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EVALUATION OF ST. LOUIS LDA/DME RUNWAY 12L APPROACH.(U)
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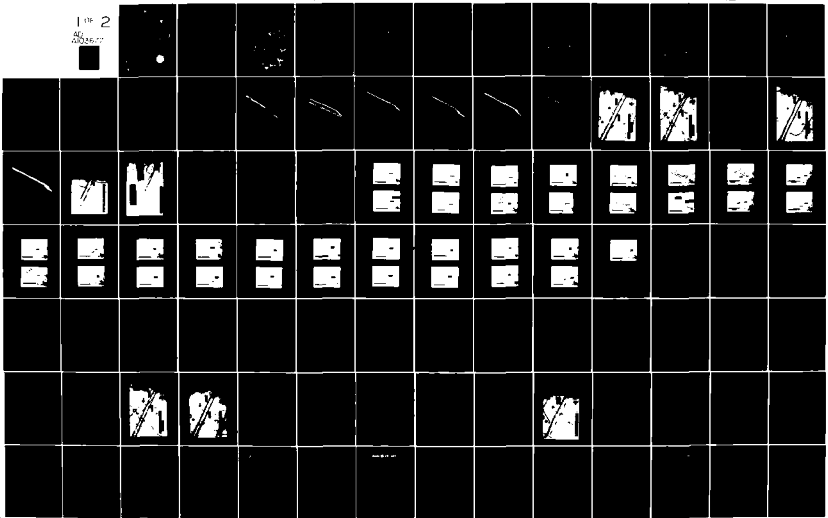

LEVEL IV

9

AD A103677

MEMORANDUM

REPORT

FAA-AFO-500-18

FEDERAL AVIATION ADMINISTRATION

EVALUATION OF ST. LOUIS LDA/DME RUNWAY 12L APPROACH

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Project AFO-560-79-22

The Standards Development Branch, AFO-560
FLIGHT STANDARDS NATIONAL FIELD OFFICE
Office of Flight Operations

July 1980

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15. Supplementary Notes

16. Abstract

Arrival delays at St. Louis Lambert International Airport, MO, prompted Washington Headquarters to authorize an evaluation of a new approach concept using an offset localizer for an LDA/DME approach to runway 12L.

The localizer was installed as proposed and flight tests flown in several different aircraft. Flight tracks of the approaches were studied, along with inflight data recorded by video cameras and tape recorders. Original figures on the approach plate were changed to more realistic numbers due to additional knowledge introduced by Ozark Airlines with the aid of their DC-9 simulator. Math model figures calculated by AFO-560 supported these figures. The evaluation of the proposed approach concept found it to be safe, flyable, and acceptable to pilots.

This document does not address the Air Traffic Control responsibilities associated with this approach concept.

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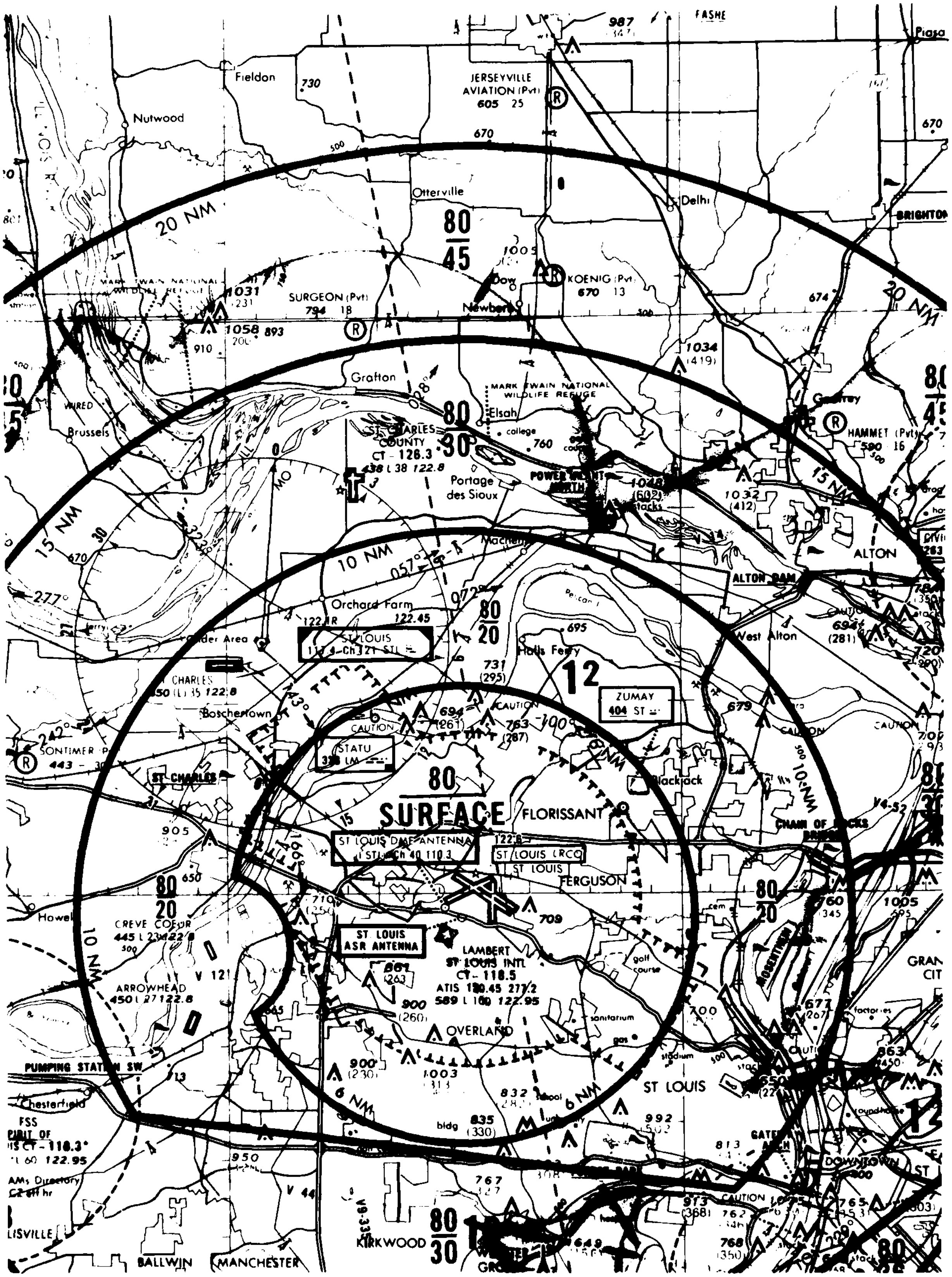
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ST LOUIS
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Chesterfield
DOWNTOWN
KIRKWOOD
BALLWIN
MANCHESTER

INTRODUCTION

Air traffic activity at St. Louis International (Lambert Field), MO, has increased to the point that arrival delays are a major problem during marginal VFR/IFR weather conditions. Studies conducted by the St. Louis Airport Improvement Task Force indicate that introduction of simultaneous approaches to runways 12L and 12R would increase the arrival acceptance capacity of the airport by up to 36 to 38 percent, with a 22 percent reduction in peak hour delay and a 10 percent reduction in total delay. See ATA letter, Appendix IV.

An ILS approach has been commissioned for runway 12R. This runway is parallel to runway 12L, with centerlines 1300 feet apart. Criteria for simultaneous approaches require runway centerline separation of at least 4300 feet. Therefore, use of both runways at Lambert Field requires longitudinal separation by ATC.

To provide for simultaneous approaches, a plan was proposed which would provide an offset localizer for runway 12L installed 3237 feet to the side of the runway. This provides a course parallel to the ILS on runway 12R, with 4537 feet of separation. The plan was approved by ATF-1 on November 14, 1979.

The approach concept was designed primarily to increase the arrival acceptance rate for air carrier traffic by providing parallel approach guidance to a point from which a visual approach can be made. According to weather statistics, VFR weather exists approximately 95% of the time, with cloud bases at 1200 feet or higher.

The approach procedure is a localizer course to a DME fix from which a visual approach can be made or where a missed approach must be initiated. The visual portion of the approach consists of a shallow right, then left turn to traverse the 3237 feet lateral distance to line up with the 12L centerline. The localizer approach can be flown simultaneously with an ILS approach on runway 12R, since there is 4537 feet of lateral separation. The approach chart is shown in Figure 1.

The present procedure to runway 12L is a VOR procedure (see Figure 2) with a final approach course which is approximately 15 degrees offset from the runway centerline. Minimums are 400-1. Longitudinal separation must be provided, eliminating simultaneous approaches to runway 12R.

Alternative procedures in use are ILS-24 and LOC-BC-06 procedures with circling approach to runway 12L. The aircraft flying these approaches are Category A and B aircraft.

STATEMENT OF THE PROBLEM

No criteria exist which would permit simultaneous approaches to parallel runways closer together than 4300 feet. An evaluation of the parallel offset concept is required to determine the feasibility of the approach.

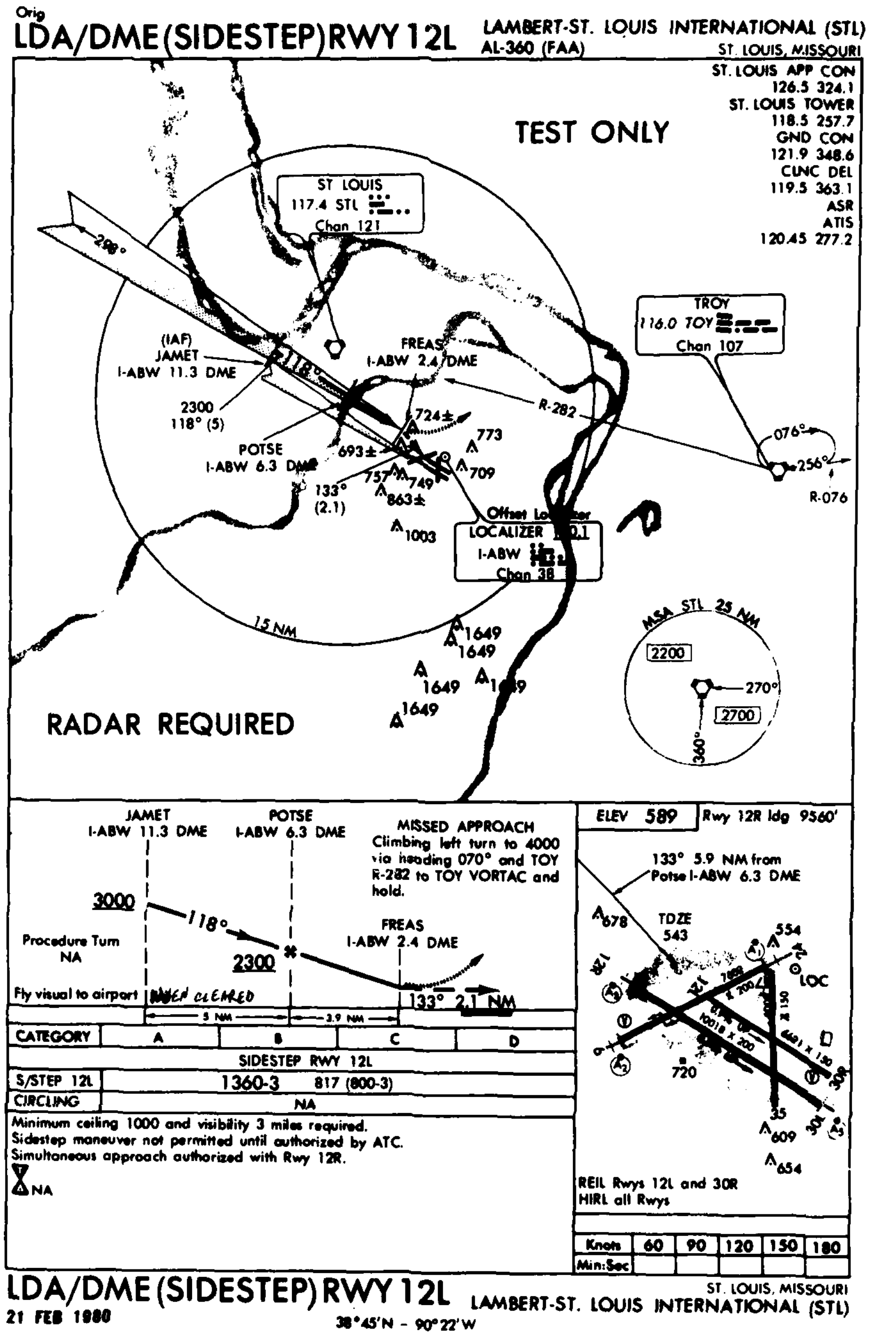
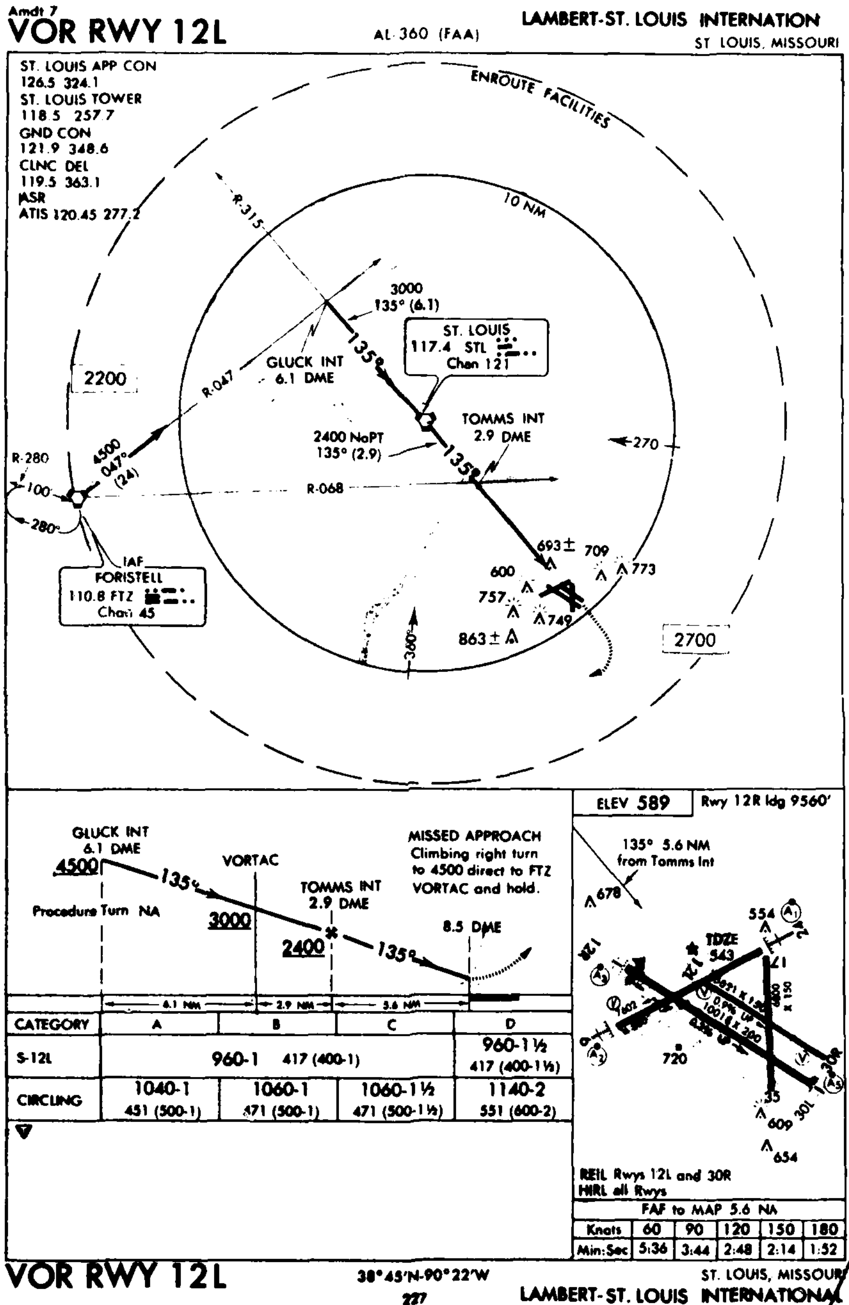


FIGURE 1. LDA/DME APPROACH CHART



CATEGORY	A	B	C	D
S-12L	960-1 417 (400-1)			960-1½ 417 (400-1½)
CIRCLING	1040-1 451 (500-1)	1060-1 471 (500-1)	1060-1½ 471 (500-1½)	1140-2 551 (600-2)

FAF to MAP 5.6 NM					
Knots	60	90	120	150	180
Min:Sec	5:36	3:44	2:48	2:14	1:52

FIGURE 2. VOR APPROACH RWY 12L

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OBJECTIVES

Operationally determine the following:

1. Approach flyability.
2. Safety of the approach.
3. Acceptability to pilots.

METHODOLOGY

The procedure was evaluated using representative air carrier, business, and general aviation aircraft. These aircraft were flown by pilots representative of these groups. Objective and subjective data were recorded for analysis. The military declined the invitation to participate since they would be flying F-4s and runway 12L did not meet their requirements.

Objective data runs were flown in FAA aircraft by qualified pilots. Air carrier aircraft used were the Boeing 727 and the Douglas DC-9. The business segment was represented by the Rockwell Sabreliner and the Cessna 500 Citation. General aviation was represented by the Cessna 421 Golden Eagle.

Subjective data were acquired through the use of questionnaires submitted by the pilots who flew the subjective tests, other pilots who flew the approach during the testing period, and air traffic controllers who were on duty during test runs. The pilot questionnaire tabulations are shown in Appendix II. Controller questionnaires will be summarized by Regional Air Traffic representatives. Additional subjective information was recorded in the form of narrative reports by some of those who participated in the flights and are shown in Appendix IV.

Pilots who flew in the evaluation represented FAA, ALPA, ATA, NBAA, AOPA, and APA. FAA pilots included academy instructors, an air traffic control flight evaluation pilot, and Flight Operations personnel. Several of the test participants flew the procedure in the Ozark Airline DC-9 flight simulator equipped with a night visual system. Pilots flew the approach with and without various lighting systems, and were requested to give their opinions of any improvement to the procedure which might be developed through the use of lights.

A mathematical model prediction of the maneuvering required for this approach concept was plotted using 130 and 153 knots with a 3.5 degree per second roll rate and a 15 degree bank angle. (See Figure 3.) These parameters were used as representative of Category C and D aircraft and they have been used in previous studies; i.e., Washington National LDA/DME 18 approach and offset angle nonprecision approaches. The math model plot indicated the 2.4 DME MAP (2.1 NM from runway threshold) specified on the NOS approach plate (Figure 1) was too close to complete the necessary maneuver at a sufficient distance from the runway without exceeding the above parameters.

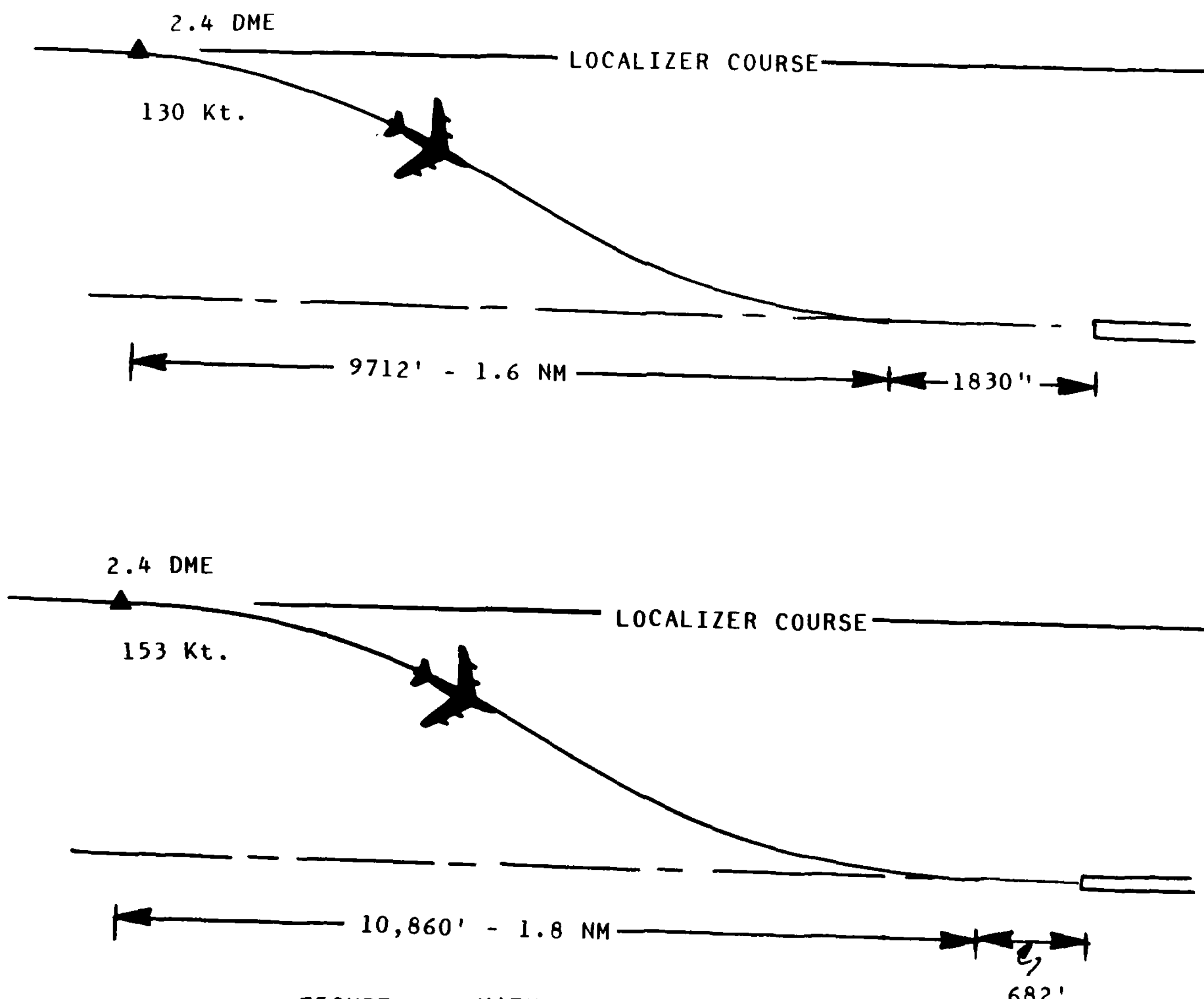


FIGURE 3. MATH MODEL TRACKS WITH 2.4 DME MAP

A minimum wings level distance of 2000 feet was determined as satisfactory for DC-9 and B-727 aircraft in a current study on offset angle approaches using a single turn. The mathematical model used for this LDA/DME approach indicated a total longitudinal distance of 9712 feet at 130K and 10,860 feet at 153K to accomplish both turns and traverse the lateral distance. With the MAP placed at 2.1 NM from the runway threshold, a wings level attitude would be attained at 1830 feet from the runway threshold at 130K. At 153K, the wings level distance would be only 682 feet. In both cases the distance was unsatisfactory.

The MAP was relocated to a point 3.0 DME from the localizer. The distance to the runway threshold from the MAP was approximately 2.7 NM. Using the mathematical model, the distance from the wings level position to the runway threshold at 130K and 153K would be 5476 feet and 4328 feet respectively. See Figure 4.

Flight Simulation. Before the flight test was initiated, studies were made in the Ozark Airlines DC-9 flight simulator at St. Louis-Lambert. Indications verified the 2.4 NM DME MAP as too close to the runway threshold. The approach charts were changed to indicate the MAP at 3.0 NM DME. Resultant bank angles and roll rates more nearly fit those of the mathematical model. It was also determined that the 1360' MDA was too high at the 2.4 DME MAP. The aircraft would be above the VASI light glidepath at that point. It was also determined that the 1360' MDA was satisfactory with the 3.0 NM DME MAP. The decision was made to lower the MDA to 1140' (597' AGL) for initial flight testing. The simulator was used to test for flyability under the most critical crosswind condition also, the wind being from 030 degrees. Crosswind from this direction would tend to cause aircraft to overshoot the runway. Winds of up to 20 knots were used. The test was conducted without the lead-in lights, as would be accomplished during the flight test evaluation. Overshoots of the runway 12L centerline were not a problem during these tests. After programing lead-in lights at the 3.0 DME point, roll rates and bank angles decreased in comparison with the approaches flown without lights. The lights provided positive guidance to the runway during the visual maneuver and positioned the aircraft on the extended runway centerline at approximately 5000 feet from the threshold. The pilot is thereby relieved of the burden of judging distance, and can concentrate on the VASI and runway alignment.

DATA ACQUISITION

The LDA/DME approaches were flown using the B-727 with the Sabreliner, the DC-9 with the Cessna 500, and in the Sabreliner with the Cessna 421.

The Kansas City ARTCC recorded radar tracks of aircraft flying the test runs.

