illegible]	[illegible]
									[illegible]
									[illegible]
2	2	9:17	0	↑		146		97 [illegible]	[illegible]
	LND	9:29	40	↓	247		at E/G Shut Down		

DATE: 11/10/83 MODEL: MU 2B-60	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: FISHER MEYERS KOHUNT	TEST: SCR 60-9-1	S.E. 1130 T.O. 1134 LDG. 1200 TOTAL 0.5 FUEL USED 345

RAMP WT: 9957.2 C.G. %MAC.... 24.16 TIA REF: RE 394

ZFW..... 8463.1 ZFW C.G. %MAC 21.07

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS: CONTINUATION OF SCR 60-9

NORMAL TAKEOFF AND CLIMB TO 8500. FLIGHT CARD ITEMS 2~12 ACCOMPLISHED. DATA ATTACHED. A 20° FLAP ILS APPROACH FLOWN to circle full stop on Rwy 18.

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

SCE-60-9-1
(11/16/23)

$W_{TO} = 9957$ #

SE 11:29
TO 11:33
LD 12:[illegible]

NO	COND	TIME	FLAPS	GEAR	PWR	[illegible]	V[illegible]	[illegible]	COMMENTS
1	[illegible]	11 [illegible]	0	↑	82	146	101	88	Power 75%
									Pitch trim 8°
2	3				88	146	101	92	Power OFF
3		11:29	40	↓	91	111	72	63	Pitch trim 9° 75%
									Pitch Tr 13° 10½
4		11:43	40	↓		111	73	71	power off stall
							75	73	
5		11:43	40	↓		111	90	74	Approach [illegible]
								S/E ←	Trim 11° Nose Left
6		11:48	0	K	160	144	110	103	8° Nose up
7						110	70	1[illegible] KTS	Full Rudder Tr[illegible]
			40	↓	83			less than	[illegible] 14°
								S/E [illegible]	
									Lot of Buffet
		11:53		E/G start					
	ILS	12:03	40	↑	[illegible]	[illegible]	3° slide slope		10 [illegible]
	LDG	12:08	40	↓		110	345	at shut Down	

Flight test report SCR 60-9 & 9-1 11/16/83

G. Meyers.

1. Trimed A/C to 112 Kts (1.5 V_{s_1}) ~~[illegible]~~ Gear down Flaps 40°
pulled to an airspeed of (82.) 1.1 V_{S0} required 17#
pushed to " " " (127) 1.7 V_{S0} " 11#

2. On items 2 through 7 and 12 The airspeed results of warning and stall are listed on the data sheet.

On Turns into the dead engine shaker comes on 1 to 2 Knots above the stall but the attitude of the aircraft and the control deflections to get there were enough warning to the pilot that stall or loss of control were ~~[illegible]~~ near.

3. ILS with 20° of flaps and a target speed of 119 KIAS. The gear up warning horn did not sound until we were within 1 mile of the runway on the approach.

5. The right ~~[illegible]~~ shoe heel hung up in rudder pedal well during an attempt to get left rudder during engine out maneuvers.

DATE: 11/16/83 MODEL: MU 2B60	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: BOEHGE KISHI THACKER	TEST: SCR 60-10	S.E. 1338 T.O. 1345 LDG. 1430 TOTAL 045 FUEL USED -445

RAMP WT: 10092.2 C.G. %MAC.... ~~24.00~~

ZFW..... 8548 1 ZFW C.G. %MAC 21.03

TIA REF: R0394

CONFIGURATION:

TEST EQUIPMENT:

SUMMARY OF RESULTS:

Normal T.O. & Climb to 10,500. All ITEMS 1-12 ON attached flight card completed - DATA ATTACHED

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

[illegible] CR-60-10 (1-1683) KISHI

MODEL	SERIAL NO.	FLIGHT TEST PLAN	FLIGHT DATE	FLIGHT NO
MU-2B-60	1500 SA		[illegible]	[illegible]

PREPARED BY	CHECKED BY (ENG'G)	CHECKED BY (FLIGHT)	APPROVED BY
[illegible]	[illegible]	[illegible]	[illegible]
PILOT BOEHLER	~~TEST CREW~~ / PILOT D ROBINSON	TEST CREW KAWAI	TEST CREW
COPILOT KISHI	~~TEST CREW~~ PILOT MEYER	TEST CREW	TEST CREW

