ORDER

7110.96

AIR TRAFFIC CONTROL FACILITY ANALYSIS PROGRAM FOR THE MICROWAVE LANDING SYSTEM

November 6, 1985

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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Initiated By: ATO-320

FOREWORD

This order prescribes policy, delegates authority, and assigns responsibility for implementation of the Air Traffic Control Facility Analysis Program for the Microwave Landing System (MLS). It also directs regional air traffic division (ATD) managers to establish an analysis plan to provide management direction for this program.

This order provides planning guidance for the use of MLS and a systematic process to conduct and document an air traffic facility analysis. An analysis using this material will greatly assist in identification of specific problems, potential areas of improvement, and a determination of the best way to use MLS at your facility from an air traffic perspective.

The step-by-step process was developed through prototype analyses of the New York Metroplex and Burbank Terminal Area and subsequently validated at New Orleans International Airport. It is applicable to all facilities.

If questions arise concerning this order, the process, or MLS background information, contact the appointed Air Traffic Division MLS Representative.

John R. Ryan

John R. Ryan
Director, Air Traffic Operations Service

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CHAPTER 1. GENERAL

1. PURPOSE. This order establishes and provides guidance for an air traffic procedural planning program for the Microwave Landing System (MLS).

2. DISTRIBUTION. This order is distributed to the Associate Administrator for Air Traffic and staffs; branch level in Air Traffic Operations Service and Air Traffic Plans and Requirements Service; air traffic branch level in regional offices, Mike Monroney Aeronautical Center, FAA Technical Center, and all air traffic field facilities.

3. ACTION. The regional air traffic division (ATD) is responsible for effective implementation of this program. Facility MLS analysis and planning shall be conducted in accordance with the guidance provided in Chapter 2. An ATD MLS representative shall be appointed to assist, monitor, and coordinate facility analysis activity and to provide interdivision coordination and representation.

a. The timing of the analysis process may be dictated by equipment delivery schedules or the perceived magnitude of MLS benefit at a particular location. The ATD MLS representative shall establish and maintain a prioritized analysis schedule using the following guidelines:

(1) Locations presently on the MLS installation schedule must be analyzed as soon as possible.

(2) Locations where a benefit is anticipated with MLS shall be scheduled early in the program to establish requirements for subsequent acquisition contracts.

(3) Locations requested by facility managers can be accomplished when workload at that facility permits.

(4) All facilities must be analyzed by June 1, 1988.

b. The regional ATD MLS representative will coordinate identification of an analysis team leader with the manager of a facility selected for analysis. This person is key to organizing the team, providing guidance, maintaining the analysis schedule, and preparing of the final report. A list of anticipated duties is in Appendix 4.

c. The ATD MLS representative will provide field facilities with MLS criteria, educational material, guidance as needed for the analysis process, and assistance in the processing of MLS approach procedures.

d. Using the information derived from each facility analysis and other known factors, the regional ATD MLS representative shall assist the regional airway facilities office in developing a regional MLS prioritized listing of desired MLS site locations.

e. Regional analysis schedules shall be submitted to the Air Traffic Operations Service, Procedures Division, ATO-300, by June 1, 1986, with subsequent status information at 6-month intervals.

4. BACKGROUND.

a. The MLS offers significant technical advantages and operational benefits to the air traffic control system. Specifically, the MLS precision signal and extensive coverage pattern will allow ATC planners to employ approach, landing, missed approach, and departure procedures not previously possible. These procedures must be developed through careful planning based on present and forecasted requirements and then the MLS ground equipment installed to support them. Since these requirements are unique to each location, it is appropriate that local air traffic personnel perform an analysis and develop operational recommendations for MLS siting.

b. The identification of airspace requirements which support the MLS plan is of equal importance with proper siting. A well developed airspace plan is critical to the effort to maintain an obstacle-free environment along the approach path of planned MLS procedures. A definite plan, developed to serve the needs of the user, the community, and air traffic control, is essential to understanding and promoting support for needed changes to air traffic flows.

c. The facility analysis process described in Chapter 2 can be used to systematically examine current air traffic operations and to evaluate possible improvements through application of the capabilities inherent to the MLS. This is the first step in the overall planning for the most effective use of MLS installations. Other steps include consideration of recommended procedures and scenarios in a detailed airspace study per Handbook 7400.2, Procedures for Handling Airspace Matters, and Handbook 8260.3, United States Standard for Terminal Instrument Procedures (TERPS). These actions must be integrated with siting considerations to ensure feasibility of the final plan.

5. FORMS. FAA Form 7110-9, Analysis Checklist; FAA Form 7110-10, Facility and Configuration List; FAA Form 7110-11, Examination Worksheet; and FAA Form 7110-12, Analysis Summary Table, are used to document the analysis process described in Chapter 2. Reproducible copies of these forms are contained in Appendix 3.

6. Objective. The objective of the Air Traffic Control MLS Facility Analysis Program is to assure the most effective use of MLS by:

a. Examining current traffic flows at each facility to identify all known conflicts and possibilities for improvement.

b. Determining the most advantageous use for MLS at each facility to enhance traffic handling capability and safety.

c. Identifying air traffic MLS installation priorities for specific runways.

d. Consolidating the study results at the regional level into a list reflecting air traffic installation priorities.

e. Coordinating with regional airway facilities offices to ensure MLS equipment is installed to support the requirements identified in the analyses.

7. SCOPE.

a. This order contains an analysis process and background information for use in conducting the facility analysis. It not only considers the relevant airport, but also adjacent airports and how their traffic flows and procedures interact within the subject terminal area. This process is divided into three phases:

(1) Preparation for the Analysis.

(2) Performing the Analysis.

(3) Follow-up Action.

b. Preparation for the analysis concerns team selection, assembling required materials, and becoming familiar with the MLS capabilities and characteristics.

c. Performing the analysis involves a detailed examination of the current system, an application of the advanced capabilities of MLS to solve problems and improve efficiency, an evaluation of the results, and a listing by priority of recommended MLS locations.

d. Follow-up action consists of development of a staff study report reflecting the results of the analysis. All traffic management issues, problems, and constraints on the local system must be considered and the staff study reflective of the best use of MLS from an air traffic control perspective. The results must then be coordinated with the regional airway facilities office to ensure air traffic requirements are known and given consideration in MLS installation planning.

8. RESERVED.

CHAPTER 2. THE ANALYSIS PROCESS

SECTION 1. PREPARATION FOR THE ANALYSIS

9. GENERAL. This section describes the preparatory events and tasks necessary to conduct an effective analysis. Careful attention to each of these tasks will enhance the efficiency of the team by ensuring that the required materials are available and that each team member is fully prepared prior to beginning the analysis phase. A checklist of events for the entire analysis process is provided in Appendix 3.

10. ACTIONS. In consultation with the facility manager, the appointed team leader should complete these actions.

a. Review the objective of the analysis program described in Chapter 1 relating it to the local air traffic situation. Estimate the magnitude of the work required to accomplish the objective and what representation is necessary to get the required level of detail during the analysis.

b. Select the analysis team considering the size and complexity of the facility to be evaluated. Including the team leader there should be no less than four members, a facility supervisor/procedures specialist, a controller, a recorder, and the procedures specialist from the FIFO responsible for the facility being analyzed. Each air traffic member must be experienced and knowledgeable in facility operations and available for the entire analysis period.

c. Prepare and distribute a schedule. Plan the actual analysis phase on consecutive work days to ensure continuity. The duration of the analysis process (3-10 days) depends on the number of airports and heliports involved, the complexity of the configurations, and the existing problems and constraints which must be considered. This schedule should be coordinated with the regional air traffic division (ATD) which can arrange for presentations or input to the analysis team from regional airports, flight standards, and airway facilities divisions. These presentations on current activities, problems, and any planned changes to the facility will be most valuable if given on the first day of the analysis study. Prior to distribution of the schedule, determine if any non-FAA offices are to be apprised of this project (e.g., airport management, operators, and users), how notification will occur, and whether briefings to the analysis team are desired. Schedule these briefings after coordination with the facility manager. This schedule is then distributed to the team as an announcement of the organizational meeting.

d. Conduct an organizational meeting of the selected facility team members. During this meeting accomplish the following actions:

(1) Show the video tape entitled, Microwave Landing System, which is available from the regional ATD MLS representative.

(2) Brief the team on the objective, the analysis process as it is described in this order, and team member duties as outlined in Appendix 4.

(3) Select one member of the team to act as the recorder. A controller is recommended.

(4) Review the materials listed in Figure 2-1, determine any additional items desired, and who will bring each item.

(5) Assign responsibility for preparation of a chart(s) showing existing arrival and departure flows for all airports and heliports in the area to be analyzed.

(6) Assign responsibility for an overall briefing of the terminal area to be given on the first day of the analysis.

(7) Distribute a copy of the "Getting Ready for MLS" booklet to each member.

(8) Review the list of briefings scheduled for the first day of the analysis and add any others determined to be required.

(9) Review any study requirements, the schedule, and task assignments.

FIGURE 2-1. RECOMMENDED MATERIALS

Facility Records and Publications

Standard Operating Procedures (SOP)
Letters of Agreement
Standard Instrument Approach Procedures
Standard Terminal Arrival Routes (STARS)
Standard Instrument Departures (SIDS)
Charted Visual Flight Procedures
Performance Measurement System (PMS) figures for each runway or locally developed runway capacity figures.
Airport Master Plans (Proposed/Project Land Changes)
Environmental Impact Studies
Noise Abatement Studies
FAA Handbook 8260.3 (TERPS)

Charts

Video Map
Terminal Area Charts
Airport Obstruction Charts (OC)
Minimum Vectoring Altitude Charts
Quad Charts
Airway Charts
Sectional Charts

Equipment

Planning Charts of the terminal area (in multiple copies)
Drawing Compass
MLS Area Coverage Template (Construct this on an appropriate material, the same scale as the planning chart, showing the range and azimuth coverage of the MLS)
Protractors
Chalkboard
Pen (Markers)
Rulers
Viewgraph

SECTION 2. PERFORMING THE ANALYSIS

11. PURPOSE. The overall purpose of an analysis is to examine current air traffic operations and develop recommendations for optimum MLS procedural applications within the airport terminal area. The results of this analysis may be used to develop an MLS installation program with appropriate priorities based on need. The analysis should culminate in the production of a study per FAA Order 1800.7, Staff Studies, which is outlined in Chapter 2, Section 3, Figure 2-13.

12. RECORDING THE ANALYSIS RESULTS.

a. Detailed records of the analysis process and results are essential. Not only do they prevent repetition and omissions, they greatly facilitate writing the staff study report at the conclusion of the analysis.

b. The following forms, which are explained in the analysis steps and in Appendix 2, will provide an organized record of the analysis and findings (Figures 2-2 through 2-4). Full size copies are in Appendix 3 for reproduction.

FIGURE 2-2. FACILITY AND CONFIGURATION LIST FORM

Facility	Facility	Facility	Facility	Facility
Configurations	Configurations	Configurations	Configurations	Configurations

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FIGURE 2-3. EXAMINATION WORKSHEET

FACILITY	Identification		Identification		Identification		Identification	
Identification	Config	REMARKS	Config	REMARKS	Config	REMARKS	Config	REMARKS
Configuration								

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FIGURE 2-4. ANALYSIS SUMMARY TABLE

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application

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13. STEPS IN THE ANALYSIS PROCESS.

a. Review the objective established during preparation for the analysis. This should ensure that the stated objective relates to the local air traffic activity and all members understand what will be accomplished in the analysis effort.

b. Review the method of analysis, roles and responsibilities, and schedules. This review of the analysis method, member roles and responsibilities, and schedule of events should prevent duplication of effort and ensure all considerations are made within the time allotted.

c. Conduct briefings on facility projects and issues which might affect the analysis. The arrangements and choice of subjects for these briefings will have been made during the preparation for analysis. These briefings provide insight to the analysis team on future developments and area needs. This information can prevent errors and omissions during the facility analysis.

d. Conduct air traffic review. The assigned member will perform an overview briefing of the terminal area discussing all existing air traffic flows and procedures. This general overview is the starting point for a more in-depth analysis which is detailed in the following steps. A review such as this provides an initial look at the obvious problems and ensures all team members are aware of the interrelationships of the different facilities within the terminal area. Providing this big picture broadens the perspective of all participants and ensures recognition and analysis of less obvious conflicts.

e. Identify existing runway configurations. This step uses the Facility and Configuration List Form.

(1) To complete this form, list all facilities within the terminal area across the top of the form starting with the primary facility. The primary facility is the facility that sets the operational pace for the entire terminal. If there is no such facility, select one for study control purposes.

(2) List all arrival and departure runway configurations for each airport on the form under the respective facility. Include all VFR and IFR traffic flows.

(3) When this list is complete (Figure 2-5), it serves as a reference to ensure all runway configurations are considered. This is only a listing and no attempt should be made to align configurations that are normally in effect at the same time.

FIGURE 2-5. USE OF FACILITY AND CONFIGURATION LIST

Facility	Facility	Facility	Facility	Facility
JFK	LGA	EWR	TEB	WALL ST
Configurations	Configurations	Configurations	Configurations	Configurations
ILS 13L	ARR 13 DPT 4	ARR/DPT 22L/R	ARR/DPT 19	HELIPORT
VOR 13L/R VFR 0 22	ARR 13 DPT 13	ARR/DPT 4L/R	ARR/DPT 1	
ILS 22L/R VFR 0 13	ARR 31 DPT 4	ARR/DPT 11	ARR/DPT 24	
ILS 4L/R	ARR 4 DPT 31	ARR/DPT 29	ARR/DPT 6	
ARR ILS 4R DPT 31L	ARR 4 DPT 13			
ILS 31L/R	ARR 22 DPT 13			
	ARR 22 DPT 31			

(O:OVERFLOW, ARR:ARRIVAL, DPT:DEPARTURE)

f. Analyze existing runway configurations. This step is an examination of the interrelationships of the various facilities and different arrival and departure configurations as they exist in current air traffic operations.

(1) Select and examine each runway configuration in turn, being sure to consider all approaches, missed approaches, and departures. Determine the influence any of these traffic flows may have upon other airports and their respective runway configurations. In addition, consider the items in Figure 2-6 in order to identify conflicts when facilities are operating simultaneously.

FIGURE 2-6 PROCEDURES AND DATA FOR FACILITY ANALYSIS

Standard Instrument Approach Procedures
Departure Paths
Missed Approach Procedures
Visual Approaches
Standard Terminal Arrival Routes
VFR Traffic Flows
Radar Vector Routings
Letters of Agreement
Standard Operating Procedures
Noise Abatement Procedures
Local Laws and Regulations
Airport Capacity
Helicopter Traffic

(2) Document all findings using the forms in Appendix 3. A format such as the Examination Worksheet (Figure 2-3) drawn on a chalkboard provides an excellent working tool for participants. As the analysis progresses the effects of the configuration being examined are listed on the chalkboard (Figure 2-7). The recorder will document this information on the Analysis Summary Form (Figure 2-8). A separate summary sheet should be used for each configuration examined.

FIGURE 2-7. ENTRY OF CONFLICTS ON WORKSHEET (JFK)

FACILITY	Identification LGA		Identification EWR		Identification TEB		Identification WALL ST	
Identification JFK	Config	REMARKS	Config	REMARKS	Config	REMARKS	Config	REMARKS
Configuration ILS 13L	ARR 13 DPT 13	SINGLE RUNWAY OPERATION REDUCES AIRPORT CAPACITY BY 50%. DEPARTURES ARE RESTRICTED TO STRAIGHT OUT CLIMB.		NO EFFECT		NO EFFECT		ARRIVALS AND DEPARTURES HAVE TO BE INTEGRATED WITH JFK 13 ARRIVALS OVER THE HUDSON RIVER.

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FIGURE 2-8. ENTRY OF CONFLICTS ON ANALYSIS SUMMARY TABLE (JFK)

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
JFK ILS 13L ARR/ DPT	1. (LGA) SINGLE RUNWAY OPERATIONS TO RUNWAY 13, REQUIRED BY OPERATIONS AT JFK, REDUCES LGA AIRPORT CAPACITY BY 50%. 2. (LGA) DEPARTURES ARE RESTRICTED TO STRAIGHT OUT CLIMB. 3. (WALL ST) ARRIVALS AND DEPARTURES HAVE TO BE INTEGRATED WITH JFK 13 ARRIVALS OVER THE HUDSON RIVER.		

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g. Review the results of configuration examination. Ensure all facilities and runway configurations have been considered and cross-analyzed against each other as illustrated in Appendix 2. Review the results through use of your Facility and Configuration List and planning charts.

h. Develop MLS operational application.

(1) Using the characteristics and capabilities of the MLS. as presented in Appendix 1, develop and recommend approach procedures designed to resolve existing conflicts. The Transport Category C general TERPS data is illustrated in Figure 2-9. Similar information for other categories is available in Section 2 of Appendix 1. When illustrating a desired procedure, use the data for the highest approach speed category of aircraft expected to use the approach.

FIGURE 2-9. PLAN VIEW ILLUSTRATING DATA (TRANSPORT CATEGORY C AIRCRAFT)

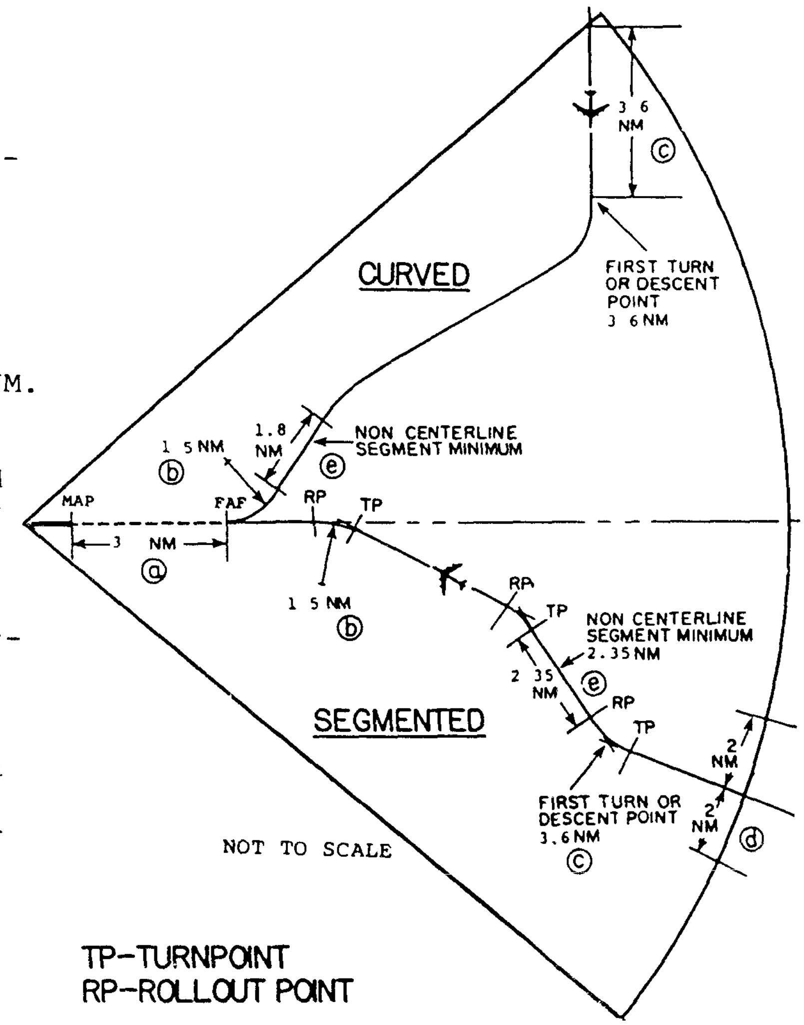
a. Final centerline segment (FCLS) of 3 NM or more. For a segmented approach where a turn is required, the FCLS is increased by .5NM for each 10° turn or portion thereof.

b. Turning radius of 1.5NM.

c. Distance inside the coverage area of 3.6NM prior to descending or turning.

d. The initial segment width inside the coverage area is 2NM each side of this course.

e. Non-centerline segment whose minimum length is 2.35NM for MLS segmented path and 1.8NM for MLS curved path.



