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Navigation Performance of Aircraft Making Dependent Instrument Landing System (ILS) Approaches at Memphis International Airport

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16. Abstract

An extremely accurate precision approach radar was installed at Memphis International Airport to collect data on aircraft flying dependent instrument landing system (ILS) approaches to parallel runways. This report summarizes the navigational performance of those aircraft during instrument flight rule (IFR) conditions. Four progressively more restrictive definitions of the navigation phase of flight (called Views) provide insight into the effects of turn-on distance, overshoot, and method of approach. Particular emphasis is placed on dispersion measures and containment profiles of the aircraft at various distances from touchdown when performing dependent ILS approaches.

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EXECUTIVE SUMMARY.

An extremely accurate military precision approach radar was installed at Memphis International Airport to collect data on aircraft flying dependent instrument landing system (ILS) approaches to parallel runways. This report summarizes the navigational performance of those aircraft during instrument flight rule (IFR) conditions.

Memphis International Airport implements dependent procedures on parallel runways separated by 3400 feet. These dependent parallel approach procedures are substantially different from simultaneous ILS approaches (often referred to as independent parallel procedures). Aircraft are permitted greater flexibility in navigation under dependent procedures. Many of the flight maneuvers observed on Memphis approaches would not have been permitted under independent procedures.

Data collection was initiated in September 1985 with the installation of a TPN-22 radar which provided approximately 46° of coverage centered on the ILS for parallel runways 36L, 36R, 18L, and 18R. The antenna scanned the area more than 10 times per second. Two teams of personnel cooperated in the data collection. The TPN-22 radar was maintained and operated by technicians from ITT Gilfillan. The TPN-22 personnel coordinated with Federal Aviation Administration (FAA) personnel stationed at an Automated Radar Terminal System (ARTS) III display via telephone. The FAA personnel identified targets approaching the parallel runways to the TPN-22 personnel who enabled the radar to acquire the track. A unique track identifier was assigned to each target. The FAA personnel entered weather data as well as the pertinent aircraft, runway, and track identifiers for each target into a microcomputer. These descriptive data were later merged with the X, Y, and Z coordinates which were recorded automatically by the radar. More than 5000 approaches were tracked; approximately 1000 of the tracked approaches were performed under instrument meteorological conditions (IMC).

The flight data were analyzed in several stages. Each stage was named a "View" and reflected a better attempt to define the portion of flight known as "navigation." View 1 includes some acquisition of the ILS and all flight thereafter. View 2 limits analysis to those portions of flight after aircraft were stabilized on the localizer, which eliminated the effect of turn-on and overshoot. View 3 eliminates the effect of the many aircraft which acquired the localizer at less than 9 miles. This multistage effort was necessary because procedures at Memphis allow turn-ons to the same ILS at a multitude of ranges (including some very short distances from the runway) and the radar acquired aircraft at various stages of approach. The multistage analysis offers some indication of the effects of these extraneous factors. View 3 represents the most rigid definition of navigation with minimum extraneous effects. Although the number of flight tracks included is much smaller than the overall number of tracks collected during IFR conditions at Memphis, data from View 3 are generally of most interest to answering the question of navigation performance. However, View 3 does not represent the entire air traffic population at Memphis Airport. Dependent operations permit aircraft to acquire the localizer at many different ranges, and View 3 is comprised of only those aircraft which acquired the localizer at a relatively long distance from the runway.

The IFR flight track data collected at Memphis have several interesting characteristics. Almost half of the data were collected when the ceiling height was between 300 and 500 feet. Over two-thirds of the traffic were on runways 36R and 36L, with less than one-third of the traffic on runways 18R and 18L. Air carriers and air taxis comprised over 89 percent of the traffic during IMC data collection. General aviation traffic accounted for almost all of the remainder. Air taxis generally had a larger dispersion than the air carriers, but much of the dispersion can be traced to the presence of a single type of aircraft. When the flight data were categorized by aircraft type, it was noted that there were differences in navigation performance for different aircraft types.

At distances greater than 550 feet from the localizer, there is a substantial difference in the sample data between aircraft deviating toward and aircraft deviating away from the adjacent runway ILS. Many more aircraft were deviating away from the other ILS than deviating toward it.

The numbers of large deviations decrease substantially when aircraft are stabilized on the ILS (i.e., when turn-on and initial overshoot are completed). At 6 miles or less from touchdown, the numbers of aircraft deviating more than 700 feet from the centerline of the localizer are extremely small or zero for each runway.

The presence of stability before descent presented more desirable data on navigation performance. Aircraft which stabilized before descending showed less dispersion about the centerline. When a stabilized set of aircraft are tracked from a range of 9 nautical miles, the effect of ceiling height on aircraft navigation seems negligible.

Three factors have been shown to be associated with a difference in navigation performance on the ILS: the range at which an aircraft acquired the ILS, the aircraft type, and whether or not the aircraft was stabilized before descent. Again, it should be pointed out that these aircraft were flying dependent parallel approach procedures. Under simultaneous ILS approach procedures (independent operations), the range and stabilization criteria are predetermined, and many flight operations observed during this data collection would not have been permitted.

1. OBJECTIVE.

To characterize the navigation performance of aircraft making dependent parallel instrument landing system (ILS) approaches at Memphis International Airport during instrument meteorological conditions (IMC).

2. BACKGROUND.

2.1 AOCI REQUEST FOR DATA COLLECTION.

The Airport Operators Council International (AOCI)-sponsored Task Force enclosed recommendations with a Letter of Transmittal, December 9, 1983, to Administrator Helms from the Chairman of the Task Force. They recommended that "FAA should collect actual data of lateral deviations (i.e., where actually are the aircraft on final approach with respect to the localizer path) at a minimum of two airports--Memphis and another airport where parallel operations are currently conducted (e.g., ORD, ATL)."

2.2 RESALAB DATA.

RESALAB Incorporated completed a report on their Lateral Separation study in July 1972 (Reference Lateral Separation, Report FAA-RD-72-58, Vol. I and II by Resalab, Inc.). For that study, data had been collected jointly by the Federal Aviation Administration (FAA) and Resalab. Aircraft data were presented on a precision approach radar (PAR) scope and multiple exposure photography recorded each aircraft track. The range history of aircraft position lay in the center of the aircraft track on the photograph. This approach had certain inherent limitations which are described in the Resalab report.

In order to collect more recent data on ILS approaches, a data collection effort was initiated at Memphis International Airport in October 1985. This report presents results of that data collection.

3. AIR TRAFFIC CONTROL PROCEDURES.

3.1 PARALLEL OPERATIONS.

Parallel runways are a frequently used means of increasing airport capacity. In the case of lightweight, single-engine, propeller-driven aircraft operating under visual flight rules (VFR), simultaneous, same-direction operation is permissible on parallel runways with centerlines separated by as little as 300 feet. For other classes of aircraft, similar operation is permissible with as little as 700 feet of runway centerline separation, provided wake turbulence is not a factor. For mixed (wake turbulence) class aircraft operations, a minimum runway separation of 2500 feet is permissible under VFR. Simultaneous parallel runway operations under IMC involve several other factors which necessitate an increase in the runway separation standards to maintain an acceptable level of safety. These factors include the accuracy and response time of the ground and airborne components of the

ILS, the proficiency of the pilot, the accuracy and update rate of the air traffic control (ATC) radar monitoring system, the response times of the controller and pilot, and whether the operations are independent or dependent.

Parallel runway operations are divided into two categories: independent or dependent. Air traffic control procedures differ, depending on the category of operation. For independent operations, approaches can be conducted on each runway almost without regard for the location of aircraft on the adjacent runway, but aircraft must be brought onto the localizer with vertical separation or 3 miles radar separation and must be stabilized on the localizer before descent (i.e., before vertical separation is lost). Independent parallel runway operations require two types of zones to be defined between the runways: the no transgression zone (NTZ) and the normal operating zone (NOZ). The NTZ is a buffer area or safety area where aircraft operations normally do not take place. An NOZ is defined for the interior of each runway and it is the normal area for aircraft operations. For purposes of illustration only, figure 1 would show the geometry of these zones for independent 4300-foot parallel runway operations, such as existed at Atlanta Airport until recently.

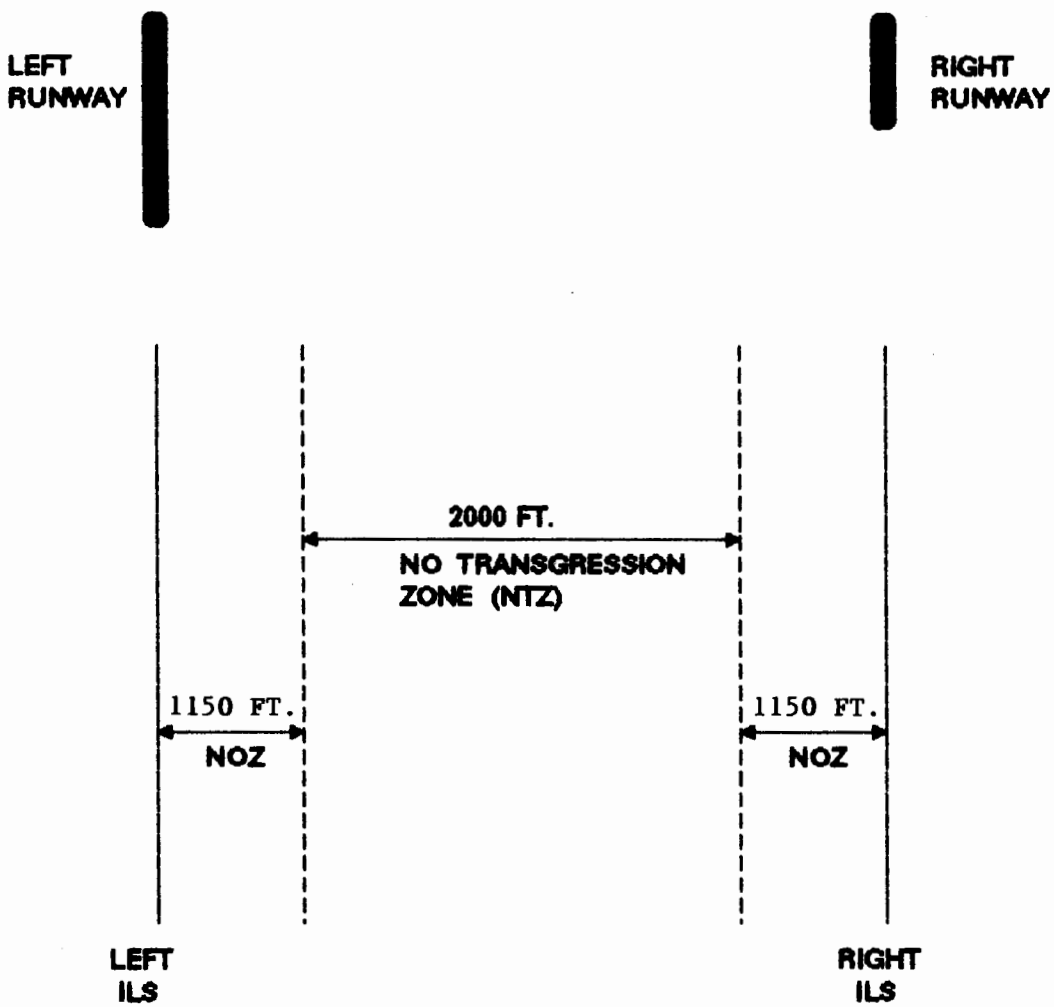


FIGURE 1. SIMULTANEOUS ILS APPROACH GEOMETRY FOR INDEPENDENT OPERATIONS (4300 FT. RUNWAY SEPARATION)

For dependent operation, parallel runways may be separated by as little as 2500 feet, but arriving successive aircraft on adjacent localizer courses must have at least a 2-mile separation. None of the other criteria necessary for independent operations apply when dependent operations are in effect. For a complete description of independent and dependent operations, see appendix A.

4. MEMPHIS INTERNATIONAL AIRPORT.

Memphis International Airport currently supports dependent landing operations on dual parallel runways with a nominal centerline-to-centerline spacing between the parallels of 3400 feet. In order to collect data on aircraft approach profiles, a modified TPN-22 radar was installed on the field at the Memphis airport between the parallel runways 18 and 36. Data were collected for a period of 6 months from September 1985 to February 1986.

Single runway procedures were in effect when no aircraft was nearby on the other runway. Except for the stipulation that all aircraft must be separated from other aircraft on the adjacent localizer by at least 2 miles diagonally, and from aircraft on the same localizer by the required longitudinal spacing, the air traffic controllers have considerable latitude in directing aircraft. Unless an action is specifically prohibited, controllers may modify their normally used routines for approaches for reasons of separation or to accommodate a pilot's request. Several unexpected maneuvers were observed; two of which were (1) crossovers to other runways and (2) vectoring of aircraft already on the ILS.

4.1 CROSSOVERS TO OTHER RUNWAYS.

During the data collection, FAA observers noticed occasional crossovers to the adjacent runway. The following is an example: Air traffic control would start to bring an aircraft onto the localizer for runway 36R. In some instances, the pilot would request a change to runway 36L. If no loss of separation would occur, the air traffic controller would accept the pilot's request to cross over the ILS course to land on the adjacent parallel runway.

4.2 VECTORING AIRCRAFT.

Several aircraft were noticed making abrupt turns away from the centerline of the localizer after it appeared that they had already acquired the localizer. The air traffic control specialist observers attributed these maneuvers to response to controller vectors. Controllers are permitted to vector aircraft to insure that proper spacing distances are maintained.

5. DATA COLLECTION.

5.1 SITING GEOMETRY FOR RADAR AND RUNWAYS.

Figures 2, 3, 4, and 5 show the published approach charts for runways 18L, 18R, 36L, and 36R, respectively. Figure 6 shows the airport layout and relative locations of the parallel runways. Figure 7 shows the location of the TPN-22 radar with reference to the parallel runways. An airport building interferred with radar tracking at low altitudes for runways 18R and 18L. No significant obstructions were present for runways 36R and 36L. The runway 36R - 18L is 8400 feet long, and runway 36L - 18R is 9319 feet long. The four glideslope antennas are located at the approach end (touchdown) for each runway. The four localizer antennas are located at the far end of each runway.

Figure 8 shows the vertical profiles of the four ILS glidepaths to runways 18L, 18R, 36L, and 36R. The elevation of the airport is 332 feet above sea level. For runways 18L and 36R the initial localizer intercept altitude is published as 3000 feet (2668 feet above ground level) while for runways 18R and 36L the published altitude is 1900 feet (1568 feet above ground level). Later plots of the flight tracks showed that aircraft were brought onto the localizer at various altitudes below the published intercept altitudes. The glidepath angle for runways 18L, 18R, and 36L is 3°; while for runway 36R, it is 2.81°. If the published localizer intercept altitudes are used, aircraft begin to lose altitude separation when landing to the south at 8.4 nautical miles from 18L, while loss of altitude separation when landing to the north occurs at 8.9 nautical miles from 36R. These two ranges are the points where aircraft intercept the glideslopes for runways 18L and 36R, respectively.

5.2 EQUIPMENT PROFILE.

Three types of equipment were important in the data collection effort. These were the TPN-22 precision approach radar, the Zenith 120 microcomputer, and the Automated Radar Terminal Systems (ARTS) III display.

5.2.1 TPN-22 Precision Approach Radar.

A contract was written to have ITT Gilfillan modify, install, operate, maintain, remove, and return to original condition a TPN-22 radar from the Marine Corps. This radar met the accuracy, update rate, and range requirements for data collection and for demonstration.

The TPN-22 radar provided approximately plus and minus 23° of horizontal angular coverage around the extended runway centerlines, initially for a distance of 10 miles for the first 3 months of data collection. Through equipment modification, this range was extended to 15 miles for the second 3-month period of data collection.

The TPN-22 personnel operated and maintained the radar and radar recording equipment. They initiated track on all aircraft making approaches to runway 18L, 18R, 36L, and 36R during data collection. The radar occasionally acquired aircraft targets which were either not landing or not intending to land on the parallel runways. The radar occasionally dropped a track after it had been acquired. When an aircraft track was dropped, no attempt was made to reacquire the aircraft.

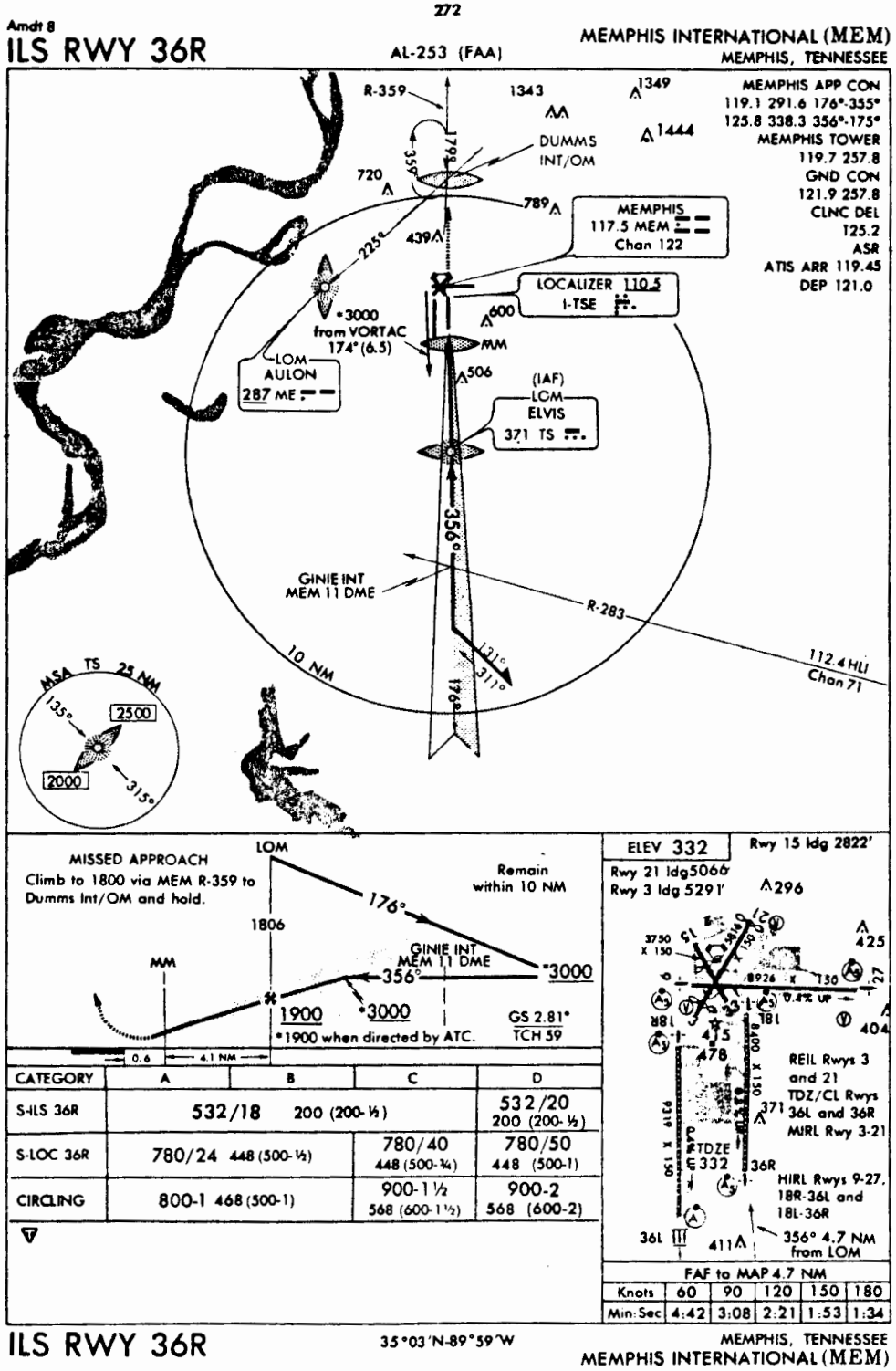
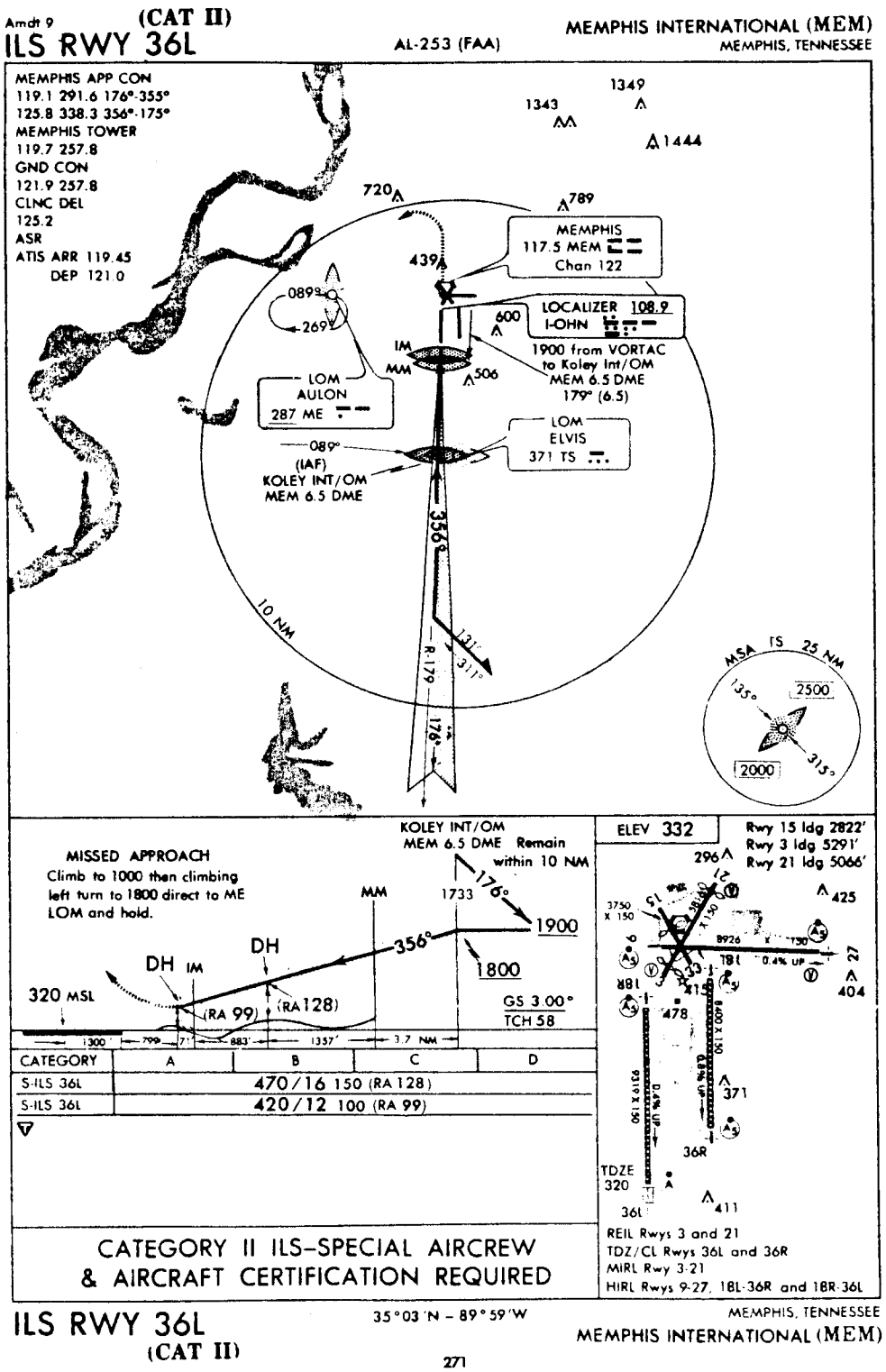
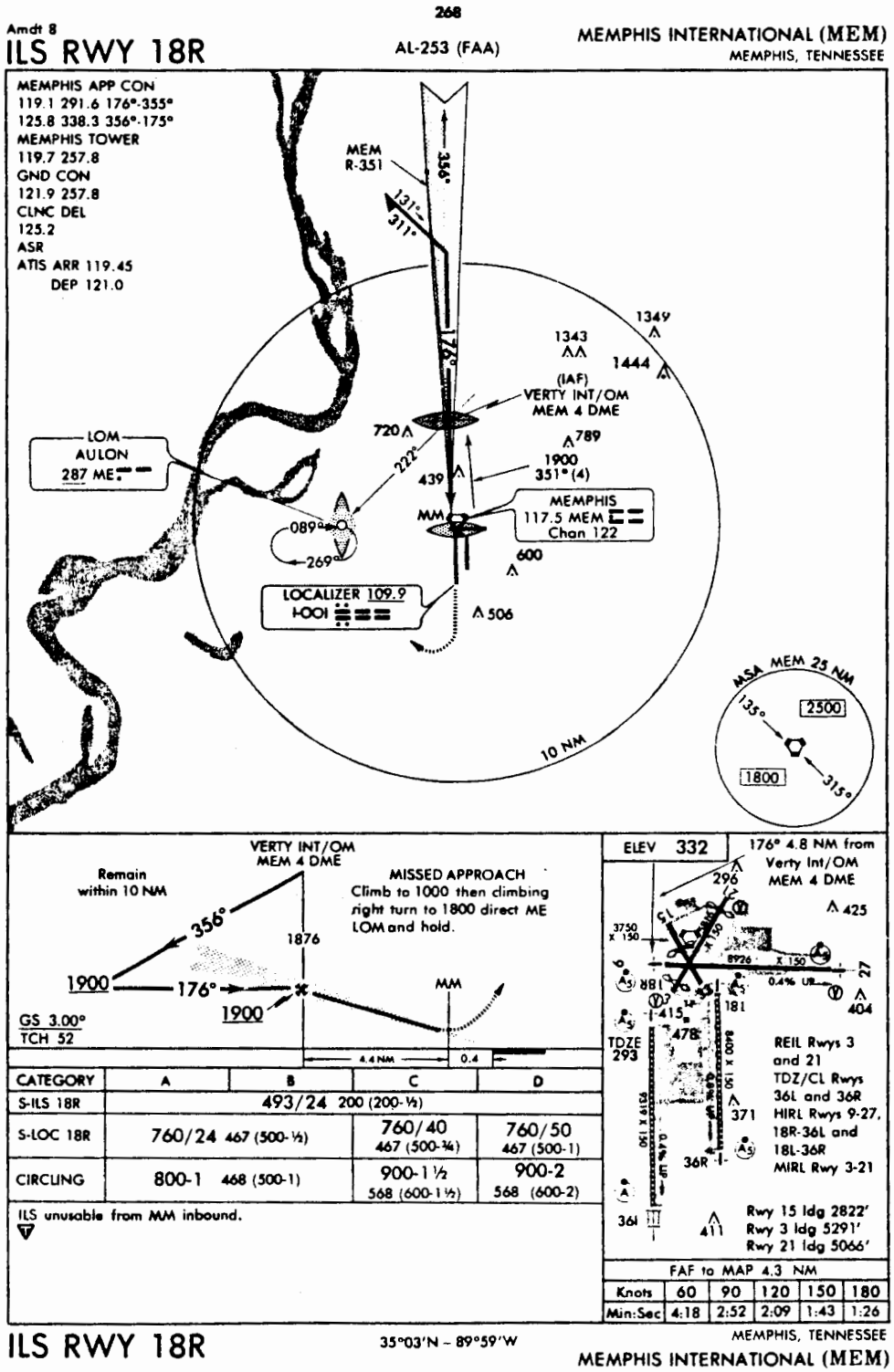


FIGURE 2. APPROACH PLATE PER RUNWAY - 36R



CATEGORY	A	B	C	D
S-ILS 36L	470/16 150 (RA 128)			
S-ILS 36L	420/12 100 (RA 99)			

FIGURE 3. APPROACH PLATE PER RUNWAY - 36L



CATEGORY	A	B	C	D
S-ILS 18R	493/24 200 (200-½)			
S-LOC 18R	760/24 467 (500-½)		760/40 467 (500-¾)	760/50 467 (500-1)
CIRCLING	800-1 468 (500-1)		900-1½ 568 (600-1½)	900-2 568 (600-2)

