FLIGHT STANDARDIZATION BOARD

Mitsubishi Heavy Industries America, Inc.
MU-2B Flight Review

Type Certificate Data Sheet Numbers

A2PC
&
A10SW

Approved by:/s/_____Date: 01/23/2006
Johnathon A Vetter
FSB Chairman

Approved by:/s/_____Date: 01/23/2006
Walter J Hutchings
Manager, Kansas City Aircraft Evaluation Group
MKC-AEG

Coordinated by:_____Date:
Tom Toula
Manager, Air Transportation Division
AFS-200

REVISION RECORD

Revision	Sections	Date	Chairman
Draft	All	12/16/2005	John Vetter
Original	All	01/23/2006	John Vetter

CONTENTS

PART 1 - Training, Checking and Currency

1. PURPOSE AND APPLICABILITY

1.1 Purpose

The Mitsubishi Heavy Industries Model MU-2B Flight Standardization Board (FSB) convened to evaluate proposed training, checking, and currency requirements for pilots operating the MU-2B aircraft. This FSB was convened as part of a Safety Evaluation of the MU-2B aircraft undertaken in July 2005. The FSB evaluated operating characteristics and techniques to propose training, checking and currency requirements applicable to the MU-2B aircraft. The objectives of this FSB were to:

- Review aircraft procedures for consistency and effectiveness.
- Identify training, checking and currency requirements necessary to improve the safety of operating the MU-2B aircraft.
- Evaluate the complexity of the MU-2B to determine if a pilot, with or without training, can safely operate the aircraft in all certificated operating conditions.
- Identify if any unique requirements exist for MU-2B operation.
- Describe acceptable training program and training device characteristics.
- Establish checking and currency standards for MU-2B operation, if required.

1.2 Applicability

All models of the MU-2B were evaluated in conjunction with this report, including several modifications to the MU-2B that were available at the time.

In accordance with existing FARs, the provisions of this report apply to all operations of all models of the MU-2B. This report is also applicable to all training and checking conducted in the aircraft, as well as the currency and experience provisions. This report is effective until amended, superceded or withdrawn by subsequent revision.

2. AIRCRAFT DETERMINATION (AMEL)

2.1 Background

In conducting its evaluation of the MU-2B the Board utilized the evaluation process outlined in Advisory Circular AC 120-53 and the Common Procedures Document for Conducting Operational Evaluation Boards (JAA, TCCA, FAA, 10 June 2004). The Board evaluated the MU-2B design and operating characteristics in the Areas of Operation required for a Commercial Pilot - Multiengine - Instrument Rating by the Practical Test Standard (PTS). For the purpose of design and operating characteristics the MU-2B falls within the Small Multiengine Aircraft Group (AMEL), Turbo-Propeller group.

The FSB requested and received a proposed MU-2B training program from Mitsubishi Heavy Industries America, Inc (MHIA). FSB members completed ground school inclusive of all models of the MU-2B aircraft. A Level 5 MU-2B Flight Training Device was utilized for procedural training and checklist review including a LOFT scenario with Normal, Abnormal and Emergency Procedures. Flight training was conducted in four different models of the MU-2B selected to be representative of the entire MU-2B fleet. The training was consistent with that proposed by Mitsubishi Heavy Industries America, Inc. (MHIA) and

provided under the supervision of MHIA. The MHIA Training Program was modified throughout the FSB process so that at the conclusion of the FSB the MHIA Training Program complies with the FSB recommendations.

A modified T2 test was conducted for the Areas of Operation required by the Practical Test Standard for Commercial Pilot - Multiengine - Instrument Rating. The T2 was modified to incorporate testing of both the aircraft and the Flight Training Devices available at the time of the FSB. T3/T5 tests were conducted to validate proposed training, checking and currency. The testing also included workload analysis to determine if the MU-2B design is consistent with acceptable pilot workload for a single pilot with adequate training.