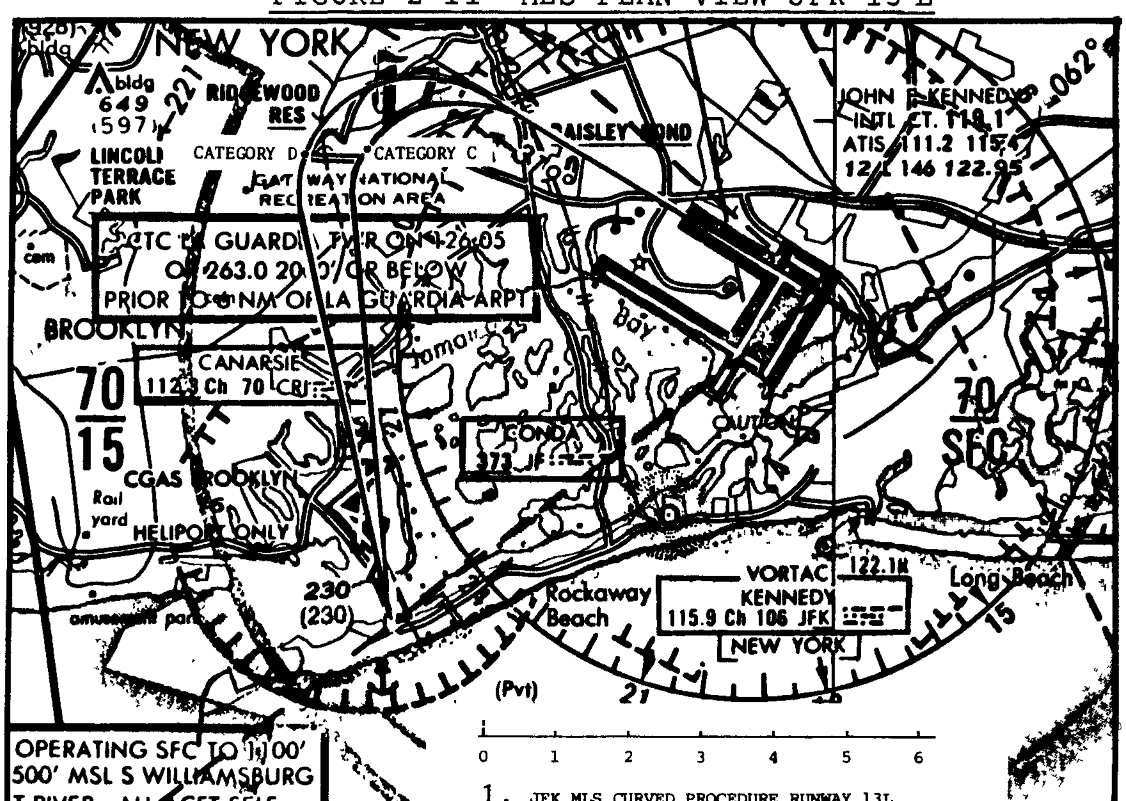
(2) Once a satisfactory MLS procedure has been developed, enter a verbal description of that procedure in Section C of the Analysis Summary Table (Figure 2-10).

FIGURE 2-10 MLS PROCEDURE DESCRIPTION ENTRY ON ANALYSIS SUMMARY TABLE

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
JFK ILS 13L ARR/ DPT	1. (LGA) SINGLE RUNWAY OPERATIONS TO RUNWAY 13, REQUIRED BY OPERATIONS AT JFK, REDUCES LGA AIRPORT CAPACITY BY 50%. 2. (LGA) DEPARTURES ARE RESTRICTED TO STRAIGHT OUT CLIMB. 3. (WALL ST) ARRIVALS AND DEPARTURES HAVE TO BE INTEGRATED WITH JFK 13 ARRIVALS OVER THE HUDSON RIVER.	CURVED PROCEDURE FROM SOUTH OVER CANARSIE VOR WHICH APPROXIMATES THE PRESENT VOR 13L/R CANARSIE APPROACH. (ILLUSTRATION 1)	

(3) Illustrate and number the proposed MLS procedure for inclusion in the staff study report (Figure 2-11). Include this illustration number with the verbal description in Section C of the Analysis Summary Table.

FIGURE 2-11 MLS PLAN VIEW JFK 13 L



1. JFK MLS CURVED PROCEDURE RUNWAY 13L

i. Analyze MLS application. List the results of the MLS application in terms of advantages and disadvantages on the chalkboard. The recorder lists these results in Section D of the Analysis Summary Table (Figure 2-12).

FIGURE 2-12 MLS APPLICATION RESULTS ENTRY ON ANALYSIS SUMMARY TABLE

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
JFK ILS 13L ARR/ DPT	1. (LGA) SINGLE RUNWAY OPERATIONS TO RUNWAY 13, REQUIRED BY OPERATIONS AT JFK, REDUCES LGA AIRPORT CAPACITY BY 50%. 2. (LGA) DEPARTURES ARE RESTRICTED TO STRAIGHT OUT CLIMB. 3. (WALL ST) ARRIVALS AND DEPARTURES HAVE TO BE INTEGRATED WITH JFK 13 ARRIVALS OVER THE HUDSON RIVER.	CURVED PROCEDURE FROM SOUTH OVER CANARSIE VOR WHICH APPROXIMATES THE PRESENT VOR 13L/R CANARSIE APPROACH. (ILLUSTRATION 1)	1. ENABLES JFK TO USE RUNWAY 13L WITH GREATER FREQUENCY WITHOUT AFFECTING OTHER AIRPORTS. 2. ALLOWS LGA TO ARRIVE RUNWAY 22 AND DEPART 13 WHICH INCREASES POSSIBLE ARRIVAL RATE FROM 15 TO 33 PER HOUR. A DEPARTURE RATE INCREASE FROM 15 TO 33 PER HOUR IS ALSO POSSIBLE. 3. JFK ARRIVALS COULD INCREASE FROM 22 TO 40 PER HOUR. 4. ELIMINATES THE AIRSPACE CONFLICTS OF ILS RUNWAY 4 AT LGA. 5. ELIMINATES CONFLICTS WITH THE MISSED APPROACH PROCEDURE ON RUNWAY 22 AT LGA. 6. ELIMINATES CONFLICT WITH MANHATTAN HELIPORTS. 7. ALLOWS LGA TO USE EXPRESSWAY APPROACH WITHOUT CONFLICT.

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j. Review results of the MLS application. Review the advantages and disadvantages of the MLS application(s) for each facility and runway considered. Cross-check with the planning chart. Ensure the following items were considered:

(1) Air traffic management restrictions (airspace, obstacles, etc.)

(2) Airspace users (all fixed wing, rotorcraft and STOL, air carriers, corporate, general aviation and fixed base operators),

(3) Environmental considerations,

(4) Improvements to existing operations,

(5) Instrumenting desirable runways.

k. Develop operational priorities for MLS installation. Utilizing the information compiled during the analysis process, develop a list in priority order of where the most advantage can be gained with each MLS installation. In determining benefit, consider these items as well as any others peculiar to your situation:

(1) Amount of time runway configuration is utilized, (primary and secondary),

(2) ATC productivity and efficiency,

(3) ATC operational problem solution,

(4) Workload factors,

(5) User advantage,

(6) Noise,

(7) Affect on other IFR/VFR operations/airports,

(8) Airport/airspace capacity,

(9) Approach minima,

(10) Improvements to existing operations,

(11) Runway occupancy times,

(12) IFR/VFR weather conditions.

14.-15. RESERVED.

SECTION 3. FOLLOW-UP ACTION

16. PURPOSE. This section provides an appropriate format for reporting the results of the facility analysis.

17. STAFF STUDY OUTLINE. The outline of items to be included in the staff study report and explanations of their source are listed in Figure 2-13. (For further guidance on content and format for staff study reports see FAA Order 1800.7, Staff Studies.)

FIGURE 2-13. FACILITY ANALYSIS STAFF STUDY

1. INTRODUCTION	
a. Purpose	Paragraph 11, Chapter 2.
b. Scope	Facilities analyzed, on what basis, time frame?. Paragraphs 3a and 7, Chapter 1.
c. Background	Who directed the study and why. Paragraphs 4a and b, Chapter 1.
d. Methodology	Reference this order.
2. ASSUMPTIONS	
a. MLS Capabilities	Reference Appendix 1 of this guide. State the MLS capabilities which can potentially apply to your facility.
b. Future Activity	Include pertinent facts from the briefings of Paragraph 13c, Chapter 2.
3. FACTS	
a. Overview	Briefly restate the results of Paragraph 13d, Chapter 2.
b. Details	Include the Facility and Configuration List. Paragraph 13e, Chapter 2. Include additional text where necessary to allow the reader to understand what was done.
4. ANALYSIS OF FACTS	
a. Approach	Present the results of paragraph 13f, Chapter 2.
b. Application of MLS	Present the results of Paragraph 13h and 13i, Chapter 2, including worksheets, drawings, and summary forms.

FIGURE 2-13. FACILITY ANALYSIS STAFF STUDY CONT'D

5. OPTIONS

a. Results	Discuss the MLS options investigated in Paragraph 13j, Chapter 2.
b. Priorities	Document the operational priorities for MLS installation from paragraph 13k, Chapter 2. Discuss in detail the advantages and disadvantages of each alternative in support of that prioritization.

6. CONCLUSIONS

a. The following is a list of several considerations that might be helpful in arriving at possible conclusions.

(1) Have potential improvements to the existing local air traffic control (ATC) system been determined through use of the capabilities of MLS?

(2) Have possible reductions in airspace requirements been identified which may alleviate existing airspace conflicts?

(3) Can the MLS provide a precision approach to a runway or helipad where an approach is not presently available?

(4) What new or innovative air traffic routings or procedures might be realized through the use of MLS?

(5) How does the use of MLS affect present airport capacity? Under what conditions?

(6) Who will be affected by the installation of an MLS (ATC, users, environmental considerations)? How, and to what extent, will they be affected?

(7) What benefits will be realized as a result of the effects of MLS on ATC, users, and environmental considerations?

(8) State problems encountered in the analysis process.

b. It is important to be thorough when developing the conclusions. The team should not be reluctant to consider all the traffic flows. All cases where the implementation of an MLS would

FIGURE 2-13. FACILITY ANALYSIS STAFF STUDY CONT'D

cause no significant effect for a runway or runway configuration should also be included in the staff study. This will enable management and future analysis teams to readily identify the affect of MLS on a particular facility configuration, both at the time of the analysis or at any future time.

7. RECOMMENDATIONS

a. The recommendations should remain in an air traffic control operational perspective. The following questions are included to assist the team in developing recommendations.

(1) Which facilities and runways should be equipped with an MLS?

(2) How would the team recommend that the procedure be designed to benefit the system and users and serve environmental considerations?

(3) What other types of procedures can be developed to increase airport capacity?

(4) Does the recommended MLS procedure require greater or less MLS azimuth area coverage than exists with the standard FAA $\pm 40^{\circ}$ system?

(5) How should the system azimuth coverage be oriented at the facility to meet the needs of the recommended procedures?

(6) What procedures are feasible and desired, but cannot be designed with existing criteria?

(7) What is the priority for installation of MLS at specific runways as perceived by the analysis team?

b. The recommendations should provide the analysis team and management with the appropriate courses of action. They should include enough detail to state fully and objectively the advantages and disadvantages of each course of action.

18.-20. RESERVED.

APPENDIX 1. MLS CHARACTERISTICS AND CAPABILITIES

SECTION 1. MLS SIGNAL CHARACTERISTICS

1. PURPOSE. This appendix provides a detailed discussion of the unique MLS characteristics and capabilities which set the MLS apart from the Instrument Landing System (ILS). These features include:

a. Wide scan coverage using narrow beam,
b. Guidance for missed approach and departure,
c. Precision distance measuring equipment (DME/P),
d. More available frequencies,
e. Data transmission capability,
f. Operational application,
g. Siting ease.

2. AREA COVERAGE.

a. The Azimuth Station (AZ) is analogous to an ILS localizer, but has a much wider proportional guidance coverage (Figure 1). The MLS AZ proportional guidance coverage is ±40 degrees normally, with a maximum of ±60 degrees of coverage from a zero degree azimuth reference radial. Localizer coverage is ±35 degrees, but provides only a left/right indication beyond 1.5 degrees. MLS provides precision position information with respect to the ground station throughout the coverage area of ±40 or ±60 degrees.

(1) Although it is normal to center this coverage, it is possible to install the azimuth station so that greater coverage is provided to one side of the runway centerline (Figure 2). This skewed orientation of the signal coverage can be useful when: greater maneuvering area is desired on one side of the runway, more than one runway is serviced by the same azimuth station, or obstacles to one side of the runway make it inappropriate to establish signal coverage in that area.

(2) Another property of the MLS is that portions of the signal coverage can be restricted or a different beamwidth used to solve multipath problems peculiar to a site. This characteristic, as well as the lesser susceptibility of MLS to signal reflections, greatly reduces siting problems normal to ILS.

b. The Elevation Station (EL) is analogous to the glideslope facility of the ILS. However, the MLS EL transmitter provides vertical signal coverage from 0.9 degrees (as influenced by line-of-sight) to 15 degrees. This makes possible a wide range of glidepath angles based on aircraft capability and obstruction clearance.

c. Azimuth, elevation, and DME/P coverage will normally extend to a range of 20 NM and 20,000 feet. This applies to the ±60 degree system except that the portion of the coverage outside the ±40 degree region extends to a range of 14 NM (Figure 1). Expanded service volume appears feasible but requires further testing to develop the necessary standards. There is no signal from the MLS equating to the backcourse of the ILS localizer.

3. MISSED APPROACH AND DEPARTURE GUIDANCE.

a. The Back Azimuth Station (BAZ) equipment is identical to that of the azimuth station and can be used to provide departure and missed approach guidance for runways equipped with an MLS for each approach direction. Since the systems are identical, either azimuth station can function as an AZ or BAZ (Figure 1).

b. The scan of a station when operating in back azimuth mode is limited to +40 degrees due to the different timing of the signal format. The service volume remains at 20 NM in range and 20,000 feet in altitude.

FIGURE 1. MLS AZIMUTH COVERAGE

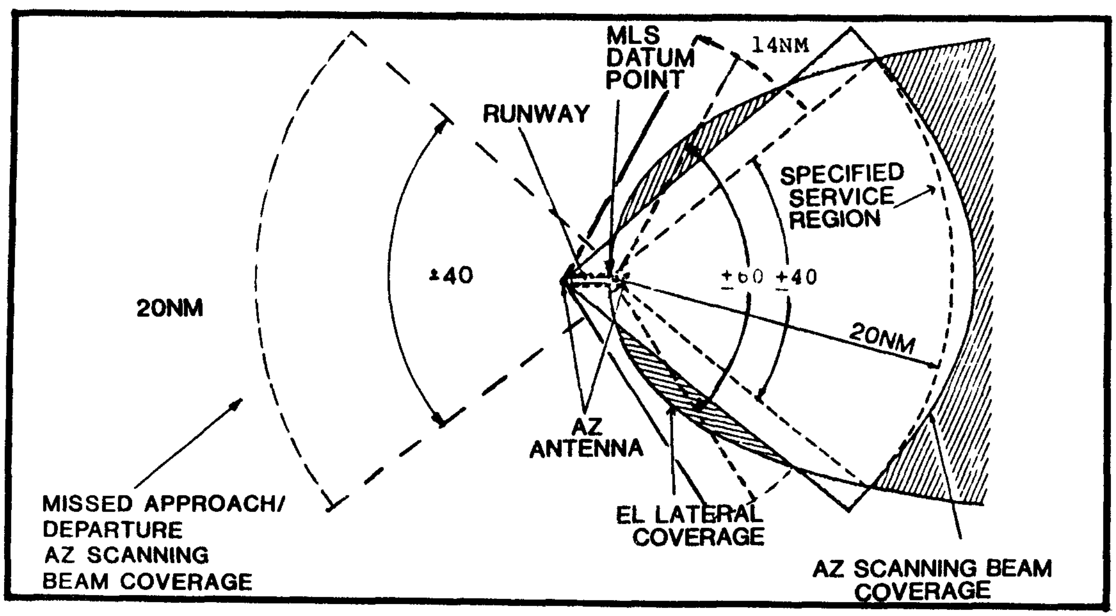


FIGURE 2. MLS SKEWED ORIENTATION

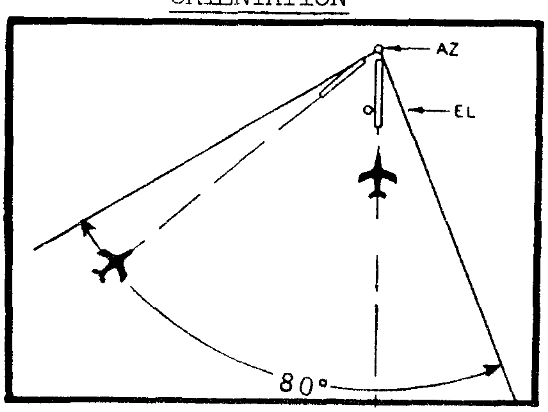
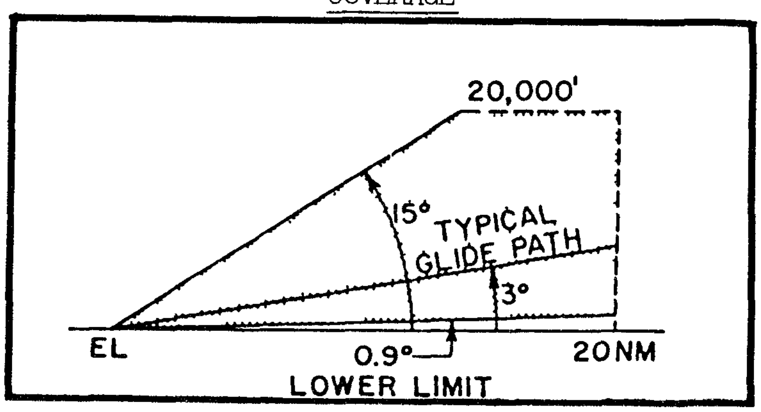


FIGURE 3. MLS ELEVATION COVERAGE



4. PRECISION DME (DME/P).

a. The DME/P is an omnidirectional transponder which will normally be collocated with the azimuth station for federal MLS installations. It can service more than 100 aircraft simultaneously to a range of 22 NM and will give priority to aircraft operating in the final approach (FA) mode. DME/P provides accurate and continuous distance information which can be used with angle data to determine accurate position anywhere within the MLS coverage area. On final approach the DME/P is used in place of the marker beacons associated with ILS.