AIRPLANE CONDITION

TAKEOFF WEIGHT	11,142 2	LBS
CENTER OF GRAVITY	FWD	%MAC
FUEL LOADING L.W.		LBS
R.W.		LBS
FUS		LBS

REMARKS

LIMITATIONS

Do not fly aircraft outside [illegible] envelope

TEST ITEMS

(1) To obtain and maintain airspeeds with the range of 1.1 V_{S1} to 1.7 V_{S1} or V_{fe} whichever is the lesser (item 2(h)) — CAR 3.109 (4) (6)

(2) stall warning (item 2 (i))

ESTIMATED FLIGHT TIME: ____ HR ____ MIN

FUEL AT LANDING: ________ LBS

Cond No	TEST ITEM	Altitude (FT)	Airspeed (KIAS)	Flap	Gear	Engine
1	CAR 3.109 (4) (6)	10,000	Trim 1.5 V_{S0}	40°	DN	Flt Idle
	STALL WARNING (AUTO PILOT OFF)					
2	Straight (climbing)	10,000	Trim 1.5 V_{S0}	0°	UP	As Req'd
3	Straight	→	→	—	→	Flt Idle
4	Straight (climbing)			40°	DN	As Req'd
5	Straight			→	→	Flt Idle
6	Single Engine		~	0°	UP	As Req'd
7	Single Engine		~	40°	DN	→
	STALL WARNING (AUTO PILOT ON)					
8	Straight (climbing)	10,000	Trim 1.5 V_{S0}	0°	UP	As Req'd
9	Straight	→	→	→	→	Flt Idle
10	Straight (climbing)			40°	DN	As Req'd
11	Straight			→	→	Flt Idle
12	ACCEL. ENTRY RATE 1KT/SEC			40	→	FLT IDLE

TEST PROCEDURES

I. To obtain and maintain airspeeds within the range of 1.1 V_{S1} to 1.7 V_{S1} or V_f, whichever is the lesser ⟶ Cond. No. 1.

1. Trim the airplane at the specified conditions.
2. Obtain and maintain 1.1 V_{S1} using primary control systems without changing trim. (with one hand)
3. Obtain and maintain 1.7 V_{S1} using primary control systems without changing trim. (with one hand)

II. Stall Warning ⟶ Cond. No. 2 thru 5 and 8 thru 11.

1. Trim the airplane at the specified conditions.
2. Reduce airspeed by means of the elevator control until stall warning starts.
   (1) Assure that the stall warning is clear and distinctive.
3. The elevator control shall be pulled back at a rate such that the airplane speed reduction does not exceed 1 mph/sec until a stall is produced.
   (1) Assure that a clear and distinctive stall warning continues until the stall occurs.
4. Recover from the stall using normal elevator control.

TEST PROCEDURES

III. Stall Warning ——→ Cond. No. 6. 7. 12 and 13

1. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank towards the inoperative engine.
2. Increase steadily angle of attack with the elevator control until a stall occurs.
   (1) Assure that a clear and distinctive stall warning is available until the stall occurs.
3. Recover from the stall by normal use of the controls reducing power on the operating engines if desired.
4. Establish a steady curvilinear flight at the specified conditions while maintaining a 15° bank away from the inoperative engine.
5. Repeat above procedures 2 and 3.

We would also want to look at accelerated rate entries (approx 4K/sec) to insure that warning occurs. Not necessarily at 4-9 K, but at least to be sure that it does come on prior to stall.

[illegible]

WEIGHT & BALANCE

CENTER OF GRAVITY

$$\frac{\underline{\qquad} - 191.5}{60.6} \times 100 + 22.0 = \underline{\qquad}$$

MODEL: MU-2B-60 S.A. DATE OF W & B: 10/15/83

AIRCRAFT SN: 1560SA AIRCRAFT "N": 486 MA

FLIGHT NO.: SCR-60-10 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VIII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	7888.1	197.2	1,555,594.7	
1st Row (P) BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) KISHI	220.0	97.2	21,384.0	
THACKER	160 0	130.5	20,880.0	
	8513.1	190.49	1,621,674.7	
Baggage Compt. **	35.0	293.7	10,279.5	
ZERO FUEL WEIGHT	8548.1	190.9	1,631,954.2	21.03 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	204.5	211,003.1	W/800lbs ____ %
Outer Tanks 34.5 / 34.5 Gal	462.3	201.0	92,922.3	GWT W/800# ____
Tip Tanks — / — Gal	—	193.1	—	
TOTAL FUEL O/B Gal		XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9579.9	192.38	1,842,957.3	23.45 %MAC
GWT MAINS/OUTERS (ONLY)	10,042.2	192.77	1,935,879.6	24.10 %MAC
GWT MAINS/OUTERS/TIPS	—	—	—	— %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 11-16-83

