

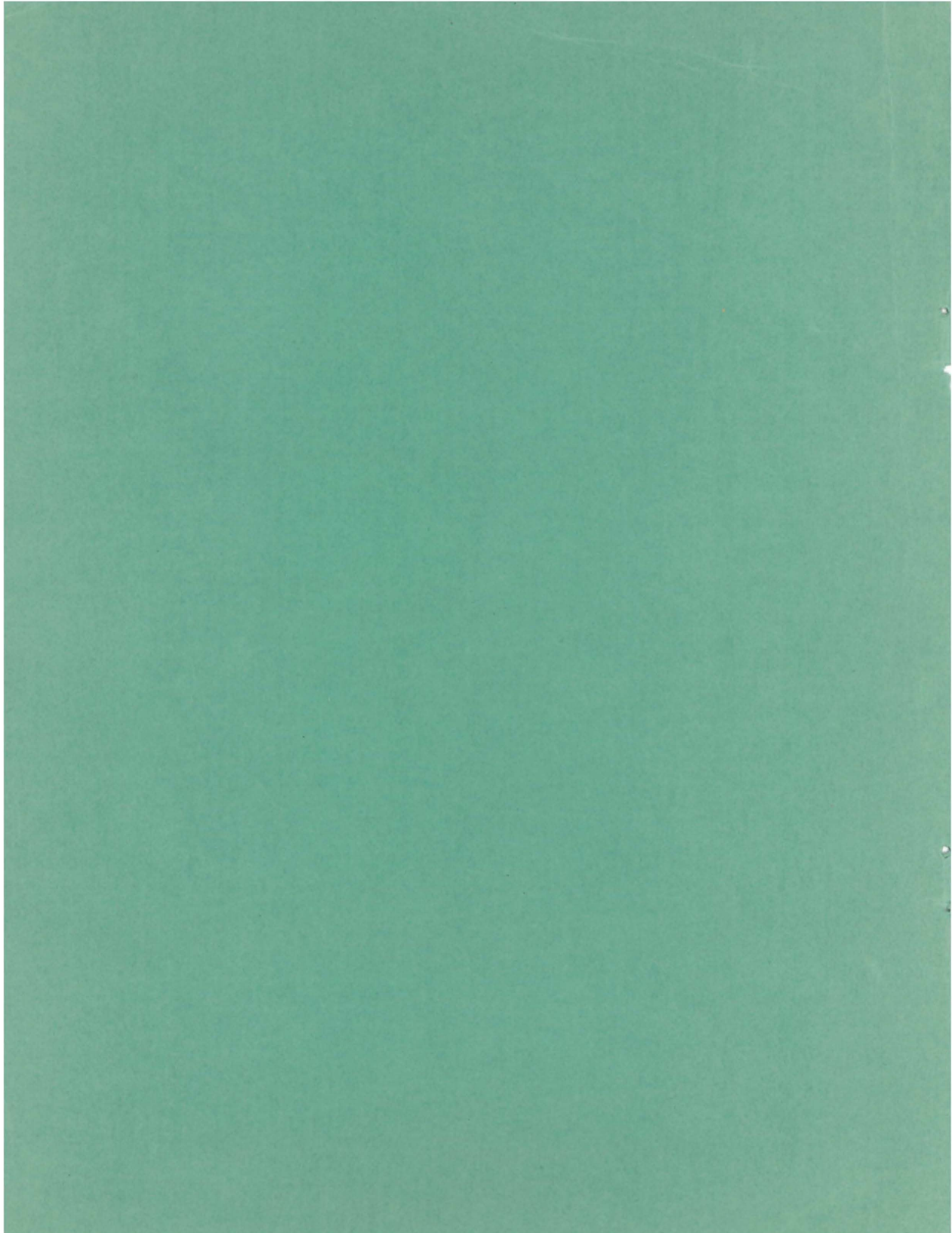
Bob Bays

**PROFILE OF OPERATIONAL ERRORS
IN THE NATIONAL AIRSPACE SYSTEM
CALENDAR YEAR 1987**



**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
OFFICE OF AVIATION SAFETY
SAFETY INFORMATION AND ANALYSIS DIVISION**

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GLOSSARY of TERMS

A/C -AIR CARRIER -a person who undertakes directly by lease, or other arrangement, to engage in air transportation.

ARSA -Airport Radar Service Areas: The Airport Radar Service Areas listed in FAR Part 71 Subpart L consist of controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and equipment requirements specified in FAR Part 91. Each location listed includes at least one primary airport around which the airport radar service area is located. ARSA airspace includes:

- a) Inner Core-Airspace within 5 nm radius of the airport; surface to 4,000 ft. AGL.
- b) Outer Core-Airspace 5-10 nm radius of the airport; from 1,200 to 4,000 ft. AGL.
- c) Outer Area-Airspace from 10 to 20 nm radius of the airport within limits of radio and radar coverage from the surface to the top of the approach control area. Pilots' participation is optional in this area.

ASF -Office of Aviation Safety, FAA

ATA -Airport Traffic Area: Unless otherwise specifically designated in FAR Part 93, that airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

ATC -Air Traffic Control: A service operated by the appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

ATC OPERATIONS: Includes;

- a) Total aircraft handled by Centers
- b) Total FAA towered instrument operations, and
- c) FAA towered airport operations

GLOSSARY Cont'd.

CENTER -ARTCC, Air Route Traffic Control Center: A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

CERAP -Combined Center/RAPCON.

CONTROL AREAS -Consist of the airspace designated in FAR 71 Subparts B, C, E, and J, but do not include the Continental Control Area. Unless otherwise designated, control areas include the airspace between a segment of a main VOR Federal airway and its associated alternate segments with the vertical extent of the area corresponding to vertical extent of the related segment of the main airway.

CONTINENTAL CONTROL AREA -Consists of the airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of longitude 160 degrees 00' 00" W., at and above 14,500 feet MSL, but does not include:

- a) The airspace less than 1,500 feet above the surface of the earth; or
- b) Prohibited and restricted area, other than restricted areas listed in FAR Part 71 Subpart D.

CONTROLLED AIRSPACE -Airspace designated as a Continental Control Area, Control Area, Control Zone, Terminal Control Area, or Transition Area, within which some or all aircraft may be subject to air traffic control.

CWF -Controller Work Force: Beginning October 1, 1987 (Fiscal Year 1988) includes only those individuals who are responsible for separating and controlling traffic; specifically, the work force includes first-line supervisors and traffic management coordinators and excludes air traffic assistants and Academy trainees.

CZ -Control Zones: The Control Zones listed in FAR Part 71 Subpart F consist of Controlled Airspace which extends upward from the surface of the earth and terminates at the base of the Continental Control Area. Control Zones that do not underlie the

GLOSSARY Cont'd.

Continental Control Area have no upper limit. A Control Zone may include one or more airports and is normally a circular area with a radius of 5 miles and any extensions necessary to include instrument approach and departure paths.

ENROUTE AIR TRAFFIC CONTROL SERVICES -Air traffic control service provided aircraft on IFR flight plans, generally by Centers, when these aircraft are operating between departure and destination terminal areas. When equipment, capabilities, and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

FAA -Federal Aviation Administration

FAR -Federal Aviation Regulation

FL -Flight Level: A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255, an indication of 25,500 feet.

FLIGHT PLAN -Specified information, relating to the intended flight of an aircraft, that is filed orally or in writing with air traffic control.

FPL -Full Performance Level controller: Beginning October 1, 1987 (Fiscal Year 1988), defined as a series GS-2152 air traffic controller who has reached the highest non-supervisory controller grade for the facility at which she/he is assigned, and is certified on all required positions in her/his area of specialization; or, a traffic management coordinator who is responsible for administering traffic management programs including enroute metering, ground delays, enroute spacing and severe weather advisory programs.

G/A -GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of public convenience and necessity from the Civil Aeronautics Board and large aircraft commercial operators.

GLOSSARY Cont'd.

GCA/PAR -Ground Control Approach/ Precision Approach Radar

IFR AIRCRAFT/IFR FLIGHT -An aircraft conducting flight in accordance with Instrument Flight Rules.

INSTRUMENT -a device using an internal mechanism to show visually or aurally the attitude, altitude, or operation of an aircraft or aircraft part. It includes electronic devices for automatically controlling an aircraft in flight.

LEVEL -Facility Levels: Level I through Level V, categories of traffic types and amounts used to describe facilities.

MOA -Military Operating Area: An airspace assignment of defined vertical and lateral dimensions established outside positive control areas to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. A type of Special Use Airspace.

MODE C -An altitude-reporting transponder.

NAS -National Airspace System: The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NMAC -Near Midair Collision: An incident associated with the operation of an aircraft in which the possibility of a collision occurs as a result of proximity of less than 500 feet to another aircraft, or a report is received from a pilot or flight crew member stating that a collision hazard existed between two or more aircraft.

OD -Operational Deviation: An occurrence where applicable separation minima, as referenced in paragraph 6.b., was maintained, but when less than the applicable

GLOSSARY Cont'd.

separation minima exists between an aircraft and protected airspace, without prior approval, or when an aircraft penetrates airspace that is delegated to another position of operation or another facility without prior approval, or an aircraft or controlled vehicle/equipment encroaches upon a landing area that is delegated to another position of operation without prior approval.

OE -Operational Error: An occurrence attributable to an element of the air traffic control system which results in less than the applicable separation minima between two or more aircraft, or between an aircraft and terrain or obstacles and obstructions as required by Handbook 7110.65, Air Traffic Control, and supplemental instructions. Obstacles include: vehicles/equipment/personnel on runways.

PCA -Positive Control Areas: The Positive Control Areas listed in FAR Part 71 Subpart H consist of controlled airspace within which there is positive control of aircraft. Flight in PCA is normally conducted under instrument flight rules. PCA is designated throughout most of the conterminous United States and its vertical extent is from 18,000 feet MSL to and including FL 600. In Alaska PCA does not include the airspace less than 1,500 feet above the surface of the earth, nor the airspace over the Alaska Peninsula west of longitude 160 degrees West.

PD -Pilot Deviation: The actions of a pilot that result in the violation of a Federal Aviation Regulation (FAR) or a North American Aerospace Defense Command (NORAD) Air Defense Identification Zone (ADIZ) tolerance.

POSITIVE CONTROL -Control of all air traffic, within designated airspace, by air traffic control.

RAPCON -Radar Approach Control Facility.

RESTRICTED AREA -Airspace designated under FAR Part 73 within which the flight of aircraft, while not wholly prohibited, is subject to restriction.

GLOSSARY Cont'd.

SUA -Special Use Airspace: Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature, or wherein limitations may be imposed upon aircraft operations that are not a part of those activities, or both. Types of Special Use Airspace are: 1) Alert Areas; 2) Controlled Firing Areas; 3) Military Operations Areas (MOAs); 4) Prohibited Areas; 5) Restricted Areas; and, 6) Warning Areas.

TCA -Terminal Control Areas: The Terminal Control Areas listed in FAR Part 71 Subpart K consist of controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and pilot and equipment requirements specified in FAR Part 91. Each such location includes at least one primary airport around which the terminal control area is located.

TOWER -(ATCT, Airport Traffic Control Tower): A terminal facility which through the use of air/ground communications, visual signaling, and other devices, provides ATC services to airborne aircraft operating in the vicinity of an airport and to aircraft operating in the movement area.

TRANSITION AREAS -The Transition Areas listed in FAR Part 71 Subpart G consist of controlled airspace extending upward from 700 feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise specified, transition areas terminate at the base of the overlying controlled airspace.

TRSA -Terminal Radar Service Areas: Airspace surrounding designated airports wherein ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft. TRSAs are depicted on VFR aeronautical charts. Pilot participation is urged but is not mandatory.

VFR -Visual Flight Rules: Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

EXECUTIVE SUMMARY

As an adjunct to the primary measure of Aviation System safety, aviation accidents, the Federal Aviation Administration (FAA) conducts on-going evaluation of several kinds of incidents occurring within the National Airspace System. These include: Near Midair Collisions (NMACs), Pilot Deviations (PDs -violations of Federal Aviation Regulations), Operational Errors (OEs) and Operational Deviations (ODs). Any significant increase observed in these data sparks agency concern and generates increased effort to reduce the frequency of these undesirable events. The purpose of this presentation of 1987 OE data is to provide a foundation for the development of remedial action.

The statistics presented herein are intended to provide insight into the characteristics and nature of Operational Errors.¹ Operational Deviations are situations where an actual violation of the required separation between aircraft does **not** take place but the potential for an operational error is created by an air traffic controller's oversight.² The focus of this report is OEs, when a loss of required separation does take place as the result of inadequate/improper action taken by a controller.

The source of the statistics presented herein was the National Airspace Information

¹ Aircraft receiving certain air traffic control services are separated from each other according to criteria established by the FAA. Separation minima between two or more aircraft are discussed in the Air Traffic Control Handbook (7110.65 and supplemental instructions). Violations of the applicable minimum separation criteria which occur as a result of inadequate action by an element of the Air Traffic Control System are defined as **Operational Errors**.

² **Operational Deviations** occur when the applicable separation minima are maintained, but: (1) less than the applicable separation minima exist between an aircraft and protected airspace, or (2) without prior approval an aircraft penetrates airspace delegated to another position of operation or another air traffic control facility, or (3) an aircraft or controlled vehicle/equipment encroaches upon a landing area designated to another position of operation.

Monitoring System (NAIMS) maintained by the FAA's Office of Aviation Safety (ASF). NAIMS is an automated database system in which information on Operational Errors, Operational Deviations, Near Midair Collisions and Pilot Deviations is collected and processed.

The reporting process began with the detection of an error at an air traffic control facility. A preliminary OE report (FAA form 7210-2) was required to be completed and phoned into FAA Headquarters within two hours of the incident occurrence. Copies were distributed to the employee involved, the FAA Communications Center, the FAA Air Traffic System Resource Analysis Division (ATS-200), the FAA Office of Aviation Safety, Safety Information and Analysis Division (ASV-100), and the Regional Air Traffic Division. An investigation of the event was required to be conducted by the facility whose personnel were cited. If it was established that an operational error occurred, a Final Operational Error Report (FAA form 7210-3) was submitted and distributed within 90 days of the event.

Following the introductory material of Chapter 1, Chapter 2 - Section 2.1 of this report presents historical OE data, and some general characteristics of OEs are presented in Section 2.2; e.g., location by region, airspace type, altitude, phase of flight, time of occurrence and closest approach distance.

The fact that the air traffic control procedures and methods used by Terminal Facilities (Control Towers and Approach Controls) differ from the procedures and methods used by Air Route Traffic Control Centers (ARTCCs) has prompted a separate examination of the error events at each type of facility. Flight Service Stations (FSSs) are excluded from this study since there was only one OE event in 1987 involving a FSS. Therefore, Chapter 3 of this report considers the OE incidents in only three groups: (1) Centers, (2) Approach Controls, and (3) Towers.

Operational error causal factors (as reported) and other measures which may have some relationship to the occurrence of OEs are examined in Chapter 4. A simple regression analysis considering factor relationships is discussed in Appendix C. The OE rates at ARTCCs and Terminal Facilities having more than three OEs during 1987 are examined in Chapter 5.

SUMMARY OF FINDINGS

There were a total of 1,439 reports of operational errors and operational deviations recorded in the OE database in 1987. Of these, 1,213 were operational errors and 226 were operational deviations which are not analyzed in this study. 812 OEs occurred at ARTCCs, 269 at Approach Controls, 131 at Control Towers and one occurred at an FSS. Final reports were filed for 835 incidents. It should be noted that final reports were not required for incidents classified as minor errors at ARTCCs. Also, some events reported in preliminary OE reports may have been, upon further investigation, re-classified as a different type of incident, such as a pilot deviation, or a military facility error; thus, no final report was required.

To summarize, some key statistical findings of this report follow:

General

- o Over the twelve-year 1976-1987 period, the smallest number of reported errors (353) occurred in 1982, and the highest number of reported errors (1,888) occurred in 1984, the year in which the automatic error detection system was introduced at all domestic ARTCCs. The total number of operational errors declined from 1,402 in 1985 to 1,203 in 1986, then showed a slight increase to 1,213 in 1987 (an overall reduction of 36 percent since the high in 1984).
- o The overall error rate (total number of operational errors reported per 100,000 ATC operations) decreased three percent (from 0.89 in 1986 to 0.86 in 1987) while total ATC operations increased by four percent. The Great Lakes Region had the highest error rate in 1987 (1.05 errors per 100,000 operations).
- o In 1987, June was the month with the greatest proportion of operational errors (11 percent). More operational errors occurred on a Wednesday or a Thursday (220 each) than any other day of the week, and more occurred between 3:00 p.m. and 4:00 p.m. than any other hour of the day.

Errors by Facility Type

- o Of the total number of operational errors reported in 1987, 67 percent (812) occurred at ARTCCs. Indianapolis ARTCC had the highest error rate per 100,000 operations in 1987 (4.19), and Honolulu CERAP (combined Center/RAPCON) had the lowest error rate (0.40).
- o Terminal facilities (Approach Controls and Towers) accounted for 33 percent (400) of the operational errors reported in 1987. Among the Approach Control facilities, Midland Texas had the highest error rate per 100,000 operations for 1987 (2.88). Among the Tower facilities, Andrews AFB had the highest error rate (2.06). Sixty five percent (85) of the 131 operational errors reported at Tower facilities in 1987 were surface errors.
- o The average number of errors per controller at ARTCCs has declined from 0.22 in 1985 to 0.16 in 1986, to 0.11 in 1987. The average number of errors per controller at Terminal Facilities declined from 0.07 in 1985 to 0.06 in 1986, to 0.05 in 1987.
- o 77 percent of the errors reported at ARTCCs involved aircraft at altitudes between 12,500 and 37,000 feet. This is an area where radar traffic control procedures are used extensively and altitude deviations are generally detected and reported by computer.
- o Almost 85 percent of the ARTCC errors involved at least one aircraft climbing or descending.
- o Less than five percent of the ARTCC errors involved separations of less than 5,000 feet (slant range).
- o At Approach Controls, more than 62 percent of the operational errors involved aircraft at altitudes between 3,000 and 10,000 feet. At Towers, over 82 percent of the aircraft were below 3,000 feet when the error occurred.

Human Performance Related Errors

- o Almost 98 percent of the 1987 Operational Errors were attributed to human factors.
- o Most of the operational errors reported in 1987 occurred where the number of aircraft being handled by the controller were as follows:

1987 OEs at ARTCCs

No. Aircraft Worked	Percent of Total
1-10	68%
11-20	22%
21+	10%

1987 OEs at Approach Controls

No. Aircraft Worked	Percent of Total
1-5	48%
6-10	47%
11+	5%

1987 OEs at Towers

No. Aircraft Worked	Percent of Total
1-5	51%
6-10	42%
11+	7%

Note: exposure data concerning the frequency of occurrence of these groupings/ranges of "number of aircraft worked" was not available at the time of this report.

- o For Centers, most errors occurred during the first 60 minutes of time into the shift. For Approach Controls, the most errors occurred during the second hour into the shift. For Towers, the error counts peaked at one hour and at four hours into the shift.

- o About 47 percent of the errors occurred after the controller involved had returned to his/her position following a work break (all facilities).
- o Of the 1,313 controllers reporting time-on-position, 29 percent (379) had been working for 30 minutes or less (all facilities).
- o The greatest number of errors occurred on the controller's first or second day after time off (276 and 278, respectively -- all facilities).
- o The majority of errors (55 percent) involved controllers who had been certified on the position of operation for less than four years (all facilities).
- o About 53 percent of the controllers involved in operational errors were Full Performance Level Controllers [FPLs comprised approximately 58% of the total 1987 CWF]. Over half (58%) of these FPLs had five years or less as an FPL Controller.
- o Center (ARTCC) reports identify "misuse of radar data" (191) and "flight progress strip data posting" (84) as the most frequent causal factors.
- o Approach Control reports identify "misuse of radar data" (94) and "misuse of aircraft observation data" (62) as the most frequent causal factors.
- o Control Tower reports identify problems with "aircraft observation" (62) and "misuse of aircraft observation data" (132) as the most frequent causal factors.

OPERATIONAL ERRORS IN THE NATIONAL AIRSPACE SYSTEM CALENDAR YEAR 1987

1.0 INTRODUCTION

1.1 Background and Purpose

This document is the third in a series of Federal Aviation Administration (FAA) Annual Reports describing operational error events¹ occurring in the National Airspace System (NAS) in the preceding calendar year. It provides a descriptive summary of these events in 1987 and compares some of their characteristics with those of previous years' events. The format is similar to that of earlier reports, with an additional brief discussion of the Operational Error System (OES) data and possible causal factors.

The source of the information contained herein is the National Airspace Information Monitoring System (NAIMS) which contains the OES data bases. The FAA's Office of Aviation Safety (ASF) maintains this automated data base management system, (NAIMS, formerly named Aviation Safety Monitoring System -- ASMS) to track and analyze reported safety-related incidents and rules violations occurring in the NAS.

The NAIMS provides a center for the collection and processing of FAA reports on several types of events: Operational Errors (OEs) and Operational Deviations (ODs), Pilot Deviations (PDs), and Near Midair Collisions (NMACs). Each event type and its corresponding data base constitute one subsystem of the NAIMS. All existing NAIMS

¹Aircraft receiving certain air traffic control services are separated from each other according to criteria established by the FAA. Separation minima between two or more aircraft are described in the Air Traffic Control Handbook (7110.65 and supplemental instructions). Violations of the applicable minimum separation criteria which occur as a result of inadequate action by an element of the Air Traffic Control System, are defined as **operational errors**.

data bases were developed from the standard FAA reporting forms; the information collected by NAIMS is updated as the reports' investigations progress to allow for timely trend analyses. The ultimate goal of these analyses is to determine whether modifications of operating practices are appropriate, and if so, where modifications might best be directed to contribute to a safer National Airspace System.

1.2 Operational Error Reporting System

As a component of the original ASMS, the Operational Error System (OES) concept was designed in 1984 by the Transportation Systems Center (TSC) of the Department of Transportation Research and Special Programs Administration. The bulk of the existing system software was designed and installed at the FAA Headquarters Office of Aviation Safety (ASF) in 1985.

The OES tracked both operational errors and operational deviations reported to FAA Headquarters by Air Traffic Control facilities nationwide. Whenever an occurrence was detected at any Air Traffic Control System field facility, a **Preliminary Operational Error Report** (FAA form 7210-2) was required to be completed and called into FAA Washington Headquarters within two hours of the event. Copies were distributed to: the employee(s) involved, the FAA Communications Center, the FAA Air Traffic System Resource Division (ATS-200), the FAA Office of Aviation Safety, Safety Information and Analysis Division (ASV-100) and the Regional Air Traffic Division.

An investigation of the event was required to be conducted by the facility whose personnel was cited. If it was established that an operational error or deviation occurred, a **Final Operational Error Report** (FAA form 7210-3) was submitted and then distributed within 90 days of the event; or, the investigation could have resulted in one of the following actions:

(1) if the event occurred at an Air Route Traffic Control Center (ARTCC) and it was established that 80 percent of the minimum lateral was maintained, the facility manager may have made the determination that a final report was not required, or;

(2) the event was reclassified as a "Pilot Deviation," a "Military Facility Deviation," or "No Occurrence" and a Form 7210-5 was filed.

All reporting was handled in accordance with FAA Order 7210.41B, "Air Traffic Service Operational Error/Deviation Investigation and Reporting Program." Order 7210.41B, and examples of Form 7210-2, Form 7210-3, and Form 7210-5 are shown in Appendix A.

The OES data base design follows that of the reporting forms (with the exception of the narrative). Preliminary and final reports forwarded to ASV-100 were coded and entered into the Operational Error System (OES) data base as they were received. The preliminary report included general background data and primary facts associated with the event, such as time and place of occurrence. The final report verified and/or superseded the preliminary data, providing additional information on employees, aircraft involved, equipment, environment, and causal factors as well as comments/recommendations.

1.3 Scope and Organization of the Annual Report

As stated previously, 1987 Operational Error incidents reported through the FAA incident reporting system and recorded in the NAIMS-OES data bases are the subject of this report. Under the present reporting system, the OES data bases are updated at discrete intervals of time as the report forms reach ASV-100. Because of the complexity involved in some incidents, reports may take a considerable amount of time to close (i.e., the final report form is submitted). According to the records in the OES data bases

as of July 4, 1988, a total of 1,439 operational error or operational deviation events took place in calendar year 1987. The daily update of the data bases may produce a different count at any later date, as investigations become finalized and accordingly some are reclassified. This should be considered by the reader when cross-referencing the data in this report to other data produced at any other time.

There were 1213 reported operational errors in 1987. Of the 1213 errors, 835 final reports were received and entered into the OES. Preliminary reports were filed for 374 events, 341 of which were determined to not require a final report, and 33 reported events remained open. Four errors were recorded (phoned into FAA Headquarters) for which there was neither a final nor a preliminary report filed.

1.3.1 General Operational Error Characteristics

Chapter 2 of this report profiles the operational error incidents and, where appropriate, compares the 1987 observations with those of previous years. General characteristics of the events are presented such as the time and location of error occurrences. The purpose is to identify the general conditions under which operational errors occur to provide some insight into where efforts might best be focused in order to reduce the number of OE occurrences.

The distribution of operational errors by FAA ATC System Divisional Region is an important dimension as the FAA must concern itself with issues of how to allocate its resources in order to maximize safety nationwide. Therefore, Chapter 2 of this report presents a number of computed statistics for individual regions.

1.3.2 Facility Operational Error Characteristics

The composition and complexity of the air traffic operations handled (i.e., mostly or exclusively IFR or VFR traffic, enroute air traffic, or landings and departures) varies

for different types of Air Traffic Control facilities. Air Traffic Control procedures and methods used by Terminal Facilities (Approach Controls and Towers) differ from the procedures and methods used by Air Route Traffic Control Centers (ARTCCs). In Chapter 3, a separate examination of the error events at each type of facility focuses on the characteristics that appear typical of the facility type (e.g., typical of ARTCC errors as opposed to Tower or Approach Control errors). Terminal Facilities are subdivided into Towers and Approach Controls, and ARTCCs are considered as a separate category.