2.2 Determination of Type Rating

The FSB has identified Level E training, checking and currency for the MU-2B aircraft. Level E requirements are normally eligible for designation of a Type Rating. However, current regulatory requirements for a single pilot type rated aircraft are not adequate to address the training, checking and currency necessary for safe operation. The FSB recommends implementation of a single standard for training, checking and currency for the MU-2B. Regulatory changes to type rating requirements or special regulatory measures are needed. Timely implementation of a single standard of training, checking and currency to all MU-2B operations, including Part 91 operations, is necessary to achieve safety.

The Board determined the MU-2B met the Advisory Circular 120-53 criteria for Level E differences in the following Areas of Operation:

2.2.1 Takeoff and Landing

Takeoff and landing characteristics for the MU-2B are affected by the position of the landing gear relative to the aircraft's center of gravity. Standard crosswind techniques apply to the MU-2B but the flight characteristics differ in crosswind operations due to a combination of landing gear positioning, center of gravity and spoiler control. Proper piloting techniques to control crosswind roll and weight shift on the landing gear are necessary to stabilize directional control. These takeoff and landing characteristics are most prominent in the short body MU-2B models. In a crosswind the direct nose wheel steering requires the rudder to be centered when the nose wheel touches down. Options for Flaps 5 and Flaps 20 takeoff configurations need to be trained and characteristics for each understood when selecting the appropriate configuration. No Flap Landings must also be performed. The combination of all of these factors and the need to use care with propeller control to maintain stable directional control on landing is best trained in the aircraft. Level E training applies.

2.2.2 Performance, Steep Turns and Stalls

An accelerated stall maneuver is recommended as a special maneuver (Special Flight Characteristics) for the MU-2B aircraft. The design of the MU-2B wing utilizes a full-span flap that results in variable wing loading. With this characteristic, pilot awareness of configuration, speed, bank angle and stall margin is critical. At a safe altitude, the aircraft is configured clean and trimmed at 115 KIAS. The aircraft then begins entry toward a 60 degree bank turn. Stall warning (stick shaker) will normally be detected prior to 40 degrees

of bank, depending on weight, and the aircraft is recovered to straight and level flight using bank, power and pitch. Level E differences apply to this maneuver.

2.2.3 Emergency Operations

All One Engine Inoperative Training Maneuvers must utilize the manufacturer's recommendation for zero thrust applicable to the MU-2B model being operated.

Engine Failure During Takeoff - Takeoff Continued.

The AFM procedure for engine failure on takeoff for the MU-2B requires pilot decision making during the event. This event requires pilot proficiency with the MU-2B aircraft and knowledge of the MU-2B aircraft operation. Consideration of landing gear position and transit, flap positions, available runway remaining, acceleration versus climb performance, rudder forces, use of trim aileron to eliminate roll spoiler drag and Beta Follow-Up are areas requiring training. The combined knowledge and skill needed to safely operate the MU-2B in this Area of Operation requires Level E training.

Engine Failure after Liftoff with Runway Remaining

The AFM checklist and procedure for engine failure on takeoff for the MU-2B requires significant pilot decision making during this event. In the event the aircraft is unable to climb with one engine inoperative and there is available runway, the maneuver for returning to the runway must be trained. The landing gear remains extended for this maneuver. Adequate runway must be available for safe completion of this maneuver. Level E training applies to this maneuver.

One Engine Inoperative Maneuvering / Loss of Directional Control

The Private and Commercial Practical Test Standard maneuver for Vmc demonstration is best accomplished using a One Engine Inoperative Maneuvering profile. The One Engine Inoperative - Loss of Directional Control maneuver is best trained and accomplished using early recognition and recovery techniques. Seat position and rudder travel should be emphasized during this maneuver. Rudder blocking by the instructor is encouraged to produce loss of directional control at Vmc plus 10 knots because early recognition and recovery is the primary objective for this maneuver. The FSB recommends the maneuver be accomplished at a safe altitude in a Flaps 20 takeoff configuration. Trim the aircraft to 120 knots in level flight with one engine set at zero thrust. Apply takeoff power to the other engine while increasing pitch to cause a deceleration rate of 1 knot per second. Recover to straight and level flight at first indication of the loss of directional control. Level E training applies to this maneuver.