Video tape recordings were made of the instrument panel and through the windshield of the test aircraft during some of the runs. Video tape records were also made through cabin windows of aircraft on the ILS runway 12R to show the aircraft flown on runway 12L making the maneuver

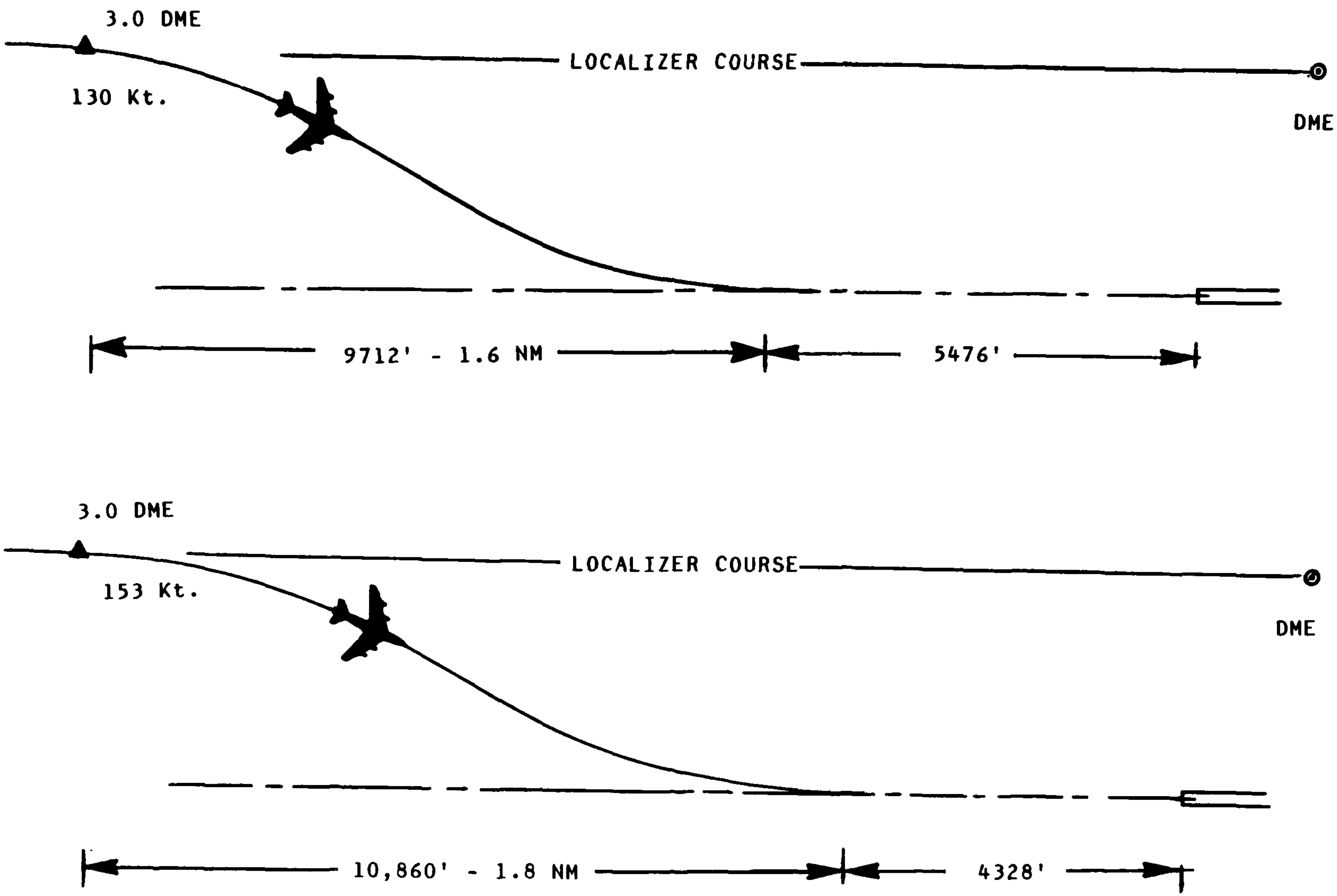


FIGURE 4. MATH MODEL TRACKS WITH 3.0 DME MAP

off the localizer to the runway centerline. Tape recordings of pilot conversations were also made.

During test runs flown by the DC-9, Cessna Citation, Rockwell Sabreliner, and the Cessna 421, open shutter photographs were made of the tracks on the Airport Surveillance Radar (ASR) screen in the St. Louis Tower IFR room. Photographs of approaches flown by other general aviation aircraft were also made.

APPROACH CONCEPTS CONSIDERED FOR EVALUATION

Alternative concepts were considered to identify advantages and disadvantages of each.

1. Offset Angle Localizer Approach. A localizer course was offset from the runway heading by 20 degrees with a runway intercept point 1.2 NM from the threshold. The final approach fix (POTSE) was placed at 6.0 NM DME. The missed approach point (FREAS) was located at 2.0 NM DME, which is 3.17 NM from the runway threshold. FREAS is approximately 3900 feet to the side of the extended centerline of runway 12L. See Figure 5. The primary advantage of this approach procedure is that only one heading change is required from the final approach course to the runway centerline rather than two. Additionally, the "wings level" distance on final approach is slightly increased. The disadvantage is that the final approach courses of the offset and the ILS are converging courses. This applies to the missed approach as well. The procedures require longitudinal separation criteria, thus having no significant increase in the potential acceptance rate of the airport.

2. Parallel ILS Approaches. This option would provide full IFR capability on both runways--12L and 12R. The minimums for each runway would be the lowest possible. It would also provide a straight-in course to each runway with a stabilized final approach from the outer marker inbound. However, this option, because of the narrow separation between runways, would not permit simultaneous approaches. Thus the traffic flow, as in the offset localizer approach, could only be increased minimally. However, the missed approach convergence problem would not exist. This would be controlled by the requirement for longitudinal separation by radar of three miles minimum. See Figure 6.

3. LDA/DME Simultaneous Approaches with a visual S-turn maneuver to the runway. The primary advantage of this option is the increase in airport acceptance rate of approximately 36 to 38 percent. This concept does not require the three miles of longitudinal radar separation since the approach courses are over 4300 feet apart. The requirement for minimums as high as 1000-3 seems disadvantageous; however, these or better conditions exist approximately 95 percent of the time. The simultaneous approach would not be available for only about five percent of the time. The apparent disadvantages of the approach are the requirement to accomplish an S-turn maneuver to runway 12L, requirements for visual separation during the S-turn portion of the approach, and the possibility that sufficient time for a wings level stable final segment may not be available.

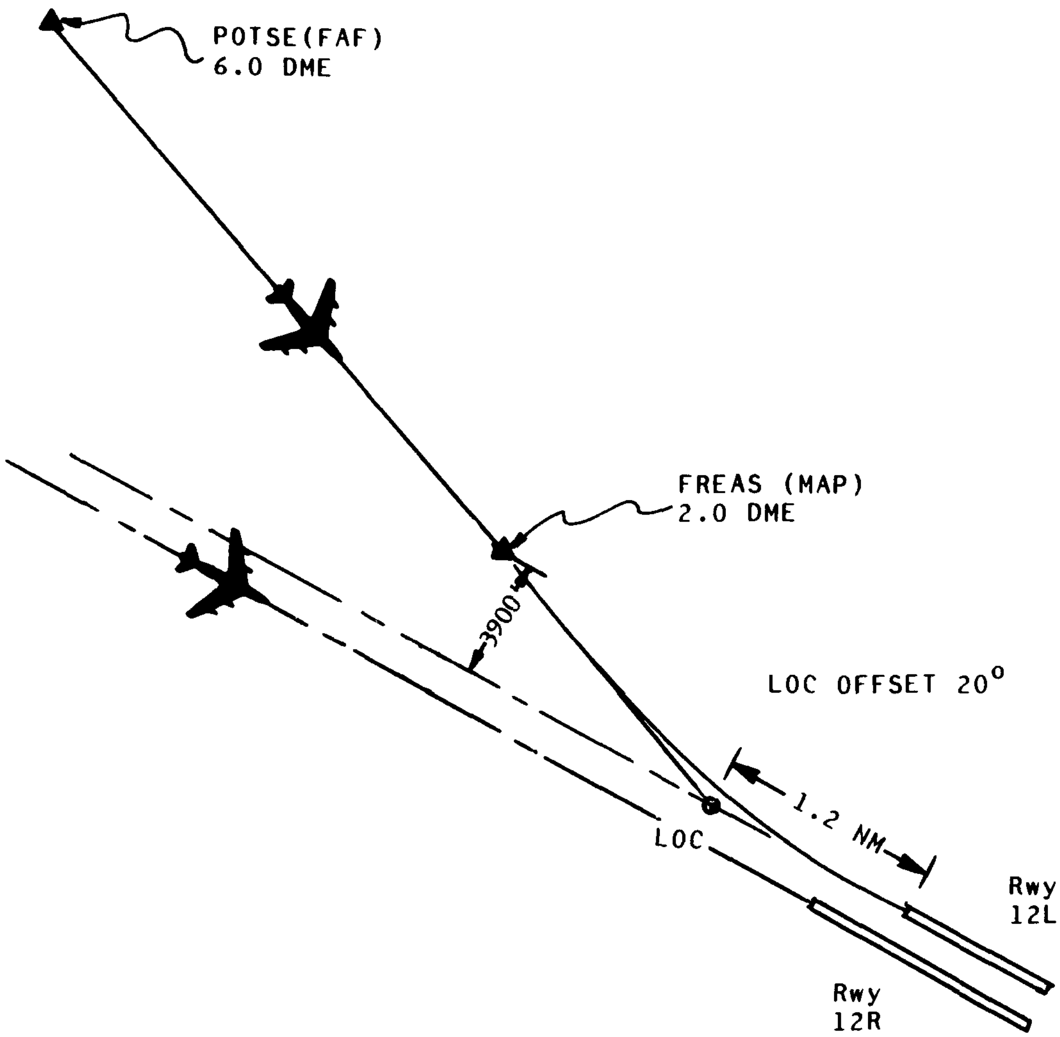


FIGURE 5. OFFSET LOCALIZER APPROACH

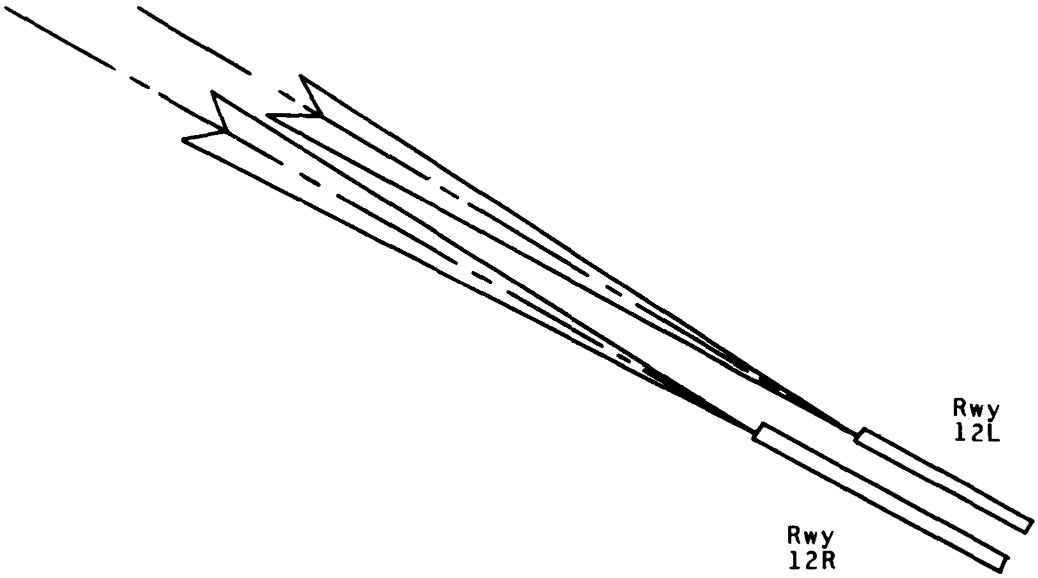


FIGURE 6. PARALLEL ILS

LDA/DME Concept Considerations.

1. Low altitude maneuvering.

2. Position of the airport environment in relation to a pilot's normal line of vision.

3. Variable conditions.

   a. Crosswind.
   b. Tailwind.
   c. Visibilities less than reported.

4. Wake turbulence.

5. Proper runway recognition.

6. Go-arounds.

The above conditions were observed and/or considered during the evaluation and are discussed in the analysis section.

ANALYSIS

A review of all objective and subjective data was conducted with the following results:

The parameters considered to be acceptable maximums for this analysis were (1) bank angles based on airspeeds used and standard rate turns; i.e., 22.5 degrees at 153K and 20 degrees at 130K, and (2) a roll rate of 6.0 degrees per second. Over 6.0 degrees per second roll rates were considered unsatisfactory during this evaluation, from a passenger comfort viewpoint. However, a study regarding ILS approaches flown with an autopilot coupler used ± 10 degree/second roll rates, so the above roll rate could be exceeded 1 or 2°/sec. without any ill effect for B-727 and DC-9 aircraft (RTCA Paper 31-63/DO-118, Standard Performance Criteria for Autopilot/Coupler Equipment).

The B-727 (N-27) tests were flown in conjunction with a Sabreliner (N40NS). A detailed report of these runs is shown in Appendix III. Conditions varied from 1500-3 by day to 2100-8 at night. There was a 10 to 12 knot tailwind. The airport environment was visible from 3 to 4 NM DME. Airport lighting was visible from 3.5 NM DME. In general the VASI was visible at about 2.5 NM DME, and some pilots stated that a VASI canted toward the MAP would be very helpful. There was agreement that the MAP should be at 3.0, not 2.4 NM DME. None of the pilots had any difficulty at all flying the approach. See Appendix II. All agreed that lead-in lights should be installed from the MAP to the runway centerline for alignment and that minimums to commence the approach should not be lower than 1000-3.

The DC-9 (N-29) flights were flown in conjunction with the Cessna 500 Citation. A detailed report of the DC-9 operation is shown in Appendix

III. Conditions were a 5000 foot ceiling with ten mile visibility for the daylight approach which deteriorated to 1200 feet and five miles visibility for the night approaches. There was again agreement that 2.4 NM DME was too close in to make the maneuver from the LOC course to the 12L centerline. The airport environment became visible at from 2.5 to 3.5 NM DME. Some pilots found that the lighting of the area around the airport was confusing, particularly the freeway lighting. All agreed that lead-in lights should be installed. None experienced difficulty on the approach, and two considered it to be a very easy maneuver. The suggested lowest MDA was 1140 feet MSL, but pilots qualified this by saying that ceiling and visibility should be no lower than 1000-3.

Sabreliner N-265 (N40NS) flights were flown in conjunction with the B-727 and with the Cessna 421 Golden Eagle. A detailed report of these flights is shown in Appendix III. Once again, an approach was flown using the 2.4 NM DME MAP, which was considered too close in. The remaining approaches utilized the 3.0 NM DME. Most of the Sabreliner pilots identified the maneuver as "very easy." No difficulties were experienced by any pilot. Weather conditions varied from 1500-3 to clear and 15 miles. No confusing lighting was noticed. Almost every pilot in this group recommended the use of lead-in lights; two of them suggested ODALS as well. Minimums which were suggested centered on MDAs of 1040 to 1140 feet MSL and visibilities ranging from two to three miles.

Three Cessna 500 Citation (N-25) approaches were flown on the system. Weather conditions were 5000-10. A report of these runs is shown in Appendix III. These runs used the 2.4 NM MAP and the pilots experienced no difficulty at all. The remainder of the Citation runs were flown on the ILS runway 12R simultaneously with the DC-9 to observe the sidestep maneuver and photograph that aircraft through cabin windows.

The Cessna 421 (N5389J) runs were flown in clear weather with unlimited visibility. A detailed report is shown in Appendix III. MDAs were varied from 1100 to 1360 feet MSL. The MAP was set at from 2.0 to 3.0 DME. Several approaches were flown at higher airspeeds to simulate tailwind conditions. One missed approach was flown under difficult conditions approaching a "worst case" simulation. (See report in Appendix III.) Pilots of these runs submit that at no time was there difficulty in executing the approach, even using the two mile MAP at 130 knots. Their opinion was that the sidestep was a distinct improvement over present procedures, which involve circling to land. They stated that the lead-in light system should be installed if this approach is approved for general use.

Category C aircraft exceeded the parameters specified on four out of the six approaches flown from the 2.4 DME MAP. One of the 25 approaches flown from the 3.0 DME MAP exceeded the specified parameters. The unsatisfactory approach exceeded the roll rate only by two degrees per second. Two approaches were flown in the C-421 from a 2.0 DME MAP at speeds of 120 and 130K respectively. Objective data was not available but the pilot reported there would be no margin for error in an approach from that point. Additional comments by aviation organizations interested in this project may be found in Appendix IV.

Radar Flight Tracks. Flight tracks from the digital readout at the Kansas City ARTCC showed that the B-727 aircraft was on track down to the MAP, and that as it executed a low approach it remained within the confines of 12L. However, the portion of the flight track from two to 2 1/2 miles out and below 600 feet AGL was not in the line of sight of the radar which is located three miles south of Lambert Field, and thus could not be recorded. It was therefore decided not to utilize this method on other aircraft. See composite drawing, Figure 7.

Video Tape Recordings. Recordings of the airport and runway environment were made through the aircraft windshields on most approaches. Recordings of the aircraft on the LDA/DME approach to runway 12L were made through the cabin windows of the aircraft flying on a simultaneous ILS approach to runway 12R. The recordings made of the instrument panels have been reviewed and the instrument readings for the B-727, DC-9, and Sabreliner are shown in Appendix V. Information includes DME, bank angle, roll rate, airspeed, vertical velocity, and heading. These recorded values show that bank angles ranged from eight to 30 degrees and roll rates ranged from two to ten degrees per second on the initial turn, and bank angles of six to ten degrees and roll rates of 1 1/2 to four degrees per second on the turn onto the runway centerline.

Tape recordings of pilot comments were made during the flights. These recorded comments supported the pilot comments on the questionnaires. Two areas of prime concern in the interviews with B-727, DC-9, and Sabreliner pilots were lead-in lights and canted VASIs.

ASR Scope Photos. Because the ARTCC flight track information was not satisfactory, ASR scope photographs were made of turns involving subsequent evaluation aircraft. Appendix I shows these individual radar scope photographs. These photos were enlarged and the radar tracks were then plotted in composite form. Figure 8 shows the thirteen parallel approach pairs of all aircraft flying simultaneously.

Figure 9 shows all eight sidestep flight tracks flown in the DC-9. No significant deviations from the expected track exist.

Figure 10 shows all thirteen sidestep runs in the Sabreliner. Again no significant deviation from the expected flight track can be seen.

Figure 11 shows all 11 sidestep runs in the Cessna Golden Eagle. No unusual tracks are apparent.

Figure 12 shows three sidestep runs made by aircraft based at St. Louis-Lambert and flown by general aviation pilots. No problems developed on these runs.

Three go-arounds were flown after the S-turn maneuver commenced--one in the C-421 and two in the Sabreliner. Figures 13 and 14 show the two Sabreliner missed approach flight tracks. In both procedures, the aircraft made a 15 degree left turn and executed missed approach instructions. Both aircraft stayed well to the left of runway 12L. No difficulty was identified by the pilots in executing the maneuvers. The

FIGURE 7. DIGITAL READ-OUT OF
B-727 TRACKS FROM
KANSAS CITY ARTCC RADAR

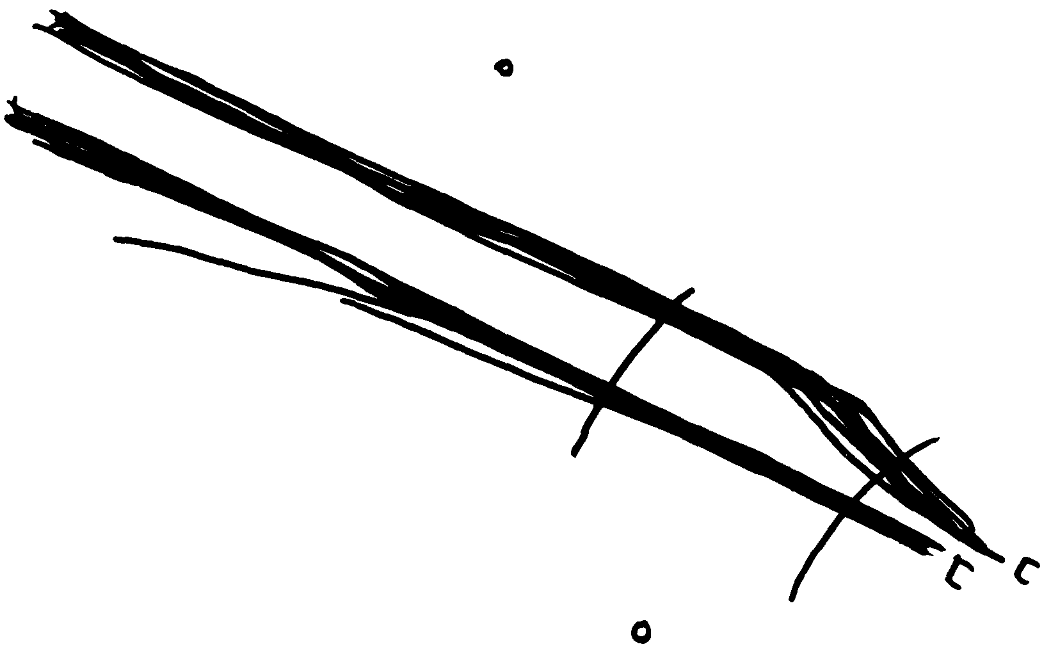


FIGURE 8. TRACKS FROM ASR SCOPE PHOTOGRAPHS. 13 PAIRED APPROACHES FLOWN SIMULTANEOUSLY.

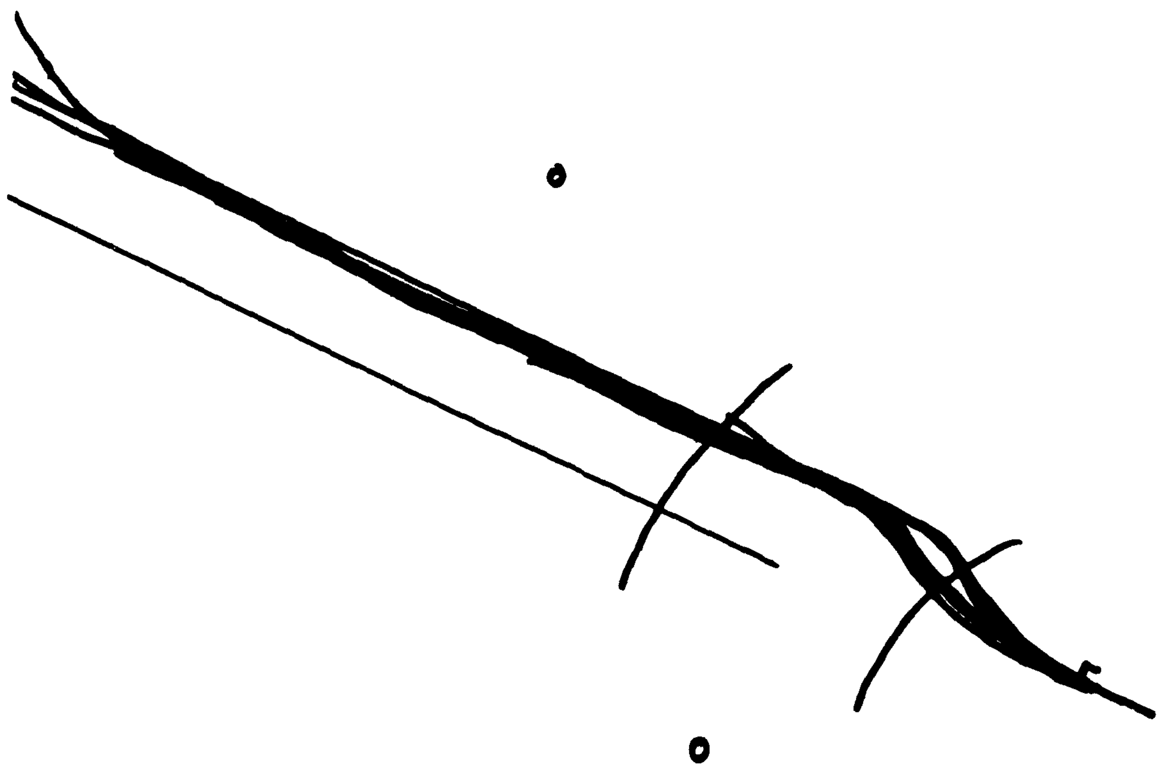


FIGURE 9. DC-9 (N-29) TRACKS
FROM ASR SCOPE PHOTOGRAPHS.
8 RUNS.

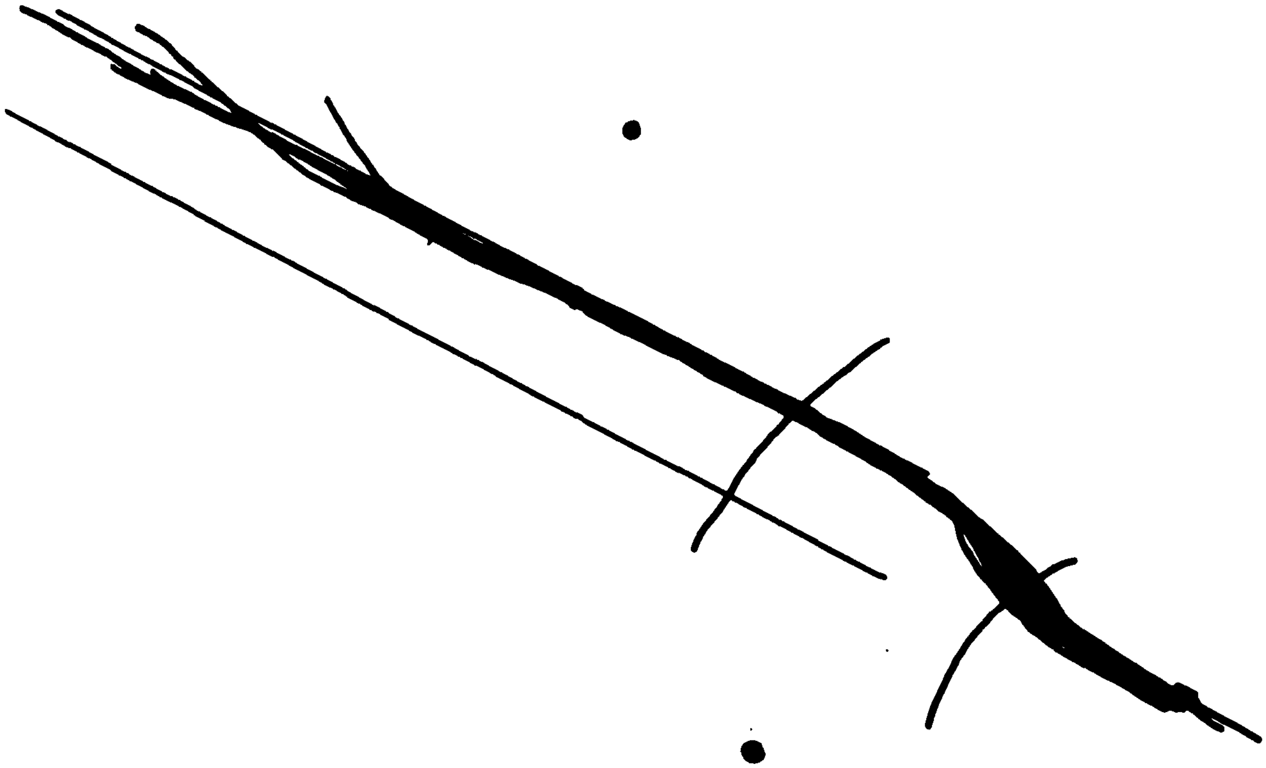


FIGURE 10. SABRELINER (N40NS) TRACKS FROM ASR SCOPE PHOTOGRAPHS. 13 RUNS.