FAF to MAP 4.3 NM					
Knots	60	90	120	150	180
Min:Sec	4:18	2:52	2:09	1:43	1:26

FIGURE 4. APPROACH PLATE PER RUNWAY - 18R

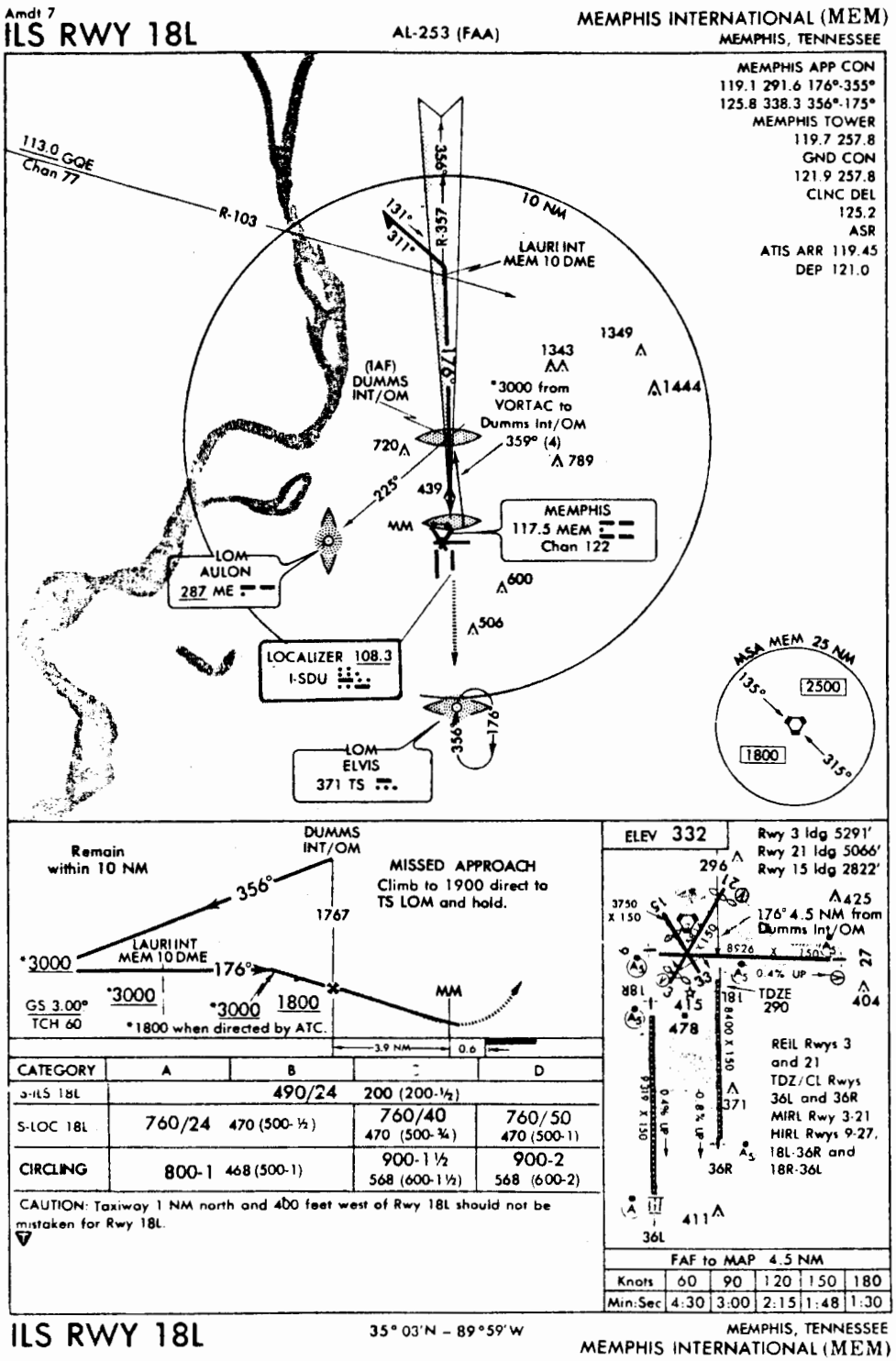


FIGURE 5. APPROACH PLATE PER RUNWAY - 18L

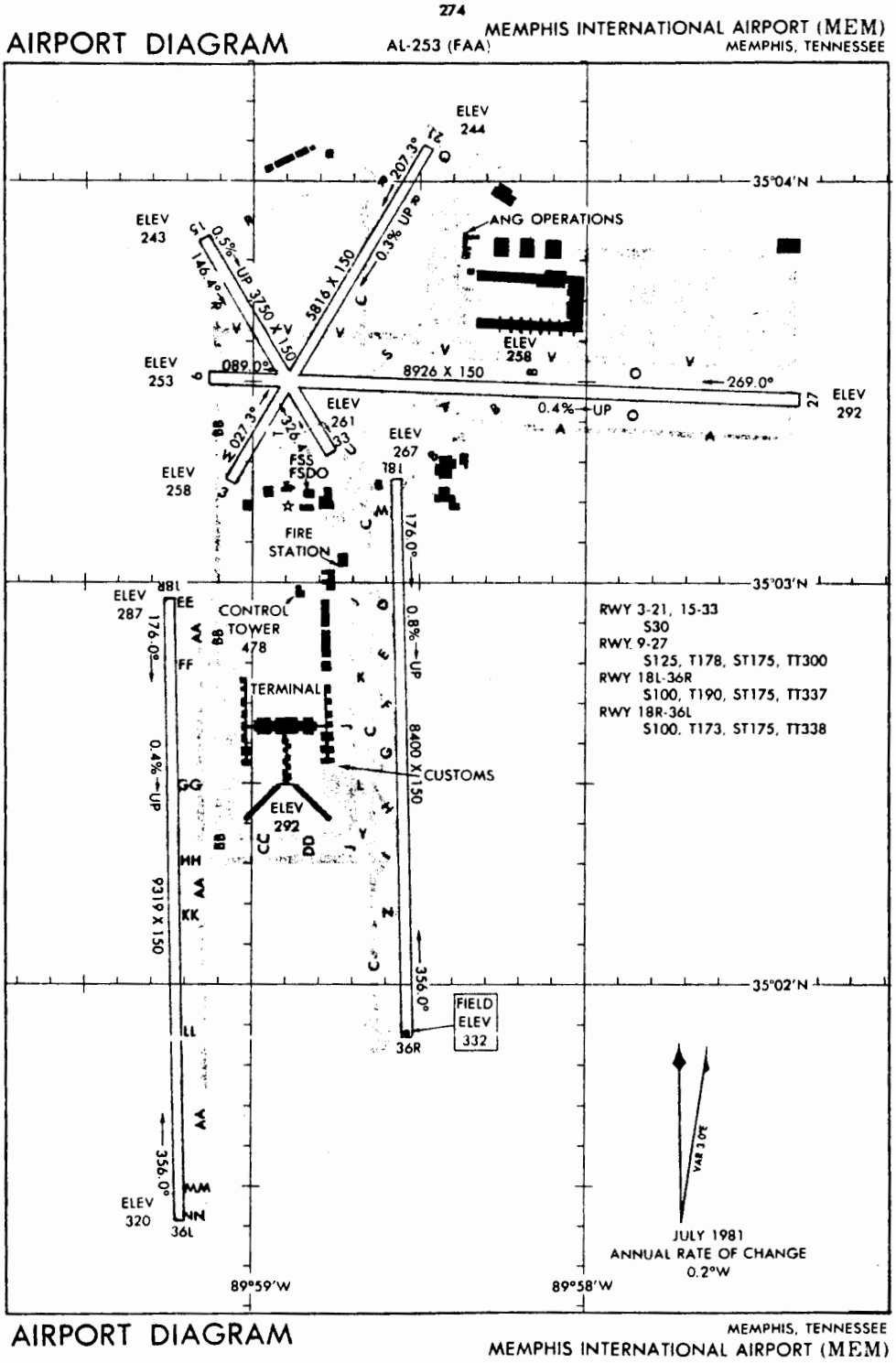


FIGURE 6. AIRPORT DIAGRAM FOR MEMPHIS AIRPORT

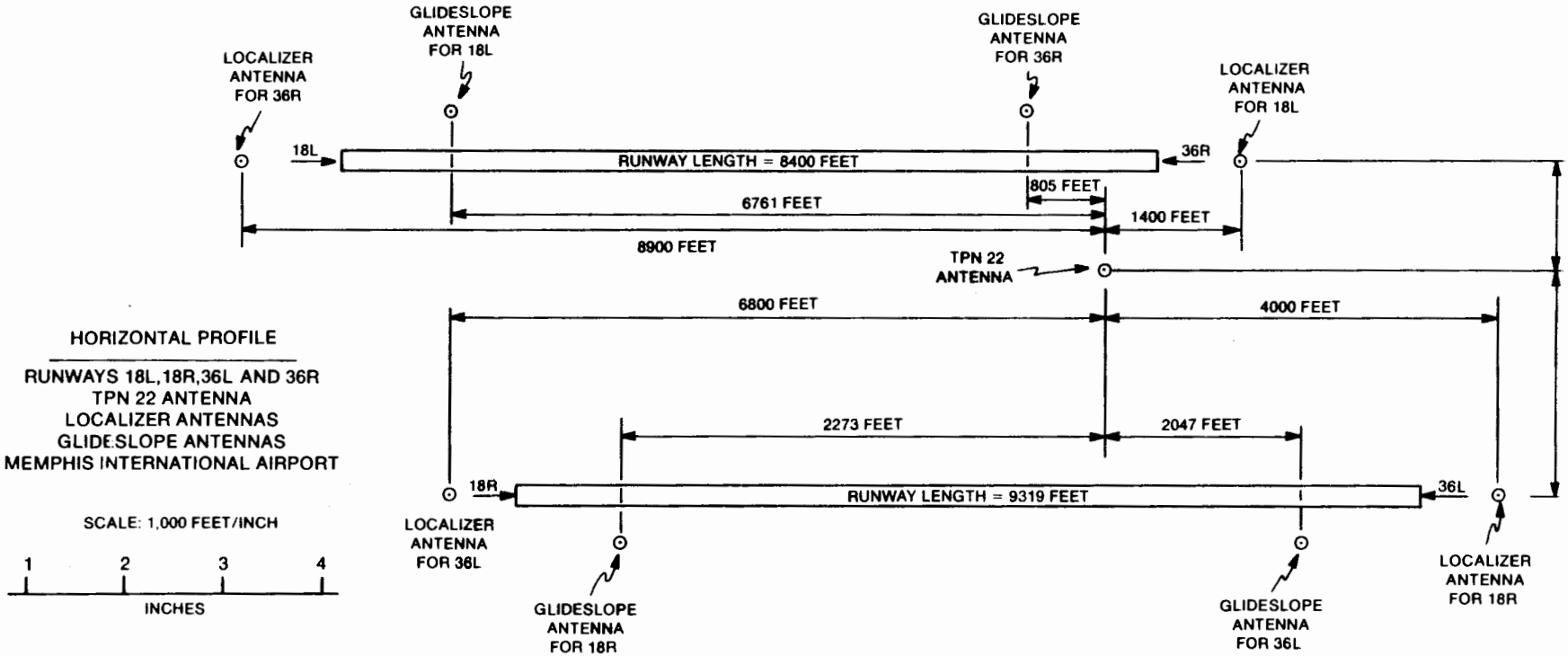


FIGURE 7. HORIZONTAL PROFILE OF TPN-22 AND RUNWAYS

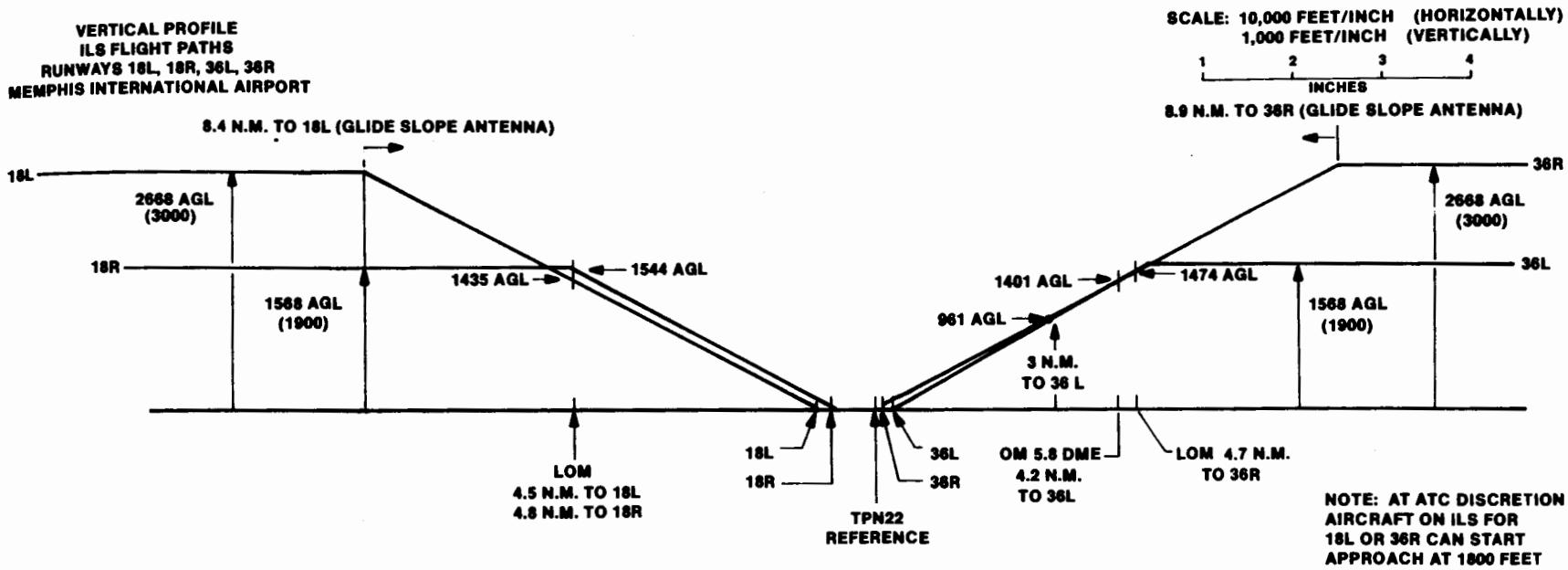


FIGURE 8. VERTICAL PROFILE OF ILS FLIGHT PATHS

The TPN-22 personnel coordinated with FAA personnel at the ARTS III display via telephone. The Electronic Target Generator (ETG) display was used by the FAA observers as a monitor for coordination of data collection.

The radar could track aircraft landing on runways 18L, 18R, 36L, and 36R. Up to six aircraft could be tracked simultaneously. A track identifier (track ID) was assigned in numerical sequence for each new aircraft. The radar was equipped with a magnetic tape recording system that recorded the X, Y, and Z coordinates of each tracked aircraft. Track ID, time, and TPN-22 internal track assignment were also recorded. All data were recorded 10 times per second and were time-tagged with an internal clock.

The PAR display console displayed both broadband and computer-assisted video from the TPN-22 radar. Target tracks, track number, and track ID were also displayed. The console provided all control needed by operators to initiate capture of new aircraft tracks and to monitor radar operation. The display console included a joy stick for positioning a cursor on the display which enabled track capture. The TPN-22 radar provided 3D radar coverage to 15 miles over a 46° horizontal sector. Horizontal scan was phase controlled and vertical scan was frequency controlled. ITT Gilfillan states that the resolution of the radar is as follows: azimuth 1.1°, elevation 0.7°, and range 300 feet; the accuracy is stated to be as follows: azimuth ±0.086°, elevation ±0.057°, and range ±10 feet or 1 percent of range whichever is greater. The radar provided raw video on all aircraft within the coverage area and precise digital position on up to six tracked aircraft at a rate of 10 times per second. The radar provided video and digital data to the PAR display in the ITT operations trailer and digital information to the AN/UYK computer for processing and recording. The AN/UYK computer was used to translate from RHO-THETA coordinates to X, Y, and Z position information for input to a tape recorder.

The radar was installed at Memphis in September of 1985, and data were collected through mid-February of 1986. More than 5000 approaches to the parallel runways at Memphis were tracked; approximately 1000 of the tracked approaches were performed under IMC.

The radar was returned to its original condition by the contractor and returned to the Marine Corps in late February 1986.

5.2.2 Zenith 120.

A Zenith 120 personal computer was installed in the training room of the air traffic control tower. With this computer, FAA observers recorded weather, runway, track ID, TPN-22 track assignment, aircraft ID, aircraft type, and remarks for aircraft making approaches during data collection. These data were merged off-line at the Technical Center with data from the nine-track radar recorder at the TPN-22 site.

5.2.3 ARTS Display in Training Room.

The ASR-8 surveillance radar provided radar coverage of all aircraft within a 60-mile radius of the ARTS IIIA system and displays. Each aircraft target report to the ARTS computer included the Mode A identifier and Mode C altitude of the aircraft. An ARTS display in the training room enabled FAA observers to identify aircraft to be tracked. This same ARTS display was used to acquire the aircraft ID

and aircraft type subsequently recorded on the Zenith 120. A telephone line provided coordination for identifying chosen aircraft to the ITT technicians operating the TPN-22 radar.

All aircraft within the 15-mile range of the ARTS IIIA sensor had 1/64 nautical mile resolution. There was a further reduction in resolution to 1/16 of a mile at the display. Mode C altitude had a resolution of plus or minus 50 feet. The antenna scan rate was approximately 12 times per minute.

5.3 DATA COLLECTION PROCEDURES.

Data were collected during 8-hour work days, 5 days a week. Shifts were scheduled 2 weeks ahead of time and included some mid shifts. An attempt was made to schedule data collection for the heaviest traffic periods.

Two teams of personnel cooperated in the data collection. Under the contract, ITT Gilfillan supplied a crew of radar technicians to operate and maintain the radar, itself, and the data recording system attached to the radar. The FAA Technical Center supplied a team of air traffic control specialists and engineers. These ATC specialists and engineers were used to coordinate the data collection, and to acquire and record pertinent weather data and aircraft identification/descriptive data in addition to the X, Y, and Z position data supplied by the TPN-22 recording system.

At the start of each day, ITT Gilfillan technicians activated the TPN-22 radar, loaded the data collection tapes, and entered the date.

Meanwhile, FAA observers readied the Zenith 120 computer in the training room of the FAA control tower. They "booted" the personal computer (PC) and inserted blank formatted diskettes. They checked the communication lines with the radar site and weather bureau. Runway visual range (RVR), ceiling, wind direction and speed, approach operations, and meteorological conditions were entered onto the diskettes. After the weather data were entered into the computer, the weather information was saved with every aircraft track.

After communications had been established and the initial static weather data had been entered, the personnel in the training room monitored the ARTS display. When they observed aircraft entering the coverage area of the TPN-22 tracking radar, they determined if the aircraft was scheduled to land on one of the parallel runways of interest, then identified the aircraft to the ITT radar crew and requested that a track be established on the aircraft. When they observed aircraft about to enter the radar coverage area that were not going to land on the runways of interest, they notified the ITT radar operator so that he did not enable the acquisition gate. This was necessary to reduce the number of tracked approaches for which no disk data were recorded.

The TPN-22 radar technicians established the track, then verified the track numbers and the track ID's to the FAA operator in the training room. They also notified the FAA observer in the training room when the track was dropped. The training room personnel entered the aircraft ID and type into the Zenith PC along with the track number and track ID. The time at which the track was entered was recorded automatically by the computer.

The aircraft ID and type, runway number, and type of approach (visual or instrument), prevalent wind, ceiling, and runway visual range were manually entered into a Zenith Z-120 PC along with the track number, track ID, and time for each aircraft that was tracked by the TPN-22 radar. The nine-track radar recorder on the TPN-22 radar was used to record track ID, internal track number, X, Y, and Z position data at a rate of 10 times per second for all tracked aircraft. Coordination of aircraft tracks, track number, and track ID from the radar site to the training room was accomplished via telephone line. FAA observers in the training room obtained the aircraft ID, aircraft type, runway, and type of approach from the screen of an ETG display which showed ARTS III data tags identical to the display data being observed by the final approach controllers located in the radar room. The FAA observers also monitored the radio communications between the final approach controllers and pilots for additional information about flights that could affect the analysis of the data. During 1985 the weather surface observations were entered twice per shift. This weather information was obtained from on-line displays in the IFR room.

Occasionally, the controller changed the assigned runway after the runway designator had been entered into the computer. No mention of this change was made at the time of the change to the persons entering data, and no change could be made after the data entry.

At a later time, computer software was used to identify changed runways and to correct the runway identifiers.

A new PC floppy disk was installed at the start of each data collection shift. Each data collection period began with a fresh disk. The radar tape was changed at the start of each new calendar date using central time to determine the start of the new date. This procedure was followed even though the previous period did not fill a disk or tape. Greenwich time and date were used for the disks while central time and date were used for the radar tapes.

Shutdown began 10 minutes prior to the end of the shift. Disks and tapes were removed, logged, and stored at the end of each data collection shift. All PC disks and some ARTS tapes (when they became available) were periodically shipped to the Technical Center by parcel post, courier, or other commercially available delivery service. Radar tape shipments to ITT's office in California were scheduled for the close of business each Friday during the data collection period. All radar tapes were shipped from Memphis to ITT's office in California for initial processing. Sometime later, the radar tapes were shipped from the ITT office to the Technical Center for additional processing and track analysis.

5.4 CHANGES IN PROCEDURES DURING COLLECTING PERIODS.

Two major changes occurred during data collection: (1) Frequency of weather collection was improved. Initially weather data were entered twice during each shift of data collection. During 1986, the weather information was entered hourly and was obtained via telephone from a local Flight Service Station. All earlier diskettes were subsequently edited at the Technical Center to include hourly updates to the weather information. The edited weather data were obtained from the National Weather Archives in Ashville, North Carolina. (2) The range of the TPN-22 radar was upgraded from 10 to 15 miles. This hardware modification occurred in early November 1985.

6. DATA REDUCTION AND ANALYSIS.

6.1 DATA REDUCTION.

The magnetic tapes were shipped first to ITT Gilfillan and later reshipped to the FAA Technical Center. The VAX 11/780 computer at the FAA Technical Center correlated data from the Z-120 PC and the nine-track radar recorder. The raw radar data files (aircraft position) supplied by ITT Gilfillan and the aircraft and airport descriptive data were combined. Position data were smoothed, using a nine-point moving average. Each point was smoothed, using itself plus four previous and four trailing points.

The speed parameters were estimated using eight previous and eight trailing data points. The value of the X coordinate carried a resolution of 4 feet; the Y coordinate, 2 feet; and the Z coordinate, 1 foot.

Data are stored on physical tape records of 1024, 16-bit words. These records are described in appendix B.

The weather data, wind direction, and speed were corrected using data from the National Weather Archives which were updated hourly.

The avionics data for the aircraft were not collected. The comments data do not describe if an aircraft was on vectors or on an ILS. Later software was implemented to provide a subset of the smoothed data file for statistical uses. This subset was formed on increments of approximately 0.15 nautical mile.

Spurious tracks were avoided with a criterion that the track must have at least 50 data points. An additional correction algorithm was added to properly identify the landing runway. There were several cases of runway switching to accommodate the carriers and/or ATC. The data at the end of the tracks (altitude less than 300 feet) were unstable. This was due to the multipath of the radar beam. These data were discarded.

Because of the volume of data, custom software was developed to print the flight tracks in graphical form. Two plots were developed: a horizontal profile and a vertical (descent) profile. Examples of these plots are shown in figures 9, 10, 11, and 12. Digital printouts accompanied each plot but are not included in the report. These plots proved to be an invaluable resource for spotting unusual flight patterns and/or missing data. Occasionally the aircraft tracked by the radar was not the aircraft intended. The plots showed aircraft that obviously did not intend to land on the parallel runways and also aircraft that were overflying the airport and did not descend.

6.2 DATA ANALYSIS.

6.2.1 Data Selection.

Navigation performance was analyzed only for approaches that were performed in IMC. (During IMC, pilots are flying the approach on instruments only.)