Approach and Landing with One Engine Inoperative

Flight characteristics and performance of the MU-2B aircraft operating with one engine inoperative requires adherence to the AFM procedures for safe operation. Airspeed maintenance is paramount to the safe completion of the maneuver. With one engine inoperative, the aircraft has slow acceleration from a deteriorated airspeed in landing configuration and requires vigilant airspeed management throughout the maneuver. Aircraft configuration is selected to minimize drag prior to the point where landing is assured and final descent is initiated. Coordinated flight and roll trim management are

essential to maximize one engine inoperative performance. Level E training applies to this maneuver.

2.2.4 Multiengine Operations

All One Engine Inoperative Training Maneuvers must utilize the manufacturer's recommendation for zero thrust applicable to the MU-2B model being operated.

Instrument Approach – One Engine Inoperative

Conduct of instrument approach procedures in the MU-2B aircraft with one engine inoperative requires pilot decision-making, approach planning and strict adherence to AFM operating procedures. The preferred one engine inoperative instrument approach procedure is the Precision Approach. The Precision Instrument Approach provides the most stable approach procedure and least deviation from normal operating procedures for the safest operation. Maximum performance will be obtained by configuring the aircraft to Flaps 20 only when the landing is assured. Level E training applies to this Area of Operation.

Non-Precision Approaches

The Straight in Non-Precision Approach is acceptable when necessary with one engine inoperative. Selection of Flaps 5 at the FAF is recommended per the AFM and the descent is planned to preclude extensive maneuvering upon reaching MDA with consideration given to aircraft weight and density altitude to maintain MDA. One Engine Inoperative Circling Approach should be conducted only when absolutely necessary and must be trained if utilized. For all Non-Precision approaches, landing gear extension and Flaps 20 should be selected only when landing is assured and descent from MDA for landing is initiated. Adherence to configuration and speeds prescribed by the AFM is necessary for safe operation. Level E training applies to this Area of Operation.

2.3 Conclusion

The Board recommends the MU-2B aircraft be trained at Level E for Initial Qualification and Level C for Recurrent and Requalification Training.

3. MASTER REQUIREMENTS (Including MCR, MDR and ODR)

3.1 Master Common Requirements

- Landing Minima Category for the MU-2B is normally Category "C".
- Normal "Landing Flap Setting" is Flaps 20 or Flaps 40.
- Normal "Takeoff Flap Setting" is Flaps 5 or Flaps 20.
- "No Flap Landing". Training and checking for the MU-2B requires demonstration of "No Flap" landings. "No Flap" approach and landing procedures include Flaps 0 and Flaps 5.

3.2 Areas of Special Interest and Emphasis

The FSB has determined that certain aspects of pilot knowledge, skills and abilities must be emphasized and evaluated during the training and checking process for the MU-2B.

- Accelerated stall awareness and training maneuvers with emphasis on configuration management. Awareness of the margin to stall in all flight operations and configurations should be emphasized throughout training.
- Vmc awareness and early recognition should be trained and checked. Minimum airspeeds for one engine inoperative must be emphasized in all configurations.
- Air speed management and recognition of airspeed deterioration below AFM recommended speeds and recovery methods must be emphasized throughout training and checking.
- Knowledge of icing conditions and encounters must be emphasized throughout training and checking including; equipment requirements, certification standards, minimum airspeeds, use of autopilot and other AFM procedures. This information should conform to the standard of training set out by the Icing Training Video established by AD.
- Knowledge of certification standards for aircraft performance, both All Engine and One Engine Inoperative operations, should be emphasized as essential for decision-making regarding aircraft operation.