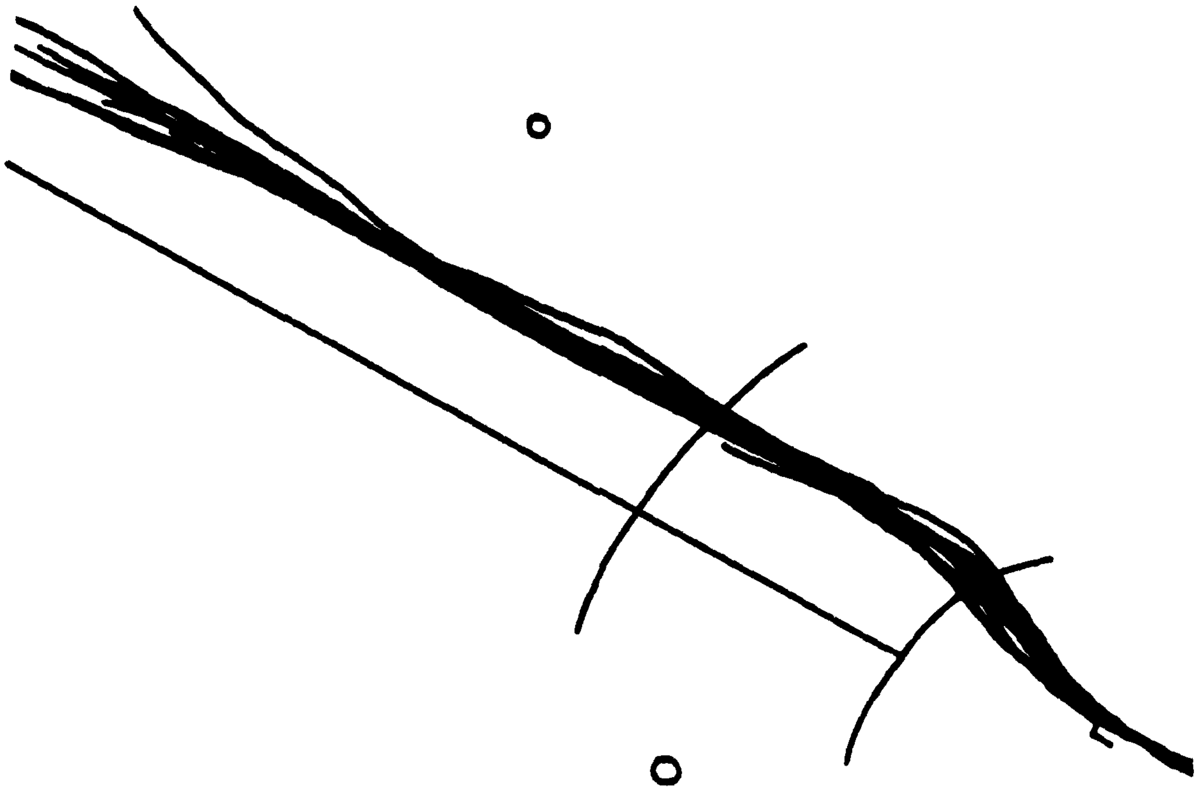


FIGURE 11. CESSNA 421 GOLDEN EAGLE (N89J) TRACKS FROM ASR SCOPE PHOTOGRAPHS. 11 RUNS.

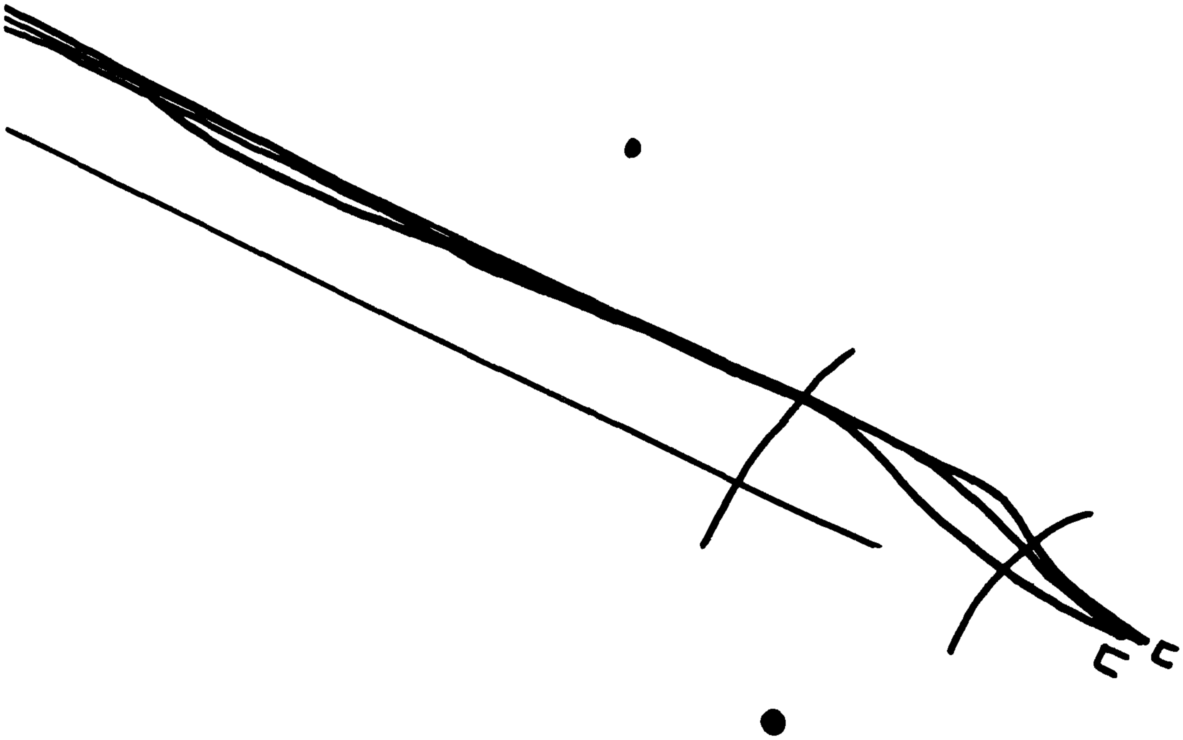


FIGURE 12. MISCELLANEOUS TRACKS FROM ASR SCOPE PHOTOGRAPHS. 3 RUNS.

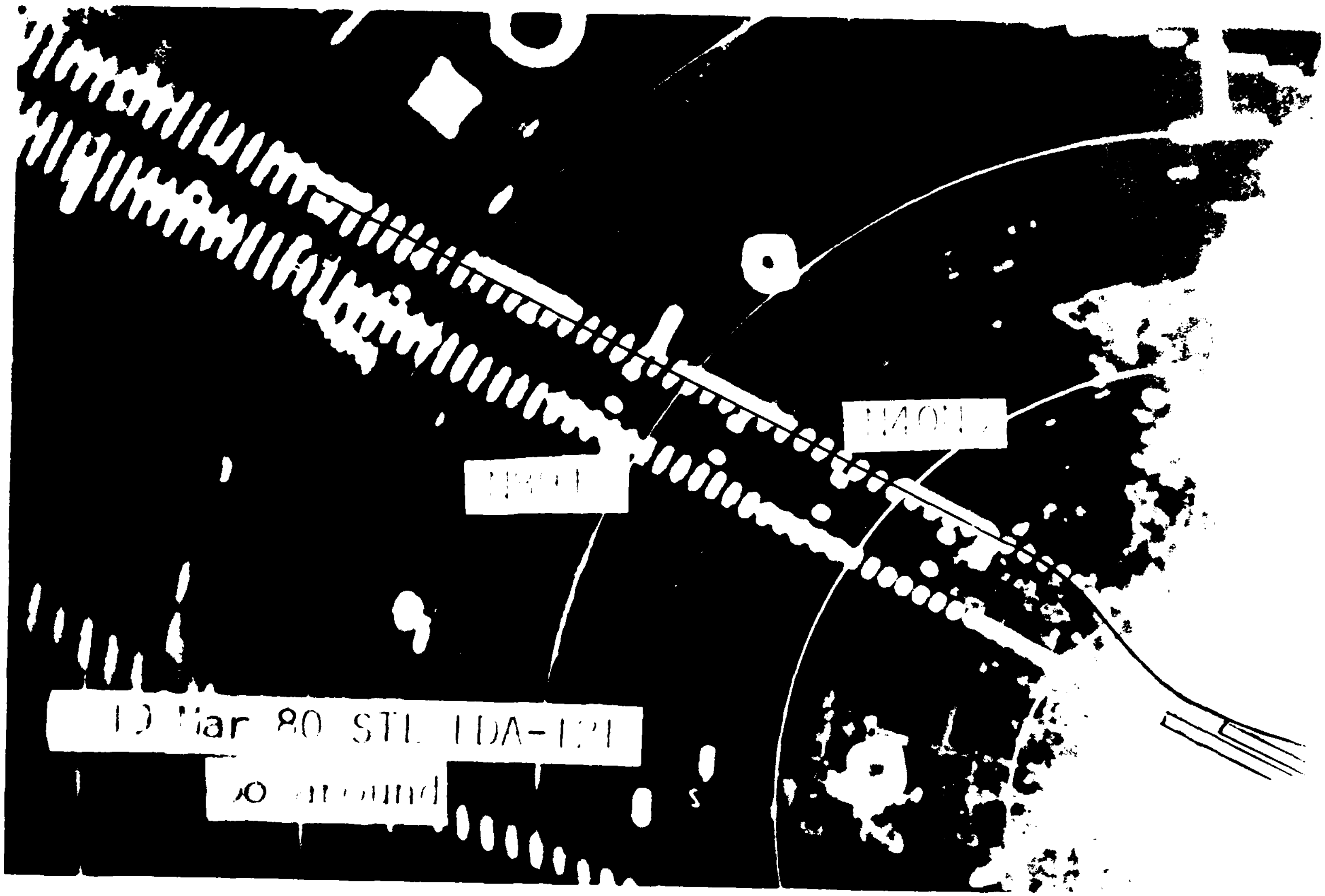


FIGURE 13. GO-AROUND
EXECUTED BY SABRELINER N-40NS.
ASR SCOPE PHOTOGRAPH.

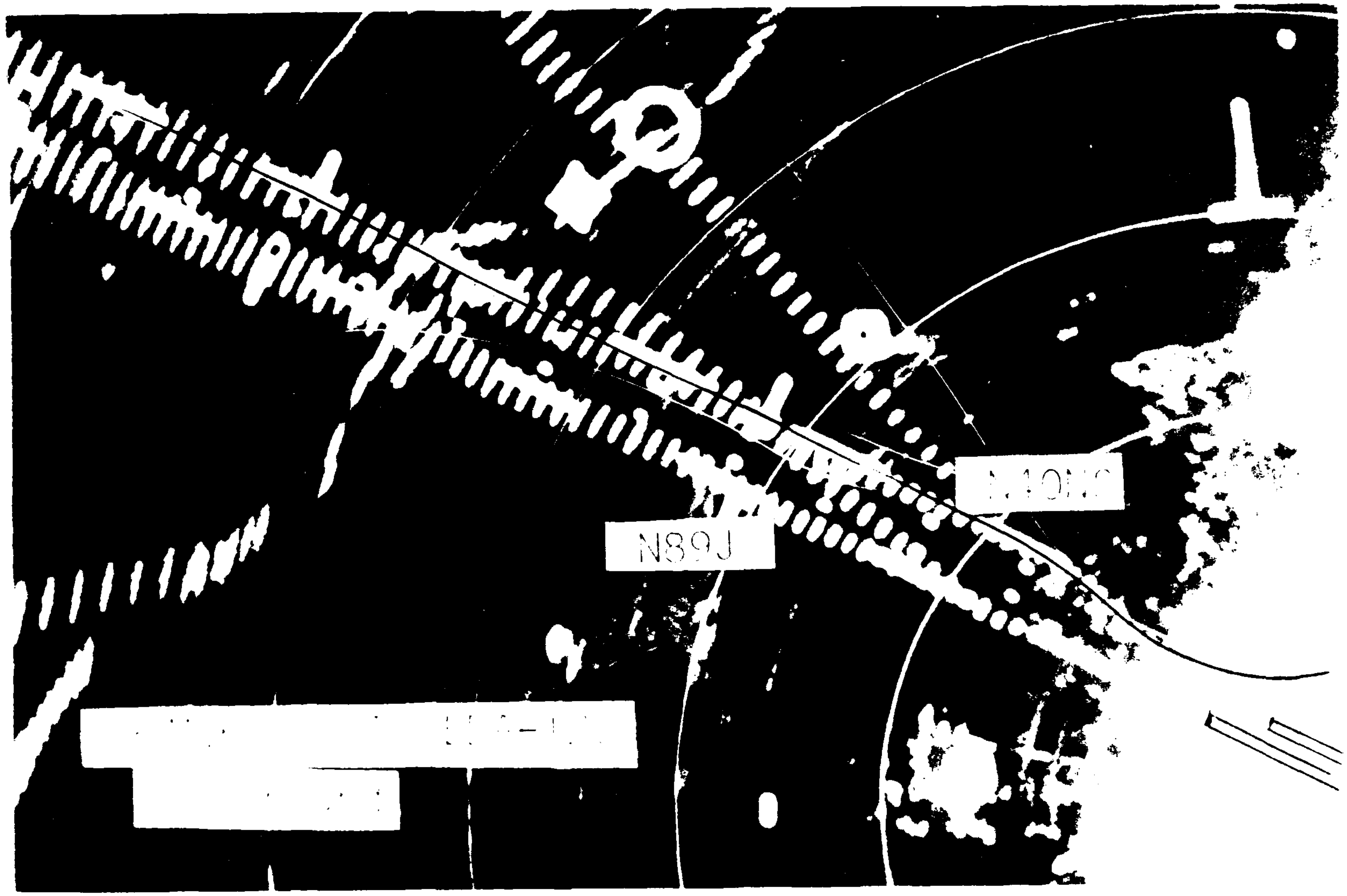


FIGURE 14. GO-AROUND
EXECUTED BY SABRELINER N-40NS.
ASR SCOPE PHOTOGRAPH.

missed approach executed with the C-421, shown in Figure 15, was executed by a pilot who had not flown the equipment in three years. It was executed by direction just as he was about to line up on the runway centerline. He did not hear the controller's instruction and initial heading. Conditions were confused as to ATC frequency, etc. This missed approach, therefore, was executed under nearly "worst case" situation. Yet, as Figure 15 shows, the aircraft crossed the extended runway centerline only a small distance.

A final composite of all 45 runs is shown in Figure 16.

Figures 17 and 18 show the present VFR (1000-3) operation. One approach is on the runway 24 ILS, then a circle-to-land maneuver to runway 12L. The other is an approach across the center of the airport, then a circling maneuver to 12L. These approaches are limited to Category A and B aircraft. Often they land on runway 12L simultaneously with traffic on runway 12R.

The approach maneuver from the 3.0 DME MAP was flown at altitudes from 597 to 817 AGL (MDAs of 1140 to 1360 feet MSL). Pilots remained at the MDA used until the VASI light glidepath was acquired before starting their descent. The point at which the descent commenced varied due to the MDA used, but generally was while on the intercept angle to runway 12L or just after the turn started to line up with the runway centerline.

As the approach commences, at or prior to the MAP, the airport environment is slightly to the right of the aircraft ground track. Under no wind conditions, the McDonnell-Douglas buildings are at the 12 o'clock position and the airport beacon is slightly to the right of the 12 o'clock position. Although the airport environment is in sight, the runway cannot be seen under certain conditions during the daylight hours from the 3.0 DME MAP; i.e., partial snow covering the ground, visibility at the three mile minimum, or sometimes higher than three miles with fog and haze. The addition of lead-in lights are necessary to provide positive guidance to help the pilot line up with the runway under all conditions. The flights in the B-727 were flown both day and night with tailwinds exceeding 10K. No adverse comments or problems were encountered with these wind conditions. Flights in the DC-9, Sabreliner, and C-421 were flown with crosswinds exceeding 8K from the right (approximately from the south). These conditions were more favorable since a wind from the right allows more time to line up with the runway centerline, and aircraft crab was to the right. As stated earlier in this report, simulation of a direct crosswind of 20K from the left (030 degrees) was made to determine the effects of the most critical crosswind condition. The results did not indicate any derogation of safety for this approach concept.

Wake turbulence. The provisions of 7110.65A apply.

Pilot questionnaires were tabulated for analysis by the Aviation Psychology Laboratory of the Civil Aeromedical Institute. The evaluation details are shown in Appendix II. In no case was the

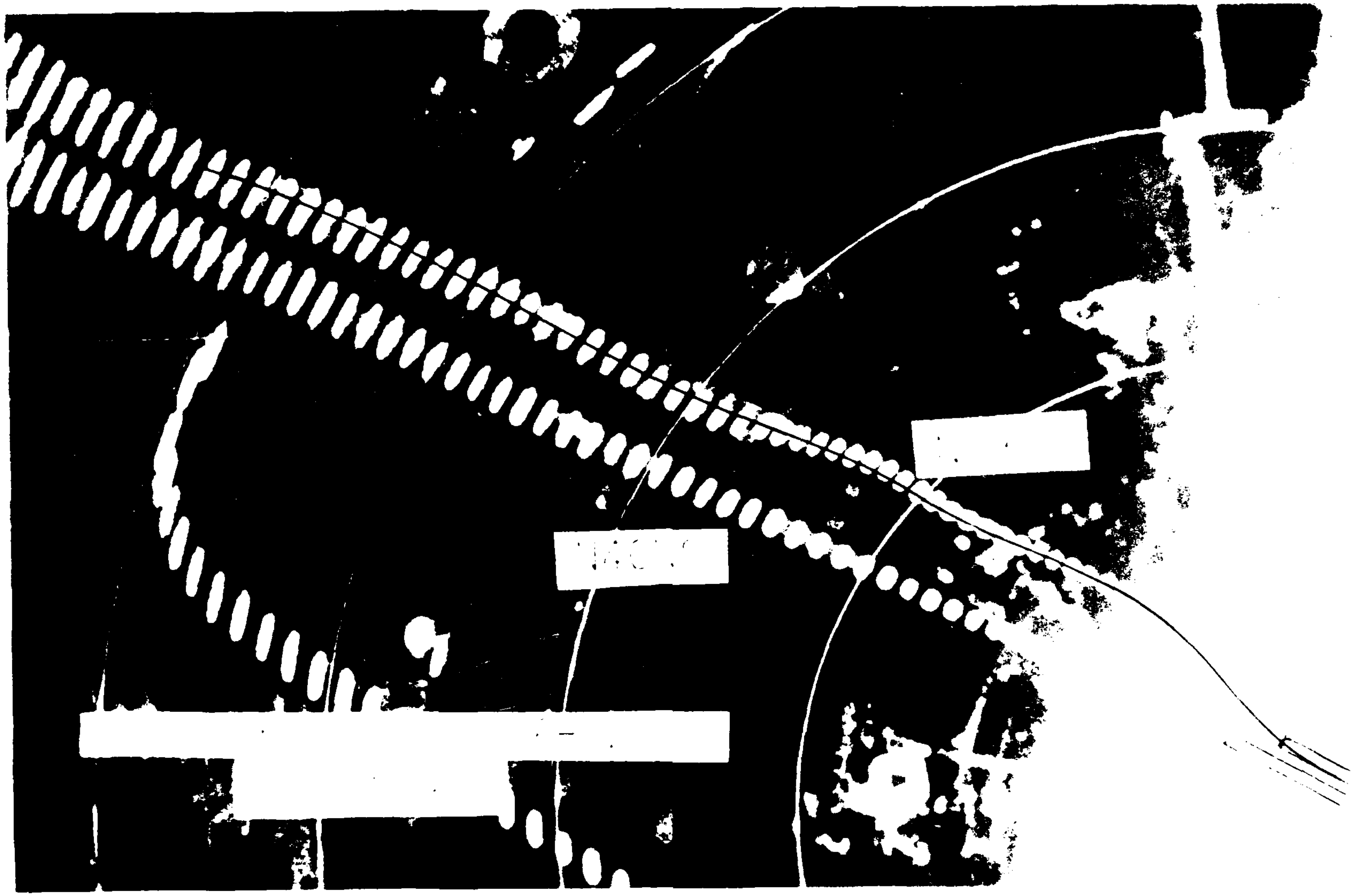


FIGURE 15. GO-AROUND
EXECUTED BY CESSNA 421 N 89J.
ASR SCOPE PHOTOGRAPH.

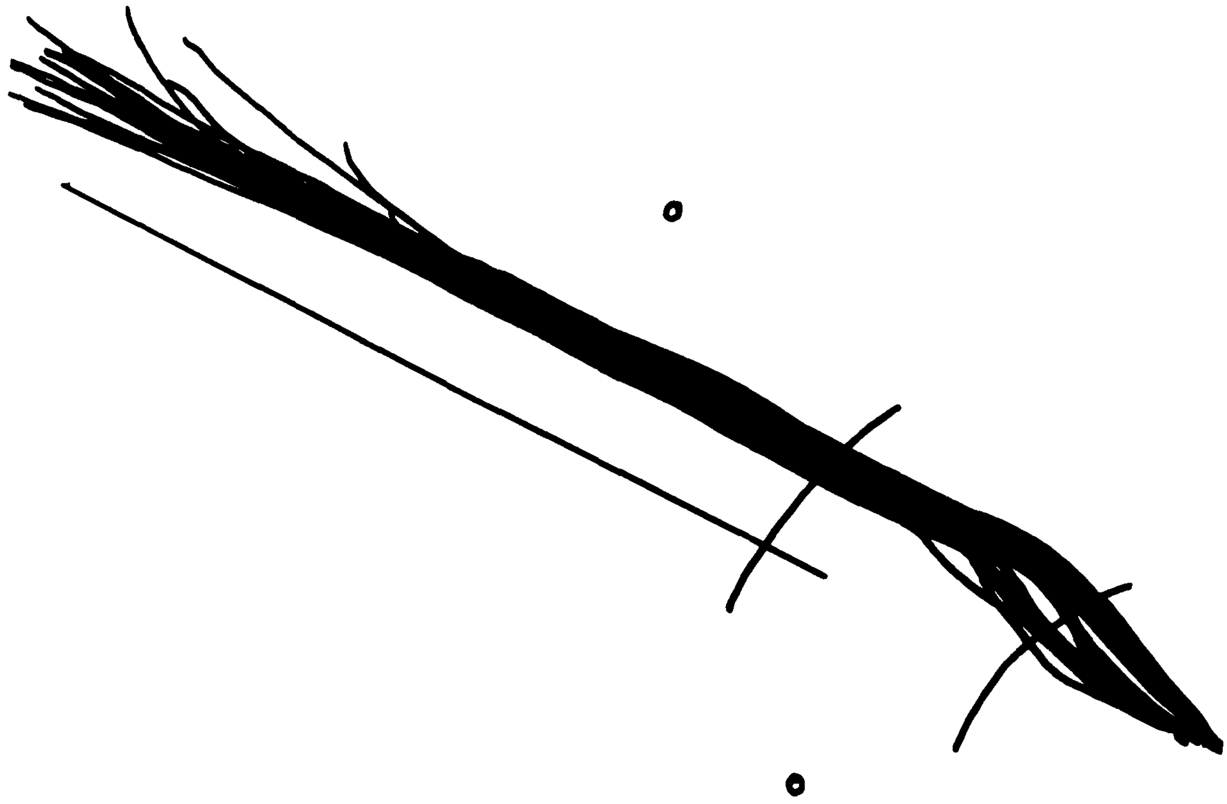


FIGURE 16. COMPOSITE TRACKS OF ALL ASR SCOPE PHOTOGRAPHS. 45 RUNS.

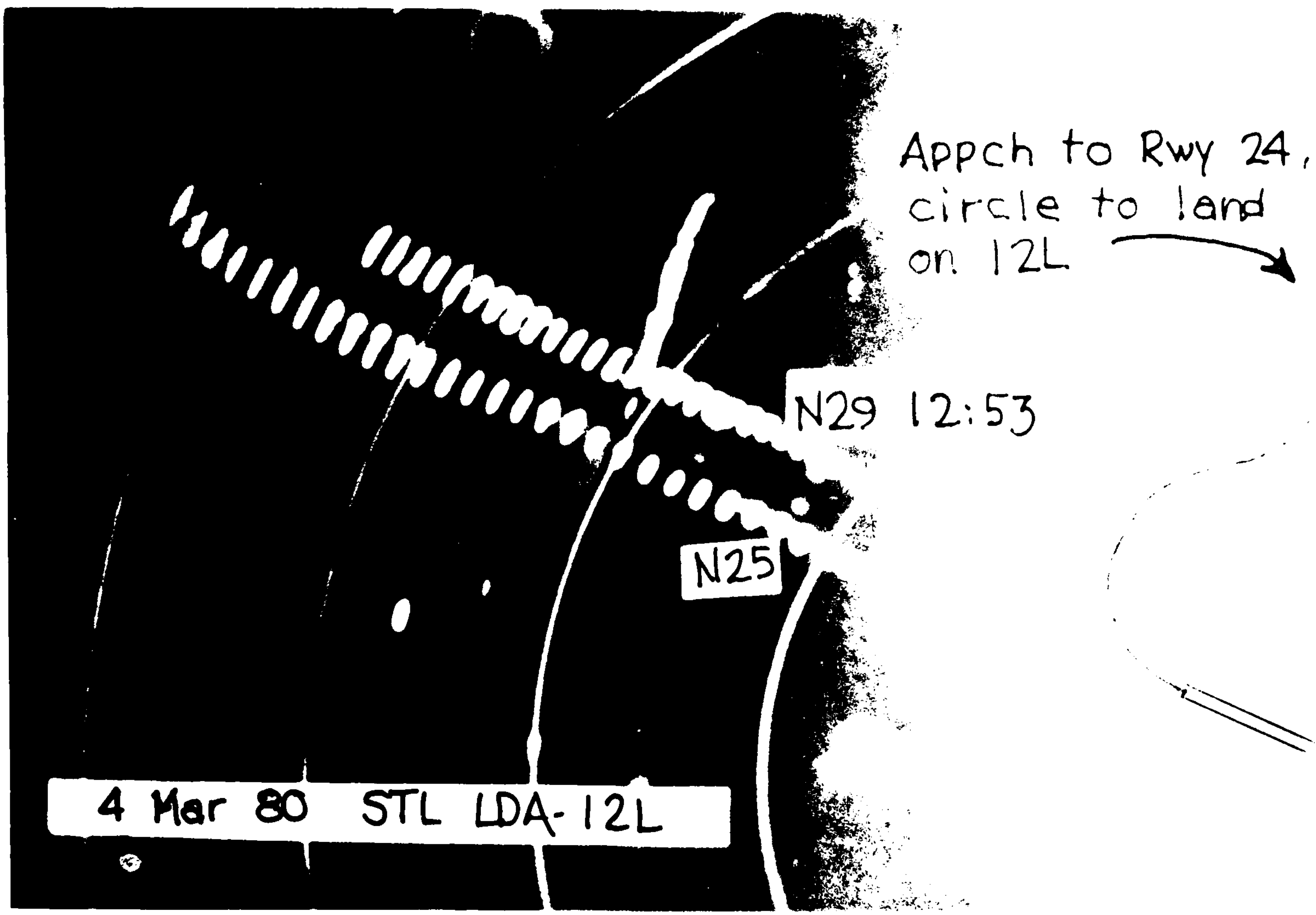


FIGURE 17. APPROACH TO RUNWAY 24. CIRCLE TO LAND ON 12L

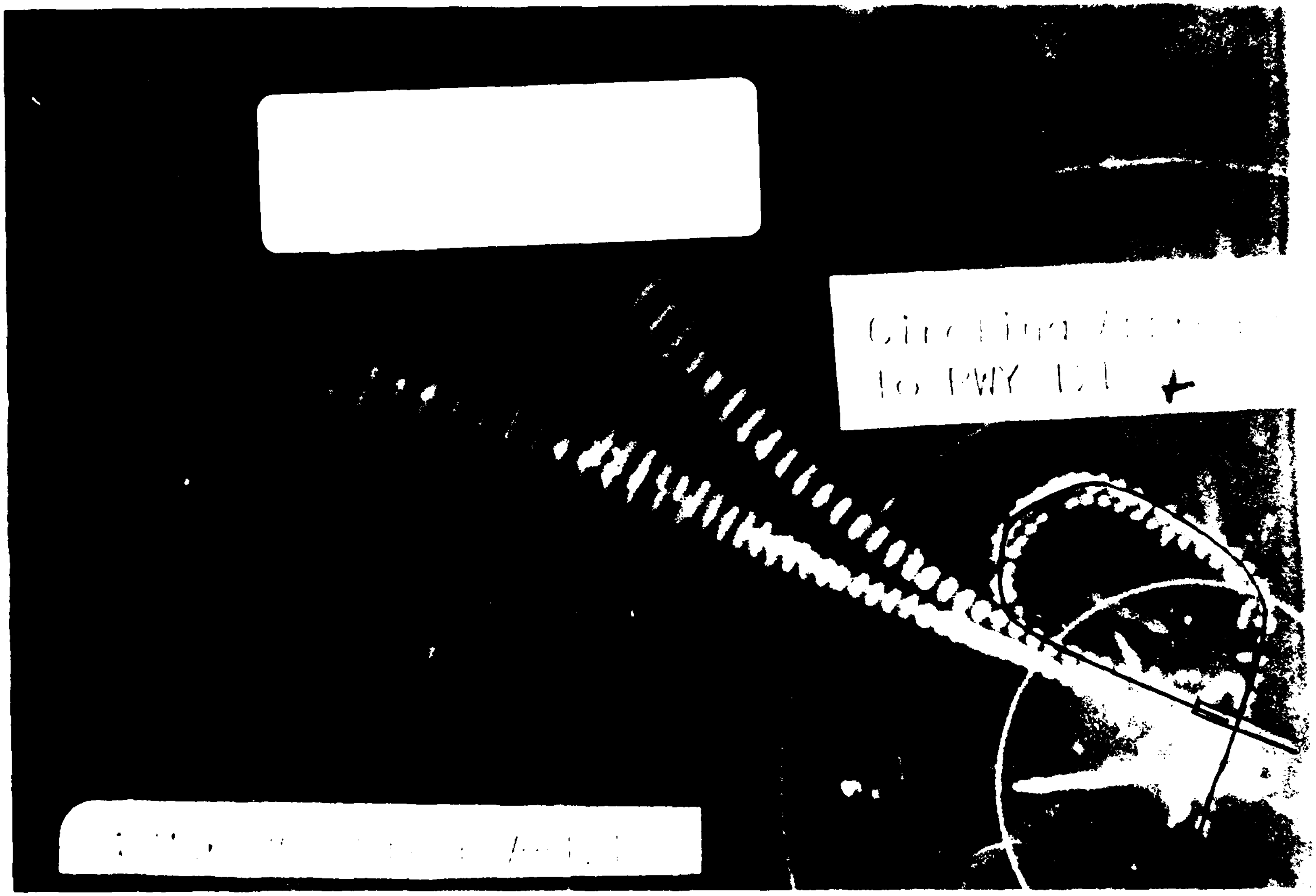


FIGURE 18. CIRCLING APPROACH TO RUNWAY 12L.

approach procedure reported as being difficult. The following statements are based upon all approaches flown--FAA evaluation flights as well as general aviation participation. Most of these approaches were flown in good weather conditions--over 2000 feet ceiling and over five miles visibility. Over 86 percent of the pilots suggested that lead-in lights should be installed. Recommended minimums from the questionnaires were 1000-3 for large jets and 600-2 to 800-2 for business aviation jets and for Category A and B aircraft.