Air Route Traffic Control Centers (ARTCCs) or **Centers** handle large numbers of aircraft simultaneously during the en route phase of flight. Jurisdiction of a Center's control may cover hundreds of thousands of square miles at all altitudes and flight levels.

Approach Controls (including Terminal Radar Approach Controls (TRACONs) and non-radar Approach Controls) provide separation services to all IFR aircraft and VFR aircraft in certain areas, arriving, departing, or transiting the airspace around an airport. The geographic area commonly considered the jurisdiction of an Approach Control is airspace of about 30 miles in radius around an airport, including altitudes up to approximately ten thousand feet. Aircraft separation is accomplished by radar or by procedural methods such as the assignment of varying altitudes.

Towers or Airport Traffic Control Towers (ATCTs), provide Air Traffic Control services to aircraft landing, taking off, taxiing and transiting their airspace.

Since Flight Service Stations (FSSs) were involved in only one operational error in 1987 they are excluded from most of the charts and tables in this report.

Thus, Chapter 3 considers the OE observations in three groups: error events occurring at (1) Centers, (2) Approach Controls, and (3) Towers. 1987 operations data at the facility level of disaggregation were used to measure exposure and develop operational

error rates. However, error rates can be misleading; they can obscure as well as exaggerate areas for concern. For example, a facility with a large number of errors and large volume of traffic can produce an error rate equal to that of a facility with little traffic and few errors. Therefore, both absolute numbers of errors and error rates are shown where appropriate.

1.3.3 Exposure Data

The use of absolute numbers of OEs alone as an indication of ATC system safety is deficient because of a direct relationship to traffic volume; an increase/decrease in the error count may merely reflect a rise/fall in the number of aircraft using the national airspace over a given period of time. A more meaningful measure is obtained when exposure data are applied to error counts, translating them into error rates. For this annual report, air traffic operations and Air Traffic Control facility staffing data were obtained from the FAA to develop facility error rates and controller error rates. **Facility error rates** for the year are computed as the number of operational errors per hundred thousand operations. **Controller error rates** are calculated by dividing the facility's error rate by the number of controllers at the facility (CWF) to obtain the average number of errors per hundred thousand operations per controller. By using error rates, the analysis accounts for differences in air traffic volume handled by controllers at the various facilities.

1.3.4 Air Traffic Operations

Facility error rates were developed from detailed data on air traffic operations activity in calendar year of 1987 (down to the level of individual facility, by month). The data were provided by the FAA Office of Management Systems (AMS), and used to develop facility error rates (overall, by facility type, and by individual facility). Total aircraft handled by Centers was computed by multiplying the number of departures by two, and

adding domestic and oceanic over-flights. Approach Control operations are the sum of FAA towered instrument operations, including aircraft handled to the primary airport and to secondary airports, plus over-flights. Tower operations are the sum of itinerant and local aircraft operations at FAA towered airports.

Facility error rates allow more meaningful comparisons between facilities of the same type. The number of errors at any one facility is qualified by the volume of operations it handles. For example, in 1987 New York Tracon reported twice as many errors (16) as Salt Lake City Tracon (8), but New York's facility error rate of 0.95 errors per 100,000 operations was less than half the rate for the Salt Lake City Tracon (2.21 per 100,000 operations).

Since different operations are being counted for each type of facility, direct comparison of error rates between facility types may not be warranted or meaningful. A Center facility's error rate of 2.5 may or may not indicate different performance as compared to an Approach Control facility's error rate of 2.0. A definitive relationship between Center workload, Approach Control workload and Tower workload has not yet been established.

1.3.5 Controller Work Force (CWF)

Data on staffing of ATC facilities as of December 31, 1987 were obtained from the FAA Office of Air Traffic Evaluations and Analysis (ATS) to calculate **controller error rates** (the facility's error rate divided by the facility's controller work force).

Comparisons between 1987 and previous years' controller error rates are severely limited due to changes in the definition of "Controller Work Force" and "Full Performance Level controller" as of October 1, 1987. The definition of controller work force for fiscal year 1988 includes First Line Supervisors, FPL controllers, and other developmental controllers who are responsible for separating and controlling traffic but does not include air traffic assistants or Academy trainees. "Full Performance Level" includes

only those controllers certified on all required positions of operation at their particular facility.²

Measures related to human performance are presented in Chapter 4. In 1987, almost 98 percent of operational errors were attributed to human factors (96% in 1986). The chapter displays general summary statistics collected by the FAA Operational Error Reporting System, including factors such as traffic complexity, number of aircraft handled at the time of the error, and employee-contributed causal factors. Personnel information including day of the work week, time into the work shift, time on control position, last non-control activity, and experience level are also examined. A simple regression analysis considering the relationships between some of the variables mentioned above and the frequency of operational errors is contained in Appendix C.

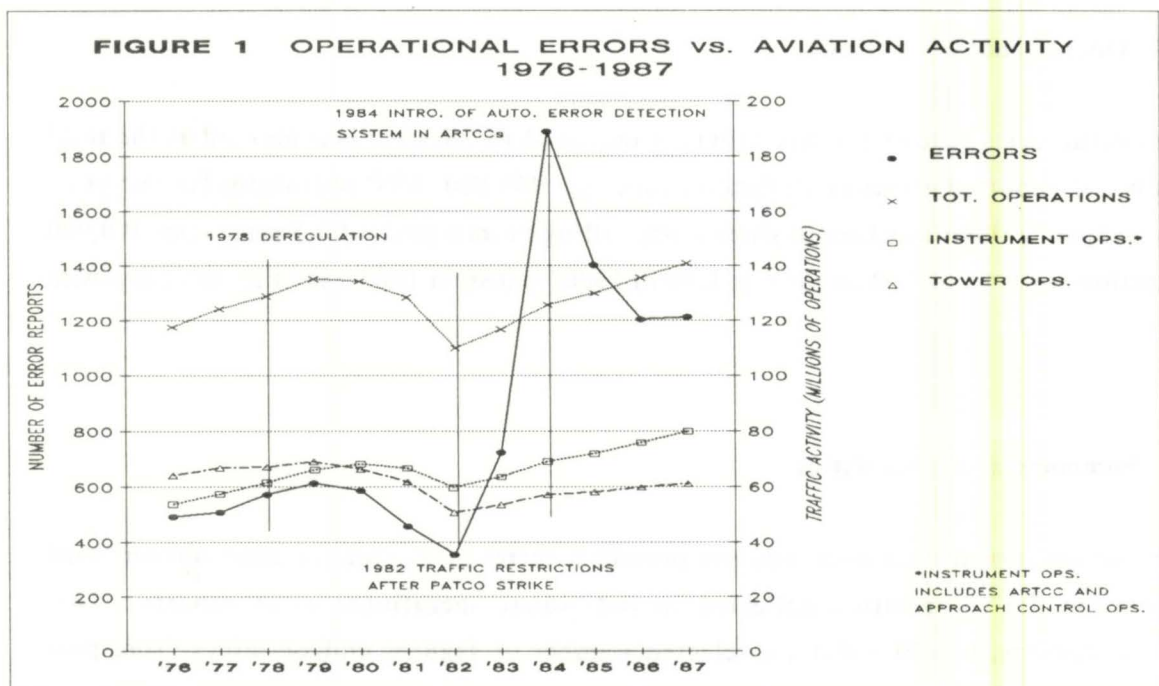
Finally, Chapter 5 briefly examines error rates at individual ARTCCs and Terminal Facilities with three or more operational errors.

²A direct comparison of CY 1986 CWF and CY 1987 CWF numbers, without accounting for the CWF definition changes, indicates a decrease of more than 5% in the total number of Center controllers from 1986 to 1987. Adjustment of the CY 1986 figures to conform to the October, 1987 CWF definition shows an increase in the CY 1987 ARTCC work force of more than 6%.

2.0 OPERATIONAL ERRORS GENERAL CHARACTERISTICS

2.1 Historic Trends

Below, Figure 1 shows the number of operational errors reported, as well as instrument operations, operations at towered airports, and total Air Traffic Control operations. Over the last decade, operational errors peaked in 1984, when an automatic error detection system was introduced at all domestic ARTCCs. FAA regulations stipulate that all IFR traffic under ARTCC control must maintain a minimum vertical separation of 1,000 feet (2,000 ft. at flight levels above 29,000 ft.), or be separated laterally by distance or time minima. Whenever these minima are violated by radar-tracked aircraft, the automatic error detection system triggers an alarm and records the event. Before this system was in place, small separation minima violations went undetected and/or unreported. As depicted below, since the 1984 peak there has been a downward trend in the number of errors.*



*1987 Operational Errors by Mode of Detection are shown in Figure 23, page 33.

Growth of the air transportation industry over the last decade is evident in the volume of total Air Traffic Control (ATC) operations. Operations decreased sharply in 1982, following the air traffic controllers' (PATCO) strike of August 3, 1981. As the ATC System was re-staffed the volume of operations resumed an upward trend, growing at annual rates of 6% and 8% in 1983 and 1984, and leveling off with annual growth rates between 3% and 4% since 1985. Rapid growth of instrument operations reflects the growth in commercial aviation since deregulation, as well as increased IFR operations by air taxis, commuters, corporate users and general aviation. The relatively slower growth in airport tower operations is attributed to numerous factors, including slow growth of general aviation. The rising cost of aircraft, fuel, insurance, the greater use of simulation for pilot training and the migration of general aviation to less busy, non-towered airports may account for this much more gradual increase.

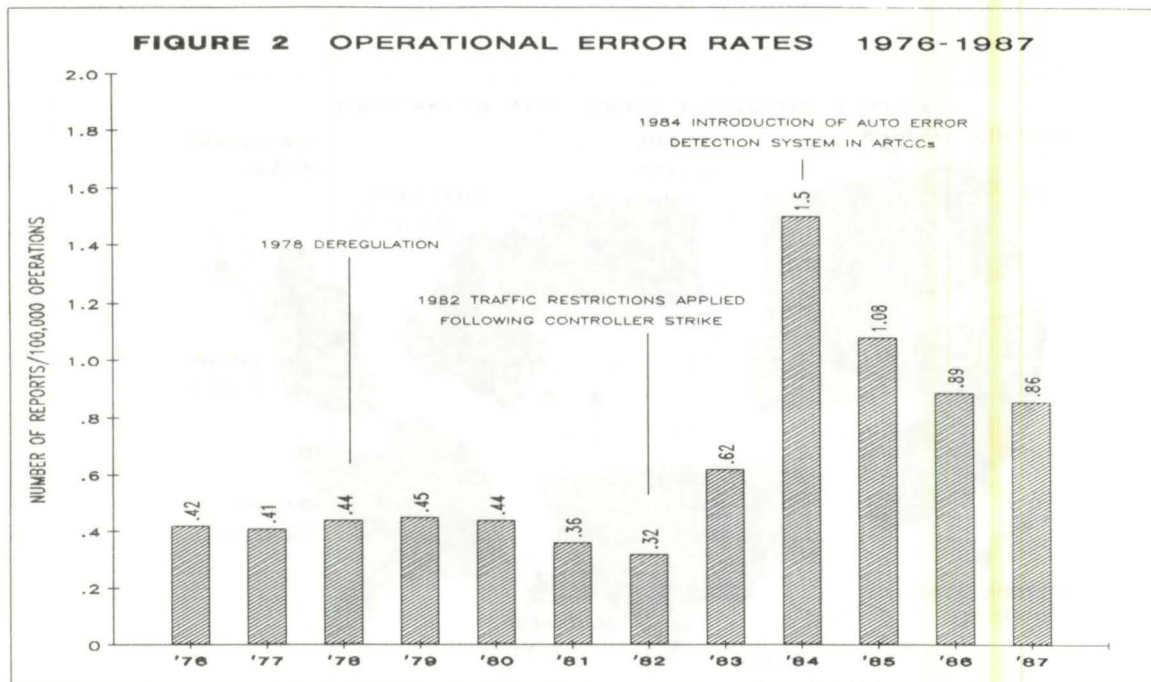
When compared with 1986 reports, the number of operational errors in 1987 increased slightly (0.8%), from 1,203 to 1,213. The increase was accompanied by a larger increase in Air Traffic Control operations (4.0%), from 135,536,754 total operations in 1986 to 140,900,717 total operations in 1987.

2.1.1 Operational Error Rates

The overall error rate of the Air Traffic Control (ATC) System is computed as the total number of reported errors at all facility types per 100,000 ATC operations for the year. It has shown a downward trend since 1985, falling from a peak of 1.5 errors per 100,000 operations in 1984 to 1.08 in 1985, to 0.89 in 1986, to 0.86 in 1987 (See Figure 2, opposite page).

2.2 Summary Event Statistics

ASF annual operational error reports present a series of frequency distributions that summarize the information collected in individual operational error reports. This section updates, for 1987 data, a selected number of figures and/or tables from past reports.

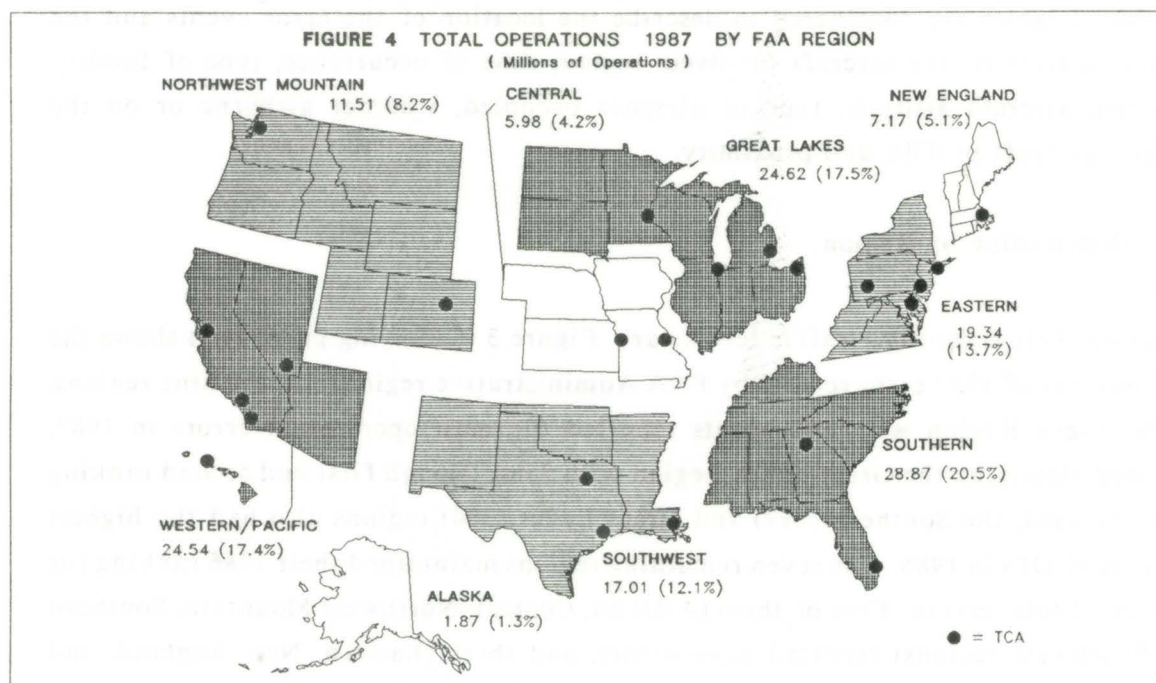
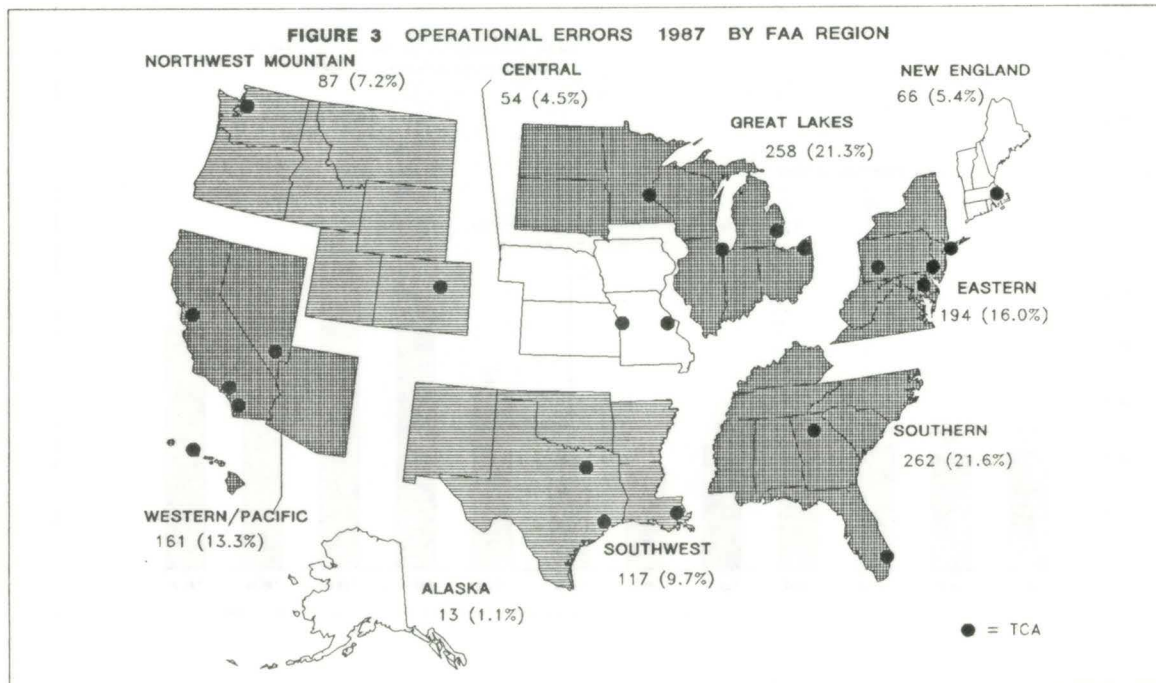


2.2.1 Location of Occurrence of Operational Errors

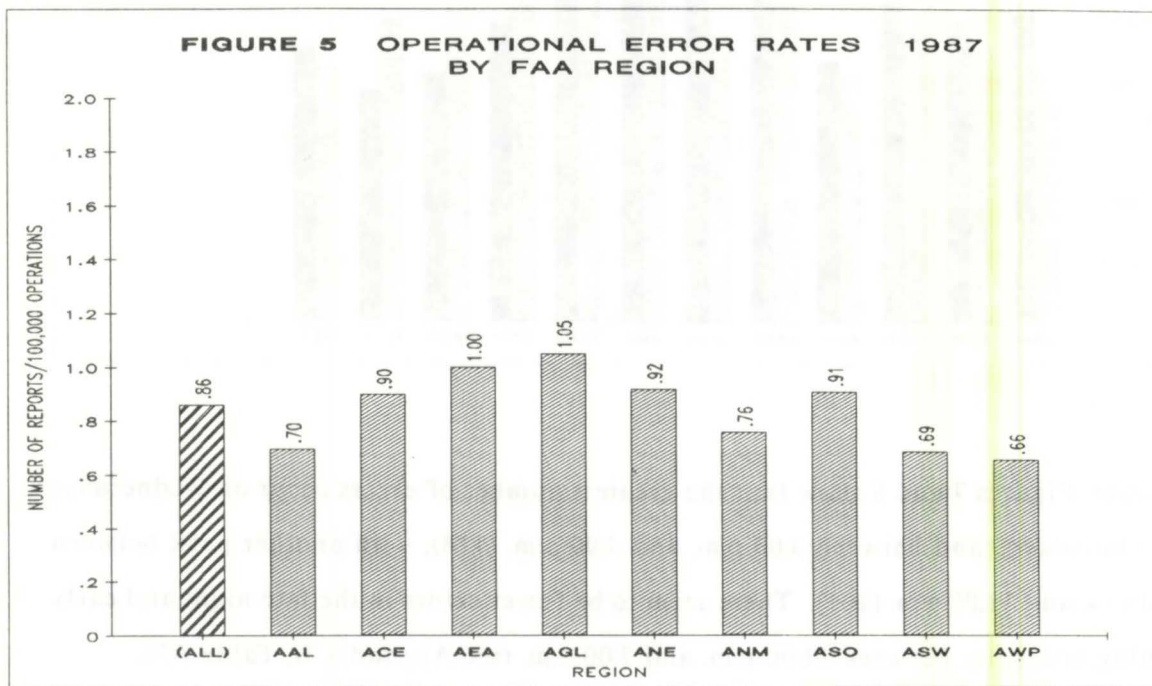
Several variables are considered to describe the location of the error events and the spatial location of the aircraft involved: region, time of occurrence, type of facility involved, aircraft altitude, type of airspace occupied, whether airborne or on the surface, aircraft profile, and proximity.

2.2.2 Distribution by Region

Although their respective traffic levels vary, Figure 3 (following page) first shows the total number of 1987 error reports by FAA Administrative region. Of the nine regions, the Southern Region with 262 events reported the most operational errors in 1987, followed closely by the Great Lakes Region with 258. Though first and second ranking were reversed, the Southern (217) and Great Lakes (304) regions also had the highest numbers of OEs in 1986. The seven remaining regions maintained their 1986 ranking for number of total errors. Five of them (Alaskan, Central, Northwest Mountain, Southern and Southwest regions) reported more errors, and three (Eastern, New England, and Western Pacific regions) reported fewer errors in 1987 than in 1986.

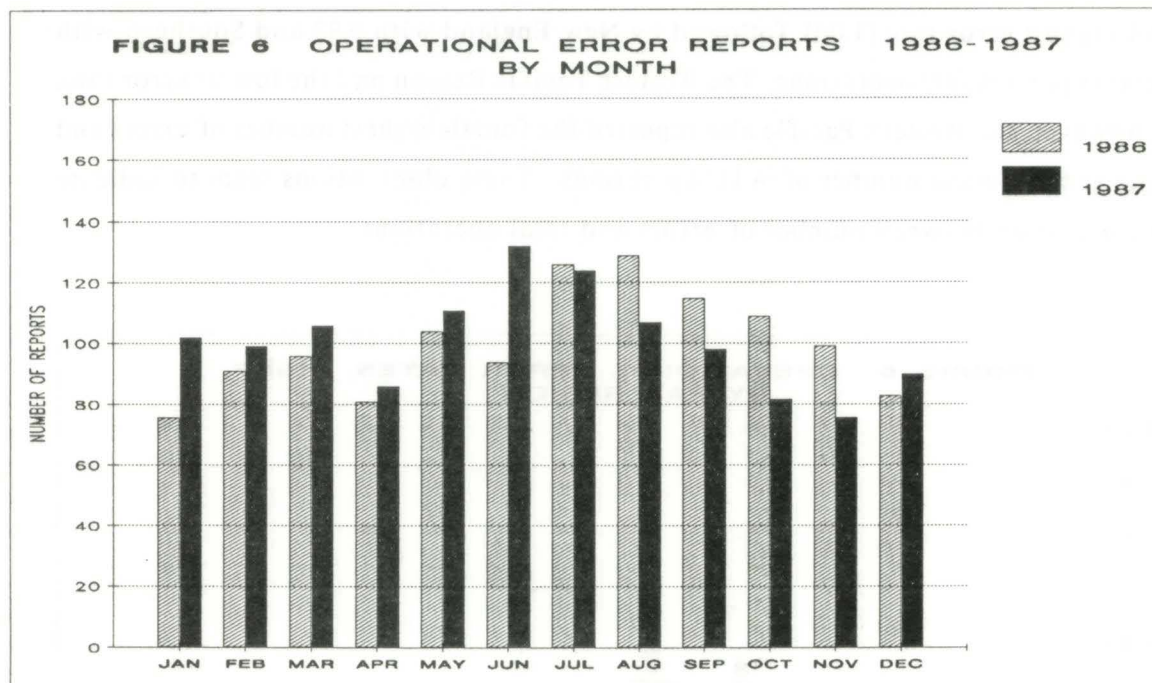


Taking into account exposure data (Figure 4), Great Lakes continued to have the highest error rate; 1.05 errors per 100,000 operations (Figure 5). The Eastern Region had the second highest error rate (1.00), followed by New England with 0.92 and Southern with 0.91 errors per 100,000 operations. The Western Pacific Region had the lowest error rate, 0.66; however, the Western Pacific also reported the fourth highest number of errors and had the third highest number of ATC operations. These observations seem to indicate some correlation between number of errors and total operations.