3.3 Master Difference Requirements Tables

The Master Difference Requirements indicate the required level of Training/Checking/Currency for MU-2B crewmembers.

Master Requirements for all models MU-2B Initial and Transition Training, Checking and Currency are E/E/E respectively.

Master Requirements for all models MU-2B Recurrent and Requalification Training, Checking and Currency are C/D/E respectively.

Master Differences Requirements for within the MU-2B models are the following table:

TO **FROM**	B, D 2B 2B-10	F 2B-20 (short)	G 2B-30 (long)	K (short)	J (long)	M (short)	L (long)	P (short)	N (long)	Solitaire 2B-40 (short)	Marquise 2B-60 (long)
B, D 2B 2B-10	//	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B
F 2B-20 (short)	B/B/B	//	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B
G 2B-30 (long)	B/B/B	B/B/B	//	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B
K 2B-25 (short)	B/B/B	B/B/B	B/B/B	//	B/B/B	A/A/A	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B
J 2B-35 (long)	B/B/B	B/B/B	B/B/B	B/B/B	//	B/B/B	A/A/A	B/B/B	B/B/B	B/B/B	B/B/B
M 2B-26 (short)	B/B/B	B/B/B	B/B/B	A/A/A	B/B/B	//	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B
L 2B-36 (long)	B/B/B	B/B/B	B/B/B	B/B/B	A/A/A	B/B/B	//	B/B/B	B/B/B	B/B/B	B/B/B
P 2B-26A (short)	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	//	B/B/B	B/B/B	B/B/B
N 2B-36A (long)	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	//	B/B/B	B/B/B
Solitaire 2B-40 (short)	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	//	B/B/B
Marquise 2B-60 (long)	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	B/B/B	//

Note: STC's for EFIS Systems in the MU-2B require Level D Differences for training, checking and currency.

3.4 Operator Difference Requirement Tables

ODR tables are used to show operator compliance methods. Sample ODR tables are available for MU-2B Initial Requirements and for MU-2B Model differences. Any additional ODR requirements must be based on the above MDR Table. Coordination with the Kansas City Aircraft Evaluation Group should occur for any additional ODR Tables proposed by an operator.

4. FSB SPECIFICATIONS FOR TRAINING

The FSB recommends annual (within preceding 12 months) training for the MU-2B aircraft. This annual training requirement must be met with an FSB compliant FAA Approved Training Program for all MU-2B operations. The FSB compliant FAA Approved Training Program must comply with the recommendations of this report and include a determination that Training Completion Standards have been met.

4.1 Training Requirements

The MU-2B is a single pilot aircraft. No training credit is given for Second in Command Training (no credit for right seat in FTD). Upgrade Training is not applicable.

Initial / Transition Training: Applies to any pilot without documented MU-2B pilot operating experience within the last two years.

Requalification Training: Applies to any pilot with documented MU-2B pilot operating experience in the last two years but does not meet eligibility for Recurrent Training.

Recurrent Training: Applies to any pilot who completed and documented training on an FSB compliant FAA Approved Training Program for the MU-2B in the last 12 months and is MU-2B current in accordance with this report. Training completed the month before or after the month it is due is considered completed in the due month.

Differences Training: Applies to any pilot who operates more than one MU-2B model. Required Ground Training subjects are in accordance with differences between applicable models of the MU-2B to be operated.

4.1.1 Ground Training Minimum Program Hours

Initial / Transition: 20 hours
Requalification: 12 hours
Recurrent: 8 hours
Differences Training at Level B: 1.5 hours for 2 models, 3 hours for more than 2 models.

All Training Programs must include ground instruction in the following:

- All applicable aircraft systems modules by ATA subjects.
- Weight and Balance.
- Aircraft Performance.
- MU-2B Icing Training consistent with Icing Training Video for AD compliance.
- Controlled Flight Into Terrain (CFIT) training according to FAA guidelines.
- Cockpit Resource Management/Single Pilot Resource Management (CRM/SPRM).