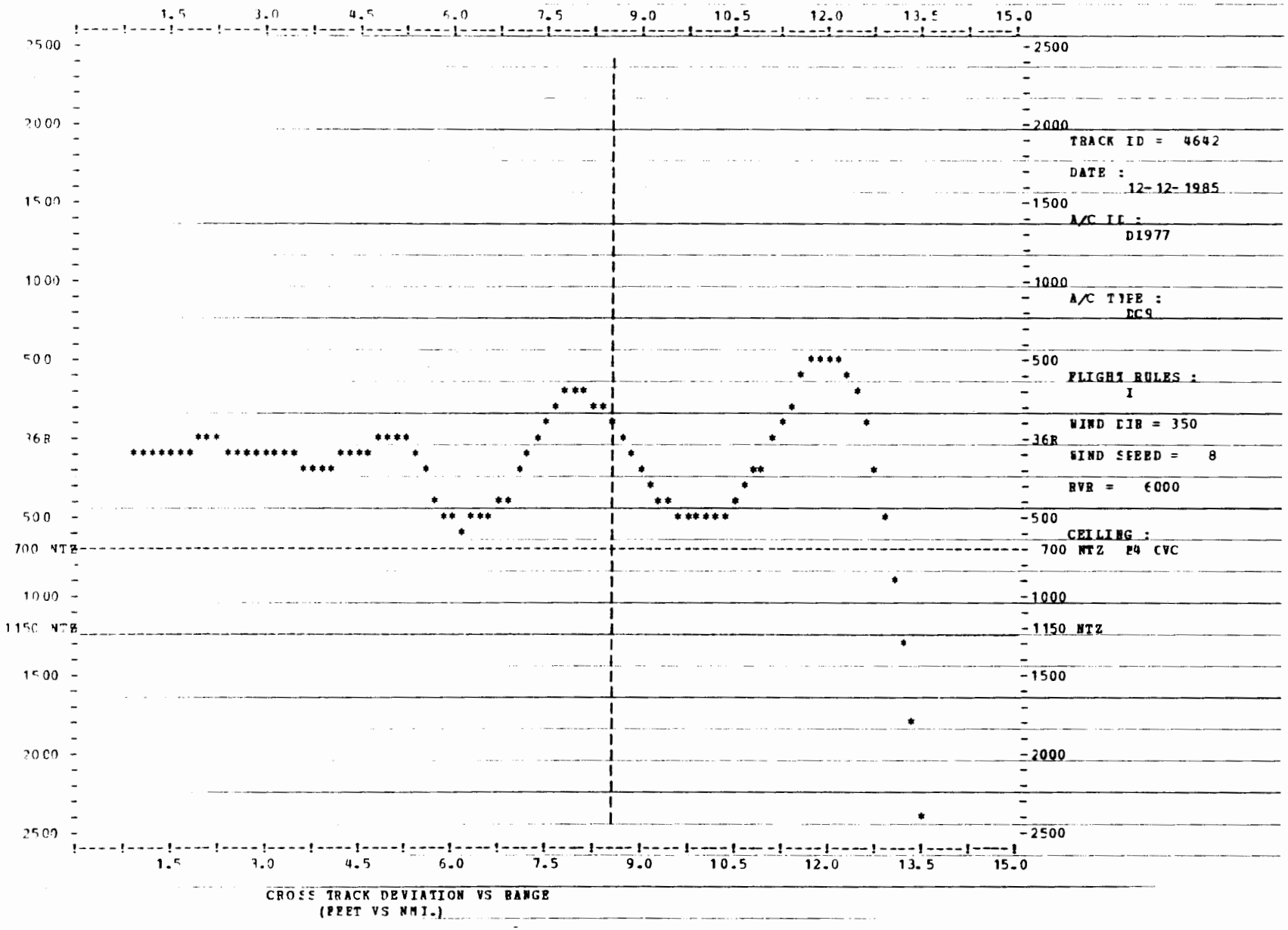


FIGURE 9. EXAMPLE OF HORIZONTAL PROFILE, TRACK 4642

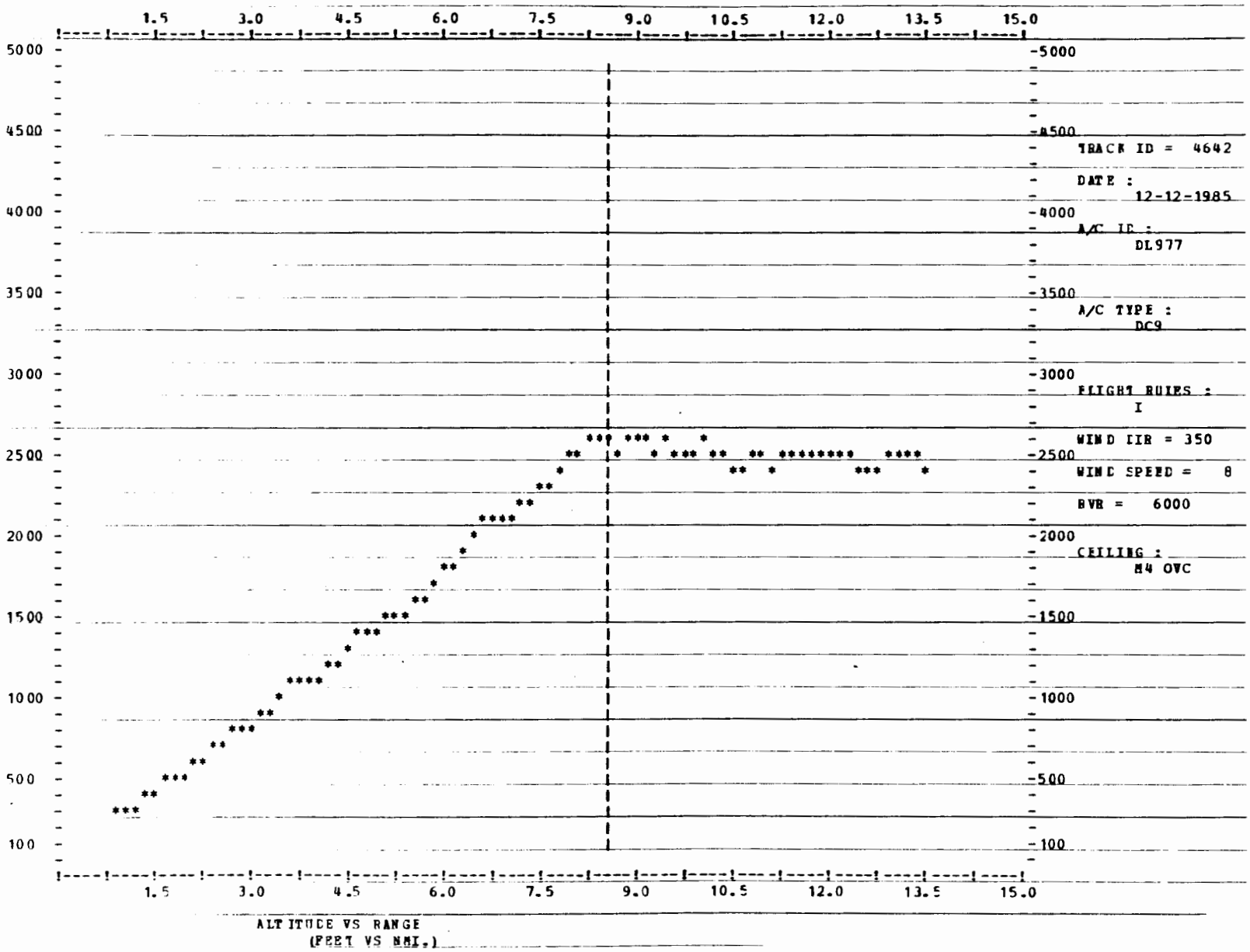


FIGURE 10. EXAMPLE OF VERTICAL PROFILE, TRACK 4642

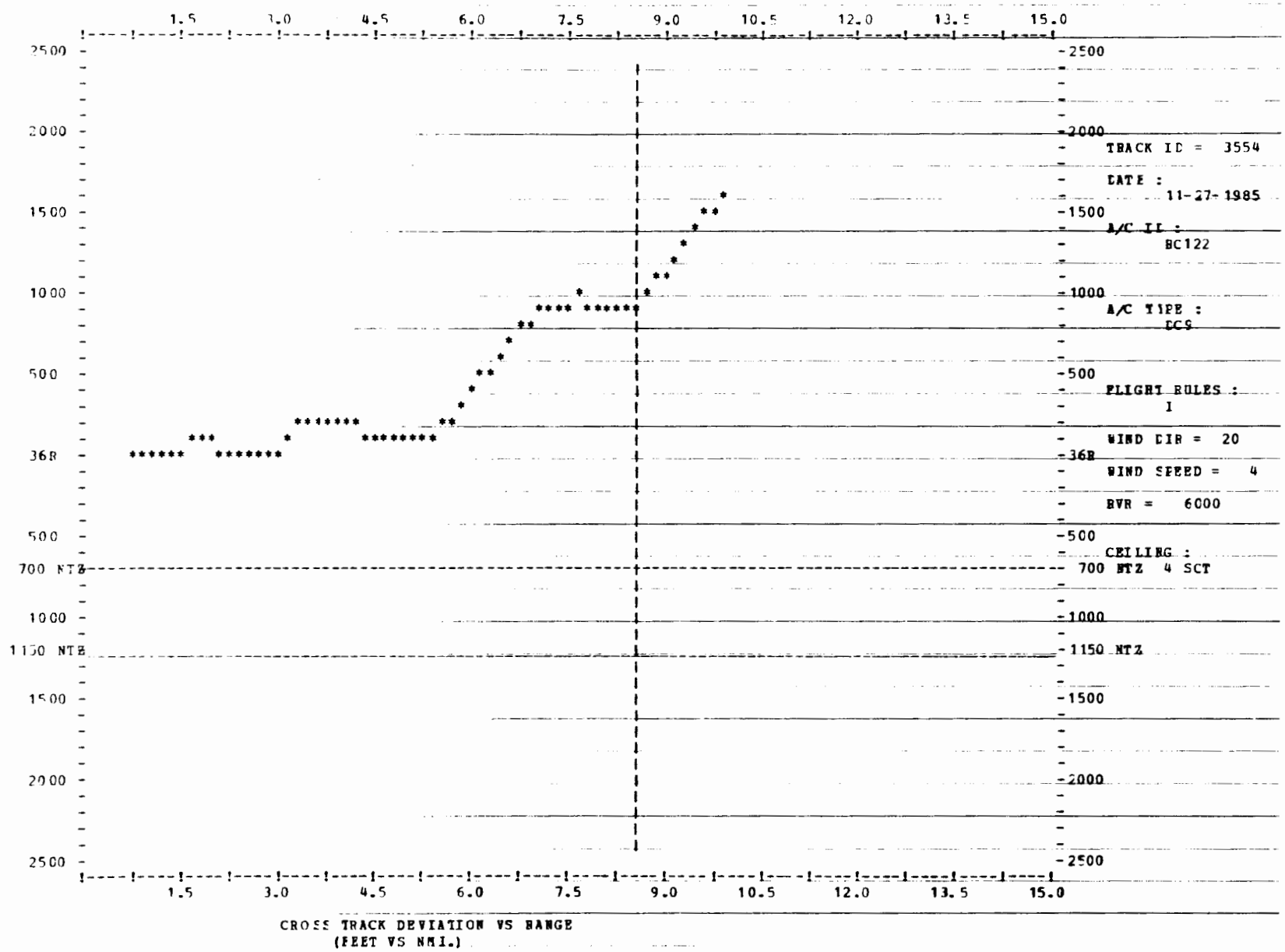


FIGURE 11. EXAMPLE OF HORIZONTAL PROFILE, TRACK 3554

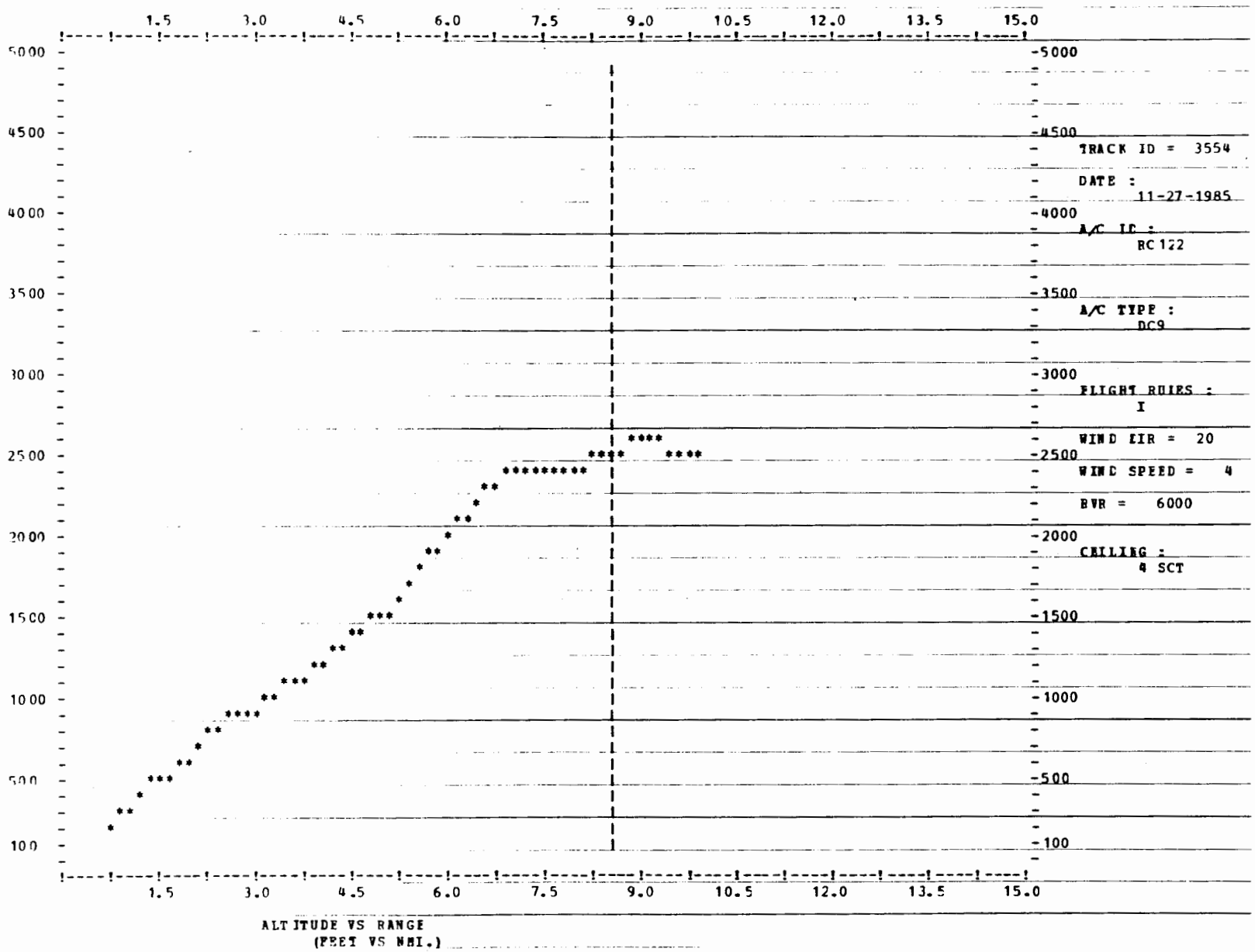


FIGURE 12. EXAMPLE OF VERTICAL PROFILE, TRACK 3554

An assessment of every IMC flight plot was performed by a group of pilots, analysts, and air traffic controllers from the Technical Center and Systems Engineering Service. Upon examination of the plots from IMC approaches, it was found that there were some flight tracks which should not be included for mechanical reasons, e.g., radar malfunctions. The team documented (appendix C) their reasons for excluding flight tracks from analysis by coding the reasons and entering the codes in a log that was then keyed into the computer file for use in analyzing the plot data.

In addition to removing mechanically unsuitable data, it was felt that further editing of the data would be appropriate since there were cases containing large overshoots and protracted turn-on legs which should not be included in an attempt to assess the quality of navigation on the ILS. In successive efforts, four views were made of the data. The editing process is described below.

6.2.2 The Views.

For purposes of comparison, a file was generated with all of the data for the 894 flight tracks and was named the "Full View." It contains very large amounts of data from aircraft that are still flying the base leg of their approach and/or have not as yet acquired the localizer. As expected, later analysis showed excessively large lateral deviations when this Full View was examined.

"View 1" contained only the usable IFR data within the start and stop segments identified by the assessment team. It contains both overshoot and navigation data as well as some data from aircraft which were still turning onto, but had not yet acquired, the localizer. Most of the base-leg data and large vectors were eliminated from this file.

In order to obtain a clearer picture of navigation performance when aircraft have stablized on the localizer, two more files were created. These were named "View 2" and "View 3." It should be noted that each succeeding view of the data is a subset of the previous set, and each succeeding view presents a more restricted definition of navigation on the localizer. Unlike View 1, Views 2 and 3 do not contain overshoot data.

View 3 is intended to more closely resemble data of simultaneous independent ILS operations. Aircraft are stablized at a predetermined range for simultaneous approaches.

6.2.2.1 Full View.

The first, or Full View, was created as follows: A file was generated with all of the data for the 894 flight tracks which had passed initial screening to eliminate mechanical problems. Except for the tracks listed in appendix C, no other tracks were excluded from this view. The Full View contains (1) large amounts of data from aircraft that have not acquired the localizer, and (2) data from aircraft that have overshot the localizer. Analysis showed larger than expected standard deviations due to this extraneous data.

The assessment team also coded start and stop points for data to be used in the navigational performance analysis and the overshoot analysis. Data were used for the navigational performance only after the aircraft was judged to be within the

ILS coverage area or after overshoot, if overshoot had occurred. Overshoot data were selected only if there was a measured overshoot of 200 feet or more from the extended runway centerline. At the end of this assessment, 894 aircraft tracks were available for navigation analysis. Overshoots occurred in 348 of those tracks.

During the assessment, exceptionally large, abrupt turns were noticed in a small number of flights. These turns extended beyond the ILS coverage volume; therefore, the pilot had no reference to the localizer. Air traffic control specialists and other team members considered these turns to be the result of vectors given by air traffic controllers. Vectors are not normal operations in navigating the ILS, and thus, these portions of the flights were excluded from all analyses. See figure 13 and figure 14 for two examples of vectors. Note that the deviations are exaggerated by the choice of scale. In these figures, lateral deviations are in feet whereas range is in nautical miles.

During the assessment process, usable aircraft tracks were also segregated into two categories: those aircraft tracks which exhibited stabilization before the descent and those aircraft which did not. These were given code numbers:

code 0 - aircraft stabilized before descent;

code 1 - aircraft <u>not</u> stabilized before descent.

6.2.2.2 View 1.

These start and stop points were used in conjunction with the Full View to generate a new file. That file, View 1, contained only the usable IFR data within the start and stop segments identified by the assessment team. View 1 contains both overshoot and navigation data as well as some data from aircraft which were still turning onto, but had not yet acquired, the localizer. Most of the base-leg data and large vectors were eliminated from this file. In the example shown in figure 13, the flight track had no overshoot data and navigation data were extracted from 7.5 to 0.9 nautical miles; and in figure 14, the flight track had overshoot data from 6.18 to 4.8 nautical miles and navigation data extended from 4.8 to 0.75 nautical miles. The vectored portions of both flight tracks were eliminated in View 1.

6.2.2.3 View 2.

View 2 eliminated the initial overshoot portion of the tracks and removed or severely limited the amount of turn-on data included for aircraft which had no overshoot. In effect, View 2 looks at aircraft which should be fairly well stabilized on the localizer. Since the pilot did not always center the needles of the course deviation indicator (CDI) on the localizer, it was not always clear at which point the aircraft should be considered stabilized or in navigation mode. If the pilot centered the CDI needles, then the actual crossing of the centerline could be used as a starting point. However, many aircraft were not tracked by the radar for a sufficient duration so that the data analysts could be certain where the stabilized portion actually began. Sometimes, the aircraft were not even headed toward the localizer when the radar first acquired their track. After examining many flight tracks, a procedure was developed. The computer implemented this procedure to create the data for View 2.

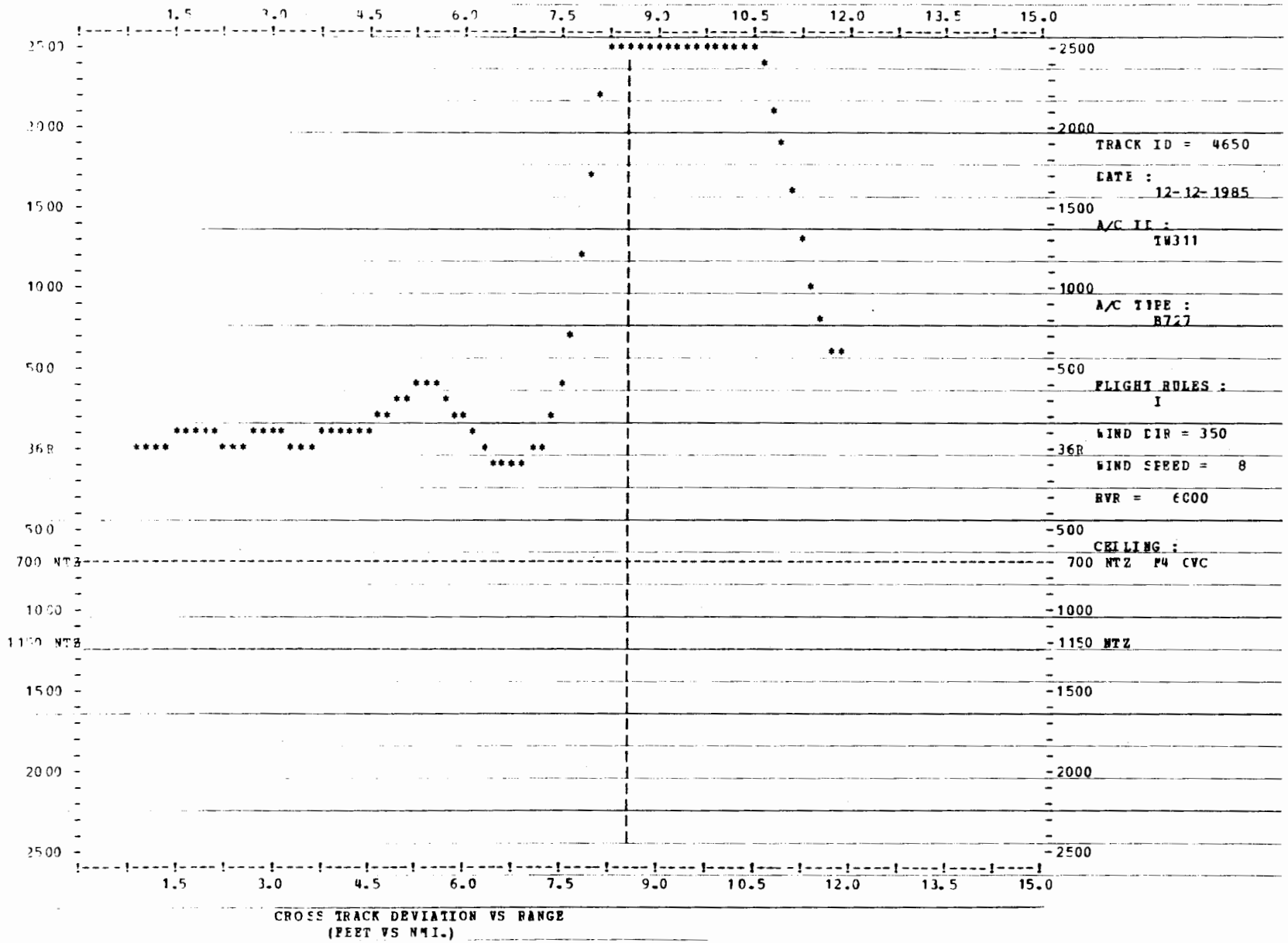


FIGURE 13. EXAMPLE OF VECTORED AIRCRAFT, TRACK 4650

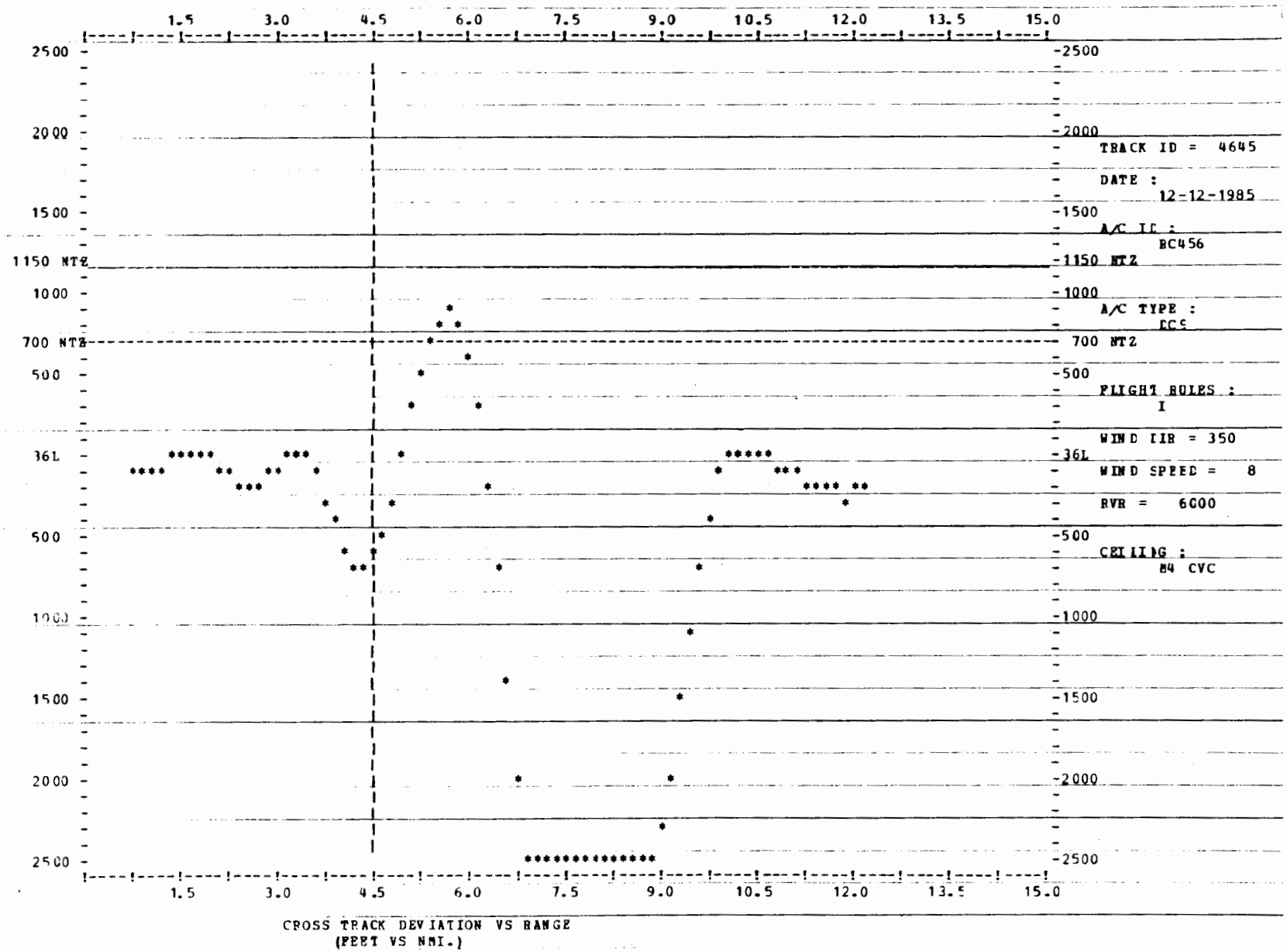


FIGURE 14. EXAMPLE OF VECTORED AIRCRAFT, TRACK 4645

The procedure used to remove the turn-on portion of the track is as follows:

a. Examine the navigation and overshoot portions selected by the assessment team.

b. If aircraft track has overshoot, start navigation portion at end of overshoot.

c. If no overshoot is present and first navigation position is within 500 feet of the centerline of the localizer, start navigation at that first point.

d. If no overshoot is present and first navigation position is more than 500 feet from the centerline of the localizer, then

1. if the aircraft is headed towards the localizer, start navigation at the first point after the aircraft has crossed the ILS centerline or the first point where the aircraft is reversing direction (i.e., correcting); or

2. if the aircraft is headed away from the localizer, assume that aircraft is already correcting, so begin navigation at first point.

6.2.2.4 View 3.

View 3 is a subset of View 2. It consists of data from the set of aircraft which were stabilized on the localizer at a range of 9 miles from the runway. Data analysts had observed from the plots of flight track that many aircraft had been turned on at short range. In effect, View 3 eliminates the effect of the many aircraft which turned onto the localizer at the various lesser ranges.

7. RESULTS.

IN ORDER NOT TO INTERRUPT THE NARRATIVE, ALL TABLES ARE IN APPENDIX D.

During IMC conditions, the radar tracked 894 aircraft which landed on the dual parallel runways. Controllers brought these aircraft onto the localizer at varying ranges from touchdown. At various distances, more or less aircraft were available for tracking. All results are presented with an indication of the number of aircraft included in the statistics (denoted by N in each table) and the distance from the runway at which the calculation was made.

All results will be presented for each of the four views of the data. As mentioned earlier, the Full View is presented merely for completeness since these flight tracks frequently include base-leg and turn-on segments of flight. That the data in the Full View contain base-leg and turn-on data is evident from the extreme ranges shown in table 1. For example, at 7.5 nautical miles from touchdown, one aircraft was tracked which was more than 11,000 feet from the centerline of the localizer in the direction away from the other ILS and another aircraft position was tracked at 20,525 feet from the localizer in the direction toward the adjacent ILS. (Note: Flight tracks were observed in which air traffic control had brought the aircraft across the adjacent ILS.) The additional views are the result of attempts to more precisely define and extract that portion of flight in which aircraft are classified as navigating the ILS rather than attempting to acquire or stabilize on the localizer.

7.1 STATISTICS AND PROFILES.

All statistics are presented (in feet) on deviation from the centerline of the localizer. A negative value denotes deviation toward the adjacent ILS, and a positive value indicates deviation away from the adjacent ILS. The general statistics will include the number of aircraft in each sample, the mean, the standard deviation (denoted by S.D.), the median (the middle value), the 95th percentile, and the minimum value and maximum value.

The 95th percentile includes all aircraft except those final 5 percent deviating toward the adjacent localizer. (For example, in table 4, the 95th percentile is shown as -337.5 feet at a range of 6 miles from runway. This indicates that 95 percent of the aircraft at that range deviated no further than 337.5 feet from the centerline in the direction of the adjacent ILS.)

Containment profiles are presented tabularly to show both the number of the aircraft and the percentages of the aircraft which were recorded within distances of 550 and 700 feet from the centerline of the localizer. These are presented in two ways; with reference to a hypothetical NOZ and with reference to defined envelopes (see figure 1 for example of an NOZ). The distribution of aircraft about the localizer is presented in 100-foot increments for each runway.

7.2 EXAMINATIONS OF THE DATA.

The first step is to examine the data as a whole. Subsequently the data will be sorted in such a way as to examine various factors which might influence navigation performance on the ILS. These will include the individual ILS used, type of aircraft, type of airway user, ceiling height, and stability code.

7.2.1 Main Data.

In this first examination, the data for all the aircraft entering the four runways will be examined for a general picture of ILS navigation performance. The four views defined above will be given, and consideration will be given to the general statistics indexes and the containment profiles as defined earlier.

7.2.1.1 General Statistics.

ALL DISCUSSION OF THE RESULTS WILL CENTER ON VIEWS 1, 2, AND 3. NO FURTHER MENTION WILL BE MADE OF THE FULL VIEW.

The examination of the general statistics can be conducted using tables 1 to 4 and figures 15 to 18.

The large variation of ranges at which the aircraft acquired the localizer can be readily seen from the number (N) of aircraft available for each calculation. At 9 miles from touchdown, fewer than 350 aircraft had acquired the localizer. At 7 1/2 miles from touchdown, 597 aircraft were in various stages of acquiring the localizer (table 2), and at 6 miles, the number of aircraft rose to 777. More than 180 aircraft acquired the localizer at a range between 7.5 and 6.0 miles from touchdown. Aircraft were still acquiring the localizer at less than 6 miles from touchdown. In fact, more than 100 aircraft acquired the localizer between 3 and 6 miles from touchdown. From the difference in the number of aircraft at varying ranges in View 2, it can be computed that more than 200 aircraft actually stabilized between 3 and 6 miles from touchdown.

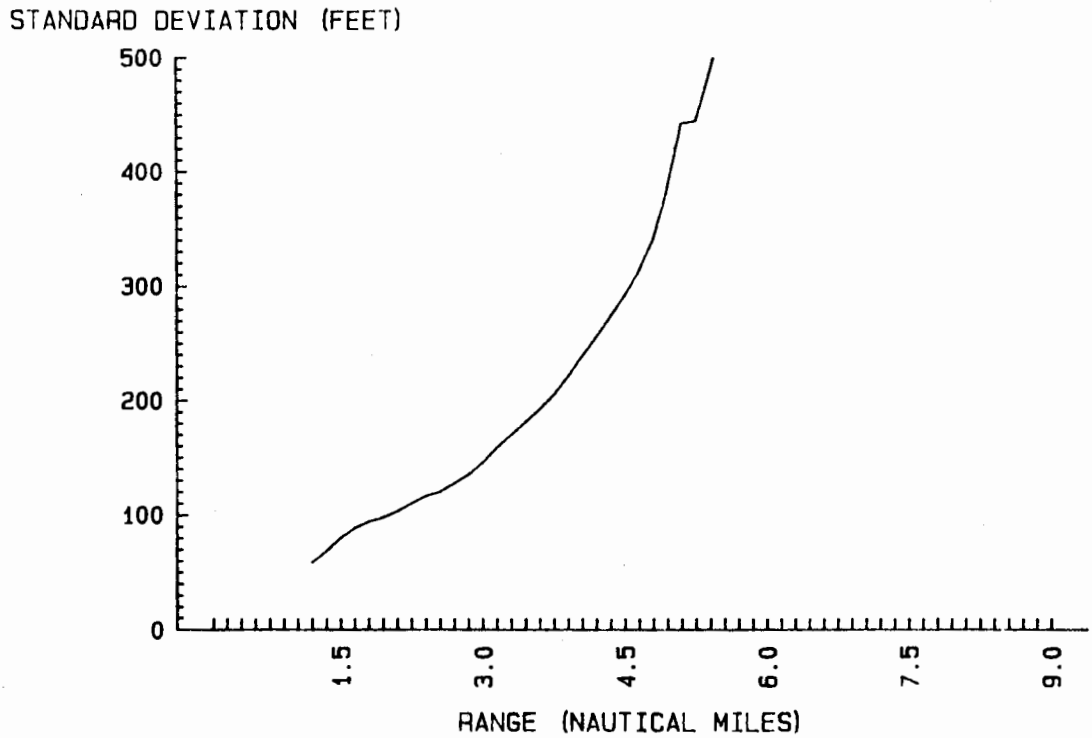


FIGURE 15. RANGE VERSUS STANDARD DEVIATION FULL VIEW, ALL RUNWAYS

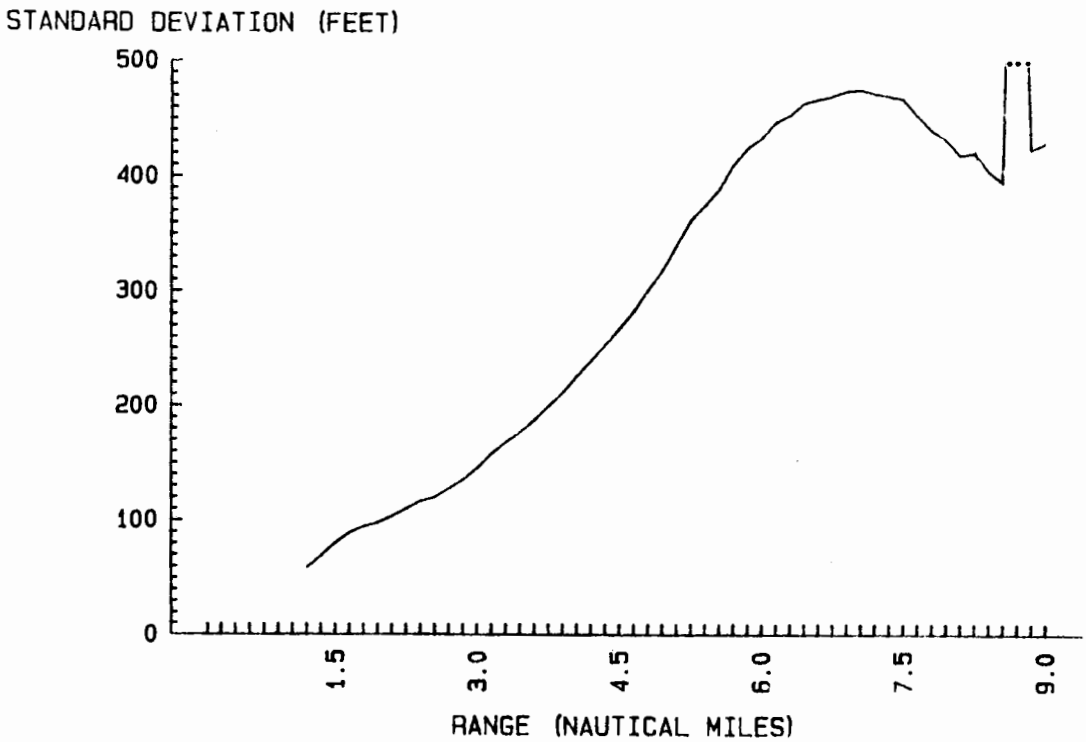


FIGURE 16. RANGE VERSUS STANDARD DEVIATION VIEW 1, ALL RUNWAYS

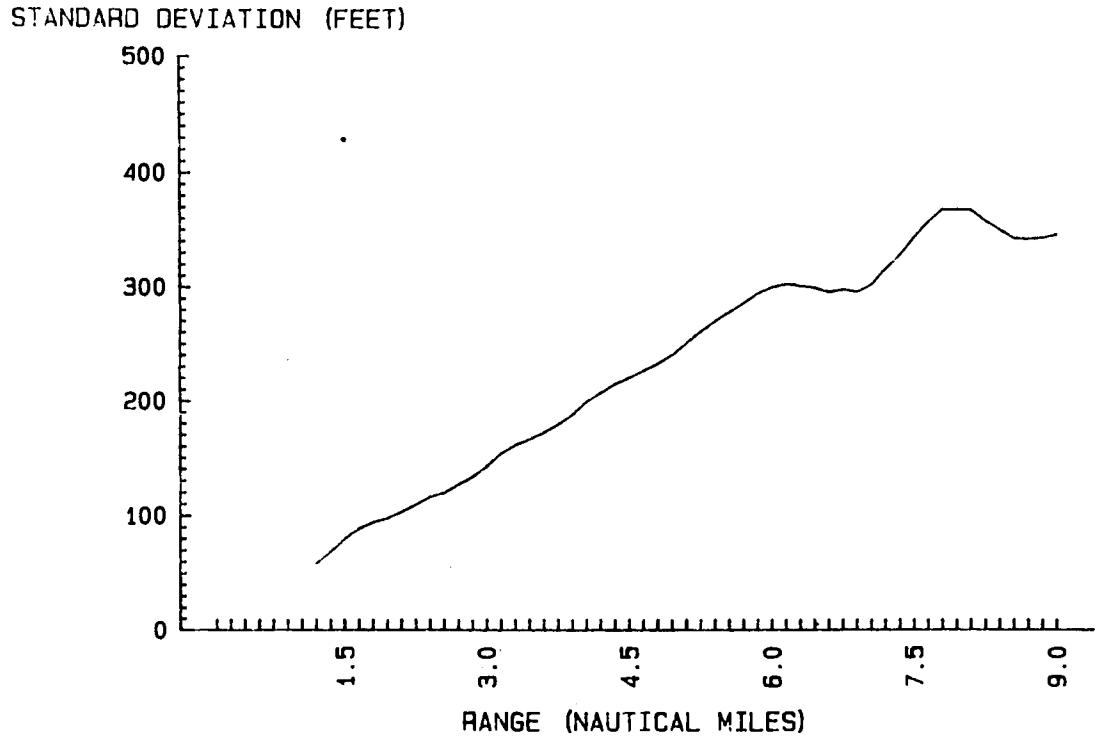


FIGURE 17. RANGE VERSUS STANDARD DEVIATION VIEW 2, ALL RUNWAYS

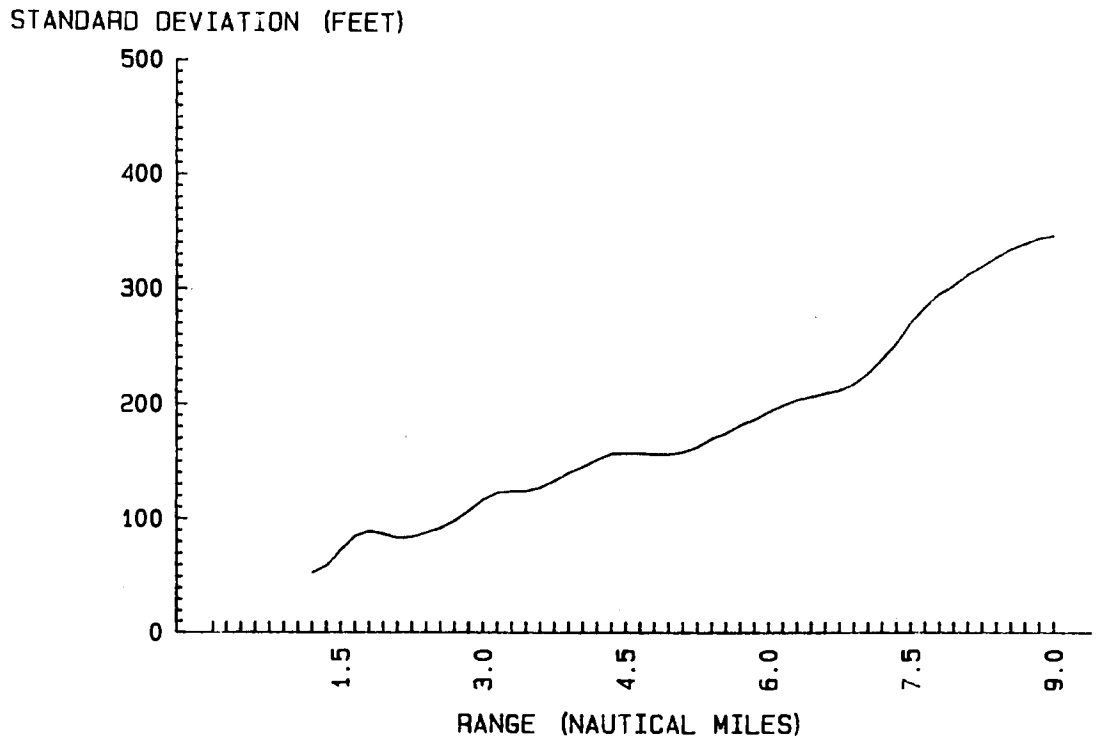


FIGURE 18. RANGE VERSUS STANDARD DEVIATION VIEW 3, ALL RUNWAYS

In figures 15 to 19, standard deviations in excess of 500 feet are not shown. Such large statistics in the Full View and View 1 are the result of base-leg and vector data being included in the database.