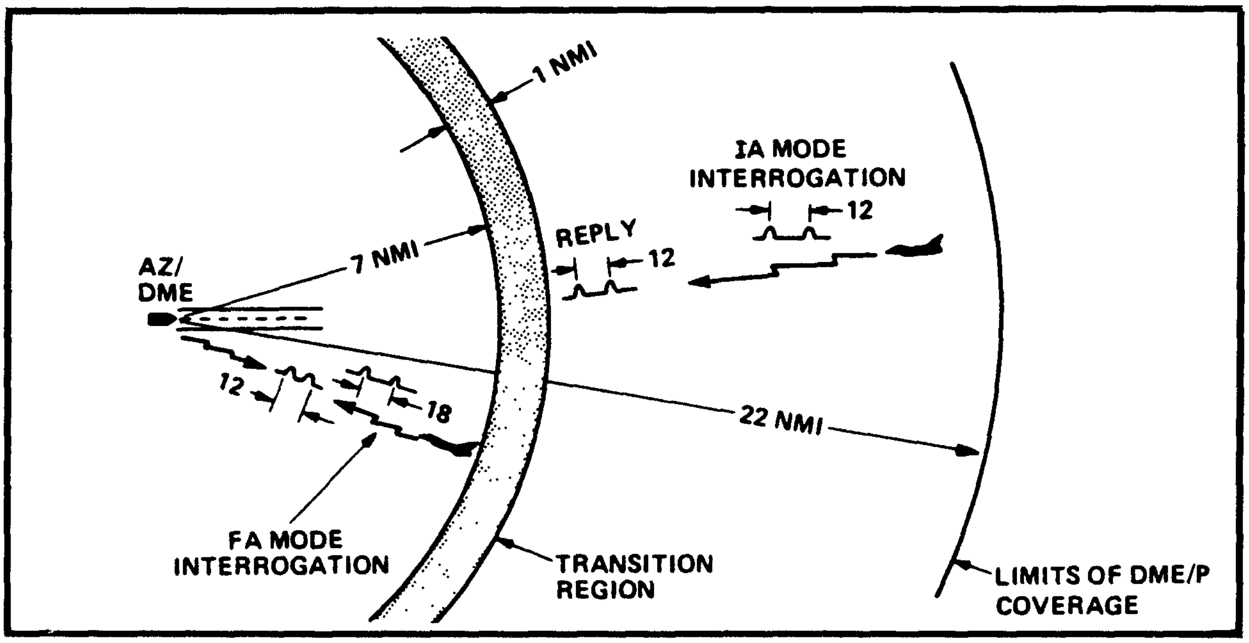
b. DME/P shares the same frequency band as the existing DME/N system. Some additional pulse codes have been assigned to DME/P, called W and Z channels to provide additional channels as the requirement increases due to multiple MLS installations. These channels are paired with the MLS angle data transmitter frequencies as described in Paragraph 5, MLS/DME Frequency Availability and Pairing.

c. The DME/P transponder is compatible with standard DME/N interrogators. Both systems obtain distance information by measuring the time between the transmitted interrogations and the reply from the ground transponder. Compatibility is such that the DME/N interrogator can be used with the DME/P ground station without a degradation in service. Similarly DME/P interrogators can interact with the DME/N ground transponder with at least the accuracy of a standard DME/N interrogator.

d. The major improvement of the DME/P over the DME/N is obtainable accuracy. The DME/N interrogator operating with a DME/N or DME/P ground station can achieve an accuracy of approximately ±1,200 feet. A DME/P interrogator is capable of accuracies up to ±100 feet within 7 miles of the runway and approximately ±300 feet in the remaining ranges (7-22 NM) when operating with DME/P ground transponder.

e. The DME/P operates in two modes, the initial approach (IA) mode and the FA mode, using different pulse time-of-arrival detection techniques (Figure 4). In the initial approach mode (7 to 22 NM), the DME/P uses the same method as the DME/N. Due to the tighter specifications of ground and airborne equipment and pulse shape, the DME/P system achieves accuracies of up to ±279 feet in this range. Between 8 and 7 NM the DME/P automatically transitions to a different pulse time-of-arrival detection technique which permits the ±100 feet accuracy. This more accurate method is not used at greater ranges since it does not work well with the lower signal strength.

FIGURE 4. DME/P 2-PULSE/2-MODE SYSTEM OPERATION



5. MLS/DME FREQUENCY AVAILABILITY AND PAIRING.

a. MLS angle functions operate in the frequency range of 5031 to 5090.7 MHz. This range supports 200 channels for MLS, as compared to only 40 channels available for ILS. The 200 channels are numbered from 500 to 699. The DME/P employs the same frequencies as conventional DME/N, and permits the creation of an additional 100 channels (called W and Z channels) through pulse coding techniques, resulting in a total of 200 DME channels. The first 100 MLS channels are paired with existing DME channels used with ILS; the second 100 channels are paired with the new W and Z DME channels.

FIGURE 5. MLS CHANNEL PLAN

DME CHANNEL NUMBER	MLS CHANNEL NUMBER	ANGLE FREQUENCY (MHz)	DME REPLY FREQUENCY (MHz)	DME REPLY PULSE CODE (US)	DME/P IA MODE INTERR. PULSE CODE (US)	DMP/P FA MODE INTERR. PULSE CODE (US)
18X	500	5031.0	979.0	12	12	18
18W	501	5031.3	979.0	24	24	30
20X	502	5031.6	981.0	12	12	18
20W	503	5031.9	981.0	24	24	30
22X	504	5032.2	983.0	12	12	18
22W	505	5032.5	983.0	24	24	30
17Y	540	5043.0	1104.0	30	36	42
17Z	541	5043.3	1104.0	15	21	27
18Y	542	5043.6	1105.0	30	36	42
18Z	543	5043.9	1105.0	15	21	27
19Y	544	5044.2	1106.0	30	36	42
19Z	545	5044.5	1106.0	15	21	27
20Y	546	5044.8	1107.0	30	36	42
119Z	699	5090.7	1080	15	21	27

b. Due to the omnidirectional radiation of DME signals and the use of the same frequencies for the DME/P and conventional DME, the major factor in assigning frequencies in a given geographical area is the DME rather than the MLS angle guidance equipment. In general, the availability of 200 MLS/DME channel pairs gives much more capability to provide MLS service in congested terminals than the 40 channels available with ILS.

c. Use of a "common frequency" assignment strategy (the same frequency employed for back-to-back systems) will probably be required on the second major purchase of MLS systems. Increased use of this technique will be required in accommodating the 1250 system MLS environment, even with use of the full 200 available channels.

d. An MLS deployment significantly in excess of the 1250 systems now envisioned may require some adjustment in the DME coverage provided (sectorized service volume, reduced altitude protection, multiple use of a single DME, etc.) to avoid saturation in the highest density areas. Unless some form of relief is obtained in the form of sectorized DME coverage or other technical adjustments, an MLS deployment in excess of the 1250 systems now envisioned will result in frequency saturation in several high density areas.

e. Difficulties experienced at major hubs where several MLS's are installed alongside the existing ILS's will ease in later years when the ILS is phased out. At high density locations, when an MLS is installed duplicating an existing ILS, the MLS channel assigned will correspond to the DME channel paired with the ILS frequency, regardless of whether DME is currently installed with that ILS. The regions will be responsible for initiating any frequency changes needed to accomplish this objective, but the headquarters frequency engineering office will assist by providing guidelines.

6. DATA TRANSMISSION.

a. The MLS transmits data in digital form in a time slot on the same frequency used for angle information. Data items are assigned to either the basic or auxiliary data function and are categorized according to the intended use. The three categories are:

1. data to enable basic processing of angle functions;

2. data used to modify outputs of the receiver or to indicate progress on the approach; and

3. data decoded by the receiver, but ultimately intended for use by other components of the airborne system.

b. Data in Categories 1 and 2 will only be provided on the basic data function and Category 3 data will be provided on the auxiliary data function. Transmission of the basic data as well as a subset of the auxiliary data is mandatory. Elements of the auxiliary data are mandatory to ensure the availability of data for desired applications. Current ICAO agreements have defined certain items to be included in each category. The basic data content is listed in Figure 6 and illustrated in Figure 7.

FIGURE 6. BASIC DATA CONTENT

1. Approach azimuth to threshold distance: the minimum distance (B1) between the approach azimuth antenna phase center and the vertical plane perpendicular to the center line which contains the landing threshold.

2. Approach azimuth proportional coverage limits: the limits of the sector (B2) in which proportional approach azimuth guidance is transmitted.

3. Clearance signal type: the method of providing the azimuth clearance signal.

4. Minimum glide path: the minimum glidepath.

5. Back azimuth status: the operational status of the back azimuth equipment.

6. DME status: the operational status of the DME equipment.

7. Approach azimuth status: the operational status of the approach azimuth equipment.

8. Approach elevation status: the operational status of the approach elevation equipment.

9. Beamwidth: the antenna beamwidth

10. DME distance: the minimum distance (B10) between the DME antenna phase center and the vertical plane perpendicular to the runway centerline which contains the MLS datum point.

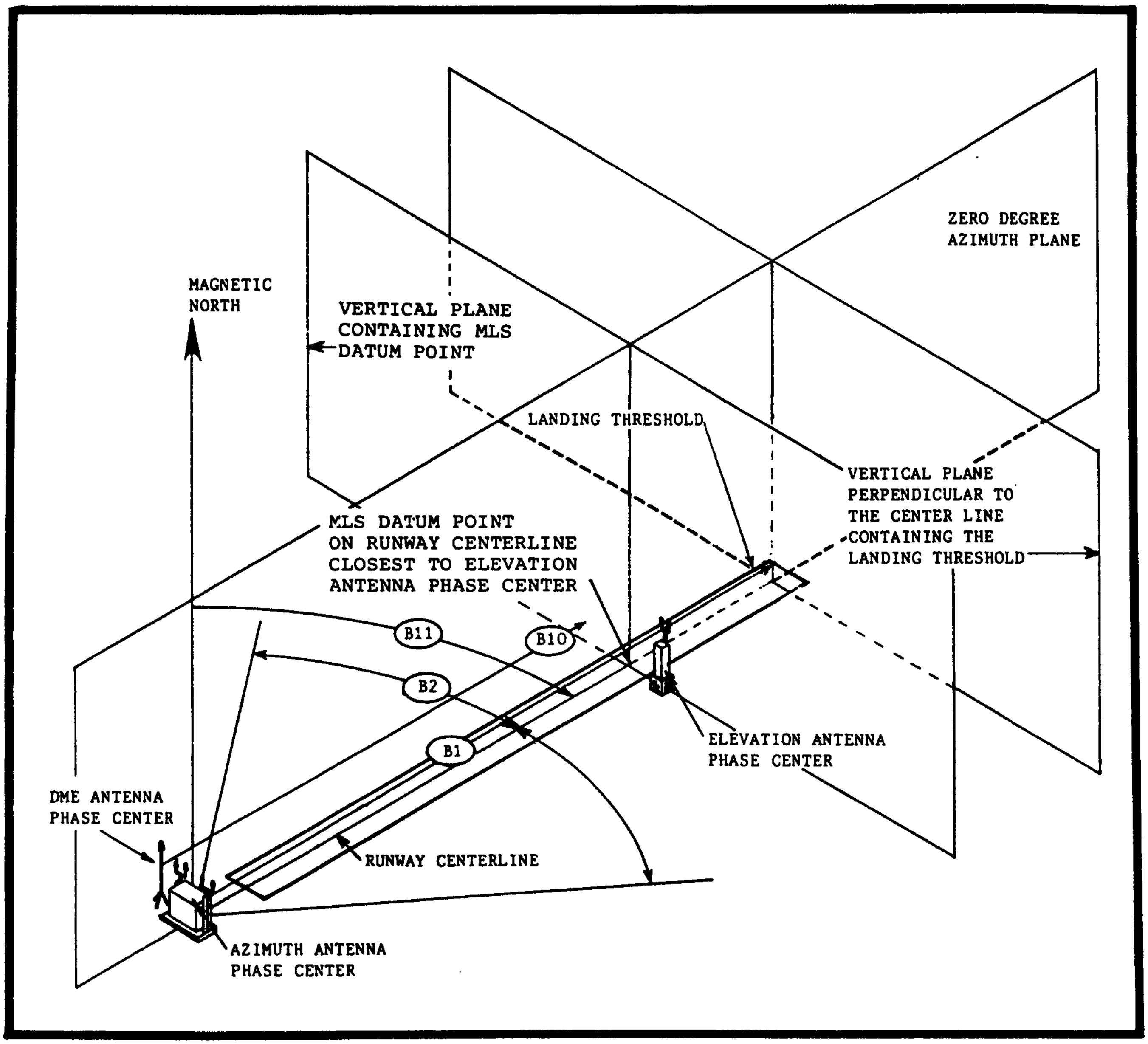
11. Approach azimuth zero-degree guidance plane orientation: the angle (B11) measured in the horizontal plane clockwise from magnetic north to the zero degree angle guidance plane of the approach azimuth antenna. The vertex of the measured angle shall be at the approach azimuth antenna phase center.

12 Back azimuth zero-degree guidance plane orientation: the angle measured in the horizontal plane clockwise from magnetic north to the zero-degree angle guidance plane of the back azimuth antenna. The vertex of the measured angle shall be at the back azimuth antenna phase center.

13. Back azimuth proportional coverage limits: the limits of the sector in which proportional back azimuth guidance is transmitted.

14. MLS ground equipment identification: the last three characters of the system identification. The characters shall be encoded in accordance with the 5-unit code of the International Telegraph Alphabet No. 2.

FIGURE 7. BASIC DATA ILLUSTRATION



c. The auxiliary data words are broken into three auxiliary data functions entitled Auxiliary Data A, Auxiliary Data B, and Auxiliary Data C. Each auxiliary data function has 64 words. The contents of four words of Auxiliary Data A have been defined and contain the data items listed in Figure 8 and illustrated in Figures 9&10. The remainder of Auxiliary Data A and all of B are as yet undefined. The contents of C are reserved for national use.

FIGURE 8. AUXILIARY DATA CONTENT

1. Approach azimuth antenna offset: the minimum distance between the approach azimuth antenna phase center and the vertical plane containing the runway centerline. (A1)

2. Approach azimuth to MLS datum point distance: the minimum distance between the approach azimuth antenna phase center and the vertical plane perpendicular to the centerline which contains the MLS datum point. (A2)

3. Approach azimuth alignment with runway centerline: the minimum angle between the approach azimuth antenna zero degree guidance plane and the runway centerline. (A3)

4. Approach azimuth antenna coordinate system: the coordinate system (planar or conical) of the angle data transmitted by the approach azimuth antenna.

5. Approach elevation antenna offset: the minimum distance between the elevation antenna phase center and the vertical plane containing the runway centerline. (A5)

6. MLS data point to threshold distance: the distance measured along the runway centerline from the MLS datum point to the runway threshold. (A6)

7. Approach elevation antenna height: the height of the elevation antenna phase center relative to the height of the MLS datum point. (A7)

8. DME offset: the minimum distance between the DME antenna phase center and the vertical plane containing the runway centerline. (A8)

9 DME to MLS datum point distance: the minimum distance between the DME antenna phase center and the vertical plane perpendicular to the centerline which contains the MLS datum point. (A9)

10. Back azimuth antenna offset: the minimum distance between the back azimuth antenna phase center and the vertical plane containing the runway centerline.

11. Back azimuth to MLS datum point distance: the minimum distance between the back azimuth antenna and the vertical plane perpendicular to the centerline which contains the MLS datum point.

12. Back azimuth antenna alignment with runway centerline: the minimum angle between the back azimuth antenna zero-degree guidance plane and the runway centerline.

FIGURE 9. AUXILIARY DATA ILLUSTRATION

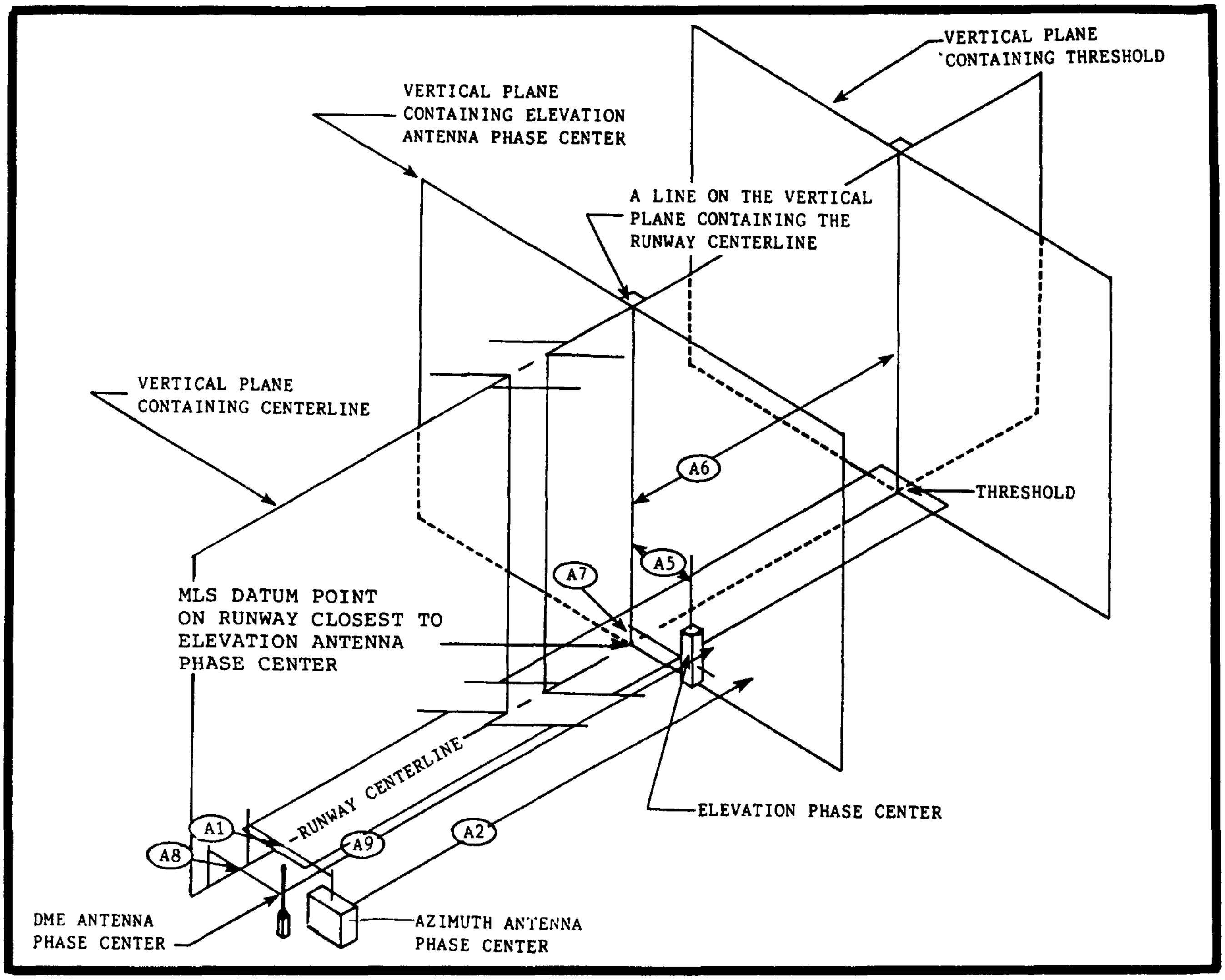
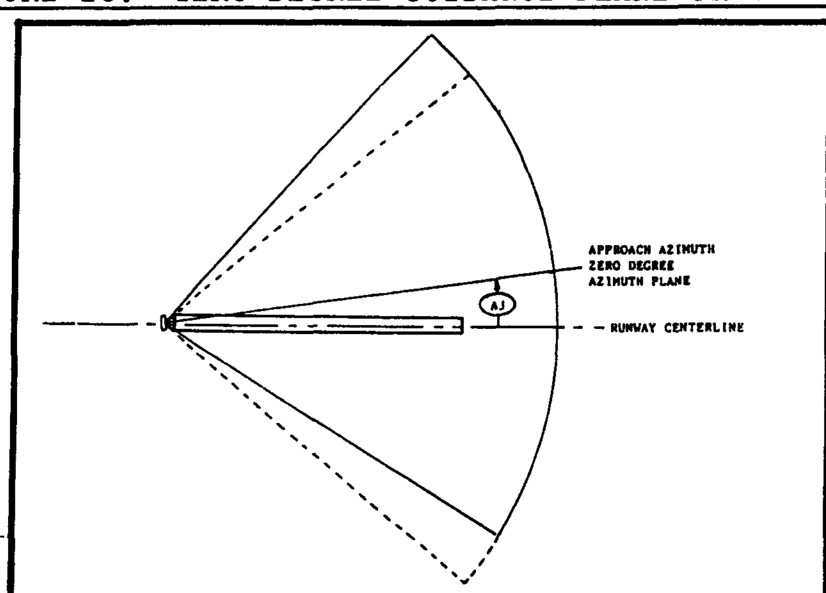


FIGURE 10. ZERO DEGREE GUIDANCE PLANE ORIENTATION



SECTION 2. OPERATIONAL CAPABILITIES.