PILOT: BOEHLER CO-PILOT: KISHI

FLIGHT TEST (Additional Crew Members): THACKER 2. ——

3. —— 4. —— 5. —— 6. ——

DATE OF FLIGHT: ________ Q.C. (Stamp & Initials): ______/______

SCR - 60 - 10

SE 13 37
TO 13 45
LP 14 30

[illegible]	[illegible]		FLAPS	GEAR	FUEL BURN	V_{TRIM} (1.5 V_S)	V_{SHAKER}	V_{STALL}	COMMENTS	
1	1	13:53	40	↓	117	112			19° @ 1.1	12° TRIM
2			40	↓		127			10° @ 17	12° TRIM
1	2	13:57	0	↑	146	145	102	89	75% PWR	8° TRIM
1	3	14:00	0	↑	189	145	102	96	F/I	8° TRIM
1	4	14:02	40	↓	213	111	71	64	75% PWR	8° TRIM
1	5	14:04	40	↓	221	111	76	70	F/I	14 TRIM
1	12	14:06	0	↑	232	111	82	70	ACC STALL 75%	
2		14:09	↑	↑	252	144	106	101	"	15 N LEFT 15 N UP
3		14:11	40	↓	287	110	79	71	"	FULL R TRIM 10° N UP
					449		LANDING			

FLIGHT NUMBER: SCR-60-010
DATE: NOVEMBER 16, 1983
LOCATION: MATHIS FIELD, SAN ANGELO, TEXAS
AIRCRAFT: MU-2B-60-1560SA (N486MA)
CREW: KISHI / BOEHLER / THACKER
FLIGHT TIME: 0.8 hours
PURPOSE: Evaluate stall warning without the autopilot, and also accelerated rate entries.

COMMENTS: The stall warning was evaluated using the test conditions in the flight test plan. The stalls were preceded by aerodynamic buffet prior to the stick shaker activating. This buffet is the most pronounced with the flaps 40° down. The accelerated rate entries resulted in similar warnings. Stall warning in the form of the stick shaker was very pronounced and effective.

James D. Kishi

DATE: 12/1/83 MODEL: MU2B60	MITSUBISHI AIRCRAFT INTERNATIONAL FLIGHT RESULTS REPORT	PAGE 1 OF FLT. NO.
CREW: Boehler Brothe [illegible]	TEST: SCR 60011	S.E. 16[illegible] T.O. 17[illegible] LDG. 18[illegible] TOTAL 1.[illegible] FUEL USED -75[illegible]

RAMP WT: 10,182.2 ZFW..... 8688.1	C.G. %MAC.... 27.3 ZFW C.G. %MAC 22.04	TIA REF: R0394

CONFIGURATION:

SEE ATTACHED W&B

TEST EQUIPMENT:

SUMMARY OF RESULTS:

2 NORMAL TAKE-OFFS. IFR CLIMB to VFR O/T. DIRECTIONAL AND LATERAL STABILITY. SPIRAL STABILITY. STALLS. IFR Approach AND LANDING (900/1)

[illegible]

MAINTENANCE AND ENGINEERING ITEMS:

RECOMMENDATIONS AND CONCLUSIONS:

WEIGHT & BALANCE

CENTER OF GRAVITY

MODEL: MU-2B-60 S.A. DATE OF W & B: 10-15-83

AIRCRAFT SN: 1560 SA AIRCRAFT "N": 486 MA

$$\frac{194.7 - 191.5}{60.6} \times 100 + 22.0 = 27$$

FLIGHT NO.: SRR-60-011 (Initial) (C of A) (R & D) (Prod)