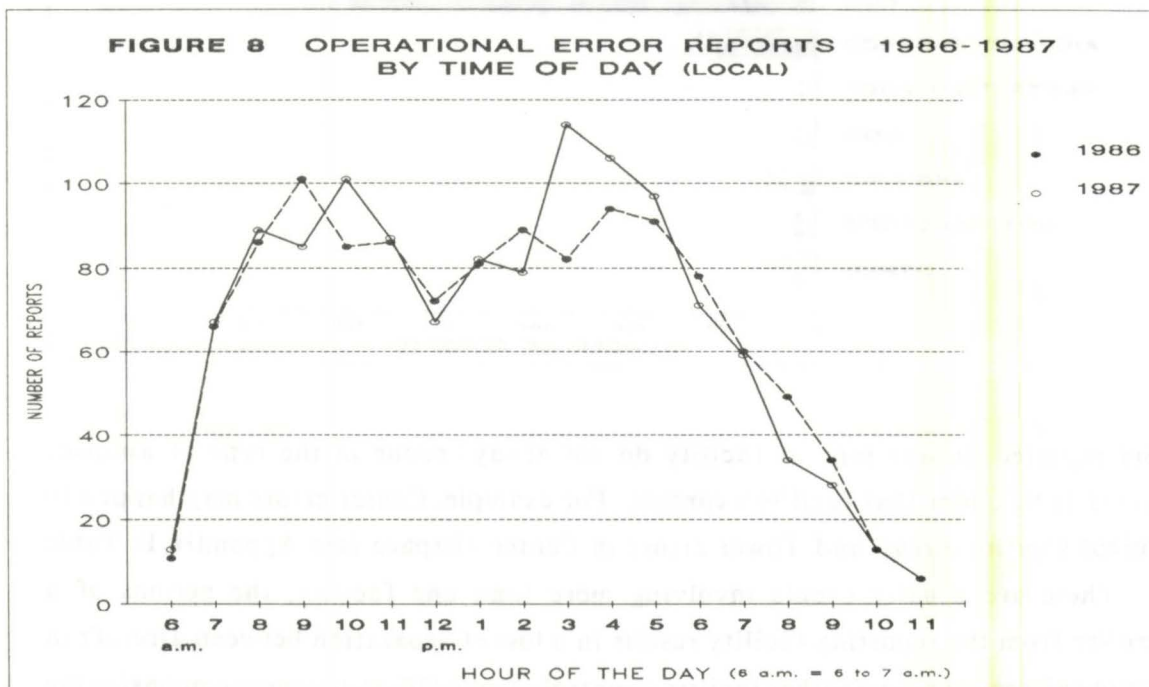
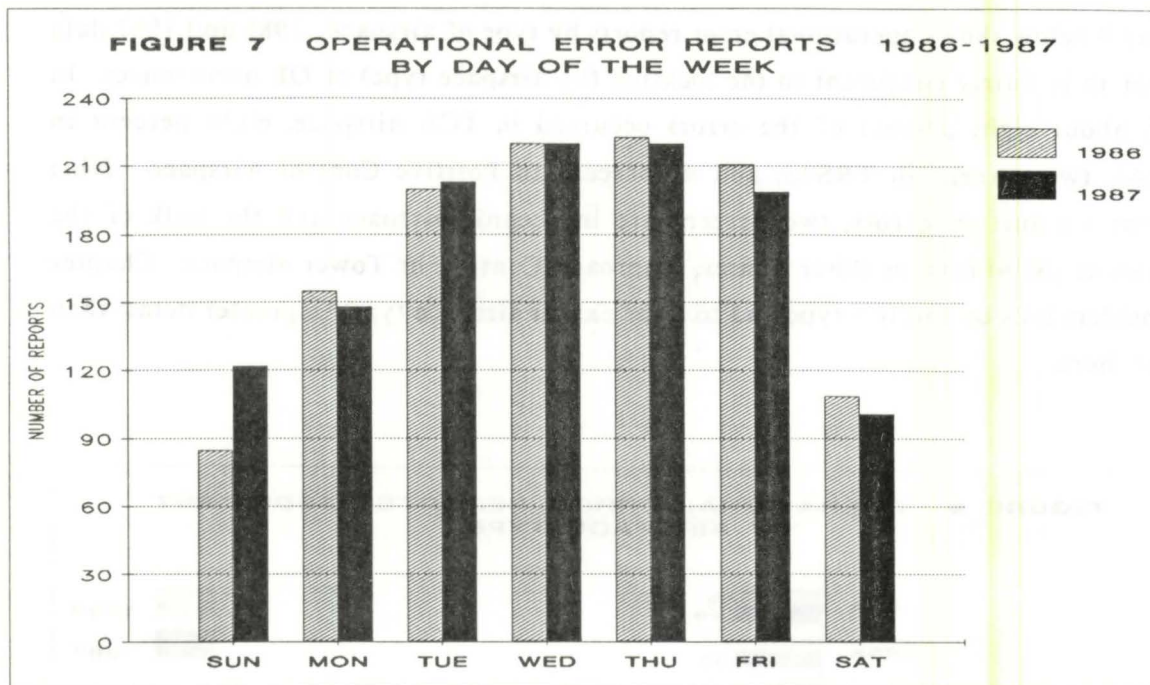
2.2.3 Operational Errors by Time of Occurrence

In 1987, June was the month when the most operational errors were reported (132), as opposed to August in 1986 (129 errors --see Figure 6, following page). Errors by region appear to loosely follow a seasonal pattern, with the highest number of errors counted in Summer months (Appendix B, Table A5). However, in 1987 the Southwestern Region reported equal peaks in June and November, and Eastern and Western Pacific errors were highest in February.



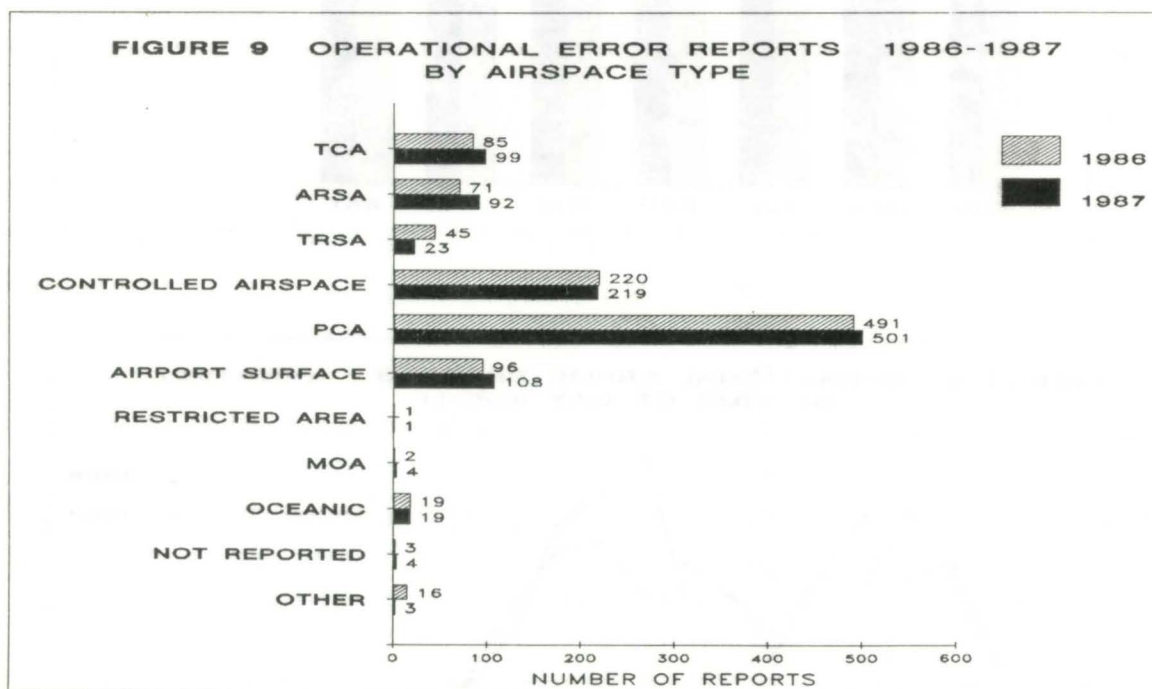
Opposite, Figures 7 and 8 show that the greatest number of errors occur on Wednesdays and Thursdays; and between 3:00 p.m. and 4:00 p.m. (114), with another peak between 10:00 a.m. and 11:00 a.m. (101). There seem to be fewer errors in the late night and early morning hours, i.e. between 11:00 p.m. and 7:00 a.m. (see Appendix B, Table A7).

The time-of-occurrence data (Figures 6, 7 and 8) appear to follow the patterns of monthly, weekly and daily traffic activity distributions. However, it should be noted that there is some variability when two-way frequency distributions are examined (see Appendix B, Tables A6 and A7). For example, those errors which occurred on Wednesdays and Thursdays did not necessarily also occur at a peak hour seen in Figure 8. Thus, while it appears that operational error patterns reflect seasonal, higher mid-week, and higher morning and afternoon traffic levels these patterns should only be considered general indicators.



2.2.4 Airspace Type

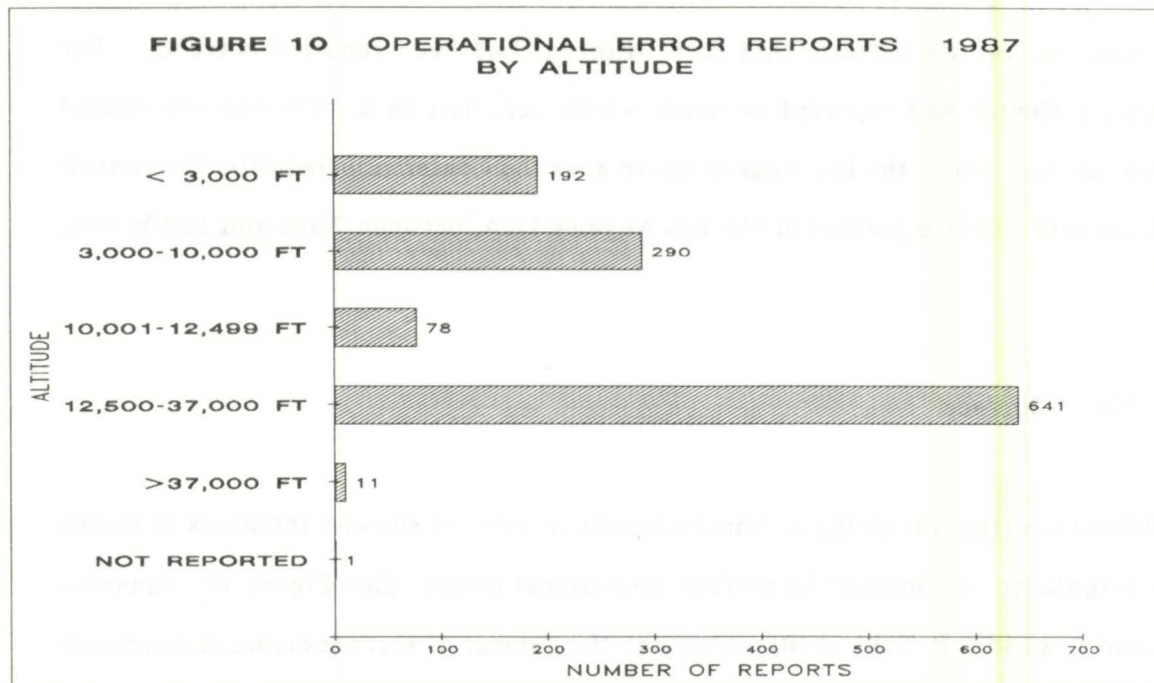
Figure 9 below shows operational error reports by type of airspace. 1986 and 1987 data appear to be fairly consistent in the location (by airspace type) of OE occurrences. In 1987, about eight percent of the errors occurred in TCA airspace, eight percent in ARSAs, two percent in TRSAs, and 41 percent in Positive Control Airspace. Nine percent are surface errors, two percent are in oceanic airspace and the bulk of the remainder (30%) involve other Center, Approach Control, or Tower airspace. Chapter 3 considers OEs by facility type and to some extent airspace type, in greater detail than shown here.



Errors reported by one type of facility do not always occur in the type of airspace expected to be under that facility's control. For example, Center errors may happen in Terminal Control Areas, and Tower errors in Center airspace (see Appendix B, Table A8). These are usually events involving more than one facility; the actions of a controller from the reporting facility results in a loss of separation between aircraft in adjoining airspace under another facility's control. These OE occurrences emphasize the need for proper coordination between facilities.

2.2.5 Aircraft Altitude

The distribution of errors by aircraft altitude varies distinctly between the three facility types. Center errors more often involve aircraft at higher altitudes during the enroute phase of flight, while Approach Control and Tower errors involve aircraft at lower altitudes (See Figure 10 and Appendix B, Table A9).



A total of 641 (almost 53%) of all 1987 errors involved aircraft at altitudes between 12,500 and 37,000 feet. While aircraft operating under VFR with Mode C transponder capability may use airspace up to 18,000 feet msl, the airspace (12,500 - 37,000 ft.) is used primarily by en route air traffic under the control of Centers [airspace under Center control may extend from the surface to 60,000 feet]. Accordingly, most of these were Center errors (624); accounting for 77 percent of all 1987 errors at Centers.

Almost 24 percent (290) of all 1987 errors involved aircraft at altitudes between three thousand and ten thousand feet. Most of these (167) were errors reported by Approach Controls (167); accounting for 62 percent of the total 1987 errors at Approach Controls.

Errors involving aircraft at altitudes below 3,000 feet or on the surface of the airport totaled 192 in 1987. These errors occurred more often at Towers (109), and accounted for almost 81 percent of the total 1987 Tower errors.

While Center errors involving aircraft at the lower altitudes, and Tower and Approach Control errors involving aircraft at the higher altitudes are atypical, examination of the source documents indicate that such instances had been reported correctly. For example, a Center had reported an error which occurred in a TCA because special procedures in effect in the Los Angeles Basin gave the Center responsibility for control of all aircraft within a portion of the Los Angeles TCA, between 7,500 and 12,500 feet.

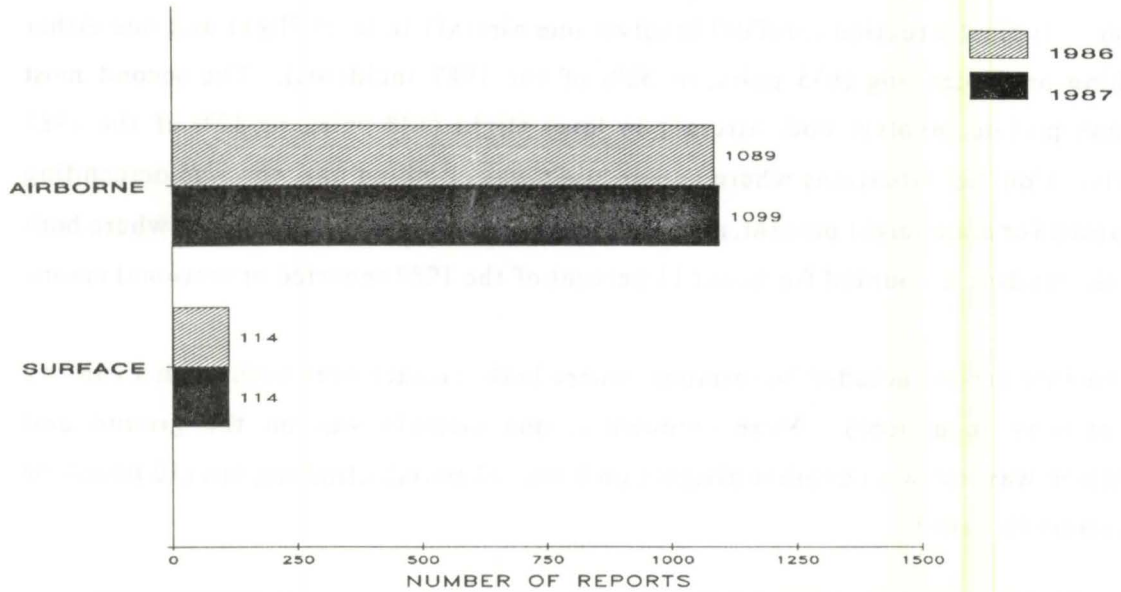
2.2.6 Air vs. Surface

In addition to errors involving airborne aircraft, a series of runway incidents in recent years heightened the interest in surface operational errors (See Figure 11 --opposite page, and Appendix B, Table A10). Although the number of surface errors at Approach Controls decreased in 1987, there was an equivalent increase of surface errors at Towers for the year. Thus, there were 114 total surface errors that occurred in both 1986 and 1987.

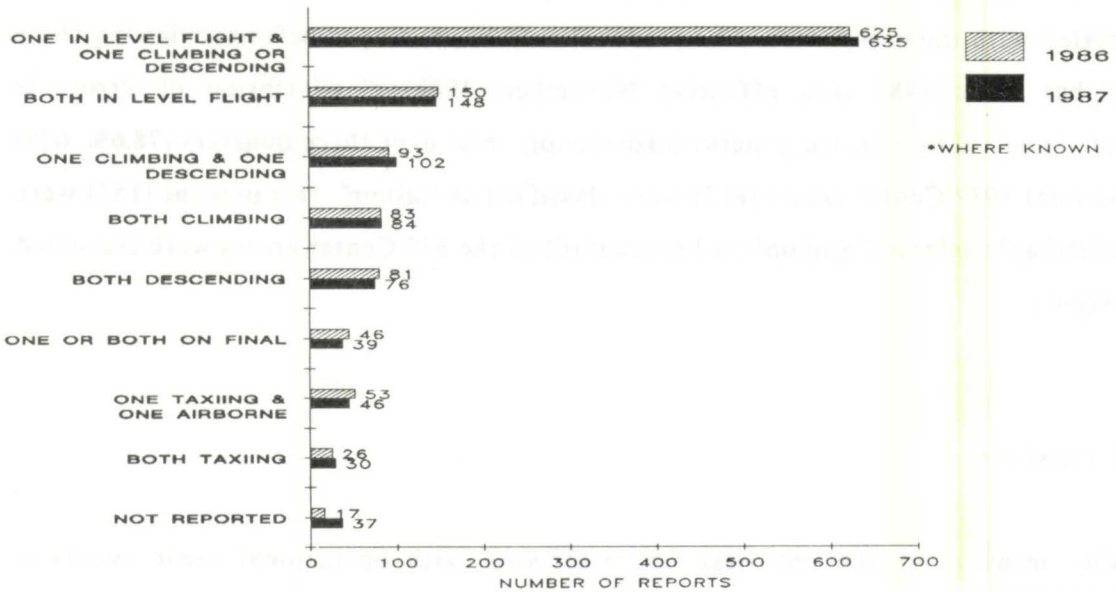
2.2.7 Profile of Aircraft Involved

Where the "phase of flight" of aircraft pairs in error events was reported, the majority of cases involved at least one aircraft in level flight when the prescribed separation

**FIGURE 11 OPERATIONAL ERROR REPORTS 1986-1987
AIRBORNE VS. SURFACE ERRORS**



**FIGURE 12 OPERATIONAL ERROR REPORTS 1986-1987
BY PHASE OF FLIGHT (CONFLICT PAIRS)***



minima were violated (see Figure 12 and Appendix B, Table A11). As can be seen in Figure 12, the 1986 and 1987 distributions of these conflict situations were consistent. The most typical situation (profile) involves one aircraft in level flight and one either climbing or descending (635 pairs, or 52% of the 1987 incidents). The second most common profile involves both aircraft in level flight (148 pairs, or 12% of the 1987 reports). Conflict situations where one aircraft was climbing and one was descending accounted for about eight percent, and conflicts where both were climbing or where both were descending accounted for about 11 percent of the 1987 reported operational errors.

1987 surface errors included 30 instances where both aircraft were taxiing on a runway (i.e., runway incursions). More frequently, one aircraft was on the ground and separation was lost with another aircraft on final (33 pairs), climbing out (10 pairs), or descending (3 pairs).

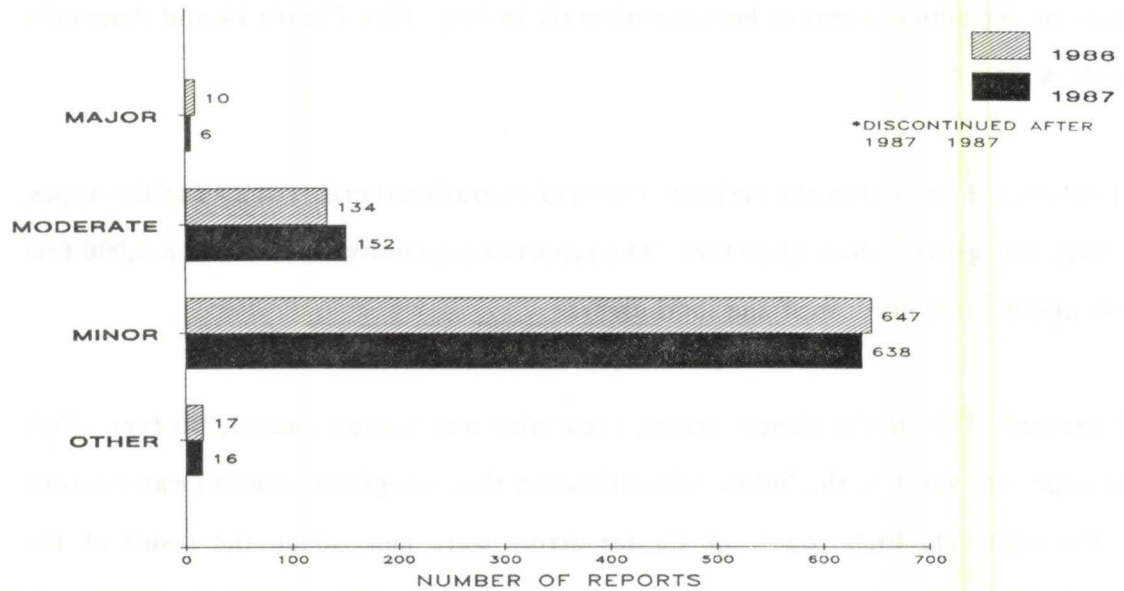
2.2.8 Classification

"Classification" of reports was indicated only for Center errors (see Figure 13 & Table A12, Appendix B). It refers to a composite "score" used to evaluate the potential risk associated with the occurrence. The reader should be cautioned before reviewing these data that since 1987 (i.e., effective November, 1988) classification of errors is discontinued. However, for general information only; over three quarters (78.6%, 638) of the total 1987 Center errors (812) were classified as "minor", 18.7 percent (152) were classified as "moderate" and only 0.7 percent (6) of the 812 Center errors were classified as "major".

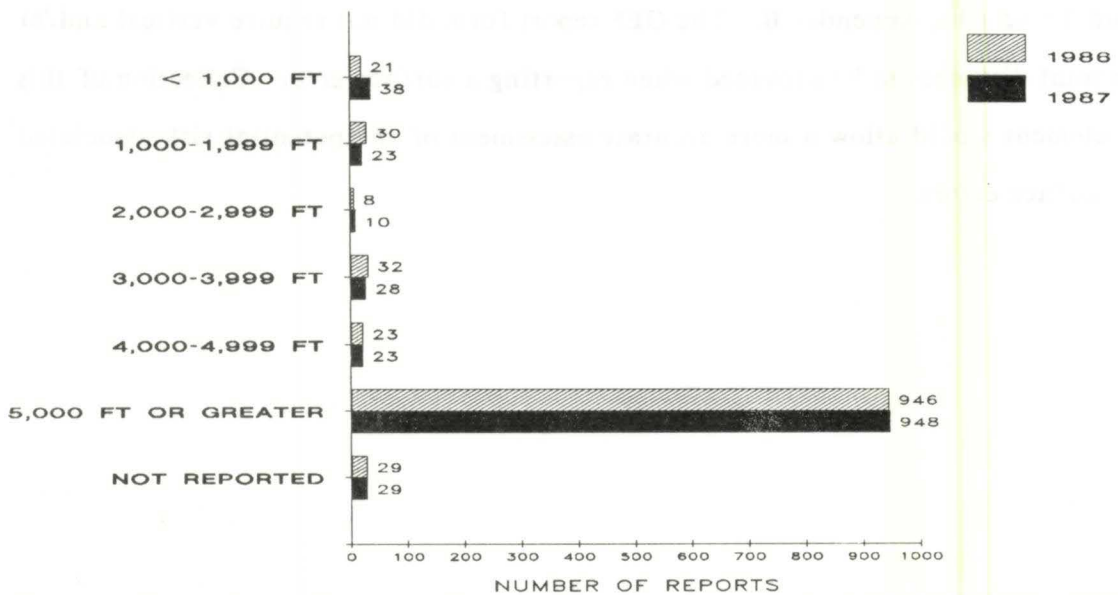
2.2.9 Proximity

Another measure of the potential risk associated with operational error events is proximity of the aircraft which violated the separation minima. Proximity was

**FIGURE 13 OPERATIONAL ERROR REPORTS 1986-1987
BY CLASSIFICATION* (INVOLVES ARTCCs ONLY)**



**FIGURE 14 OPERATIONAL ERROR REPORTS 1986-1987
BY PROXIMITY**



calculated as the square root of the sum of the squares of the minimum horizontal and vertical separations between the aircraft involved (i.e., "slant"), and represents an estimate of the actual distance between aircraft in feet. (See Figure 14 and Appendix B, Table A13)

The 1987 data show that in the majority (78%) of operational errors at all facility types, proximity was greater than 5,000 feet. The reported proximity was less than 1,000 feet in only about three percent of the total errors.

In 96 percent (777) of the Center errors, proximity was greater than 5,000 feet. This would appear to validate the "minor" classification that was given to most Center errors. Also, the relatively high counts of Center errors were most often the result of the automatic error detection system.

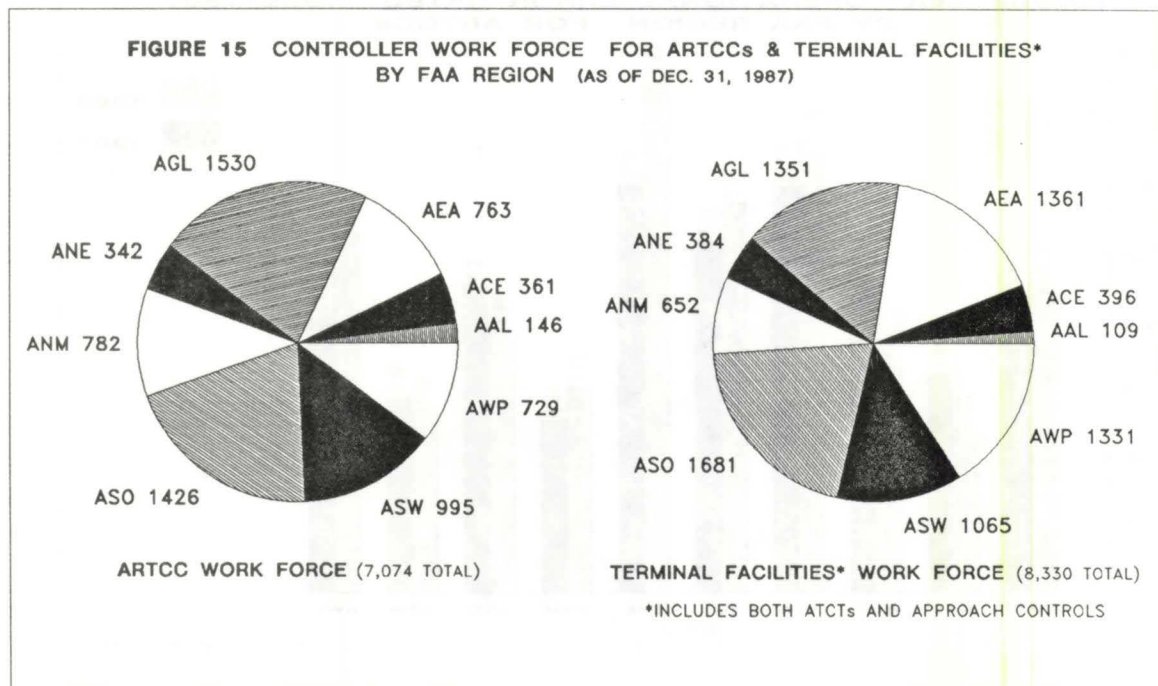
It should be noted that the 114 surface errors occurring in 1987 are missing from Figure 14 and Table A13, Appendix B. The OES report form did not require vertical and/or horizontal distances to be provided when reporting a surface error. Collection of this data element would allow a more accurate assessment of the potential risk associated with surface errors.