7. APPLICATION OF MLS OPERATIONAL CAPABILITIES

a. The traffic flows used during VFR conditions are generally the facility traffic management planners' best assessment of environmentally acceptable and efficient procedures. These flows are changed when weather conditions deteriorate to the point that they are no longer practical or possible. Under such conditions, the characteristics of the ILS are restrictive and greatly reduce the traffic handling capability. Application of the varied approach capabilities possible with the MLS could restore much of the efficiency lost when these traffic flows are changed.

b. The volumetric coverage of the MLS permits great flexibility in the design of approach procedures. These illustrations (Figures 11 through 16) are presented to stimulate thought on the development of procedures that may improve traffic management capability.

FIGURE 11
APPROACH TO A NON-INSTRUMENTED HELICOPTER LANDING AREA

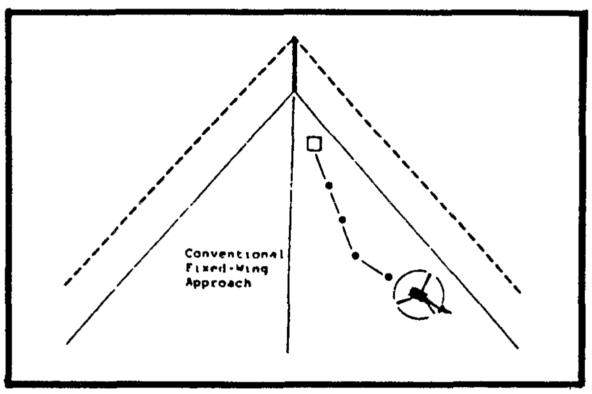


FIGURE 12
OFF AIRPORT LANDING AREA (OIL FIELD)

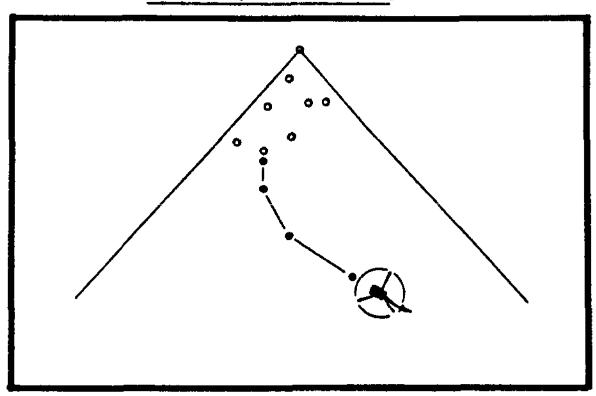


FIGURE 13
SEGMENTED FLIGHT PATH TO PARALLEL RUNWAYS

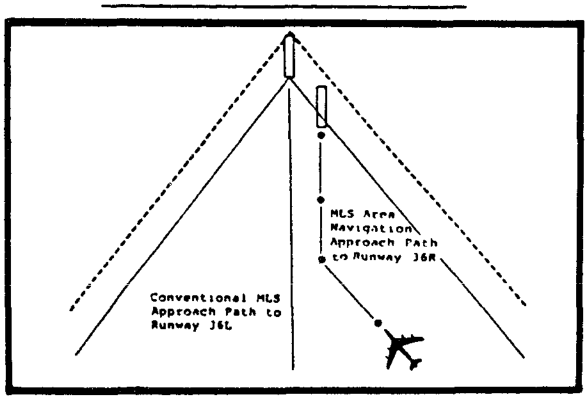


FIGURE 14
MULTIPLE TURN ON TO FINAL

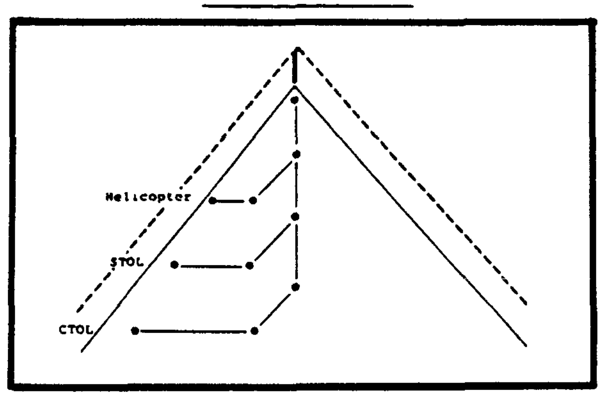


FIGURE 15
SEGMENTED FLIGHT PATH
TO INTERSECTING RUNWAYS

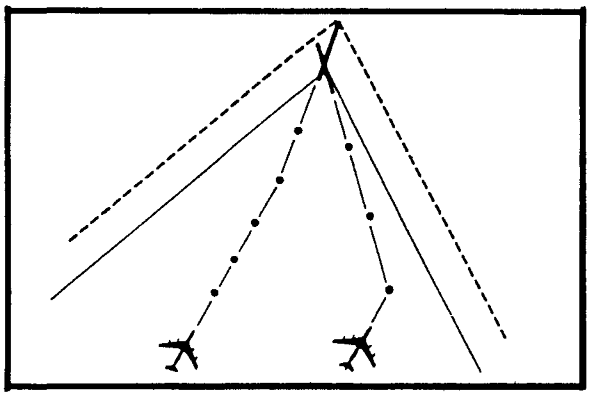
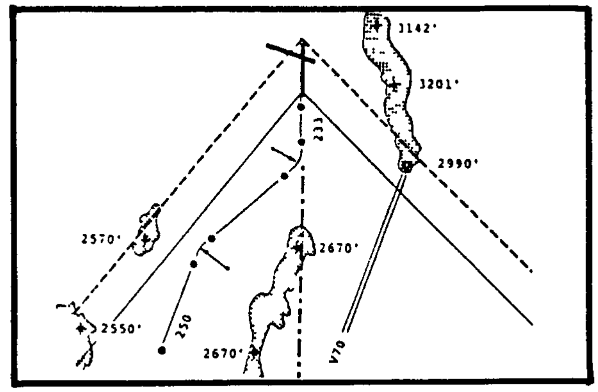


FIGURE 16
CURVED PATH DESIGNED
FOR TERRAIN AVOIDANCE



c. While the curved and segmented capabilities may not be immediately available, failure to consider them prior to installation could result in improper signal coverage orientation for the most effective future use. To use the more advanced capabilities of MLS, an aircraft must have a computer; however, the problem of varied avionics in aircraft should not be allowed to interfere with the analysis. Once the analysis is complete, the problem of varied capabilities must be dealt with procedurally. The analysis team should consider ways that advantage can be realized even when only a small percentage of aircraft are so equipped. In this way users can recognize benefits and be encouraged to equip their aircraft with the appropriate avionics.

d. In developing MLS procedures to satisfy a particular operational requirement, consider the following:

(1) MLS approaches which closely approximate VFR traffic flows.

(2) New approaches to other than the primary instrumented landing surface (such as heliports or other runways within coverage).

(3) Paths to maintain noise abatement measures.

(4) Separate approaches for varied aircraft types.

(5) Installing MLS where siting restrictions would not permit ILS.

(6) Cost savings by development of approaches to multiple landing surfaces using one MLS ground station.

(7) Approach paths to avoid obstacles.

(8) Precise missed approach and departure paths with positive course guidance.

(9) Multiple turn on paths for various aircraft.

(10) Additional way points or variations in flight path planned into procedures to facilitate spacing control.

(11) Use of steeper glidepath angles in developing approaches for specific aircraft or circumstances.

(12) Approach paths to surfaces which have a terrain drop off at the approach end.

e. The values and definitions presented in Figures 17 and 18 are still in the draft stage of development. Analysis of test data to date indicates that these design parameters are achievable with the MLS. In illustrating approach plan views, use the values listed in Figure 17 for the highest aircraft category for which the approach is being planned.

FIGURE 17. MLS/RNAV AND MLS CURVED COURSE DESIGN PARAMETERS

AIRCRAFT CATEGORY	A	B	C	D	E
TURNING RADIUS	1	1.25	1.5	1.75	2
NONCENTERLINE SEGMENT (NCLS) MINIMUM LEG LENGTH MLS/RNAV MLS/CP	 1.5 1.1	 2.0 1.5	 2.35 1.8	 2.75 2.1	 3.75 2.8
FINAL CENTERLINE SEGMENT (FCLS) FINAL SEGMENT MINIMUM LENGTH	1.9	2.5	3.0	3.4	4.2
FIRST MANEUVER POINT DISTANCE(FMPD)	2.3	3.1	3.6	4.2	5

FIGURE 18. EXPLANATION OF TERMS

1. Segmented Path (MLS/RNAV). An MLS approach with computed initial and intermediate and/or final segments. Final segments aligned with runway centerline and coincident with an MLS azimuth angle shall be based on MLS guidance directly. The procedure is defined by straight line segments that begin and end with MLS-defined waypoints. Distances are computed from collocated azimuth and DME, and may be defined as along track distance to touchdowns (ATK).

2. Curved Path (MLS/CP). An MLS approach with a computed continuous path in space. The initial, intermediate, final, missed approach and all other points along the path, such as turn points and rollout points are computed from the collocated azimuth and DME and may be defined as the distance along track from touchdown. Final centerline segments coincident with an MLS azimuth angle shall be based on MLS guidance directly.

3. Final Approach Segment. The final approach shall begin at the final approach point (FAP) and end at the missed approach point (MAP). The final may contain one or more curved segments and one or more straight segments. The FCLS shall be straight and shall have at least the final segment straight length specified in Figure 17.

4. Non-centerline Segment (NCLS). Any portion of an approach not aligned with the runway centerline. Its length is the distance between the rollout point and the turn point on the segment.

5. Final Centerline Segment (FCLS). That portion of the final approach segment where no further course changes shall be required.

6. First Maneuver Point Distance (FMPD). The distance inside the MLS coverage area required to transition to MLS/RNAV or MLS/CP guidance prior to turning or descending.

7. Final Approach Fix (FAF). The DME distance used for identifying the FAF will be to the nearest 0.1 NM and shall be located coincident with or prior to the FAP. Paragraph 287c of TERPS applies except that the fix error shall not exceed ± 1 mile.

8. Turn Point (TP). The point in an MLS/RNAV or an MLS/CP procedure where a turn begins.

9. Roll Out Point (RP). The point in an MLS/RNAV or an MLS/CP procedure where a turn is completed.

10. Final Approach Point (FAP). The point where the elevation angle intercepts the intermediate altitude.

f. The capability of a particular aircraft to fly the various MLS approaches is dependent upon its installed MLS avionics. The range of capabilities is illustrated in Figure 19.

FIGURE 19. TYPICAL MLS INFORMATION/FUNCTIONAL CAPABILITIES
RTCA/DO-177

REQUIREMENTS (R = REQUIRED, O = OPTIONAL)

APPLICATION	APPROACH PATH CAPABILITY	INFORMATION: AZIMUTH	ELEVATION	BASIC DATA**	DISTANCE INFORMATION*	DME/P (PRECISION)	SELECTED PATH DEVIATION OUTPUT	AUXILIARY DATA**	MLS FLARE	FUNCTIONAL: MLS CHANNEL SELECT	AZIMUTH (OFFSET) SELECT	GLIDE SLOPE SELECT	WAYPOINT/FLIGHT PATH ENTRY	COMPUTATIONAL CAPABILITY
LOW DENSITY OR SMALL COMMUNITY AIRPORTS	STRAIGHT-IN ALIGNED WITH RUNWAY CENTERLINE	R	R	R	R	O	R			R		O		
	OFFSET AZIMUTH	R	R	R	R	O	R			R	R	O		
MEDIUM AND HIGH DENSITY AIRPORTS	STRAIGHT-IN ALIGNED WITH RUNWAY CENTERLINE	R	R	R	R	O	R			R		O		
	ABOVE PLUS SEGMENTED OR CURVED PATHS	R	R	R		R	R	R		R	O	O	R	R
MISSED APPROACH AND DEPARTURE	MLS RUNWAY CENTERLINE EXTENDED	R		R		O	R			R				
	SELECTED MLS MISSED APPROACH AZIMUTH	R		R		O	R			R	R			
	ABOVE PLUS SEGMENTED OR CURVED PATHS	R		R		R	R	R		R	O		R	R
SPECIAL APPLICATIONS: NON-INSTRUMENTED RUNWAYS	OFFSET AZIMUTH	R	R	R	R	O	R			R	R	O		
	ABOVE PLUS SEGMENTED OR CURVED PATHS	R	R	R		R	R	R		R	R	O	R	R
SPECIAL APPLICATIONS: REMOTE AREAS	STRAIGHT-IN	R	R	R	R	O				R		O		
AUTOMATIC LANDING AND ROLLOUT GUIDANCE		R	R	R		R		R	O	R		O		R

*SUCH AS MARKER BEACONS, DME/N OR OTHER POSITION FIX.
**IN SOME APPLICATIONS ONLY PORTIONS OF THE DATA MAY BE NEEDED

SECTION 3. MLS SITING

8. SITING CONSIDERATIONS.

a. The higher frequencies of the MLS provide the desired signal in space with less affect from local terrain features, tidal affects, snow accumulation, etc. This is due to the short wavelength signal of MLS and the fact that MLS does not use the ground to form the signal. The net result is that airports and heliports with difficult or expensive ILS site preparation problems can usually accept MLS installations with minimal site preparation.

b. The standard configuration of the MLS is composed of:

(1) approach azimuth equipment, associated monitor, remote control, and indicator equipment;

(2) approach elevation equipment, associated monitor, remote control, and indicator equipment;

(3) a means for the transmission of essential data words, associated monitor, remote control, and indicator equipment, (essential data words include the basic data and certain essential auxiliary data); and

(4) DME/P, associated monitor, remote control, and indicator equipment.

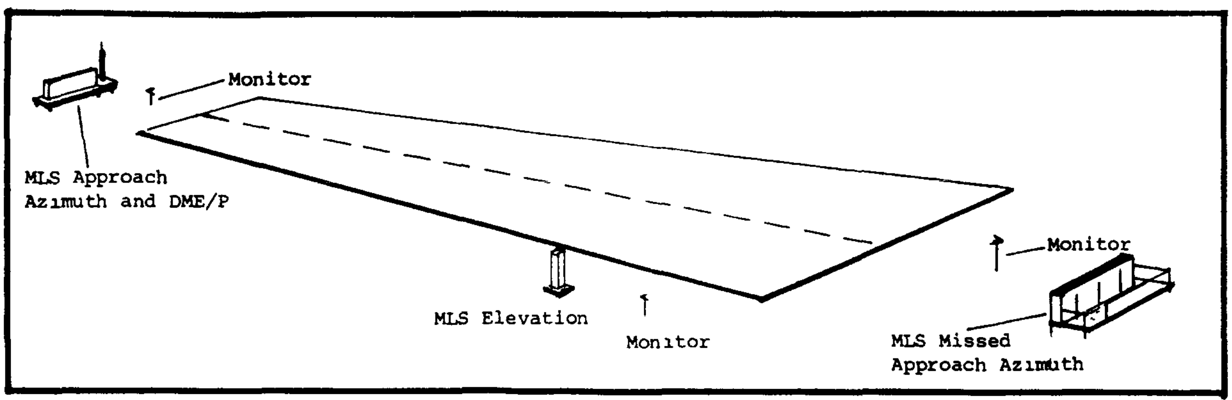
c. Expansion of the standard MLS can be accomplished by the addition of one or more of the following functions or characteristics:

(1) back azimuth equipment, associated monitor, remote control, and indicator equipment;

(2) provisions for the encoding and transmission of additional auxiliary data words, associated monitor, remote control, and indicator equipment; or

(3) larger proportional guidance sectors.

FIGURE 20. EXPANDED MLS CONFIGURATION



d. The MLS siting procedure is, relative to the ILS, a straight-forward, uncomplicated process. All units are self-contained in compact weatherproof enclosures that are installed at the antenna sites (Figures 21, 23 and 25).

FIGURE 21. AZIMUTH STATION WITH PERSONNEL SHELTER

AZIMUTH STATION. The desired location is on the extended runway centerline between 1000 and 1500 feet beyond the stop end of the runway as shown in Figure 22. The shaded area indicates the alternate siting area. Location in the alternate siting area may result in slightly higher decision heights. If symmetrical coverage is required (±40° centered on the runway), locate the azimuth station on the line AB in Figure 22 and align the azimuth antenna so that the 0° azimuth overlays the runway centerline.