NOTE: SEE P.O.M. - SECTION VII - FOR LOADING OTHER THAN LISTED BELOW

ITEM	WEIGHT (lbs)	ARM (in.)	MOMENT (in/lbs)	
Basic Weight *	7888.1	197.2	1,555,596.7	
1st Row (P) E. BOEHLER	245.0	97.2	23,814.0	
1st Row (CP) E. BOOTHE	170.0	97.2	16,524.0	
C. ARNOLD	185.0	130.5	24,142.5	
Baggage Compt. ** BALLAST	200.0	293.7	58,740.0	
ZERO FUEL WEIGHT	8688.1	193.2	1,678,817.2	22.04 %MAC
Main Tank 6.7 lb/gal 154 Gal	1031.8	204.5	211,003.1	W/800lbs ____ %
Outer Tanks 34.5/34.5 Gal	462.3	201.0	92,922.3	GWT W/800# ____
Tip Tanks — / — Gal	—	193.1	—	
TOTAL FUEL O/B 223.0 Gal	1494.1	XXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	
GWT MAINS (ONLY)	9719.9	194.4	1,889,820.3	26.8 %MAC
GWT MAINS/OUTERS (ONLY)	10,182.2	194.7	1,982,742.6	27.3 %MAC
GWT MAINS/OUTERS/TIPS	—	—	—	____ %MAC

*Includes oil and unuseable fluids ** Location of Ballast When Installed

Prepared By: D. THACKER Date Prepared: 12-01-83

PILOT: E. BOEHLER CO-PILOT: E. BOOTH

FLIGHT TEST (Additional Crew Members): C. ARNOLD 2. —

3. — 4. — 5. — 6. —

DATE OF FLIGHT: ____________ Q.C. (Stamp & Initials): ________/______

72

12/2/83
DEB

EVALUATION OF MU2B-60

On Dec 1, 1983 a brief evaluation of the flying qualities of MU2B-60 was conducted at the Mitsubishi facility in San Angelo, Texas. Edward M Boothe, FAA, ASO-205, Atlanta, was evaluation pilot. Mr. Lincoln Boehler, Mitsubishi was pilot in command and safety pilot. Mr. Charles Arnold, FAA ACE 406 was observer. All evaluation flying was done from the left seat. The evaluation task included the following:

1. A ~~brief~~ VFR traffic pattern and landing
2. An IFR departure to VFR on top
3. High speed and low speed longitudinal and lateral-directional stability, roll control characteristics, precision of bank angle control, precision of heading control, power-off landing configuration stall. Steep turns, climbs and descents were conducted in the process of evaluation. Spiral stability was also briefly examined.
4. An IFR descent to holding

12/2/1.
(2)

followed by an arc approach to localizer intercept and and ILS approach to minimums with a full stop landing. The ceiling was 900 feet. All instrument procedures were flown using raw data. Flight director was available but not used for this evaluation. All flying was performed with the yaw damper off.

The following are findings from the evaluation.

1. The airplane exhibited a low degree of directional stability as manifest by its tendency to weathercock and its Dutch-roll characteristics. When disturbed directionally, the airplane was slow to return to a zero sideslip coordinated condition. (There was no sideslip indicator, but the airplane would continue in a flat turn and the "slip ball" would remain out of center until corrected by pilot rudder application. Weathercock Stability was therefore quite weak at small ~~[illegible]~~ angles of sideslip. For large excursions in sideslip the airplane would return to a small

steady state deflection where it would remain. The dutch roll was excited by a rudder doublet input. For this class of airplane, the Dutch roll frequency was quite low, however the mode was well damped. No attempt was made to measure Dutch roll frequency except to note that it was surprisingly low. The damping ratio was on the order of 0.5 or more. These observations apply to both the high speed, approximately 220 KIAS, and low speed, approximately 140 KIAS, cases.

2. The longitudinal characteristics were mostly noticed by light pitch control forces with wing flaps extended. This produced some difficulty in predicting the results of a control input which, in turn, resulted in constant pitch attitude corrections and a lot of attention to altitude control. During the VFR traffic pattern turn from down wind to base to final approach at an airspeed of approximately 120 KIAS pitch control forces were quite light and caused some overcontrol and "bobbling" in pitch attitude with excursions of about ± 3°. At high speeds with wing flaps retracted pitch control

forces were moderate and there was no tendencies to overcontrol. The forces at high speeds appeared matched to the airplane response characteristics.

3. Roll control was predictable and bank angle control was precise. There was considerable backlash or dead band about the center position of the roll control wheel but it did not interfere with bank angle control. There was no tendency for small bank angle excursions when attempting to maintain a precise bank angle. Heading control was also precise, but a conscious effort was required of the pilot to keep the "slip ball" centered by use of rudder. If no effort was made to center the ball it would remain about one half ball-width out of center and have little effect on heading and bank angle control since any resulting roll tendency was easily controlled. Roll control forces appeared quite well matched to the roll response of the airplane.

3. Spiral stability at both high and low speed (flaps extended) was

essentially neutral. At high bank angles, 20° or greater, there was a tendency to roll back to level, indicating positive spiral stability.