Controller questionnaires were filled out by air traffic control personnel involved in the project. These questionnaires will be summarized in the Central Region Headquarters.

FINDINGS

The following findings have been identified as a result of the analysis of data acquired in this evaluation at St. Louis:

1. A 3.0 NM DME distance was determined to be the minimum acceptable placement of the MAP.

2. Lead-in lights should be installed to provide positive guidance from the 3.0 NM DME MAP and continuing to the extended centerline of runway 12L. See Figure 19.

3. VASI-4 should be installed on the left side of runway 12L with the boxes canted toward the MAP.

4. The lowest ceiling and visibility acceptable to all the pilots flying this evaluation were 1000-3. These conditions, or better, must be available prior to any pilot commencing the approach.

5. The procedure is safe, flyable, and acceptable to pilots.

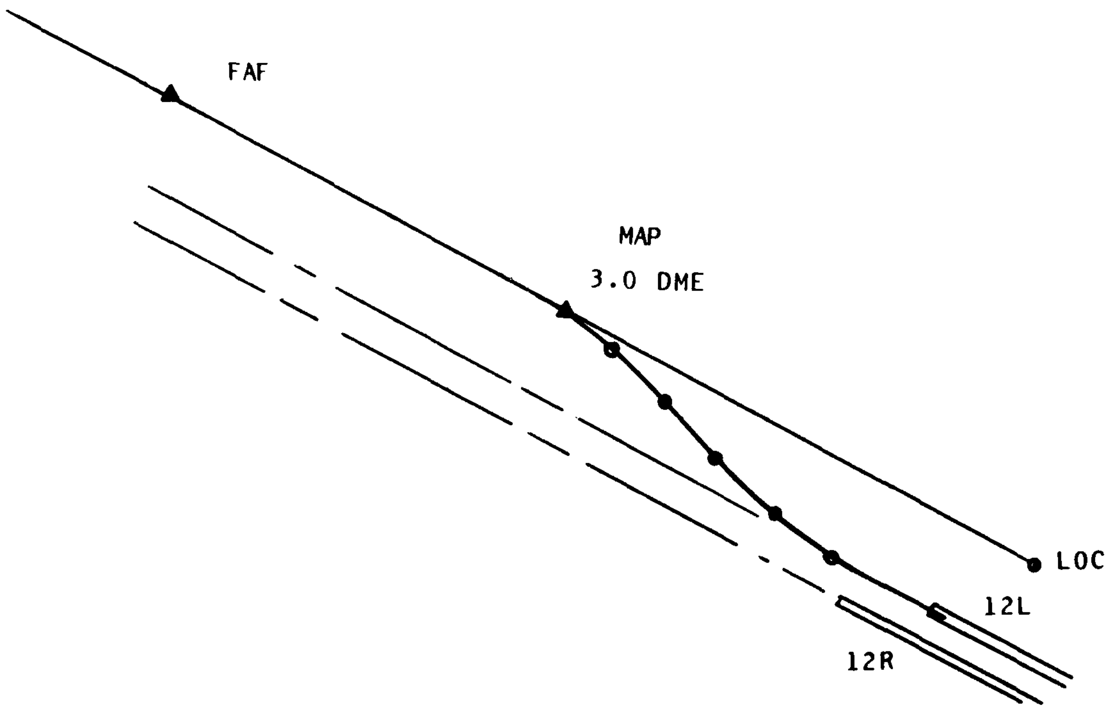
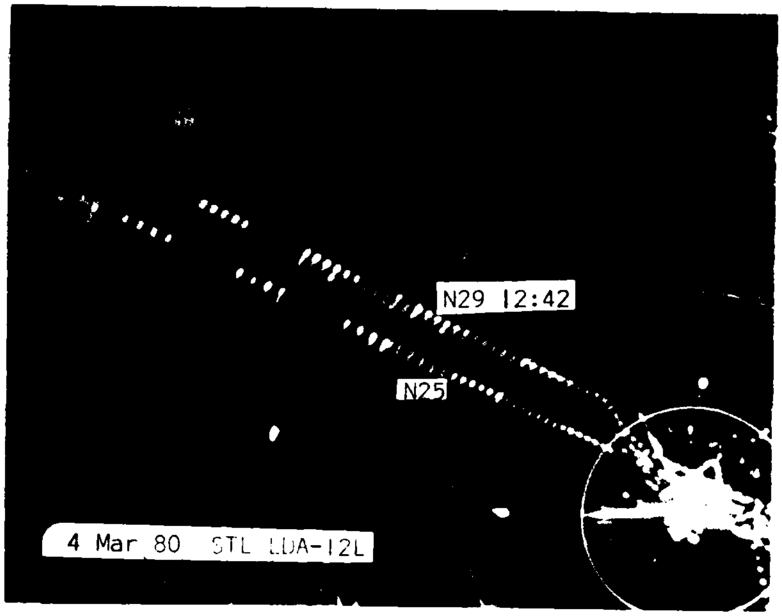
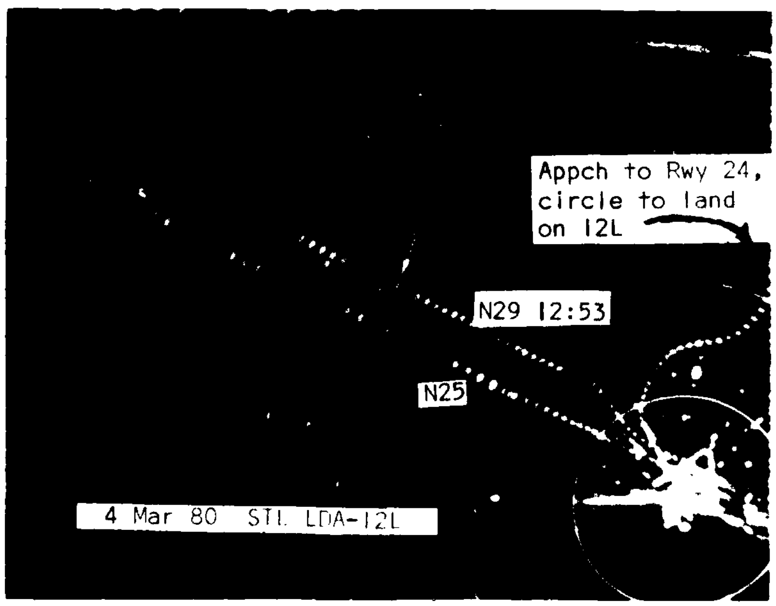


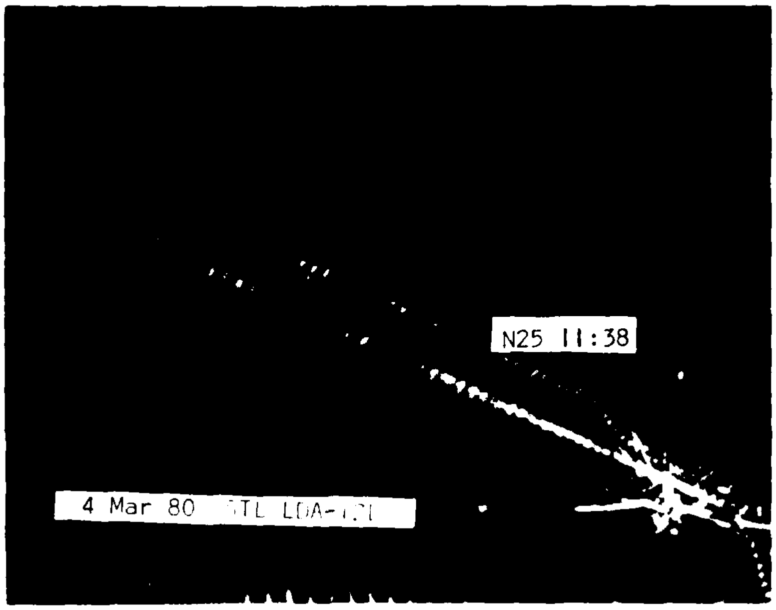
FIGURE 19. LEAD-IN LIGHTS INSTALLATION.

APPENDIX I

TIMED PHOTOGRAPHS OF APPROACH TRACKS


N29 12:42
N25
4 Mar 80 STL LDA-12L


Appch to Rwy 24,
circle to land
on 12L
N29 12:53
N25
4 Mar 80 STL LDA-12L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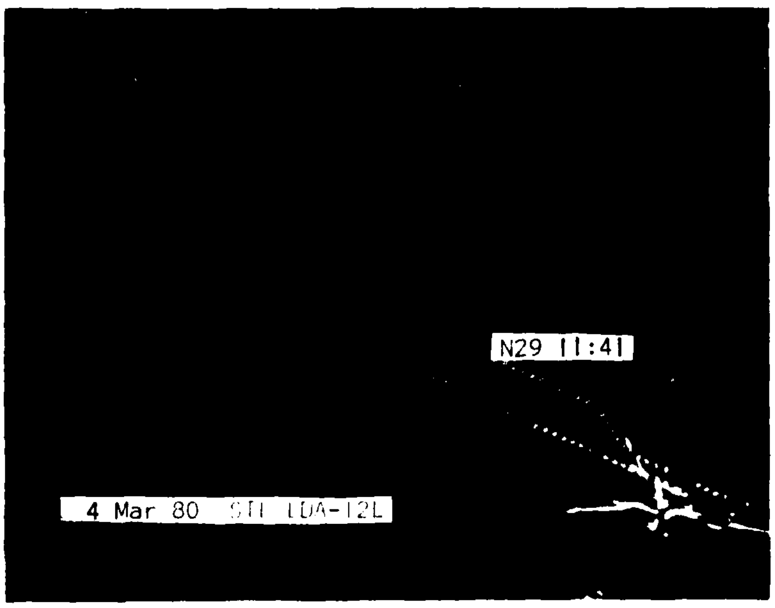
4 Mar 80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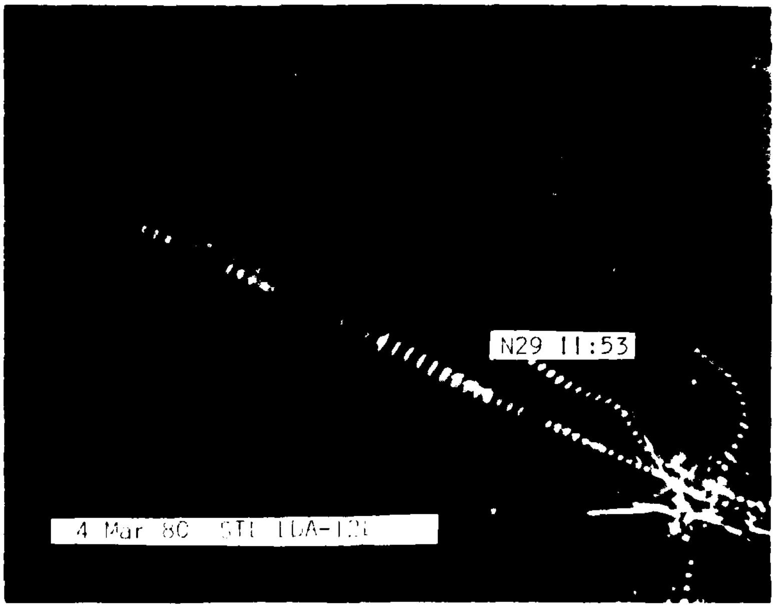
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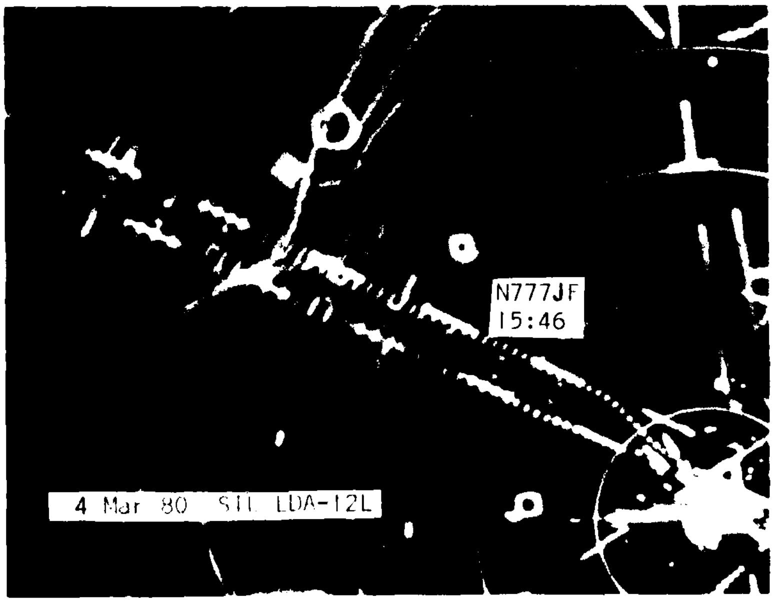
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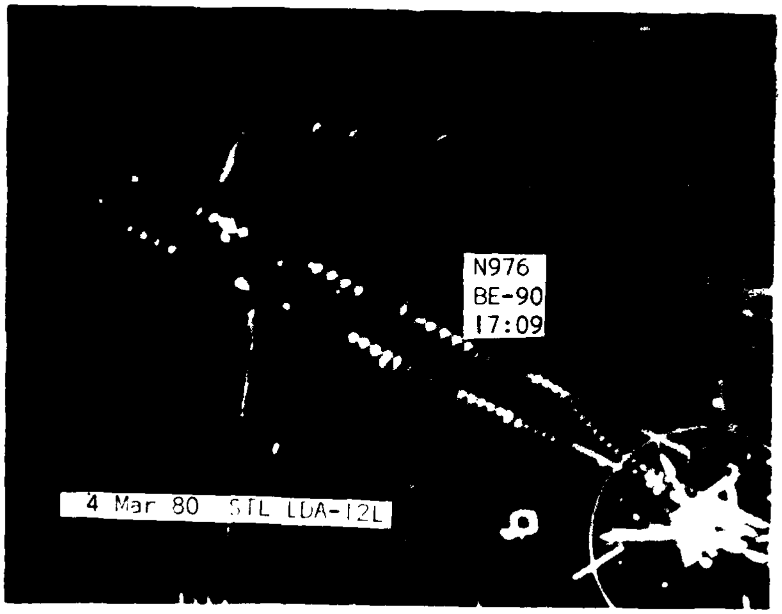
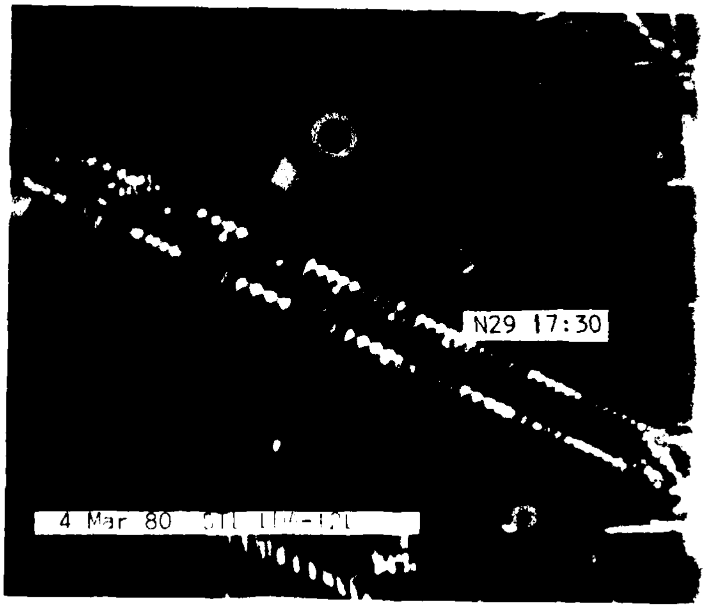
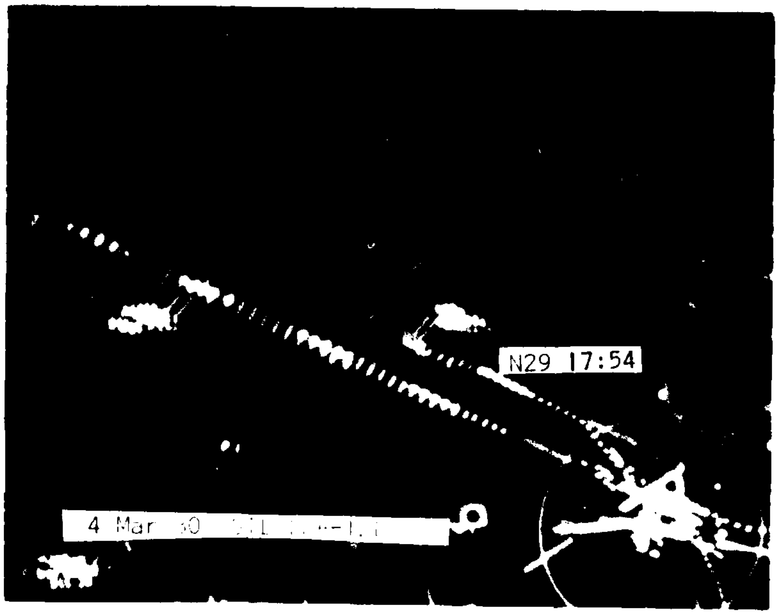
APPENDIX I



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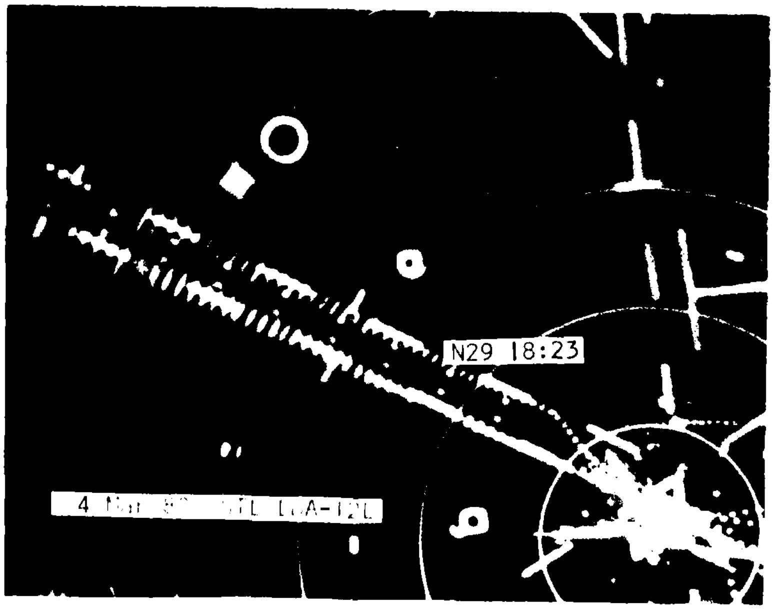
4 Mar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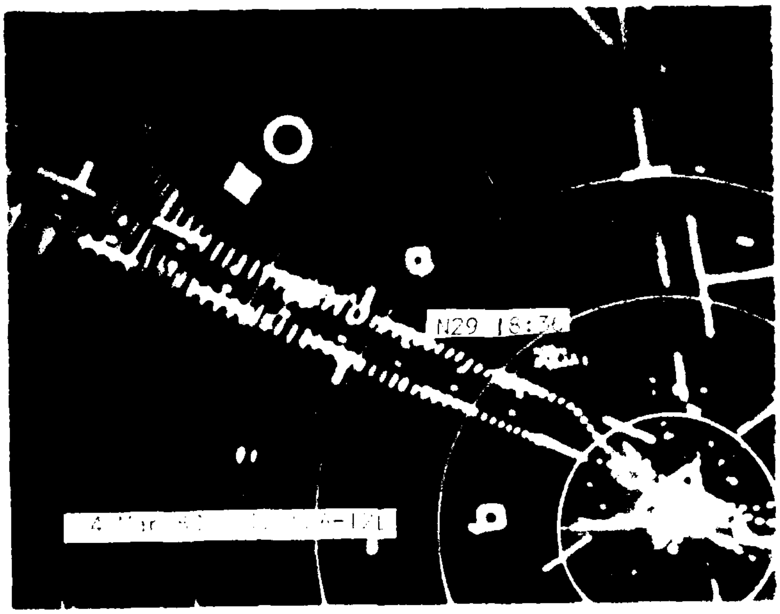
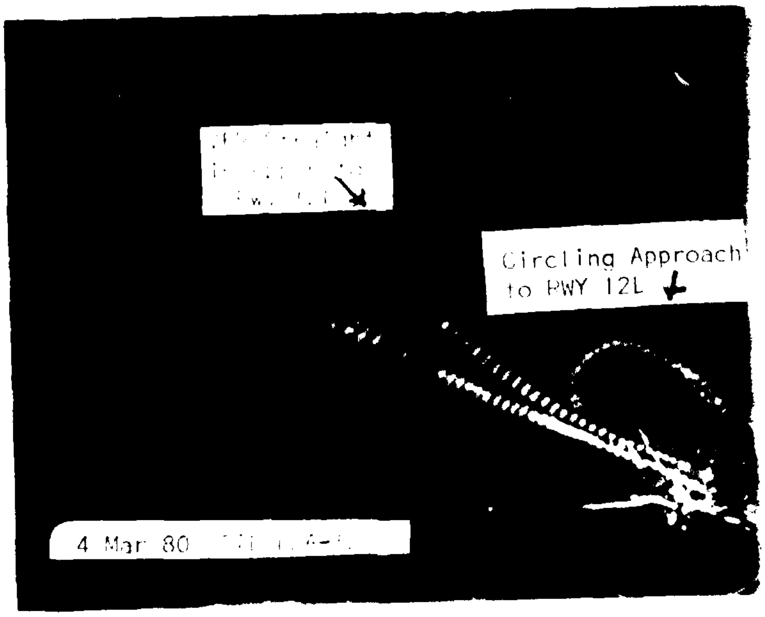
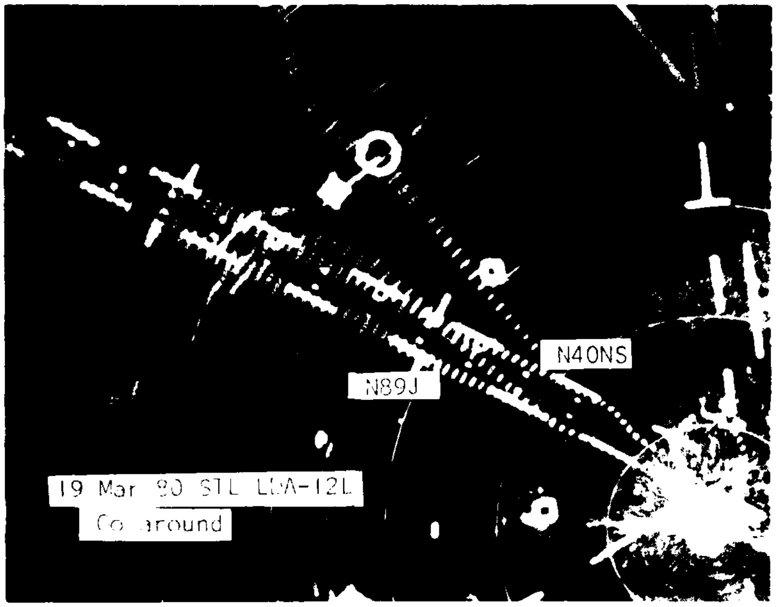
APPENDIX I