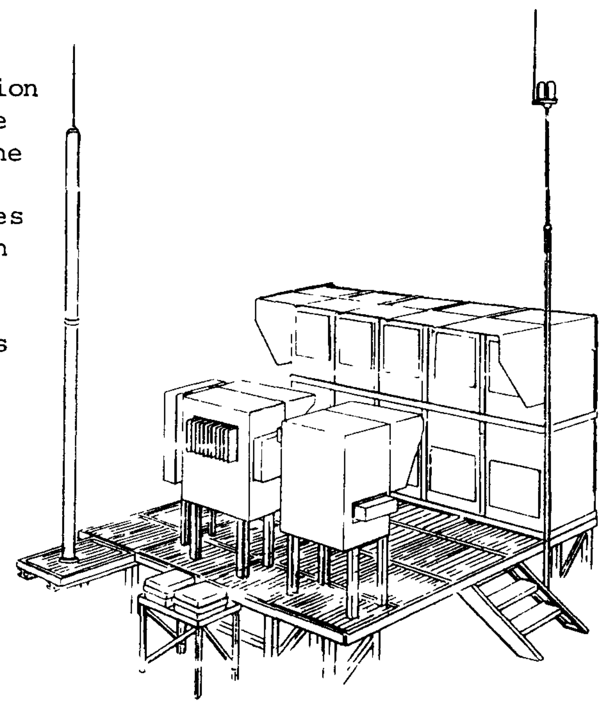


FIGURE 22. AZIMUTH STATION SITING

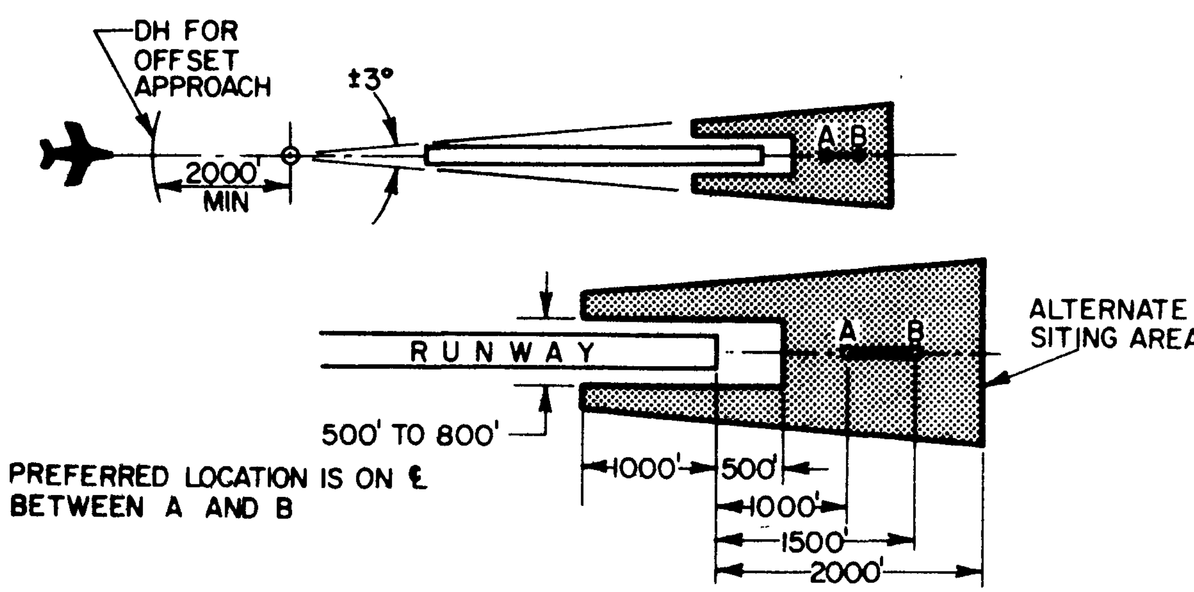


FIGURE 23. ELEVATION STATION WITH PERSONNEL STATION

ELEVATION STATION. The elevation station is located as close as possible to the runway centerline consistent with obstacle clearance criteria (nominally 250 feet), and at a distance from the landing threshold that will provide an optimum threshold crossing height(TCH) of 50 feet. The maximum TCH is 60 feet and the minimum is 45 feet. The elevation station should be located on the side opposite the entry taxiway to avoid interference or shadowing problems with taxiing aircraft.

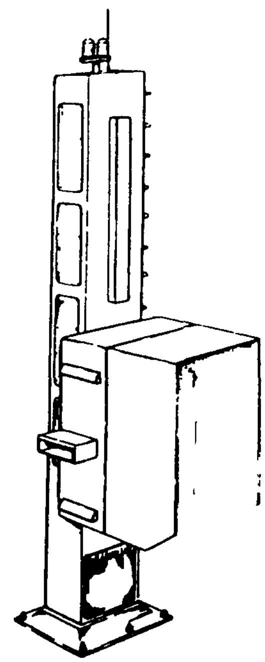


FIGURE 24. ELEVATION STATION LOCATION

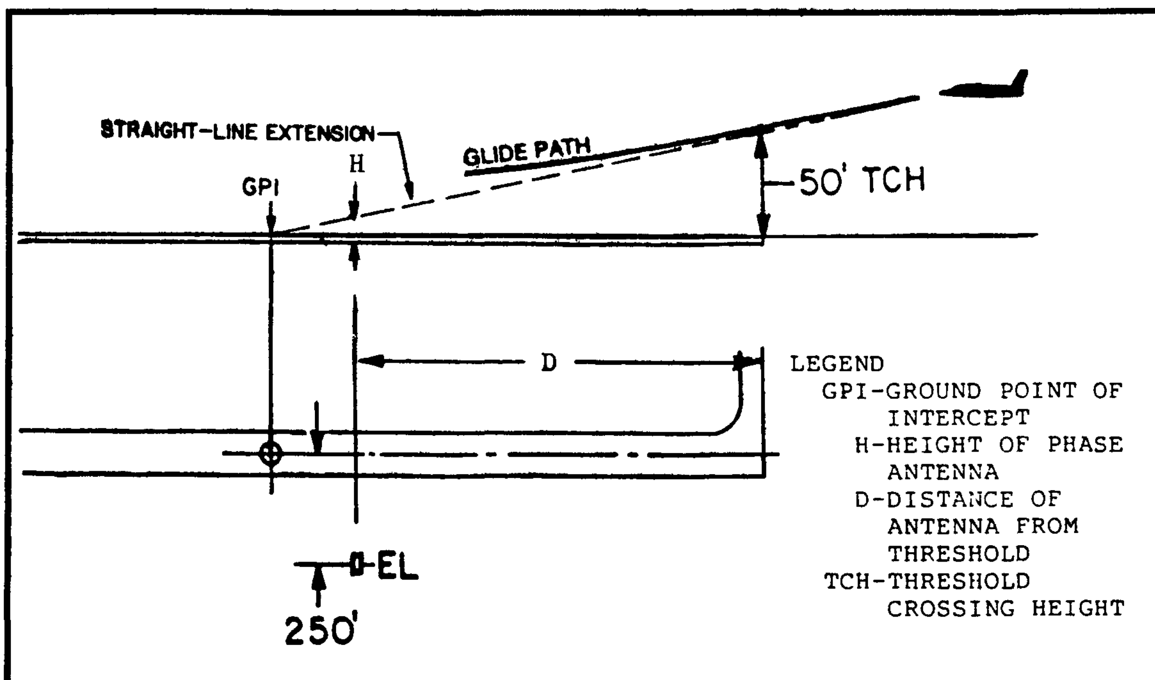
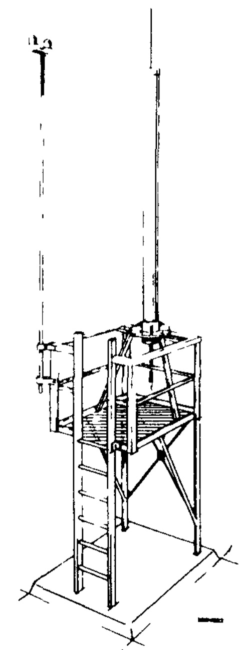


FIGURE 25. DME/P ANTENNA AND TOWER

PRECISION DME. The DME/P is normally collocated with the azimuth element.



e. There are six types of MLS antenna options on the first MLS contract. Figure 26 lists these types with the corresponding recommended use, environment, and specifications.

FIGURE 26. ANTENNA OPTIONS

	AZIMUTH GUIDANCE		ELEVATION GUIDANCE		TYPICAL APPLICATION	
TYPE	BEAMWIDTH	SCAN ANGLE	BEAMWIDTH	SCAN ANGLE	RUNWAY	ENVIRONMENT
TYPE I	2°	±40°	1.5°	0.9° to 15°	LESS THAN 9000 FT	LEVEL TERRAIN
TYPE II	2°	±40°	1	0.9° to 15°	LESS THAN 9000 FT	RISING/IRREGULAR TERRAIN
TYPE III	1°	±40°	1.5°	0.9° to 15°	9000 - 15000 FT	LEVEL TERRAIN
TYPE IV	1°	±40°	1°	0.9° to 15°	9000 - 15000 FT	RISING/IRREGULAR TERRAIN
TYPE V	1°	±10°	1°	0.9° to 15°	9000 - 15000 FT	LARGE REFLECTING OBJECTS
TYPE VI	1°	±60°	1°	0.9° to 15°	9000 - 15000 FT	RISING/IRREGULAR TERRAIN NOISE ABATEMENT

f. Although the MLS has features that permit installation virtually any place where a pad or platform can be installed, in order to optimize performance, care must be taken to avoid the possibility of guidance signal perturbations due to signal reflections (multipath) or blockage (shadowing) by objects in the proportional guidance area. (See Figures 27 through 30)

FIGURE 27. ELEVATION MULTIPATH

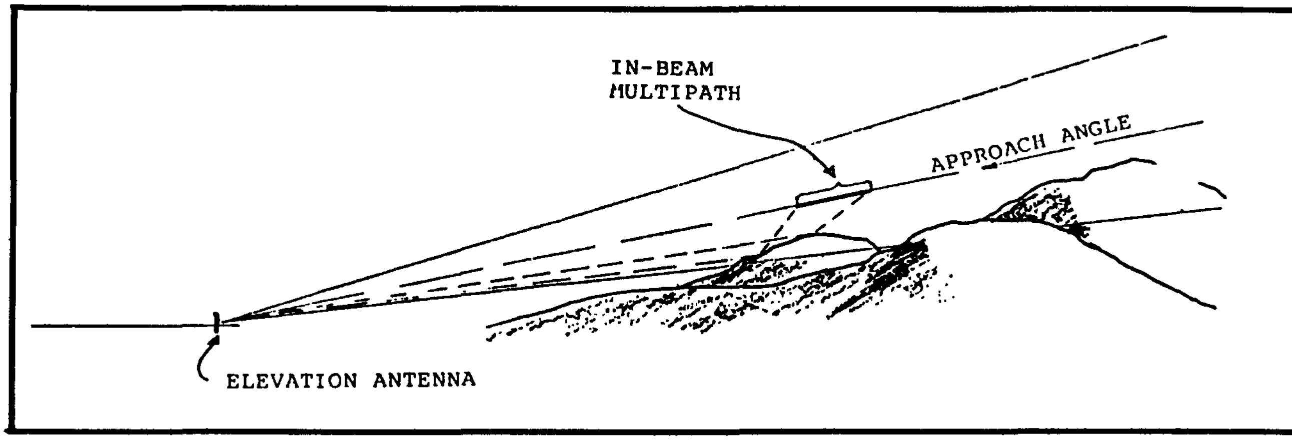


FIGURE 28. ELEVATION SHADOWING/DIFFRACTION

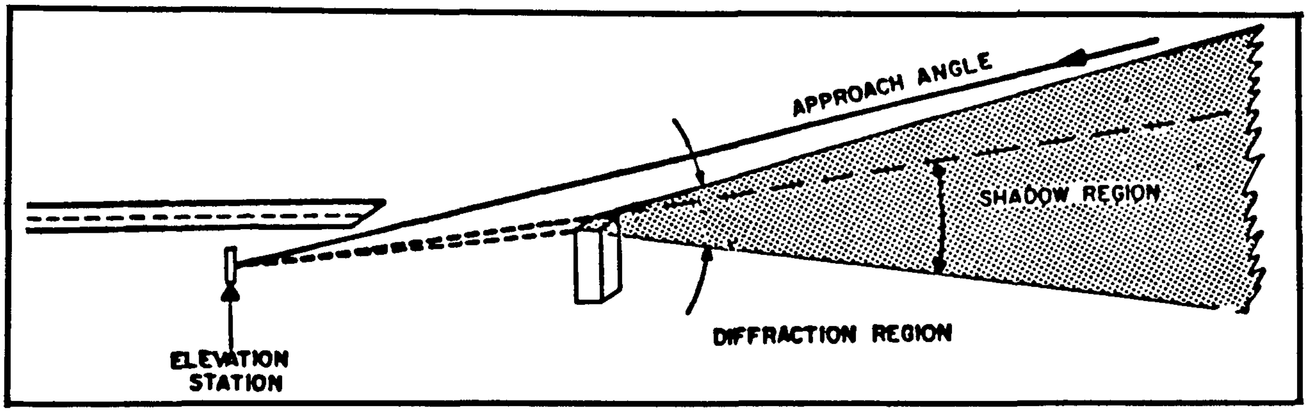


FIGURE 29. AZIMUTH MULTIPATH

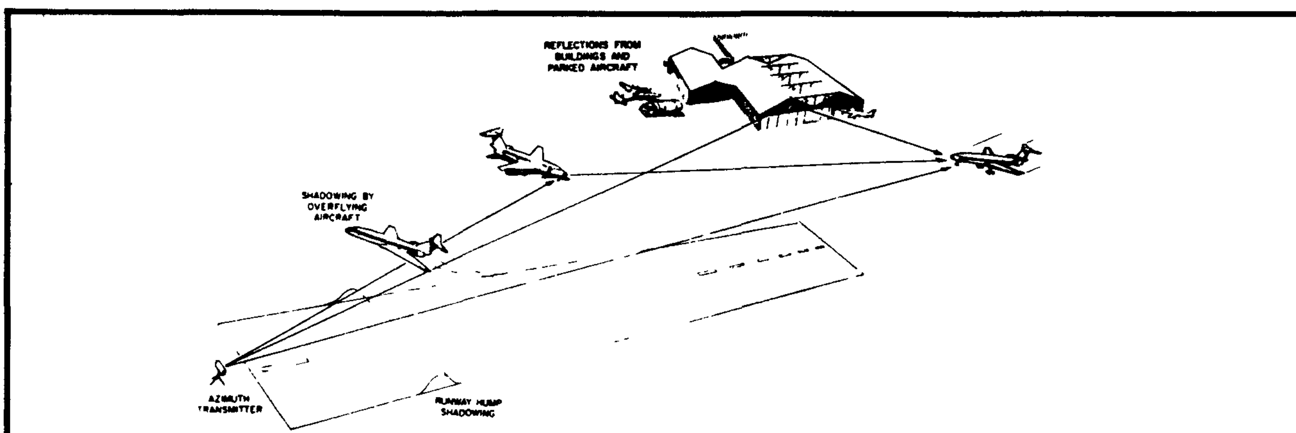
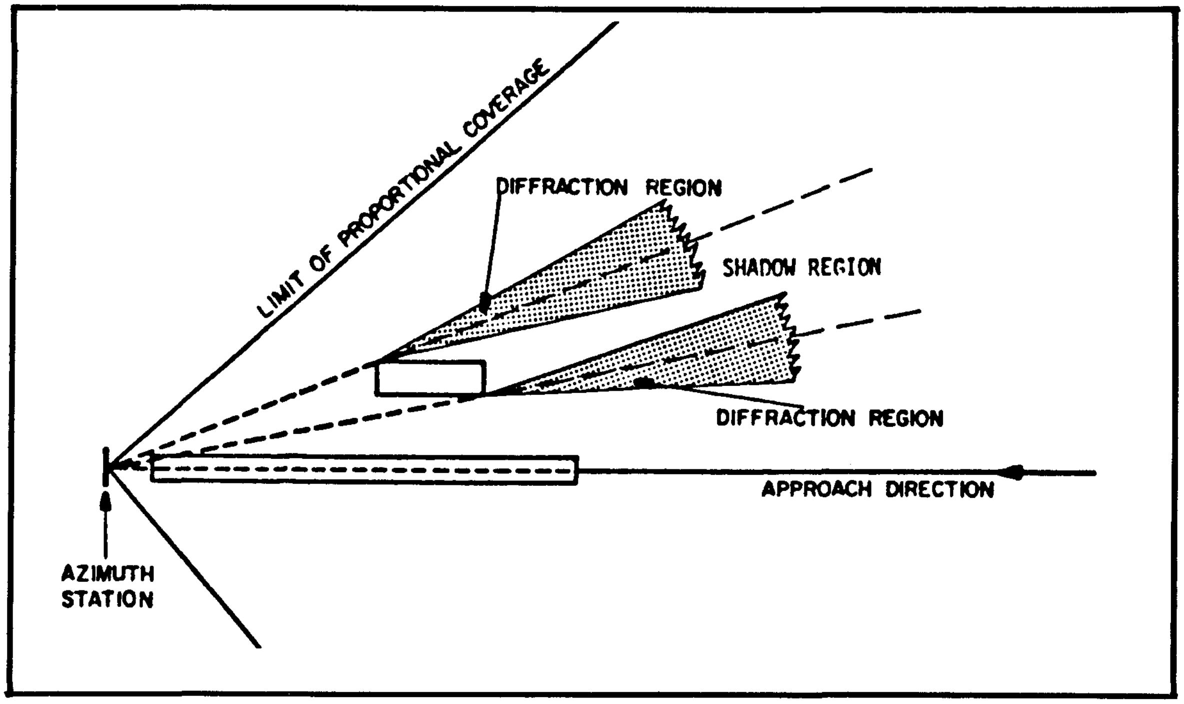
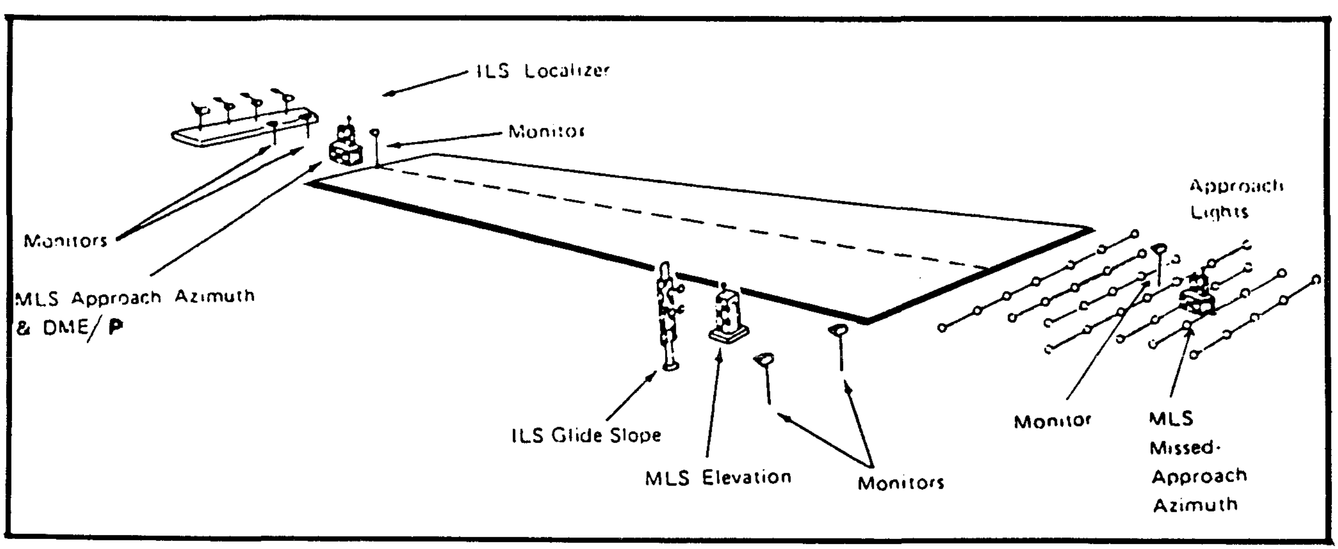


FIGURE 30. AZIMUTH SHADOWING/DIFFRACTION



g. Phasing-in MLS will involve a considerable period of coexistence with the present ILS systems. It is therefore necessary that MLS ground antennas be able to operate at an ILS-equipped runway with no decline in performance of either MLS or the ILS. A typical site arrangment is illustrated in Figure 31. Because of their relatively small size and low profile, the MLS azimuth and DME antennas can be sited on the runway centerline between the ILS localizer and the stop end of the runway. It has been demonstrated that this can be accomplished with negligible affect on the ILS performance.