4. Stall characteristics in the landing configuration (power off) were good. Bank angle was controllable through the stall. There was no undue tendency to enter a spin. In fact, the airplane was fully stalled and held in the stall and the bank angle remained fully controllable.

5. Except for the pitch control characteristics previously discussed and the tendency for small residual steady sideslip, there was nothing particularly significant about the ILS approach. The approach was flown using raw data only. Because of the pitch control forces constant attention to maintaining glide slope was required but there were never any large glide slope deviations, i.e. greater than one dot, during the approach. A truly stabilized approach was not achieved, but the pitch control workload was not excessive.

No estimation of overall workload can be derived from this evaluation. Such an evaluation would require training in the airplane, attainment of a reasonable degree of proficiency and a subsequent single pilot evaluation.

APPENDIX-D

AIRWORTHINESS DIRECTIVES(ADs)

PITOT MODIFICATION: Docket No. 84-CE-21-AD

ENGINE BLEED AIR COUPLING NUT: Docket No. 84-CE-14-AD

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[14 CFR Part 39]

[Docket No. 84-CE-21-AD]

AIRWORTHINESS DIRECTIVES:

MITSUBISHI HEAVY INDUSTRIES, LTD. (MHI), Models MU-2B, -10, -15, -20, -25, -26, -30, -35, -36 Airplanes

and

MITSUBISHI AIRCRAFT INTERNATIONAL, INC. (MAI), MODELS MU-2B, -25, -26, -26A, -35, -36A, -40, and -60 Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of Proposed Rulemaking (NPRM).

SUMMARY: This notice proposes to adopt a new Airworthiness Directive (AD), applicable to certain serial numbered Mitsubishi Models MU-2B, -10, -15, -20, -25, -26, -26A, -30, -35, -36, -36A, -40, and -60 airplanes manufactured by Mitsubishi Heavy Industries Ltd., (MHI), and Mitsubishi Aircraft International, Inc. (MAI) which would require modifying the pitot system by installing an improved pitot head with a higher heat capacity and mast heater. Since 1975, 18 pitot/airspeed malfunctions have occurred in either severe icing or extreme cold conditions. The modification will preclude these occurrences by providing more heat in these locations.

DATES: Comments must be received on or before October 5, 1984.

ADDRESSES: Mitsubishi Heavy Industries, Ltd., MU-2 Service Recommendation No. 053 dated January 19, 1979, applicable to this AD, may be obtained from Mitsubishi Heavy Industries, Ltd., Nagoya Aircraft Works, 10, Oye-cho, Minato-ku, Nagoya, Japan, or Mitsubishi Aircraft International, Inc., P.O. Box 3848, San Angelo, Texas 76901.

Mitsubishi Aircraft International, Inc., MU-2 Service Recommendation No. SR020/34-005, Revision A dated July 31, 1979, applicable to this AD, may be obtained from Mitsubishi Aircraft International, Inc., P.O. Box 3848, San Angelo, Texas 76901.

Copies of these service bulletins are also contained in the Rules Docket, Federal Aviation Administration, Office of the Regional Counsel, Room 1558, 601 East 12th Street, Kansas City, Missouri 64106.

FOR FURTHER INFORMATION CONTACT:

For the MHI Series airplanes manufactured in Japan: John G. Sullivan, Aerospace Engineer, Western Aircraft Certification Office, ANM-172W, Federal Aviation Administration, P.O. Box 92007, Worldway Postal Center, Los Angeles, California 90009, Telephone: (213) 536-6166.

For the MAI Series airplanes manufactured in the U.S.: Mark R. Schilling, Systems Engineer, Airplane Certification Branch, ASW-150, Federal Aviation Administration, P.O. Box 1689, Fort Worth, Texas 76101, Telephone: (817) 877-2598.

SUPPLEMENTARY INFORMATION:

COMMENTS INVITED.

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Communications should identify the regulatory docket or notice number and be submitted in duplicate to the Rules Docket at the address specified above. All communications received on or before the closing date for comments specified above will be considered by the Director before taking action on the proposed rule. The proposals contained in this notice may be changed in the light of comments received. All comments submitted will be available both before and after the closing date for comments in the Rules Docket for examination by interested persons. A report summarizing each FAA-public contact concerned with the substance of this proposal will be filed in the Rules Docket.