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N89J
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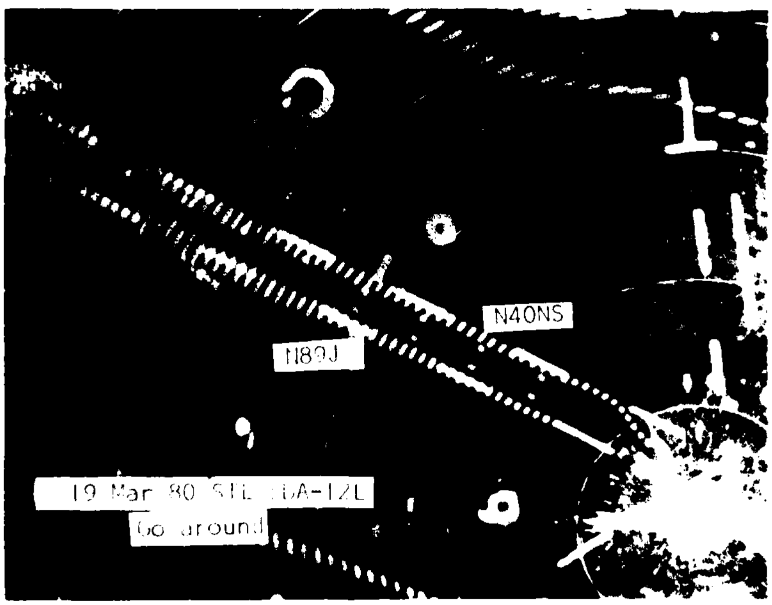
Go around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Go around

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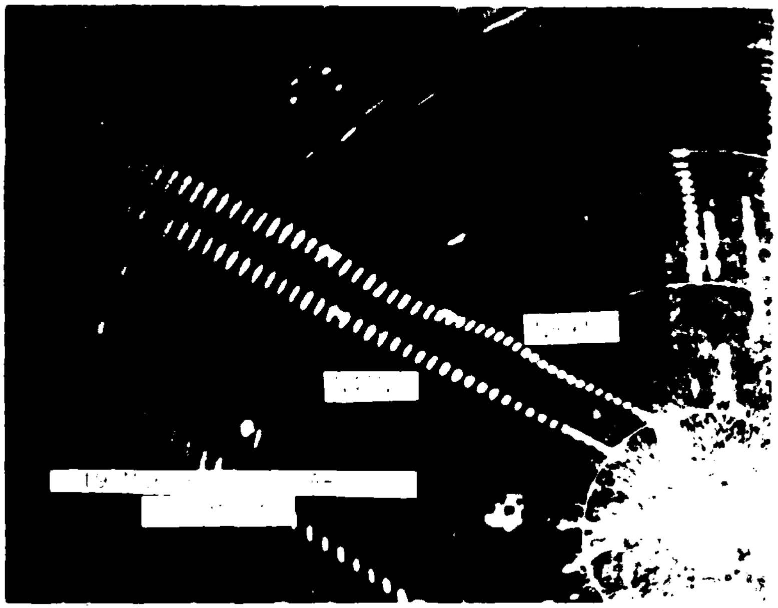

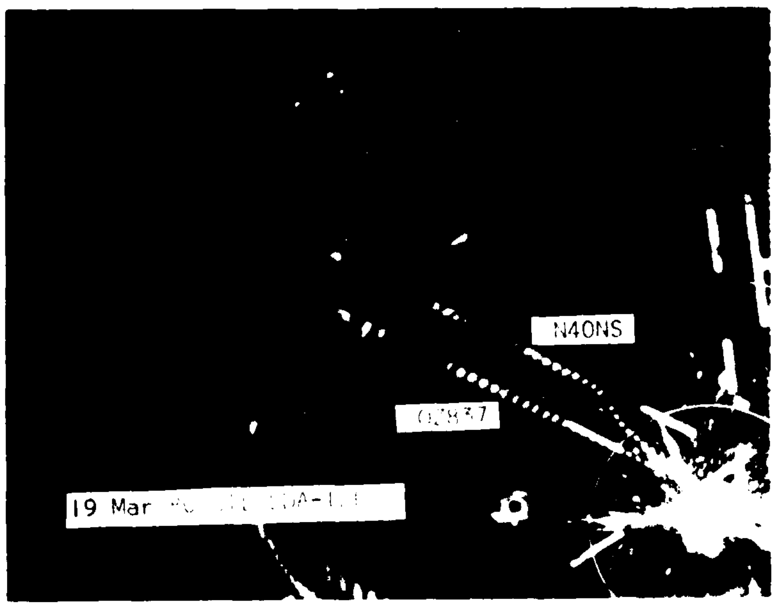

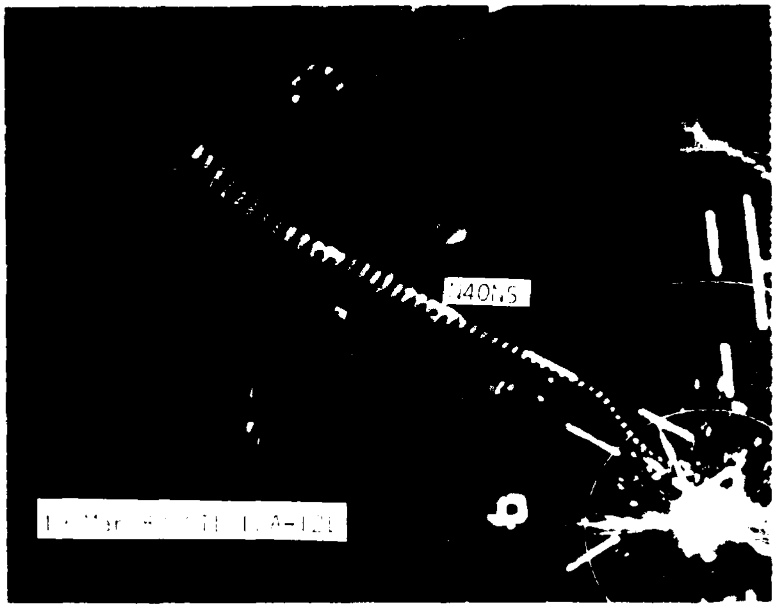
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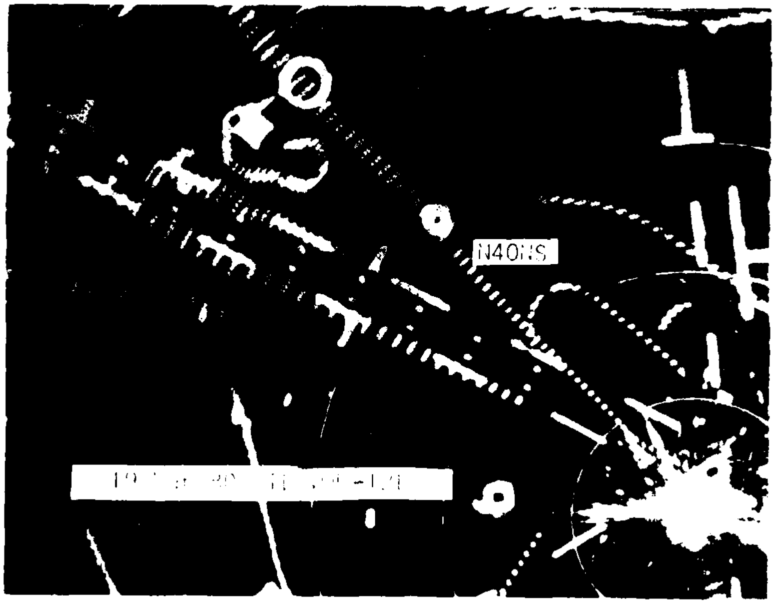
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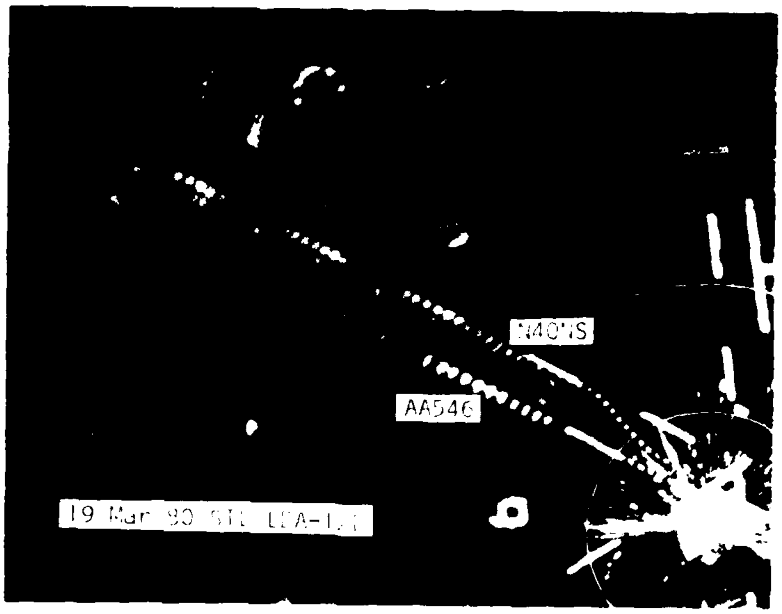

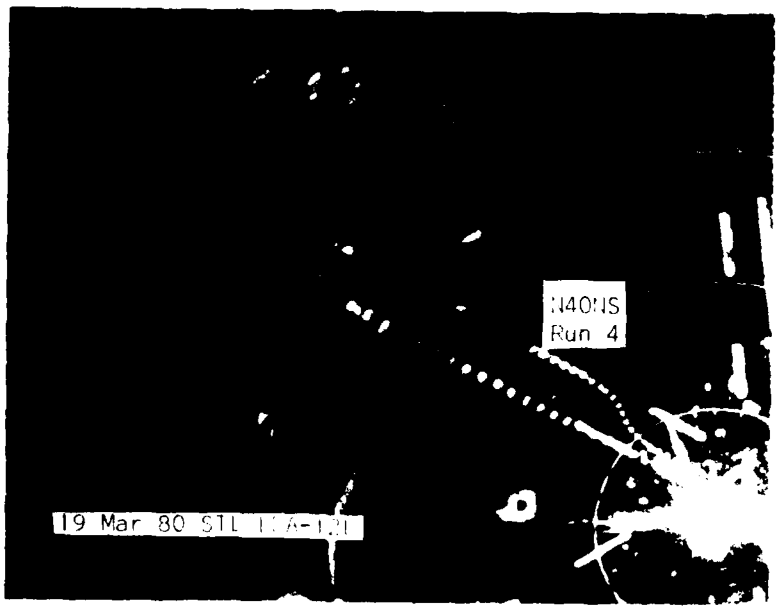

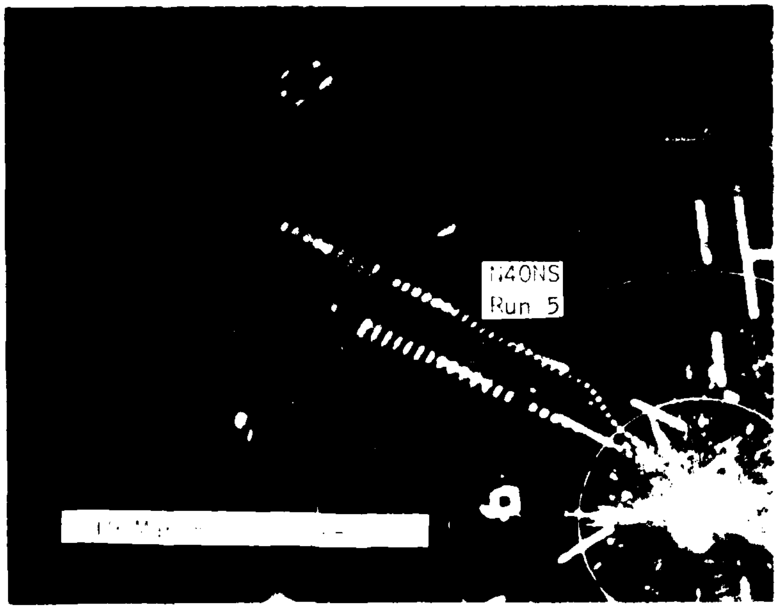
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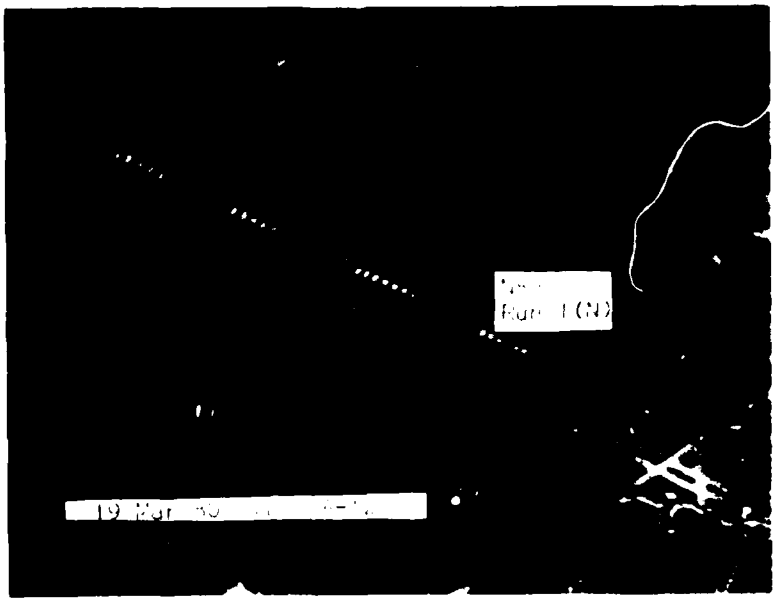
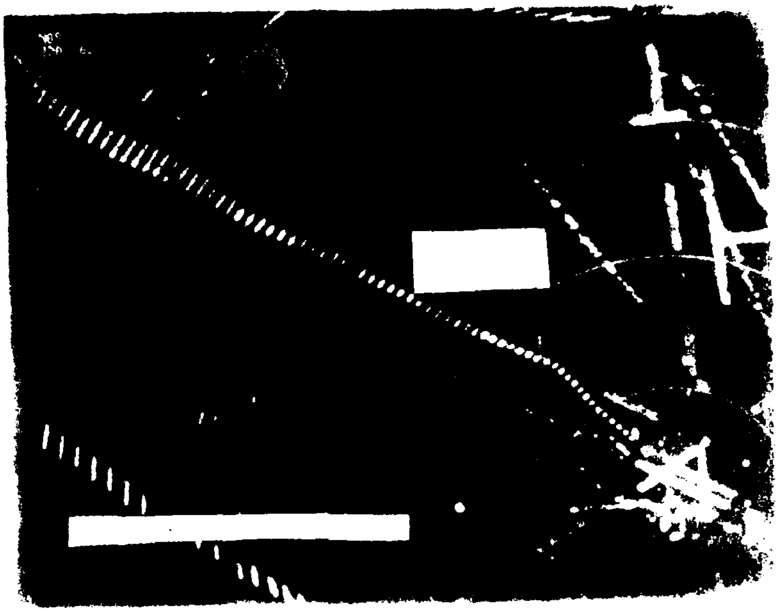
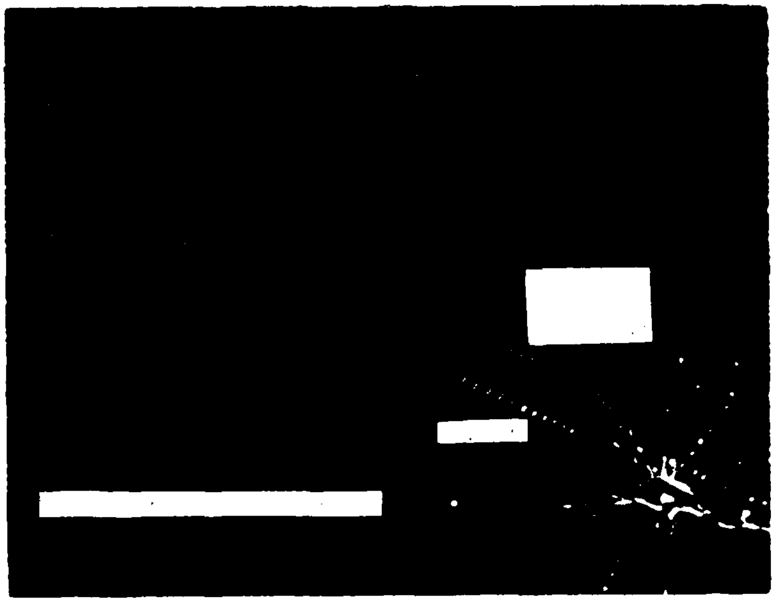
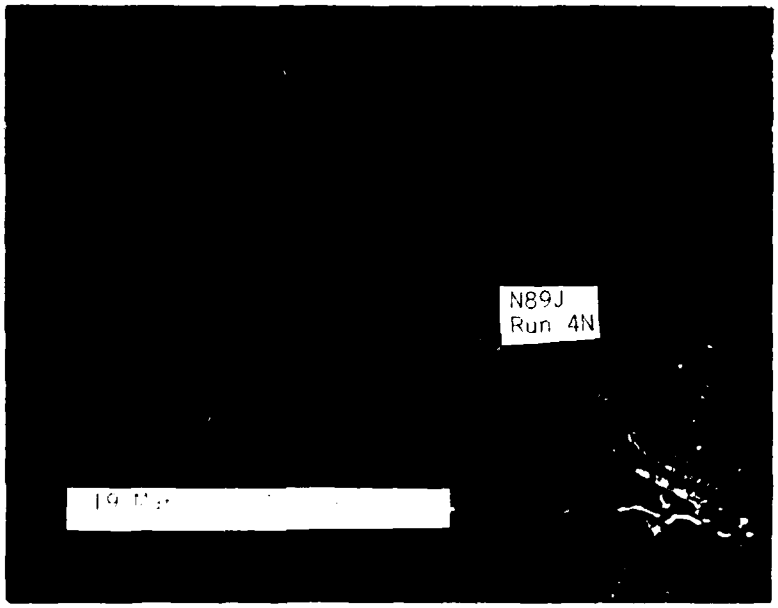

Run 1(N)

APPENDIX I



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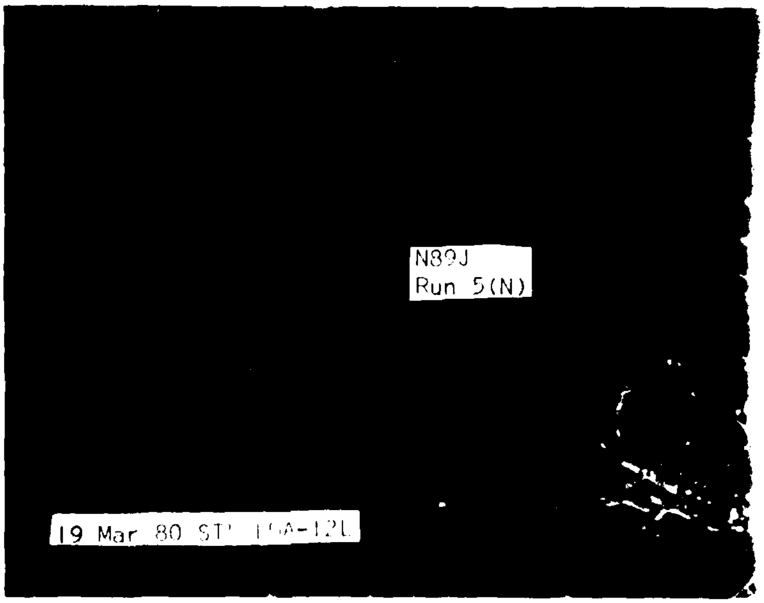
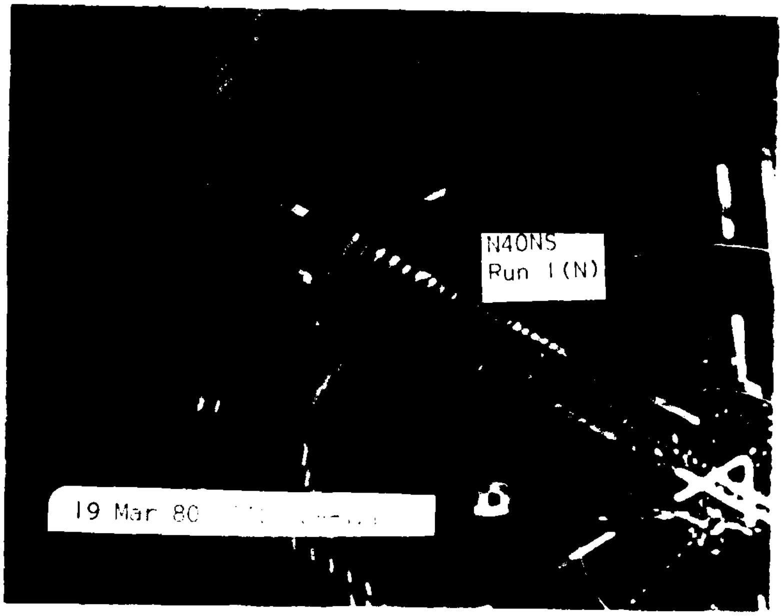
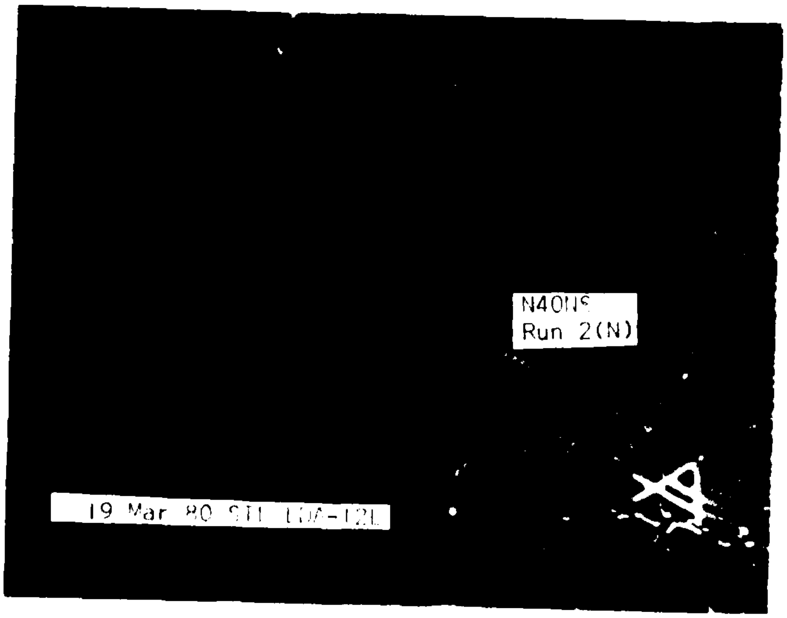
Run 4N

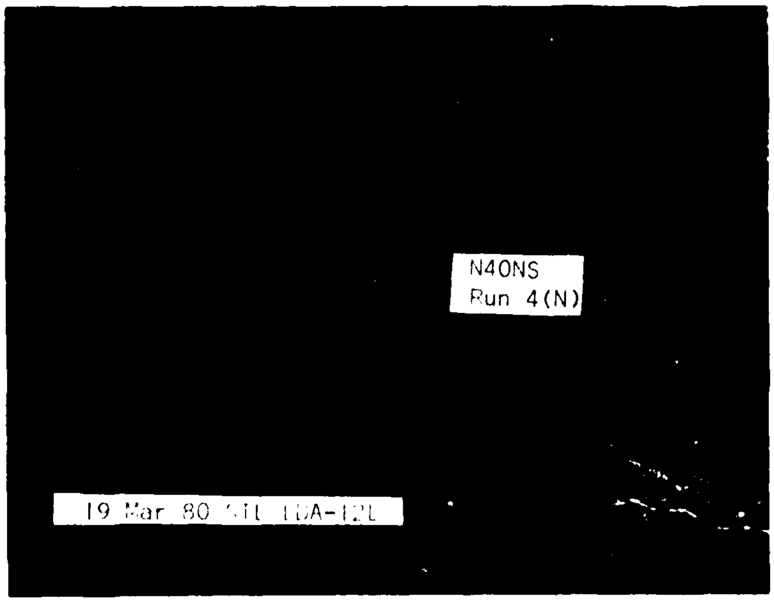

N89J
Run 5(N)
19 Mar 80

APPENDIX I






N40NS
Run 3(N)
19 Mar 80 STL LDA-12L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Run 4(N)
19 Mar 80 STL LDA-12L