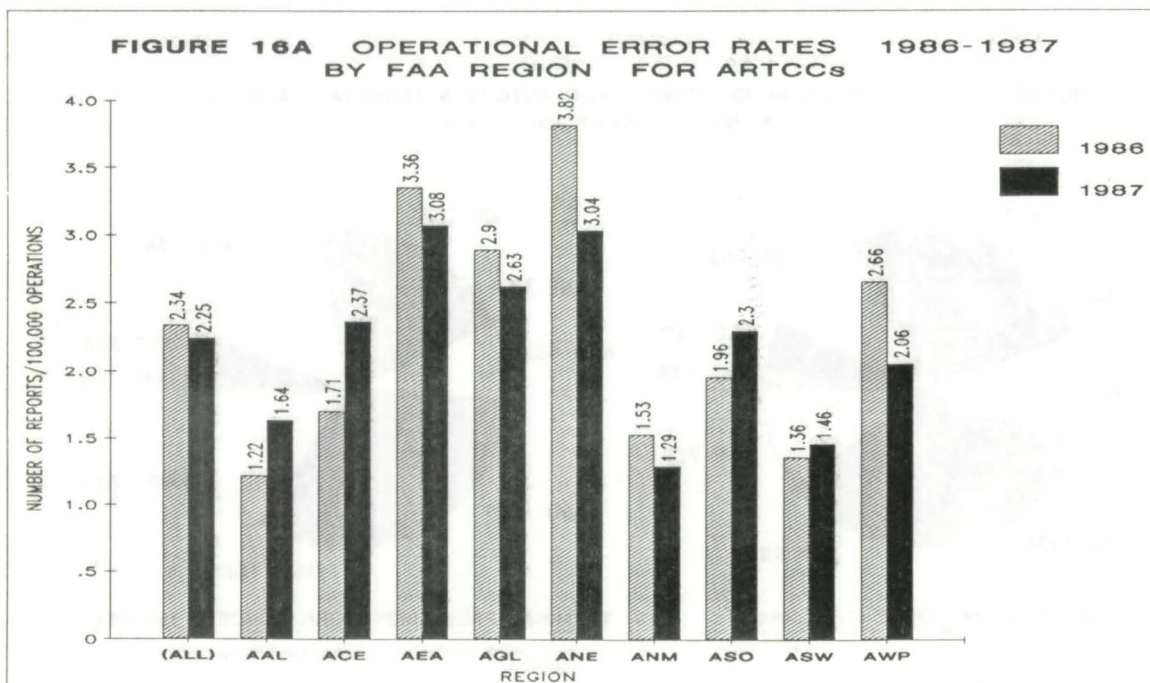
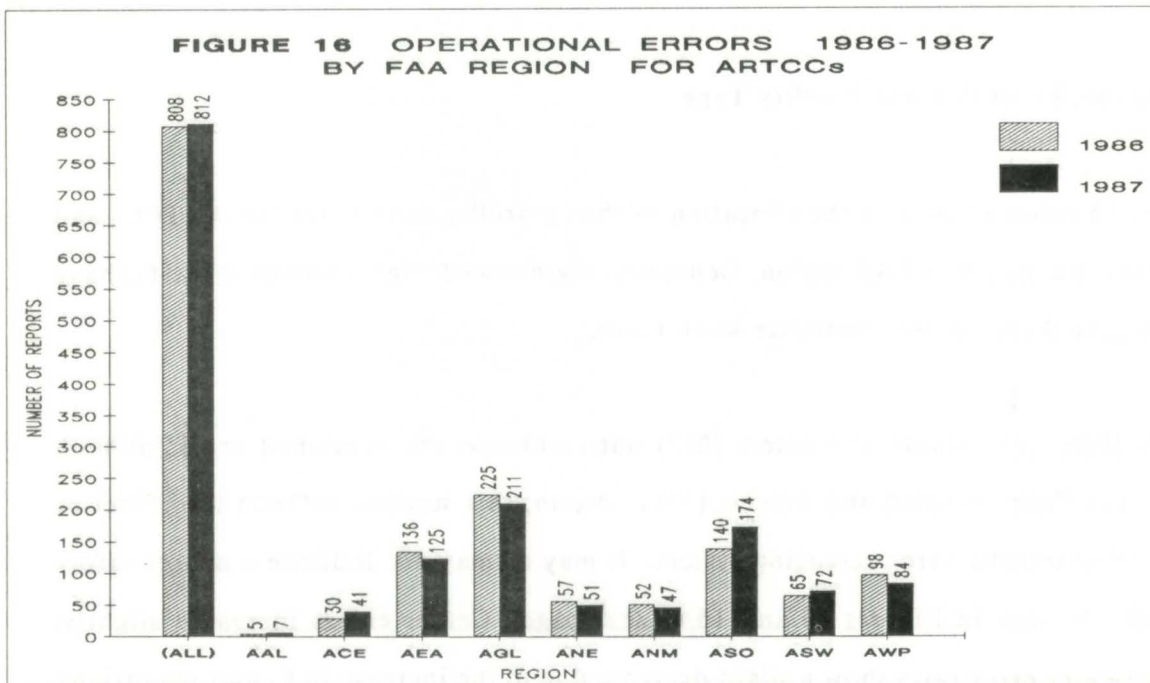
3.0 LOCATION OF OPERATIONAL ERRORS BY FACILITY TYPE

3.1 Errors by Region and Facility Type

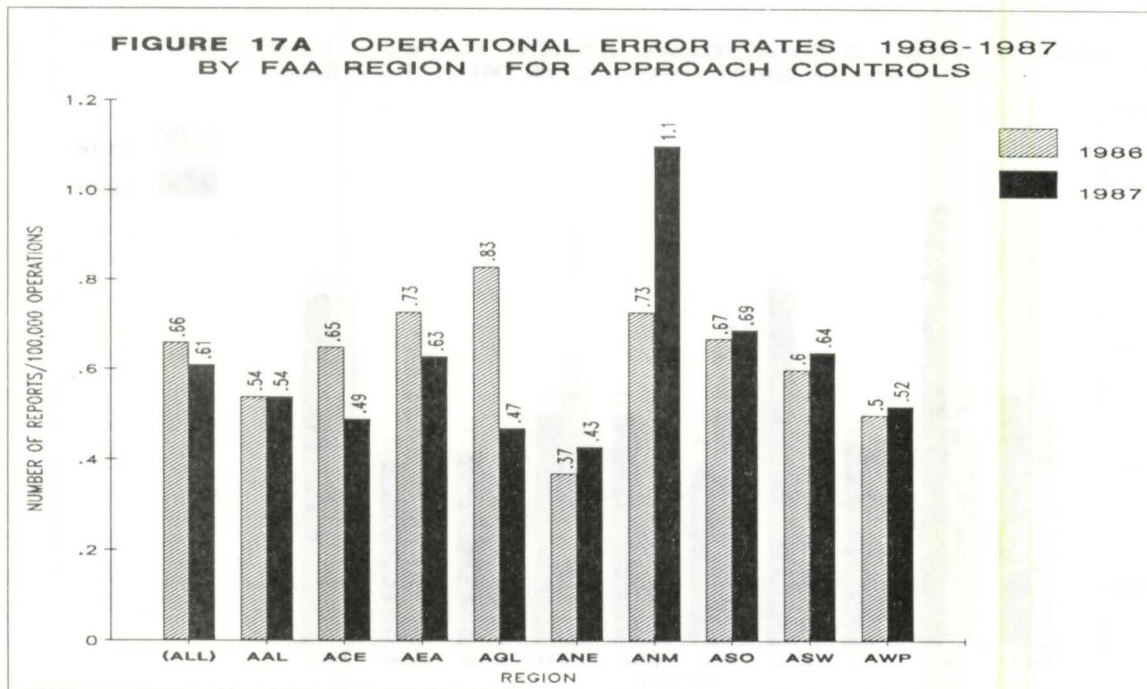
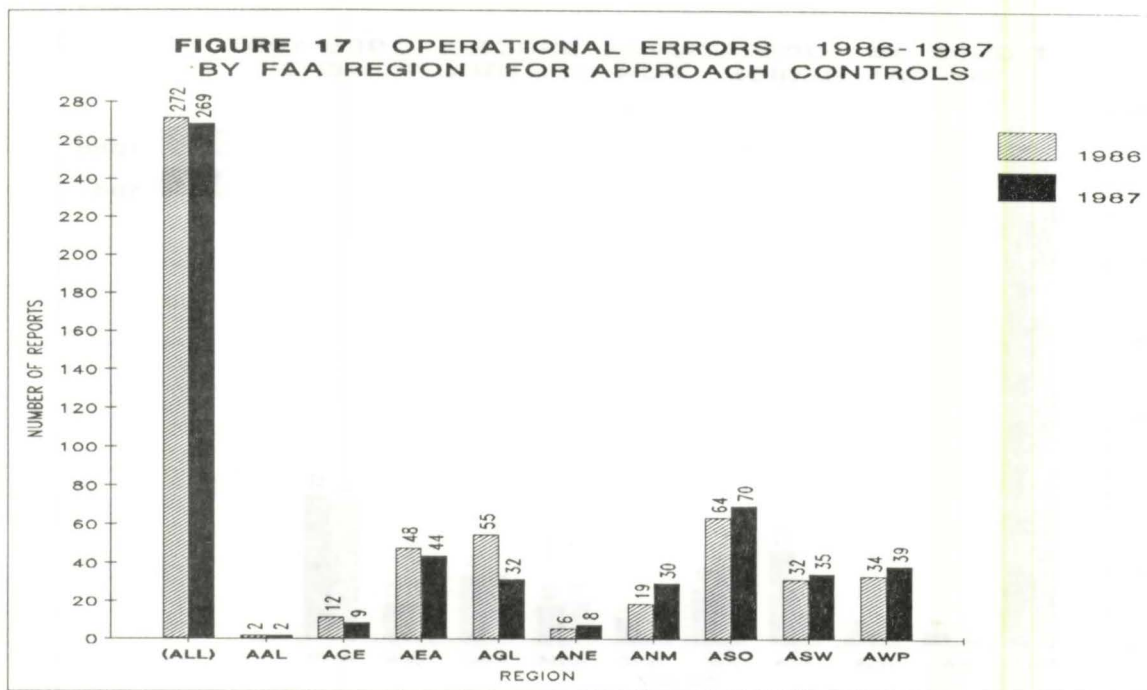
Figure 15 below illustrates the allocation of the controller work force for ARTCCs and Terminal Facilities by FAA region. Generally, regions with high volumes of traffic have the largest shares of the controller work force.

As in 1986, 1987 errors at Centers (812) out-numbered the combined errors at both Approach Controls (269) and Towers (131). Again, this statistic reflects the effect of Centers' automatic error reporting system. It may or may not indicate a poorer safety record. As seen in Figures 16 and 16A (next page), Center errors increased slightly, while Center error rates show a slight decrease due to the increase in Center operations.

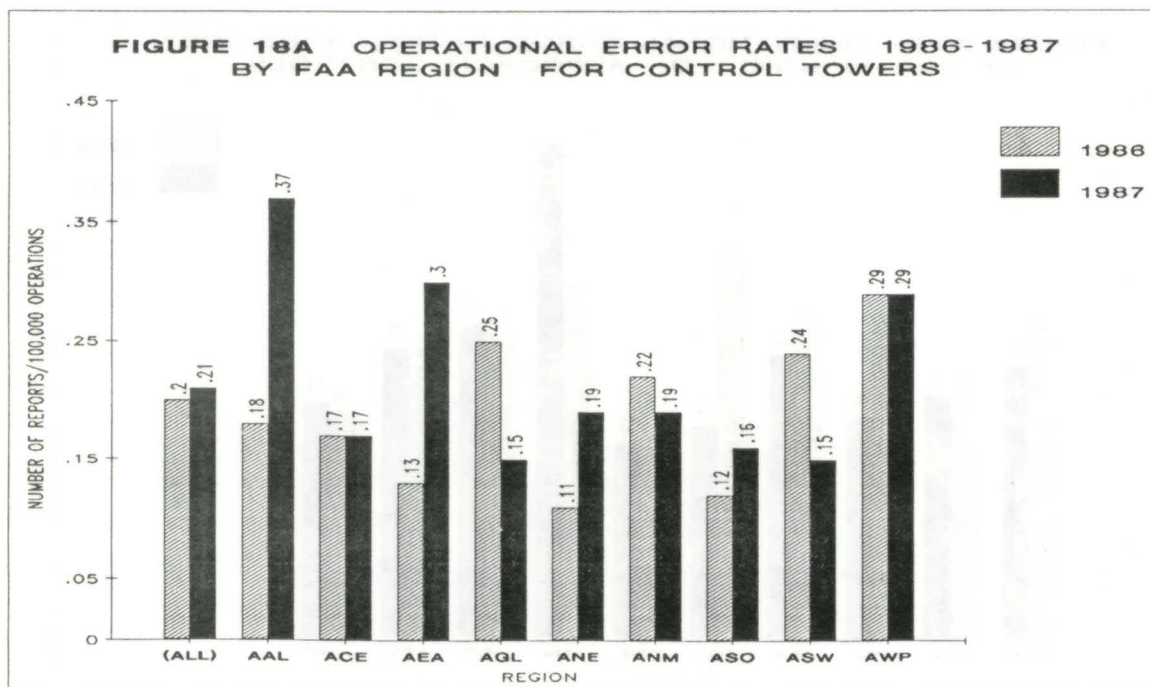
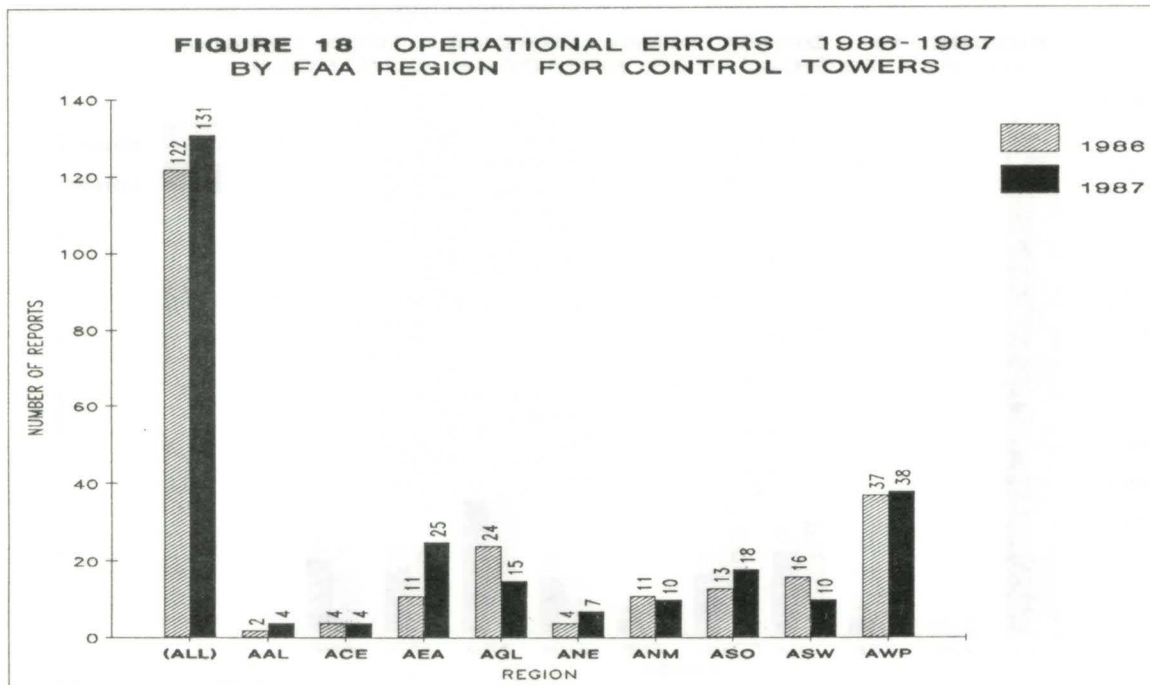




Although moderate exceptions can be seen in the Great Lakes and Northwest Mountain Regions, Figures 17 and 17A below show that Approach Control errors and error rates remained fairly stable from 1986 to 1987 (overall and by individual region).



Again, while several exceptions can be seen, Figures 18 and 18A show general consistency between the two years for the overall as well as regional Tower error and error rates. Consideration of the error rates alone as indicators of relative performance

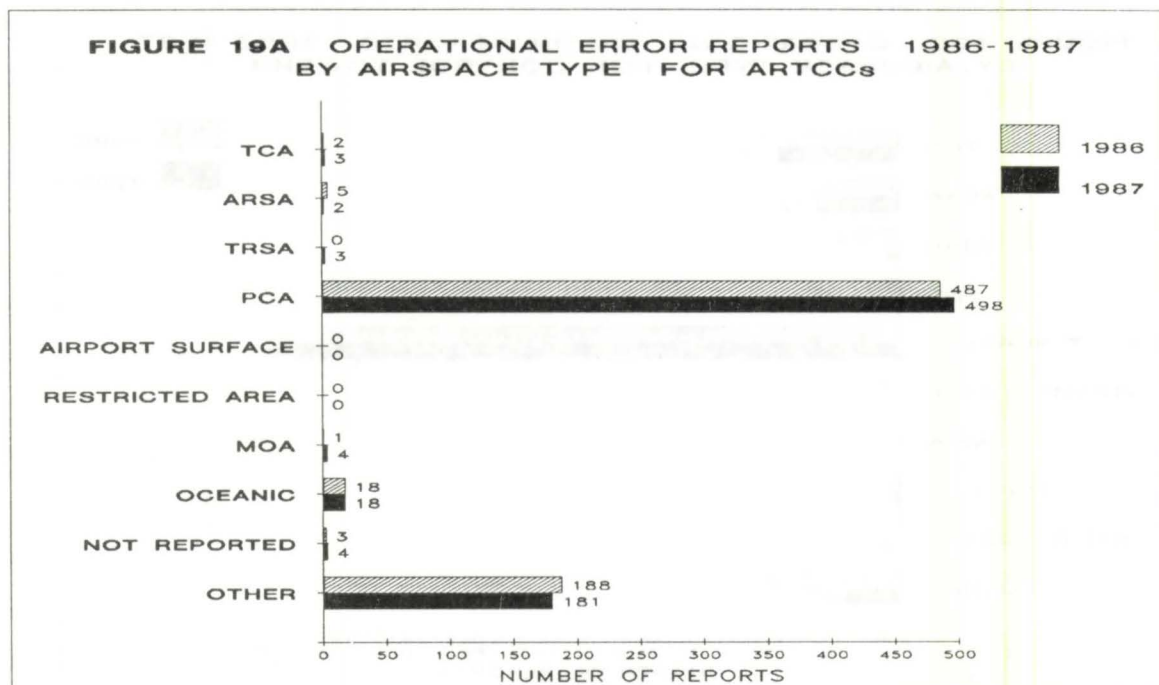


should be cautioned. For example, the apparent substantial increase depicted for the 1987 Alaska Region error rate in Figure 18A represents only two total errors (Figure 18).

Great Lakes is the only one of the nine regions to show a decrease in errors and error rates at all three facility types from 1986 to 1987. The Southern region is the only one that showed an increase in all facility types.

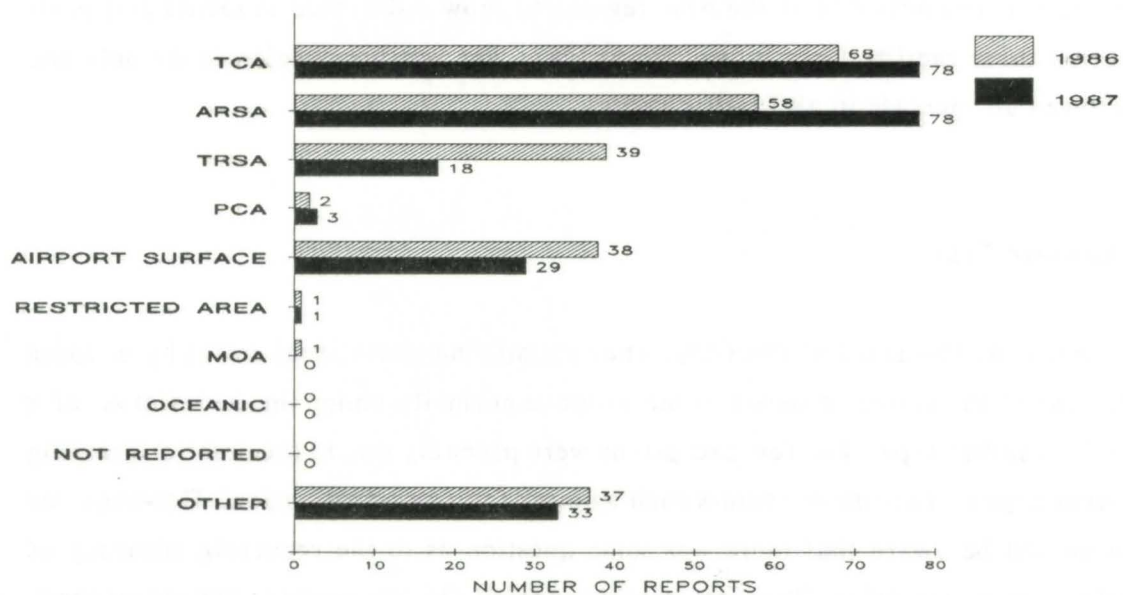
3.2 Airspace Type

As Figures 19A, 19B and 19C illustrate, when classifying operational errors by airspace type*, most of the errors occurred in the airspace normally under the jurisdiction of a particular facility type. The few exceptions were probably due to the error originating at another type of facility or factors such as inter-facility coordination. However, the reader should be aware that there was some question as to the reporting accuracy of several airspace categories. Thus, definitive counts of OEs by airspace type are suspect.

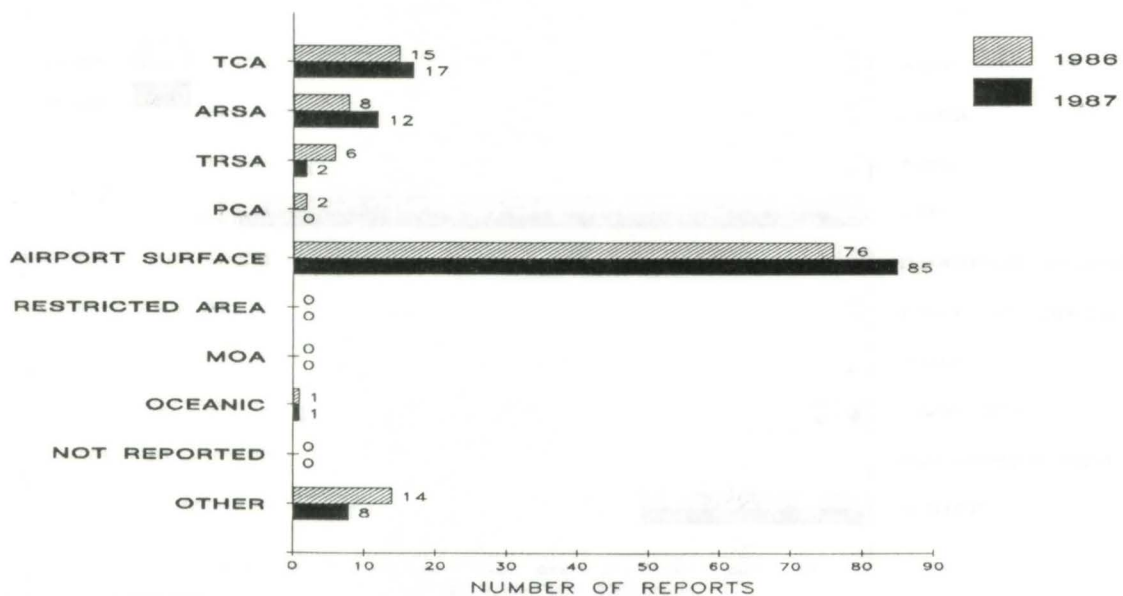


*See Glossary for descriptions of airspace types.