As the aircraft approach the runway, the decreasing standard deviations show that they tend to become more concentrated about the centerline of the ILS. In table 4, the stabilized subset of aircraft defined as View 3 shows that the average distance from the centerline can be either toward the other runway or away from it. In View 2 (table 3), some aircraft are still turning onto the localizer at various points and this turning-on affects the average. If we examine the comparison of the three Views as shown in figure 19, the effect of the turn-on data can be readily seen in the separation between the graphs for View 2 and View 3. In figure 19, the stabilized subset of aircraft without turn-on shows a constantly decreasing dispersion as they approach the runway. As mentioned earlier, View 3 eliminates the effect of turn-on from 9 miles out until landing. In the figures, the tracking data do not extend completely to the beginning of the runway. At short distances from the runways, ground obstructions hampered the radar from accumulating data.

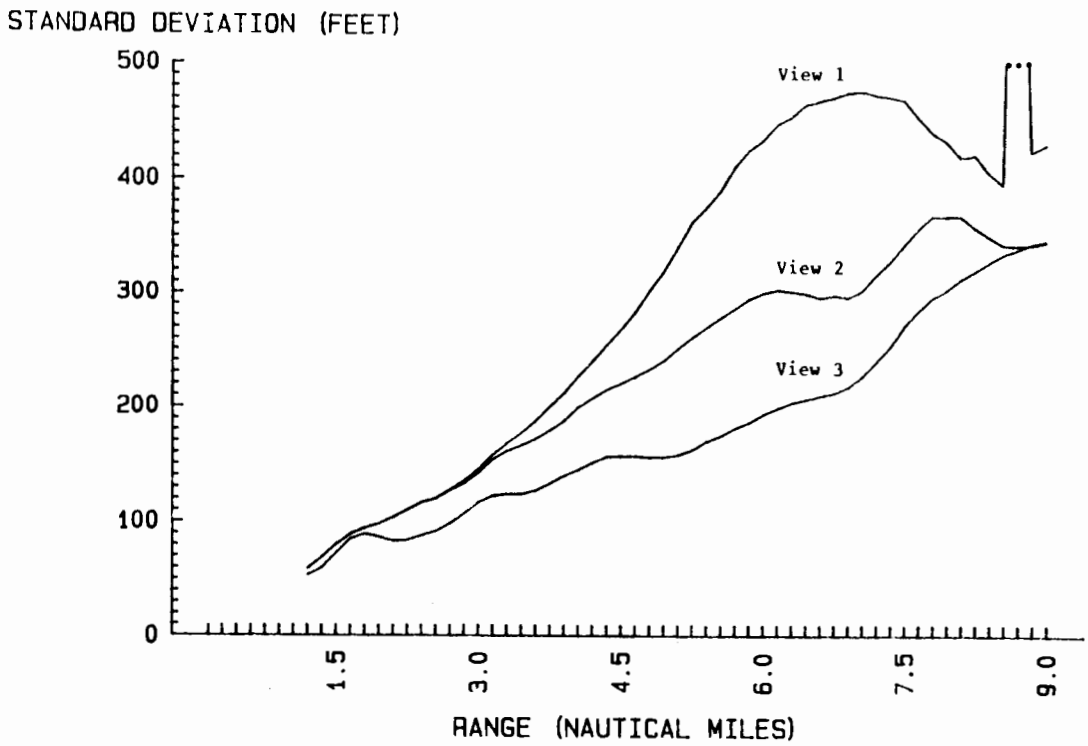


FIGURE 19. RANGE VERSUS STANDARD DEVIATION VIEWS 1, 2, 3, ALL RUNWAYS

The 95th percentile data in table 4 give another indication of the degree of dispersion of the stabilized subset of aircraft as they fly along the localizer beam towards the runway. At 9 miles from touchdown, 95 percent of the aircraft are flying either on the side of the localizer away from the other runway or within a 417.5-foot operating zone on the side of their localizer towards the other runway. The width of this operating zone decreases as the distance to the runway decreases. At 6 miles from touchdown, the operating zone is within 339 feet; at 3 miles, within 202 feet (i.e., at 6 miles from touchdown, 95 percent of all aircraft are at least 3061 feet from the centerline of the other ILS). A short extract from table 4 expressed in this alternate manner follows.

95 PERCENT CONTAINMENT*
(View 3, All Runways)

Distance From Runway	Distance From Other ILS
9.0 nmi	2982.5 feet
7.5 nmi	3047.6 feet
6.0 nmi	3061.4 feet
4.5 nmi	3177.6 feet
3.0 nmi	3198.5 feet
1.5 nmi	3290.7 feet

*Data on the remaining less than 5 percent are presented in Section 7.2.2.

From these results, two main facts emerge: All indices of dispersion (standard deviation, range, and 95th percentile) lessen in size as the distance to the runway decreases. They also lessen in size in the progression from the Full View, which included long turn-ons and overshoots, to View 3 in which the aircraft have established navigation on the ILS. This effect is particularly visible in figure 19 which compares the standard deviations at various ranges for the three relevant Views, 1, 2, and 3. The distinguishing feature of View 3, it must be remembered, is that it is the only view which considers the behavior of the systems once the state of navigation has been attained by a given set of aircraft; all of the other views include extraneous effect from whatever aircraft have turned on or continued on at any given distance from the runway.

7.2.1.2 Containment Profiles.

Containment profiles describe the flights of those aircraft which did not deviate more than the specified distances from the centerline of the ILS. Containment profiles for this set of data are presented in tables 5 through 12 showing containment areas both as operating zones and as envelopes. Frequency and percentage data are given for all four views with reference to 550- and 700-foot distances (see figure 20). Containment within a 550-foot operating zone refers to the number and percentage of aircraft counted not exceeding 550 feet from the centerline in the direction of the adjacent ILS. Containment within a 550-foot envelope refers to the number and percentage of aircraft counted within 550 feet on either side of the centerline of the localizer.

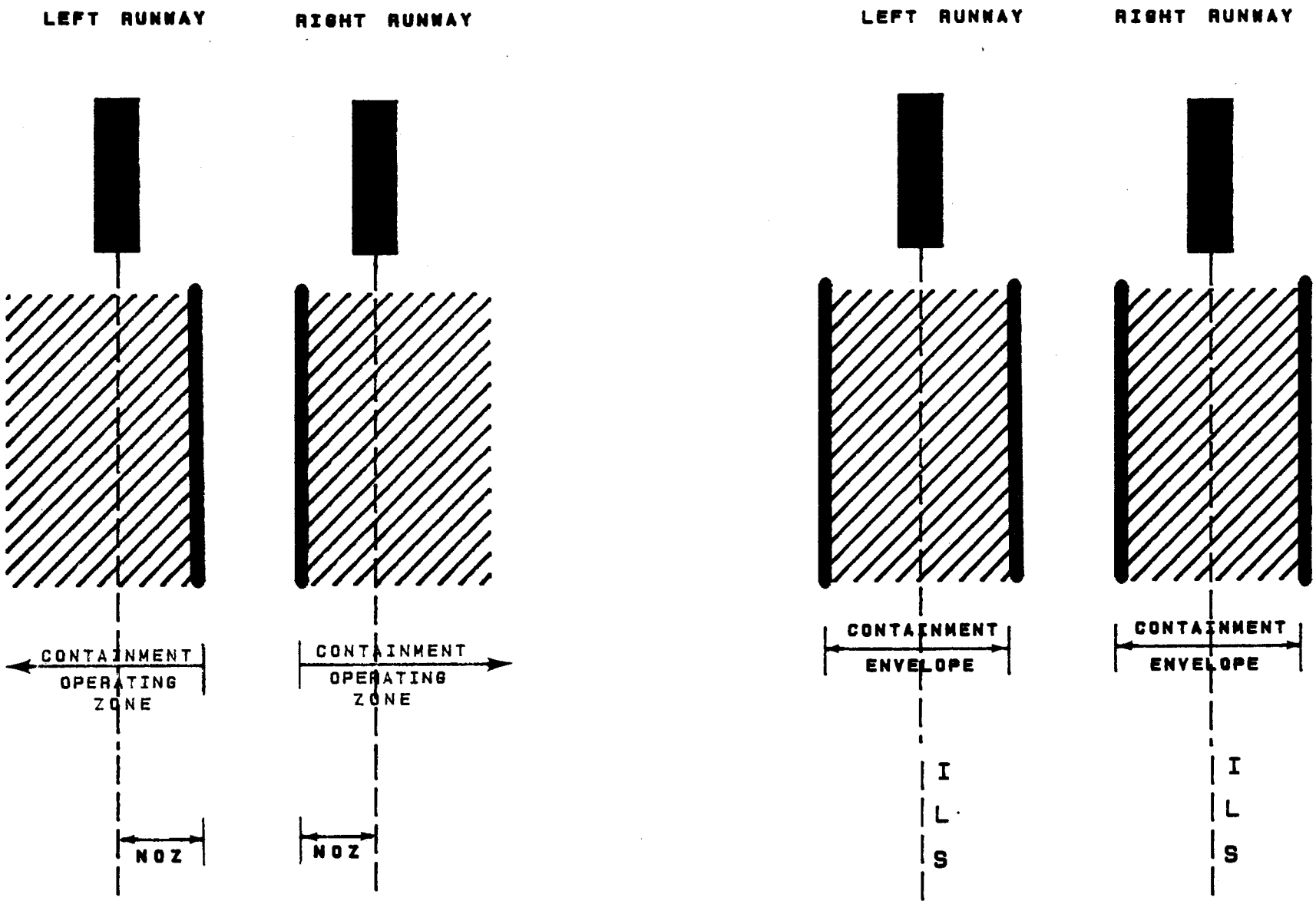


FIGURE 20. CONTAINMENT AREAS FOR OPERATING ZONES AND ENVELOPES

In order to comply with the AOCI request, data on containment within an envelope of 550 feet on both sides of the centerline of the localizer are shown. Similarly, containment data are shown for aircraft not deviating more than 700 feet on either side. The numbers of aircraft contained in the 550/700-foot envelopes are shown in tables 6, 8, 10, and 12. Aircraft in those columns can be further classified into two more subcategories: those aircraft which deviated toward the other runway, and those aircraft which deviated away from the other runway. Since aircraft which have deviated toward the other runway would represent more of a problem than those which deviated away from the other runway, the concept of a normal operating zone (NOZ) was borrowed to describe the 550/700-foot boundary beyond which aircraft would not be expected to navigate. The numbers of aircraft contained by those hypothetical 550/700-foot operating zones are shown in tables 5, 7, 9, and 11.

In all of the tables, the frequency data tell how many aircraft were within the 550/700-foot operating zone or envelope. The percentages tell what percent of the total number of aircraft were contained. However, percentages can be deceiving. In table 7, View 1 (with overshoots and some turn-on included) shows that 87.5 percent of the aircraft tracked at a range of 13.65 nautical miles were within a hypothetical 550-foot NOZ. Actually, only 24 aircraft were tracked at that range. The fact that three of those aircraft traveled more than 550 feet toward the adjacent ILS is not really surprising. Those three aircraft were either in a turning-on phase or in an initial overshoot phase, and thus were not stabilized on the localizer for navigation purposes.

As can be readily seen in the raw numbers comparing tables 9 and 10, and again comparing tables 11 and 12, there is a substantial difference in the sample data for the two subcategories: aircraft deviating toward and aircraft deviating away from the other runway. To illustrate the point, two very short comparisons extracted from tables 11 and 12 are shown below.

VIEW 3, AIRCRAFT STABILIZED AT 9 NAUTICAL MILES

Range (nmi)	Aircraft Outside 700-ft. Envelope	Aircraft Outside 700-ft. Operating Zone
3.0	0	0
4.5	1	0
6.6	3	0
7.5	10	1
8.4	15	3
9.9	10	3

Range (nmi)	Aircraft Outside 550-ft. Envelope	550-ft. Operating Zone
3.0	0	0
4.5	2	1
6.6	7	2
7.5	15	4
8.4	19	5
9.9	16	6

In this stabilized subset of aircraft navigating the ILS, more aircraft are deviating on the side of the ILS away from the other runway than are deviating on the side towards the other ILS. The data for the 100-foot containment illustrates this point. At 8.4 miles from touchdown, 3 aircraft are deviating toward the other runway ILS and 12 (15 in envelope minus 3 deviating the other way) aircraft are deviating away from the other runway ILS. This is not at all surprising since many of the pilots did not initially contact the centerline but, instead, used a lengthy gradual turn onto the ILS centerline. An example of this type of approach has been shown in figure 11. Since most aircraft approached the ILS from the far side (that is, the side away from the adjacent parallel ILS), the navigation data included many sample points from the far side during this lengthy gradual turn onto the ILS. The side of the ILS used for approaches is a function of air traffic control procedures and not a function of navigation performance of aircraft.

7.2.2 Runways.

The four runways involved were compared in some detail. Figure 21 shows the numbers of aircraft tracked on all four runways. The pie chart shows that the overwhelming majority of the traffic were on runways 36L and 36R. Of the 894 aircraft tracks used, 653 used runways 36L and 36R while only 241 used runways 18L and 18R.

Tables 13, 14, 15, and 16 show the general statistics for the four runways for the four views of the data. For the views with the most stable navigation data (tables 15 and 16), the aircraft show much larger dispersion on runways 36R and 36L than on runways 18L and 18R. Also there seems to be some tendency towards the left of centerline for both sets of runways. This fact can be difficult to see at first, since a negative sign indicates a value towards the adjacent ILS. Thus, a negative mean for the right runways shows the left bias whereas a positive mean for the left runways indicates the same left bias. When questioned about this fact, observers at Memphis recalled that they had noticed this bias during the data collection. One veteran observer noted that such biases are not unusual.

A very detailed and graphic treatment of the distribution of aircraft about the ILS is shown separately for each runway in tables 17 to 48. The numbers (and corresponding percentages) of aircraft appearing at various distances toward and away from a hypothetical NOZ are presented for the various distances from the runway. Note that all percentages have been rounded to the next highest percent. At each 100-foot interval, the percentages indicate the percent of the total targets recorded at that range. Totals may exceed 100 percent due to rounding. Percentiles of interest can readily be perceived from these tables. At 7.5 miles, table 25 shows 36 targets located within the 0- to 100-foot interval away from the localizer in the direction of the adjacent ILS. Table 26 indicates that these targets are 15 percent of the total sample at that range.

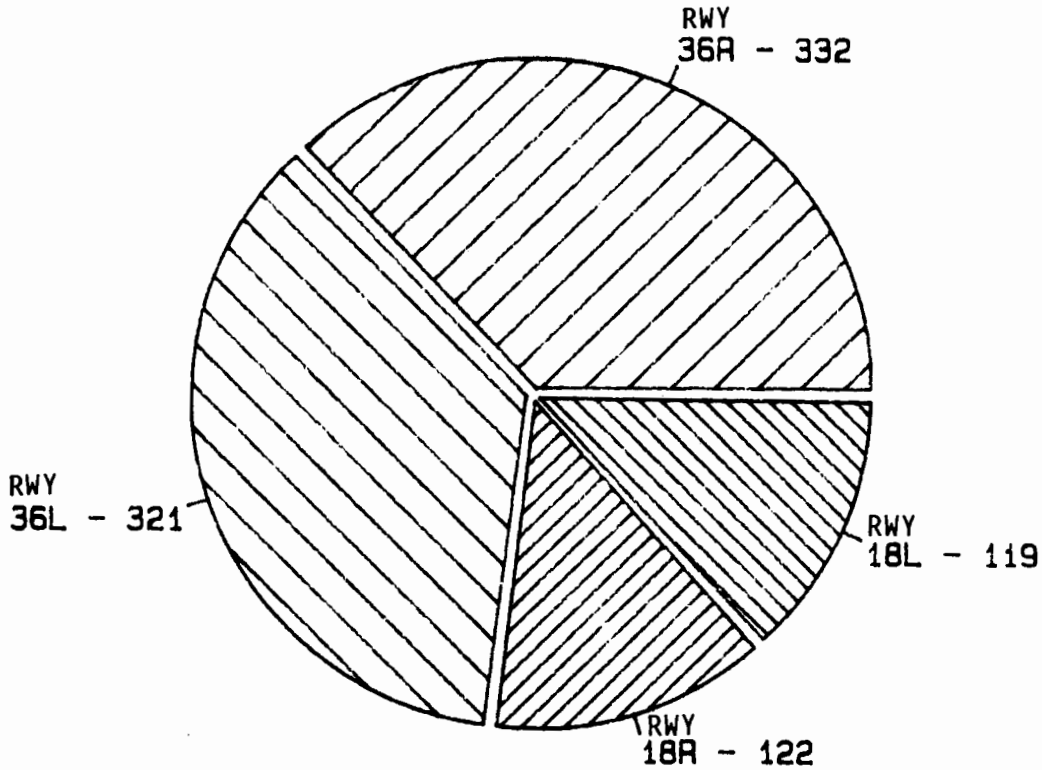


FIGURE 21. AIRCRAFT TRACKED BY RUNWAY

In View 1 (tables 25, 27, 29, and 31), we see the distribution of aircraft about the centerline of the localizer for each runway. View 1 includes aircraft overshoots and a substantial amount of turn-on data. At 6 miles from touchdown on runway 36R, 14 aircraft are more than 700 feet from the centerline. Five of these aircraft are in the direction of the adjacent ILS. A similar situation exists on runway 36L--at 6 miles from touchdown, 17 aircraft are more than 700 feet from the centerline. Of these 17 aircraft, 6 are in the direction of the adjacent ILS. With overshoots and turn-on data included, 19 aircraft are more than 1000 feet from the parallel ILSs for runways 36L and 36R.

When overshoots and most of the turn-on data are eliminated in View 2 (tables 33, 35, 37, and 39), the numbers of aircraft exceeding 700 and 1000 feet decrease substantially. At 6 miles from touchdown on runway 36R, only 4 aircraft are more than 700 feet from the centerline and only one in the direction of the other ILS. On the ILS for runway 36L, 11 exceed 700 feet from the centerline. Of these 11, only 2 are in the direction of the adjacent ILS. In the cases of runways 18L and 18R, only one aircraft exceeded 700 feet on the ILS for 18R and no aircraft on the ILS for 18L.

When all of the turn-on data are eliminated (View 3, tables 41, 43, 45, and 47), no aircraft deviated more than 700 feet from the localizer for any runway at the 6-mile range. However, a closer look at table 43 does show one aircraft between 700 and 800 feet from the localizer at 5.25 miles from touchdown and again at 3.75 miles from touchdown. Table 47 also shows one aircraft between 700 and 800 feet from the centerline of the ILS for runway 18L at 4.5 miles from touchdown.

The vast majority of the aircraft are within 300 feet of the centerline of the ILS. The distributions verify the bias toward the left as noted earlier.

Some trends are clearly visible from the aircraft distribution data in tables 25 through 47. Data from each runway confirm that larger deviations from the localizer centerline are found with initial overshoots and turn-ons. The numbers of large deviations decrease substantially when aircraft are stabilized on the ILS, i.e., turn-on and initial overshoot completed. At 6 miles or less from touchdown, the numbers of aircraft deviating more than 700 feet from the centerline of the localizer are extremely small or zero for each runway.

7.2.3 Airway User Group.

During the period of data collection, considerably more than half the traffic at Memphis consisted of air carriers. Air taxis were second, followed by a small number of general aviation flights. Two military aircraft were also recorded. The pie chart in figure 22 illustrates the relative proportions of the four user groups. When examining all results, it should be remembered that 89 percent of the aircraft tracked were either air carriers or air taxis. By user group, the 894 aircraft tracked can be categorized as follows: 615 air carriers, 185 air taxis, 92 general aviation, and 2 military.

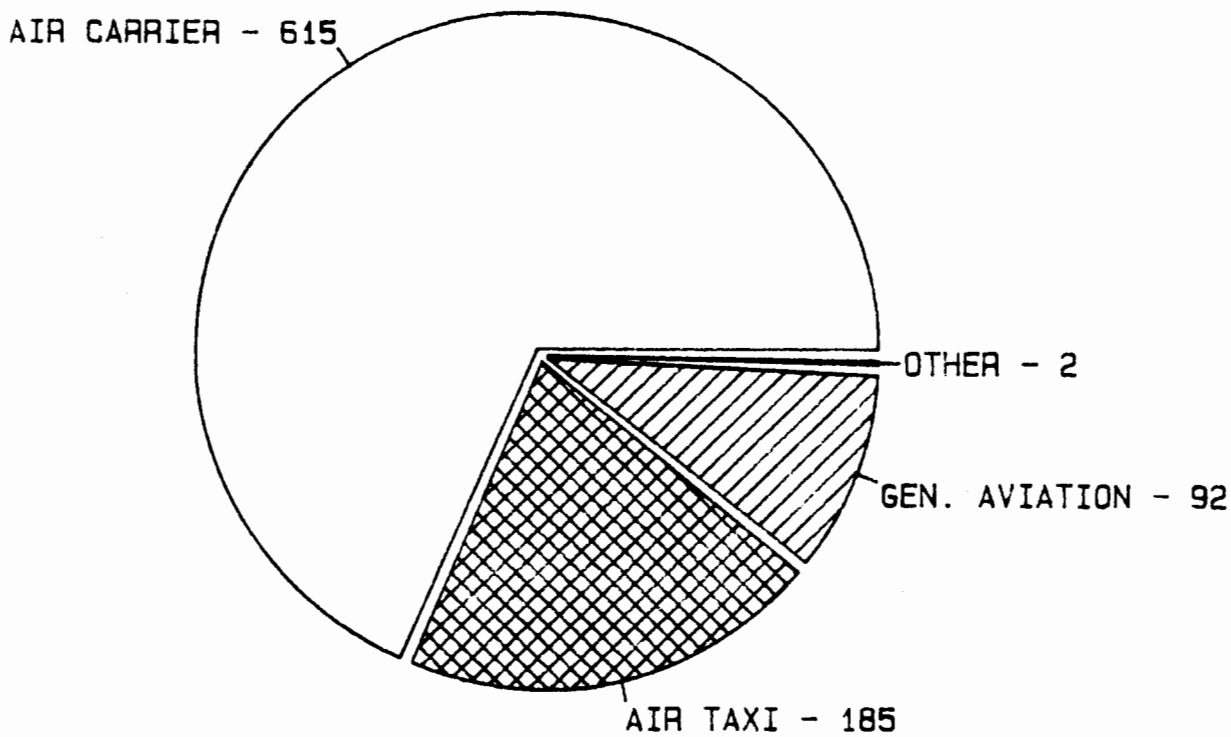


FIGURE 22. AIRCRAFT TRACKED BY USER GROUP

Tables 49, 50, 51, and 52 give some general statistics for the user groups. In all tables, the air taxis exhibit a larger dispersion than either the air carriers or the general aviation aircraft. In View 3, at 6 miles from touchdown, the standard deviation for air taxis is 258.7 feet versus a standard deviation of 166 feet for air carriers and 149.9 feet for general aviation. At 3 miles from touchdown, air taxis still have a standard deviation of 175.5 feet versus 89.6 feet for air carriers and 104.8 feet for general aviation. When the aircraft are later categorized by actual type of aircraft, some of this difference can be attributed to one specific type of aircraft.

In the stabilized group of aircraft (View 3, table 52), it is also interesting to note that the average deviation from the centerline of the localizer is considerably larger for general aviation aircraft than for either the air carriers or the air taxis. The average distances from the centerline in Views 1 and 2 are distorted by the presence of turn-ons and overshoots.

7.2.4 Ceiling.

The tracked aircraft were also coded and examined by ceiling at the time of the tracking. The numbers of aircraft tracked at very low, low, medium, and high ceiling are shown in figure 23. These categories are defined as follows:

Category	Ceiling Height
very low	300 to 500 feet
low	600 to 800 feet
medium	900 to 1100 feet
high	1200 to 1600 feet

Instrument meteorological conditions were present for higher ceilings due to reduced visibility (e.g., fog, drizzle).

Almost half of the sample were tracked during very low ceiling conditions and a quarter were tracked during low ceiling conditions. Categorized by ceiling conditions, the numbers of aircraft tracked are as follows:

Category	Aircraft
very low	424
low	242
medium	138
high	75

General statistics, by ceiling category, are presented in tables 53 through 56. When the same aircraft are being tracked as in View 3 (table 56), the effect of ceiling height seems negligible. There exists some question whether pilots were using visual flight rules during short-range turn-ons when the high ceiling conditions existed. In previous statistics, the dispersion as indicated by standard deviation decreases from View 2 (aircraft acquiring ILS at various ranges) to View 3 (set of aircraft which were stabilized by 9 miles from touchdown). At 3 miles from touchdown, this pattern is broken for aircraft tracked during high ceiling conditions. Thirty-nine additional aircraft are included in

View 2, but the dispersion is less than that of the stabilized set of aircraft that were tracked from farther out. Normally, the effect of aircraft newly acquired at short range increases the standard deviation. In this case the standard deviation decreases. After noting this discrepancy, observers at Memphis were questioned. Under some conditions (e.g., intermittent fog), it may have been possible for some aircraft to use visual rules at short range.