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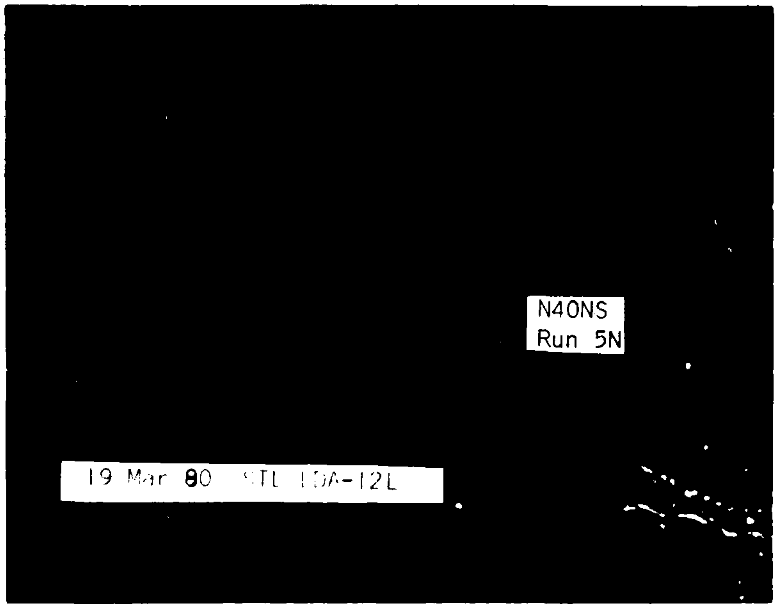
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Run 5N
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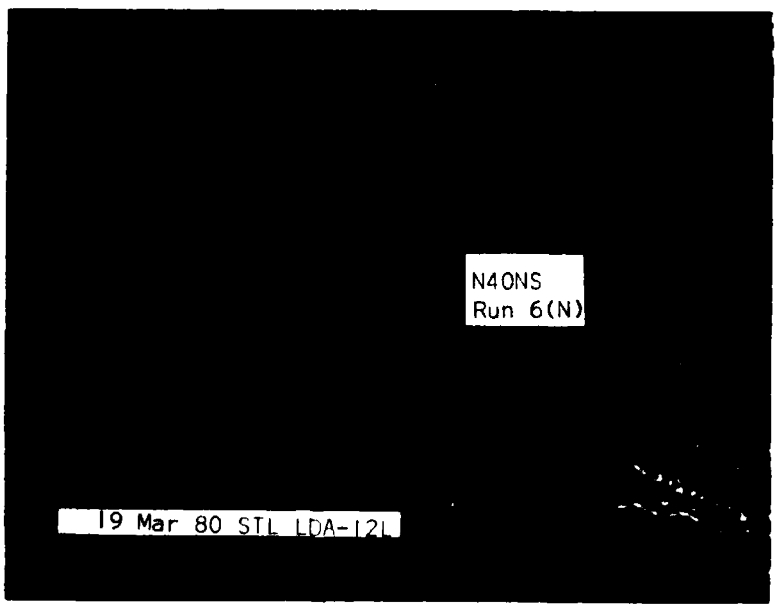
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Run 6(N)
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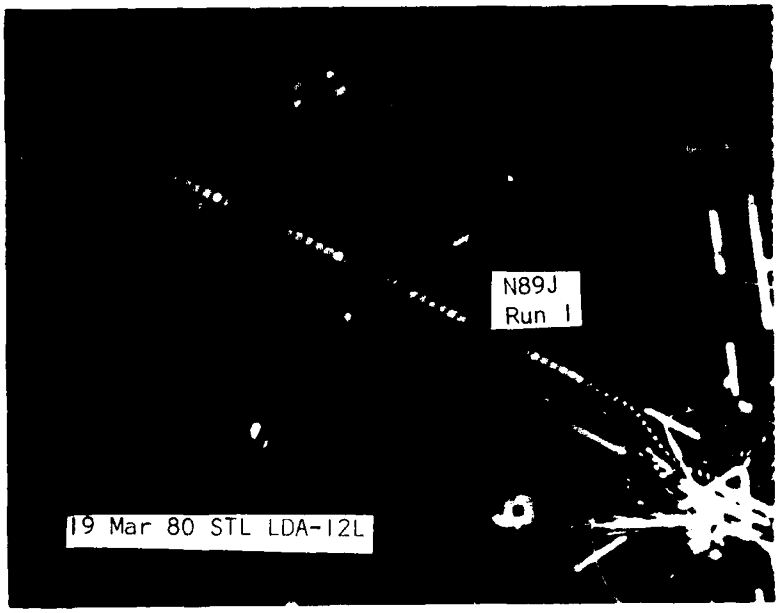
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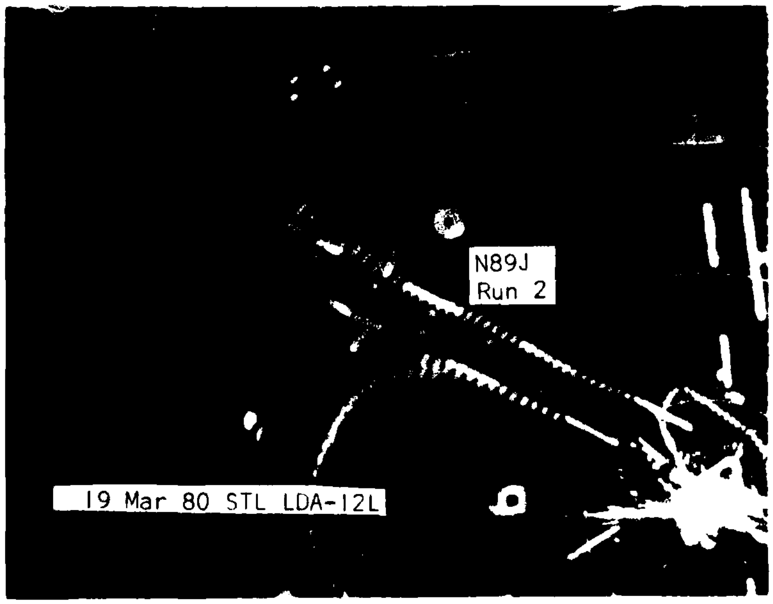
Run 1
19 Mar 80 STL LDA-12L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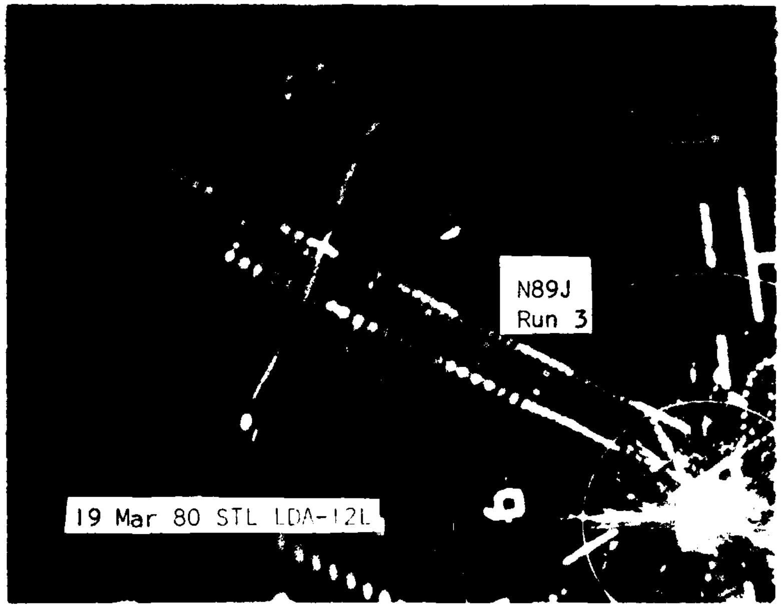
Run 2
19 Mar 80 STL LDA-12L

APPENDIX I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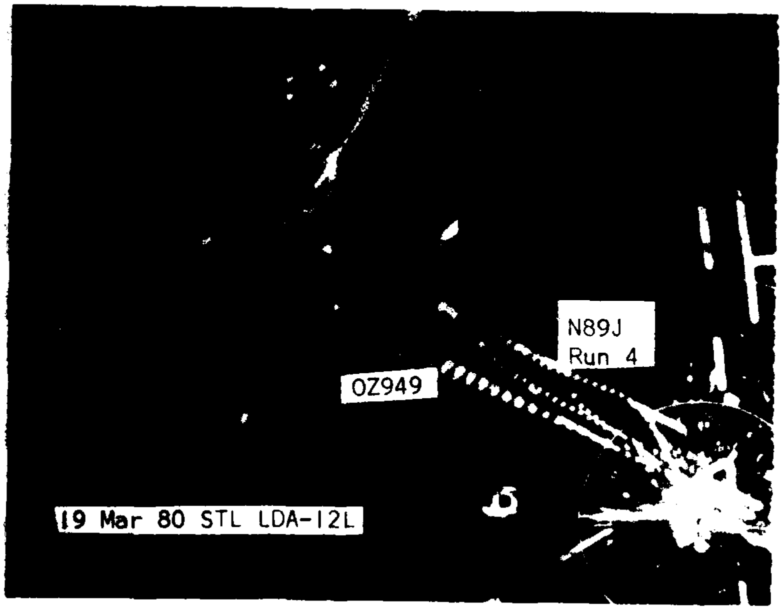
Run 3
19 Mar 80 STL LDA-12L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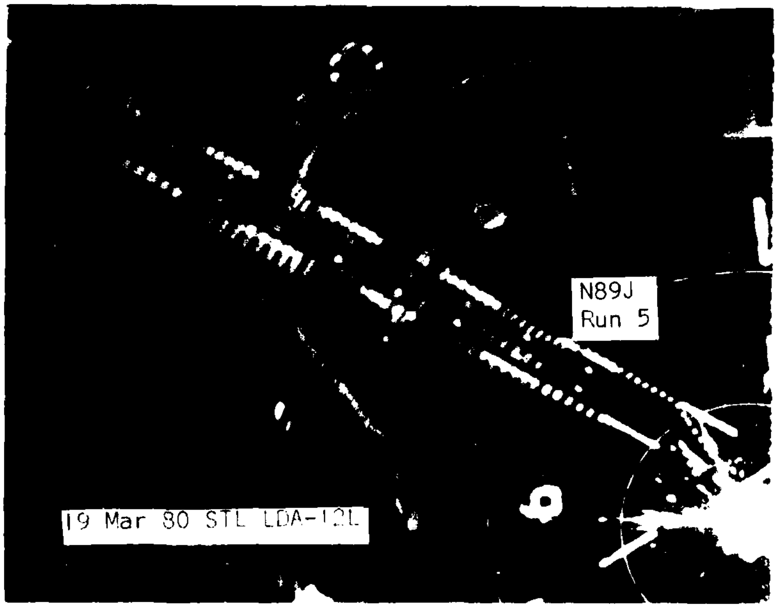
Run 4
OZ949
19 Mar 80 STL LDA-12L


N89J
Run 5
19 Mar 80 STL LDA-12L

APPENDIX II

PILOT QUESTIONNAIRES SUMMARY

PILOT QUESTIONNAIRE

Sidestep Procedure for STL

Rwy 12L LDA/DME (Sidestep Approach)

(Please check applicable items.)

Time

_ Night ____ Clg. ____
_ Day ____ Vis. ____

Aircraft Type ____________
Approach Speed ____ (Knots)

1. What was the first recognizable feature of the airport that was visible to you? Your distance from 12L?

	NM	
_ Airport Tower	_ 5.0	_ 3.0
_ McDon. Doug. Bldgs.	_ 4.5	_ 2.5
_ Arpt. Term. Bldgs.	_ 4.0	_ 2.0
_1 Air Guard Bldgs.	_ 3.5	_ 1.5
_ ATS Bldgs.		_ 1.0
_ Other (Please specify) ____		

2. What airport lighting was first visible to you? Distance from 12L?

	NM	
_ Airport Beacon	_ 5.0	_ 3.0
_ Appr. Lts. to 12R	_ 4.5	_ 2.5
_ REILS on 12L	_ 4.0	_ 2.0
_ VASI on 12L	_ 3.5	_ 1.5
_ Rwy Lts. _ 12R _ 12L		_ 1.0
_ Other ____		

3. At what distance from Rwy 12L did the VASI become useful during the sidestep?

	NM	
_ 5.0	_ 3.5	_ 2.0
_ 4.5	_ 3.0	_ 1.5
_ 4.0	_ 2.5	_ 1.0

4. How confusing was any other lighting (on or off the airport) which affected your determination of the location of Rwy 12L?

_ Very Confusing
_ Some Indecision
_ Not Confusing

Please specify the area of confusing lights (if applicable). ____

5. What type of lighting do you think would improve recognition of Rwy 12L farther out on the approach?

_ Omnidirectional Approach Lights (ODALS)
_ Medium Intensity Approach Lights (MALS)
_ Standard Approach Lights (ALS)
_ Runway Alignment Indicator Light (RAIL)
_ Lead-in Lights (LDIN)

6. What problems did you have in accomplishing the sidestep maneuver?

_ None
_ Overshot the turn by ____ feet.
_ Undershot the turn by ____ feet.
_ Not enough visual clues to line up with the runway.
_ Other (Please specify) ____

7. How difficult was the sidestep maneuver for you?

_ Very Easy _ Easy _ No Difficulty
_ Difficult _ Very Difficult

8. In your opinion, how low could minimums be set and still retain a safe approach?

MDA: _ 1500 _ 1000 _ 900
_ 800 _ 700 _ 600 _ 500

VIS (SM): _ 5.0 _ 3.0 _ 2.5 _ 2.0
_ 1.5 _ 1.0

Other (please specify) ____

9. Do you foresee any problem areas flying this approach at the minimums specified in 8?

_ No _ Yes If yes, what problems?

10. How many times per year do you fly into Lambert Field? ____

11. Pilot information:

_ Private _ IFR _ ATP
_ Commercial _ Multi-engine

Total Time ____ In Type ____
Total IFR ____

Write down any other information you deem pertinent to this approach.

APPENDIX II

A. Pilot Characteristics

1. Type of Certificate:

ATP	32 respondents
Commercial	3 respondents
Private	0 respondents
?	2 respondents

2. Instrument Rated:

Yes	35 respondents
No	0 respondent
?	2 respondents

3. Multi-Engine:

Yes	34 respondents
No	1 respondent
?	2 respondents

4. Pilot Experience:

Average Total Time	8,820 hours (range 1,500 to 17,000)
Average Instrument Time	1,350 hours (range 150 to 8,000)
Average Time in Type	2,510 hours (range 100 to 8,500)

5. Familiarity With Airport:

Less than 10 approaches per year	2 respondents
10 to 24 approaches per year	4 respondents
25 to 99 approaches per year	6 respondents
100 or more approaches per year	18 respondents

6. Comments:

In general, the participants in this evaluation were highly experienced pilots with a high degree of familiarity with the airport. These data cannot be generalized to low-time pilots or pilots unfamiliar with this airport.

B. Type of Aircraft Used in the Evaluation

1. Large Jet:

DC-9	7 respondents
727	4 respondents

2. Small Jet:

Sabreliner	15 respondents
Falcon	5 respondents
Jetstar	2 respondents

3. Propeller:

Miscellaneous type	5 respondents

C. Conditions on Approach

1. Time of Day:

Daylight	24 respondents
Night	9 respondents
?	4 respondents

2. Ceiling at Time of Approaches:
   - 1,000-2,000 feet.. 5 respondents
   - 2,001 to 9,999 feet.. 12 respondents
   - 10,000 feet or higher.. 20 respondents

3. Visibility at Time of Approaches:
   - 3-5 miles.. 11 respondents
   - 6-9 miles.. 10 respondents
   - 10 miles or more... 16 respondents

4. Comments:
   The approaches were conducted under a considerable variety of conditions representative of those that would be encountered making this approach.

D. General Findings

1. Problems in Conducting the Side-Step Approach:
   - No problems encountered.. 28 respondents
   - Not enough visual cues to line up with the runway.................... 4 respondents
   - Problems with VASI... 2 respondents
   - Picking up runway from other lights.................................. 1 respondent
   - Other.. 3 respondents

2. Difficulty of the Approach:
   - Very easy.. 19 respondents
   - Easy... 7 respondents
   - No difficulty.. 10 respondents
   - Difficult or very difficult.. 0 respondents
   - No response.. 1 respondent

3. Recommended minimums:
   - MDA: 500'.. 8 respondents
   - 600'... 14 respondents
   - 800'... 6 respondents
   - 1,000'... 8 respondents
   - ? .... 1 respondent

   - Visibility: 2.0 miles.. 16 respondents
   - 2.5 miles.. 5 respondents
   - 3.0 miles.. 14 respondents

4. Comments:
   Overall, the respondents report that the proposed approach creates no particular difficulty. Problems were noted only occasionally and in no cases did they make the approach difficult.

E. Item-by-Item Analyses

The overall findings for each item are presented unless the responses to the item differed according to the variable of type of aircraft flown, time of day, or familiarity with the airport. No other variables were found to have any effect on the answers to the questionnaire. Note that totals between analyses will not always be equal because not every respondent answered every item, and on occasion more than one alternative per item was checked.

Item 1a. First recognizable feature of the airport:

McDonnell Douglas Building	10 respondents
ATS Building	9 respondents
Airport Terminal Buildings	8 respondents
Airport Tower	4 respondents
Other	5 respondents

Comment: The three sets of buildings--McDonnell Douglas, ATS, and Terminal--account for 75 percent of the airport features first recognized by pilots.

Item 1b. Distance at which first feature recognized:

Less than 3.0 miles	8 respondents
3.0 or 3.5 miles	7 respondents
4.0 or 4.5 miles	6 respondents
5.0 miles or more	6 respondents

As a function of pilot familiarity with the airport:

	100 or more approaches per year	Less than 100 approaches per year
Less than 3.0 miles	6	2
3.0 or 3.5 miles	3	1
4.0 or 4.5 miles	0	1
5.0 or more	0	6

Comment: The overall distribution of responses shows that the distance at which airport features were first recognized varied considerably. When familiarity with the airport is taken into account, it shows that the less familiar pilots report the greater recognition distances. It is not clear why this is so. Perhaps the more familiar pilots were relying on DME measurement rather than estimation of distance; however, these data do not address this possibility.

There was a possible pattern between the feature first recognized, the distance at which it was recognized, and familiarity with the airport. The less familiar pilots who reported recognition at 5 miles or greater indicated either the ATS (N=3) or McDonnell Douglas (N=2) buildings as first seen. The more familiar pilots reporting first recognition within less than 3.0 miles of the runway reported a wider variety of features first recognized.

Item 2a. First airport lighting visible:

	Respondents Day	Respondents Night
VASI	11	1
Beacon	3	4
REILs	1	3
Other	4	1

Comment: The difference in visibility airport lighting between day and night is substantial. The light first seen during the day is usually the VASI, at night it is either the airport beacon or REILs.

Item 2a. (Continued)--

As a function of aircraft type:

	Large Jet	Small Jet	Propeller
VASI......................	4	10	0
Beacon....................	0	4	3
REILs.....................	0	4	0
Other.....................	5	2	1

Comment: Note that pilots of large jets did not attend to beacon or REILs as did small jet or propeller pilots.

Item 2b. Distance at which lighting sighted:

	Respondents	
	Day	Night
2.5 miles or less...	8	0
3.0 to 3.5 miles..	4	3
4.0 or 4.5 miles..	2	1
5.0 miles or more...	0	5

Comment: It is certainly not surprising that lights are visible at a greater distance at night than day.

Item 3. Distance at which VASI became useful:

	Respondents	
	Day	Night
Less than 2.0 miles...	6	0
2.0 to 2.5 miles..	11	3
3.0 to 3.5 miles..	2	5
4.0 to 4.5 miles..	2	0
5.0 miles or more...	2	1

Comment: The single VASI was not usually useful as currently set up until within 3-mile visibility range, particularly during daylight hours.

As a function of aircraft type:

	Large Jet	Small Jet	Propeller
Less than 2.0 miles.........	5	1	0
2.0 to 2.5 miles............	4	13	0
3.0 to 3.5 miles............	1	4	2
4.0 to 4.5 miles............	0	2	0
5.0 miles or more...........	1	1	2

Comment: Pilots of large jet aircraft had to be significantly closer to runway for present VASI to be of use than pilots of small jet aircraft. Useful distances were greatest for propeller-type aircraft.

Item 4. Confusion from other lighting:

	Large Jet	Small Jet	Propeller
Very confusing..............	2	0	0
Some confusion..............	3	0	0
Not confusing...............	5	21	5

Comment: In general the lighting at and around the airport is not confusing. The only pilots to report confusion were in large jet aircraft.

APPENDIX II

Item 5. Lighting improvement:

LDIN	32 respondents
ODALS	6 respondents
MALS	4 respondents
Other	5 respondents

Comment: Clearly, the pilots feel the most needed lighting improvement is the addition of LDIN lights. Other lights are probably in the "nice to have" category. The need for a canted VASI was mentioned twice.

Item 6. Problems in making approach:

	Large Jet	Small Jet	Propeller
None	5	18	5
Lack of visual cues to line up approach	2	2	0
Other	6	0	0

Comment: Basic findings already discussed. Problems generally stem from approaches with large jets. These problems are probably related to those noted on Items 4 (Confusion) and 5 (Needed lights).

Item 7. Difficulty in conducting approach:

	Large Jet	Small Jet	Propeller
Very easy	2	12	5
Easy	2	5	0
No difficulty	6	4	0

Comment: As the complexity of the aircraft increased, the ease of the approach decreased; however, in no case was the approach judged of any notable difficulty.

Item 8a. MDA

	Day	Night
500 feet	8	0
600 feet	5	8
800 feet	5	1
1,000 feet	5	0
or 1,500 feet	1	0

Comment: Some of those flying day approaches tended to feel that the approach could be lower than those who flew at night, while others felt the MDA should be higher.

As a function of type of aircraft:

	Large Jet	Small Jet	Propeller
500 feet	0	6	2
600 feet	4	7	3
800 feet	0	6	0
1,000 feet	7	1	0
1,500 feet	0	1	0

Comment: For the most part only the large jet pilots felt the MDA should be at 1,000 feet. All propeller pilots were comfortable at 600 feet.

Item 8b. Visibility minima:

	Large Jet	Small Jet	Propeller
1.0 miles....................	0	1	1
2.0 miles....................	0	12	4
2.5 miles....................	1	4	0
3.0 miles....................	10	4	0

Comment: As with MDA, pilots of large jet aircraft feel the need for more distance on approaches than do small jet or propeller pilots.

Item 9. Problems with minimums:
Already noted in general comments.

F. Other Comments From Pilots

At the end of the questionnaire, the pilots were asked for additional comments. Several pilots provided added statements, but only two matters were specifically mentioned by more than one respondent. Nine pilots emphasized the need for good lead-in approach lights. Another five pilots expressed a desire for a canted VASI on the left side of the runway. Otherwise, the comments covered a variety of issues, most of which have already been discussed in the item analyses.

G. Summary

These data taken together suggest that experienced pilots should have no difficulty accomplishing the proposed approach. Addition of lead-in lights should make the approach even easier.

APPENDIX III

REPORTS ON B-727, DC-9, AND N-265

B-727 EVALUATION, STL LOC/DME RUNWAY 12L

The B-727 (N27) departed Lambert at 0825 to start the evaluation of the STL LDA/DME (Offset) 12L approaches. Due to heavy traffic and using runways contrary to the flow of runway 12 FAA flights, a 45 minute delay resulted. The weather conditions for this flight were a measured 1600 foot ceiling with three miles visibility. The wind was 10-12 knots from the northwest (310-330°), with a temperature of 40 degrees and an altimeter setting of 30.06 inches.

N27 made the initial approach without the observer aircraft (Sabreliner N40NS) to assure feasibility of the approach procedure. The result was favorable and four more approaches were made, with N40NS flying in various longitudinal positions taking video tape pictures of N27 through the left cabin and cockpit windows while flying the ILS to runway 12R. N27 then landed to deplane one passenger, Mr. Gerry Gibson, AFO-210, who desired to view the approach from the control tower.

N40NS accomplished two LDA approaches, during the time N27 was on the ground, filming both approaches through the cockpit windshield. A landing was then made by N40NS to refuel.

N27 was flown on three more approaches prior to landing. Seven approaches were started at 3.0 DME and one at 2.4 DME. A total of eight approaches were accomplished by N27 and two by N40NS.

During the first approach filmed by N40NS, N27 was on the localizer and appeared to the left when at an altitude of 1700 ft. MSL. The aircraft did not appear to the pilots of the Sabreliner to be close when the two aircraft were 4537 ft. apart. As N27 commenced the sidestep maneuver, the turn was hardly noticeable from N40NS. Similarly, the turn to line up with runway 12L was so slight as to go almost unnoticed. It was only apparent that N27 had altered its course very slightly. N27 did not appear to be too close to N40NS when N27 was lined up with runway 12L. All four approaches gave the same impression to personnel flying in N40NS.

The first approach was observed with N27 approximately one-half mile ahead of N40NS. The second and fourth approaches had both aircraft side by side with the third approach having N27 approximately one-half mile behind N40NS.

The two approaches in N40NS made to Runway 12L were considered easy to accomplish using the sidestep maneuver. A maximum bank angle of 15 degrees was used, with approximately a 3 1/2 degree per second roll rate on both turns. An intercept angle of 30 degrees provided a good rate of lateral translation for lineup with the extended runway centerline at a sufficient distance (approximately one mile) to maintain a stabilized approach.

The first approach was made from the Missed Approach Point (MAP) at 2.4 DME while the second was made from 3.0 DME.

It was noted on both approaches that the VASI was visible at 3.0 DME and throughout the remainder of the approach, but the REILs were not visible until after the sidestep maneuver had begun. In fact, they were not visible in the minimum existing daylight weather conditions until the second turn to line up with the runway had been started. The runway environment was adequately visible at 3.0 DME, but the runway itself could not readily be distinguished.

The override radar system was not available for the initial testing on 2-23-80 so that simultaneous approaches could not be flown. N40NS did descend in VFR conditions from the minimum vectoring altitude (MVA) to the MDA used by N-27 on the LDA/DME approach to facilitate obtaining the required video taping of the sidestep maneuver.

It was determined that tracking data for the sidestep maneuver was impossible to obtain. The radar site is located approximately three miles south of Lambert Field and an aircraft below 600 AGL within two to 2 1/2 miles of the approach end of runway 12L is out of the line of sight of the radar.

Also, the camera used to video tape the approaches through the cockpit windshield of N-27 was found to be defective. As a result, only one approach, at night, was obtained when we used another camera to plug in the monitor in the passenger cabin.

Evaluation of the Night Approaches at STL

N-27 departed Lambert Field at 1805 CST on 2-23-80 to conduct six approaches to runway 12L using the LDA/DME (Offset Sidestep) approach. N40NS was not used for the night approaches.

The weather conditions for this flight started out with a 1600 ft. overcast ceiling and 5 miles visibility in haze. It later improved to 2000 ft. and 7 miles in haze. The wind was from the northwest (310-330°) at 10 knots.

Each approach was flown by a different pilot and the six approaches were completed by 1930 CST.

All approaches were observed to be accomplished with precision while in the landing configuration and in a stabilized descent condition using the VASI.

On all approaches the VASI was visible at the greatest distance. It was observed on the last approach at 8 DME. The REILs were not visible until less than 3 DME on any of the approaches.

Two approaches were made when the approach lights to runway 12R were illuminated. There was no confusion regarding the other runway, but all pilots were familiar with Lambert Field. Unfamiliarity could cause confusion.

Results of the Night Approach Evaluation

The comments relating to the day approaches are also valid for the night approaches, although the VASIs are visible at a greater distance than during the daylight hours.

Results of the Evaluation of Daylight Approaches to Runway 12L at STL

It is apparent the present visual lighting aids to Rwy 12L are not adequate for this approach procedure under the minimum weather conditions specified on the LDA/DME (Sidestep) Rwy 12L approach plate. The VASI is visible and apparent if the pilot is familiar with the airport. The REILs are not visible while on the localizer and are not seen until starting the turn in to line up with the runway centerline on 12L.

The approach plate would be somewhat confusing to a pilot who had not heard of this type approach and therefore needs to be revised. The execution of the sidestep maneuver is relatively easy to accomplish without an undershoot or overshoot.

B-727 DATA

APPROACH NUMBER	DME DISTANCE (NM)	BANK ANGLE 1st/2nd	ROLL* RATE (°/Sec.)	SPEED (Knots)	MAXIMUM VERTICAL SPEED (Ft./Min.)	HEADING
DAY						
1	3.0	16°/10°	3.2	135	900	120°
2	3.0	14°/14°	3.0	145	1000	123°
3	2.4	12°/10°	4.5	135	800	124°
4	3.0	15°/10°	5.0	138	850	120°
5	3.0	10°/10°	3.0	135	1000	120°
6	3.0	10°/8°	2.0	140	900	130°
7	3.0	18°/12°	6.0	140	900	120°
NIGHT						
1	3.0	15°/10°	4.0	140	1000	Unreadable
2	3.0	12°/10°	3.5	138	1000	Unreadable
3	3.0	22°/10°	4.3	140	1000	120°
4	3.0	18°/12°	5.0	140	1000	120°
5 & 6	Camera was used for exterior view.					