AVAILABILITY OF NPRMS

Any person may obtain a copy of this Notice of Proposed Rulemaking (NRPM) by submitting a request to the Federal Aviation Administration, Central Region, Office of the Regional Counsel, Attention: Airworthiness Rules Docket No. 84-CE-21-AD, Room 1558, 601 East 12th Street, Kansas City, Missouri 64106.

DISCUSSION: There have been at least 18 documented instances, during heavy icing or extreme cold conditions when the airspeed indicator has given erroneous readings or has dropped to no indicated airspeed. The erroneous readings of the airspeed indicator have been linked to the pitot tube (P/N PH506) icing over and/or accumulated moisture freezing within the mast casting. There have been no accidents directly attributable to the pitot icing; however, FAA has determined that pitot icing could lead to hazardous conditions in certain flight regimes.

MHI issued Service Recommendation No. 053, dated January 19, 1979, and MAI issued Service Recommendation SR 020/34-005, dated July 31, 1979, that gave operators of MU-2 aircraft the option of changing to an improved pitot head. The improved pitot head (P/N PH 1100) utilizes a higher heat on the pitot probe and incorporates a mast heater in the mast casting. Since these service recommendations were issued, there have been no additional documented pitot icing problems. However, it cannot be determined how many airplanes in the field have been modified with the improved pitot tube. Because FAA has determined that there may be airplanes in the field with the unmodified pitot system, and that in certain circumstances the unmodified pitot system could cause a hazardous condition by allowing the pitot probe to ice over or allow moisture within the mast casting to freeze, FAA is proposing an AD that would make compliance with MHI Service Recommendation No. 053 and MAI Service Recommendation SR 020/34-005 mandatory on or before December 1, 1984. The proposed AD is applicable to all MHI and MAI Model MU-2B, -10, -15, -20, -25, -26, -26A, -30, -35, -36, -36A, -40, -60 airplanes. Approximately 322 MHI and 120 MAI Model MU-2 airplanes could be affected by the proposal. Estimated costs of $734 for parts and $1,400 for labor are expected to accrue for a total of $2,134 per airplane ($943,228 for the fleet). However, as many as half of the fleet may have already complied with the Service Recommendation. Few, if any, small entities operate the affected airplane and any that may would operate only one airplane. Therefore, the possible cost to any small entity will not exceed the significant threshold cost level for small entities.

For reasons discussed earlier in the preamble, the FAA has determined that this document: 1) involves a proposed regulation which is not major under the provisions of Executive Order 12291; 2) is not significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979), and 3), I certify under the criteria of the Regulatory Flexibility Act that this proposed rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. A draft regulatory evaluation has been prepared and has been placed in the public docket. A copy of it may be obtained by contacting the Rules Docket at the location provided under the caption "Addresses."

List of subjects in 14 CFR 39

Aviation Safety, Aircraft

THE PROPOSED AMENDMENT

Accordingly, the FAA proposes to amend Section 39.13 of Part 39 of the Federal Aviation Regulations (14 CFR 39.13) by adding the following new AD:

MITSUBISHI: Applies to Models MU-2B, -10, -15, -20, -25, -26, -26A, -30, -35, -36, -36A, -40, and -60 Serial Numbers 1 up to and including 753, with or without the SA suffix, airplanes certificated in any category.

NOTE: The serial numbers of airplanes manufactured in the United States by Mitsubishi Aircraft International, Inc. (MAI) are suffixed by "SA." The serial numbers of airplanes manufactured in Japan by Mitsubishi Heavy Industries, Ltd. (MHI) have no suffix.

Compliance: Required as indicated, unless already accomplished.

To assure anti-ice capability of the pitot tubes accomplish the following:

(a) On or before December 1, 1984, modify the pitot system of the affected model and serial numbered airplanes in accordance with MHI Service Recommendation No. 053, dated January 19, 1979, or MAI Service Recommendation SR 020/34-005, Revision A, dated July 31, 1979, as applicable.

(b) Airplanes may be flown in accordance with FAR 21.197 to a location where this AD may be accomplished.

(c) An equivalent method of compliance with this AD may be used on the MHI airplanes, if approved by the Manager, Western Aircraft Certification Office, ANM-170W, Federal Aviation Administration, P.O. Box 92007, Worldway Postal Center, Los Angeles, California 90009, and on the MAI airplanes, if approved by the Manager, Airplane Certification Branch, ASW-150, Federal Aviation Administration, Southwest Region, P.O. Box 1689, Fort Worth, Texas 76101.