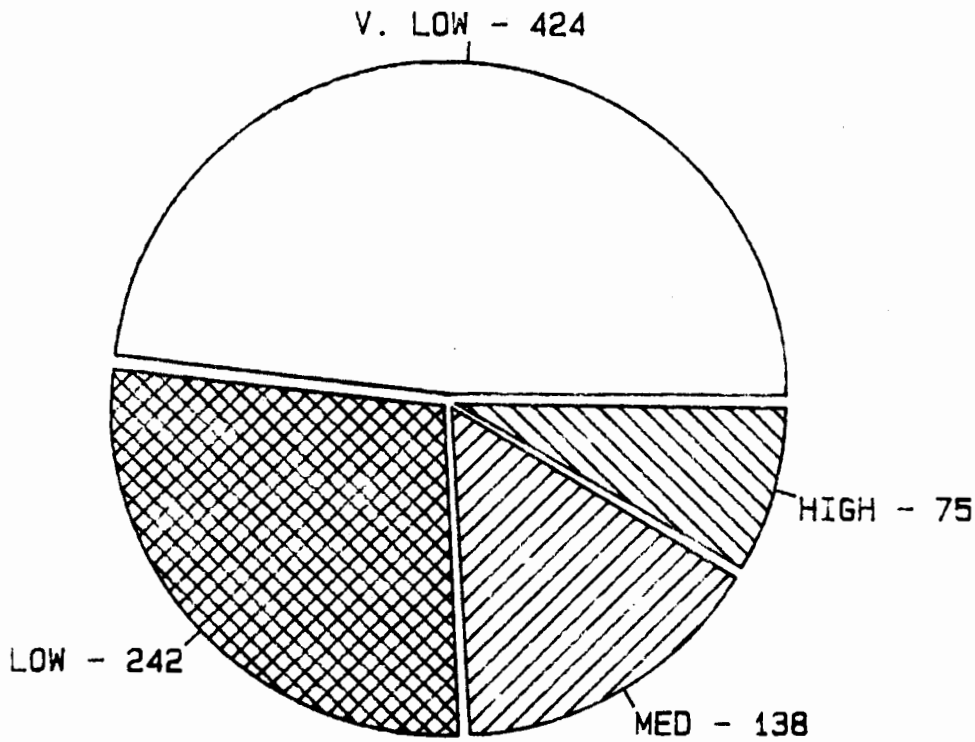


FIGURE 23. AIRCRAFT TRACKED BY CEILING

7.2.5 Stability Codes.

Both air traffic control specialists and experienced pilots felt that aircraft stabilized before descending would exhibit better navigation performance. Therefore, the assessment team examined both the horizontal and vertical profiles of each flight. If the flight was stabilized before descent or if the flight was sufficiently far from touchdown so that it could have been stabilized, code 0 was assigned to the flight. Otherwise, code 1 was assigned. The "not able to stabilize before descent" flights usually indicated very short turn-ons where the pilot was forced by the short distance to touchdown to stabilize laterally while descending the aircraft simultaneously. The thought is that the increased workload of doing two tasks at the same time produces poorer navigation performance than doing one task (stabilizing laterally) then the other task (descending).

Figure 24 shows that most of the aircraft were able to stabilize before descent. Only 136 aircraft out of the 894 total were not able to stabilize. The statistics in tables 57 through 59 seem to indicate that being able to stabilize before descent produces smaller lateral deviation. Table 60 does not provide additional information since View 3 contains only those aircraft defined as stabilized 9 miles from touchdown. It has been included only for completeness.

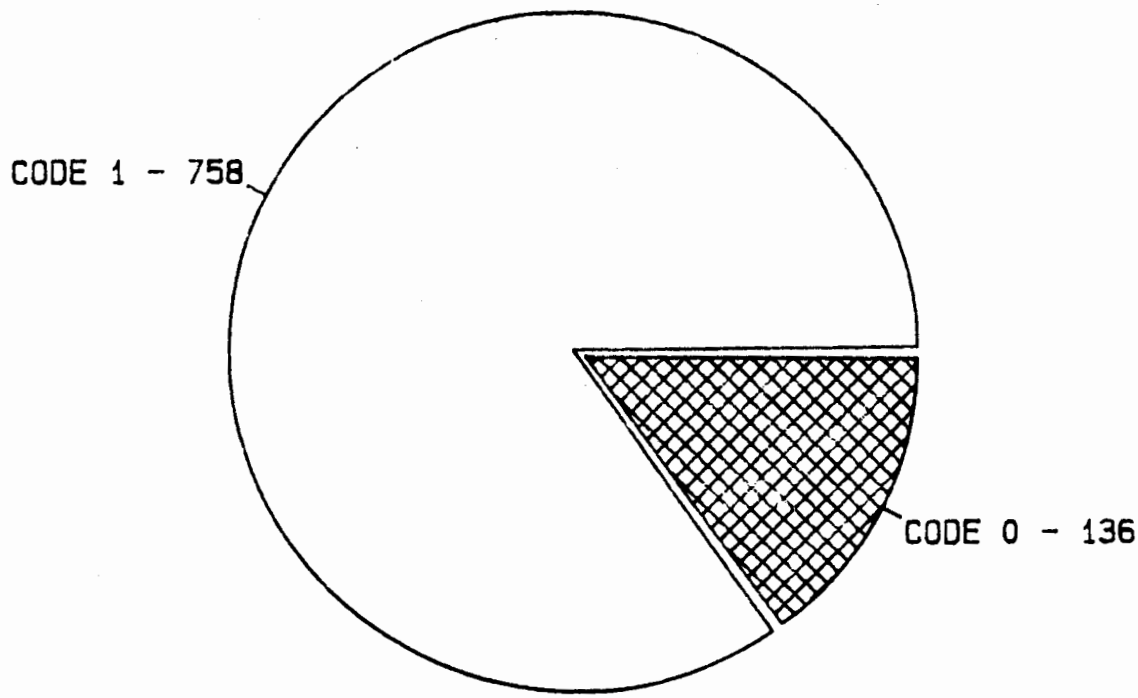


FIGURE 24. AIRCRAFT TRACKED BY STABILITY CODES

7.2.6 Aircraft Type.

Only 12 aircraft types showed five or more flight tracks available for analysis. For the benefit of people unfamiliar with the aircraft type, these twelve types were then classified according to the Air Traffic Control Manual 7110.65D appendix B, Change 6 - 6/20/86. In one instance, a new aircraft not yet listed was classified by an air traffic control specialist familiar with the aircraft. In the classification S, L, and H refer to small, large, or heavy aircraft respectively.

The twelve types with five or more tracks are:

	Aircraft Type	Number Of Tracks	Classification
DC9	McDonnell-Douglas DC-9	406	L/4
B727	Boeing 727	174	L/4
BA14	British Aerospace Jetstream 31	69	L/3
E110	Embraer Bandeirante	49	S/3
SW4	Swearingen Aviation Merlin IV/Metro	24	S/3
SF34	Saab Fairchild 34	18	L/4
B737	Boeing 737	17	L/4
DC10	McDonnell-Douglas DC-10	14	H/5
PA31	Piper Aircraft Chieftan	8	S/2
BE90	Beech Aircraft King Air 90	8	S/2
BE20	Beech Aircraft Super King Air 200	6	S/3
BE10	Beech Aircraft King Air 100	5	S/3

Figure 25 graphically shows the predominance of DC-9, Boeing 727, Jetstream, and Bandeirante aircraft at Memphis International Airport.

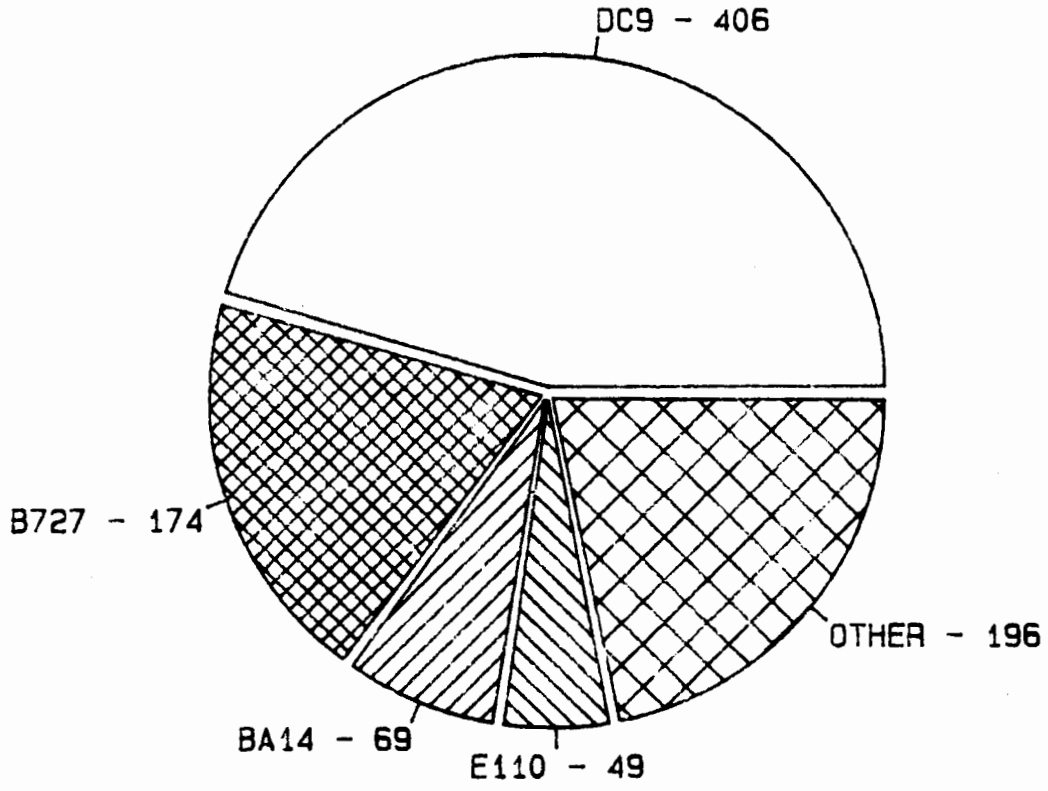


FIGURE 25. AIRCRAFT TRACKED BY AIRCRAFT TYPE

Tables 61 through 64 seem to show a definite difference in dispersion among the different types of aircraft. The Bandeirante (E110) presents consistently larger standard deviations than the other aircraft types. Differences in standard deviation among the four predominent types of aircraft are graphically demonstrated in figures 26 through 29. The opinion of an observer at Memphis, who is also an experienced pilot, was sought. He felt that this particular aircraft was using S-turns on the localizer to slow this well-powered airplane for landing. Similar larger values were observed when data for the SF34 were examined. The number of SF34 observations is too small to include a complete three-view presentation in this report, but the presence of another aircraft type with consistently larger deviations lends credence to the thought that aircraft type is a factor affecting navigation performance.

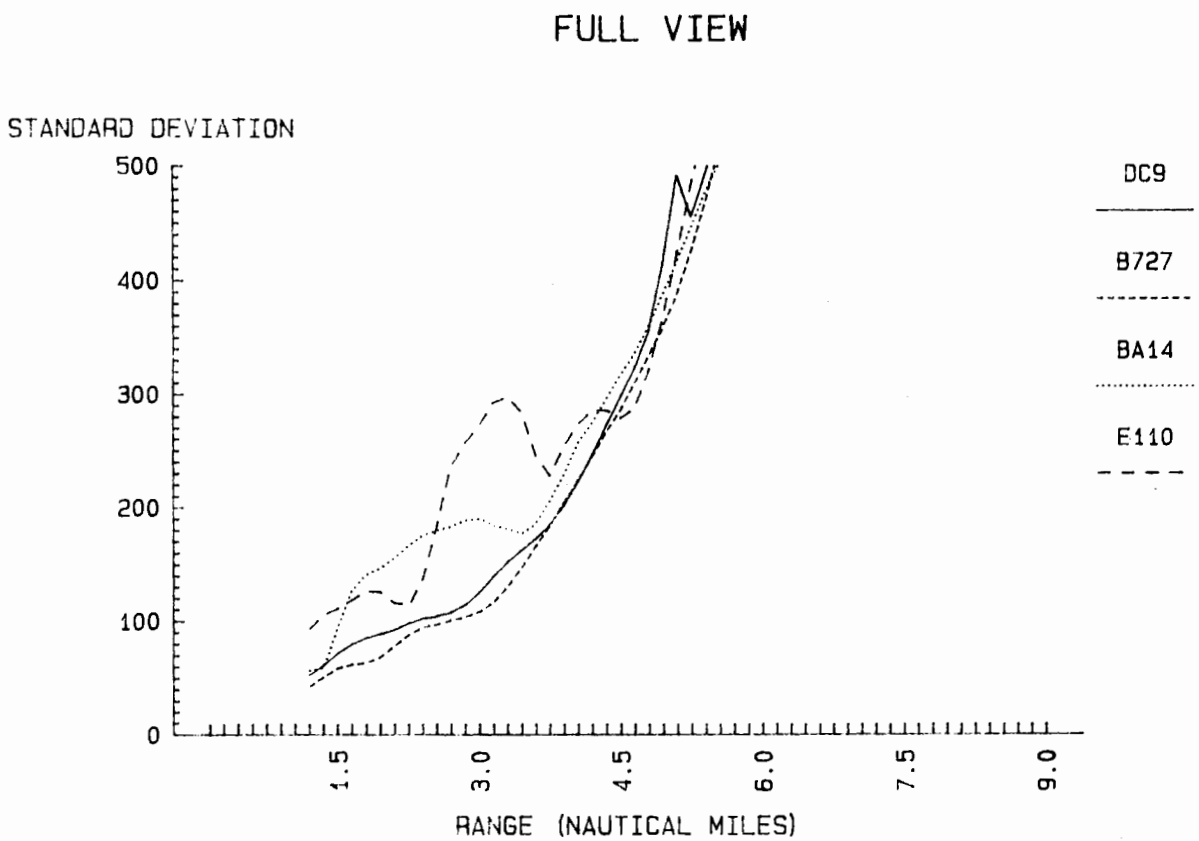


FIGURE 26. RANGE VERSUS STANDARD DEVIATION FULL VIEW, BY MAJOR AIRCRAFT TYPE

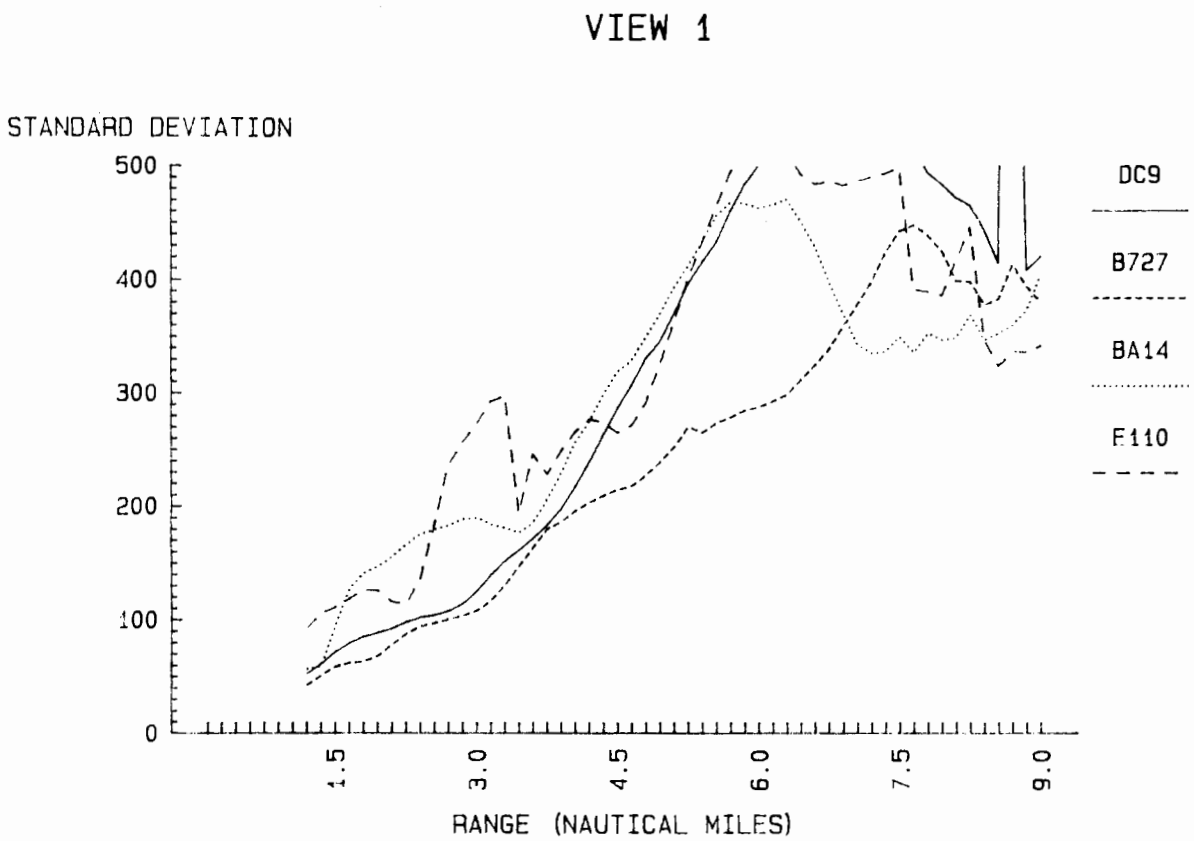


FIGURE 27. RANGE VERSUS STANDARD DEVIATION VIEW 1, BY MAJOR AIRCRAFT TYPE

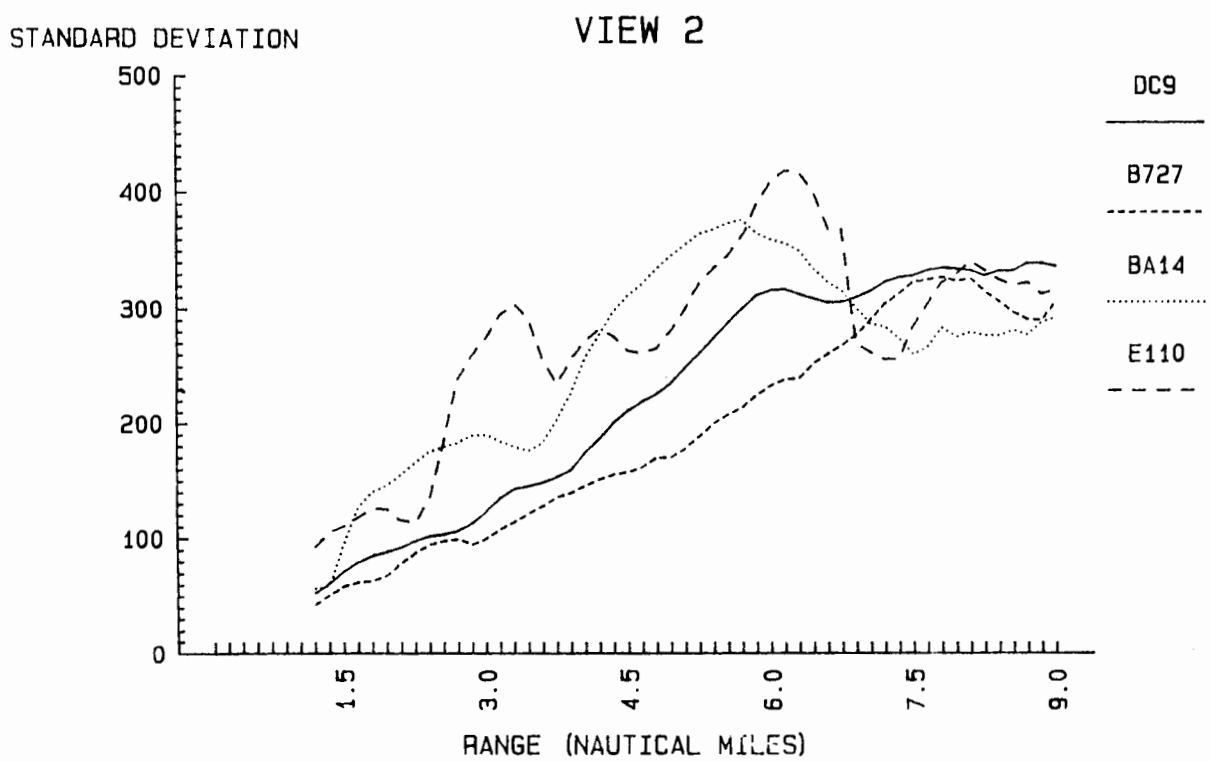


FIGURE 28. RANGE VERSUS STANDARD DEVIATION VIEW 2, BY MAJOR AIRCRAFT TYPE

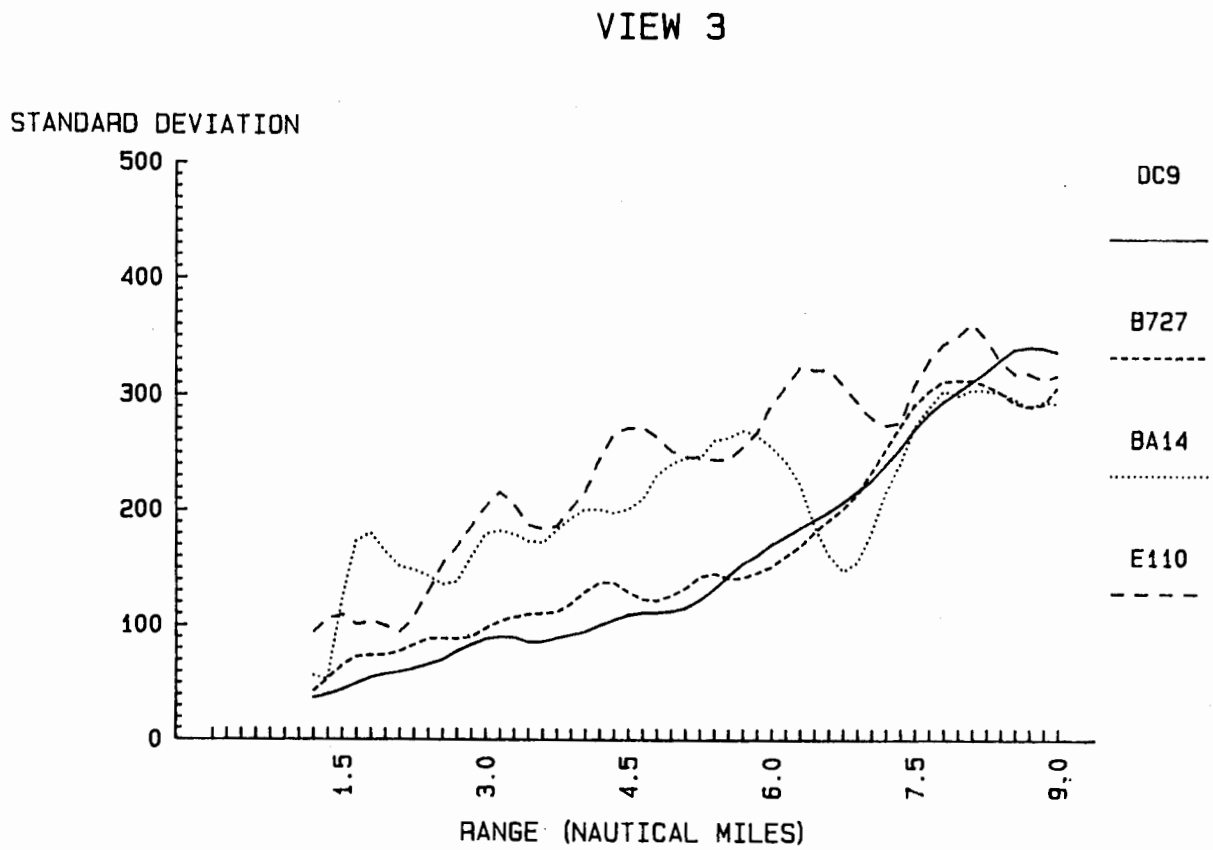


FIGURE 29. RANGE VERSUS STANDARD DEVIATION VIEW 3, BY MAJOR AIRCRAFT TYPE

8. CONCLUSIONS.

Detailed data have been collected and presented which characterize the navigational performance of 894 aircraft which were tracked flying the instrument landing system (ILS) on dependent parallel runways at Memphis International Airport. Several cautions are offered to those examining the data.

Memphis International Airport operates its parallel runways using dependent procedures, and these dependent rules are different and more flexible for the controllers and pilots than when simultaneous ILS approaches, also called independent procedures, are in use. The effect of the range at which the aircraft acquires the localizer on the navigation performance has been clearly and graphically shown by the varying statistics among Views 1, 2, and 3. If the group of aircraft which had acquired the localizer and were stabilized at 9 miles or more from the runway are examined, aircraft are seen to be more concentrated about the centerline of the localizer. Also, the degree of dispersion lessens as the distance to the runway decreases. At a range of 9 miles, 95 percent of the aircraft are contained either on the side of the ILS away from the adjacent runway or within 418 feet toward the adjacent runway. At a range of 6 miles, that figure shrinks to within 339 feet; and at a range of 3 miles, the figure is within 201 feet.

A point to be made is that the data make it clear that there are many different factors in the situation which influence the values of the general statistics about navigation, and such influences must be kept in mind. Two factors have been noted to correlate heavily with differences in navigation performance. These were the aircraft type and the presence or nonpresence of stability before descent. Even though the general population of aircraft may exhibit a given performance on the localizer, individual aircraft types may show a much better or much worse performance. Underlying this difference in aircraft types, there may be a multitude of factors. Some of these factors might be the pilot's experience and background, the company's policies, the navigation equipment on board, etc.

The presence of stability before descent presented more desirable data on navigation performance. Aircraft which stabilized before descending showed less dispersion about the centerline. When a stabilized set of aircraft are tracked from a range of 9 nautical miles, the effect of ceiling height on aircraft navigation seems negligible.

Three factors have been shown to be associated with a difference in navigation performance on the ILS: the range at which an aircraft acquired the ILS, the aircraft type, and whether or not the aircraft was stabilized before descent. Again, it should be pointed out that these aircraft were flying dependent parallel approach procedures. Under simultaneous ILS approach procedures (independent operations), the range and stabilization criteria are predetermined, and many flight operations observed during this data collection would not have been permitted.

APPENDIX A

ARRIVAL PROCEDURES FOR PARALLEL RUNWAYS

375. SIMULTANEOUS ILS/MLS APPROACHES [INDEPENDENT OPERATIONS]

a. System: An approach system permitting simultaneous ILS/MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment. The Approach Procedure Chart permitting simultaneous approaches will contain the note "simultaneous approach authorized Rwys 14L and 14R" identifying the appropriate runways as the case may be. When advised that simultaneous ILS approaches are in progress, pilots shall advise approach control immediately of malfunctioning or inoperative receivers or if simultaneous approach is not desired.

b. Radar Monitor Service: This service is provided for each ILS/MLS to insure prescribed lateral separation during approaches. Pilots will be assigned frequencies to receive advisories and instructions. Aircraft deviating from either final approach course to the point where the no transgression zone (an area at least 2,000 feet wide) may be penetrated will be instructed to take corrective action. If an aircraft fails to respond to such instruction, the aircraft on the adjacent final approach course may be instructed to alter course.

c. Radar Advisories: Whenever simultaneous approaches are in progress radar advisories will be provided on the tower frequency.

(1) The monitor controller will have the capability of overriding the tower controller on the tower frequency.

(2) The pilot will be advised to monitor the tower frequency.

(3) The monitor will automatically be terminated no farther than 1 mile from the runway threshold.

(4) The monitor controller will not advise when the monitor is terminated.

376. PARALLEL ILS/MLS APPROACHES [DEPENDENT OPERATIONS]

a. Parallel approaches are an ATC procedure permitting parallel ILS, MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 2,500 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment.

b. A parallel approach differs from a simultaneous approach in that the minimum distance between parallel runway centerlines is reduced; there is no requirement for radar monitoring or advisories; and a staggered separation of aircraft on the adjacent localizer course is required.

c. Aircraft are afforded a minimum of 2 miles radar separation between successive aircraft on the adjacent localizer course and a minimum of 3 miles radar separation from aircraft on the same final approach course. In addition, a minimum of 1,000 feet vertical or a minimum of 3 miles radar separation is provided between aircraft during turn on.

d. Whenever parallel approaches are in progress, aircraft are informed that approaches to both runways are in use. In addition, the radar controller will have the interphone capability of communicating directly with the tower controller where the responsibility for radar separation is not performed by the tower controller.

This information has been obtained from the Airman's Information Manual (AIM), Basic Flight Information and ATC Procedures, August 28, 1986.

APPENDIX B

DESCRIPTION OF PHYSICAL TAPE RECORDS

Data are stored on physical records of 1024, 16-bit words. The first physical record contains date and time. No other data are contained in the first record. The first 16-bit word contains the buffer information word which was not utilized. The second 16-bit word contains the month in bits 7-4; the day in bits 3-0, 15; and the year in bits 14-8. The third 16-bit word contains the hour in bits 3-0 and 15-14, and the minute in bits 13-8. Word three contains the high order bits of the most significant bits in bits 7-0, followed by the least significant bits in positions 15-8. Word four contains the most significant bits in bits 7-0 followed by bits 15-8.

After the first physical record, the subsequent records consist of 128 units of eight 16-bit words. The first unit is not used. In the second and subsequent eight, 16-bit units consist of the following: in word one, the track number high order bits are in bits 7-0, and the low order bits are in bits 15-8; the high order bits for the track ID are in bits 4-0, with the low order bits in 15-8. Bits 7,6, and 5 are ignored; the high order bits for the dropped track indicator are in bits 7-0, with the low order bits in 15-8.

On the last physical record, two words (each 16 bits) of zeros are on words 1022 and 1023. This is the flag that indicates the halt of data collection for that day.

The most significant bits of the real-time clock are in word four in bits 7-0, followed by bits 15-8; the least significant bits (LSB) of the real-time clock are in 7-0, followed by bits 15-8. The x, y, and z coordinates are in words 6, 7, and 8. The most significant bits are in 7-0 followed by 15-8 for these coordinates. The x-coordinate is a signed 2 bit-complement number with a LSB of 4 feet; the y-coordinate has a LSB of 2 feet; and the z-coordinate has an LSB of 1 foot.

APPENDIX C

AIRCRAFT EXCLUDED FROM ANALYSES

All aircraft tracks under visual flight conditions were excluded from the analyses, and some instrument flight rules (IFR) aircraft were excluded for the following reasons:

Number Excluded	Explanation
152	Insufficient position data
20	Aircraft not descending
14	No position data
10	Undetermined flight path
3	Partial 3400-ft. correction
3	Radar not stabilized yet
2	Not instrument landing system (ILS) approach
1	Crossover to adjacent runway
1	Training flight

Due to the data collection procedures, some aircraft which initially appeared to be landing on the parallel runways either did not land or requested a change of runway. Also, due to radar malfunctions, some aircraft were acquired by the radar but not tracked, or the track was dropped after a very short period of time.

APPENDIX D

TABLES 1 THROUGH 64

All statistics on deviation from the centerline of the localizer are presented in feet. A negative value indicates deviation toward the adjacent instrument landing system (ILS), and a positive value indicates deviation away from the adjacent ILS.

The general statistics will include the number of aircraft in each sample, the mean, the standard deviation (denoted by S.D.), the median (the middle value), the 95th percentile, and the minimum value and maximum value.

Data on deviation from centerline and aircraft containment are presented for a variety of ranges, i.e., distances from runway. All ranges are presented in nautical miles.