**FIGURE 19B OPERATIONAL ERROR REPORTS 1986-1987
BY AIRSPACE TYPE FOR APPROACH CONTROLS**

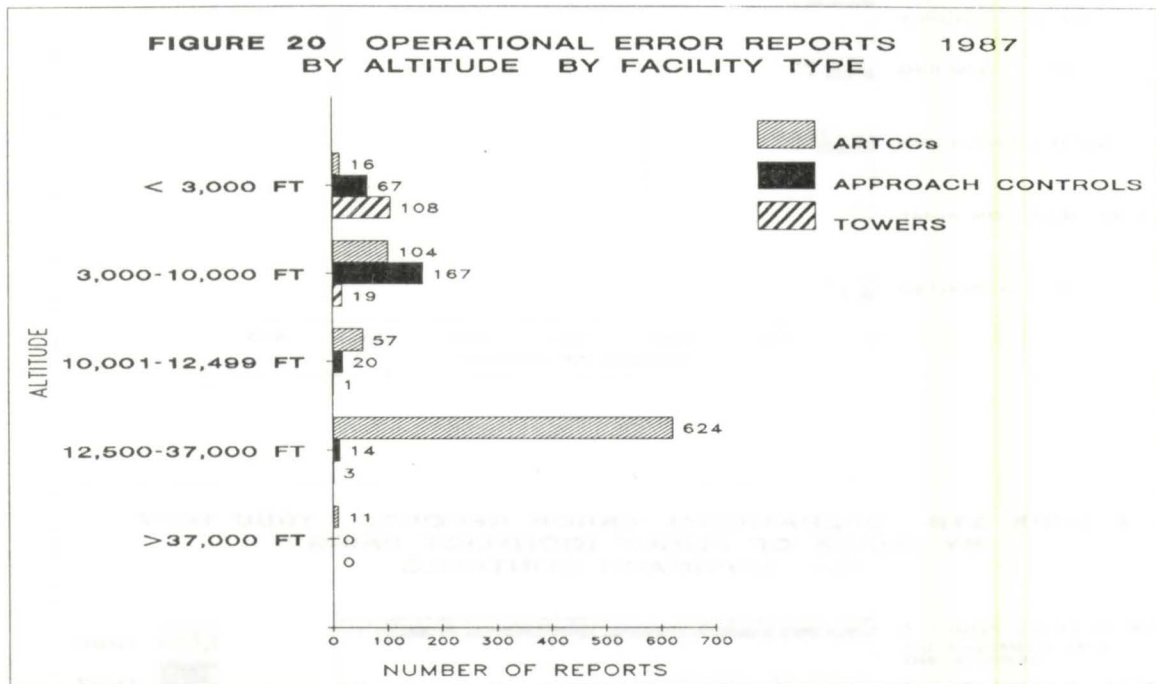


**FIGURE 19C OPERATIONAL ERROR REPORTS 1986-1987
BY AIRSPACE TYPE FOR CONTROL TOWERS**



3.3 Aircraft Altitude

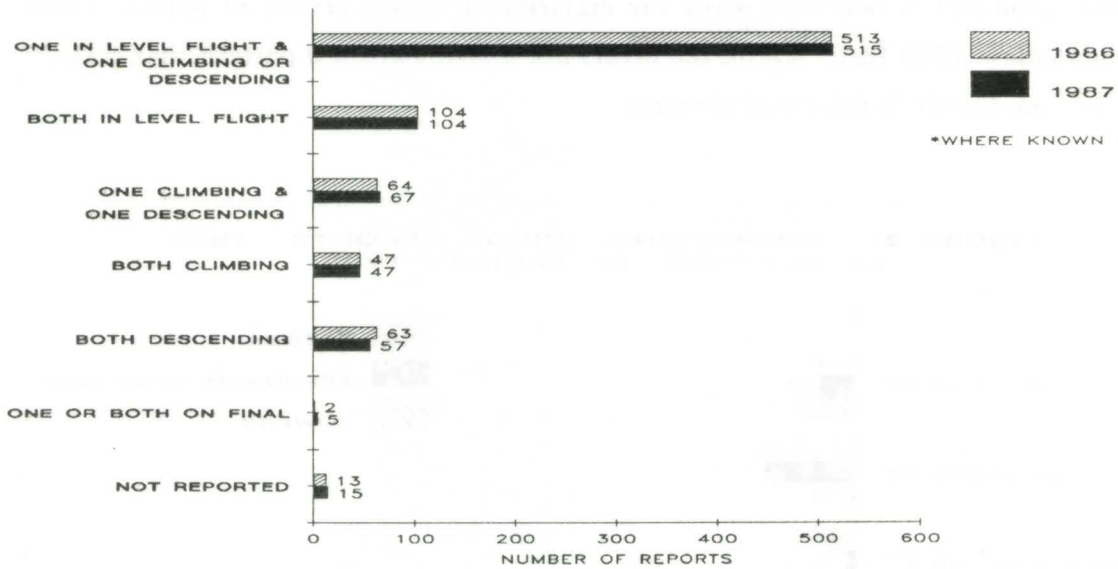
As seen in Figure 20 below, 77 percent (624) of the 812 Center error reports occurred between 12,500 and 37,000 feet. 62 percent (167) of Approach Control errors occurred between 3,000 and 10,000 feet; while the majority of Tower errors, 81 percent (108), occurred below 3,000 feet. Again, the errors are distributed in a pattern that reflects the reporting facility's delegated airspace.



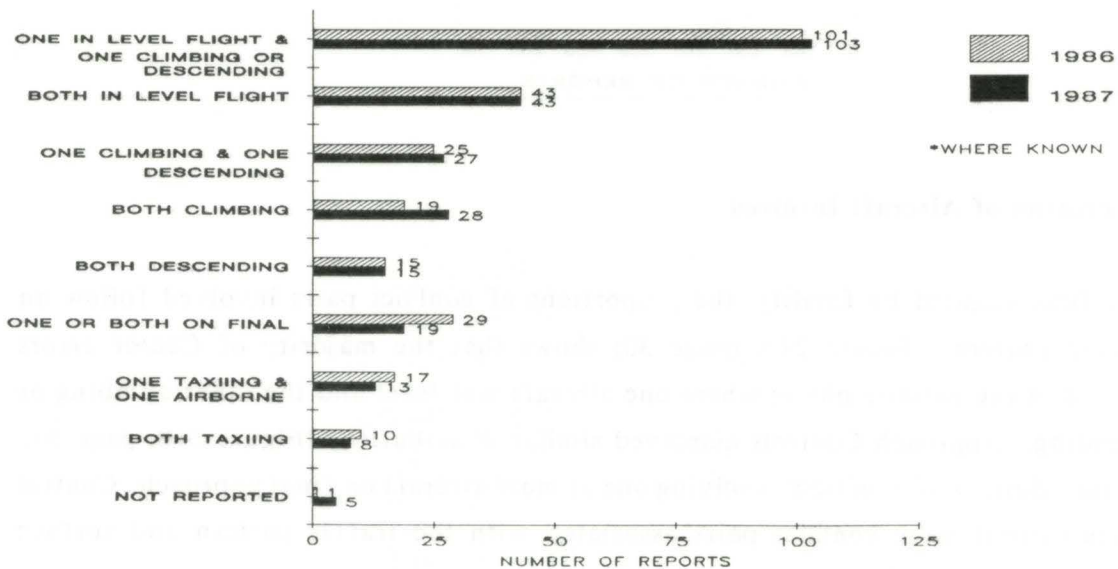
3.4 Profiles of Aircraft Involved

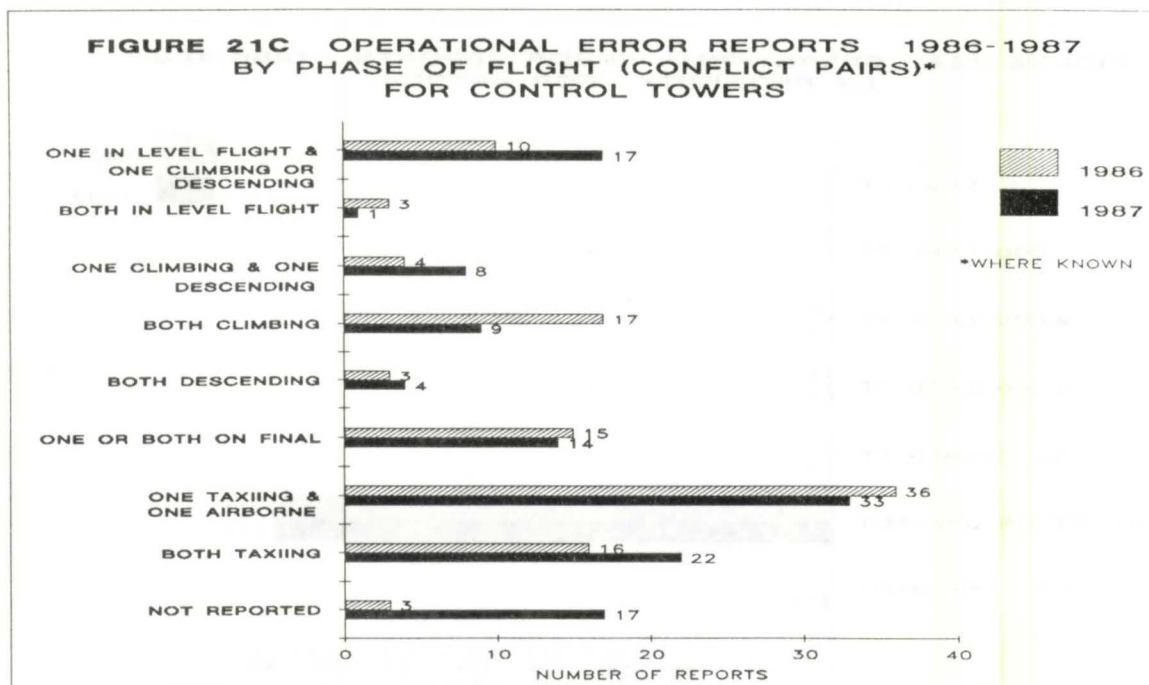
When disaggregated by facility, the proportions of conflict pairs involved follow an expected pattern. Figure 21A (page 30) shows that the majority of Center errors occurred in the enroute phase; where one aircraft was level and the other climbing or descending. Approach Controls displayed similar distributions (Figure 21B, page 30), with the addition of conflicts involving one or more aircraft on final approach. Control Towers exhibit more conflict pairs associated with the traffic pattern and surface incidents (Figure 21C, page 31).

**FIGURE 21A OPERATIONAL ERROR REPORTS 1986-1987
BY PHASE OF FLIGHT (CONFLICT PAIRS)*
FOR ARTCCs**



**FIGURE 21B OPERATIONAL ERROR REPORTS 1986-1987
BY PHASE OF FLIGHT (CONFLICT PAIRS)*
FOR APPROACH CONTROLS**





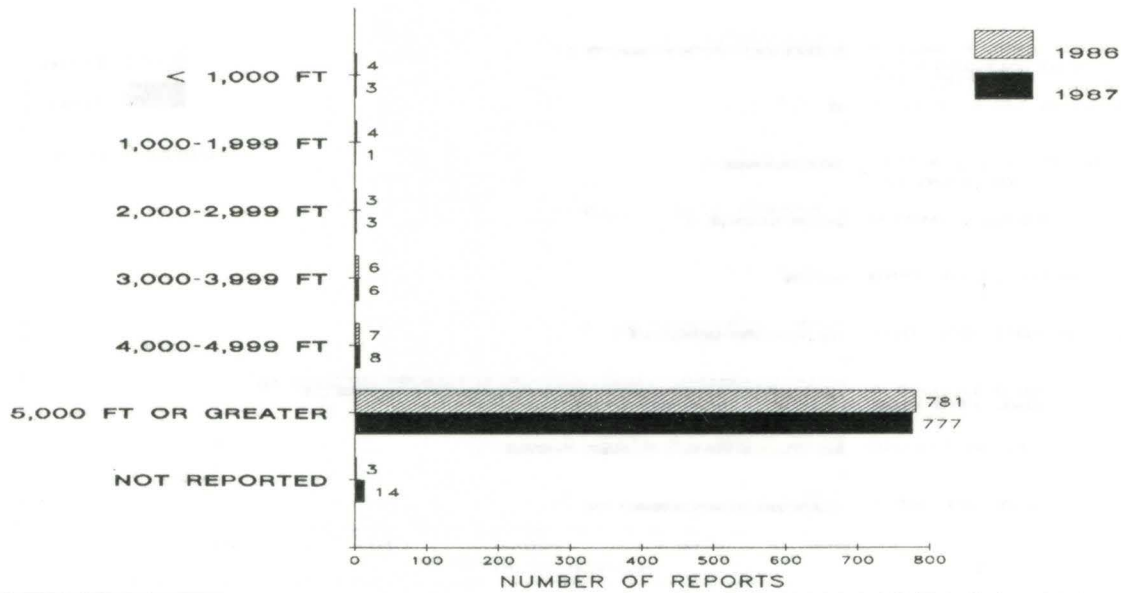
3.5 Proximity

As discussed in Chapter 2, all facility types show a substantial number of operational errors in which the separation exceeds 5,000 feet. Following (pages 32-33), Figures 22A, 22B and 22C illustrate the predominance of this category in all three facility types.

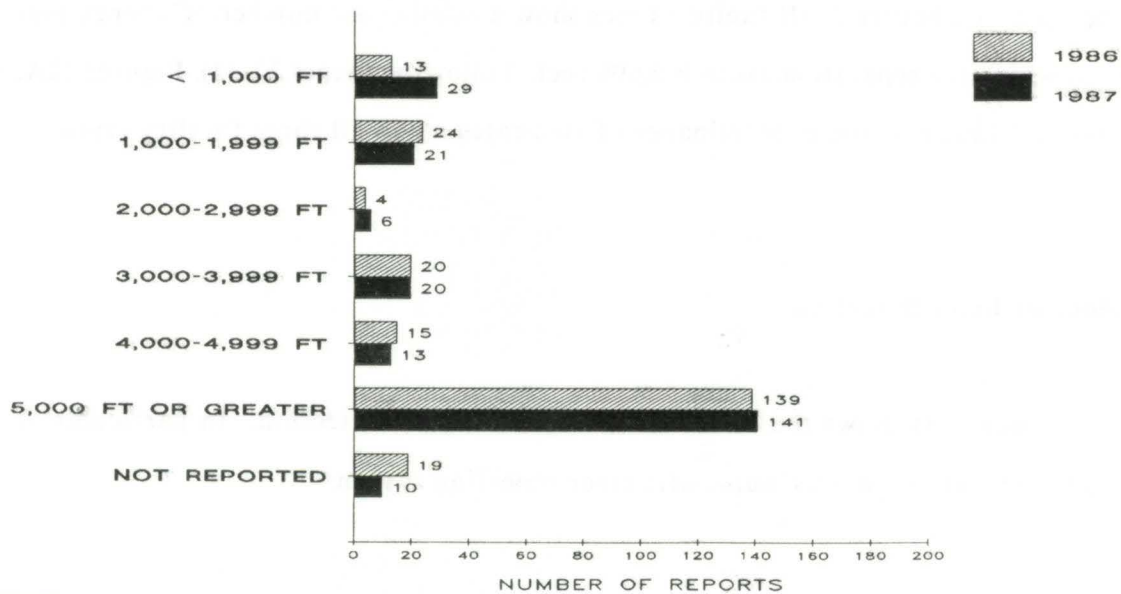
3.6 Mode of Error Detection

Figure 23 (page 33) shows the influence of mode of error detection. In particular, it reveals the effect of Centers' automatic error reporting system.

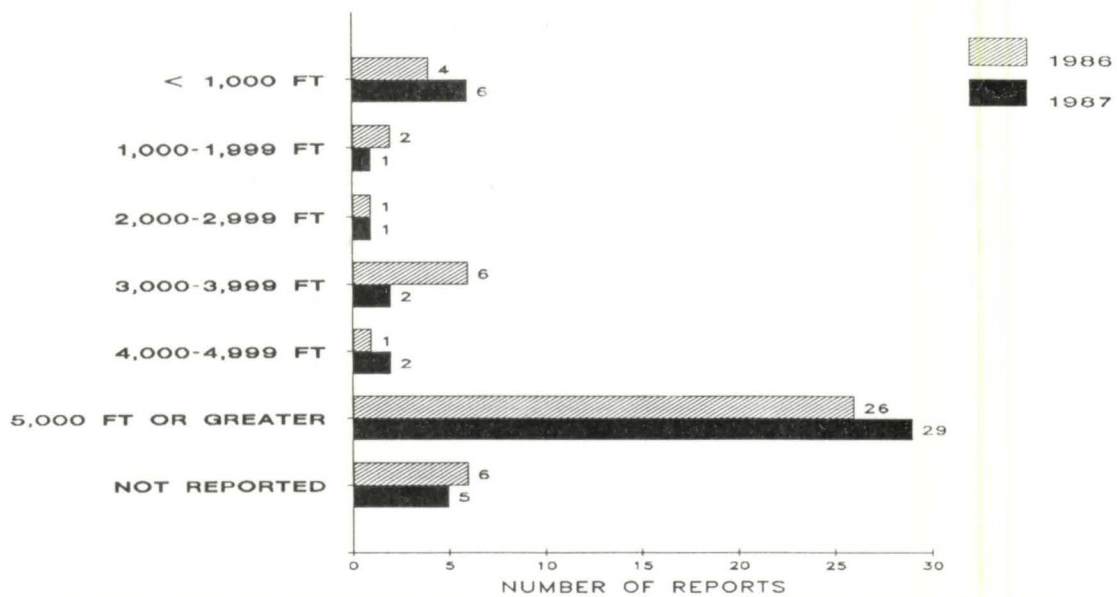
**FIGURE 22A OPERATIONAL ERROR REPORTS 1986-1987
BY PROXIMITY FOR ARTCCs**



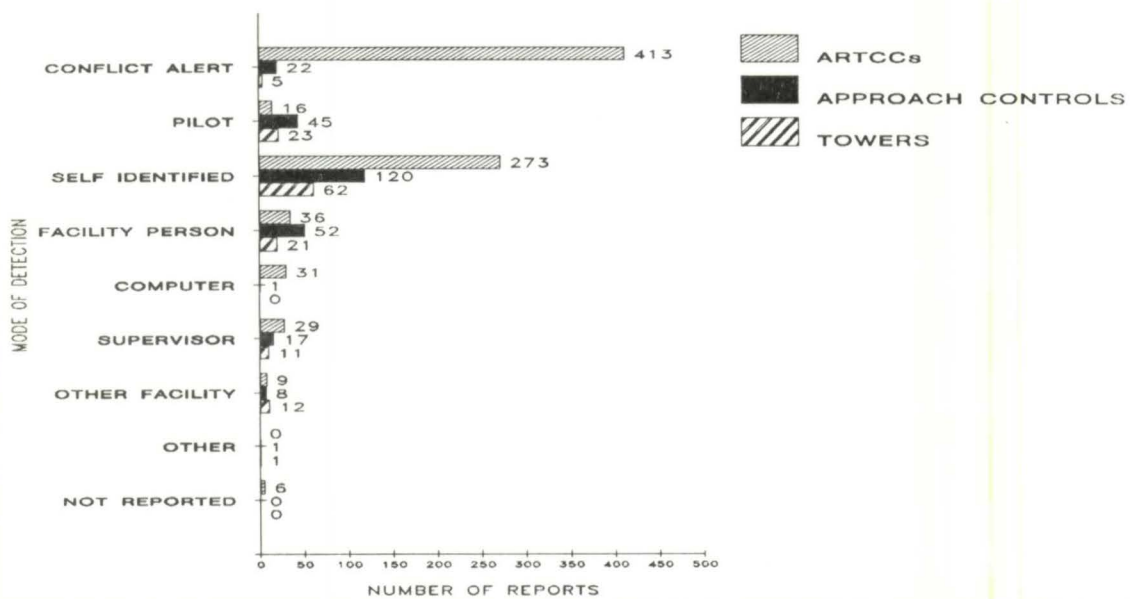
**FIGURE 22B OPERATIONAL ERROR REPORTS 1986-1987
BY PROXIMITY FOR APPROACH CONTROLS**



**FIGURE 22C OPERATIONAL ERROR REPORTS 1986-1987
BY PROXIMITY FOR CONTROL TOWERS**



**FIGURE 23 OPERATIONAL ERROR DETECTION 1987
BY FACILITY TYPE**



4.0 CAUSAL FACTORS OF OPERATIONAL ERRORS

There is little question that a number of different factors may combine to actuate the occurrence of operational errors. The preliminary and final investigative report forms (7210-2.1 and 7210-3) request information on factors that might have contributed to operational error events. These factors include: equipment failure, lack of adherence to established procedures, traffic demand, environment, human elements, and other factors.

Of the 1,213 operational errors reported in 1987, almost 98 percent (1,187) cited "human" factors as the primary cause (and similarly, 96% in 1986). There is general agreement that human error is the major source of operational errors, but it is unclear which human factors are relevant in the air traffic control environment and how they should be managed to minimize the incidence of errors.

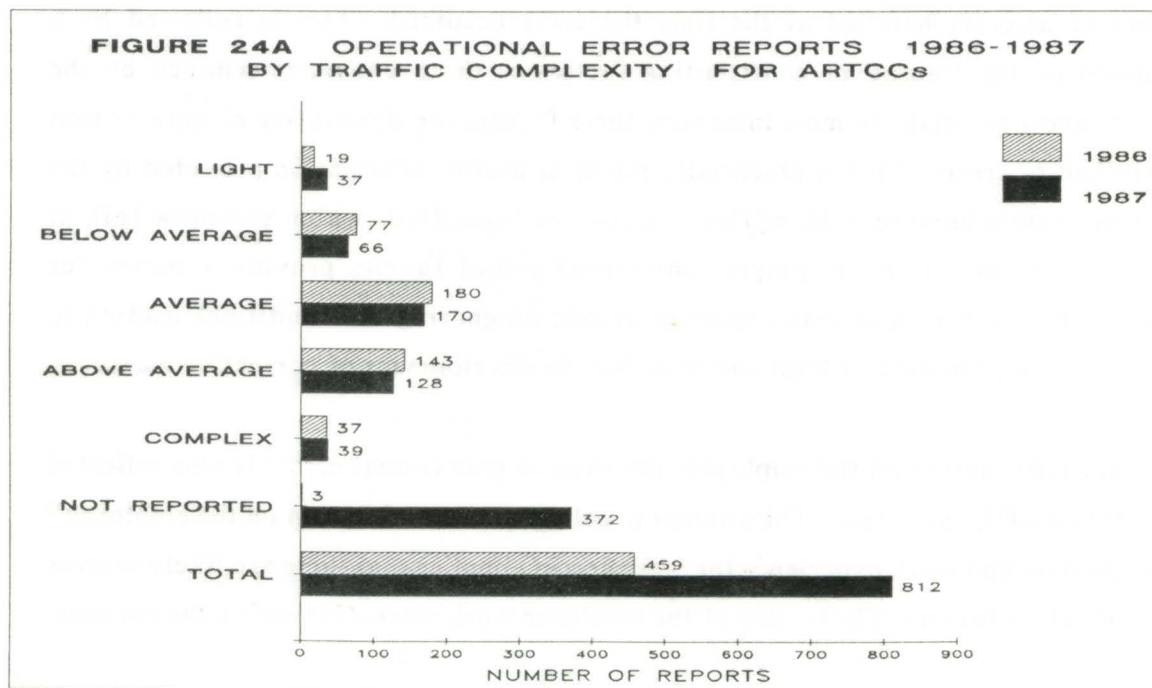
To address these issues, this chapter presents general summary statistics on data elements collected by the FAA Operational Error Reporting System. The first section evaluates workload and operational errors; specifically, the complexity of air traffic and the number of aircraft handled at the time the error occurred. This is followed by a discussion of the "causal" or contributing factors to the event as determined by the report's investigator(s). In most instances, these factors are descriptive of actions that contributed to errors. This is potentially the most useful information provided by the reporting system because it identifies processes or procedures which somehow fail, at least on occasion. These employee-contributed causal factors provide a means for analyzing the evolution of many types of errors; diagnosing the conditions leading to errors, thereby providing at least one basis for the development of corrective measures.

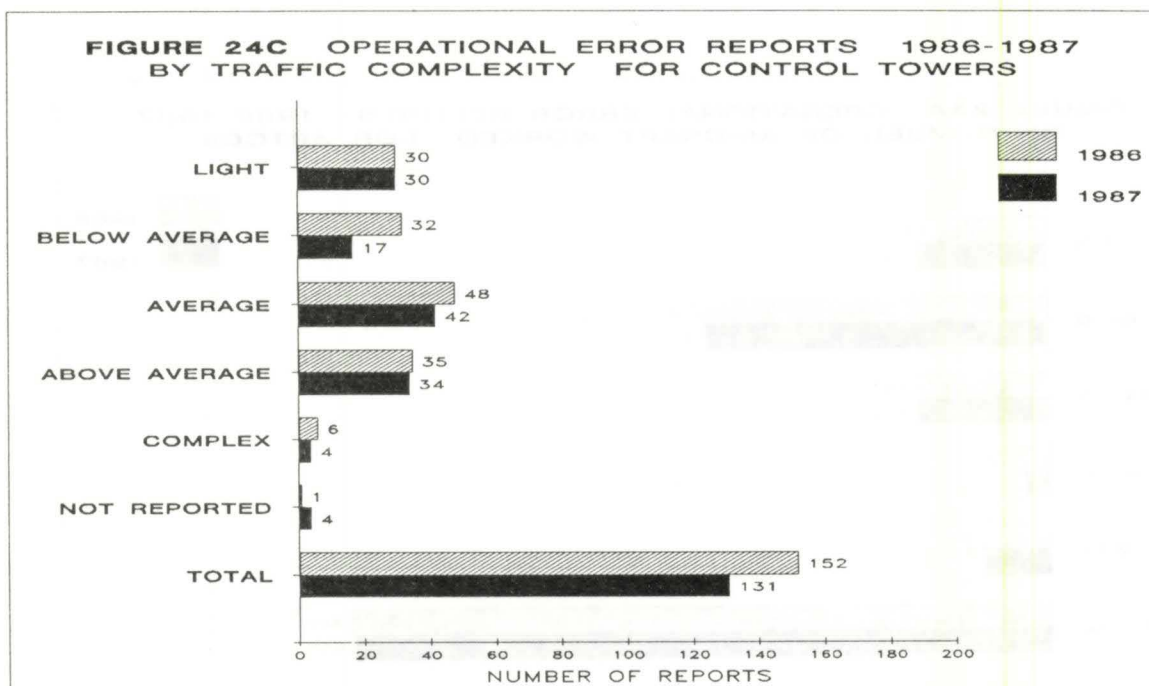
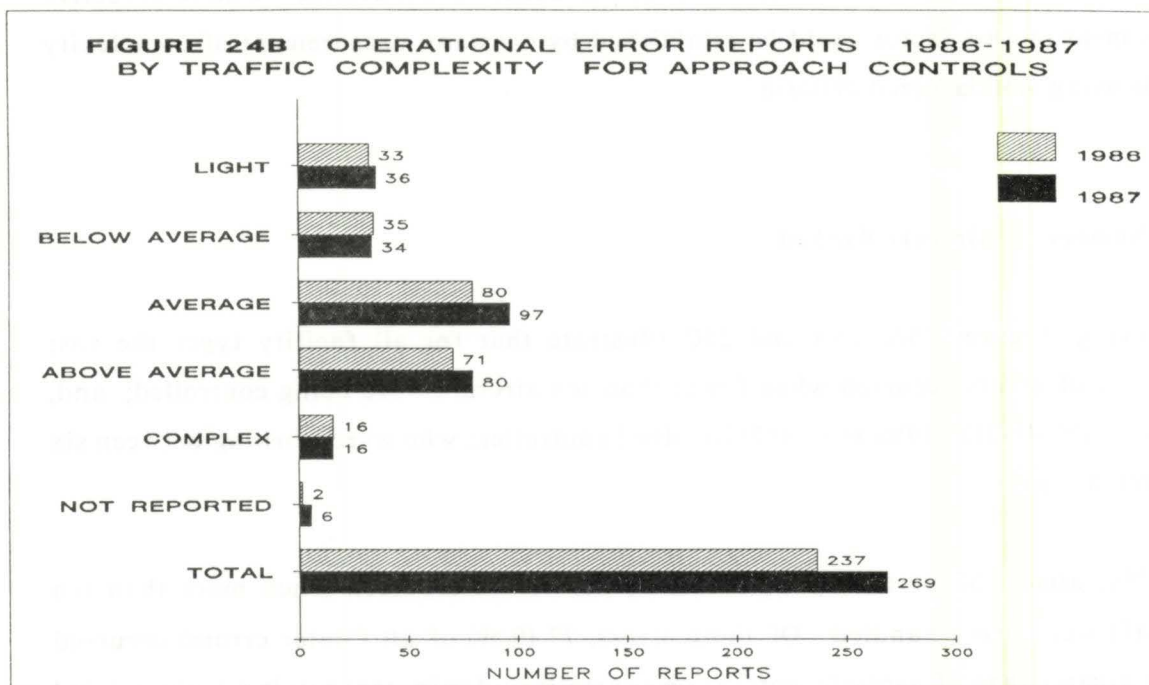
Personnel information on the employees involved in operational errors is also collected in the NAIMS-OES data base. The attempt to collect and examine data on the employees' work schedule and work experience (or lack thereof) implies that these are likely sources of contributing factors. The (1) day of the employee work week, (2) time on the position,

(3) type of last non-control activity, and (4) number of hours into the shift, are variables used to describe the work schedule carried by the employees at the time of the error. The work experience of the controllers involved in errors has been measured by the length of time they held positions as FPL (Full Performance Level) controllers, and/or by the total time they had been certified on the position of operation assigned at the time of the incident.