4.1.2 Flight Training Minimum Program Hours

Initial / Transition: 12 hours with a minimum of 6 hours of Level E training.
Requalification: 8 hours.
Recurrent: 4 hours at Level E training, or
6 hours at Level C training

FAA Order 8400.10, Volume 3, Chapter 2, Section 6, Paragraph 471, Course Completion Requirements regarding Training Program Hours is applicable without the subsequent checking requirement being met provided detailed records for satisfactory completion of each required maneuver are maintained.

Training Completion Standards are performance of all FSB required maneuvers to Commercial Multiengine and Instrument Practical Test Standards.

All Training Programs must include Flight Training in the following:

- All maneuvers applicable for Commercial Multiengine Instrument PTS for instrument rated pilots. Maneuvers applicable for Commercial Multiengine PTS for non-instrument rated pilots.
- All specific maneuvers identified in Sections 2.2.1 through 2.2.4 of this report as Level E Training.
- All Training Maneuvers must be consistent with the most Current FAA Approved AFM procedures (latest revision) and AFM compliant checklists
- Training in the use of the autopilot, if installed
- Icing Awareness Procedures applicable to the MU-2B
- CFIT procedures and CRM/SPRM procedures

5. FSB SPECIFICATIONS FOR CHECKING

No additional checking requirements are specified for 14 CFR Part 91, MU-2B operations.

Checking for the MU-2B is in accordance with current regulations of 14 CFR 135.

The MU-2B is considered a separate type of aircraft as described in 14 CFR 135.293(b) for the purpose of recurrent testing. Twelve month testing currency applies to the MU-2B exclusively for compliance with FAR 135.293.

6. FSB SPECIFICATIONS FOR CURRENCY

Landing currency requirements of FAR 61.57 must be maintained in the MU-2B aircraft exclusively. Landings in other AMEL aircraft will not be credited for landing currency in the MU-2B aircraft. Landings in either short or long body MU-2B aircraft may be credited toward landing currency in both model groups.

Instrument experience to satisfy FAR 61.57 is not MU-2B exclusive provided the FSB compliant FAA Approved Training is completed satisfactorily to the Commercial Pilot - Multiengine and Instrument PTS and MU-2B currency is maintained.

Satisfactory completion of a Flight Review to satisfy FAR 61.56 is valid for operation of an MU-2B only if that Flight Review is conducted in an MU-2B at Level E. The Flight Review must include training in Areas of Operation identified in Sections 2.2.1 through 2.2.4 of this report and be given by an MU-2B qualified instructor meeting the minimum experience level established within this report for aircraft instruction.

7. AIRCRAFT REGULATORY COMPLIANCE CHECKLIST

A Compliance Checklist has not been included in this report due to the extensive operating experience of the Mitsubishi MU-2B fleet.

Proving tests to satisfy FAR 135.145 should be conducted in accordance with FAA Order 8400.10, Volume 3, Chapter 9.

8. FSB SPECIFICATIONS FOR SIMULATORS AND DEVICES

Requests for device approval should be made in accordance with FAA procedures.
Credit for flight training in an approved Flight Training Device (FTD) is allowed in accordance with the Commercial Pilot - Multiengine Practical Test Standards except where this report is more restrictive. An MU-2B aircraft may be used for all levels of training, checking and currency.

Level C Flight Training and Checking specified in this report must be conducted in an approved Level 5 FTD. In addition to Level 5 FTD basic requirements, the FTD must be representative of the MU-2B aircraft with MU-2B cockpit controls and a visual system as a minimum. Any higher approval FTD or Simulator may be used provided it has MU-2B cockpit controls and a visual system.

Level D Flight Training specified in this report must be conducted in an approved Level 6 FTD with a visual system as a minimum or an approved simulator.

Level D Checking specified in this report must be conducted in an approved Level 7 FTD with a visual system as a minimum or an approved simulator.