FIGURE 31. MLS/ILS COLLOCATION



h. For sites where unusual features inhibit this type of installation, an implementation is available where the azimuth antenna is located above and behind the localizer antenna. This siting arrangement has also been demonstrated to provide adequate performance. The MLS elevation antenna is located to the inside and forward of the ILS glideslope, closer to the centerline and the threshold.

i. The back azimuth function will normally be provided by the MLS installed to service approaches to the opposite end of the MLS runway. In some special cases a station may be installed for missed approach only. In this case, the missed approach azimuth antenna is located on the runway centerline, on the downwind side of the Approach Lightning System (ALS). The ALS does not affect the azimuth performance.

APPENDIX 2. RECORDING THE ANALYSIS

SECTION 1. USE OF THE FACILITY ANALYSIS FORMS

1. PURPOSE. This section provides detailed information on the recording and management forms associated with the facility analysis process.

2. RECORDING THE ANALYSIS RESULTS. The difficulty of performing a facility analysis depends upon the complexity of the traffic flow and surrounding natural or manmade restrictions to flight routing. In any case it will be much more conclusive if properly organized and accurately recorded. The following explanation illustrates organizational and recording measures which will help you ensure that the analysis effort is productive.

3. FACILITY AND CONFIGURATION LIST.

a. As an organizational tool this list, when complete, is particularly useful in quickly assessing the magnitude of the task and in tracking progress.

FIGURE 1. FACILITY AND CONFIGURATION LIST FORM

Facility	Facility	Facility	Facility	Facility
Configurations	Configurations	Configurations	Configurations	Configurations

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b. List all facilities across the top of the form beginning with the primary facility (Figure 2). If you cannot identify a primary facility, then select one for purposes of the analysis.

FIGURE 2. FACILITY AND CONFIGURATION LIST FORM

Facility JFK	Facility LGA	Facility EWR	Facility TEB	Facility WALL ST
Configurations	Configurations	Configurations	Configurations	Configurations

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c. List all arrival and departure configurations both present and desired for each facility. This is accomplished in a random manner without regard to alignment of configurations normally used together (Figure 3).

FIGURE 3. FACILITY AND CONFIGURATION LIST FORM

Facility JFK	Facility LGA	Facility EWR	Facility TEB	Facility WALL ST
Configurations	Configurations	Configurations	Configurations	Configurations
ILS 13L	ARR 13 DPT 4	ARR/DPT 22L/R	ARR/DPT 19	HELIPORT
VOR 13L/R VFR 0 22	ARR 13 DPT 13	ARR/DPT 4L/R	ARR/DPT 1	
ILS 22L/R VFR 0 13	ARR 31 DPT 4	ARR/DPT 11	ARR/DPT 24	
ILS 4L/R	ARR 4 DPT 31	ARR/DPT 29	ARR/DPT 6	
ARR ILS 4R DPT 31L	ARR 4 DPT 13			
ILS 31L/R	ARR 22 DPT 13			
	ARR 22 DPT 31			

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(1) It is most beneficial to construct this list on a chalkboard or similar large surface for use by the team during the analysis.

(2) The recorder makes a formal copy of the list for inclusion in the final report.

4. EXAMINATION WORKSHEET.

a. A worksheet is used to itemize the problems and conflicts associated with a particular facility configuration (Figure 4).

FIGURE 4. EXAMINATION WORKSHEET FORM

FACILITY	Identification		Identification		Identification		Identification	
Identification	Config	REMARKS	Config	REMARKS	Config	REMARKS	Config	REMARKS
Configuration								

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b. Draw the Examination Worksheet on a chalkboard or suitable surface for use by the team as they examine each configuration. There is no need to maintain copies of this form once the recorder has copied the results on an Analysis Summary Table.

5. USE OF THE FACILITY AND CONFIGURATION LIST WITH THE EXAMINATION WORKSHEET.

a. In the left column enter the first facility that was selected as the control facility (Figure 5). Enter also the identification for the first configuration of that facility to be examined.

b. List the remaining facilities across the top of the examination worksheet.

c. Consider the effect that the configuration being examined has on each configuration of the other facilities and enter it in the appropriate column.

FIGURE 5. EXAMINATION WORKSHEET (JFK)

FACILITY	Identification LGA		Identification EWR		Identification TEB		Identification WALL ST	
Identification JFK	Config	REMARKS	Config	REMARKS	Config	REMARKS	Config	REMARKS
Configuration ILS 13L	ARR 13 DPT 13	SINGLE RUNWAY OPERATION REDUCES AIRPORT CAPACITY BY 50%. DEPARTURES ARE RESTRICTED TO STRAIGHT OUT CLIMB.		NO EFFECT		NO EFFECT		ARRIVALS AND DE-PARTURES HAVE TO BE INTEGRATED WITH JFK 13 ARRIVALS OVER THE HUDSON RIVER.

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d. When the recorder has copied the information on an Analysis Summary Table, erase the chalkboard, select the next configuration from the Facility and Configuration List and continue the examination process.

FIGURE 6. ANALYSIS SUMMARY TABLE (JFK)

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
JFK ILS 13L ARR/ DPT	1. (LGA) SINGLE RUNWAY OPERA-TIONS TO RUNWAY 13, REQUIRED BY OPERATIONS AT JFK, REDUCES LGA AIRPORT CAPACITY BY 50%. 2. (LGA) DEPARTURES ARE RE-STRICTED TO STRAIGHT OUT CLIMB. 3. (WALL ST) ARRIVALS AND DE-PARTURES HAVE TO BE INTE-GRATED WITH JFK 13 ARRIVALS OVER THE HUDSON RIVER.		

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e. The recorder should use a separate Analysis Summary Table for each configuration examined during the analysis.

f. Continue this process until all configurations in the first column of the Facility and Configuration List have been examined.

g. Select the first configuration from the second column and examine it as before (Figures 7, and 8). Continue the process until each configuration of each facility has been separately examined. The time to analyze each configuration will vary according to the problems and conflicts it creates, but each should be considered to ensure that no conflicts or potential problems are overlooked.

FIGURE 7. FACILITY AND CONFIGURATION LIST USE

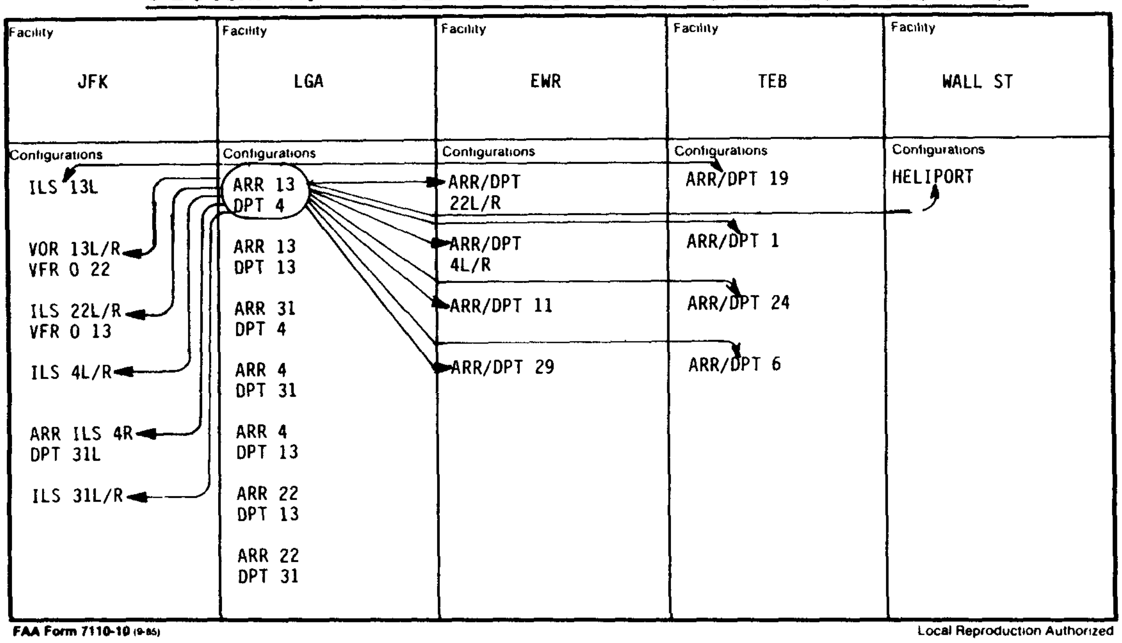

FIGURE 8. EXAMINATION WORKSHEET USE

FACILITY	Identification JFK		Identification EWR		Identification TEB		Identification WALL ST	
Identification LGA	Config	REMARKS	Config	REMARKS	Config	REMARKS	Config	REMARKS
Configuration ILS ARR 13/ DPT 4	ILS 13L	NO EFFECT, HOWEVER, WHEN JFK IS LIMITED TO THE ILS 13L APPROACH LGA MUST MAKE ARRIVALS TO 13 AND DEPARTURES FROM 4 OR SINGLE RUNWAY OPERATIONS FROM RUNWAY 13 ONLY.	ARR/ DPT 22 L/R	LGA ILS 13 CREATES ALTITUDE RESTRICTION ON ARRIVIALS TO RUNWAY 22. RESTRICTIONS CREATE AN INCREASE IN CONTROLLER WORKLOAD.	ARR/ DPT 19 ARR/ DPT 1 ARR/ DPT 24 ARR/ DPT 6	IFR ARRIVALS AND DEPARTURES MUST BE INTEGRATED WITH ARRIVALS TO LGA USING ILS 13 APPROACH. THIS CREATES DELAYS AND DECREASES CAPACITY AT BOTH FACILITIES.	HELI PORT	ARRIVALS TO THE HELIPORT MAY BE RESTRICTED TO THE SOUTH. ARRIVALS MUST BE INTEGRATED WITH JFK TRAFFIC.

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6. ANALYSIS SUMMARY TABLE.

a. Section A and B of the Analysis Summary Table are copied from the chalkboard (Figure 9) during the team's analysis of existing configurations and traffic flows.

FIGURE 9. ANALYSIS SUMMARY TABLE CONFLICT ENTRIES

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
1. (LGA) ILS ARR 13 DPT 4	1. (JFK) SINGLE RUNWAY OPERATIONS TO RUNWAY 13, REQUIRED BY OPERATIONS AT JFK, REDUCES LGA AIRPORT CAPACITY BY 50%. 2. (EWR) LGA 13 ILS CREATES AN ALTITUDE RESTRICTION FOR AIRCRAFT ARRIVING EWR 22R. 3. (TEB) LGA 13 ILS APPROACH COURSE OVERFLYS TEB WHICH CREATES DELAYS AND DECREASES CAPACITY AT LGA AND TEB. 4. (WALL ST) LGA 13 ILS RESTRICTS HELICOPTER ARRIVALS AND DEPARTURES TO THE SOUTH.		

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b. In Section C describe the MLS procedure developed in the MLS operational application portion of the analysis (Figure 10).

FIGURE 10. ANALYSIS SUMMARY TABLE WITH MLS PROCEDURE DESCRIPTION

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
1. (LGA) ILS ARR 13 DPT 4	1. (JFK) SINGLE RUNWAY OPERATIONS TO RUNWAY 13, REQUIRED BY OPERATIONS AT JFK, REDUCES LGA AIRPORT CAPACITY BY 50%. 2. (EWR) LGA 13 ILS CREATES AN ALTITUDE RESTRICTION FOR AIRCRAFT ARRIVING EWR 22R. 3. (TEB) LGA 13 ILS APPROACH COURSE OVERFLYS TEB WHICH CREATES DELAYS AND DECREASES CAPACITY AT LGA AND TEB. 4. (WALL ST) LGA 13 ILS RESTRICTS HELICOPTER ARRIVALS AND DEPARTURES TO THE SOUTH.	1. CURVED OR SEGMENTED PROCEDURE WITH INGRESS ROUTE FOLLOWING THE HUDSON RIVER FROM THE NORTH AND SOUTH. CONSISTING OF A STRAIGHT-IN FINAL APPROACH COURSE WITH THE FINAL APPROACH FIX BEING LOCATED 3.5 MILES FROM THE MISSED APPROACH POINT. (ILLUSTRATION 8)	

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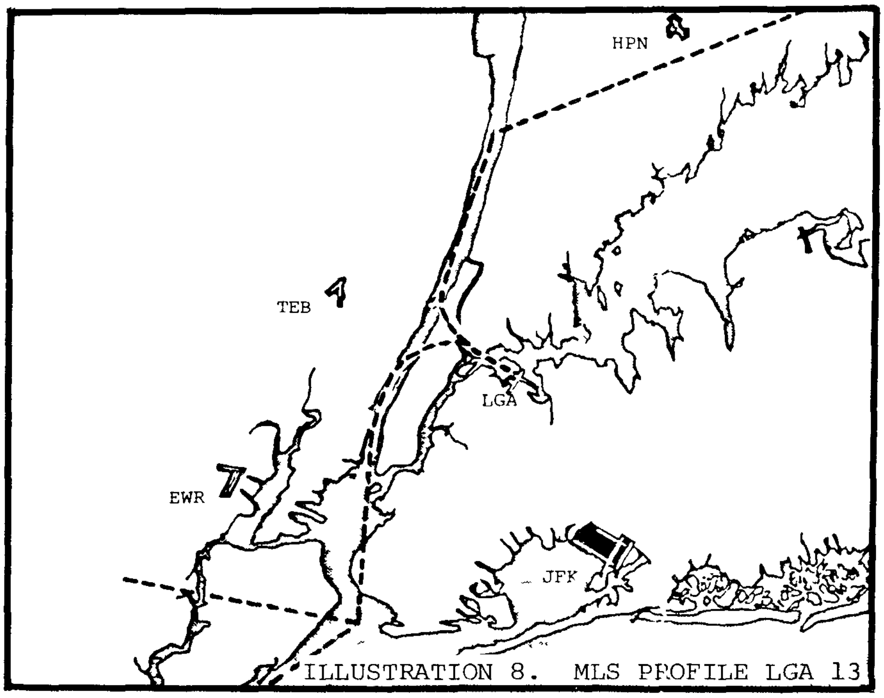
c. Make a copy of the MLS procedure illustration developed by the team (Figure 11), number it and enter that number in Column C of the Analysis Summary Table form with the description. Maintain this drawing for inclusion in the report.

FIGURE 11. MLS PLAN VIEW LGA 13



d. Record the remarks of the analysis team in Column D as they assess the results of each MLS application.

FIGURE 12. MLS APPLICATION RESULTS ENTRY ON ANALYSIS SUMMARY TABLE

Section A	Section B	Section C	Section D
Facility Runway Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
1. (LGA) ILS ARR 13 DPT 4	1. (JFK) SINGLE RUNWAY OPERATIONS TO RUNWAY 13, REQUIRED BY OPERATIONS AT JFK, REDUCES LGA AIRPORT CAPACITY BY 50%. 2. (EWR) LGA 13 ILS CREATES AN ALTITUDE RESTRICTION FOR AIRCRAFT ARRIVING EWR 22R. 3. (TEB) LGA 13 ILS APPROACH COURSE OVERFLYS TEB WHICH CREATES DELAYS AND DECREASES CAPACITY AT LGA AND TEB. 4 (WALL ST) LGA 13 ILS RESTRICTS HELICOPTER ARRIVALS AND DEPARTURES TO THE SOUTH.	1. CURVED OR SEGMENTED PROCEDURE WITH INGRESS ROUTE FOLLOWING THE HUDSON RIVER FROM THE NORTH AND SOUTH. CONSISTING OF A STRAIGHT-IN FINAL APPROACH COURSE WITH THE FINAL APPROACH FIX BEING LOCATED 3.5 MILES FROM THE MISSED APPROACH POINT. (ILLUSTRATION 8)	1. (JFK) MLS MAY ALLOW AN INCREASE IN AIRPORT CAPACITY WHILE LIMITED TO SINGLE RUNWAY OPERATIONS, DUE TO SHORTENED FINAL APPROACH COURSE. 2. (EWR) PROPOSED MLS ELIMIATES CONFLICT DUE TO SHORTENED FINAL APPROACH. 3. (TEB) PROPOSED MLS WITH A SHORTENED FINAL APPROACH ELIMINATES THE PROBLEM. 4. (WALL ST) MLS MAY NOT AFFECT THE HELIPORT. 5 MLS INTRODUCES THE POSSIBILITY FOR THE DEVELOPMENT OF AN APPROACH PROCEDURE TO THE LGA HELIPAD. 6 MLS ENHANCES THE POSSIBILITY FOR THE DEVELOPMENT OF POINT-IN-SPACE APPROACHES TO THE MANHATTEN AREA HELIPORTS, (60th St., 34th St. and West 30th St.)

7. USE OF THE COMPLETED FORMS. The completed forms can be used to review each step during the process as well as the entire analysis. The team leader should be satisfied that the analysis is complete and sufficiently documented prior to developing the prioritized listing for MLS installations. These forms are used to write, and as attachments to, the staff study report.

SECTION 2. SAMPLE DOCUMENTATION FROM THE NEW YORK, NEW ORLEANS, AND BURBANK TERMINAL AREA ANALYSES

8. PURPOSE. This section contains completed examples of documentation based on the New York, New Orleans, and Burbank Terminal Area analyses.

9. TERRAIN AND FACILITY RELATIONSHIP DEPICTION. The drawings listed below and illustrated in Figures 13 through 15 show the information discussed in Chapter 2, Section 1, Paragraph 9d(5), Preparation for the Analysis; and in Chapter 2, Section 2, Paragraph 13d, Performing the Analysis. A terminal area chart or other suitable chart is used as the base for these drawings.

a. Figure 13 is an illustration of the facilities affecting the Burbank Terminal Area along with terrain obstructions.

b. Figure 14 illustrates the general physical relationship ot facilities in the New York Terminal Area.

c. Figure 15 shows the present departure and arrival flows affecting facilities within the Burbank Terminal Area.

10. USE OF FACILITY ANALYSIS RECORDING FORMS. The figures listed below are additional examples of the recordkeeping forms discussed in Chapter 2, Section 2, Performing the Analysis.

a. Figure 16 is the facility and configuration list composed during the New Orleans Terminal Area Analysis.

b. Figure 17 is a typed version of the information written on the chalkboard when Moisant (MSY) ILS 28 approach configuration was analyzed for effect on other facilities.

c. Figure 18 is a completed analysis summary table using Moisant Runway 28 operations. This form is a continuation of the situation in Figure 17. It describes MLS approaches developed for MSY 28 and the resulting effect they would be expected to have on the conflicts that exist with the other facilities.