4.1 Traffic Complexity

While 33 percent (403) of the error reports contain no data on traffic complexity, information that is available indicates that errors are most likely to occur when complexity is rated "average" or "above average." Over one third of the rated error reports list complexity as "average," and another 29 percent describe complexity as "above average." As shown in Figures 24A, 24B and 24C following, only 7.1 percent of the errors occurred when traffic was rated "complex." This proportion may be a function of the distribution of aircraft activity; it could also reflect a higher level of awareness on the part of controllers during periods of more intense traffic activity.



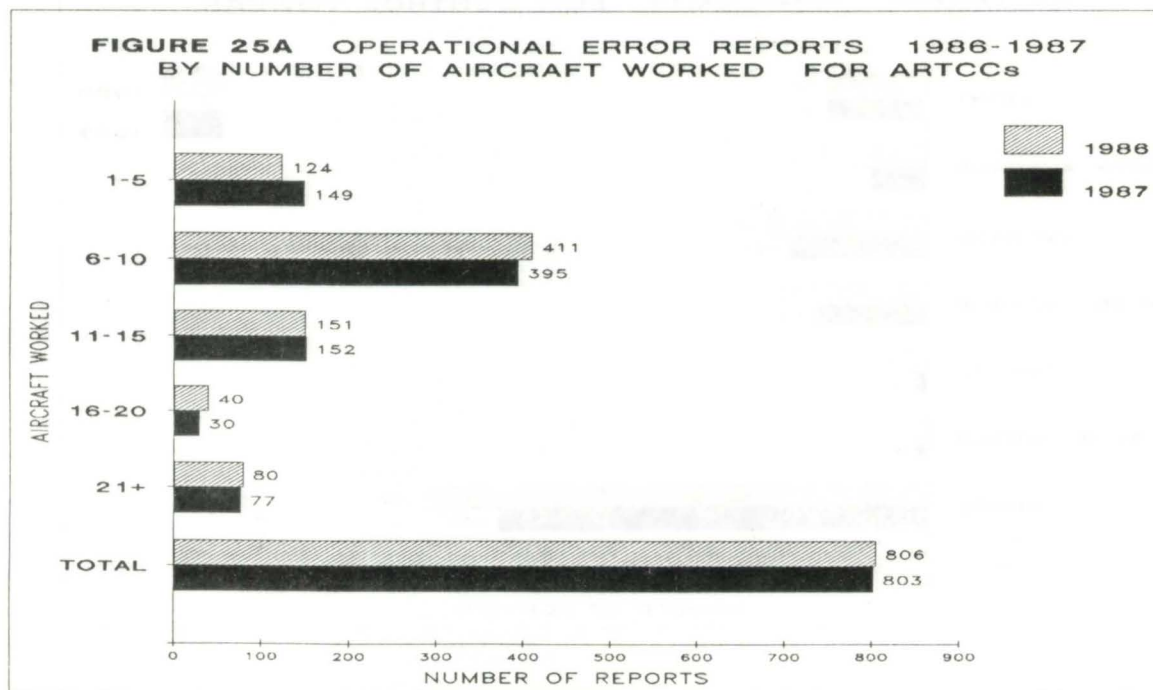


Subjectivity and lack of specifically defined characteristics regarding traffic complexity make it difficult to determine its' level of influence in OE events. A more effective assessment of this factor could be established by constant measurement of complexity levels using standardized criteria.

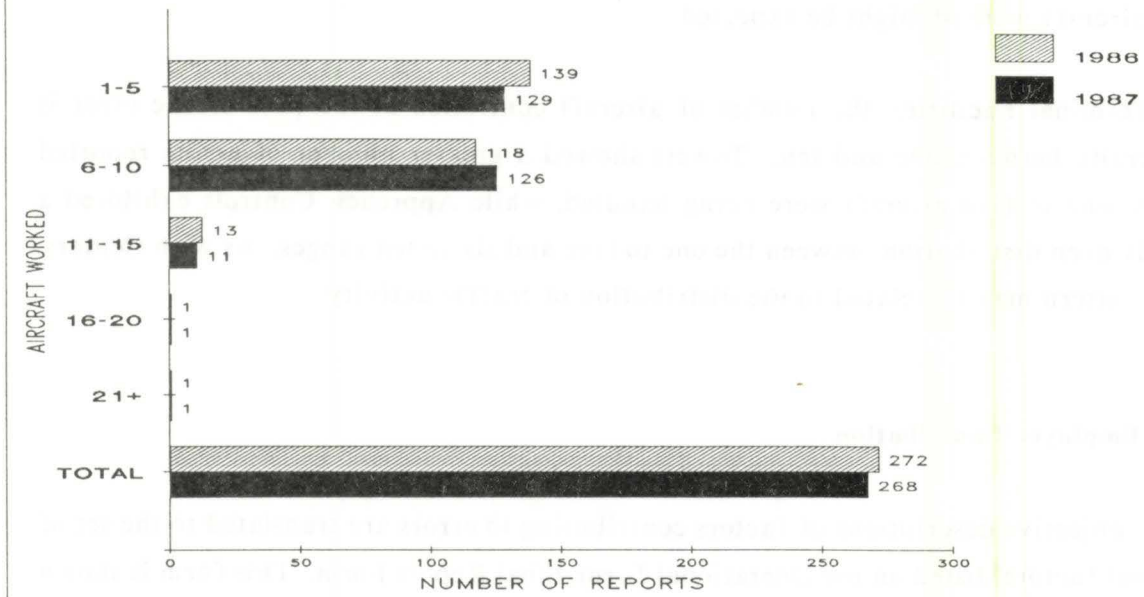
4.2 Number of Aircraft Worked

Following, Figures 25A, 25B and 25C illustrate that for all facility types the vast majority of errors occurred when fewer than ten aircraft were being controlled; and, almost half all OEs (1986 and 1987) involved controllers who were working between six and ten aircraft.

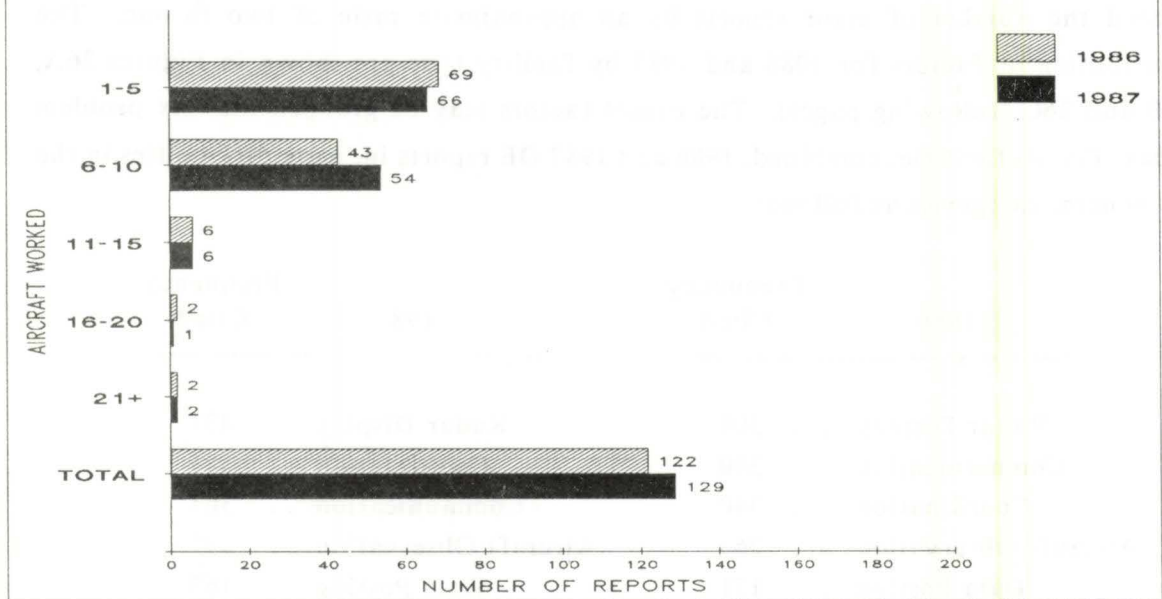
Notably, almost 32 percent (259) of all Center errors occurred when more than ten aircraft were being handled. Of those errors, 77 (9.5% of all Center errors) occurred when greater than 20 aircraft were being controlled. Again, this result may be related to the exposure distribution.



**FIGURE 25B OPERATIONAL ERROR REPORTS 1986-1987
BY NUMBER OF AIRCRAFT WORKED FOR APPROACH CONTROLS**



**FIGURE 25C OPERATIONAL ERROR REPORTS 1986-1987
BY NUMBER OF OF AIRCRAFT WORKED FOR CONTROL TOWERS**



These numbers exhibit differences between ATC operations at Centers and Terminal Facilities. Centers are designed to handle larger numbers of aircraft at higher altitudes; therefore, based on exposure, their higher error counts in events involving more than ten aircraft worked might be expected.

At Terminal Facilities, the number of aircraft controlled at the time of the error is generally between one and ten. Towers showed a greater number of errors reported while one to five aircraft were being handled, while Approach Controls exhibited a fairly even distribution between the one to five and six to ten ranges. As with Centers, this pattern may be related to the distribution of traffic activity.

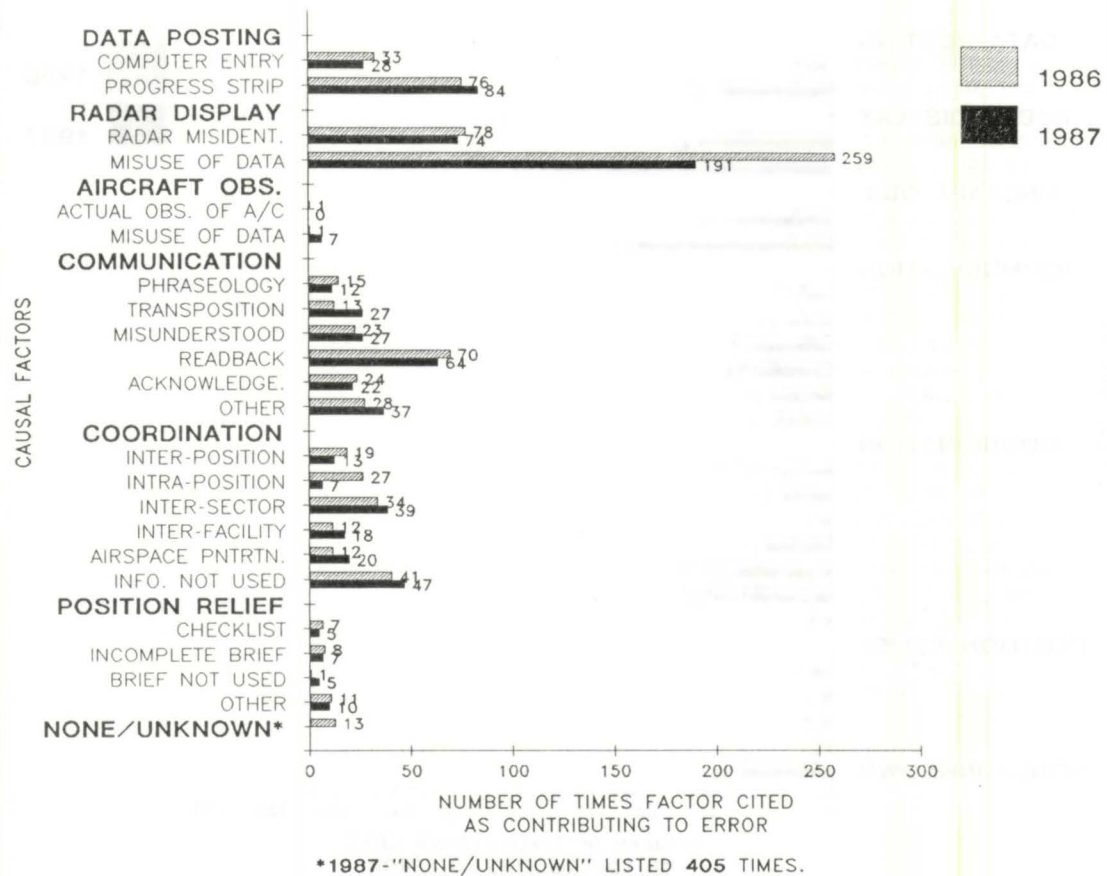
4.3 Employee Contribution

The subjective descriptions of factors contributing to errors are translated to the set of "causal factors" listed on the Operational Error Final Report Form. This form is shown in Appendix A.

Since some errors involve more than one employee and each employee may have contributed more than one causal factor, the number of observations for this variable exceed the number of error reports by an approximate ratio of two to one. The distribution of factors for 1986 and 1987 by facility type are shown in Figures 26A, 26B and 26C (following pages). The causal factors may be grouped into six problem areas. For all facilities combined, 1986 and 1987 OE reports indicate difficulties in the six general categories as follows:

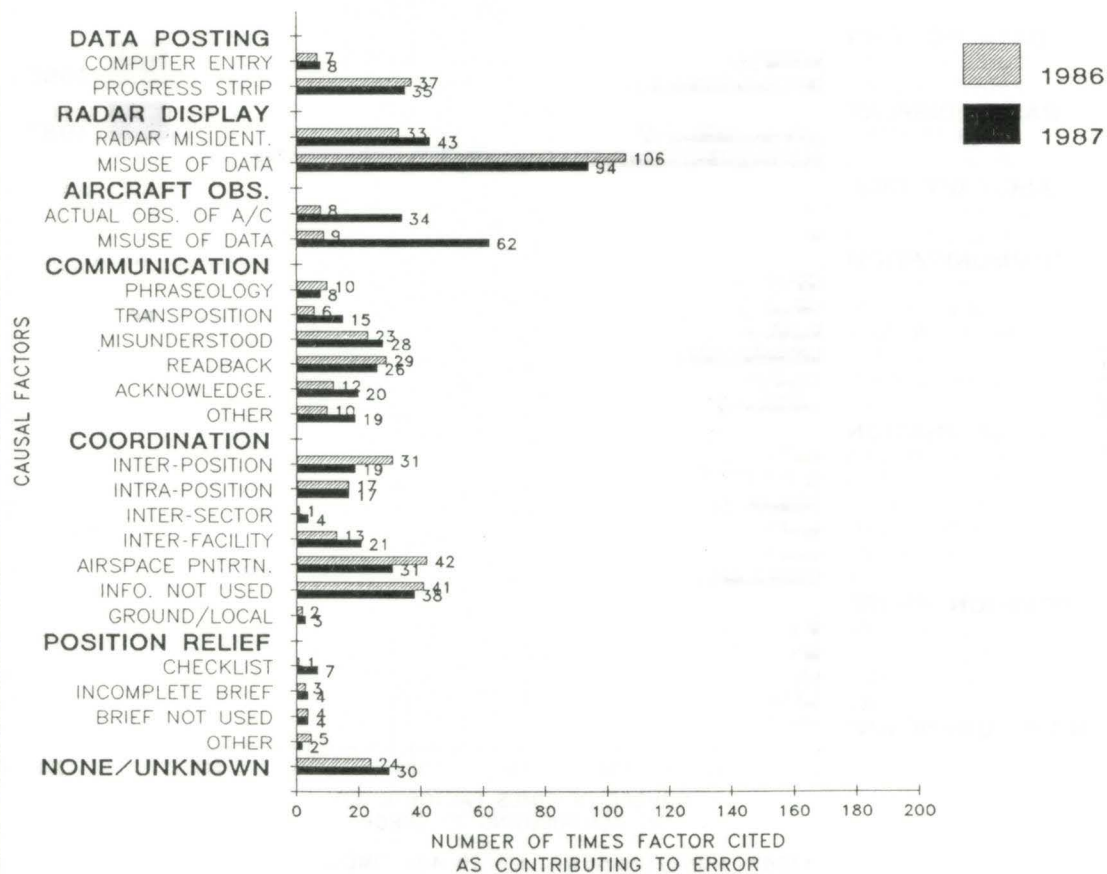
1986	Frequency Cited	1987	Frequency Cited
-----		-----	
Radar Display ...	508	Radar Display ..	431
Communication ...	390	Coordination ..	385
Coordination ...	340	Communication ..	367
Aircraft Observation ...	269	Aircraft Observation ..	297
Data Posting ...	171	Data Posting ..	163
Position Relief	57	Position Relief ...	51

**FIGURE 26A OPERATIONAL ERROR REPORTS 1986-1987
BY EMPLOYEE-CONTRIBUTED CAUSAL FACTOR*
FOR ARTCCs**



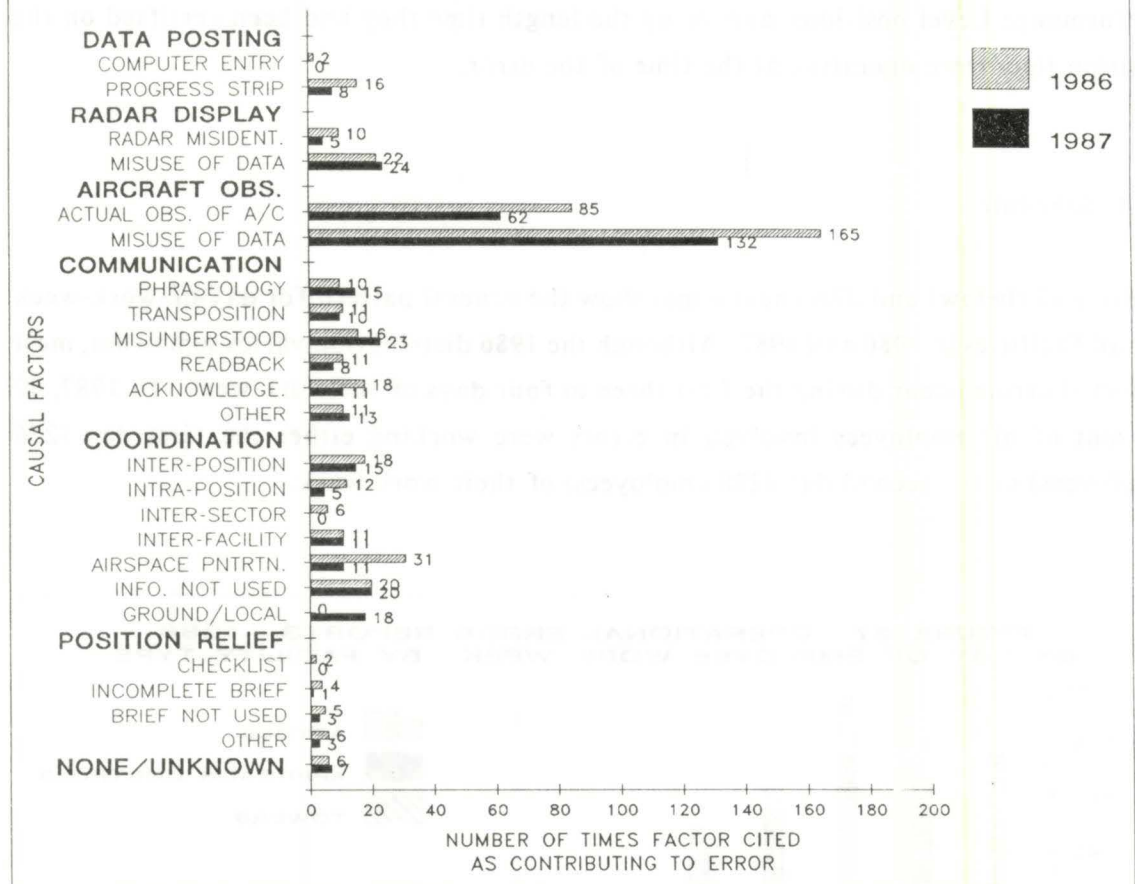
Center reports cite **radar display** and **data posting** factors twice as frequently as Terminal Facilities reports (see Figures 26B and 26C). The frequency in which these two categories were specified decreased in 1987 from 1986 numbers by 16 percent; however, in 1987, there were 405 factors associated with Center OEs listed as none or unknown.

**FIGURE 26B OPERATIONAL ERROR REPORTS 1986-1987
BY EMPLOYEE-CONTRIBUTED CAUSAL FACTOR
FOR APPROACH CONTROLS**



Approach Control OE reports also indicate that **radar display** factors were the most frequently cited problem area; radar display factor counts for 1987 stayed close to the 1986 numbers (down only 1.5 percent). In 1987, the frequency of **communication** factors increased 29 percent over 1986, **coordination** factors were mentioned almost ten percent less often, while **data posting** and **position relief** factors stayed close to the same level.

**FIGURE 26C OPERATIONAL ERROR REPORTS 1986-1987
BY EMPLOYEE-CONTRIBUTED CAUSAL FACTOR
FOR CONTROL TOWERS**



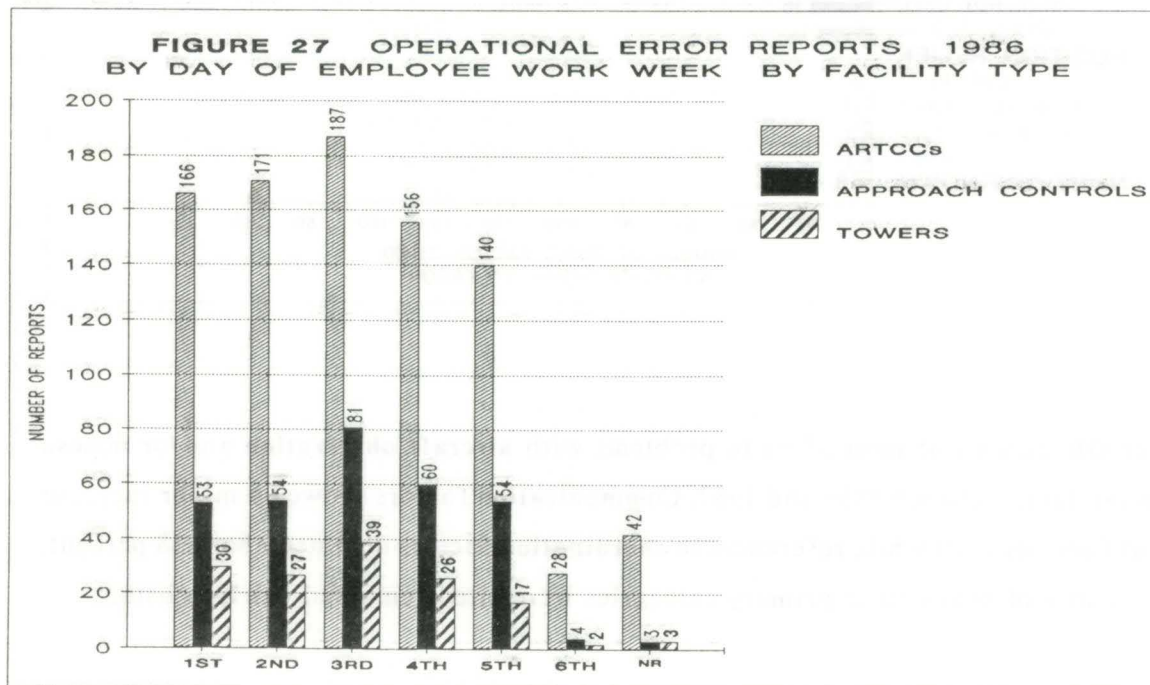
Tower OE data point most often to problems with **aircraft observation** and/or **misuse of visual data**. Between 1986 and 1987, **Communication** factors showed a minor increase (about four percent) while references to **coordination** factors declined about 18 percent. The number of times other primary categories were cited remained fairly constant.