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TABLE 1. LATERAL DEVIATION FROM LOCALIZER CENTERLINE
FULL VIEW, ALL RUNWAYS

Distance From Runway	N	Mean	S.D.	Median	95%	Range Min.	Range Max.
1.5 nmi	885	0.2	80.1	0.4	-109.3	-480.6	765.1
3.0 nmi	893	7.1	145.6	-1.3	-198.6	-934.8	1313.7
4.5 nmi	890	38.8	292.3	16.3	-337.5	-2144.4	1813.9
6.0 nmi	862	41.4	676.4	21.7	-618.8	-5848.4	3557.5
7.5 nmi	795	63.3	1914.8	54.6	-2466.8	-20525.5	11285.1
9.0 nmi	558	494.6	3301.3	81.5	3629.3	-19003.3	19221.9
10.5 nmi	393	947.6	4834.5	144.4	-2965.1	-26668.4	19933.1
12.0 nmi	262	1449.8	4502.0	194.3	-2459.3	-13885.1	28820.6

TABLE 2. LATERAL DEVIATION FROM LOCALIZER CENTERLINE
VIEW 1, ALL RUNWAYS

Distance From Runway	N	Mean	S.D.	Median	95%	Range Min.	Range Max.
1.5 nmi	885	0.2	80.1	0.4	-109.3	-480.6	765.1
3.0 nmi	892	6.8	145.4	-1.3	-198.6	-934.8	1313.7
4.5 nmi	877	34.4	268.1	15.7	-314.9	-2144.4	1704.6
6.0 nmi	777	20.8	434.2	18.6	-488.0	-5848.4	2532.2
7.5 nmi	597	36.2	467.8	29.5	-612.2	-2414.2	3469.7
9.0 nmi	349	29.1	430.0	10.0	-626.8	-2009.5	1560.0
10.5 nmi	238	-13.5	470.3	10.5	-670.4	-2510.2	1458.0
12.0 nmi	150	-42.0	462.1	17.2	-906.9	-2284.4	985.1

TABLE 3. LATERAL DEVIATION FROM LOCALIZER CENTERLINE
VIEW 2, ALL RUNWAYS

Distance From Runway	N	Mean	S.D.	Median	95%	Range Min.	Range Max.
1.5 nmi	885	0.2	80.1	0.4	-109.3	-480.6	765.1
3.0 nmi	875	6.6	142.5	-1.7	-196.2	-934.8	1313.7
4.5 nmi	814	33.2	220.3	13.8	-281.1	-940.6	1456.2
6.0 nmi	653	46.9	300.0	24.8	-356.0	-1413.1	2532.2
7.5 nmi	459	53.1	304.3	28.6	-378.4	-1242.0	1413.3
9.0 nmi	264	39.5	345.6	15.8	-417.5	-2009.5	1560.0
10.5 nmi	163	-3.2	313.3	13.1	-465.5	-1587.3	1078.2
12.0 nmi	99	-9.5	319.1	28.4	-694.8	-1310.6	882.8

TABLE 4. LATERAL DEVIATION FROM LOCALIZER CENTERLINE
VIEW 3, ALL RUNWAYS

Distance From Runway	N	Mean	S.D.	Median	95%	Range Min.	Range Max.
1.5 nmi	261	-0.6	72.5	-2.4	-109.3	-480.6	370.2
3.0 nmi	263	-7.1	116.8	-12.4	-201.5	-401.1	536.6
4.5 nmi	264	10.1	157.4	6.4	-222.4	-696.4	725.9
6.0 nmi	264	5.8	193.5	14.0	-338.6	-651.3	665.9
7.5 nmi	264	35.1	270.9	18.4	-352.4	-1242.0	1146.8
9.0 nmi	264	39.5	346.4	15.8	-417.5	-2009.5	1560.0
10.5 nmi	163	-3.2	313.3	13.1	-465.5	-1587.3	1078.2
12.0 nmi	99	-9.5	319.1	28.4	-694.8	-1310.6	822.8

TABLE 5. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
FULL VIEW, ALL RUNWAYS

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
0.15	0	0	0.0	0	0.0
0.30	7	6	85.7	6	85.7
0.45	12	11	91.7	11	91.7
0.60	84	83	98.8	83	98.8
0.75	385	384	99.7	384	99.7
0.90	748	747	99.9	747	99.9
1.05	842	842	100.0	842	100.0
1.20	856	856	100.0	856	100.0
1.35	867	867	100.0	867	100.0
1.50	885	885	100.0	885	100.0
1.65	889	888	99.9	888	99.9
1.80	890	889	99.9	890	100.0
1.95	890	889	99.9	890	100.0
2.10	891	889	99.8	890	99.9
2.25	892	889	99.7	891	99.9
2.40	893	890	99.7	891	99.8
2.55	893	891	99.8	892	99.9
2.70	893	889	99.6	892	99.9
2.85	893	889	99.6	892	99.9
3.00	893	890	99.7	892	99.9
3.15	892	887	99.4	890	99.8
3.30	892	886	99.3	889	99.7
3.45	892	882	98.9	886	99.3
3.60	892	881	98.8	885	99.2
3.75	891	879	98.7	883	99.1
3.90	891	873	98.0	881	98.9
4.05	891	872	97.9	882	99.0
4.20	891	872	97.9	879	98.7
4.35	890	872	98.0	879	98.8
4.50	890	873	98.1	880	98.9
4.65	888	867	97.6	879	99.0
4.80	885	863	97.5	874	98.8
4.95	884	858	97.1	868	98.2
5.10	884	855	96.7	865	97.9
5.25	881	848	96.3	860	97.6
5.40	878	841	95.8	854	97.3
5.55	876	840	95.9	849	96.9
5.70	873	831	95.2	844	96.7
5.85	867	817	94.2	833	96.1
6.00	862	807	93.6	826	95.8
6.15	860	799	92.9	819	95.2
6.30	856	793	92.6	808	94.4
6.45	855	786	91.9	799	93.5
6.60	847	771	91.0	789	93.2
6.75	839	761	90.7	771	91.9
6.90	833	747	89.7	761	91.4
7.05	824	730	88.6	749	90.9
7.20	816	718	88.0	733	89.8
7.35	804	706	87.8	716	89.1
7.50	795	692	87.0	706	88.8

TABLE 5. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
FULL VIEW, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
7.65	777	680	87.5	695	89.4
7.80	763	670	87.8	683	89.5
7.95	740	646	87.3	661	89.3
8.10	722	632	87.5	648	89.8
8.25	692	614	88.7	620	89.6
8.40	662	587	88.7	594	89.7
8.55	631	559	88.6	564	89.4
8.70	613	538	87.8	546	89.1
8.85	577	503	87.2	511	88.6
9.00	558	483	86.6	494	88.5
9.15	542	464	85.6	476	87.8
9.30	512	438	85.5	448	87.5
9.45	502	429	85.5	441	87.8
9.60	487	417	85.6	424	87.1
9.75	466	399	85.6	409	87.8
9.90	453	388	85.7	396	87.4
10.05	435	371	85.3	387	89.0
10.20	420	366	87.1	374	89.0
10.35	406	356	87.7	363	89.4
10.50	393	348	88.5	355	90.3
10.65	382	341	89.3	346	90.6
10.80	371	327	88.1	334	90.0
10.95	354	314	88.7	323	91.2
11.10	338	301	89.1	306	90.5
11.25	323	292	90.4	294	91.0
11.40	312	279	89.4	283	90.7
11.55	303	270	89.1	272	89.8
11.70	288	256	88.9	259	89.9
11.85	271	240	88.6	243	89.7
12.00	262	229	87.4	235	89.7
12.15	249	215	86.3	221	88.8
12.30	230	194	84.3	202	87.8
12.45	216	189	87.5	195	90.3
12.60	203	176	86.7	184	90.6
12.75	178	156	87.6	161	90.4
12.90	159	135	84.9	141	88.7
13.05	143	123	86.0	129	90.2
13.20	125	105	84.0	109	87.2
13.35	110	90	81.8	94	85.5
13.50	90	70	77.8	72	80.0
13.65	71	57	80.3	57	80.3
13.80	55	43	78.2	43	78.2
13.95	41	31	75.6	31	75.6
14.10	33	24	72.7	25	75.8
14.25	23	18	78.3	18	78.3
14.40	10	9	90.0	9	90.0
14.55	6	6	100.0	6	100.0
14.70	4	4	100.0	4	100.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 6. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE) FULL VIEW, ALL RUNWAYS

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
0.15	0	0	0.0	0	0.0
0.30	7	6	85.7	6	85.7
0.45	12	11	91.7	11	91.7
0.60	84	83	98.8	83	98.8
0.75	385	384	99.7	384	99.7
0.90	748	747	99.9	747	99.9
1.05	842	842	100.0	842	100.0
1.20	856	856	100.0	856	100.0
1.35	867	866	99.9	867	100.0
1.50	885	884	99.9	884	99.9
1.65	889	887	99.8	887	99.8
1.80	890	888	99.8	889	99.9
1.95	890	887	99.7	889	99.9
2.10	891	887	99.6	889	99.8
2.25	892	887	99.4	890	99.8
2.40	893	887	99.3	890	99.7
2.55	893	888	99.4	891	99.8
2.70	893	887	99.3	890	99.7
2.85	893	888	99.4	891	99.8
3.00	893	888	99.4	891	99.8
3.15	892	884	99.1	889	99.7
3.30	892	880	98.7	887	99.4
3.45	892	878	98.4	882	98.9
3.60	892	870	97.5	880	98.7
3.75	891	866	97.2	879	98.7
3.90	891	854	95.8	873	98.0
4.05	891	853	95.7	870	97.6
4.20	891	848	95.2	865	97.1
4.35	890	844	94.8	863	97.0
4.50	890	836	93.9	864	97.1
4.65	888	821	92.5	857	96.5
4.80	885	810	91.5	848	95.8
4.95	884	804	91.0	832	94.1
5.10	884	792	89.6	824	93.2
5.25	881	783	88.9	810	91.9
5.40	878	767	87.4	799	91.0
5.55	876	768	87.7	797	91.0
5.70	873	756	86.6	788	90.3
5.85	867	739	85.2	778	89.7
6.00	862	722	83.8	770	89.3
6.15	860	707	82.2	755	87.8
6.30	856	703	82.1	740	86.4
6.45	855	681	79.6	721	84.3
6.60	847	658	77.7	702	82.9
6.75	839	643	76.6	672	80.1
6.90	833	613	73.6	650	78.0
7.05	824	587	71.2	634	76.9
7.20	816	574	70.3	615	75.4
7.35	804	554	68.9	591	73.5
7.50	795	534	67.2	568	71.4
7.65	777	511	65.8	549	70.7

TABLE 6. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE)
FULL VIEW, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
7.80	763	488	64.0	523	68.5
7.95	740	469	63.4	507	68.5
8.10	722	454	62.9	492	68.1
8.25	692	443	64.0	468	67.6
8.40	662	419	63.3	444	67.1
8.55	631	394	62.4	417	66.1
8.70	613	369	60.2	387	63.1
8.85	577	339	58.8	364	63.1
9.00	558	313	56.1	343	61.5
9.15	542	296	54.6	318	58.7
9.30	512	279	54.5	300	58.6
9.45	502	266	53.0	289	57.6
9.60	487	262	53.8	280	57.5
9.75	466	245	52.6	267	57.3
9.90	453	244	53.9	259	57.2
10.05	435	233	53.6	261	60.0
10.20	420	230	54.8	250	59.5
10.35	406	223	54.9	239	58.9
10.50	393	212	53.9	230	58.5
10.65	382	204	53.4	220	57.6
10.80	371	196	52.8	214	57.7
10.95	354	183	51.7	204	57.6
11.10	338	178	52.7	192	56.8
11.25	323	177	54.8	187	57.9
11.40	312	166	53.2	175	56.1
11.55	303	158	52.1	165	54.5
11.70	288	152	52.8	160	55.6
11.85	271	143	52.8	149	55.0
12.00	262	136	51.9	147	56.1
12.15	249	126	50.6	138	55.4
12.30	230	116	50.4	131	57.0
12.45	216	117	54.2	124	57.4
12.60	203	103	50.7	116	57.1
12.75	178	92	51.7	101	56.7
12.90	159	78	49.1	90	56.6
13.05	143	71	49.7	83	58.0
13.20	125	61	48.8	71	56.8
13.35	110	54	49.1	61	55.5
13.50	90	36	40.0	44	48.9
13.65	71	28	39.4	31	43.7
13.80	55	19	34.5	24	43.6
13.95	41	12	29.3	16	39.0
14.10	33	10	30.3	13	39.4
14.25	23	7	30.4	7	30.4
14.40	10	3	30.0	3	30.0
14.55	6	1	16.7	1	16.7
14.70	4	1	25.0	1	25.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 7. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
VIEW 1, ALL RUNWAYS

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
0.15	0	0	0.0	0	0.0
0.30	6	6	100.0	6	100.0
0.45	11	11	100.0	11	100.0
0.60	83	83	100.0	83	100.0
0.75	384	384	100.0	384	100.0
0.90	747	747	100.0	747	100.0
1.05	842	842	100.0	842	100.0
1.20	856	856	100.0	856	100.0
1.35	867	867	100.0	867	100.0
1.50	885	885	100.0	885	100.0
1.65	889	888	99.9	888	99.9
1.80	890	889	99.9	890	100.0
1.95	890	889	99.9	890	100.0
2.10	891	889	99.8	890	99.9
2.25	892	889	99.7	891	99.9
2.40	893	890	99.7	891	99.8
2.55	893	891	99.8	892	99.9
2.70	892	888	99.6	891	99.9
2.85	892	888	99.6	891	99.9
3.00	892	889	99.7	891	99.9
3.15	891	886	99.4	889	99.8
3.30	890	884	99.3	887	99.7
3.45	889	879	98.9	883	99.3
3.60	889	878	98.8	882	99.2
3.75	886	874	98.6	878	99.1
3.90	882	865	98.1	872	98.9
4.05	882	865	98.1	874	99.1
4.20	882	865	98.1	872	98.9
4.35	878	862	98.2	869	99.0
4.50	877	862	98.3	868	99.0
4.65	860	841	97.8	852	99.1
4.80	855	838	98.0	845	98.8
4.95	847	828	97.8	836	98.7
5.10	839	817	97.4	826	98.5
5.25	835	813	97.4	822	98.4
5.40	819	797	97.3	806	98.4
5.55	811	791	97.5	797	98.3
5.70	800	776	97.0	785	98.1
5.85	790	761	96.3	773	97.8
6.00	777	747	96.1	761	97.9
6.15	753	718	95.4	734	97.5
6.30	742	711	95.8	720	97.0
6.45	724	692	95.6	702	97.0
6.60	707	672	95.0	685	96.9
6.75	693	661	95.4	668	96.4
6.90	663	629	94.9	640	96.5
7.05	643	608	94.6	622	96.7
7.20	623	587	94.2	597	95.8
7.35	610	576	94.4	583	95.6
7.50	597	560	93.8	572	95.8

TABLE 7. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
VIEW 1, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
7.65	551	519	94.2	529	96.0
7.80	531	504	94.9	512	96.4
7.95	515	489	95.0	499	96.9
8.10	500	472	94.4	486	97.2
8.25	480	459	95.6	463	96.5
8.40	449	432	96.2	436	97.1
8.55	419	407	97.1	411	98.1
8.70	393	376	95.7	383	97.5
8.85	362	345	95.3	351	97.0
9.00	349	328	94.0	336	96.3
9.15	331	308	93.1	315	95.2
9.30	307	286	93.2	293	95.4
9.45	297	274	92.3	283	95.3
9.60	287	266	92.7	272	94.8
9.75	283	259	91.5	268	94.7
9.90	271	247	91.1	254	93.7
10.05	263	237	90.1	251	95.4
10.20	258	238	92.2	244	94.6
10.35	251	231	92.0	236	94.0
10.50	238	221	92.9	227	95.4
10.65	226	213	94.2	216	95.6
10.80	218	202	92.7	208	95.4
10.95	208	191	91.8	200	96.2
11.10	198	183	92.4	187	94.4
11.25	190	179	94.2	181	95.3
11.40	178	164	92.1	168	94.4
11.55	169	154	91.1	156	92.3
11.70	166	151	91.0	154	92.8
11.85	154	141	91.6	144	93.5
12.00	150	137	91.3	141	94.0
12.15	142	130	91.5	133	93.7
12.30	128	115	89.8	120	93.8
12.45	121	110	90.9	115	95.0
12.60	109	98	89.9	104	95.4
12.75	91	83	91.2	87	95.6
12.90	80	70	87.5	76	95.0
13.05	69	61	88.4	66	95.7
13.20	61	54	88.5	58	95.1
13.35	51	44	86.3	48	94.1
13.50	34	30	88.2	31	91.2
13.65	24	21	87.5	21	87.5
13.80	13	12	92.3	12	92.3
13.95	10	9	90.0	9	90.0
14.10	9	8	88.9	9	100.0
14.25	6	6	100.0	6	100.0
14.40	2	2	100.0	2	100.0
14.55	1	1	100.0	1	100.0
14.70	1	1	100.0	1	100.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 8. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE)
VIEW 1, ALL RUNWAYS

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
0.15	0	0	0.0	0	0.0
0.30	6	6	100.0	6	100.0
0.45	11	11	100.0	11	100.0
0.60	83	83	100.0	83	100.0
0.75	384	384	100.0	384	100.0
0.90	747	747	100.0	747	100.0
1.05	842	842	100.0	842	100.0
1.20	856	856	100.0	856	100.0
1.35	867	866	99.9	867	100.0
1.50	885	884	99.9	884	99.9
1.65	889	887	99.8	887	99.8
1.80	890	888	99.8	889	99.9
1.95	890	887	99.7	889	99.9
2.10	891	887	99.6	889	99.8
2.25	892	887	99.4	890	99.8
2.40	893	887	99.3	890	99.7
2.55	893	888	99.4	891	99.8
2.70	892	886	99.3	889	99.7
2.85	892	887	99.4	890	99.8
3.00	892	887	99.4	890	99.8
3.15	891	883	99.1	888	99.7
3.30	890	879	98.8	886	99.6
3.45	889	876	98.5	880	99.0
3.60	889	868	97.6	878	98.8
3.75	886	862	97.3	875	98.8
3.90	882	849	96.3	866	98.2
4.05	882	849	96.3	865	98.1
4.20	882	845	95.8	861	97.6
4.35	878	840	95.7	857	97.6
4.50	877	831	94.8	857	97.7
4.65	860	806	93.7	838	97.4
4.80	855	799	93.5	828	96.8
4.95	847	791	93.4	814	96.1
5.10	839	773	92.1	802	95.6
5.25	835	767	91.9	790	94.6
5.40	819	752	91.8	776	94.7
5.55	811	748	92.2	772	95.2
5.70	800	732	91.5	758	94.8
5.85	790	716	90.6	747	94.6
6.00	777	702	90.3	737	94.9
6.15	753	669	88.8	706	93.8
6.30	742	667	89.9	692	93.3
6.45	724	639	88.3	669	92.4
6.60	707	622	88.0	655	92.6
6.75	693	612	88.3	634	91.5
6.90	663	578	87.2	609	91.9
7.05	643	553	86.0	590	91.8
7.20	623	543	87.2	566	90.9
7.35	610	528	86.6	552	90.5
7.50	597	511	85.6	538	90.1

TABLE 8. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE)
VIEW 1, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
7.65	551	476	86.4	498	90.4
7.80	531	461	86.8	481	90.6
7.95	515	443	86.0	470	91.3
8.10	500	434	86.8	461	92.2
8.25	480	418	87.1	436	90.8
8.40	449	394	87.8	410	91.3
8.55	419	370	88.3	387	92.4
8.70	393	344	87.5	355	90.3
8.85	362	314	86.7	328	90.6
9.00	349	295	84.5	313	89.7
9.15	331	277	83.7	290	87.6
9.30	307	257	83.7	273	88.9
9.45	297	251	84.5	267	89.9
9.60	287	247	86.1	259	90.2
9.75	283	233	82.3	253	89.4
9.90	271	229	84.5	241	88.9
10.05	263	218	82.9	242	92.0
10.20	258	217	84.1	232	89.9
10.35	251	211	84.1	222	88.4
10.50	238	201	84.5	213	89.5
10.65	226	193	85.4	204	90.3
10.80	218	184	84.4	199	91.3
10.95	208	172	82.7	189	90.9
11.10	198	164	82.8	176	88.9
11.25	190	163	85.8	170	89.5
11.40	178	151	84.8	158	88.8
11.55	169	142	84.0	148	87.6
11.70	166	142	85.5	146	88.0
11.85	154	133	86.4	137	89.0
12.00	150	127	84.7	136	90.7
12.15	142	118	83.1	127	89.4
12.30	128	106	82.8	117	91.4
12.45	121	105	86.8	111	91.7
12.60	109	94	86.2	101	92.7
12.75	91	79	86.8	84	92.3
12.90	80	66	82.5	74	92.5
13.05	69	58	84.1	65	94.2
13.20	61	52	85.2	57	93.4
13.35	51	43	84.3	48	94.1
13.50	34	29	85.3	31	91.2
13.65	24	21	87.5	21	87.5
13.80	13	12	92.3	12	92.3
13.95	10	9	90.0	9	90.0
14.10	9	8	88.9	9	100.0
14.25	6	6	100.0	6	100.0
14.40	2	2	100.0	2	100.0
14.55	1	1	100.0	1	100.0
14.70	1	1	100.0	1	100.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 9. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
VIEW 2, ALL RUNWAYS

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
0.15	0	0	0.0	0	0.0
0.30	6	6	100.0	6	100.0
0.45	11	11	100.0	11	100.0
0.60	83	83	100.0	83	100.0
0.75	384	384	100.0	384	100.0
0.90	747	747	100.0	747	100.0
1.05	842	842	100.0	842	100.0
1.20	856	856	100.0	856	100.0
1.35	867	867	100.0	867	100.0
1.50	885	885	100.0	885	100.0
1.65	889	888	99.9	888	99.9
1.80	890	889	99.9	890	100.0
1.95	890	889	99.9	890	100.0
2.10	888	886	99.8	887	99.9
2.25	889	886	99.7	888	99.9
2.40	888	885	99.7	886	99.8
2.55	885	883	99.8	884	99.9
2.70	883	879	99.5	882	99.9
2.85	878	874	99.5	877	99.9
3.00	875	872	99.7	874	99.9
3.15	868	863	99.4	866	99.8
3.30	865	861	99.5	862	99.7
3.45	858	851	99.2	855	99.7
3.60	855	847	99.1	851	99.5
3.75	850	842	99.1	846	99.5
3.90	844	832	98.6	838	99.3
4.05	839	827	98.6	835	99.5
4.20	830	819	98.7	825	99.4
4.35	820	812	99.0	816	99.5
4.50	814	807	99.1	812	99.8
4.65	792	783	98.9	789	99.6
4.80	783	775	99.0	781	99.7
4.95	769	759	98.7	766	99.6
5.10	758	747	98.5	753	99.3
5.25	747	737	98.7	742	99.3
5.40	729	719	98.6	725	99.5
5.55	716	708	98.9	713	99.6
5.70	697	688	98.7	695	99.7
5.85	668	658	98.5	665	99.6
6.00	653	642	98.3	650	99.5
6.15	626	614	98.1	622	99.4
6.30	608	599	98.5	604	99.3
6.45	584	574	98.3	580	99.3
6.60	565	555	98.2	562	99.5
6.75	541	533	98.5	536	99.1
6.90	523	515	98.5	519	99.2
7.05	503	494	98.2	501	99.6
7.20	483	474	98.1	479	99.2
7.35	473	467	98.7	468	98.9
7.50	459	451	98.3	455	99.1

TABLE 9. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
VIEW 2, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
7.65	425	417	98.1	421	99.1
7.80	407	400	98.3	405	99.5
7.95	395	388	98.2	393	99.5
8.10	377	370	98.1	375	99.5
8.25	361	355	98.3	357	98.9
8.40	338	332	98.2	334	98.8
8.55	315	310	98.4	312	99.0
8.70	295	290	98.3	292	99.0
8.85	273	269	98.5	270	98.9
9.00	264	259	98.1	261	98.9
9.15	249	244	98.0	246	98.8
9.30	232	227	97.8	228	98.3
9.45	221	215	97.3	217	98.2
9.60	208	202	97.1	204	98.1
9.75	199	192	96.5	196	98.5
9.90	189	183	96.8	186	98.4
10.05	178	171	96.1	175	98.3
10.20	173	166	96.0	170	98.3
10.35	168	161	95.8	165	98.2
10.50	163	158	96.9	161	98.8
10.65	159	156	98.1	157	98.7
10.80	152	150	98.7	151	99.3
10.95	145	143	98.6	144	99.3
11.10	136	133	97.8	135	99.3
11.25	127	125	98.4	126	99.2
11.40	120	115	95.8	119	99.2
11.55	113	109	96.5	110	97.3
11.70	109	104	95.4	106	97.2
11.85	101	96	95.0	98	97.0
12.00	99	94	94.9	96	97.0
12.15	93	88	94.6	89	95.7
12.30	82	78	95.1	79	96.3
12.45	77	74	96.1	74	96.1
12.60	73	69	94.5	70	95.9
12.75	62	59	95.2	60	96.8
12.90	55	52	94.5	54	98.2
13.05	47	45	95.7	47	100.0
13.20	40	38	95.0	40	100.0
13.35	35	34	97.1	35	100.0
13.50	25	25	100.0	25	100.0
13.65	16	16	100.0	16	100.0
13.80	10	10	100.0	10	100.0
13.95	7	7	100.0	7	100.0
14.10	7	7	100.0	7	100.0
14.25	5	5	100.0	5	100.0
14.40	1	1	100.0	1	100.0
14.55	0	0	0.0	0	0.0
14.70	0	0	0.0	0	0.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 10. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE)
VIEW 2, ALL RUNWAYS

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
0.15	0	0	0.0	0	0.0
0.30	6	6	100.0	6	100.0
0.45	11	11	100.0	11	100.0
0.60	83	83	100.0	83	100.0
0.75	384	384	100.0	384	100.0
0.90	747	747	100.0	747	100.0
1.05	842	842	100.0	842	100.0
1.20	856	856	100.0	856	100.0
1.35	867	866	99.9	867	100.0
1.50	885	884	99.9	884	99.9
1.65	889	887	99.8	887	99.8
1.80	890	888	99.8	889	99.9
1.95	890	887	99.7	889	99.9
2.10	888	884	99.5	886	99.8
2.25	889	884	99.4	887	99.8
2.40	888	882	99.3	885	99.7
2.55	885	880	99.4	883	99.8
2.70	883	877	99.3	880	99.7
2.85	878	873	99.4	876	99.8
3.00	875	871	99.5	873	99.8
3.15	868	861	99.2	865	99.7
3.30	865	858	99.2	861	99.5
3.45	858	849	99.0	853	99.4
3.60	855	838	98.0	848	99.2
3.75	850	833	98.0	844	99.3
3.90	844	818	96.9	834	98.8
4.05	839	813	96.9	828	98.7
4.20	830	803	96.7	817	98.4
4.35	820	795	97.0	807	98.4
4.50	814	786	96.6	804	98.8
4.65	792	761	96.1	780	98.5
4.80	783	749	95.7	771	98.5
4.95	769	736	95.7	752	97.8
5.10	758	721	95.1	738	97.4
5.25	747	712	95.3	727	97.3
5.40	729	693	95.1	709	97.3
5.55	716	683	95.4	701	97.9
5.70	697	664	95.3	682	97.8
5.85	668	633	94.8	652	97.6
6.00	653	616	94.3	637	97.5
6.15	626	584	93.3	609	97.3
6.30	608	573	94.2	588	96.7
6.45	584	544	93.2	563	96.4
6.60	565	526	93.1	544	96.3
6.75	541	507	93.7	518	95.7
6.90	523	485	92.7	502	96.0
7.05	503	463	92.0	484	96.2
7.20	483	447	92.5	461	95.4
7.35	473	442	93.4	450	95.1
7.50	459	428	93.2	437	95.2
7.65	425	392	92.2	404	95.1

TABLE 10. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE)
VIEW 2, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
7.80	407	375	92.1	386	94.8
7.95	395	362	91.6	376	95.2
8.10	377	344	91.2	359	95.2
8.25	361	332	92.0	342	94.7
8.40	338	313	92.6	318	94.1
8.55	315	295	93.7	299	94.9
8.70	295	274	92.9	279	94.6
8.85	273	254	93.0	258	94.5
9.00	264	244	92.4	249	94.3
9.15	249	230	92.4	236	94.8
9.30	232	214	92.2	219	94.4
9.45	221	204	92.3	209	94.6
9.60	208	191	91.8	197	94.7
9.75	199	179	89.9	189	95.0
9.90	189	173	91.5	179	94.7
10.05	178	164	92.1	171	96.1
10.20	173	159	91.9	166	96.0
10.35	168	155	92.3	161	95.8
10.50	163	152	93.3	158	96.9
10.65	159	151	95.0	155	97.5
10.80	152	147	96.7	149	98.0
10.95	145	139	95.9	142	97.9
11.10	136	130	95.6	133	97.8
11.25	127	122	96.1	124	97.6
11.40	120	113	94.2	117	97.5
11.55	113	106	93.8	109	96.5
11.70	109	102	93.6	105	96.3
11.85	101	94	93.1	97	96.0
12.00	99	91	91.9	95	96.0
12.15	93	85	91.4	88	94.6
12.30	82	75	91.5	78	95.1
12.45	77	72	93.5	73	94.8
12.60	73	68	93.2	69	94.5
12.75	62	58	93.5	59	95.2
12.90	55	50	90.9	53	96.4
13.05	47	43	91.5	46	97.9
13.20	40	37	92.5	39	97.5
13.35	35	33	94.3	35	100.0
13.50	25	24	96.0	25	100.0
13.65	16	16	100.0	16	100.0
13.80	10	10	100.0	10	100.0
13.95	7	7	100.0	7	100.0
14.10	7	7	100.0	7	100.0
14.25	5	5	100.0	5	100.0
14.40	1	1	100.0	1	100.0
14.55	0	0	0.0	0	0.0
14.70	0	0	0.0	0	0.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 11. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
VIEW 3, ALL RUNWAYS