11. MLS PLAN VIEW ILLUSTRATIONS. These drawings illustrate MLS procedures that were developed during the New York, New Orleans, and Burbank Terminal Area analyses.

a. Figure 19 illustrates the procedures proposed for the Burbank Runway 15 approach.

b. Figure 20 shows MLS procedures proposed for New Orleans, MSY 28 operations.

c. Figure 21 shows MLS procedures proposed for JFK Runway 13L.

d. Figure 22 shows the proposed MLS procedure for JFK Runways 22L and 22R operations.

FIGURE 13. BURBANK AREA AIRPORTS

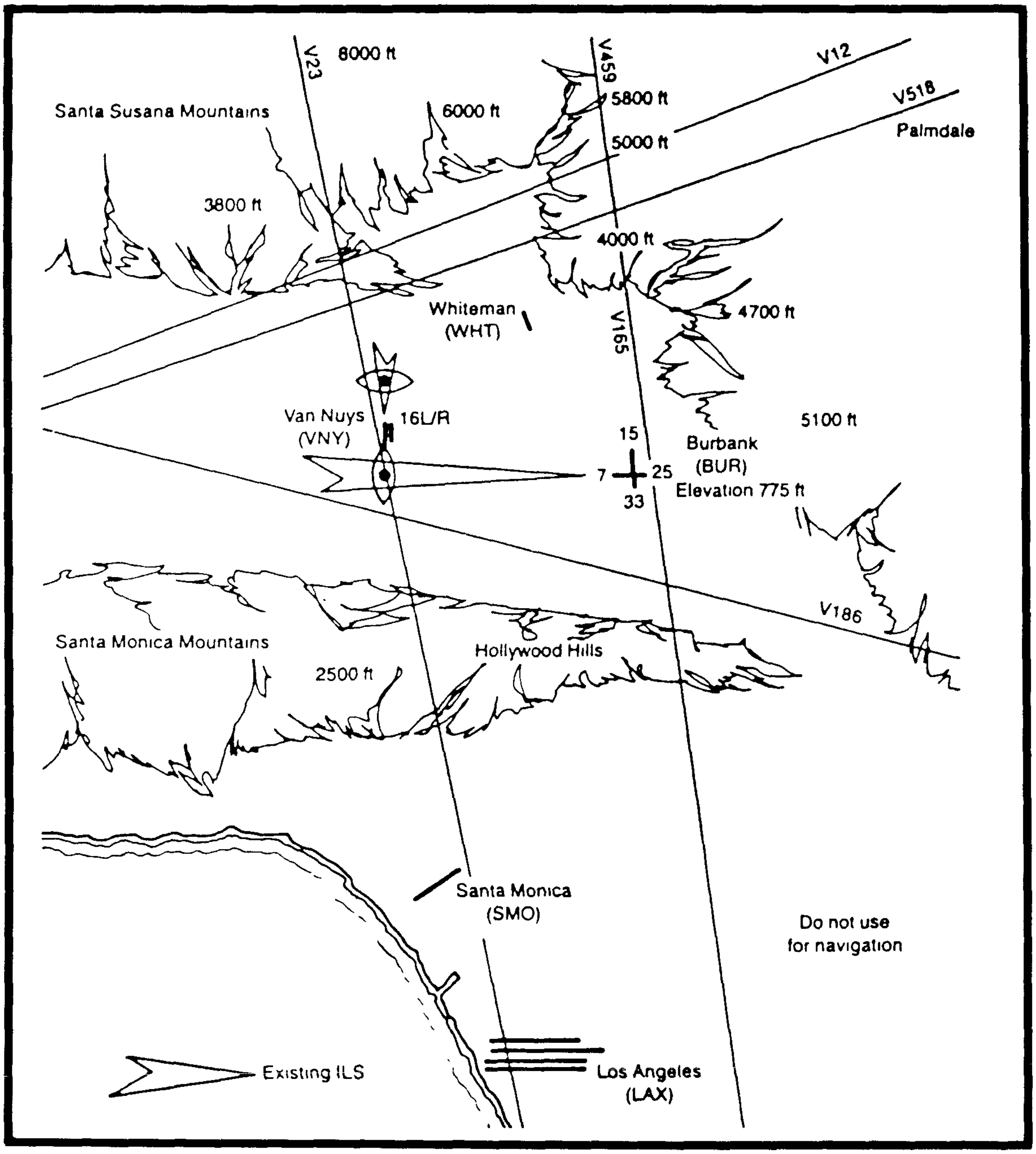
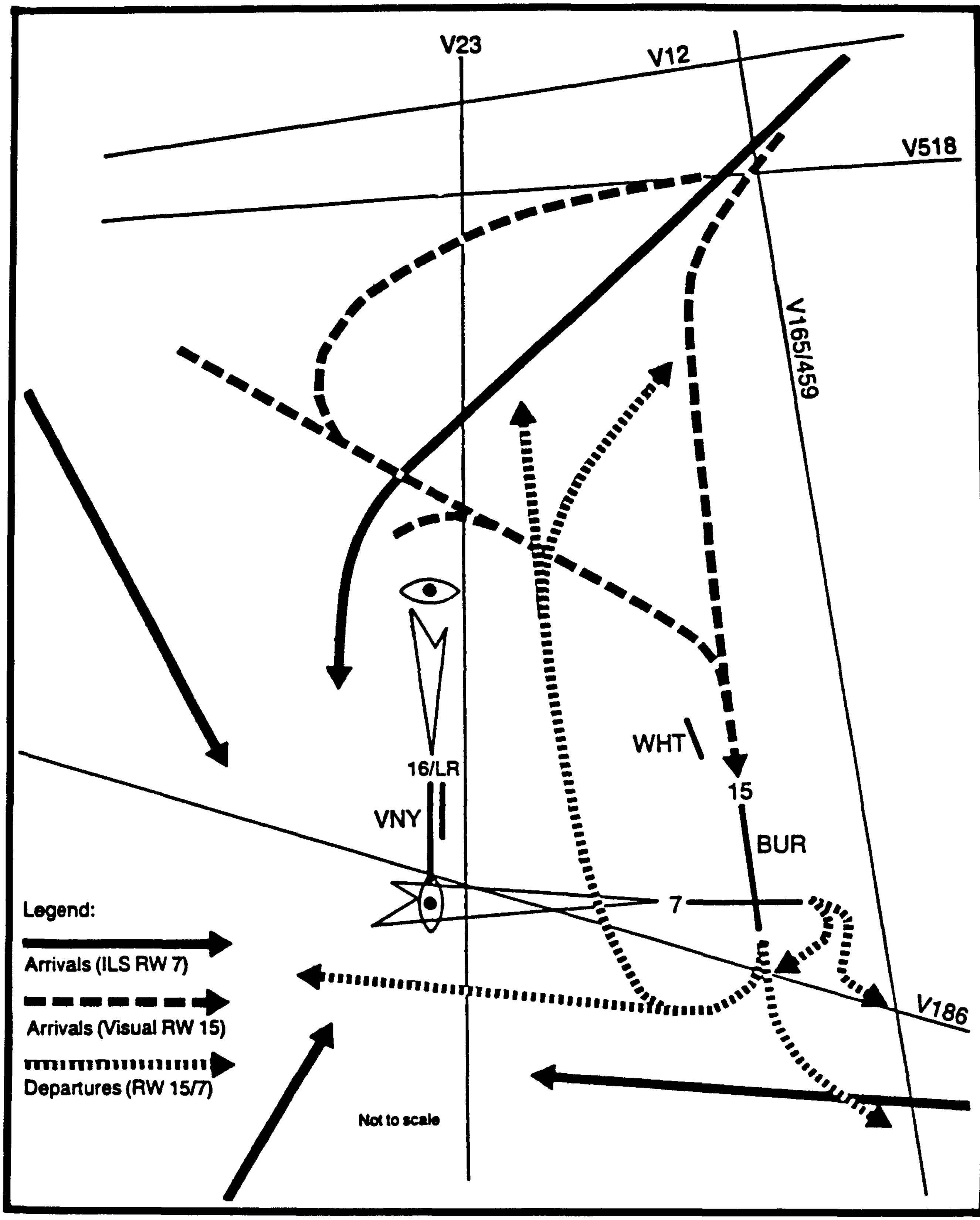


FIGURE 14. BURBANK PLANNING CHART/DEPARTURE AND ARRIVAL FLOWS



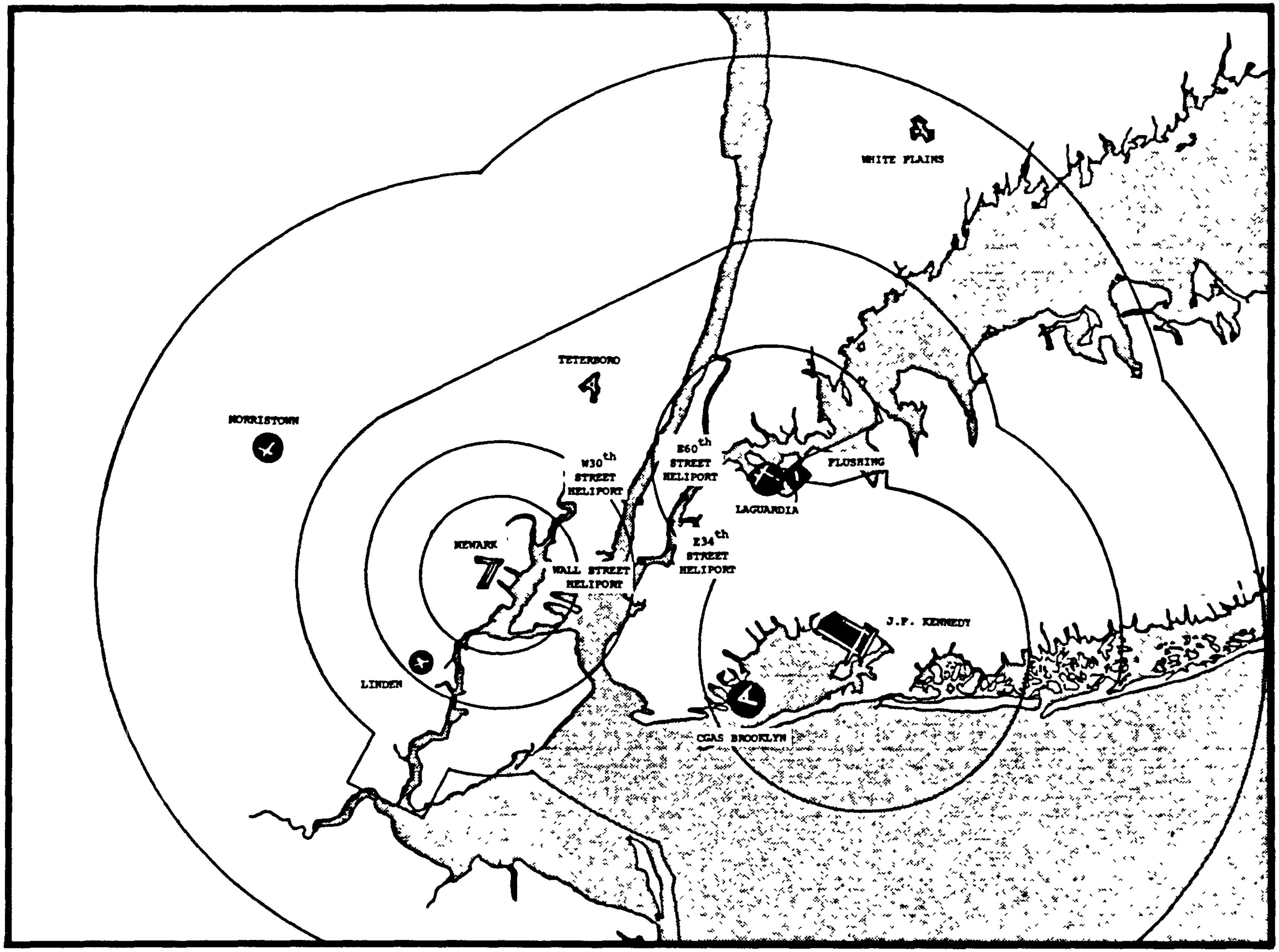


FIGURE 15. NEW YORK TERMINAL AREA

FACILITY AND CONFIGURATION LIST

Facility	Facility	Facility	Facility	Facility
MSY	NEW	NBG	HUM	PTN
Configurations	Configurations	Configurations	Configurations	Configurations
L10/D19 L10/D1 L10/D10 L1/D28 L1/D1 L19/D28 L19/D19 L28/D1 L28/D28 L24/D24 L6/D6	L18/D18 L36/D36 L27/D27 L9/D9 VRA	L04/D04 L22/D22 L14/D14 L32/D32 L04/D14	18 16 30 12	5 25
			OR9	SUPERDOME HELIPORT
			18 36 30 12	

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FIGURE 16. FACILITY AND CONFIGURATION LIST FOR NEW ORLEANS TERMINAL AREA

EXAMINATION WORKSHEET

FACILITY	Identification NEW		Identification NBG		Identification HELIPORT		Identification HUM/OR9/PTN	
Identification MSY	Config	REMARKS	Config	REMARKS	Config	REMARKS	Config	REMARKS
Configuration L28/D28	D18	1. ILS RWY 28 TRAFFIC INTE-GRATED WITH DE-PARTURES RWY 18 NEW	L14	ARRIVALS INTE-GRATED WITH TAC 14 NBG (OR NBG ARRIVALS ALTITUDE RESTRICTED)		PROPOSED HELIPORT (ANY ARRIVAL PATTERN) WILL CONFLICT WITH RWY 28 ARRIVALS		NO EFFECT
		2. ALTITUDE RE-STRICTIONS OR TRAFFIC INTE-GRATION WITH VOR/DME 36 ARRIVALS NEW.	22 4 32 D14	NO EFFECT				
	L18 D36 27 9	NO EFFECT						

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FIGURE 17. EXAMINATION WORKSHEET FOR NEW ORLEANS, MSY RWY 28

ANALYSIS SUMMARY TABLE

Section A	Section B	Section C	Section D
Facility, Runway, Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application
MSY L28/D28 (ILS RWY 28)	1. ILS RWY 28 INTEGRATED WITH DEPARTURES RWY 18 NEW 2. ALTITUDE RESTRICTIONS OR TRAFFIC INTEGRATION WITH VOR/DME 36L ARRIVALS. NEW 3. ARRIVALS INTEGRATED WITH TAC14 NBG (OR NBG ARRIVALS ALTITUDE RESTRICTED.) 4. PROPOSED SUPERDOME HELI-PORT (ANY ARRIVAL PATTERN) WILL CONFLICT WITH RWY 28 ARRIVALS.	THREE PROCEDURES: APPROACH 'A' FROM THE SOUTH WITH CURVE, TO FINAL: APPROACH 'B' AS A STRAIGHT IN FOLLOWING CURRENT ILS PATTERN. APPROACH 'C' FROM OVER NEW CURVED TO MEET FINAL WITH ALTITUDE RESTRICTIONS TO CLEAR NEW ATA AND SOUTH ARRIVALS TO NEW. (ILLUS. #2) A CURVE TO FINAL. APPROACH 'B' AS A STRAIGHT IN FOLLOWING CURRENT ILS PATTERN APPROACH 'C' FROM OVER NEW CURVED TO MEET FINAL WITH ALTITUDE RESTRICTIONS TO CLEAR NEW ATA AND SOUTH ARRI-VALS TO NEW:	1. PROCEDURES 'A' & 'C' KEEP CLEAR OF PROBLEM #1 & #2. 2. PROCEDURE 'C' ALLOWS OPERATION TO RWY 28 & PRO-POSED SW APPROACH TO SUPER-DOME HELIPORT. 3. PROCEDURE 'B' PROVIDES APPROACH STILL TO BE USED BY PREDICTED MAJORITY AT BE-GINNING OF PROGRAM. 4. PROBLEM #3 NOT SOLVED BY SINGLE MLS TO RWY 28 BUT BY COMBINATION OF MLS TO NBG RWY 14. 5. THOUGH USE OF RWY 28 ARRIVALS IS NOT NORMALLY HEAVY DUE TO NOISE PROCE-DURES BASED ON COMPLEXITY OF ILS RWY 28, THIS IS RECOM-MENDED AS PRIORITY RECEIPT FOR MLS.

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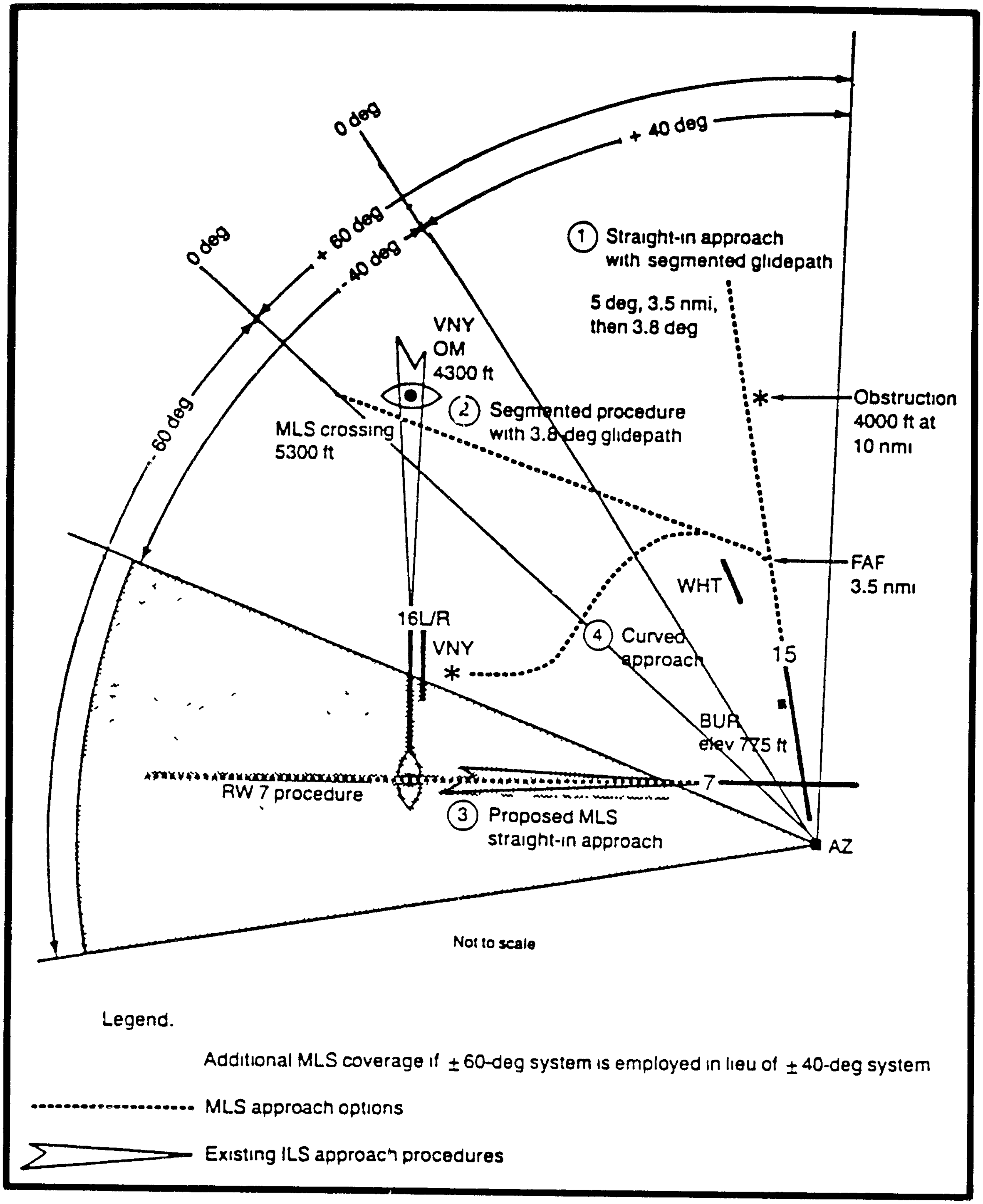
FIGURE 18. ANALYSIS SUMMARY TABLE FOR NEW ORLEANS, MSY RWY 28