*NOTE: All roll rates on the turn-in to the runway centerline were under 4°/sec.

STL LDA/DME APPROACH USING DC-9 (N-29)

The DC-9 made day and night approaches using the new LDA/DME concept procedure. The weather for the day approaches, executed between 1140 and 1300 on March 4, 1980, was 5,000' broken to overcast with 10 miles visibility in haze. The wind was from 170 degrees at 10K.

Six day approaches were flown, one by each of the participating pilots. Two approaches were executed from the present missed approach point of 2.4 miles, two from 2.6 miles, one from 2.8 miles and one from 3.0 miles DME. The approaches started from 2.4 NM DME showed the pilots using bank angles of 25 to 30 degrees with 6 to 8 degree per second roll rates. The bank angles and roll rates decreased as the distance from the localizer increased to commence the approach.

At 3 NM DME, a 20 degree bank angle with a roll rate of 4 degrees per second was used and the pilot commented that it was almost a leisurely approach.

Six night approaches were flown between 1730 and 1900. Weather conditions were 1500 feet broken with 6 miles visibility in fog with a wind from 160 degrees at 8 knots. The first three approaches were flown starting at the 2.4 NM DME missed approach point by the pilots flying the more distant approaches on the morning flight. The results were similar, in that bank angles used were from 20 to 25 degrees with roll rates of 4.5 to 10 degrees per second.

The next three approaches were flown from the 3.0 NM DME fix by the pilots who used the 2.4 NM DME missed approach point on the morning flights. The weather conditions had deteriorated to 1200 feet overcast with 5 miles visibility in fog. Bank angles used on these approaches were 15 to 20 degrees with roll rates of 3.7 to 5 degrees per second.

All approaches commencing at the 3.0 NM DME fix were satisfactory, from a passenger comfort viewpoint, and the pilots did not feel rushed during the maneuvering required for accomplishment of the approach.

During the daylight approaches, neither the VASI nor the REILs were visible until after the 3.0 NM DME had been passed. The REILs became visible while on the intercept angle to runway 12L and the VASI just after the turn started toward the centerline.

When the approach was made from the 2.4 NM DME missed approach point, the VASI and REILs were not visible until starting the turn onto the runway centerline.

The rotating beacon was the first recognizable light in view on the night approaches. The VASI became visible at about 6.0 DME with the REILs visible at 4.0 DME. When the approach commenced at the 2.4 DME, the VASI went out of sight after the first turn and did not reappear until the airplane was about to make the second turn onto the runway centerline. Observation of all the approaches indicated no tendency to overshoot the runway centerline.

DC-9 DATA

APPROACH NUMBER	DME DISTANCE (NM)	BANK ANGLE 1st/2nd	ROLL* RATE (°/Sec.)	SPEED (Knots)	MAXIMUM VERTICAL SPEED (Ft./Min.)	HEADING
DAY						
1	2.4	25°/15°	8.0	138	900	120°
2	2.4	30°/16°	6.0	138	820	120°
3	2.6	25°/15°	8.6	130	750	120°
4	2.6	15°/12°	2.0	135	800	121°
5	2.8	25°/10°	10.0	130	750	121°
6	3.0	20°/10°	4.0	130	750	121°
NIGHT						
1	2.4	25°/15°	10.0	140	900	124°
2	2.4	23°/20°	4.5	140	MAP	122°
3	2.4	20°/12°	4.5	130	700	125°
4	3.0	15°/10°	3.7	130	800	122°
5	3.0	20°/12°	5.0	125	800	122°
6	3.0	15°/10°	4.0	125	820	123°

*NOTE: All roll rates on the turn-in to the runway centerline were under 4°/sec.

REPORT ON THE STL LDA/DME RUNWAY 12L APPROACH USING N-265 (N40NS)

Day and night approaches were flown on 3-18-80 using the LDA/DME runway 12L approach. The weather was clear with winds of 10-12K from 170 degrees.

The first two approaches were simulated go-arounds from two positions in the approach maneuver (Figure 1). The pilot was on an intercept path of 30 degrees after the first turn from the localizer track when an IFR condition was imposed upon him. His response was to make a left turn to 113 degrees (15° left of a parallel course to the runway) and start a climb. The still photo track (Figure 2) indicates the aircraft stayed on the left side of the runway centerline on the go-around. Missed approach instructions were then followed.

The second go-around was initiated on the second approach after the turn was started to line up with the runway centerline while the aircraft was descending on the VASI glidepath. The pilot continued the left turn to approximately 113 degrees while starting a climb. The gear and flaps were retracted and the missed approach procedure was used. Again, the still photo track (Figure 3) indicated the aircraft was never to the right side of the runway 12L centerline.

Six approaches were then flown. The first approach was from the 2.4 DME MAP with the rest from the 3.0 DME MAP. The roll rate was 7.2 degrees per second on the first approach, exceeding the specified maximum of 5.5 degrees per second. One of the five remaining approaches from 3.0 DME exceeded the maximum roll rate by 2.5 degrees per second.

The six night approaches commenced from the 3.0 DME MAP and all approaches were satisfactory.

Bank angles used on the night approaches tended to be less than in daylight conditions and the roll rates lower. As can be seen in Figure 4, the bank angles used on the night approaches were 12 to 15 degrees, in comparison to the 15 to 20 degrees used during daylight approaches. Similarly, roll rates at night ranged from 2.5 to 4.8 degrees per second while the roll rates during the day were from 3.5 to 8 degrees per second.

The difference relates to the visual illusion of the runway being closer during daylight conditions, hence the imaginary requirement for a steeper, faster turn. As during the DC-9 and B-727 testing, the bank angles and roll rates were considerably less on the second turn to line up with the runway centerline.

None of the approaches were uncomfortable to the pilots or passengers even though the specified acceptable roll rate was exceeded on two of the approaches.

Various minimum descent altitudes (MDAs) were used on both day and night approaches, ranging from 1140 to 1300 feet (597 to 757 feet, height above touchdown (HAT)). One thousand two hundred feet down to 1140 feet MDAs appeared to be more acceptable during daylight hours, but 1300 feet was better at night. The reason for this apparent contradiction is that the VASI can be seen further from the runway at night and at 1300 feet the aircraft approaches the VASI glidepath further out which allows a longer stabilized descent to the runway.

During daylight hours, the VASI could not easily be seen beyond approximately the 2.3 DME point; therefore, a lower MDA allowed the aircraft to be below the VASI glidepath longer until it could be seen. The addition of a VASI on the left side of runway 12L, aimed at the 3.0 DME MAP, would be necessary primarily for the daylight approaches.

The approaches flown in N40NS reinforced the results of the tests flown in the DC-9 and B727.

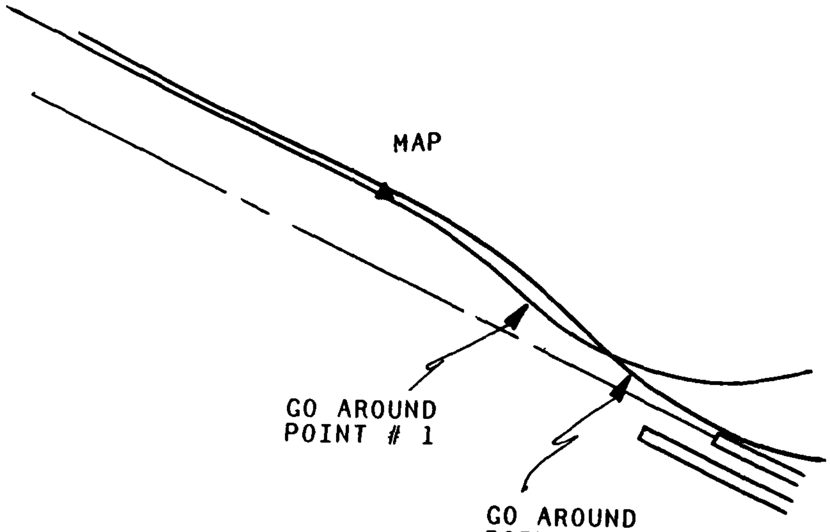


FIGURE 1.

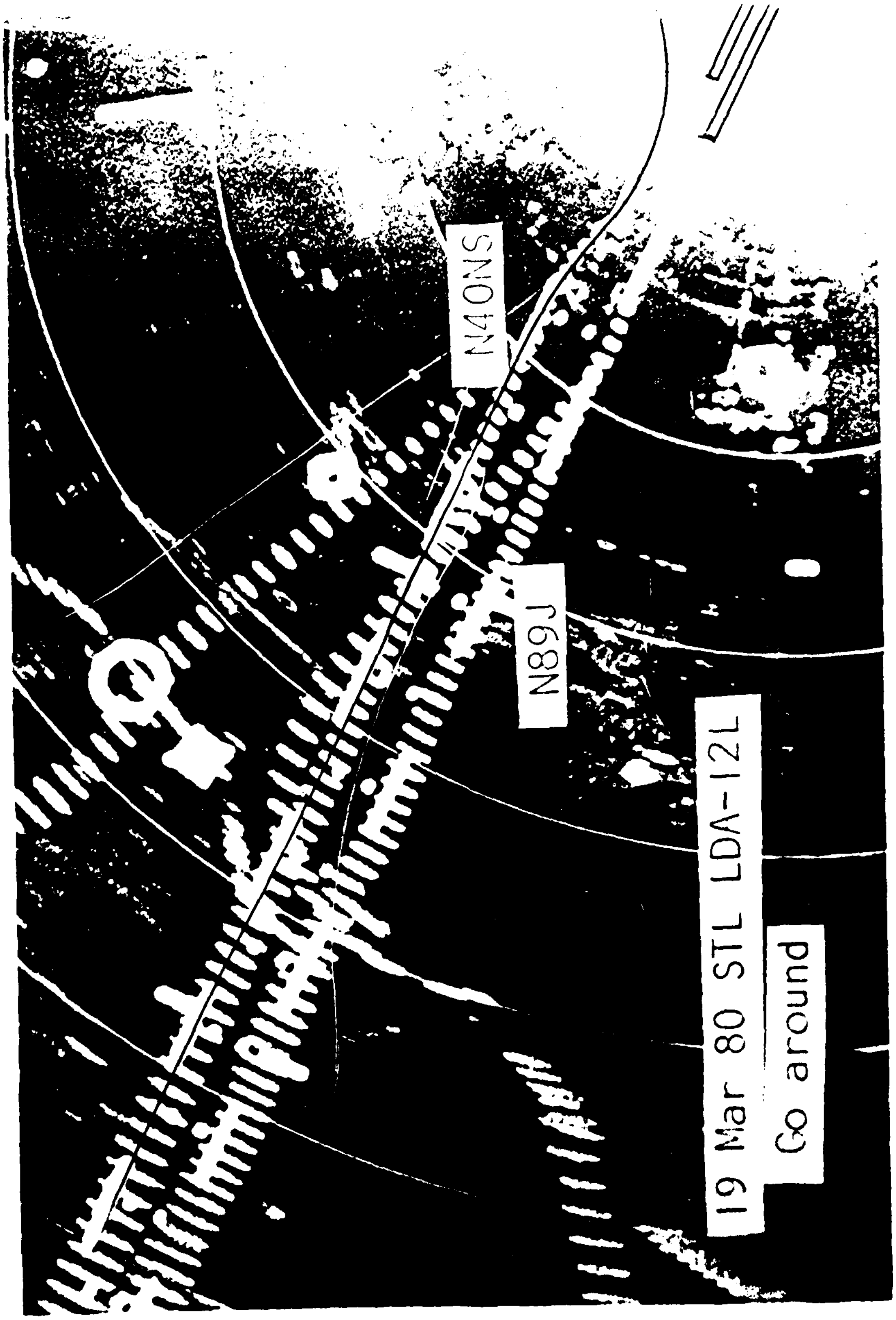


FIGURE 2.

APPENDIX III

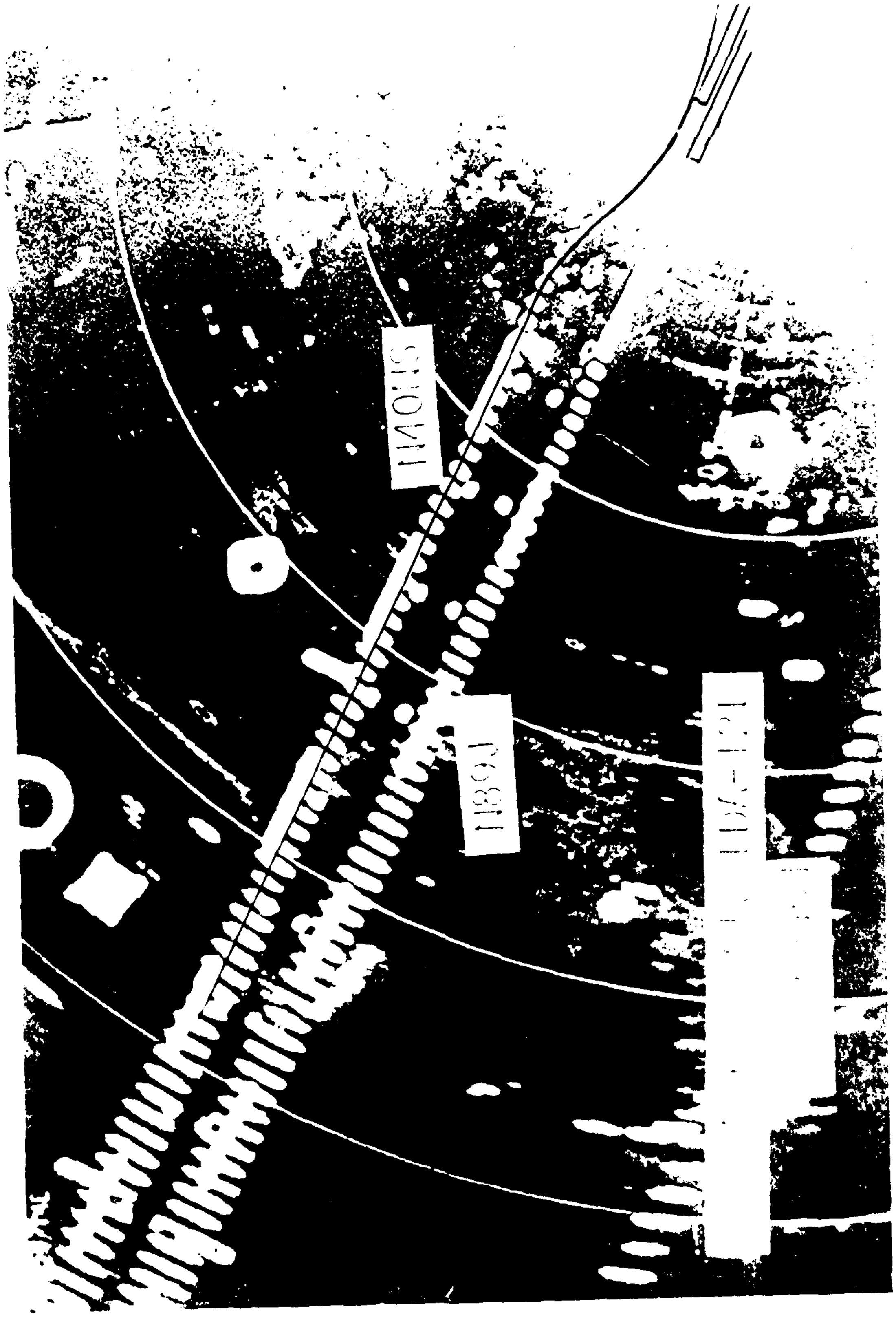


FIGURE 3.

N-265 DATA

APPROACH NUMBER	DME DISTANCE (NM)	BANK ANGLE 1st Turn	ROLL RATE (°/Sec.)	SPEED (Knots)	MAXIMUM VERTICAL SPEED (Ft./Min.)	HEADING
DAY						
1	2.4	18°	7.2	130	700	122°
2	3.0	15°	6.0	130	800	123°
3	3.0	20°	8.0	125	800	122°
4	3.0	15°	3.9	120	800	123°
5	3.0	18°	5.5	120	1000	121°
6	3.0	15°	3.5	120	800	121°
NIGHT						
1	3.0	12°	3.0	125	700	125°
2	3.0	12°	2.5	125	800	128°
3	3.0	15°	3.3	120	800	129°
4	3.0	15°	2.7	120	800	131°
5	3.0	15°	3.5	120	750	130°
6	3.0	15°	4.8	120	800	130°
DAY GO-AROUND						
1	2.0	20°	6.2	140		145°
2	1.7	20°	8.3	136		130°

FIGURE 4.

APPENDIX III

On March 4, 1980, three STL LDA/DME RWY 121 approaches were conducted to Lambert-St. Louis International, St. Louis, MO, in Cessna, CE-500, N-25. The flight crew consisted of Roger A. Baker, AFO-560, pilot in command and Keith C. Thamer, AAC-953C, second in command.

During the approaches the aircraft was radar vectored by St. Louis approach control to intercept the localizer outside of POTSE intersection at 3000 feet MSL. Once the localizer was intercepted, the aircraft was descended to 2100 feet MSL, and the indicated airspeed was reduced to 145 KIAS. After passing POTSE intersection (FAF) the aircraft was descended to 1140 feet MSL (MDA).

At 2.4 DME the second in command informed the pilot in command of DME position and the pilot in command switched from instrument to visual references, maintained 1140 MSL and 145 KIAS and initiated right-left "S" turn to line up with Runway 12L. The bank angle and roll rates were approximately 30° and 3 to 4° per second.

The VASIs were observed as red on red at the 3.0 DME point by the second in command; however, the pilot in command did not have visual contact with the VASIs until the second turn of the "S" turn and a 1.7 DME indication. At this point the airspeed was reduced and descent to the runway was accomplished.

For the CE-500, the 145 KIAS was some Ref + 40 KIAS and was not a simple maneuver. Flying a normal reference at 2.4 DME (MAP) would make this approach very simple.

Report on daylight evaluation flights at St. Louis, on March 18 with Aircraft Owners Pilot Assocation (AOPA) pilots, and Cessna 421 aircraft.

General. This evaluation of the LDA DME (sidestep) runway 12L, Lambert - St. Louis International, St. Louis, Missouri, consisted of day and night evaluations flown in FAA C-421, aircraft 5389J by AOPA pilots Roger Roselle, and Mike Burrows. AAT-20, evaluation pilot, Mr. Tim Halpin flew as PIC on the night flight and will provide a separate report. Lt. Col. Ruana observed night operations in the control tower from 1800 to 2300 while plugged in with the local controller. Weather was clear, visibility unlimited, with winds approximately 160/10 G20.

Approaches. The table below lists the 10-daylight approaches. Approaches are listed in the order of decreasing MDA and/or MAP and not in the order flown.

Approach #	MDA	(AGL alt.)	MAP (DME)	(SM)	Speed on Final
1	1360	817	3	3.11	140
2	1300	757	3	3.11	110
3	1200	657	2.4	2.42	130
4	1140	597	2.4	2.42	110
5	1100	557	2.0	1.96	130
6	1100	557	2.0	1.96	120

Approach #4 was the first approach. The pilot had not flown in similar equipment in the past 3-years. Confusion existed on the ATC frequency (ie., assigned to monitor tower on 120.05 vice 118.5). The pilot did not anticipate a go-around. Go-around instructions were given as the aircraft was about to line up with the extended runway centerline. Initial go-around instructions were given twice, and the pilot did not hear the tower controllers initial heading. In these rather difficult conditions, the aircraft overshot runway 12L to the extent that the aircraft passed midway between runways 12L and 12R. The go-around under these circumstances tended to simulate the worst condition that may be expected if an aircraft is required to make an inadvertent go-around. All other go-arounds were accomplished without obviously overshooting the landing runway. Approaches #1, 2, and 3 were accomplished with relative ease. The higher airspeeds flown on approaches 1 and 3 simulated tailwind conditions with B Category aircraft. At no time was the pilot under excessive pressure, nor did the aircraft have to make excessive maneuvers. Some light turbulence was encountered and bank angles may momentarily have approached 20°s with vertical velocities of 600 fpm, occassionally 800 fpm.

Approaches #5 and 6 were flown to determine how low minimums might be established for Categories B aircraft and under. The pilot accomplished the procedure safely and without excesses at speeds as high as 130 knots. Using 2 statute miles visibility, events occurred at such pace that there

2.

was no room for hesitation or mistakes in judgement, and it appears that sufficient time and room for maneuver would not be available in marginal conditions. If obstruction clearances are met, it appears that an MDA of 1100 feet MLS and visibilities of 2.5 statute miles would be more than adequate.

Control Tower Observations

The 107 foot control tower provides tower controllers an excellent perspective of the sidestep maneuver. Physical landmarks such as roads, mountain peaks, etc., provide accurate guidance as to aircraft distance. Aircraft heading changes are obvious from the tower as the sidestepping aircraft appear to be heading directly towards the tower while they are in the lateral transition phase. The Brite radar provides excellent target resolution. During the course of the evening, several VFR aircraft overshot the final approach course. Impending overshoots were obvious. On some occassions of conflicting traffic, pilots were advised by ATC of the impending overshoot and associated traffic.

Conclusions

1. The LDA DME (sidestep) runway 12L delivers the aircraft to the same geographical position each time and is a great improvement over vectors to the airport for a purely visual approach. In marginal weather conditions, it would improve existing procedures used for circling approaches.

2. The sidestep manuever was accomplished at AGL altitudes from 557 to 817 feet at visibilities from 1.96 to 3.11 statute miles. It is possible to keep the runway in sight at all times, maintain a continuous descent, and use moderate bank angles (less than 20°s) at all times in Category B aircraft.

3. A direct turn to final is desirable to the S-turn now being tested. Missed approach considerations caused by converging courses may tend to preclude approach design with a dogleg to finale.

4. Visual separation provided by the control tower, pilots, or a combination of the two is an adequate viable means of providing separation between straight-in and sidestepping aircraft, particularly when augmented by the Brite radar; however, the Brite does not appear to be mandatory.

5. Visibility minimums as low as 2 statute miles are possible for CAT A and B aircraft. Visibility minimums of 2.5 statute miles will allow for significant errors in judgement.

6. LDIN lights, or a system of sequenced flashing lights are required for guidance to provide an equivalent level of safety for sidestepping aircraft.

3.

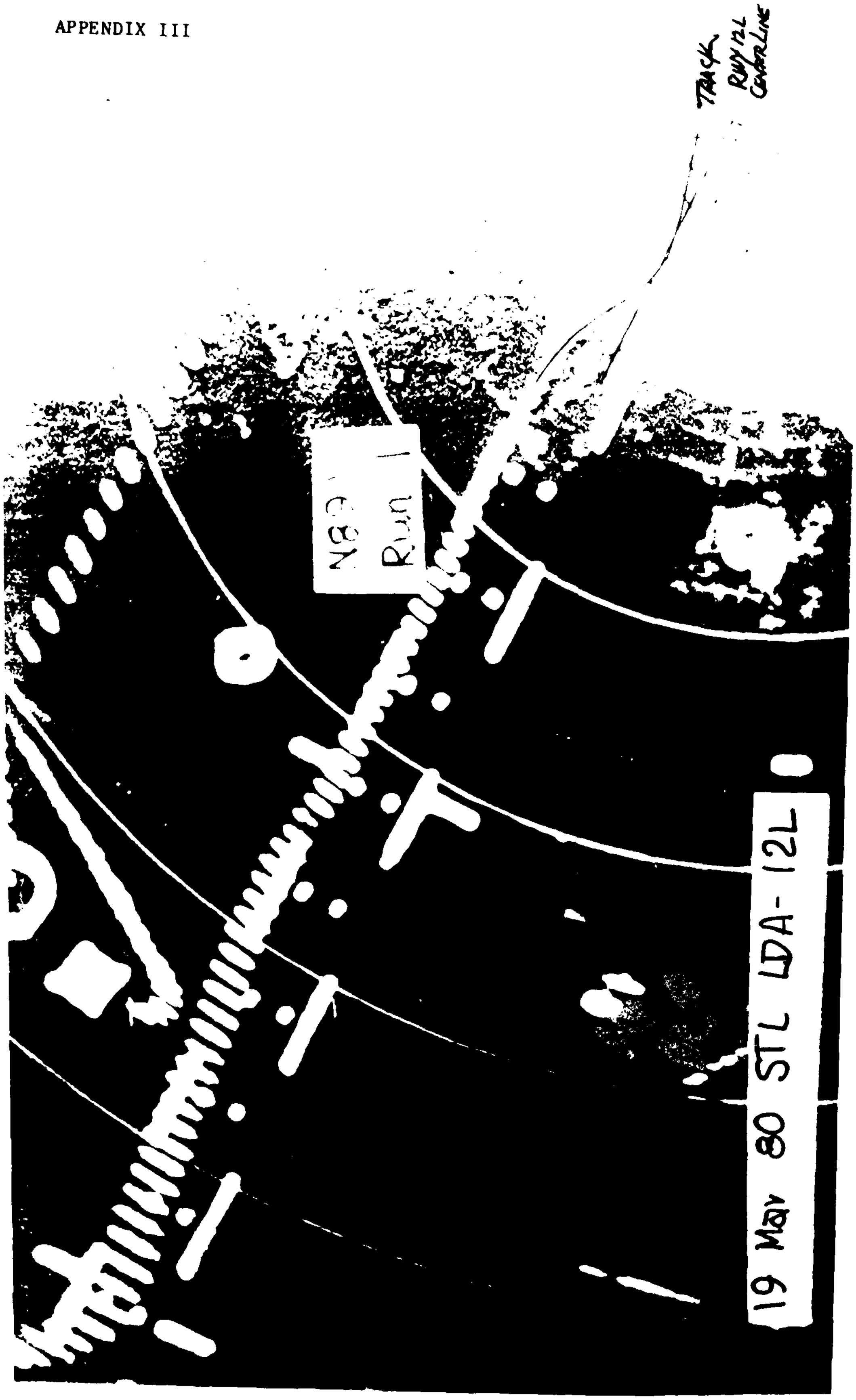
Recommendations

1. The existing LDA DME (sidestep) runway 12L, with minor refinements, should be well advertized to the users and then given an extensive full scale operational evaluation.

2. Criteria, considering the information gained in 1. above, should be developed to increase the IFR acceptance rate at similarly configured airports. Where feasible, vertical guidance should be developed.

3. Evaluations should be made to determine the feasibility of providing vectors, through the overcast to points where pilots can accomplish visual landings.