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
0.15	0	0	0.0	0	0.0
0.30	3	3	100.0	3	100.0
0.45	3	3	100.0	3	100.0
0.60	26	26	100.0	26	100.0
0.75	106	106	100.0	106	100.0
0.90	223	223	100.0	223	100.0
1.05	250	250	100.0	250	100.0
1.20	256	256	100.0	256	100.0
1.35	259	259	100.0	259	100.0
1.50	261	261	100.0	261	100.0
1.65	261	260	99.6	260	99.6
1.80	261	260	99.6	261	100.0
1.95	261	261	100.0	261	100.0
2.10	262	262	100.0	262	100.0
2.25	262	262	100.0	262	100.0
2.40	263	263	100.0	263	100.0
2.55	263	263	100.0	263	100.0
2.70	263	263	100.0	263	100.0
2.85	263	263	100.0	263	100.0
3.00	263	263	100.0	263	100.0
3.15	263	263	100.0	263	100.0
3.30	263	263	100.0	263	100.0
3.45	263	263	100.0	263	100.0
3.60	263	263	100.0	263	100.0
3.75	263	263	100.0	263	100.0
3.90	264	264	100.0	264	100.0
4.05	264	263	99.6	264	100.0
4.20	264	263	99.6	264	100.0
4.35	264	263	99.6	263	99.6
4.50	264	263	99.6	264	100.0
4.65	264	261	98.9	264	100.0
4.80	264	262	99.2	264	100.0
4.95	264	262	99.2	264	100.0
5.10	264	263	99.6	264	100.0
5.25	264	263	99.6	264	100.0
5.40	264	263	99.6	264	100.0
5.55	264	264	100.0	264	100.0
5.70	264	264	100.0	264	100.0
5.85	264	263	99.6	264	100.0
6.00	264	263	99.6	264	100.0
6.15	264	261	98.9	264	100.0
6.30	264	262	99.2	264	100.0
6.45	264	262	99.2	264	100.0
6.60	264	262	99.2	264	100.0
6.75	264	263	99.6	264	100.0
6.90	264	263	99.6	264	100.0
7.05	264	263	99.6	264	100.0
7.20	264	263	99.6	263	99.6
7.35	264	263	99.6	263	99.6
7.50	264	260	98.5	263	99.6

TABLE 11. CONTAINMENT PROFILE (550 FT. NOZ, 700 FT. NOZ)
VIEW 3, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. NOZ	Percent	Contained by 700 ft. NOZ	Percent
7.65	264	260	98.5	263	99.6
7.80	264	260	98.5	263	99.6
7.95	264	258	97.7	263	99.6
8.10	264	258	97.7	263	99.6
8.25	264	259	98.1	261	98.9
8.40	264	259	98.1	261	98.9
8.55	264	260	98.5	262	99.2
8.70	264	260	98.5	262	99.2
8.85	264	260	98.5	261	98.9
9.00	264	259	98.1	261	98.9
9.15	249	244	98.0	246	98.8
9.30	232	227	97.8	228	98.3
9.45	221	215	97.3	217	98.2
9.60	208	202	97.1	204	98.1
9.75	199	192	96.5	196	98.5
9.90	189	183	96.8	186	98.4
10.05	178	171	96.1	175	98.3
10.20	173	166	96.0	170	98.3
10.35	168	161	95.8	165	98.2
10.50	163	158	96.9	161	98.8
10.65	159	156	98.1	157	98.7
10.80	152	150	98.7	151	99.3
10.95	145	143	98.6	144	99.3
11.10	136	133	97.8	135	99.3
11.25	127	125	98.4	126	99.2
11.40	120	115	95.8	119	99.2
11.55	113	109	96.5	110	97.3
11.70	109	104	95.4	106	97.2
11.85	101	96	95.0	98	97.0
12.00	99	94	94.9	96	97.0
12.15	93	88	94.6	89	95.7
12.30	82	78	95.1	79	96.3
12.45	77	74	96.1	74	96.1
12.60	73	69	94.5	70	95.9
12.75	62	59	95.2	60	96.8
12.90	55	52	94.5	54	98.2
13.05	47	45	95.7	47	100.0
13.20	40	38	95.0	40	100.0
13.35	35	34	97.1	35	100.0
13.50	25	25	100.0	25	100.0
13.65	16	16	100.0	16	100.0
13.80	10	10	100.0	10	100.0
13.95	7	7	100.0	7	100.0
14.10	7	7	100.0	7	100.0
14.25	5	5	100.0	5	100.0
14.40	1	1	100.0	1	100.0
14.55	0	0	0.0	0	0.0
14.70	0	0	0.0	0	0.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 12. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE), VIEW 3, ALL RUNWAYS

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
0.15	0	0	0.0	0	0.0
0.30	3	3	100.0	3	100.0
0.45	3	3	100.0	3	100.0
0.60	26	26	100.0	26	100.0
0.75	106	106	100.0	106	100.0
0.90	223	223	100.0	223	100.0
1.05	250	250	100.0	250	100.0
1.20	256	256	100.0	256	100.0
1.35	259	259	100.0	259	100.0
1.50	261	261	100.0	261	100.0
1.65	261	260	99.6	260	99.6
1.80	261	260	99.6	261	100.0
1.95	261	261	100.0	261	100.0
2.10	262	262	100.0	262	100.0
2.25	262	262	100.0	262	100.0
2.40	263	263	100.0	263	100.0
2.55	263	263	100.0	263	100.0
2.70	263	263	100.0	263	100.0
2.85	263	263	100.0	263	100.0
3.00	263	263	100.0	263	100.0
3.15	263	262	99.6	263	100.0
3.30	263	262	99.6	263	100.0
3.45	263	262	99.6	262	99.6
3.60	263	261	99.2	262	99.6
3.75	263	261	99.2	262	99.6
3.90	264	262	99.2	264	100.0
4.05	264	261	98.9	264	100.0
4.20	264	261	98.9	264	100.0
4.35	264	261	98.9	262	99.2
4.50	264	262	99.2	263	99.6
4.65	264	260	98.5	264	100.0
4.80	264	260	98.5	264	100.0
4.95	264	261	98.9	264	100.0
5.10	264	262	99.2	264	100.0
5.25	264	262	99.2	263	99.6
5.40	264	262	99.2	263	99.6
5.55	264	263	99.6	263	99.6
5.70	264	262	99.2	263	99.6
5.85	264	261	98.9	264	100.0
6.00	264	261	98.9	264	100.0
6.15	264	257	97.3	264	100.0
6.30	264	259	98.1	263	99.6
6.45	264	258	97.7	261	98.9
6.60	264	257	97.3	261	98.9
6.75	264	258	97.7	260	98.5
6.90	264	255	96.6	261	98.9
7.05	264	254	96.2	260	98.5
7.20	264	253	95.8	257	97.3
7.35	264	253	95.8	255	96.6
7.50	264	249	94.3	254	96.2
7.65	264	247	93.6	255	96.6

TABLE 12. CONTAINMENT PROFILE (550 FT. ENVELOPE, 700 FT. ENVELOPE) VIEW 3, ALL RUNWAYS (Continued)

Range	Count	Contained by 550 ft. Envelope	Percent	Contained by 700 ft. Envelope	Percent
7.80	264	247	93.6	253	95.8
7.95	264	244	92.4	255	96.6
8.10	264	243	92.0	254	96.2
8.25	264	243	92.0	251	95.1
8.40	264	245	92.8	249	94.3
8.55	264	246	93.2	250	94.7
8.70	264	245	92.8	250	94.7
8.85	264	246	93.2	250	94.7
9.00	264	244	92.4	249	94.3
9.15	249	230	92.4	236	94.8
9.30	232	214	92.2	219	94.4
9.45	221	204	92.3	209	94.6
9.60	208	191	91.8	197	94.7
9.75	199	179	89.9	189	95.0
9.90	189	173	91.5	179	94.7
10.05	178	164	92.1	171	96.1
10.20	173	159	91.9	166	96.0
10.35	168	155	92.3	161	95.8
10.50	163	152	93.3	158	96.9
10.65	159	151	95.0	155	97.5
10.80	152	147	96.7	149	98.0
10.95	145	139	95.9	142	97.9
11.10	136	130	95.6	133	97.8
11.25	127	122	96.1	124	97.6
11.40	120	113	94.2	117	97.5
11.55	113	106	93.8	109	96.5
11.70	109	102	93.6	105	96.3
11.85	101	94	93.1	97	96.0
12.00	99	91	91.9	95	96.0
12.15	93	85	91.4	88	94.6
12.30	82	75	91.5	78	95.1
12.45	77	72	93.5	73	94.8
12.60	73	68	93.2	69	94.5
12.75	62	58	93.5	59	95.2
12.90	55	50	90.9	53	96.4
13.05	47	43	91.5	46	97.9
13.20	40	37	92.5	39	97.5
13.35	35	33	94.3	35	100.0
13.50	25	24	96.0	25	100.0
13.65	16	16	100.0	16	100.0
13.80	10	10	100.0	10	100.0
13.95	7	7	100.0	7	100.0
14.10	7	7	100.0	7	100.0
14.25	5	5	100.0	5	100.0
14.40	1	1	100.0	1	100.0
14.55	0	0	0.0	0	0.0
14.70	0	0	0.0	0	0.0
14.85	0	0	0.0	0	0.0
15.00	0	0	0.0	0	0.0

TABLE 13. STATISTICS BY RUNWAY
FULL VIEW

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
36R	332	-2.1	146.6
36L	321	16.0	157.7
18R	122	-5.5	107.6
18L	118	22.3	141.2
All	893	7.1	145.6
6.0 nmi			
36R	323	-20.2	529.0
36L	310	137.6	691.6
18R	119	-96.0	738.2
18L	110	100.1	883.3
All	862	41.4	676.4
9.0 nmi			
36R	242	398.5	3317.5
36L	214	681.3	3684.2
18R	54	283.6	2496.1
18L	48	384.0	1980.1
All	558	494.6	3301.3

TABLE 14. STATISTICS BY RUNWAY
VIEW 1

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
36R	332	-2.1	146.6
36L	320	15.2	157.3
18R	122	-5.5	107.6
18L	118	22.3	141.2
All	892	6.8	145.4
6.0 nmi			
36R	304	-7.0	332.1
36L	268	81.3	423.0
18R	105	-55.0	339.9
18L	100	23.4	722.6
All	777	20.8	434.2
9.0 nmi			
36R	141	23.7	457.3
36L	125	74.9	484.8
18R	43	-138.8	240.9
18L	40	85.9	218.8
All	349	29.1	430.0

TABLE 15. STATISTICS BY RUNWAY
VIEW 2

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
36R	328	-3.2	147.0
36L	316	13.6	155.5
18R	119	-3.7	103.5
18L	112	26.6	124.1
All	875	6.6	142.5
6.0 nmi			
36R	257	-5.0	262.5
36L	230	112.0	374.5
18R	88	-55.7	167.5
18L	78	142.4	202.5
All	653	46.9	300.0
9.0 nmi			
36R	101	17.8	392.4
36L	89	111.3	367.5
18R	39	-111.5	190.4
18L	35	87.9	204.8
All	264	39.5	345.6

TABLE 16. STATISTICS BY RUNWAY
VIEW 3

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
36R	101	-16.6	108.8
36L	89	10.7	142.8
18R	39	12.9	85.9
18L	34	-48.5	78.9
All	263	-7.1	116.8
6.0 nmi			
36R	101	-37.7	184.1
36L	89	61.8	228.2
18R	39	-45.9	141.2
18L	35	46.7	119.1
All	264	5.8	193.5
9.0 nmi			
36R	101	17.8	392.4
36L	89	111.3	367.5
18R	39	-111.5	190.4
18L	35	87.9	204.8
All	264	39.5	346.4

TABLE 17. AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 36R

ILS

Away From Other Runway ← | → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	1	1	3	14	129	161	18	1	1	2	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	1	1	2	1	7	17	126	142	26	8	-	1	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	1	-	-	-	-	-	-	-	-	1	4	10	35	98	36	33	7	4	2	-	-	-	-	1	-	-	-	-	-	-
3.75	-	-	-	-	1	-	-	-	-	2	3	2	6	11	37	109	102	36	7	3	5	-	3	2	-	2	-	-	-	-	-	-
4.50	1	1	1	-	-	1	-	1	-	1	5	5	6	23	32	91	91	26	19	11	7	2	3	2	1	-	-	-	-	-	-	-
5.25	1	2	-	-	1	-	-	7	3	2	2	3	9	26	40	77	63	47	15	7	8	4	5	2	-	-	-	-	2	-	-	-
6.00	5	1	1	2	-	-	1	1	2	4	7	6	11	12	39	63	50	50	19	16	7	6	7	1	2	-	1	2	-	-	2	5
6.75	7	2	2	1	2	2	1	2	6	3	4	5	11	22	32	46	40	31	26	22	7	8	6	3	4	2	1	-	2	4	-	9
7.50	15	-	2	4	1	5	5	3	9	4	4	9	12	21	22	36	32	24	19	13	7	7	5	1	7	4	3	2	2	-	1	19
8.25	37	-	3	2	-	5	3	4	-	3	4	11	12	19	15	29	32	22	12	9	6	4	3	8	3	2	1	-	2	-	1	21
9.00	50	1	-	2	5	2	3	1	4	5	3	7	8	10	13	20	25	17	8	9	4	7	6	1	-	1	1	1	1	2	4	21
9.75	47	-	2	2	1	2	2	5	6	2	-	4	5	6	9	18	17	15	5	3	4	4	4	2	-	1	-	-	-	2	1	17

TABLE 18. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 36R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	39	49	5	-	-	1	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	1	-	2	5	38	43	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	1	3	11	30	41	10	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	1	1	2	3	11	33	31	11	2	1	2	-	1	1	-	1	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	2	2	2	7	10	28	28	8	6	3	2	1	1	1	-	-	-	-	-	-	-	-
5.25	-	1	-	-	-	-	-	2	1	1	1	1	3	8	12	24	19	14	5	2	2	1	2	1	-	-	-	-	1	-	-	-
6.00	2	-	-	1	-	-	-	-	1	1	2	2	3	4	12	20	15	15	6	5	2	2	2	-	1	-	-	1	-	-	1	2
6.75	2	1	1	-	1	1	-	1	2	1	1	2	4	7	10	15	13	10	8	7	2	3	2	1	1	1	-	-	1	1	-	3
7.50	5	-	1	1	-	2	2	1	3	1	1	3	4	7	7	12	11	8	6	4	2	2	2	-	2	1	1	1	1	-	-	6
8.25	14	-	1	1	-	2	1	1	-	1	1	4	4	7	5	11	12	8	4	3	2	1	1	3	1	1	-	-	1	-	-	8
9.00	21	-	-	1	2	1	1	-	2	2	1	3	3	4	5	8	10	7	3	4	2	3	2	-	-	-	-	-	-	1	2	9
9.75	25	-	1	1	1	1	1	3	3	1	-	2	3	3	5	10	9	8	3	2	2	2	2	1	-	1	-	-	-	1	1	9

TABLE 19. AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 36L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	1	-	-	1	1	2	13	159	128	10	5	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	1	-	-	-	-	-	-	-	1	4	27	132	134	16	2	1	1	1	-	-	1	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	3	3	10	14	38	95	115	23	10	4	3	2	1	-	-	-	-	-	-	-	-	-
3.75	-	-	1	-	-	-	-	-	2	3	6	6	12	22	40	112	61	37	6	5	1	4	-	-	-	1	-	-	1	-	-	-
4.50	1	1	1	1	-	-	2	3	1	10	9	5	14	36	40	70	77	33	5	3	2	1	2	-	-	2	-	-	-	-	-	-
5.25	9	-	1	1	4	-	2	1	9	4	6	17	15	22	38	64	57	26	17	10	2	4	2	2	1	1	-	-	-	-	-	2
6.00	8	5	3	3	1	2	2	3	2	9	17	12	15	26	33	54	41	26	11	11	4	5	5	-	2	-	-	4	1	-	1	4
6.75	15	2	4	1	2	5	5	8	7	5	11	16	15	29	37	41	38	20	9	6	7	1	-	1	2	1	1	2	-	1	3	7
7.50	34	3	1	4	3	3	5	6	7	6	13	13	15	22	20	40	25	15	10	8	5	4	1	1	2	2	-	-	1	1	-	19
8.25	52	5	2	1	1	4	6	6	7	7	7	7	11	18	22	22	25	17	7	6	6	2	1	1	3	-	1	-	-	2	1	14
9.00	44	2	2	2	4	3	6	5	1	8	3	3	4	7	21	24	16	14	11	2	3	3	-	3	1	-	1	2	-	-	1	18
9.75	43	1	2	-	2	2	4	3	4	4	2	3	7	12	16	11	9	11	7	5	3	2	1	2	1	1	1	-	1	2	1	21

TABLE 20. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 36L

ILS

Away From Other Runway ←——→ Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	50	40	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	1	8	41	42	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	1	3	4	12	30	36	7	3	1	1	1	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	1	1	2	2	4	7	13	35	19	12	2	2	-	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	1	1	-	3	3	2	4	11	13	22	24	10	2	1	1	-	1	-	-	1	-	-	-	-	-	-
5.25	3	-	-	-	1	-	1	-	3	1	2	5	5	7	12	20	18	8	5	3	1	1	1	1	-	-	-	-	-	-	-	1
6.00	3	2	1	1	-	1	1	1	1	3	5	4	5	8	11	17	13	8	4	4	1	2	2	-	1	-	-	1	-	-	-	1
6.75	5	1	1	-	1	2	2	3	2	2	4	5	5	10	12	14	13	7	3	2	2	-	-	-	1	-	-	1	-	-	1	2
7.50	12	1	-	1	1	1	2	2	2	2	4	4	5	8	7	14	9	5	3	3	2	1	-	-	1	1	-	-	-	-	-	7
8.25	20	2	1	-	-	2	2	2	3	3	3	3	4	7	8	8	9	6	3	2	2	1	-	-	1	-	-	-	-	1	-	5
9.00	21	1	1	1	2	1	3	2	-	4	1	1	2	3	10	11	7	7	5	1	1	1	-	1	-	-	-	1	-	-	-	8
9.75	23	1	1	-	1	1	2	2	2	2	1	2	4	7	9	6	5	6	4	3	2	1	1	1	1	1	1	-	1	1	1	11

TABLE 21. AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 18R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	4	42	72	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	55	42	10	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	4	10	44	46	13	3	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	1	-	5	9	23	53	20	7	1	2	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	1	-	1	3	5	9	17	45	23	9	4	2	1	1	-	-	-	-	-	-	-	-	1
5.25	1	-	-	-	-	-	-	3	1	1	2	1	-	4	7	17	34	24	15	2	3	1	-	1	1	1	-	-	-	-	-	3
6.00	2	-	-	1	-	-	-	-	1	2	2	3	1	4	9	23	23	21	8	7	6	-	-	-	-	1	-	-	-	-	-	5
6.75	6	-	1	-	-	1	-	-	1	1	1	2	2	8	4	17	25	19	3	10	2	1	1	-	1	-	1	-	1	-	1	8
7.50	10	-	-	-	-	-	1	1	2	1	3	1	3	1	7	12	20	16	12	6	2	1	-	-	2	-	-	1	1	-	-	10
8.25	5	-	-	-	-	-	-	-	1	2	1	2	2	3	6	10	14	13	8	8	3	1	2	-	1	-	-	1	-	-	-	4
9.00	8	-	-	-	-	-	-	-	-	-	-	-	1	2	4	5	6	11	5	5	3	-	-	1	1	-	-	-	-	-	-	2
9.75	7	-	-	-	-	-	-	-	-	-	2	1	1	3	2	3	3	11	4	10	-	-	1	1	-	-	-	-	-	-	-	-

TABLE 22. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 18R

I
L
S

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	34	59	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	45	34	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	3	8	36	38	11	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	1	-	4	7	19	43	16	6	1	2	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	1	-	1	2	4	7	14	37	19	7	3	2	1	1	-	-	-	-	-	-	-	-	1
5.25	1	-	-	-	-	-	-	2	1	1	2	1	-	3	6	14	28	20	12	2	2	1	-	1	1	1	-	-	-	-	-	2
6.00	2	-	-	1	-	-	-	-	1	2	2	3	1	3	8	19	19	18	7	6	5	-	-	-	-	1	-	-	-	-	-	4
6.75	5	-	1	-	-	1	-	-	1	1	1	2	2	7	3	15	21	16	3	9	2	1	1	-	1	-	1	-	1	-	1	7
7.50	9	-	-	-	-	-	1	1	2	1	3	1	3	1	6	11	18	14	11	5	2	1	-	-	2	-	-	1	1	-	-	9
8.25	6	-	-	-	-	-	-	-	1	2	1	2	2	3	7	11	16	15	9	9	3	1	2	-	1	-	-	1	-	-	-	5
9.00	15	-	-	-	-	-	-	-	-	-	-	-	2	4	7	9	11	20	9	9	6	-	-	2	2	-	-	-	-	-	-	4
9.75	14	-	-	-	-	-	-	-	-	-	4	2	2	6	4	6	6	22	8	20	-	-	2	2	-	-	-	-	-	-	-	-

TABLE 23. AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 18L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	71	29	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	7	11	54	34	8	1	-	-	-	1	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	2	1	5	17	43	29	15	4	-	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	3	7	7	24	31	24	13	3	3	-	-	-	-	1	-	1	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	1	1	5	5	3	9	24	42	18	4	2	-	-	1	-	1	-	-	-	-	-	1	-	2
5.25	-	1	-	-	-	1	-	-	2	4	4	2	9	14	24	22	15	6	4	-	3	-	-	-	-	1	-	1	-	1	-	2
6.00	3	-	1	1	-	-	3	1	1	2	2	3	8	16	14	22	12	6	3	2	3	1	1	1	-	-	-	-	-	-	-	4
6.75	6	-	1	1	1	2	1	-	4	3	4	5	8	6	15	20	9	6	1	1	-	-	-	1	2	2	2	-	1	-	-	5
7.50	9	-	1	-	1	-	-	1	2	1	3	8	6	9	15	11	9	6	2	1	-	-	-	-	-	-	-	1	1	-	-	8
8.25	4	-	-	-	-	-	1	1	2	-	3	5	6	5	11	8	8	2	2	3	1	-	-	-	-	-	1	1	-	-	-	4
9.00	4	-	-	-	-	-	1	1	-	1	1	1	3	3	12	7	5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	2
9.75	5	1	-	-	-	-	-	-	1	2	2	2	3	1	7	8	4	3	1	1	2	-	1	-	-	-	-	-	-	1	-	2

TABLE 24. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
FULL VIEW, RUNWAY - 18L

ILS

Away From Other Runway ←——→ Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	64	26	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	6	9	46	29	7	1	-	-	-	1	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	2	1	4	14	36	25	13	3	-	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	3	6	6	20	26	20	11	3	3	-	-	-	-	1	-	1	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	1	1	4	4	3	8	20	35	15	3	2	-	-	1	-	1	-	-	-	-	-	1	-	2
5.25	-	1	-	-	-	1	-	-	2	3	3	2	8	12	21	19	13	5	3	-	3	-	-	-	-	1	-	1	-	1	-	2
6.00	3	-	1	1	-	-	3	1	1	2	2	3	7	15	13	20	11	5	3	2	3	1	1	1	-	-	-	-	-	-	-	4
6.75	6	-	1	1	1	2	1	-	4	3	4	5	7	6	14	19	8	6	1	1	-	-	-	1	2	2	2	-	1	-	-	5
7.50	9	-	1	-	1	-	-	1	2	1	3	8	6	9	16	12	9	6	2	1	-	-	-	-	-	-	-	1	1	-	-	8
8.25	6	-	-	-	-	-	1	1	3	-	4	7	9	7	16	12	12	3	3	4	1	-	-	-	-	-	1	1	-	-	-	6
9.00	8	-	-	-	-	-	2	2	-	2	2	2	6	6	25	15	10	6	4	2	2	-	-	-	-	-	-	-	-	-	-	4
9.75	11	2	-	-	-	-	-	-	2	4	4	4	6	2	15	17	9	6	2	2	4	-	2	-	-	-	-	-	-	2	-	4

TABLE 25. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 36R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	1	1	3	14	129	161	18	1	1	2	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	1	1	2	1	7	17	126	142	26	8	-	1	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	1	-	-	-	-	-	-	-	-	1	4	10	35	98	136	33	7	4	2	-	-	-	-	1	-	-	-	-	-	-
3.75	-	-	-	-	1	-	-	-	-	2	3	2	6	11	37	109	101	36	7	3	5	-	3	2	-	2	-	-	-	-	-	-
4.50	1	-	1	-	-	1	-	1	-	1	5	5	6	23	32	91	91	25	19	11	6	2	3	2	1	-	-	-	-	-	-	-
5.25	-	2	-	-	1	-	-	6	3	2	2	3	9	26	40	77	63	47	15	7	8	1	5	1	-	-	-	-	1	-	-	-
6.00	1	-	1	2	-	-	1	1	2	3	7	5	11	12	39	63	50	49	18	16	7	6	4	1	1	-	1	2	-	-	1	-
6.75	1	-	1	1	2	1	-	1	5	2	3	5	9	21	31	46	40	31	26	20	7	7	4	3	2	-	1	-	1	2	-	1
7.50	-	-	-	1	1	3	3	1	5	4	4	9	10	21	21	36	32	24	18	13	7	7	4	1	2	2	2	1	1	-	1	3
8.25	1	-	2	-	-	-	2	3	-	3	4	11	12	18	14	27	32	20	11	9	5	4	3	6	2	1	1	-	-	-	-	1
9.00	1	-	-	-	3	1	2	-	3	3	3	6	7	9	13	19	24	16	6	7	4	6	4	1	-	1	-	-	-	-	1	1
9.75	1	-	2	-	-	-	-	2	4	1	-	3	5	5	8	18	16	15	5	3	3	4	3	-	-	1	-	-	-	2	-	2

TABLE 26. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 36R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	39	49	5	-	-	1	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	1	-	2	5	38	43	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	1	3	11	30	41	10	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	1	1	2	3	11	33	31	11	2	1	2	-	1	1	-	1	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	2	2	2	7	10	28	28	8	6	3	2	1	1	1	-	-	-	-	-	-	-	-
5.25	-	1	-	-	-	-	-	2	1	1	1	1	3	8	13	24	20	15	5	2	3	-	2	-	-	-	-	-	-	-	-	-
6.00	-	-	-	1	-	-	-	-	1	1	2	2	4	4	13	21	16	16	6	5	2	2	1	-	-	-	-	1	-	-	-	-
6.75	-	-	-	-	1	-	-	-	2	1	1	2	3	8	11	17	15	11	9	7	3	3	1	1	1	-	-	-	-	1	-	-
7.50	-	-	-	-	-	1	1	-	2	2	2	4	4	9	9	15	14	10	8	5	3	3	2	-	1	1	1	-	-	-	-	1
8.25	1	-	1	-	-	-	1	2	-	2	2	6	6	9	7	14	17	10	6	5	3	2	2	3	1	1	1	-	-	-	-	1
9.00	1	-	-	-	2	1	1	-	2	2	2	4	5	6	9	13	17	11	4	5	3	4	3	1	-	1	-	-	-	-	1	1
9.75	1	-	2	-	-	-	-	2	4	1	-	3	5	5	8	17	16	15	5	3	3	4	3	-	-	1	-	-	-	2	-	2

TABLE 27. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 36L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	1	-	-	1	1	2	13	159	128	10	5	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	1	-	-	-	-	-	-	-	1	4	27	132	134	16	2	1	1	1	-	-	1	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	3	3	10	13	38	95	115	23	10	4	3	2	1	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	2	3	6	5	12	22	40	112	61	37	6	5	1	4	-	-	-	1	-	-	1	-	-	-
4.50	-	1	1	-	-	-	2	1	1	10	9	4	14	35	40	69	77	33	5	3	2	1	2	-	-	2	-	-	-	-	-	-
5.25	3	-	-	1	2	-	1	1	6	4	5	13	14	20	38	64	57	26	16	10	2	3	2	2	1	1	-	-	-	-	-	1
6.00	2	2	1	1	1	-	2	1	1	7	11	10	15	25	33	52	40	25	11	10	4	5	3	-	2	-	-	1	1	-	1	1
6.75	-	-	3	1	1	1	2	5	1	3	8	13	11	28	37	40	38	20	9	6	7	1	-	-	2	1	1	1	-	1	1	-
7.50	2	1	-	-	-	-	4	3	4	4	10	9	14	21	20	40	25	14	10	7	5	3	1	1	2	2	-	-	-	-	-	1
8.25	1	1	-	-	1	2	4	3	4	4	6	5	9	17	20	21	24	17	6	6	6	2	-	-	2	-	-	-	-	2	-	1
9.00	2	-	2	1	1	1	1	4	1	2	2	2	4	7	19	24	16	13	9	2	2	3	-	3	1	-	1	1	-	-	-	1
9.75	-	-	-	-	1	-	1	3	1	4	2	3	5	12	14	11	8	11	7	5	3	2	1	2	1	1	1	-	-	1	1	2

TABLE 28. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 36L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	50	40	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	1	8	41	42	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	1	3	4	12	30	36	7	3	1	1	1	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	1	1	2	2	4	7	13	35	19	12	2	2	-	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	1	-	-	3	3	1	4	11	13	22	25	11	2	1	1	-	1	-	-	1	-	-	-	-	-	-
5.25	1	-	-	-	1	-	-	-	2	1	2	4	5	7	13	22	19	9	5	3	1	1	1	1	-	-	-	-	-	-	-	-
6.00	1	1	-	-	-	-	1	-	-	3	4	4	6	9	12	19	15	9	4	4	1	2	1	-	1	-	-	-	-	-	-	-
6.75	-	-	1	-	-	-	1	2	-	1	3	5	5	12	15	17	16	8	4	2	3	-	-	-	1	-	-	-	-	-	-	-
7.50	1	-	-	-	-	-	2	1	2	2	5	4	7	10	10	20	12	7	5	3	2	1	-	-	1	1	-	-	-	-	-	-
8.25	1	1	-	-	1	1	2	2	2	2	4	3	5	10	12	13	15	10	4	4	4	1	-	-	1	-	-	-	-	1	-	1
9.00	2	-	2	1	1	1	1	3	1	2	2	2	3	6	15	19	13	10	7	2	2	2	-	2	1	-	1	1	-	-	-	1
9.75	-	-	-	-	1	-	1	3	1	4	2	3	5	12	14	11	8	11	7	5	3	2	1	2	1	1	1	-	-	1	1	2

TABLE 29. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 18R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	4	42	72	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	55	42	10	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	4	10	44	46	13	3	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	1	-	5	8	23	53	20	7	1	1	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	1	3	5	9	17	45	23	9	4	2	1	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	1	1	1	2	1	-	4	5	17	34	24	14	2	3	1	-	1	-	-	-	-	-	-	-	1
6.00	1	-	-	-	-	-	-	-	-	2	-	2	1	3	9	22	23	21	8	6	6	-	-	-	-	-	-	-	-	-	-	1
6.75	2	-	-	-	-	-	-	-	-	-	-	2	1	6	4	16	25	17	3	9	2	1	1	-	-	-	-	-	-	-	-	2
7.50	1	-	-	-	-	-	1	-	-	1	1	1	2	1	7	10	20	16	11	6	1	1	-	-	1	-	-	-	-	-	-	2
8.25	-	-	-	-	-	-	-	-	-	1	-	1	2	2	6	9	14	13	7	8	3	1	1	-	1	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	-	-	-	1	2	3	5	6	11	5	5	3	-	-	1	1	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	1	1	1	3	2	3	3	11	4	10	-	-	1	1	-	-	-	-	-	-	-	-