Sections 313(a), 601 and 603 of the Federal Aviation Act of 1958, as amended, (49 U.S.C. 1354(a), 1421 and 1423); 49 U.S.C. 106(g) (Revised, P.L. 97-449, January 12, 1983); Section 11.85 of the Federal Aviation Regulations (14 CFR 11.85).

Issued in Kansas City, Missouri, on August 27, 1984.

Murray E. Smith
Murray E. Smith, Director
Central Region

[4910-13]

Title 14 - Aeronautics and Space

CHAPTER I - FEDERAL AVIATION ADMINISTRATION
DEPARTMENT OF TRANSPORTATION

[Docket No. 84-CE-14-AD; Amendment 39-4883]

PART 39 - AIRWORTHINESS DIRECTIVES

MITSUBISHI HEAVY INDUSTRIES, LTD.
(MHI) MODELS MU-2B, -10, -15, -20, -25, -26, -30, -35, -36 Airplanes
and
MITSUBISHI AIRCRAFT INTERNATIONAL, INC.
(MAI) MODELS MU-2B, -25, -26, -26A, -35, -36A, -40, -60 Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final Rule.

SUMMARY: This amendment adopts a new Airworthiness Directive (AD) applicable to certain serial numbered Mitsubishi Models MU-2B, -10, -15, -20, -25, -26, -26A, -30, -35, -36, -36A, -40, and -60 airplanes manufactured by Mitsubishi Heavy Industries (MHI), Ltd., and Mitsubishi Aircraft International, Inc. (MAI). The AD requires the retorquing and lockwire safetying of coupling nuts on the bleed air tubing. A field report has been received indicating that the engine air inlet anti-ice system malfunctioned as a result of loss of bleed air at a loose tube coupling nut. The action required by this AD will eliminate the cause of this malfunction of the air inlet anti-ice system and the possible loss of engine power during in-flight icing conditions.

EFFECTIVE DATE: June 28, 1984

COMPLIANCE: As prescribed in the body of the AD.

ADDRESSES: Mitsubishi Heavy Industries, Ltd., MU-2 Service Bulletin No. 196A, dated April 12, 1984, applicable to this AD, may be obtained from Mitsubishi

Heavy Industries, Ltd., Nagoya Aircraft Works, 10, Oye-cho, Minato-ku, Nagoya, Japan, or Mitsubishi Aircraft International, Inc., P.O. Box 3848, San Angelo, Texas 76901.

Mitsubishi Aircraft International, Inc., MU-2 Service Bulletin No. 047/30-001, dated February 20, 1984, applicable to this AD, may be obtained from Mitsubishi Aircraft International, Inc., P.O. Box 3848, San Angelo, Texas 76901.

Copies of these service bulletins are also contained in the Rules Docket, Federal Aviation Administration, Office of the Regional Counsel, Room 1558, 601 East 12th Street, Kansas City, Missouri 64106.

FOR FURTHER INFORMATION CONTACT: For the MHI Series airplanes manufactured in Japan: John G. Sullivan, Aerospace Engineer, Western Aircraft Certification Office, ANM-172W, Federal Aviation Administration, P.O. Box 92007, Worldway Postal Center, Los Angeles, California 90009, Telephone: (213) 536-6166.

For the MAI Series airplanes manufactured in the U.S.: Billy R. Parker, Propulsion Engineer, Airplane Certification Branch, ASW-150, Federal Aviation Administration, P.O. Box 1689, Fort Worth, Texas 76101, Telephone: (817) 877-2449.

SUPPLEMENTARY INFORMATION: As a result of a field report of an engine air inlet anti-ice system malfunction caused by loss of bleed air at a loose tube coupling nut on a Mitsubishi MU-2B airplane, the Japan Civil Aviation Bureau (JCAB) issued their Airworthiness Directive (AD) No. TCD-2342-84 dated January 28, 1984, applicable to certain serial Mitsubishi Model MU-2B airplanes manufactured by MHI of Japan. This AD required retorquing and lockwire safetying the bleed air tube couplings in accordance with MHI Service Bulletin No. 196A, dated April 12, 1984.

MAI has also issued a service bulletin, SB 047/30-001, dated February 22, 1984, recommending the same action on Mitsubishi Model MU-2B Series airplanes manufactured in San Angelo, Texas.