4. A complete evaluation of wake turbulence considerations is required, ie., the LDA DME (sidestep) runway 12L glidepath is essentially above and beyond the approach path on the ILS runway 12R so that wake turbulence problems do not appear significant on landing in this case. This will not always be true and adequate criteria is required.


TRACK
RWY 12L
CENTERLINE
Run 1
19 May 80 STL LDA- 12L

RECORD OF [X] **VISIT** [ ] **CONFERENCE OR** [ ] **TELEPHONE CALL**

TIME

2/21/80

NAME(S) OF PERSON(S) CONTACTED OR IN CONFERENCE AND LOCATION

Representatives of ALPA, APA, TWA, Ozark, Industry and FAA.

ROUTING

SYMBOL	INITIALS

SUBJECT

To observe the LDA/DME sidestep procedure runway 12-L St. Louis (STL)

DIGEST

Flights in the hangar 6 Sabre N-40, and the OKC 727 N-27 were scheduled at STL on 2/21 and 22 to participate in the STL 12-L sidestep procedure. Departed Washington National 2/21 and diverted to OKC because of weather below minimums at STL. Arrived STL 2/22 and met with representatives of ALPA, APA, TWA, Ozark, industry and FAA. A briefing on the 12-L sidestep procedure was presented by representatives of AFO and ATC. Weather at STL on 2/23 was 1500-3. Runway 12-L is 6621' in length separated by 1300' from runway 12-R. 12-R is 10,018' in length and the thresholds are staggard approximately 4000'. 12-L has a VASI, 4 on the right side and REILS. The REILS are not correctly aimed and are not seen beyond about 1/2-mile from threshold. The localizer (LDA) is parallel to 12-L off-set 3000'.

Three sidestep approaches were observed from the flight deck of the 727 and 4 sidestep approaches were observed from the tower. All pilots agreed that a stabilized approach of at least 1 mile prior to threshold is required. Others felt a minimum of 1 1/2 to 2 miles stabilized approach was required. Of the three approaches observed, none of the three pilots was able to have a 2-mile stabilized final approach. Distances of 1.1, 1.4 and 1.5 before the aircraft had acquired runway centerline and had speed and altitude stabilized. Visual contact with the other aircraft is difficult to achieve because the pilots of the maneuvering aircraft are too busy to spend time attempting to establish visual contact. Visual contact by the tower cannot be depended upon.

CONCLUSION, ACTION TAKEN, OR REQUIRED

1. This type of approach procedure can be made to work satisfactorily if safeguards are used.
2. A sidestep maneuver of this magnitude (3000') requires heading changes of 30 - 40 degrees depending upon wind, with bank angles of 15-20° and more, if the pilot overshoots his initial turn.
3. The sidestep maneuver (S Turn) should be eliminated.
4. A single turn to the final approach course can be made with the correct orientation of the localizer.

DATE	TITLE	SIGNATURE
2/26/80	Aviation Safety Inspector (Operations)	[signature]

APPENDIX III

2

5. With the off-set type of approach, single turn to final, the pilot will have the runway environment in view throughout the turn.

6. Visual acquisition by the pilots or controllers cannot be depended upon.

7. Radar separation appears to be more dependable - (ARTS-3).

8. Require sufficient visibility to permit a stabilized approach of 1.5 - 2.0 miles from threshold.

9. Limit procedure to category A-B and some C aircraft.

10. Determine if parallel ILS approaches can be made at less than 3000' separation using dependent parallel criteria.

Recommendations:

Establish a project at NAFEC or AFO-560 to evaluate off-set and dependent parallel approaches to determine:

- Can parallel dependent approaches be made at less than 3000' runway separation
- The best siting for the localizer for off-set approaches
- What visual aids are required to ensure runway identification for both parallel and off-set approaches

cc:
AFO-200 AFO-500 ✓
AFO-210 AFO-700

AFO-210:GGibson:vy/pr:x6845?:2/26/80
MC: NONE
FILE: 1340-2 x/f ______

FLIGHT PROCEDURES STANDARDS WAIVER	*Reports Identificat* APPENDIX III DATE 12/18/79

1. FLIGHT PROCEDURE IDENTIFICATION

LDA/DME (Sidestep) Rwy 12L
Lambert-St. Louis International, St. Louis, MO

2. WAIVER REQUIRED AND APPLICABLE STANDARD

Separation of less than 4300 feet between centerlines of parallel runways for simultaneous approaches.

Paragraph 992, 8260.3B (TERPS)

3. REASON FOR WAIVER *(Justification for nonstandard treatment)*

Centerline separation between runways 12L and 12R is 1300 feet. The LDA antenna location for runway 12L provides a final approach course that is parallel to the final approach course for runway 12R and the courses are separated centerline to centerline by 4541.6 feet. The approach to runway 12L terminates at a missed approach point on the course centerline.

EQUIVALENT LEVEL OF SAFETY PROVIDED

Simultaneous approaches to runway 12L will only be authorized when the ceiling is 1000 feet or better and the visibility is 3 miles or better. The LDA/DME missed approach point is 2.05 NM (2.36 SM) from the threshold and the track from the missed approach point to the threshold is at 15° angular divergence with the runway centerline. Criteria for simultaneous approaches is maintained to the missed approach point and throughout the missed approach procedure.

5. HOW RELOCATION OR ADDITIONAL FACILITIES WILL AFFECT WAIVER REQUIREMENT

The installation of a lead-in lighting system would require additional evaluation for possible minima change.

6. COORDINATION WITH USER ORGANIZATIONS *(Specify)*

7. SUBMITTED BY

FICE IDENTIFICATION	TITLE	SIGNATURE
MSP FIFO	Chief, Procedures Section	JAMES R. DAVIS

FAA Form 8260-1 (7-66)

FLIGHT PROCEDURES STANDARDS WAIVER

Reports Identification Symbol FS 8220-7

DATE
12/18/79

1. FLIGHT PROCEDURE IDENTIFICATION

---/DME (Sidestep) Rwy 12L
ert-St. Louis International, St. Louis, MO

2. WAIVER REQUIRED AND APPLICABLE STANDARD

LDA alignment does not meet criteria.

Paragraph 952, 8260.3B (TERPS)

3. REASON FOR WAIVER *(Justification for nonstandard treatment)*

This procedure provides a final approach course that is parallel to the runway of intended landing. The final approach course and the runway are separated centerline to centerline by 3236.85 feet. A point-in-space missed approach point is specified from which visual flight to the runway is conducted or a missed approach executed.

UIVALENT LEVEL OF SAFETY PROVIDED

.s approach will only be authorized when the ceiling is 1000 feet or better and the visibility is 3 miles or better. The LDA/DME missed approach point is 2.05 NM (2.36 SM) from the runway threshold and the track from the missed approach point to the threshold is at 15° angular divergence with the runway centerline.

5. HOW RELOCATION OR ADDITIONAL FACILITIES WILL AFFECT WAIVER REQUIREMENT

The installation of a lead-in lighting system would require additional evaluation for possible minima change.

6. COORDINATION WITH USER ORGANIZATIONS *(Specify)*

7. SUBMITTED BY

E IDENTIFICATION	TITLE	SIGNATURE
MSP FIFO	Chief, Procedures Section	JAMES R. DAVIS

FAA Form 8260-1 (7-66)

APPENDIX III

FLIGHT PROCEDURES STANDARDS WAIVER

DATE 12/18/79

1. FLIGHT PROCEDURE IDENTIFICATION

'DME (Sidestep) Rwy 12L
...ert-St. Louis International, St. Louis, MO

2. WAIVER REQUIRED AND APPLICABLE STANDARD

Separation in excess of 1200 feet between centerlines of parallel runways for "sidestep" maneuver.

Paragraph 407, 8260.19 (Flight Procedures & Airspace)

3. REASON FOR WAIVER (Justification for nonstandard treatment)

The LDA final approach course terminates at a DME missed approach point and no "primary" runway is involved. The centerline of the final approach course is parallel to and separated from the centerline of runway 12L by 3236.85 feet. Visual flight is conducted from the LDA/DME missed approach point or a missed approach is executed.

4. EQUIVALENT LEVEL OF SAFETY PROVIDED

This approach will only be authorized when the ceiling is 1000 feet or better and visibility is 3 miles or better. The LDA/DME missed approach point is 2.0[illegible] NM (2.36 SM) from the runway threshold and the track from the missed approach point to the threshold is at 15° angular divergence with the runway centerline.

5. HOW RELOCATION OR ADDITIONAL FACILITIES WILL AFFECT WAIVER REQUIREMENT

The installation of a lead-in lighting system would require additional evaluation for possible minima change.

6. COORDINATION WITH USER ORGANIZATIONS (Specify)

7. SUBMITTED BY

ORGANIZATION	TITLE	SIGNATURE
[illegible] FIFO	Chief, Procedures Section	JAMES R. DAVIS

FAA Form 8260-1 [illegible]

DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION
EXPERIMENTAL
DA STANDARD INSTRUMENT APPROACH PROCEDURE
FLIGHT STANDARDS SERVICE - FAR PART 97.

Bearings, headings, courses and radials are magnetic. Elevations and altitudes are in feet, MSL, except HAA, and RA. Altitudes are minimum altitudes unless otherwise indicated. Ceilings are in feet above airport elevation. Distances are in nautical miles unless otherwise indicated except visibilities which are in statute miles or in feet RVR.

TERMINAL ROUTES

FROM	TO	COURSE AND DISTANCE	ALT
JAMET 11.3 DME (IAF)	POTSE 6.3 DME	118/5.0 (I-ABW)	2300

"INFORMATION COPY ONLY"
NOT TO BE USED TILL EFFECTIVE DATE
ESTABLISHED BY AGENCY TRANSMITTAL

MISSED APPROACH

MAP: Freas 2.4 DME

Climbing left turn to 4000 via heading 070 and TOY R-282 to TOY VORTAC and hold.

ADDITIONAL FLIGHT DATA

Hold E RT 256 inbound.

FAS Obst: 724 Trees 384617/902252

Depict LOC Rwy 12R.

FAC lies 3237' left and parallels Rwy 12L.

Chart visual flight path MAP to THR 133°/2.1 miles.

PT NA SIDE OF CRS ______ OUTBND ______ FT WITHIN ______ MI. OF ______ (IAF)
Profile starts at JAMET 11.3 DME (IAF)
FAC 118 FAF POTSE 6.3 DME DIST FAF TO: MAP —— THLD 5.9
MIN ALT JAMET 11.3 DME, 3000; POTSE 6.3 DME, 2300
MSA FROM STL VORTAC 090-180, 2700; 180-090, 2200

VAR 4E YR 1975

MINIMUMS

TAKEOFF: [ ] STD [X] SEE FAA FORM 8260-15 FOR THIS AIRPORT ALTERNATE: [X] NA

CAT →	A MDA	A VIS	A HAT/HAA	B MDA	B VIS	B HAT/HAA	C MDA	C VIS	C HAT/HAA	D MDA	D VIS	D HAT/HAA	E MDA	E VIS	E HAT/HAA
SIDESTEP RUNWAY 12L															
S/Step 12L	1360	3	817	1360	3	817	1360	3	817	1360	3	817			
Circling		NA			NA			NA			NA				

NOTES

1. Radar required.
2. Minimum ceiling 1000 and visibility 3 required.
3. Sidestep maneuver not permitted until authorized by ATC.
4. Simultaneous approach authorized with Rwy 12R.
5. ASR.

CITY AND STATE	ELEVATION 589 TDZE 543 AIRPORT	FACILITY IDENT.	PROC. NO.-AMDT. NO.-EFFECTIVE DATE	SUP. / AMDT. / DATED
St. Louis, MO	Lambert-St. Louis International	I-ABW	EXPERIMENTAL LDA/DME(Sidestep)Rwy 12L, Orig.	AMDT. None

AFFECTED PROCEDURES REVIEWED?	COORDINATES OF FACILITIES	REQUIRED EFFECTIVE DATE
[X] YES [ ] NO	*	APPENDIX III

COORDINATED WITH

ATA [ ] ALPA [ ] APA [ ] AOPA [ ] NBAA [ ] OTHER (Specify) [X] ZKC STL ATCT

FLIGHT CHECKED BY

NAME	FIFO	DATE
Pending		

DEVELOPED BY	APPROVED BY
SIGNATURE Charles P. Jewell DATE 12/31/79 Procedures Specialist MSP FIFO	SIGNATURE M. Wells DATE 12/31/79 Robert J. Morlott MANAGER, MSP FIFO

CHANGES

*LDA Ant: 384520.69N/902110.9W

DME Ant: 384522.95N/902107.38W

REASONS

GPO 900-023

APPENDIX IV

COMMENTS FROM INTERESTED ORGANIZATIONS

AIR LINE PILOTS ASSOCIATION ☐ OZARK M.E.C.
11771 Natural Bridge ☐ Bridgeton, Missouri 63044 ☐ (314) 731-0443

March 21, 1980

Mr. Jim Forgas
Engineering Department
Air Line Pilots Association
1625 Massachusetts Avenue, N.W.
Washington, D. C. 20036

Dear Jim:

This letter is to summarize our committee's findings regarding the test flights of the proposed St. Louis 12L LDA approaches. As you know, both Jack O'Brien and I had an opportunity to fly the approach in question. Jack flew as a pilot during day and night runs in the Boeing 727-100 and as a day observer in the Cessna Citation chase aircraft. I flew day approaches in the 727 and DC9-10 and a night approach in the DC-9. In addition, we both flew numerous approaches in the Ozark Air Lines DC-9-30 visual flight simulator. As we indicated in our earlier discussions with you and Ed Krupinski, there are three areas of concern.

1. High Descent Rates - In all cases the depicted missed approach point FREAS (2.4 LDA DME) lead to unacceptable maneuvering and high descent rates. We recommend moving FREAS back to the 3.0 LDA DME point. This proved satisfactory during flight testing. We also recommend a MDA of 1140' instead of the depicted 1360.

2. Runway Environment Acquisition - The existing lighting is totally unacceptable. Runway 12L is very difficult to discern against the airport backdrop. The existing REIL lights are extremely dim and are often spotted after the single VASI unit.

   We recommend the installation of a "Canarsie-Type" lead-in lighting system from the 3.0 LDA DME missed approach point to the runway. In addition, we recommend the canted left side VASI unit you suggested. This additional VASI would certainly remove the indecision from the final descent portion, and when coupled with the 3.0 DME MAP would alleviate the high sink rate problem. These two lighting recommendations are the minimum acceptable. We noted both a ceiling and visibility of 1000-3 required for this approach. Under no circumstances should this be lessened.

3. Traffic Separation Responsibility - We do not feel the pilots should have the additional burden of traffic separation during the "visual maneuver" and landing. The tower must assume total responsibility for traffic separation from the moment they clear the aircraft to leave the localizer until touchdown.

I hope you will consider our observations and recommendations and feel free to call either Jack or myself regarding this or other programs.

Sincerely,

Gregory Pochapsky
Ozark Air Safety-ALPA

GMP:dn

cc: OZA MEC
FAA Flight Standards-OKC
Mr. Glen Bales-STL Tower
File

OZARK AIR LINES

P.O. Box 10007 • Lambert - St. Louis International Airport • St. Louis, Missouri 63145

March 18, 1980

Federal Aviation Administration
Flight Standards National Field Office
AFO-560
P. O. Box 25082
Oklahoma City, Oklahoma 73125

Attention: Mr. Dean Juhlin
Standards Development Branch

Dear Mr. Juhlin:

In reviewing the new Offset Approach to 12L in St. Louis I would like to express my observations.

I flew this approach on March 4, 1980 in the FAA DC9-10 aircraft and I have also flown 8 to 10 approaches in Ozark Air Lines' simulator in the past six weeks. I believe the modifications to the approach and approach chart as listed below, would be beneficial to the operation of the 12L Offset Approach.

1. I would like to suggest that POTSE (final approach fix) be moved to 7.0 DME and the altitude be lowered to 2100 feet. The reason for the DME change is that most air carrier operators do not have the equipment to read DME intents.

2. I recommend the missed approach point be located at 3 DME and the MDA be lowered to 1140 feet at that point. The minimums of 1,000 feet and 3 miles visibility as published category C and D aircraft were adequate. I felt that after flying the approach that the 2.4 DME fix required an abrupt turn to final approach and would certainly cause great passenger concern.

3. We have evaluated several different types of lead-in lighting aids in our simulator. I would like to recommend the Canarise type lights starting at the 3 DME fix and going to the one mile point straight in to 12L. As you are aware, 12L will be extended to approximately 9100 feet by October 1980. Also 30L will be a Category II runway at that time. With those lights plus one additional VASI installed on the north side of 12L and cantered to the 3 DME point would be an asset. The users of the St. Louis Airport will benefit greatly from the new approach due to the

March 18, 1980
Page 2

fact that simultaneous parallel approaches could be used. The Airport Improvements Task Force Committee has indicated an increase of 36 to 38 percent capacity for the St. Louis International Airport with this new approach.

Sincerely,

Gene Eakle

Captain C. E. "Gene" Eakle
Manager of Flying - STL

CEE/mc

cc: Mr. Chris Quinn - ATA
Mr. Glen Bales - STL Tower

APPENDIX IV

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

April 21, 1980

Mr. Dean Juhlin
Mike Monroney Aeronautical Center
AFO-560
P. O. Box 25082
Oklahoma City, OK 73125

Dear Mr. Juhlin:

AOPA appreciates the FAA having provided us an opportunity to participate in the flight testing of the LDA DME approach to Runway 12L at Lambert Field on March 18.

The conclusions drawn from our staff pilot's experience in the flight test, are that the approach appears to be safe from the aircraft operating viewpoint. At Lambert, with strict adherence to the minimums established, the approach should safely increase capacity by permitting simultaneous instrument approaches to the parallel runways.

The following is our staff pilot's report:

I flew PIC of an FAA Cessna 421-B for a total of five hours in two separate flights. The first flight of approximately three hours was flown during daylight and a second flight was flown of two hours at night. I flew approximately 15 approaches during those two flights. Although the published approach procedure called for a missed approach at an MDA of 1360' MSL (817') and a MAP of 2.4 DME, we varied the MDA to approximately 900' MSL and a MAP ranging from approximately 1.8 miles to 3.0 miles. The approaches included some landings, go-arounds and missed approaches.

Using an MAP of 2 miles or less, required a significant turn to the right, and then again to the left, in order to establish the aircraft on the approach to the runway. It was, in my opinion, an excessive maneuver, under marginal weather conditions in a landing configuration. Due to cockpit activity and possible distractions, this could cause some difficulties in overshooting the runway centerline.

7315 Wisconsin Avenue (Air Rights Building) /Washington D.C. 20014 /Telephone (301) 654 0500 /Cable Address AOPA, Washington, D.C.
Member International Council of Aircraft Owner and Pilot Associations When writing ALWAYS use your AOPA number

Mr. Dean Juhlin
April 21, 1980
Page 2

Attempting to correct it while so close to the threshold could result in unsafe maneuvering. Additionally, the nature of this approach means that the pilot must look up at the MAP and scan out the right side of the aircraft to obtain visual contact with the runway. Under some circumstances, such as correcting for a strong crosswind, it might be possible for the runway to appear out a right side window making it difficult for the pilot to see and perhaps invite initiation of the sidestep maneuver before the runway is seen. (These flights required a 10-15 degree crosswind correction toward Runway 12L.)

Using an MAP at 2.4 miles allowed a relatively smooth maneuver to establish the aircraft on the approach centerline. It also allowed a more comfortable effort on the pilot's part in looking for the airport, which appeared more forward in the right forward windshield. There was little reason to expect a pilot might drift onto the parallel approach, or have insufficient room to accomplish the maneuver under busy conditions amid distractions (radio work, etc.).

Establishing the MAP at 3 miles also allowed a smooth maneuver to establish the aircraft on the runway centerline. This distance from the airport also allowed the pilot to expect the airport to appear more near the right center of the windshield in obtaining visual contact. However, I felt that establishing the aircraft on the runway centerline was less well-defined that far from the runway, and offered the possibility of drifting.

I did not find the VASI lights were helpful until I was actually established on the runway centerline, or close to it, since I was also concerned about controlling the aircraft during the sidestep maneuver.

I did not experience any significant difficulties in locating the airport during the day, but I believe that well-defined lead-in lights and REILS are essential to this approach, even in daylight conditions.

Night approaches were perhaps a little more difficult, since there were many other lights in the area (clear VFR conditions) competing for my attention; the REILS made the difference in this situation. Again I would want to see lead-in lighting used with this approach.

In my opinion the MDA could be lowered to 500 or 600 feet.

It was my opinion, and that of the observers on board the aircraft, that all of the approaches I made to Runway 12L were safe. Although I have in excess of 500+ hours in a Cessna 421-B, it had been more than 2.5 years since I had flown in the aircraft. Yet, this approach was not so demanding that I was unable to cope with it under simulated instrument conditions and the lack of recent familiarity with the aircraft.

This report and our immediate comments do not speak to any problem that may be encountered as a result of ATC procedures (i.e., the actual conduct of these parallel operations under IMC). It is our understanding that there has been some discussion in this area. This situation should be looked into carefully.

We look forward to working with the FAA in the future on such testing.

Cordially,

Robert T. Warner

Robert T. Warner
Assistant Vice President
Policy and Technical Planning

Air Transport Association ata OF AMERICA

Central Regional Office
2360 East Devon Avenue
Des Plaines, Illinois 60018
Phone (312) 635-7120

April 24, 1980

Mr. Dean Juhlin
Standards Development Branch
Flight Standards National Field Office
AFO-560
Post Office Box 25082
Oklahoma City, Oklahoma 73215

Dear Dean:

Although it was decided not to include a reference to increased airport capacity and reduced delays in the attached letter to you, the STL Airport Improvement Task Force, using the FAA Airport Capacity Simulation Model, has determined that with the offset LDA approach, there is potential for:

36-38% increase in airfield capacity,
22% reduction in peak hour delay,
10% reduction in total (24 hr/day)delay.

Sincerely,

C. T. Quinn

Christopher T. Quinn,
Deputy Director

Attachment

Air Transport Association **ata** OF AMERICA

Central Regional Office
2360 East Devon Avenue
Des Plaines, Illinois 60018
Phone (312) 635-7120

April 24, 1980

Mr. Dean Juhlin
Standards Development Branch
Flight Standards National Field Office
AFO-560
Post Office Box 25082
Oklahoma City, Oklahoma 73125

Dear Dean:

The ATA and airlines are pleased to have participated in the St. Louis R12L LDA/DME (sidestep) approach test evaluation. We expect the test evaluation to determine the flyability and acceptability of the offset procedure, to recommend what additional visual aids are desirable and to determine the acceptability of the air traffic control procedures.

Runway 12L/30R is scheduled for upgrading with improved edge lighting and centerline lights. These improvements, in addition to LDIN lights and a canted VASI on the left side to supplement the right side VASI would seem to make the runway environment much more visible, both day and night. Several LDIN light configurations have been programmed in Ozark Airlines' simulator and are available to assist in determining what might be a "best" system.

The ATA Flight Operations Committee has reviewed the St. Louis LDA/DME Sidestep Approach Procedure and recommend a continued evaluation leading to a determination of its acceptability for air carrier use, for the purposes of increasing airfield capacity and reducing aircraft delay.

Very truly yours,

Jerome F. Mann,
Director

APPENDIX V

DATA FROM VIDEO TAPE INSTRUMENT READINGS

FROM THREE TEST AIRCRAFT

AD-A103 677 FEDERAL AVIATION ADMINISTRATION OKLAHOMA CITY OK FLI--ETC F/G 1/2
EVALUATION OF ST. LOUIS LDA/DME RUNWAY 12L APPROACH.(U)
MAY 80 D JUHLIN, F PARR
UNCLASSIFIED FAA-AFO-500-18 NL

2 OF 2
AD
A103677

END
DATE
FILMED
10 81
DTIC

B-727 DATA

APPROACH NUMBER	DME DISTANCE (NM)	BANK ANGLE 1st/2nd	ROLL* RATE (°/Sec.)	SPEED (Knots)	MAXIMUM VERTICAL SPEED (Ft./Min.)	HEADING
DAY						
1	3.0	16°/10°	3.2	135	900	120°
2	3.0	14°/14°	3.0	145	1000	123°
3	2.4	12°/10°	4.5	135	800	124°
4	3.0	15°/10°	5.0	138	850	120°
5	3.0	10°/10°	3.0	135	1000	120°
6	3.0	10°/8°	2.0	140	900	130°
7	3.0	18°/12°	6.0	140	900	120°
NIGHT						
1	3.0	15°/10°	4.0	140	1000	Unreadable
2	3.0	12°/10°	3.5	138	1000	Unreadable
3	3.0	22°/10°	4.3	140	1000	120°
4	3.0	18°/12°	5.0	140	1000	120°
5 & 6	Camera was used for exterior view.					

*NOTE: All roll rates on the turn-in to the runway centerline were under 4°/sec.

APPENDIX V

DC-9 DATA

APPROACH NUMBER	DME DISTANCE (NM)	BANK ANGLE 1st/2nd	ROLL* RATE (°/Sec.)	SPEED (Knots)	MAXIMUM VERTICAL SPEED (Ft./Min.)	HEADING
DAY						
1	2.4	25°/15°	8.0	138	900	120°
2	2.4	30°/16°	6.0	138	820	120°
3	2.6	25°/15°	8.6	130	750	120°
4	2.6	15°/12°	2.0	135	800	121°
5	2.8	25°/10°	10.0	130	750	121°
6	3.0	20°/10°	4.0	130	750	121°
NIGHT						
1	2.4	25°/15°	10.0	140	900	124°
2	2.4	23°/20°	4.5	140	MAP	122°
3	2.4	20°/12°	4.5	130	700	125°
4	3.0	15°/10°	3.7	130	800	122°
5	3.0	20°/12°	5.0	125	800	122°
6	3.0	15°/10°	4.0	125	820	123°

*NOTE: All roll rates on the turn-in to the runway centerline were under 4°/sec.

N-265 DATA

APPROACH NUMBER	DME DISTANCE (NM)	BANK ANGLE 1st Turn	ROLL RATE (°/Sec.)	SPEED (Knots)	MAXIMUM VERTICAL SPEED (Ft./Min.)	HEADING
DAY						
1	2.4	18°	7.2	130	700	122°
2	3.0	15°	6.0	130	800	123°
3	3.0	20°	8.0	125	800	122°
4	3.0	15°	3.9	120	800	123°
5	3.0	18°	5.5	120	1000	121°
6	3.0	15°	3.5	120	800	121°
NIGHT						
1	3.0	12°	3.0	125	700	125°
2	3.0	12°	2.5	125	800	128°
3	3.0	15°	3.3	120	800	129°
4	3.0	15°	2.7	120	800	131°
5	3.0	15°	3.5	120	750	130°
6	3.0	15°	4.8	120	800	130°
DAY GO-AROUND						
1	2.0	20°	6.2	140		145°
2	1.7	20°	8.3	136		130°

END

DATE

FILMED

10-81

DTIC