Level E Flight Training and Checking specified in this report may be conducted in an approved Level C or D Simulator, or in the actual aircraft.

There was no approved Level 6 or 7 FTD, or simulator in existence at the time of this FSB meeting. The FSB was able to evaluate an approved Level 5 FTD with MU-2B cockpit controls and a visual system for training in maneuvers and procedures for the MU-2B. The training credit allowed for Level C training and checking in this report is based on the demonstrated ability of the particular Level 5 device to accomplish effective training and is the foundation for the specific additional requirements imposed in this report for Level 5 FTDs.

9. INSTUCTORS, CHECK AIRMEN AND EXAMINERS

Instruction given for the MU-2B must be consistent with manufacturers recommendations and comply with latest revision FAA Approved AFM procedures and AFM compliant checklists.

Flight Instructors must be qualified and current in the MU-2B aircraft consistent with this report. Flight Instructors must receive instructor training consistent with the Initial and Transition Training requirements of this report using the latest revision FAA Approved AFM procedures.

To provide instruction in the aircraft, Flight Instructors must have a minimum of 2000 hours total time, 800 hours of multiengine time and 300 hours in the MU-2B. Fifty (50) hours of MU-2B PIC experience must be within the last 12 months.

For the purpose of checking, FAA Aviation Safety Inspectors, Designated Pilot Examiners, Training Center Evaluators and Check Airmen must have completed appropriate qualification in the MU-2B aircraft in accordance with this report. Examiners and Check Airmen must have 100 hours PIC in the MU-2B and maintain currency in accordance with this report.

10. MISCELLANEOUS RECOMMENDATION

The FSB recommends that all MU-2B operations be conducted with standard Normal, Abnormal and Emergency checklists in user-friendly format consistent with the latest FAA Approved Aircraft Flight Manual.

To support the Engine Failure After Lift-Off Procedures in the standard checklist, the FSB recommends MHI publish one-engine inoperative performance data for both Flaps 5 and Flaps 20 takeoffs with the landing gear retracted. This would provide essential information to assist the pilot in deciding whether or not to continue a takeoff after experiencing an engine failure after liftoff.

The FSB recommends all single pilot IFR operations be conducted with an autopilot. The Work Load Analysis conducted by the FSB during training and the LOFT scenario demonstrated that workload was significantly reduced during transition phases of flight through the effective use of an autopilot.

The FSB recommends installation of Trim in Motion Warning and Autopilot Disconnect systems. The Trim in Motion Warning and Autopilot Disconnect are useful warning indications and low speed awareness tools for all operating conditions.

11. APPLICATION OF FSB REPORT

All MU-2B aircraft operations are subject to the provisions of this report. This report becomes effective when given final approval by the FAA.

All training and checking for the MU-2B aircraft must be conducted in accordance with an FAA Approved Training Program that complies with all provisions of this report for the MU-2B aircraft. All FAA Approved Training Programs must incorporate the latest FAA Approved AFM Procedures, AFM compliant checklist and manufacturer's recommendations for training maneuvers.

12. ALTERNATE MEANS OF COMPLIANCE

Alternate means of compliance to requirements of this report must be approved by the FSB. If alternate compliance is sought, operators must show that the proposed alternate means provides an equivalent level of safety to the provisions of AC 120-53 and this FSB report. Analysis, demonstrations, proof of concept testing, differences documentation or other evidence may be required.

12.1 Equivalent Safety

Significant restrictions may apply in the event alternate compliance is sought, and the reporting requirements may be increased to ensure equivalent safety. FAA will generally not consider relief through alternate compliance unless sufficient lead-time has been planned by an operator to allow for any necessary testing and evaluation.

12.2 Interim Programs

In the event of clearly unforeseen circumstances in which it is not possible for an operator to comply with MDR provisions, the operator may seek an interim program approval rather than a permanent alternate compliance method. Financial arrangements, scheduling adjustments and other such reasons are not considered "unforeseen circumstances" for the purposes of this provision.