The FAA has examined the available information relating to the issuance of the aforementioned service bulletins and the JCAB AD. Based on the foregoing, the FAA has determined that the condition addressed by these service bulletins and the JCAB AD is an unsafe condition and may exist on all Mitsubishi Model MU-2B Series airplanes certificated for operation in the United States irrespective of the location of their manufacture. Therefore, an AD is being issued which requires the retorquing and lockwire safetying of bleed air tubing coupling nuts on both MHI- and MAI-manufactured Mitsubishi Models MU-2B, -10,-15, -20, -25, -26, -26A, -30, -35, -36, -36A, -40 and -60 (all serial numbers up to and including 1564SA) airplanes in accordance with instructions contained in either Mitsubishi Heavy Industries MU-2 Service Bulletin No. 196A dated April 12, 1984, for MHI-manufactured airplanes or Mitsubishi Aircraft International, Inc., MU-2 Service Bulletin No. 047/30-001 dated February 20, 1984, for MAI-manufactured airplanes.

Because an emergency condition exists that requires the immediate adoption of this regulation, it is found that notice and public procedure hereon are impractical and contrary to the public interest, and good cause exists for making this amendment effective in less than 30 days.

List of Subjects in 14 CFR 39

Aviation Safety, Aircraft

ADOPTION OF THE AMENDMENT

Accordingly, pursuant to the authority delegated to me by the Administrator, Section 39.13 of the Federal Aviation Regulations (14 CFR 39.13) is amended by adding the following new AD:

MITSUBISHI: Applies to Models MU-2B, -10, -15, 20, 25, -26, -26A, -30, -35, 36, 36A, 40, and -60 Serial Numbers 1 up to and including 1564 with or without the SA suffix airplanes certificated in any category.

NOTE: The serial numbers of airplanes manufactured in the United States by Mitsubishi Aircraft International, Inc. (MAI) are suffixed by "SA." The serial numbers of airplanes manufactured in Japan by Mitsubishi Heavy Industries, Ltd. (MHI) have no suffix.

Compliance: Required as indicated, unless already accomplished.

To prevent malfunction of the engine air inlet anti-ice system, accomplish the following:

(a) Within the next 25 hours time-in-service after the effective date of this AD, install on the main instrument panel, in full view of the pilot, a temporary placard, having letters at least 0.10 inch high, which reads as follows:

"FLIGHT INTO KNOWN ICING IS PROHIBITED."

(b) Within the next 100 hours time-in-service after the effective date of this AD, retorque and lockwire safety the bleed air tubing coupling nuts:

(1) On the MHI airplanes, in accordance with the instructions contained in Mitsubishi MU-2 Service Bulletin No. 196A, dated April 12, 1984, and

(2) On the MAI airplanes in accordance with the instructions contained in Mitsubishi Aircraft International, Inc., MU-2 Service Bulletin No. 047/30-001 dated February 20, 1984.

(c) When paragraph (b) of this AD has been accomplished, the placard specified in paragraph (a) is no longer required and shall be removed from the airplane.

(d) Airplanes may be flown in accordance with Federal Aviation Regulation 21.197 to a location where this AD can be accomplished.

(e) An equivalent method of compliance with this AD may be used on the MHI airplanes, if approved by the Manager, Western Aircraft Certification Office, ANM-170W, Federal Aviation Administration, P.O. Box 92007, Worldway Postal Center, Los Angeles, California 90009, and on the MAI airplanes, if approved by the Manager, Airplane Certification Branch, ASW-150, Federal Aviation Administration, Southwest Region, P.O. Box 1689, Fort Worth, Texas 76101.

This amendment becomes effective on June 28, 1984.

Secs. 313(a), 601, and 603, Federal Aviation Act of 1958, as amended, (49 U.S.C. 1354(a), 1421, and 1423); 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); Sec. 11.89 of the Federal Aviation Regulations (14 CFR 11.89).

NOTE: The FAA has determined that this regulation is an emergency regulation that is not major under Section 8 of Executive Order 12291. It is impracticable for the agency to follow the procedures of Order 12291 with respect to this rule since the rule must be issued immediately to correct an unsafe condition in aircraft. It has been further determined that this document involves an emergency regulation under DOT Regulatory Policies and Procedures (44 FR 11034: February 26, 1979). If this action is subsequently determined to involve a significant regulation, a final regulatory evaluation or analysis, as appropriate, will be prepared and placed in the regulatory docket (otherwise, an evaluation is not required). A copy of it, when filed, may be obtained by contacting the Rules Docket under the caption "ADDRESSES" at the location identified.

Issued in Kansas City, Missouri, on June 12, 1984.

John E. Shaw

JOHN E. SHAW
Acting Director, Central Region