4.4 Personnel Information

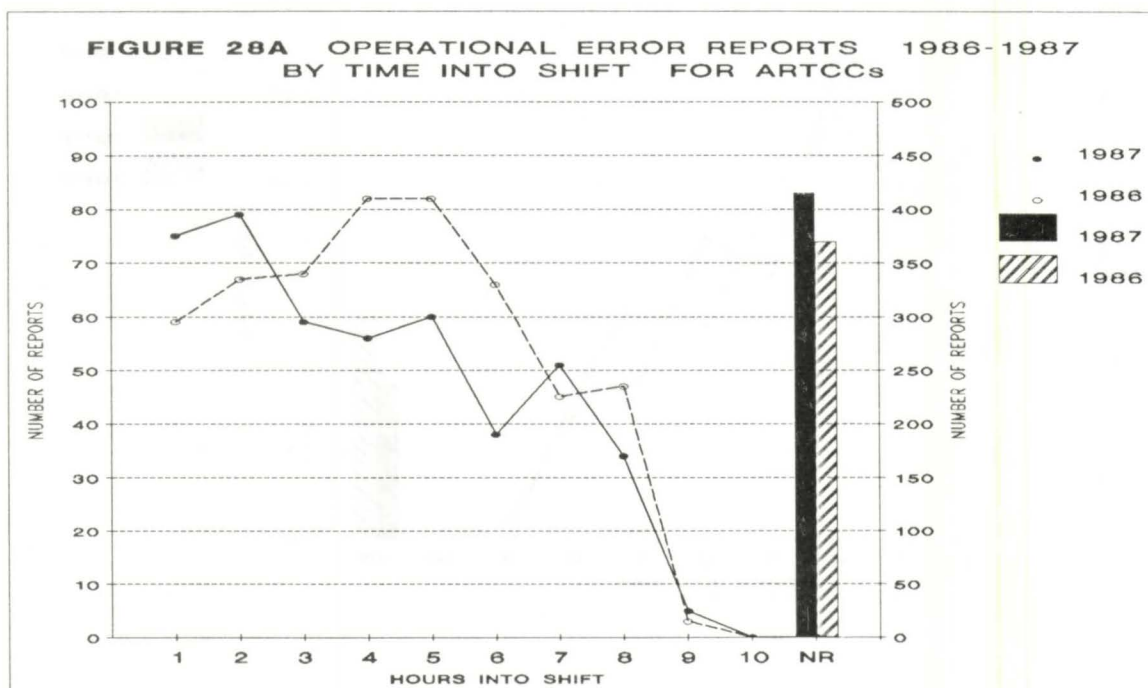
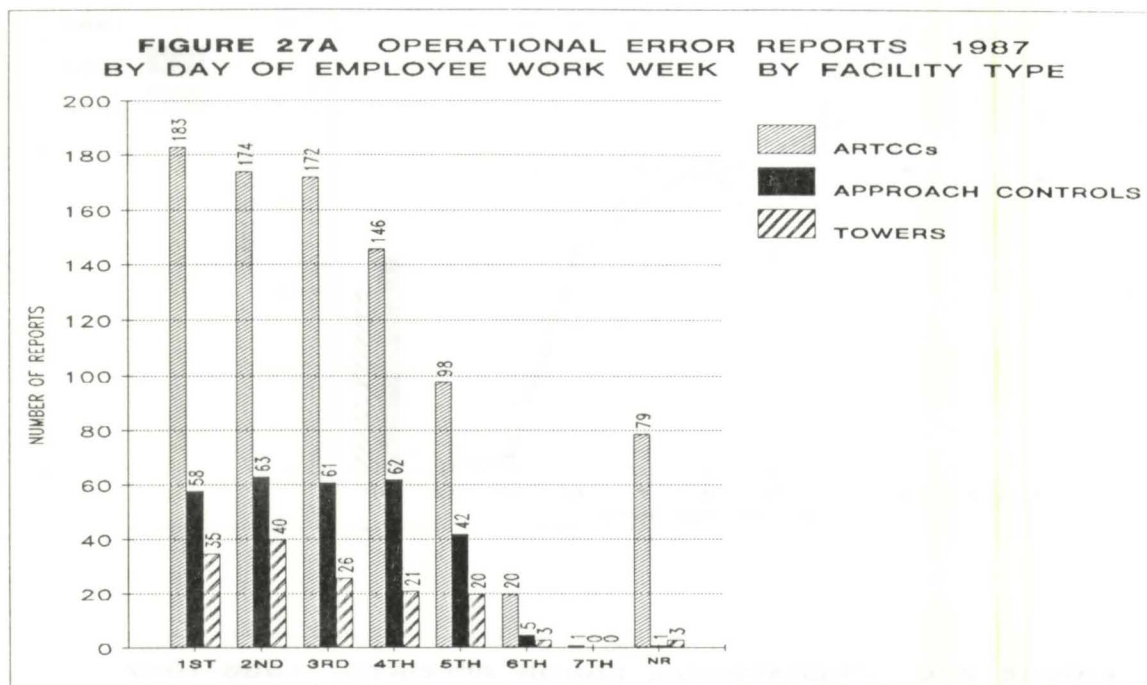
This section examines the work schedule and experience level of employees involved in operational errors. Schedule information includes: day of employee work week, hour into shift, time on position, and type of last non-control activity. The work experience of implicated employees is measured by the length of time they had held Full Performance Level positions, and/or by the length time they had been certified on the position they were operating at the time of the error.

4.4.1 Schedule

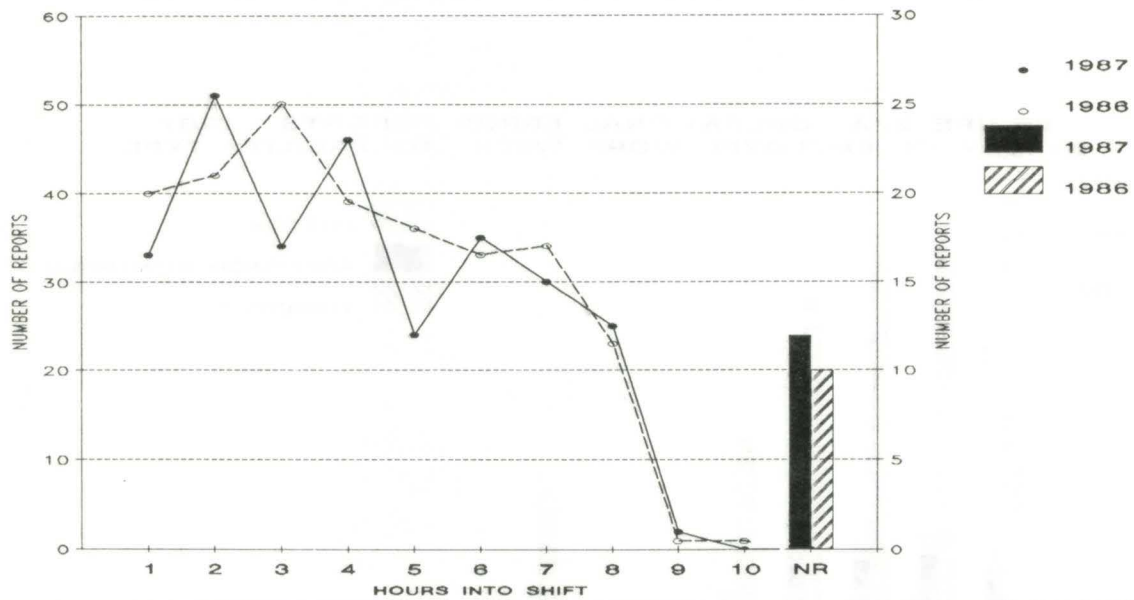
Figures 27 (below) and 27A (next page) show the general pattern for day-of-work-week for all facilities in 1986 and 1987. Although the 1986 distribution varies somewhat, most reported errors occur during the first three to four days of the work week. In 1987, 42 percent of all employees involved in errors were working either the first day (276 employees) or the second day (278 employees) of their work week.



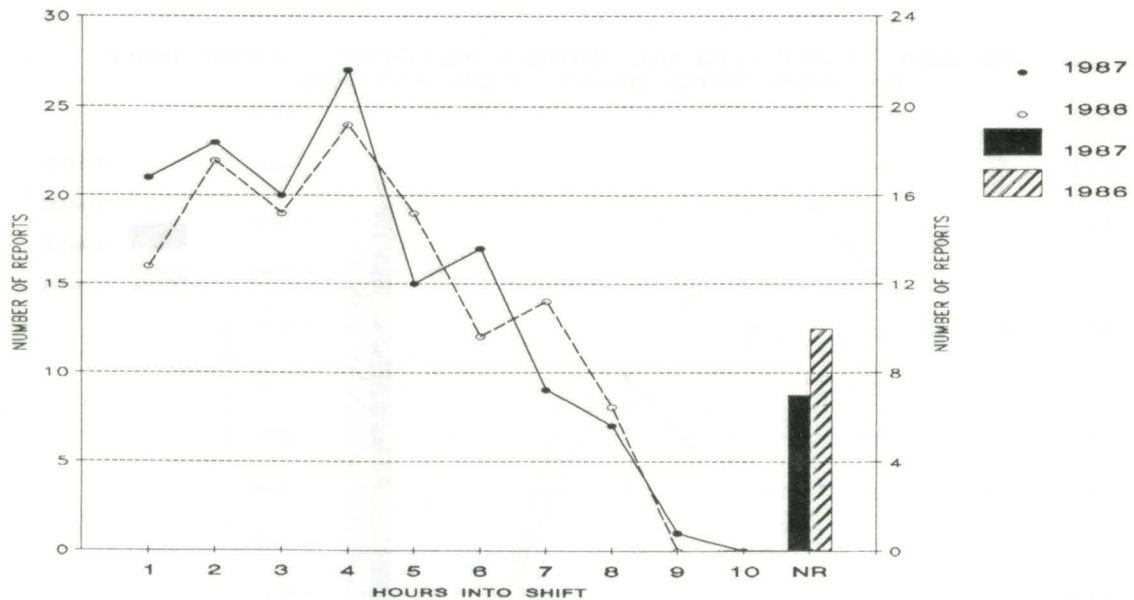
As seen in Figures 28A (bottom), 28B and 28C (following), most reported errors occurred in the earlier half of an eight-hour shift. At Centers, the majority of errors occurred before the completion of the first hour into the shift; however, Tower and Approach Control errors are shown to peak later, between one and four hours into the shift.



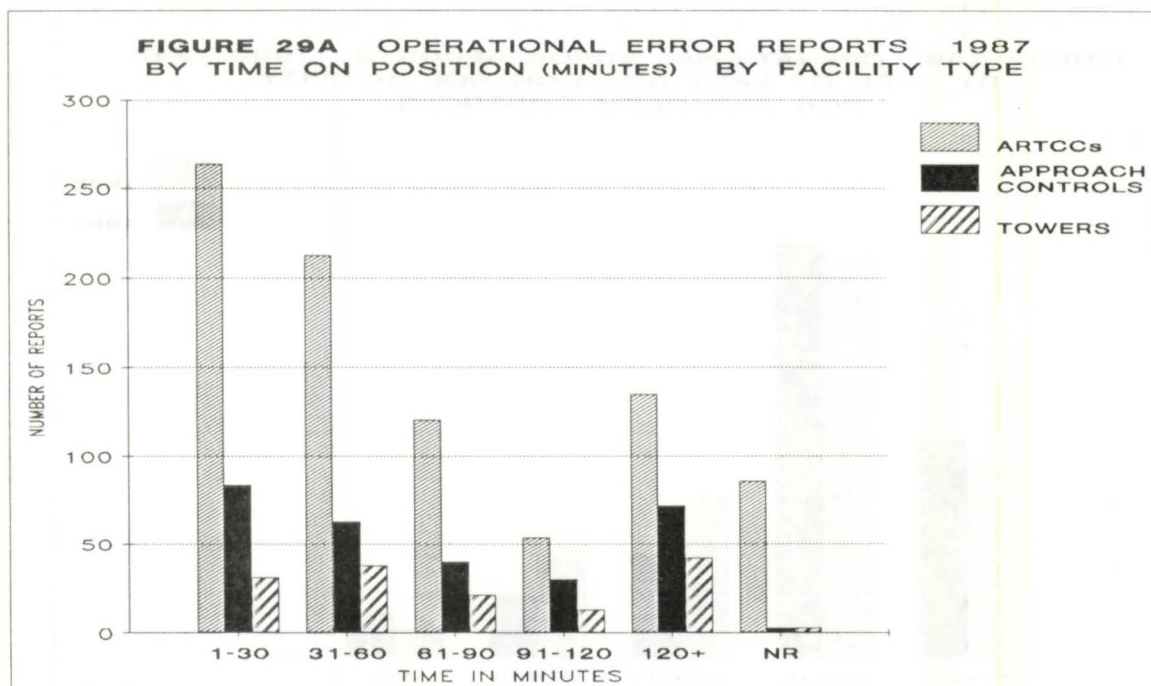
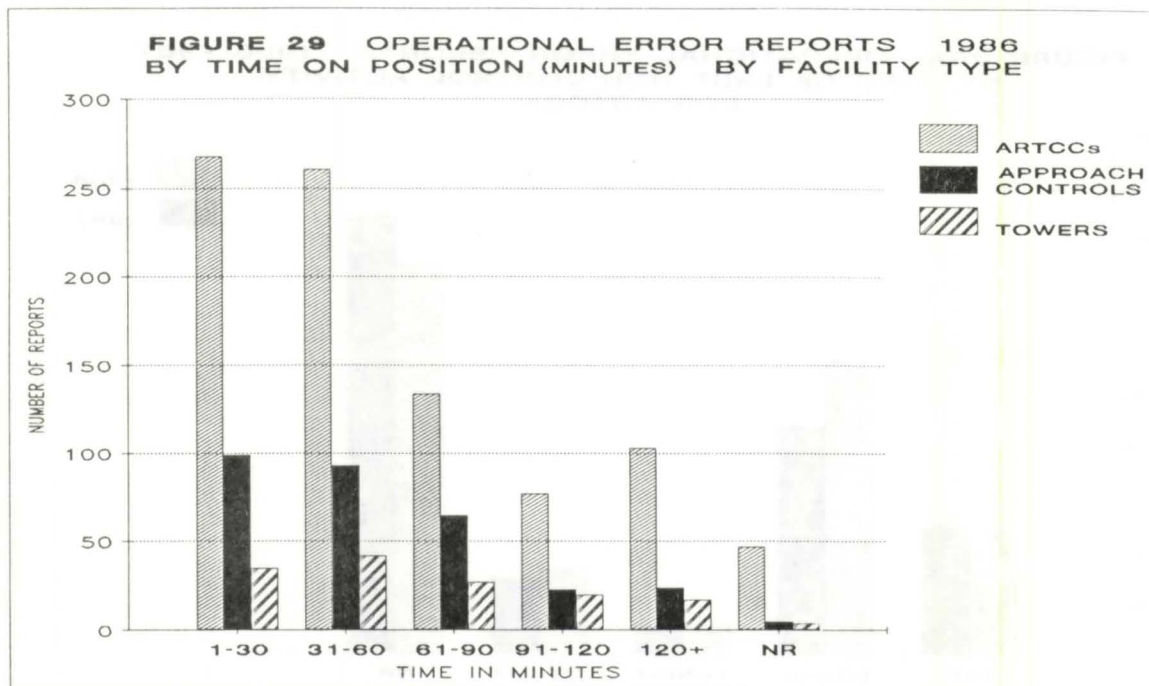
**FIGURE 28B OPERATIONAL ERROR REPORTS 1986-1987
BY TIME INTO SHIFT FOR APPROACH CONTROLS**



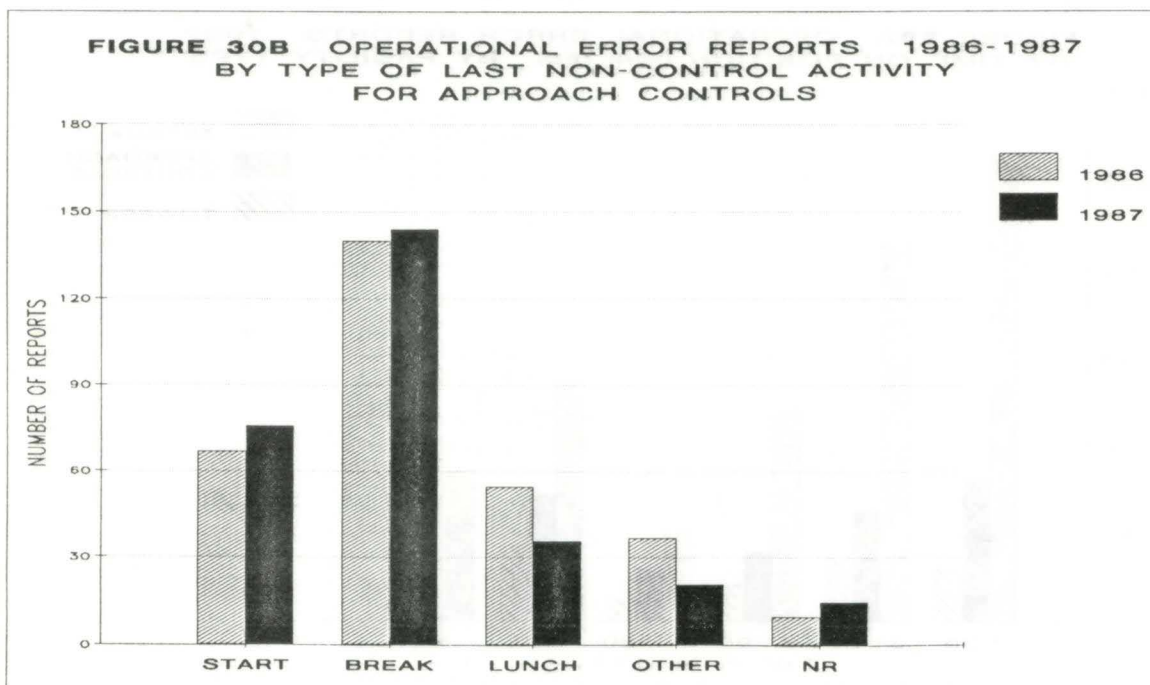
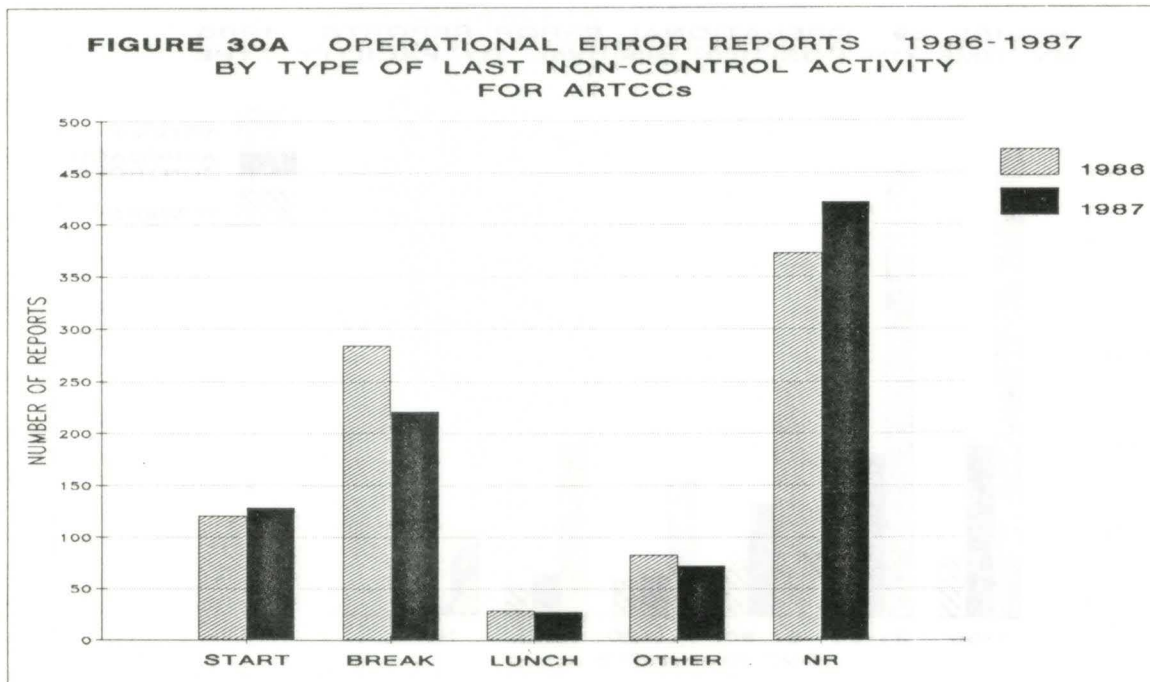
**FIGURE 28C OPERATIONAL ERROR REPORTS 1986-1987
BY TIME INTO SHIFT FOR CONTROL TOWERS**

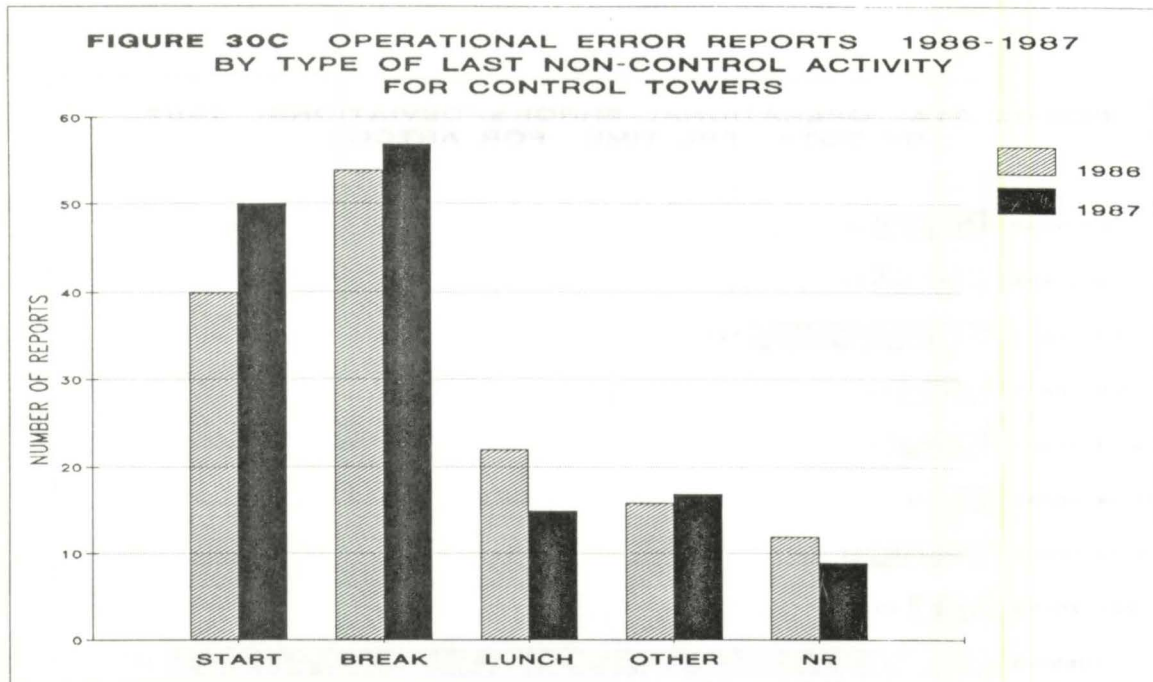


Below, Figures 29 and 29A show that for all three facility types, more errors occurred during the first 60 minutes on position.



Of the 1,314 employees involved in 1987 operational errors, the most frequently reported non-control activities engaged in before the error occurred were a **break** (32% --422), and at the **start of a shift** (19% --256).



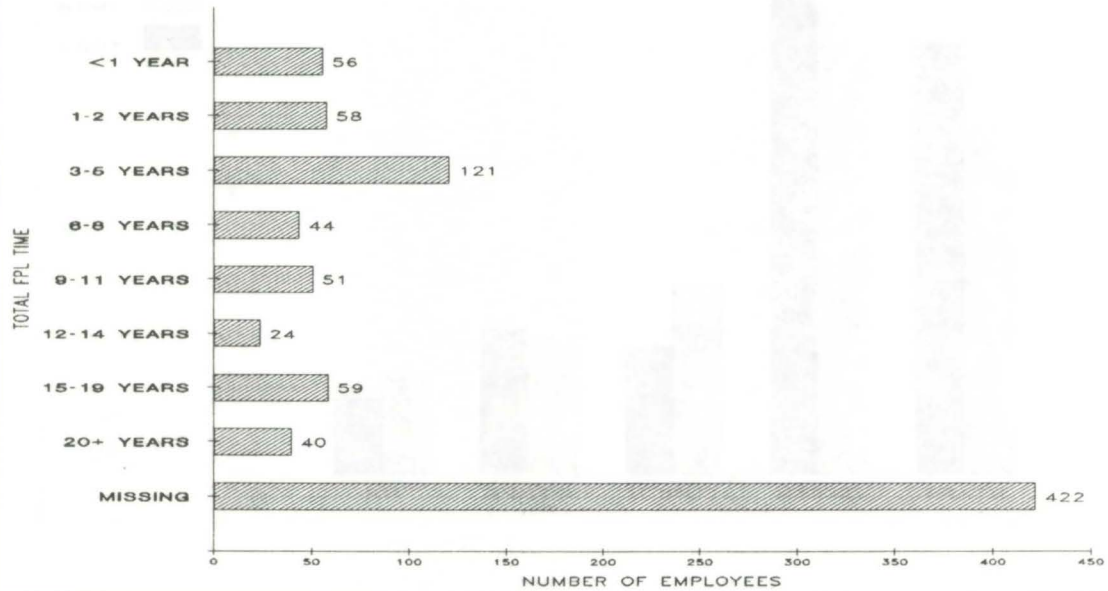


4.4.2 Experience

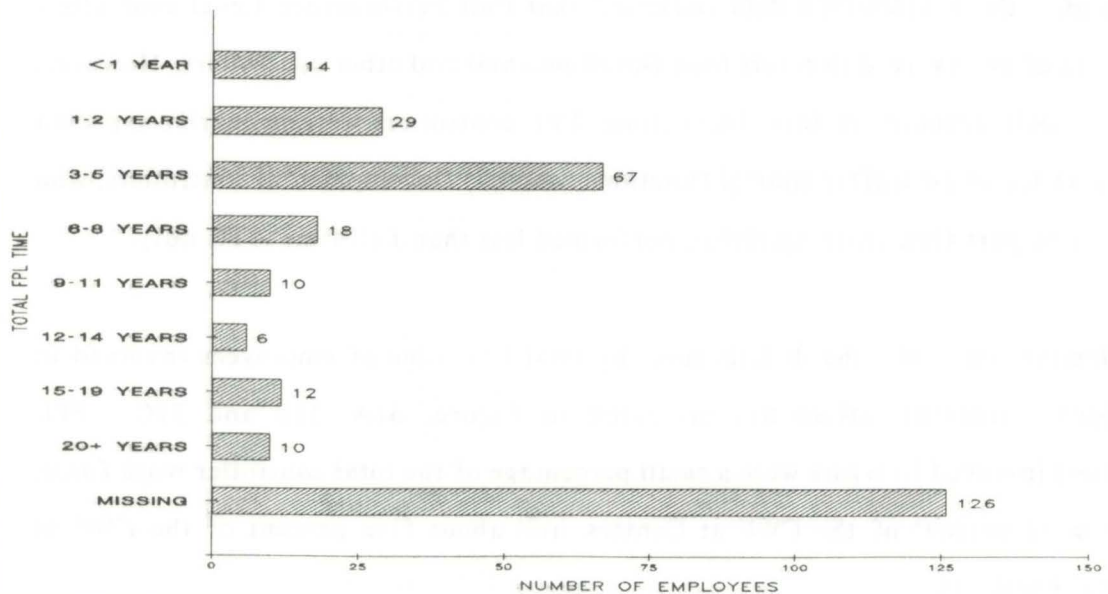
Historically, the NAIMS-OES data indicated that Full Performance Level controllers were more often involved in errors than Developmental and other controllers. However, exposure could account for this observation; FPL controllers were primarily expected to perform active air traffic control functions, whereas Developmental controllers, who were still on part-time training status, performed less than full-time ATC duty.