TABLE 30. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 18R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	34	59	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	45	34	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	3	8	36	38	11	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	1	-	4	7	19	44	17	6	1	1	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	1	3	4	8	14	38	19	8	3	2	1	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	1	1	1	2	1	-	4	4	15	30	21	13	2	3	1	-	1	-	-	-	-	-	-	-	1
6.00	1	-	-	-	-	-	-	-	-	2	-	2	1	3	9	21	22	20	8	6	6	-	-	-	-	-	-	-	-	-	-	1
6.75	2	-	-	-	-	-	-	-	-	-	-	2	1	7	4	18	27	19	3	10	2	1	1	-	-	-	-	-	-	-	-	2
7.50	1	-	-	-	-	-	1	-	-	1	1	1	2	1	8	12	24	19	13	7	1	1	-	-	1	-	-	-	-	-	-	2
8.25	-	-	-	-	-	-	-	-	-	1	-	1	3	3	9	13	20	19	10	12	4	1	1	-	1	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	-	-	-	2	5	7	12	14	26	12	12	7	-	-	2	2	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	2	2	2	7	5	7	7	27	10	24	-	-	2	2	-	-	-	-	-	-	-	-

TABLE 31. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 18L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	71	29	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	7	11	54	34	8	1	-	-	-	1	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	2	1	5	17	43	29	15	4	-	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	3	7	7	24	31	24	13	3	3	-	-	-	-	1	-	1	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	1	1	5	5	3	9	24	42	18	4	2	-	-	1	-	1	-	-	-	-	-	1	-	2
5.25	-	1	-	-	-	1	-	-	2	3	4	1	8	14	24	22	15	6	4	-	2	-	-	-	-	1	-	-	-	1	-	2
6.00	-	-	1	-	-	-	1	1	1	2	2	3	7	16	14	22	12	5	3	2	3	1	1	-	-	-	-	-	-	-	-	3
6.75	-	-	-	-	-	2	-	-	4	3	4	4	8	6	13	20	9	6	1	-	-	-	-	1	2	-	1	-	-	-	-	2
7.50	-	-	-	-	1	-	-	1	2	1	2	6	6	9	15	10	9	6	2	1	-	-	-	-	-	-	-	1	-	-	-	2
8.25	-	-	-	-	-	-	-	1	2	-	3	4	5	5	11	8	8	2	2	3	1	-	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	1	1	1	3	3	12	7	5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	2	2	2	2	1	7	8	4	3	1	1	2	-	1	-	-	-	-	-	-	-	-	-

TABLE 32. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 1, RUNWAY - 18L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	64	26	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	6	9	46	29	7	1	-	-	-	1	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	2	1	4	14	36	25	13	3	-	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	3	6	6	20	26	20	11	3	3	-	-	-	-	1	-	1	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	1	1	4	4	3	8	20	35	15	3	2	-	-	1	-	1	-	-	-	-	-	1	-	2
5.25	-	1	-	-	-	1	-	-	2	3	4	1	7	13	22	20	14	5	4	-	2	-	-	-	-	1	-	-	-	1	-	2
6.00	-	-	1	-	-	-	1	1	1	2	2	3	7	16	14	22	12	5	3	2	3	1	1	-	-	-	-	-	-	-	-	3
6.75	-	-	-	-	-	2	-	-	5	3	5	5	9	7	15	23	10	7	1	-	-	-	-	1	2	-	1	-	-	-	-	2
7.50	-	-	-	-	1	-	-	1	3	1	3	8	8	12	20	14	12	8	3	1	-	-	-	-	-	-	-	1	-	-	-	3
8.25	-	-	-	-	-	-	-	2	4	-	5	7	9	9	20	15	15	4	4	5	2	-	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	3	3	3	8	8	30	18	13	8	5	3	3	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	6	6	6	6	3	19	22	11	8	3	3	6	-	3	-	-	-	-	-	-	-	-	-

TABLE 33. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 36R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	1	1	3	14	129	161	18	1	1	2	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	1	1	2	1	7	17	125	142	26	8	-	1	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	1	-	-	-	-	-	-	-	-	1	4	10	34	95	136	33	7	4	2	-	-	-	-	1	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	2	2	2	6	10	36	108	101	36	7	3	4	-	3	1	-	2	-	-	-	-	-	-
4.50	-	-	-	-	-	1	-	-	-	1	3	4	5	20	31	89	90	25	19	11	6	2	2	-	1	-	-	-	-	-	-	-
5.25	-	-	-	-	1	-	-	2	1	1	1	2	6	25	40	74	59	45	13	7	7	1	3	1	-	-	-	-	-	-	-	-
6.00	1	-	1	-	-	-	1	-	-	1	4	3	9	10	36	62	45	42	17	12	5	5	2	1	-	-	-	-	-	-	-	-
6.75	-	-	1	1	1	-	-	1	3	-	3	3	7	17	24	42	35	28	15	12	6	4	2	1	2	-	-	-	-	-	-	-
7.50	-	-	-	-	1	2	3	-	1	-	1	6	9	15	17	34	30	21	12	10	6	3	1	-	1	2	-	-	1	-	-	-
8.25	-	-	2	-	-	-	1	-	-	2	2	2	10	11	13	25	30	12	5	5	3	1	2	3	-	1	-	-	-	-	-	-
9.00	1	-	-	-	2	-	-	-	1	-	1	3	6	8	13	17	21	12	4	3	4	2	1	-	-	1	-	-	-	-	-	1
9.75	-	-	1	-	-	-	-	2	1	-	-	2	4	4	5	17	14	11	4	2	-	4	2	-	-	-	-	-	-	1	-	1

TABLE 34. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 36R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	39	49	5	-	-	1	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	1	-	2	5	38	43	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	1	3	10	29	41	10	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	1	1	2	3	11	33	31	11	2	1	1	-	1	-	-	1	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	1	1	2	6	10	29	29	8	6	4	2	1	1	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	1	-	-	-	1	2	9	14	26	20	16	4	2	2	-	1	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	2	1	4	4	14	24	18	16	7	5	2	2	1	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	1	-	1	1	3	8	12	20	17	13	7	6	3	2	1	-	1	-	-	-	-	-	-	-
7.50	-	-	-	-	1	1	2	-	1	-	1	3	5	9	10	19	17	12	7	6	3	2	1	-	1	1	-	-	1	-	-	-
8.25	-	-	2	-	-	-	1	-	-	2	2	2	8	8	10	19	23	9	4	4	2	1	2	2	-	1	-	-	-	-	-	-
9.00	1	-	-	-	2	-	-	-	1	-	1	3	6	8	13	17	21	12	4	3	4	2	1	-	-	1	-	-	-	-	-	1
9.75	-	-	1	-	-	-	-	3	1	-	-	3	5	5	7	23	19	15	5	3	-	5	3	-	-	-	-	-	-	1	-	1

TABLE 35. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 36L

ILS

Away From Other Runway ←——→ Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	1	-	-	1	1	2	13	159	128	10	5	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	1	-	-	-	-	-	-	-	1	4	27	132	134	15	2	1	1	1	-	-	1	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	3	3	8	13	38	94	115	22	10	4	3	2	1	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	2	3	4	4	11	22	38	112	60	36	6	3	1	4	-	-	-	1	-	-	-	-	-	-
4.50	-	1	1	-	-	-	2	1	1	7	6	3	14	33	39	67	76	29	5	3	1	1	2	-	-	1	-	-	-	-	-	-
5.25	3	-	-	1	1	-	1	1	3	3	5	11	13	16	35	64	55	24	12	6	2	2	1	2	-	1	-	-	-	-	-	-
6.00	2	2	-	1	1	-	1	1	1	5	9	8	13	24	30	51	38	20	8	5	3	3	2	-	1	-	-	-	-	-	1	-
6.75	-	-	2	-	1	-	2	3	1	1	4	11	8	25	32	36	31	16	4	4	5	-	-	-	1	-	-	-	-	-	1	-
7.50	-	1	-	-	-	-	4	2	2	1	5	8	11	17	15	37	23	11	8	5	3	1	-	-	-	-	-	-	-	-	-	-
8.25	-	1	-	-	1	2	2	1	4	2	4	3	7	15	17	18	20	14	4	4	3	2	-	-	-	-	-	-	-	-	-	-
9.00	1	-	-	1	1	1	1	3	-	1	-	1	4	6	14	20	15	12	5	2	-	-	-	-	-	-	1	-	-	-	-	-
9.75	-	-	-	-	-	-	1	2	-	2	2	1	4	11	9	8	6	9	1	2	1	-	-	-	-	-	-	-	-	1	-	-

TABLE 36. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 36L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	50	40	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	1	8	41	42	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	1	3	4	12	30	36	7	3	1	1	1	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	1	1	1	1	4	7	12	36	20	12	2	1	-	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	1	-	-	2	2	1	5	11	13	23	26	10	2	1	-	-	1	-	-	-	-	-	-	-	-	-
5.25	1	-	-	-	-	-	-	-	1	1	2	4	5	6	13	24	21	9	5	2	1	1	-	1	-	-	-	-	-	-	-	-
6.00	1	1	-	-	-	-	-	-	-	2	4	3	6	10	13	22	17	9	3	2	1	1	1	-	-	-	-	-	-	-	-	-
6.75	-	-	1	-	1	-	1	2	1	1	2	6	4	13	17	19	16	9	2	2	3	-	-	-	1	-	-	-	-	-	1	-
7.50	-	1	-	-	-	-	3	1	1	1	3	5	7	11	10	24	15	7	5	3	2	1	-	-	-	-	-	-	-	-	-	-
8.25	-	1	-	-	1	2	2	1	3	2	3	2	6	12	14	15	16	11	3	3	2	2	-	-	-	-	-	-	-	-	-	-
9.00	1	-	-	1	1	1	1	3	-	1	-	1	4	7	16	22	17	13	6	2	-	-	-	-	-	-	1	-	-	-	-	-
9.75	-	-	-	-	-	-	2	3	-	3	3	2	7	18	15	13	10	15	2	3	2	-	-	-	-	-	-	-	-	2	-	-

TABLE 37. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 18R

ILS

Away From Other Runway ← | → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	4	42	72	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	55	42	10	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	3	10	44	46	12	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	-	-	5	7	23	52	17	6	1	1	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	1	3	4	8	17	43	22	5	3	2	1	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	1	-	1	1	1	-	3	5	17	34	24	12	2	2	-	-	1	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	1	1	3	8	22	23	17	6	3	4	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	-	-	-	1	1	5	4	16	25	16	3	6	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	-	-	1	1	2	1	5	10	19	16	9	5	-	1	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	-	-	-	-	-	2	2	6	7	14	13	7	7	-	1	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	5	6	11	4	5	3	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	-	1	1	3	1	3	3	9	4	10	-	-	1	-	-	-	-	-	-	-	-	-

TABLE 38. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 18R

ILS

Away From Other Runway ←——→ Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	34	59	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	45	34	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	3	8	37	39	10	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	-	-	4	6	20	46	15	5	1	1	1	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	1	3	4	7	16	39	20	5	3	2	1	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	1	-	1	1	1	-	3	5	16	33	23	12	2	2	-	-	1	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	1	1	3	9	25	26	19	7	3	5	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	-	-	-	1	1	6	5	21	32	21	4	8	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	-	-	1	1	3	1	7	14	27	23	13	7	-	1	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	-	-	-	-	-	3	3	10	12	24	22	12	12	-	2	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	-	-	-	3	3	8	13	15	28	10	13	8	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	-	3	3	8	3	8	8	25	11	28	-	-	3	-	-	-	-	-	-	-	-	-

TABLE 39. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 18L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	71	29	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	6	11	54	34	8	1	-	-	-	1	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	2	1	5	17	42	29	13	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	3	5	6	23	29	23	13	1	3	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	1	1	1	4	2	9	21	40	18	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	2	2	1	7	11	23	22	15	5	3	-	1	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	1	-	2	1	3	6	14	14	21	9	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	1	-	-	1	2	3	3	7	6	12	18	9	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	2	1	1	4	6	6	13	10	8	5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	1	-	-	2	4	4	4	11	8	8	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	1	-	1	2	3	12	7	4	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	2	1	1	1	7	7	4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-

TABLE 40. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 2, RUNWAY - 18L

I
L
S

Away From Other Runway ←——————→ Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	64	26	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	5	9	47	29	7	1	-	-	-	1	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	2	1	4	15	38	26	12	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	3	5	6	21	27	21	12	1	3	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	1	1	1	4	2	9	21	39	18	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	2	2	1	8	12	25	24	16	5	3	-	1	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	1	-	3	1	4	8	18	18	27	12	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	1	-	-	1	3	4	4	10	9	18	26	13	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	3	2	2	7	10	10	22	17	14	8	3	2	-	-	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	2	-	-	4	8	8	8	23	17	17	4	2	6	-	-	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	3	-	3	6	9	34	20	11	6	3	3	3	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	7	4	4	4	25	25	14	11	-	-	7	-	-	-	-	-	-	-	-	-	-	-

TABLE 41. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 36R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	41	51	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	36	56	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	5	8	25	46	13	3	1	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	1	-	1	14	31	34	15	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	1	1	1	6	8	34	35	7	5	1	1	-	1	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	-	-	1	-	7	13	28	28	14	6	2	2	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	2	2	2	13	25	21	21	6	6	1	2	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	1	-	2	1	-	5	13	24	20	20	5	6	2	2	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	1	1	-	-	1	-	-	3	4	5	9	22	24	12	7	7	1	3	-	-	-	-	-	-	1	-	-	-
8.25	-	-	2	-	-	-	-	-	-	2	1	-	7	7	12	20	23	9	5	4	3	1	2	3	-	-	-	-	-	-	-	-
9.00	1	-	-	-	2	-	-	-	1	-	1	3	6	8	13	17	21	12	4	3	4	2	1	-	-	1	-	-	-	-	-	1
9.75	-	-	1	-	-	-	-	2	1	-	-	2	4	4	5	17	14	11	4	2	-	4	2	-	-	-	-	-	-	1	-	1

TABLE 42. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 36R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	41	51	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	36	55	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	5	8	25	46	13	3	1	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	1	-	1	-	1	14	31	34	15	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	1	1	1	6	8	34	35	7	5	1	1	-	1	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	-	-	1	-	7	13	28	28	14	6	2	2	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	2	2	2	13	25	21	21	6	6	1	2	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	1	-	2	1	-	5	13	24	20	20	5	6	2	2	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	1	1	-	-	1	-	-	3	4	5	9	22	24	12	7	7	1	3	-	-	-	-	-	-	1	-	-	-
8.25	-	-	2	-	-	-	-	-	-	2	1	-	7	7	12	20	23	9	5	4	3	1	2	3	-	-	-	-	-	-	-	-
9.00	1	-	-	-	2	-	-	-	1	-	1	3	6	8	13	17	21	12	4	3	4	2	1	-	-	1	-	-	-	-	-	1
9.75	-	-	1	-	-	-	-	3	1	-	-	3	5	5	7	23	19	15	5	3	-	5	3	-	-	-	-	-	-	1	-	1

TABLE 43. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 36L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	47	35	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	1	8	42	31	5	-	-	1	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	1	-	2	15	25	31	7	5	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	1	-	-	-	1	5	13	35	20	12	-	2	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	-	2	12	11	23	25	13	1	-	1	1	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	1	-	-	1	4	7	13	22	24	8	6	2	-	1	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	1	4	3	3	10	10	27	14	9	3	3	1	-	1	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	1	1	1	-	-	5	4	8	14	25	18	9	-	2	1	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	2	2	2	1	2	3	7	9	7	26	13	7	4	2	1	1	-	-	-	-	-	-	-	-	-	-
8.25	-	1	-	-	1	1	2	1	2	2	3	3	5	10	12	12	14	10	3	4	1	2	-	-	-	-	-	-	-	-	-	-
9.00	1	-	-	1	1	1	1	3	-	1	-	1	4	6	14	20	15	12	5	2	-	-	-	-	-	-	1	-	-	-	-	-
9.75	-	-	-	-	-	-	1	2	-	2	2	1	4	11	9	8	6	9	1	2	1	-	-	-	-	-	-	-	-	1	-	-

TABLE 44. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 36L

ILS

Away From Other Runway ←——————→ Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	6	53	39	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	1	1	9	47	35	6	-	-	1	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	1	1	-	2	17	28	35	8	6	1	1	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	1	-	-	-	1	6	15	39	22	13	-	2	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	-	2	13	12	26	28	15	1	-	1	1	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	1	-	-	1	4	8	15	25	27	9	7	2	-	1	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	1	4	3	3	11	11	30	16	10	3	3	1	-	1	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	1	1	1	-	-	6	4	9	16	28	20	10	-	2	1	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	2	2	2	1	2	3	8	10	8	29	15	8	4	2	1	1	-	-	-	-	-	-	-	-	-	-
8.25	-	1	-	-	1	1	2	1	2	2	3	3	6	11	13	13	16	11	3	4	1	2	-	-	-	-	-	-	-	-	-	-
9.00	1	-	-	1	1	1	1	3	-	1	-	1	4	7	16	22	17	13	6	2	-	-	-	-	-	-	1	-	-	-	-	-
9.75	-	-	-	-	-	-	2	3	-	3	3	2	7	18	15	13	10	15	2	3	2	-	-	-	-	-	-	-	-	2	-	-

TABLE 45. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 18R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	13	23	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	23	8	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	16	18	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	8	20	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	8	15	8	1	1	1	-	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	5	16	11	4	-	-	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	12	13	6	2	1	1	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2	8	13	10	1	2	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	-	-	-	-	1	-	4	8	8	9	6	3	-	-	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	6	9	10	5	4	-	1	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	5	6	11	4	5	3	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	-	1	1	3	1	3	3	9	4	10	-	-	1	-	-	-	-	-	-	-	-	-

TABLE 46. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 18R

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	33	59	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	59	21	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	3	5	41	46	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	21	51	18	5	-	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	-	-	-	-	3	3	8	21	38	21	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3	13	41	28	10	-	-	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5	31	33	15	5	3	3	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	-	-	-	-	-	8	5	21	33	26	3	5	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	-	-	-	-	3	-	10	21	21	23	15	8	-	-	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	-	-	-	-	-	3	-	8	15	23	26	13	10	-	3	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	-	-	-	3	3	8	13	15	28	10	13	8	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	-	3	3	8	3	8	8	25	11	28	-	-	3	-	-	-	-	-	-	-	-	-

TABLE 47. AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 18L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	14	13	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	7	19	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	18	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	9	16	4	-	1	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	1	-	-	-	-	2	3	20	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	-	-	-	2	1	9	10	8	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	-	1	3	6	16	5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	-	-	-	1	3	2	6	12	8	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	-	-	-	-	2	4	9	10	6	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	-	-	-	-	1	4	3	9	7	7	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	1	-	1	2	3	12	7	4	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	2	1	1	1	7	7	4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-

TABLE 48. PERCENTAGES OF AIRCRAFT COUNT AT 100 FT. INTERVALS
VIEW 3, RUNWAY - 18L

ILS

Away From Other Runway ← → Toward Other Runway

NM	>15	+15	+14	+13	+12	+11	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	<15
1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	42	39	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	21	58	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	53	15	6	-	-	-	-	-	-	-	-	-	-	-	-	-
3.75	-	-	-	-	-	-	-	-	-	-	-	-	3	-	9	26	47	12	-	3	-	-	-	-	-	-	-	-	-	-	-	-
4.50	-	-	-	-	-	-	-	-	3	-	-	-	-	6	9	57	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.25	-	-	-	-	-	-	-	-	-	-	-	-	6	3	26	29	23	6	9	-	-	-	-	-	-	-	-	-	-	-	-	-
6.00	-	-	-	-	-	-	-	-	-	-	-	-	3	9	17	46	14	6	6	-	-	-	-	-	-	-	-	-	-	-	-	-
6.75	-	-	-	-	-	-	-	-	-	-	-	3	9	6	17	34	23	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.50	-	-	-	-	-	-	-	-	-	-	-	-	6	11	26	29	17	6	6	-	-	-	-	-	-	-	-	-	-	-	-	-
8.25	-	-	-	-	-	-	-	-	-	-	-	3	11	9	26	20	20	-	3	9	-	-	-	-	-	-	-	-	-	-	-	-
9.00	-	-	-	-	-	-	-	-	-	3	-	3	6	9	34	20	11	6	3	3	3	-	-	-	-	-	-	-	-	-	-	-
9.75	-	-	-	-	-	-	-	-	-	-	7	4	4	4	25	25	14	11	-	-	7	-	-	-	-	-	-	-	-	-	-	-

TABLE 49. STATISTICS BY USER GROUP
FULL VIEW, ALL RUNWAYS

Distance From Runway	N*	Mean	Standard Deviation
3.0 nmi			
Air Carrier	615	12.2	118.8
General Aviation	92	4.6	146.4
Air Taxi	184	-5.9	210.9
All	893	7.1	145.6
6.0 nmi			
Air Carrier	598	44.6	670.3
General Aviation	81	62.0	917.7
Air Taxi	181	16.8	566.7
All	862	41.4	676.4
9.0 nmi			
Air Carrier	399	406.3	3413.9
General Aviation	40	495.2	3543.3
Air Taxi	118	799.2	2816.1
All	558	494.6	3301.3

*Does not include 2 military aircraft.

TABLE 50. STATISTICS BY USER GROUP
VIEW 1, ALL RUNWAYS

Distance From Runway	N*	Mean	Standard Deviation
3.0 nmi			
Air Carrier	615	12.1	118.8
General Aviation	91	1.7	144.7
Air Taxi	184	-5.9	210.9
All	892	6.8	145.4
6.0 nmi			
Air Carrier	535	24.5	443.0
General Aviation	72	130.1	361.6
Air Taxi	168	-42.9	425.6
All	777	20.8	434.2
9.0 nmi			
Air Carrier	248	9.8	418.9
General Aviation	23	175.7	393.0
Air Taxi	77	51.1	471.6
All	349	29.1	430.0

*Does not include 2 military aircraft.

TABLE 51. STATISTICS BY USER GROUP
VIEW 2, ALL RUNWAYS

Distance From Runway	N*	Mean	Standard Deviation
3.0 nmi			
Air Carrier	604	11.5	115.7
General Aviation	88	-2.9	133.0
Air Taxi	181	-2.5	210.9
All	875	6.6	142.5
6.0 nmi			
Air Carrier	450	54.8	290.6
General Aviation	59	98.6	259.7
Air Taxi	143	-2.1	336.7
All	653	46.9	300.0
9.0 nmi			
Air Carrier	183	26.8	324.4
General Aviation	17	156.9	316.3
Air Taxi	63	49.0	411.0
All	264	39.5	345.6

*Does not include 2 military aircraft.

TABLE 52. STATISTICS BY USER GROUP
VIEW 3, ALL RUNWAYS

Distance From Runway	N*	Mean	Standard Deviation
3.0 nmi			
Air Carrier	183	-6.1	89.6
General Aviation	17	-46.3	104.8
Air Taxi	62	3.3	175.5
All	263	-7.1	116.8
6.0 nmi			
Air Carrier	183	0.059	166.0
General Aviation	17	73.9	149.9
Air Taxi	63	-3.4	258.7
All	264	5.8	193.5
9.0 nmi			
Air Carrier	183	26.8	324.4
General Aviation	17	156.9	316.3
Air Taxi	63	49.0	411.0
All	264	39.5	346.4

*Does not include 2 military aircraft.

TABLE 53. STATISTICS BY CEILING
FULL VIEW, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Very Low	423	9.9	156.3
Low	242	12.6	142.6
Medium	138	3.0	133.7
High	75	-13.7	92.0
All	893	7.1	145.6
6.0 nmi			
Very Low	405	56.6	610.5
Low	233	57.5	758.0
Medium	135	14.0	635.0
High	75	-42.1	837.5
All	862	41.4	676.4
9.0 nmi			
Very Low	238	280.6	2984.9
Low	141	892.0	3712.8
Medium	110	677.7	2562.9
High	65	267.2	4240.6
All	558	494.6	3301.3

TABLE 54. STATISTICS BY CEILING
VIEW 1, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Very Low	423	9.9	156.3
Low	241	11.6	141.9
Medium	138	3.0	133.7
High	75	-13.7	92.0
All	892	6.8	145.4
6.0 nmi			
Very Low	364	31.6	362.4
Low	201	5.3	612.6
Medium	129	21.0	357.2
High	70	-4.3	245.5
All	777	20.8	434.2
9.0 nmi			
Very Low	159	63.4	437.8
Low	82	-34.3	477.7
Medium	70	3.1	437.6
High	37	74.5	217.5
All	349	29.1	430.0

TABLE 55. STATISTICS BY CEILING
VIEW 2, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Very Low	413	7.6	152.6
Low	235	15.2	137.8
Medium	138	3.0	133.7
High	74	-14.5	92.4
All	875	6.6	142.5
6.0 nmi			
Very Low	313	43.5	276.5
Low	157	86.4	358.8
Medium	111	37.9	300.7
High	64	-1.0	235.7
All	653	46.9	300.0
9.0 nmi			
Very Low	121	35.2	360.0
Low	55	-2.6	369.6
Medium	53	74.7	361.1
High	35	67.4	221.2
All	264	39.5	345.6

TABLE 56. STATISTICS BY CEILING
VIEW 3, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Very Low	120	-9.8	119.6
Low	55	14.9	118.8
Medium	53	-20.4	115.6
High	35	-12.1	105.1
All	263	-7.1	116.8
6.0 nmi			
Very Low	121	18.8	197.8
Low	55	-8.9	174.2
Medium	53	-8.6	205.7
High	35	5.8	193.2
All	264	5.8	193.5
9.0 nmi			
Very Low	121	35.2	360.0
Low	55	-2.6	369.6
Medium	53	74.7	361.1
High	35	67.4	221.2
All	264	39.5	346.4

TABLE 57. STATISTICS BY STABILITY CODES
FULL VIEW, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Code 0	757	8.5	141.0
Code 1	136	-0.7	169.4
All	893	7.1	145.6
6.0 nmi			
Code 0	737	46.8	563.7
Code 1	125	9.5	1135.8
All	862	41.4	676.4
9.0 nmi			
Code 0	520	463.6	2881.0
Code 1	38	919.0	6884.7
All	558	494.6	3301.3

TABLE 58. STATISTICS BY STABILITY CODES
VIEW 1, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Code 0	757	8.5	141.0
Code 1	135	-2.7	168.5
All	892	6.8	145.4
6.0 nmi			
Code 0	684	32.6	344.8
Code 1	93	-65.3	836.1
All	777	20.8	434.2
9.0 nmi			
Code 0	349	29.1	430.0
Code 1	0	--	--
All	349	29.1	430.0

TABLE 59. STATISTICS BY STABILITY CODES
VIEW 2, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Code 0	751	7.8	139.8
Code 1	124	-0.8	158.5
All	875	6.6	142.5
6.0 nmi			
Code 0	614	46.1	295.4
Code 1	39	59.1	368.6
All	653	46.9	300.0
9.0 nmi			
Code 0	264	39.5	345.6
Code 1	0	--	--
All	264	39.5	345.6

TABLE 60. STATISTICS BY STABILITY CODES
VIEW 3, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
Code 0	263	-7.1	116.8
Code 1	0	--	--
All	263	-7.1	116.8
6.0 nmi			
Code 0	264	5.8	193.5
Code 1	0	--	--
All	264	5.8	193.5
9.0 nmi			
Code 0	264	39.5	346.4
Code 1	0	--	--
All	264	39.5	346.4

TABLE 61. STATISTICS BY AIRCRAFT TYPE
FULL VIEW, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
DC9	406	11.3	125.5
B727	174	15.3	108.3
BA14	69	-16.6	190.1
E110	49	1.1	273.9
Other	195	1.2	150.4
All	893	7.1	145.6
6.0 nmi			
DC9	397	78.8	677.5
B727	167	-19.5	668.8
BA14	69	64.8	528.0
E110	48	31.4	717.9
Other	181	9.5	720.3
All	862	41.4	676.4
9.0 nmi			
DC9	263	499.5	3043.4
B727	113	468.4	3826.3
BA14	50	875.5	2547.9
E110	30	487.1	2860.9
Other	102	326.7	3774.3
All	558	494.6	3301.3

TABLE 62. STATISTICS BY AIRCRAFT TYPE
VIEW 1, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
DC9	406	11.3	125.5
B727	174	15.3	108.3
BA14	69	-16.6	190.1
E110	49	1.1	273.9
Other	194	-0.2	149.6
All	892	6.8	145.4
6.0 nmi			
DC9	366	24.6	500.5
B727	144	38.7	288.7
BA14	61	-0.7	464.0
E110	45	-57.4	533.0
Other	161	26.5	328.0
All	777	20.8	434.2
9.0 nmi			
DC9	173	45.5	420.3
B727	62	-47.0	380.4
BA14	29	42.6	404.9
E110	23	93.7	342.4
Other	62	29.8	534.9
All	349	29.1	430.0

TABLE 63. STATISTICS BY AIRCRAFT TYPE
VIEW 2, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
DC9	402	12.4	123.8
B727	167	10.1	100.1
BA14	68	-14.0	190.3
E110	47	10.4	275.8
Other	191	-2.4	144.6
All	875	6.6	142.5
6.0 nmi			
DC9	302	64.3	317.3
B727	129	39.3	234.2
BA14	51	81.0	360.3
E110	39	-58.4	409.2
Other	132	32.7	245.3
All	653	46.9	300.0
9.0 nmi			
DC9	126	43.3	337.4
B727	49	-19.1	307.1
BA14	24	25.3	293.3
E110	20	142.8	318.1
Other	45	54.5	440.0
All	264	39.5	345.6

TABLE 64. STATISTICS BY AIRCRAFT TYPE
VIEW 3, ALL RUNWAYS

Distance From Runway	N	Mean	Standard Deviation
3.0 nmi			
DC9	126	-1.3	88.4
B727	49	-20.7	97.5
BA14	24	43.3	180.2
E110	20	-54.6	203.9
Other	44	-14.6	106.3
All	263	-7.1	116.8
6.0 nmi			
DC9	126	1.9	171.3
B727	49	1.4	151.6
BA14	24	46.6	255.7
E110	20	-24.5	292.7
Other	45	13.4	207.0
All	264	5.8	193.5
9.0 nmi			
DC9	126	43.3	337.4
B727	49	-19.1	307.1
BA14	24	25.3	293.3
E110	20	142.8	318.1
Other	45	54.5	440.0
All	264	39.5	346.4

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