FIGURE 19. MLS PROCEDURES BURBANK RWY 15



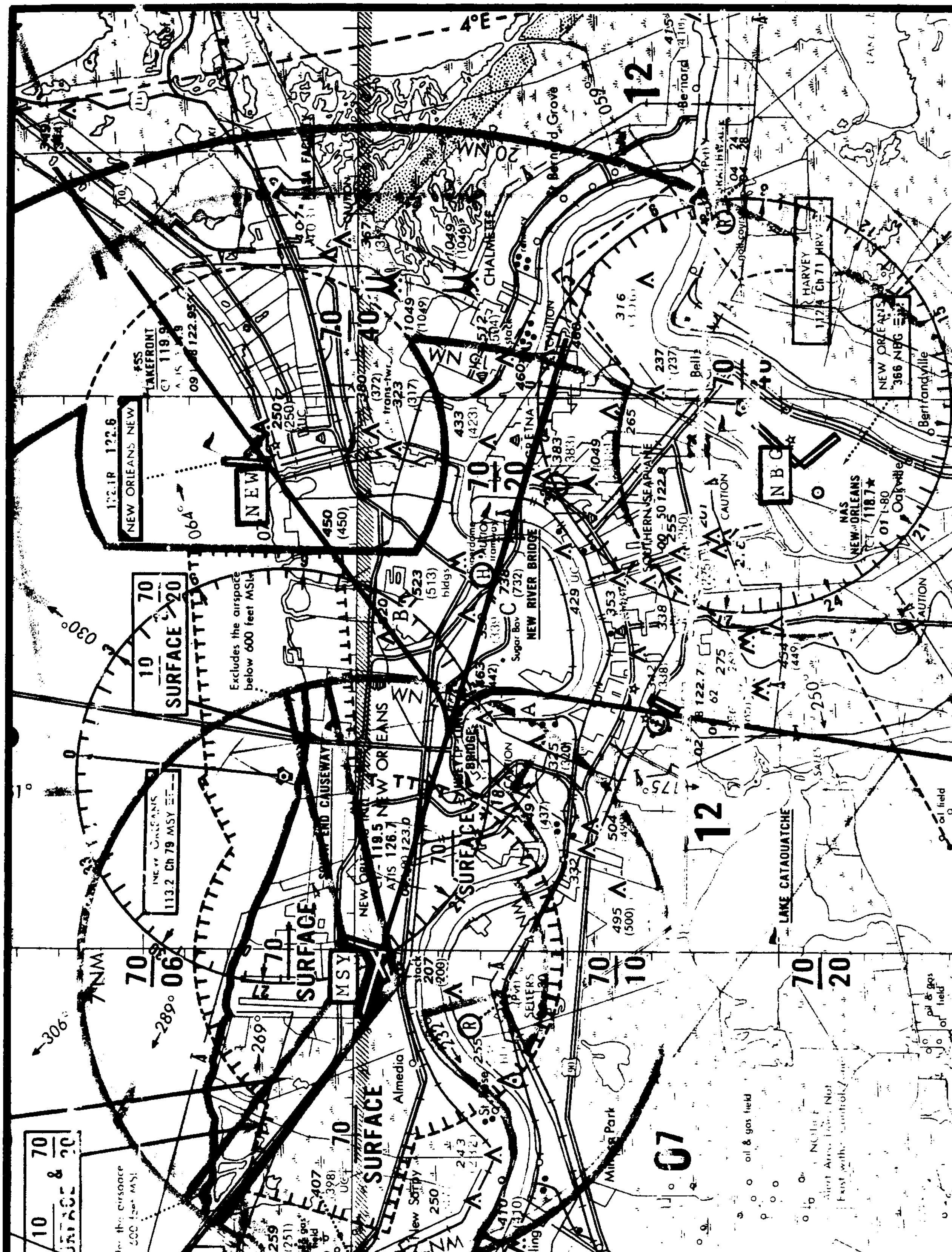


FIGURE 20. PROPOSED MLS PROCEDURE FOR NEW ORLEANS, MSY RWY 28

FIGURE 21. MLS PROCEDURE JFK RWY 13L

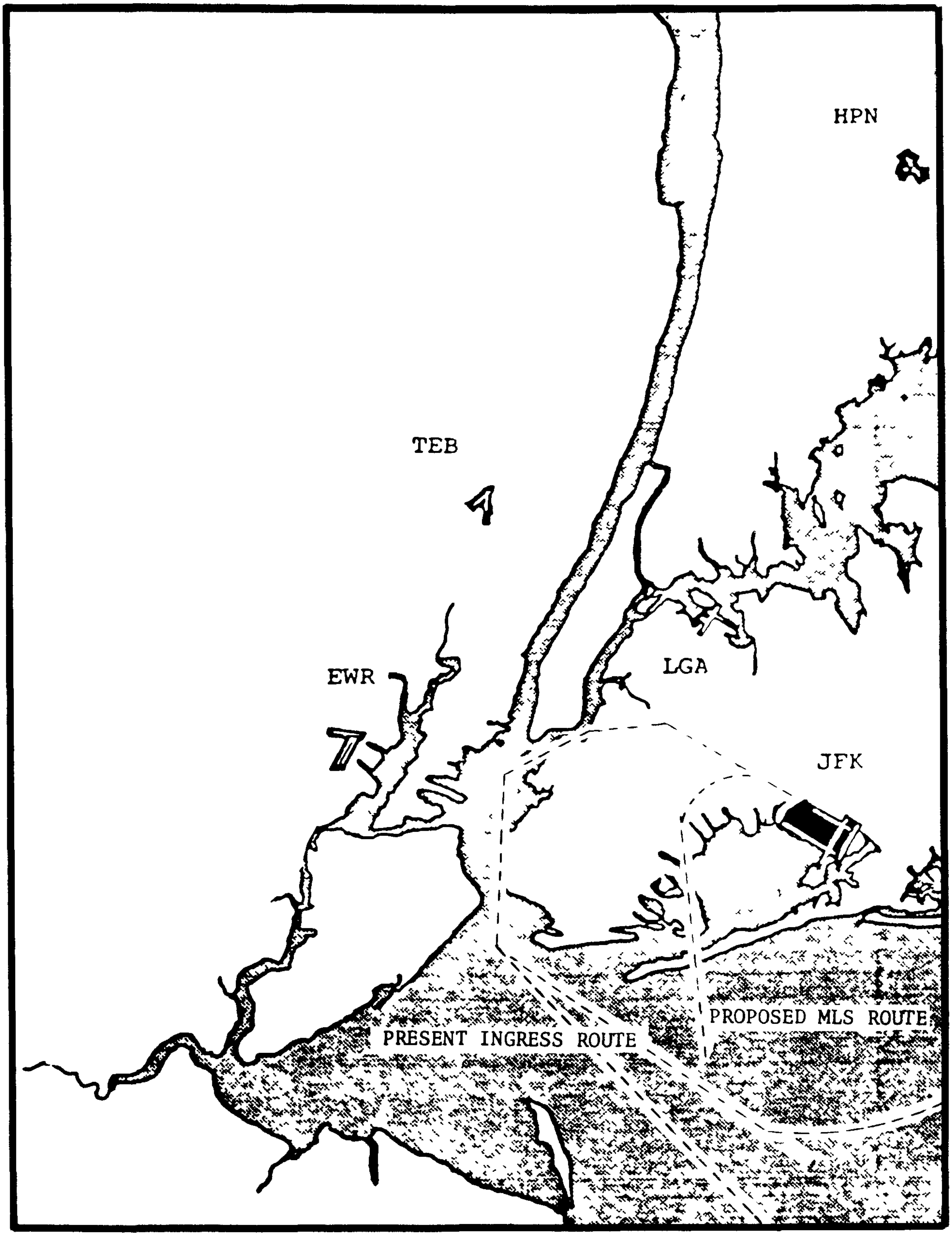
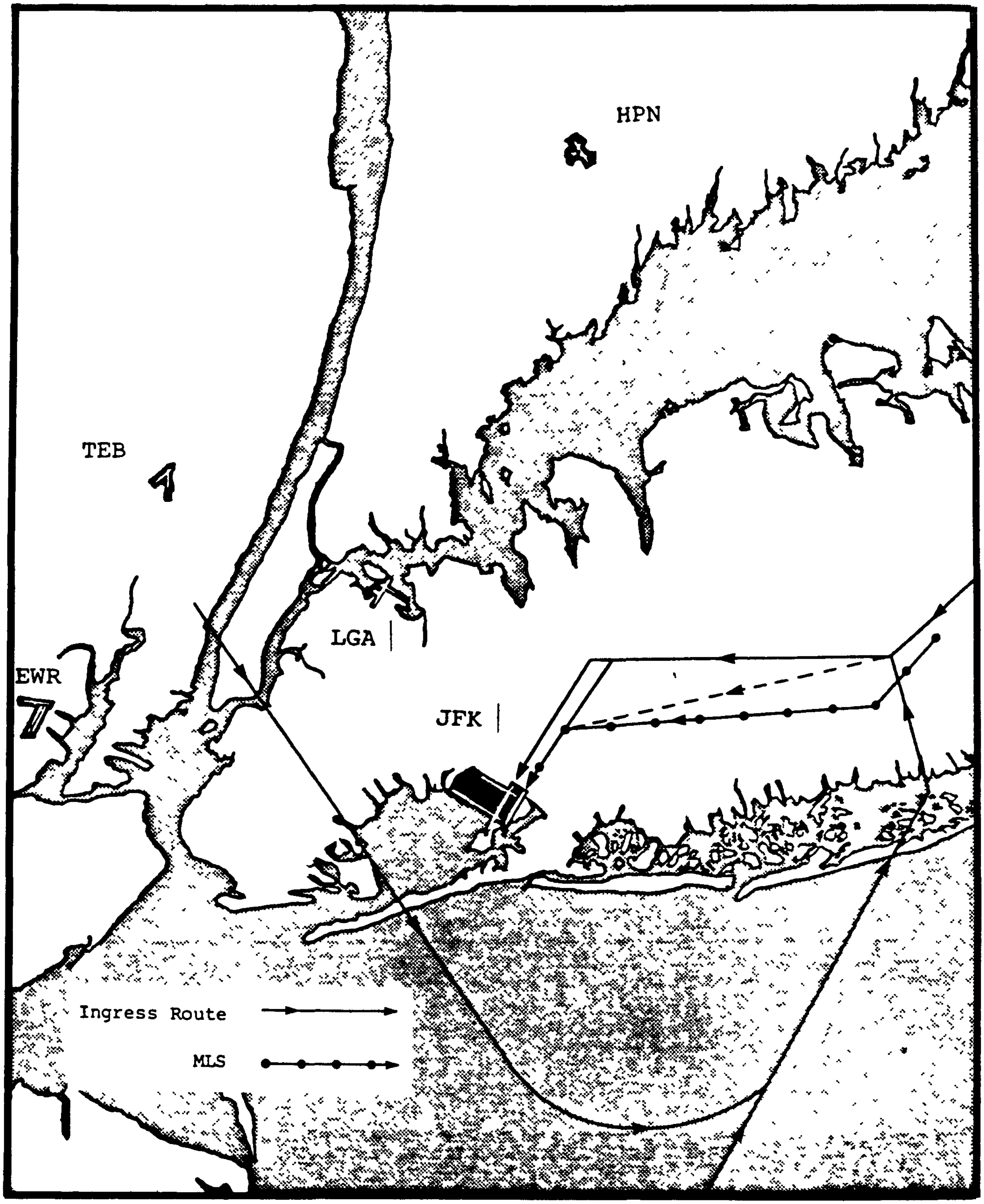


FIGURE 22. MLS PROCEDURE JFK 22 L/R



APPENDIX 3. ANALYSIS CHECKLIST AND RECORDING FORMS

ANALYSIS CHECKLIST

STEPS	CONSIDERATIONS	✓	REMARKS
	PREPARATION		
1 Review objective	Relate the objective to the local air traffic situation Estimate the magnitude of the work required, and what representation is necessary		
2 Team selection	Consider the number of airports and heliports, the knowledges required, experience level and availability of personnel Coordinate with facility managers		
3 Prepare and distribute analysis schedule	Schedule enough time between the organizational meeting and the analysis to allow for study and gathering of materials Coordinate schedule with facility managers Copy of schedule to each team member		
4 Organizational meeting	Provide orientation on MLS Discuss the analysis process, determine responsibility for gathering materials, overview briefing and assignments Determine desired briefings		
	ANALYSIS		
1 Review objective	Ensure team members understand objective and purpose of analysis		
2 Review method of analysis, roles and responsibilities, and schedules	Review analysis process format, and recordkeeping process		
3 Conduct briefings	Future developments and area needs Environmental issues, expansion plans, and user needs		
4 Conduct air traffic overview	Complete description of local air traffic situation Consider all ATC issues or problems Routes, airports, noise sensitive areas, and constraints		
5 Identification of runway configurations	List all existing facilities and runway configurations		
6 Analysis of existing facility runway configurations	Ensure consideration of all approaches, missed approaches and departures available for each runway configuration and determine the influence any of these procedures may have upon any and all area facilites and their respective configurations		
7 Review results of configuration examination	Ensure all existing facilites and runway configurations have been considered and cross checked against each other		
8 Develop MLS operational application	Develop MLS procedures to resolve existing conflicts and to improve efficiency		
9 Analyze MLS application	Weigh and record the advantages/disadvantages derived from the application of the various MLS procedural options to each facility runway configuration		
10 Review results of the MLS application	Recheck the MLS procedural solutions and other system changes required to optimize the described runway configuration situations		
11 Develop operational priorities for MLS installation	Prioritize the MLS procedural options based upon magnitude of system benefits		
	FOLLOW-UP		
1 Write facility analysis summary report	Review all record documents for inclusion of all pertinent information in staff study report		

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FACILITY AND CONFIGURATION LIST

Facility	Facility	Facility	Facility	Facility
Configurations	Configurations	Configurations	Configurations	Configurations

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EXAMINATION WORKSHEET

FACILITY	Identification		Identification		Identification		Identification	
Identification	Config	REMARKS	Config	REMARKS	Config	REMARKS	Config	REMARKS
Configuration								

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ANALYSIS SUMMARY TABLE

Section A	Section B	Section C	Section D
Facility, Runway, Type of Operation	Existing Traffic Conflicts and Problem Areas	MLS Procedure Description	Results of MLS Application

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APPENDIX 4. DUTIES OF THE ANALYSIS TEAM

1. GENERAL. This appendix describes the duties of the analysis team members. Since each facility will have different requirements, this list should serve only as a starting point in organizing and conducting the analysis. Tasks assigned to specific team members may also vary at the discretion of the team leader. The listing that follows typifies the task assignments used in the prototype analyses used to develop this order. Although specific duties are assigned, each team member should actively participate and contribute to the analysis.

2. DUTIES OF THE TEAM LEADER.

a. Become thoroughly familiar with the contents of this order.

b. Select or assist in the selection of team members.

c. Plan the analysis schedule per Chapter 2, Section 1, Paragraph d.

d. Arrange appropriate briefings for the organizational meeting per Chapter 2, Section 2, Paragraph c.

e. Conduct the organizational meeting per Chapter 2, Section 1, Paragraph d.

(1) Brief team on the analysis process.

(2) Make assignments.

(3) Finalize the schedule.

f. Direct the analysis per Chapter 2, Section 2.

(1) Ensure accurate recording.

(2) Ensure complete analysis of present and potential operations.

(3) Ensure comprehensive staff study preparation.

g. Brief appropriate personnel on analysis results.

h. Submit staff study report on the analysis to the facility manager.

i. Coordinate all actions with the facility manager.

. DUTIES OF THE RECORDER.

a. Become thoroughly familiar with the contents of this order, particularly the recording process outlined in Chapter 2, Section 2 and Appendix 2.

b. Make copies of the recording forms prior to the analysis.

(1) Analysis Checklist, FAA Form 7110-9 (one for the team leader and one for the recorder).

(2) Facility and Configuration List, FAA Form 7110-10 (two for recording and two for final type of the staff study).

(3) Examination Worksheet, FAA Form 7110-11 (one for each configuration of each airport/heliport). This form is a worksheet and will not be part of the staff study.

(4) Analysis Summary Table, FAA Form 7110-12 (two for each configuration of each airport/heliport, one for draft and one for final type).

c. Record the analysis being careful to capture all input from the team.

d. Be prepared to review portions of the analysis upon request from team members.

e. Be prepared to orient the team at the beginning of each analysis day on the last activity of the previous day.

f. Maintain order and control of all documentation to prevent confusion during the analysis and when writing the staff study.

g. Write or assist in writing the staff study.

h. Assist the team leader as directed.

4. DUTIES OF THE TEAM MEMBERS.

a. Become familiar with the contents of this order.

b. Participate in the analysis process.

c. Other tasks or duties as assigned by the team leader.

APPENDIX 5. REFERENCE MATERIAL

Getting Ready for MLS, FAA, Program Engineering and Maintenance Service, January 1985

Microwave Landing System, - FAA Program Engineering and Maintenance Service, Video Tape 27 Minutes - 1984

Curved Approach Path Study, Duning, K.E., N.B. Hemesath, et al, Collins Radio company, for FAA, April 1983. Report # FAA-RD-72-143.

System Implementation Plan Microwave Landing System, Order 6830.1.

Flight Demonstration of Curved, Descending Approaches and Automatic Landings Using Time Reference Scanning Beam Guidance, William F. White, NASA, Langley Research Center, May 1978.

Operational Considerations in Utilization of Microwave Landing System Approach and Landing Guidance, William F. White, Leonard V. Clark, NASA, Langley Research center, March 1981.

ATC Simulation of Helicopter IFR Approaches into Major Terminal Areas Using RNAV, MLS, and CDTI, Tobias, L., H.Q. Lee, et al, NASA, AMES RESEARCH CENTER, April 1981.

SITING CRITERIA FOR THE MICROWAVE LANDING SYSTEM, Thomas Hom, Thomas J. Laginja, DOT/FAA/PM-83/2, February 1983.

RNAV AND THE CONTROLLER, Colier, M.W., National Business Aircraft Association, Inc.

Interim Category Instrument Approach Procedures Criteria for Microwave Landing Systems, Order 8260.35, Dec. 14, 1983.

FAA Handbook 8260.3, United States Standard for Terminal Instrument Procedures (TERPS)

FAA Handbook 7030.1A, Protected Airspace for Instrument approach Procedures.

FAA Order 1800.7, Staff Studies

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