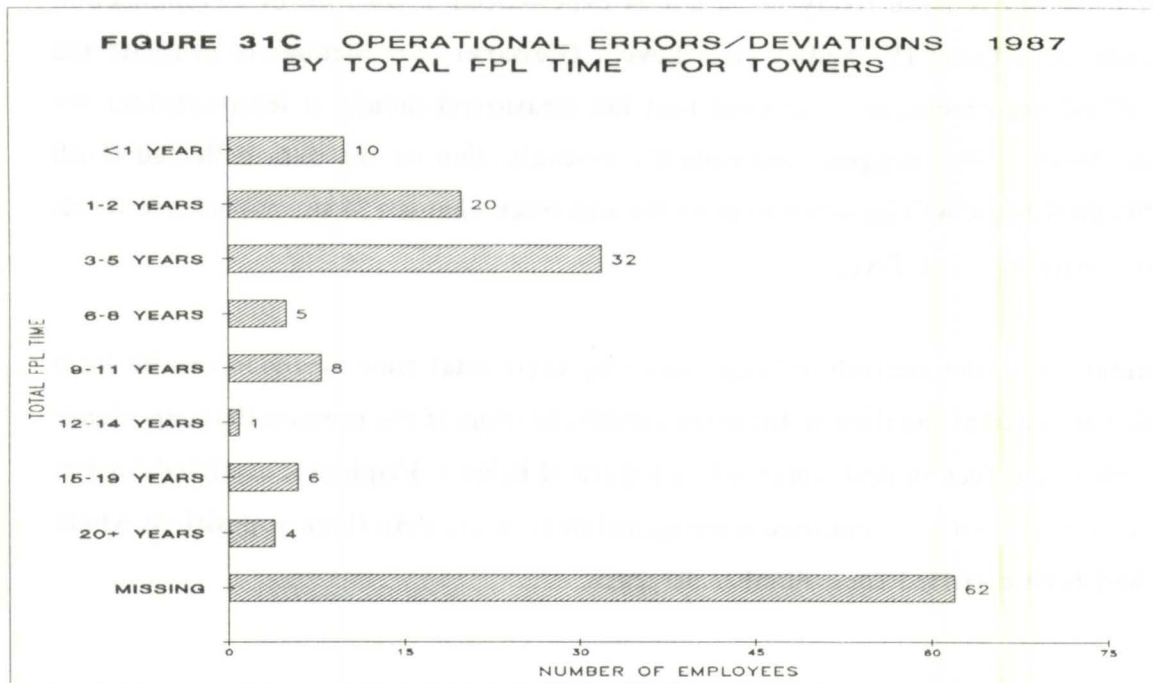
For calendar year 1987, the distributions by total FPL time of employees involved in operational errors/deviations are presented in Figures 31A, 31B and 31C. FPL controllers involved in errors were a small percentage of the total controller work force, involving 12 percent of the CWF at Centers, and about five percent of the CWF at Terminal Facilities.

**FIGURE 31A OPERATIONAL ERRORS/DEVIATIONS 1987
BY TOTAL FPL TIME FOR ARTCCs**



**FIGURE 31B OPERATIONAL ERRORS/DEVIATIONS 1987
BY TOTAL FPL TIME FOR APPROACH CONTROLS**





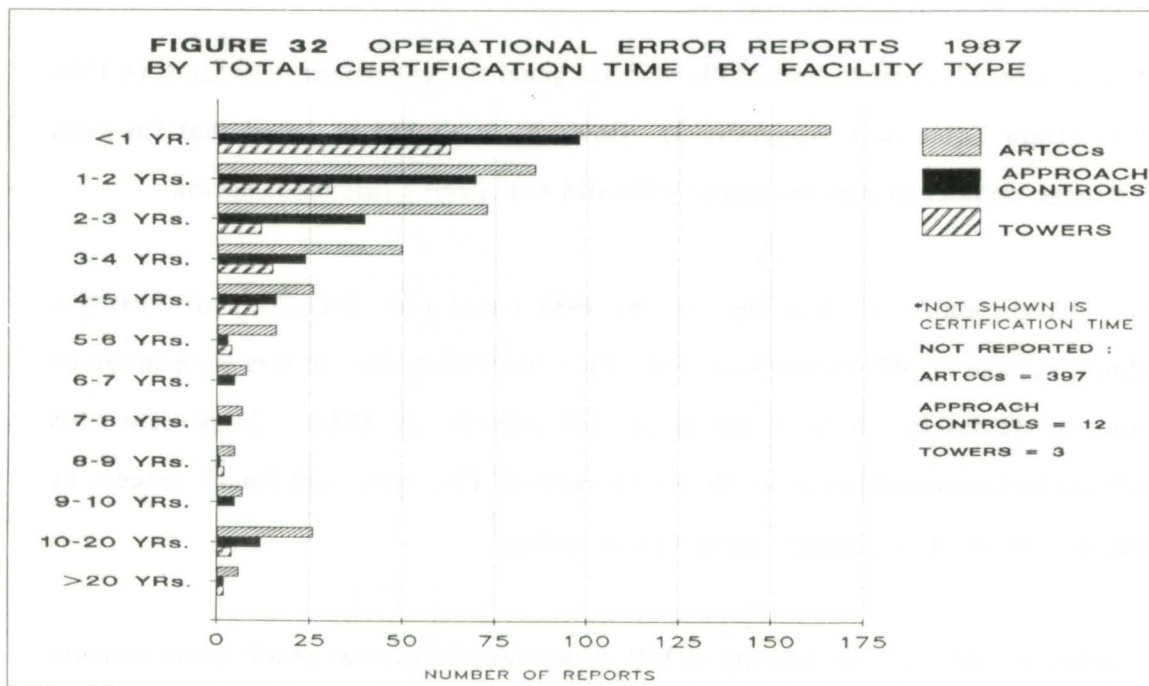
The distribution of errors by total FPL time are generally consistent between CYs 1986 and 1987 (Data Table A24, Appendix 3). However, it should be noted that for both years, a large number of reports (about 45%) did not specify this information.

Figures 31A through 31C show that by the 1988 fiscal year definition of **FPL** (see Introduction, page 8), 407 controllers with FPL time of five years or less were involved in errors or deviations (31% of the total 1319 reports for 1987). 23 percent (298 controllers) had accumulated more than five years of FPL time, and for 47 percent of the 1987 reports (614 employees) the data was missing.

Some question exists as to the validity of FPL time/classification as an adequate measure of experience. The reader should be made aware that, in reality, the term **FPL** has different meanings at different facility levels. For example, an FPL controller at a

Level I facility is more likely to be not as experienced as an FPL or developmental controller at a Level IV facility (see "Level", Glossary). To adequately evaluate the controllers' experience, it is believed that the measure(s) should at least consider the facility level. This suggests the need for re-evaluation of the data collected (both NAIMS-OES and CWF) in order to describe and track changes in the experience levels of the controller work force.

Examination of the controllers' experience by their total time certified on the local position assigned at the time of the error appears to support the premise that experience has a positive effect on performance (see Figure 32 below). Employees certified for less than a year on position committed more operational errors than those at positions where they had been certified for a number of years.



5.0 CHARACTERISTICS OF ERRORS/ERROR RATES BY INDIVIDUAL FACILITY

Facility	Errors	Rate	Facility	Errors	Rate
1001.0	100	100	1001.0	100	100
1002.0	100	100	1002.0	100	100
1003.0	100	100	1003.0	100	100
1004.0	100	100	1004.0	100	100
1005.0	100	100	1005.0	100	100
1006.0	100	100	1006.0	100	100
1007.0	100	100	1007.0	100	100
1008.0	100	100	1008.0	100	100
1009.0	100	100	1009.0	100	100
1010.0	100	100	1010.0	100	100
1011.0	100	100	1011.0	100	100
1012.0	100	100	1012.0	100	100
1013.0	100	100	1013.0	100	100
1014.0	100	100	1014.0	100	100
1015.0	100	100	1015.0	100	100
1016.0	100	100	1016.0	100	100
1017.0	100	100	1017.0	100	100
1018.0	100	100	1018.0	100	100
1019.0	100	100	1019.0	100	100
1020.0	100	100	1020.0	100	100
1021.0	100	100	1021.0	100	100
1022.0	100	100	1022.0	100	100
1023.0	100	100	1023.0	100	100
1024.0	100	100	1024.0	100	100
1025.0	100	100	1025.0	100	100
1026.0	100	100	1026.0	100	100
1027.0	100	100	1027.0	100	100
1028.0	100	100	1028.0	100	100
1029.0	100	100	1029.0	100	100
1030.0	100	100	1030.0	100	100
1031.0	100	100	1031.0	100	100
1032.0	100	100	1032.0	100	100
1033.0	100	100	1033.0	100	100
1034.0	100	100	1034.0	100	100
1035.0	100	100	1035.0	100	100
1036.0	100	100	1036.0	100	100
1037.0	100	100	1037.0	100	100
1038.0	100	100	1038.0	100	100
1039.0	100	100	1039.0	100	100
1040.0	100	100	1040.0	100	100
1041.0	100	100	1041.0	100	100
1042.0	100	100	1042.0	100	100
1043.0	100	100	1043.0	100	100
1044.0	100	100	1044.0	100	100
1045.0	100	100	1045.0	100	100
1046.0	100	100	1046.0	100	100
1047.0	100	100	1047.0	100	100
1048.0	100	100	1048.0	100	100
1049.0	100	100	1049.0	100	100
1050.0	100	100	1050.0	100	100

TABLE 5.1

FACILITY ERRORS/ERROR RATES --ARTCCs

ID	FACILITY	OE's	Operations	Facility Error Rate	Controller Work Force	Average Work Load	Controller Error Rate
ZID	INDIANAPOLIS, IN	75	1,789,703	4.19	319	5,610	0.0131
ZLA	LOS ANGELES, CA	65	1,905,540	3.41	332	5,740	0.0103
ZDC	WASHINGTON, DC	73	2,295,370	3.18	422	5,439	0.0075
ZBW	BOSTON, MA	51	1,676,245	3.04	342	4,901	0.0089
ZTL	ATLANTA, GA	73	2,436,770	3.00	458	5,320	0.0065
ZNY	NEW YORK, NY	52	1,765,011	2.95	341	5,176	0.0086
ZAU	CHICAGO, IL	64	2,353,192	2.72	451	5,218	0.0060
ZJX	JACKSONVILLE, FL	45	1,738,742	2.59	345	5,040	0.0075
ZKC	KANSAS CITY, MO	41	1,728,229	2.37	361	4,787	0.0066
ZOB	CLEVELAND, OH	48	2,272,121	2.11	461	4,929	0.0046
ZHU	HOUSTON, TX	29	1,650,464	1.76	344	4,798	0.0051
ZDV	DENVER, CO	23	1,309,314	1.76	336	3,897	0.0052
ZAN	ANCHORAGE, AK	7	427,209	1.64	146	2,926	0.0112
ZMP	MINNEAPOLIS, MN	24	1,612,999	1.49	299	5,395	0.0050
ZME	MEMPHIS, TN	25	1,829,666	1.37	320	5,718	0.0043
ZFW	FORT WORTH, TX	24	1,804,095	1.33	368	4,902	0.0036
ZAB	ALBUQUERQUE, NM	19	1,461,126	1.30	283	5,163	0.0046
ZMA	MIAMI, FL	20	1,558,347	1.28	270	5,772	0.0048
ZSE	SEATTLE, WA	14	1,247,768	1.12	236	5,287	0.0048
ZOA	OAKLAND, CA	17	1,612,308	1.05	321	5,023	0.0033
ZLC	SALT LAKE CITY, UT	10	1,084,550	0.92	210	5,165	0.0044
ZHN	HONOLULU, HI	2	503,783	0.40	64	7,872	0.0062
ZUA	GUAM	0	49,627	0	12	4,136	0.0000
ZSU	SAN JUAN, PR	11			33		
TOTALS & AVERAGE RATES		812	36,112,179	2.25	7,074	5,105	0.0076

5.1 Center Facilities

Table 5.1 (opposite left) shows the 1987 operations, average controller work loads, facility error rates (operational errors per 100,000 operations, and controller error rates (facility error rate/number of controllers) for individual ARTCCs¹. Operations ([departures x 2] + domestic overs + oceanic overs) were highest in 1987 at Atlanta Center, with 2,436,770, and lowest at Anchorage Center (ZAN), with 427,209. The greatest average work load was 5,772 operations per controller at Miami Center, and ZAN's average work load of 2,926 was the smallest.

Of the enroute facilities, Indianapolis Center (ZID) displayed the highest facility error rate (4.19 per 100,000 operations), Los Angeles (3.41*) and Washington, DC (3.18*) placed second and third in facility error rates. The three facilities with the lowest error rates were: Salt Lake City (ZLC) with 0.92*, Oakland (ZOA) with 1.05*, and Seattle (ZSE) with 1.12*. **

Indianapolis also displayed the highest controller error rate (0.013 per 100,000 operations per controller), Anchorage, with the lowest number of operations and lowest workload, ranked second in controller error rate (0.011**), while Los Angeles was third (0.010**). The smallest controller error rates occurred at: Oakland Center (0.0033**), Fort Worth Center (0.0036**), and Memphis Center (0.0043**).

¹Guam (ZUA), San Juan (ZSU), and to some extent, Honolulu (ZHN), are anomalies, as they provide both approach control and enroute functions at offshore locations in limited airspace. Also, offshore ARTCCs do not have automatic error detection systems. Therefore, they are not considered in the ranking.

* Operational Errors per 100,000 operations

** Operational Errors per 100,000 operations per Controller

TABLE 5.2

FACILITY ERRORS/ERROR RATES --APPROACH CONTROLS WITH THREE OR MORE OES

FAA Region	ID	FACILITY	OEs	Operations	Facility Error Rate	Controller Work Force	Average Work Load	Controller Error Rate
ASW	MAF	MIDLAND	3	104,071	2.88	25	4,163	0.1153
ASO	SDF	LOUISVILLE STANDIFOR	6	245,812	2.44	42	5,853	0.0581
AGL	CMI	CHAMPAIGN UNIV. ILL.	3	132,994	2.26	21	6,333	0.1074
ANM	S56	SALT LAKE CITY TRAC.	8	362,676	2.21	26	13,949	0.0848
AWP	BUR	BURBANK	10	460,048	2.17	46	10,001	0.0473
ASO	CLT	CHARLOTTE/DOUGLAS	9	453,178	1.99	50	9,064	0.0397
ASO	CVG	CINCINNATI GRTR.	7	384,706	1.82	47	8,185	0.0387
ASW	TUL	TULSA INTL.	4	233,912	1.71	31	7,546	0.0552
AGL	IND	INDIANAPOLIS	5	316,058	1.58	42	7,525	0.0377
ACE	MCI	KANSAS CITY INTL.	5	321,555	1.55	45	7,146	0.0346
ASW	SAT	SAN ANTONIO	5	360,746	1.39	47	7,675	0.0295
AEA	PHL	PHILADELPHIA	8	588,792	1.36	66	8,921	0.0206
ANM	D84	DENVER TRACON	8	594,279	1.35	40	14,857	0.0337
ANM	S46	SEATTLE TRACON	6	459,948	1.30	43	10,696	0.0303
AWP	EDW	EDWARDS RAPCON	4	307,022	1.30	29	10,587	0.0449
ASO	BHM	BIRMINGHAM	3	235,611	1.27	32	7,363	0.0398
AEA	DCA	WASHINGTON NATL.	6	515,754	1.16	64	8,059	0.0182
AWP	NZJ	COAST TRACON	5	476,317	1.05	45	10,585	0.0233
ASO	ATL	ATLANTA INTL.	10	994,567	1.01	91	10,929	0.0110
AWP	LAS	LAS VEGAS	4	407,073	0.98	37	11,002	0.0266
ASO	BNA	NASHVILLE	3	309,749	0.97	41	7,555	0.0236
AEA	N90	NEW YORK TRACON	16	1,678,941	0.95	183	9,175	0.0052
ASW	IAH	HOUSTON INTERCONT.	6	656,852	0.91	70	9,384	0.0130
ASO	JAX	JACKSONVILLE, FL	3	347,905	0.86	44	7,907	0.0196
ASO	MIA	MIAMI INTL.	6	703,909	0.85	73	9,643	0.0117
ANE	BOS	BOSTON LOGAN	5	586,968	0.85	58	10,120	0.0147
ACE	STL	ST. LOUIS INTL.	3	357,236	0.84	47	7,601	0.0179
AGL	ORD	CHICAGO O'HARE	9	1,115,266	0.81	63	17,703	0.0128
AGL	MSP	MINNEAPOLIS/ST. PAUL	4	516,550	0.77	N/A		
ASO	TPA	TAMPA	4	517,454	0.77	69	7,499	0.0112
AWP	HNL	HONOLULU	3	390,327	0.77	41	9,520	0.0187
ASO	PNS	PENSACOLA	3	414,180	0.72	45	9,204	0.0161
AEA	BWI	BALT./ WASH. INTL.	4	571,477	0.70	64	8,929	0.0109
ASO	MEM	MEMPHIS INTL.	3	431,557	0.70	53	8,143	0.0131
ASW	D10	DAL/FT.WTH TRACON	6	1,035,372	0.58	76	13,623	0.0076
AGL	DTW	DET. METRO WAYNE	3	601,895	0.50	N/A		
AWP	P50	PHOENIX TRACON	3	674,641	0.44	45	14,992	0.0099
TOTALS & AVERAGE RATES			203	18,865,398	1.08	1,841	10,247	0.0210

5.2 Terminal Facilities

There are over 450 facilities nationwide providing Approach/Tower Control service. The following Tables (5.2 and 5.3) provide data for Approach Controls and Towers where three or more operational errors occurred.

Table 5.2 (opposite left) shows the 1987 operations, average controller work loads, facility error rates*, and controller error rates** for individual Approach Controls. Operations (instrument operations + VFR aircraft receiving services) were highest at New York TRACON, with 1,678,941, and lowest at Midland, TX (MAF) with 104,701. Chicago O'Hare International had the greatest average work load of 17,703 operations per controller, and Midland with average work load of 4,163 was the least.

Midland showed the highest facility error rate (2.88*), followed by Louisville (2.44*) and Champaign University (2.26*). The three facilities with the lowest error rates were: Phoenix Tracon (0.44*), Detroit Metro (0.50*), and Dallas-Ft. Worth (0.58*).

Midland also displayed the highest controller error rate (0.115**), Champaign, IL ranked second in controller error rate (0.107**), and Salt Lake City Tracon (0.085**) was third. The lowest controller error rates occurred at: New York Tracon (0.0052**), Dallas-Ft. Worth Tracon (0.0076**), and Phoenix Tracon (0.0098**).

* Operational Errors per 100,000 operations

** Operational Errors per 100,000 operations per Controller

TABLE 5.3

FACILITY ERRORS/ERROR RATES --TOWERS WITH THREE OR MORE OEs

FAA Region	ID	FACILITY	OEs	Operations	Facility Error Rate	Controller Work Force	Average Workload	Controller Error Rate
AEA	ADW	ANDREWS AFB	3	145,876	2.06	25	5,835	0.0823
ASO	FTY	ATL. FULTON CTY.	3	159,019	1.89	14	11,359	0.1348
AWP	LAX	LOS ANGELES INTL	11	667,186	1.65	30	22,240	0.0550
ANE	BDL	BRADLEY/WINDSOR	3	185,107	1.62	43	4,305	0.0377
AEA	TEB	TETERBORO	3	214,989	1.40	21	10,238	0.0664
AWP	LGB	LONG BEACH	5	434,995	1.15	18	24,166	0.0639
ASW	HOU	HOUSTON HOBBY	3	276,760	1.08	21	13,179	0.0516
AEA	PHL	PHILADELPHIA	4	417,668	0.96	66	6,328	0.0145
AEA	JFK	J.F. KENNEDY	3	317,900	0.94	30	10,597	0.0315
ANE	BOS	BOSTON LOGAN	4	440,653	0.91	58	7,597	0.0157
AWP	SFO	SAN FRANCISCO	4	455,874	0.88	31	14,706	0.0283
AEA	EWR	NEWARK INTL.	3	377,902	0.79	32	11,809	0.0248
AWP	VNY	VAN NUYS	3	476,627	0.63	21	22,697	0.0300
ANM	DEN	DENVER STAPLETON	3	520,858	0.58	25	20,834	0.0230
AGL	ORD	CHICAGO O'HARE	3	791,886	0.38	43	18,416	0.0088
TOTALS & AVERAGE RATES			58	5,883,300	0.99	478	12,308	0.0309

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AWP	SFO	SAN FRANCISCO	4	455,874	0.88	31	14,706	0.0283
AEA	EWR	NEWARK INTL.	3	377,902	0.79	32	11,809	0.0248
AWP	VNY	VAN NUYS	3	476,627	0.63	21	22,697	0.0300
ANM	DEN	DENVER STAPLETON	3	520,858	0.58	25	20,834	0.0230
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TOTALS & AVERAGE RATES			58	5,883,300	0.99	478	12,308	0.0309

Table 5.3 (opposite left) shows the 1987 operations, average Controller work loads, facility error rates*, and controller error rates** for Control Towers. Operations (arrivals + departures) were highest in 1987 at Chicago O'Hare, with 791,886 and lowest at Andrews AFB, with 145,876. The greatest average work load was 24,166 operations per controller at Long Beach, CA, and Bradley CT's average work load of 4,305 was the smallest.

Andrews AFB had the highest facility error rate (2.06*), Atlanta Fulton County (1.89*) rated second and Los Angeles International (1.65*) was third. The three facilities with the lowest error rates were: Chicago O'Hare (0.38*), Denver Stapleton (0.58*), and Van Nuys CA (0.63*).

Atlanta Fulton County displayed the highest controller error rate (0.135**), Andrews AFB was next at 0.082**, while Teterboro placed third (0.066**). The smallest controller error rates occurred at: Chicago O'Hare (0.009**), Philadelphia (0.015**), and Boston Logan (0.016**).

* Operational Errors per 100,000 operations

** Operational Errors per 100,000 operations per Controller

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APPENDIX A

Sample Operational Error Report Forms

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

7210.41B

3/7/86

AIR TRAFFIC (AT) OPERATIONAL ERROR/DEVIATION INVESTIGATION AND REPORTING
SUBJ: PROGRAM

1. PURPOSE. This order provides and defines procedures for the investigation and reporting of operational errors/deviations that occur in the air traffic system.
2. DISTRIBUTION. This order is distributed to branch level in Air Traffic Washington and regional offices and to all air traffic field facilities.
3. CANCELLATION. This order cancels Order 7210.41A, Air Traffic Service (ATS) Operational Error/Deviation Investigation and Reporting Program, dated July 1, 1982.
4. EFFECTIVE DATE: February 10, 1986.
5. BACKGROUND.

a. The Associate Administrator for Air Traffic, in order to maintain an effective air traffic system, must identify any and all deficiencies within that system and take appropriate corrective action.

b. Since the introduction of the first Operational Error Reporting Program in 1964, the basic program has undergone many changes.

c. This order further amplifies the program by introducing changes designed to improve the reporting and analyzation of operational errors.

6. EXPLANATION OF CHANGES. This order changes Greenwich Meridian Time (GMT) to Coordinated Universal Time (UTC), the title, Chief, to Manager, and adds the requirement to provide personnel information with the Preliminary Operational Error/Deviation Report. The requirement to indicate whether a near midair collision report was or will be filed has been deleted.

7. DEFINITIONS.

a. Operational Duties. Operational duties mean duties that require an FAA employee to issue or relay an air traffic control clearance or instruction; make a control decision which will effect coordination; perform a strip marking function or update computer generated information which would be used by an air traffic controller to make a control decision; or supervise these duties.

b. Operational Error. An occurrence attributable to an element of the air traffic control system which results in less than the applicable separation minima between two or more aircraft, or between an aircraft and terrain or obstacles and obstructions as required by Handbook 7110.65, Air Traffic Control, and supplemental instructions. Obstacles include: vehicles/equipment/personnel on runways.

Distribution: A-W(AT/TO/TR)-3; A-X(AT)-3
A-FAT-O(STD)

Initiated By: AAT-60

3/7/86

c. Operational Deviation. An occurrence where applicable separation minima, as referenced in paragraph 6.b., was maintained, but when less than the applicable separation minima exists between an aircraft and protected airspace, without prior approval, or when an aircraft penetrates airspace that is delegated to another position of operation or another facility without prior approval, or an aircraft or controlled vehicle/equipment encroaches upon a landing area that is delegated to another position of operation without prior approval.

d. Operational errors/deviations are classified as follows:

(1) HUMAN operational errors/deviations are those where one or more of the following results in an error or deviation:

(a) Nonadherence to procedures in FAA Orders 7110.65, Air Traffic Control/7110.10, Flight Services/7110.83, Oceanic Air Traffic Control, and supplemental instructions;

(b) An employee acts according to an individual misinterpretation of FAA Orders 7110.65/7110.10/7110.83 and supplemental instructions; or

(c) Substandard performance by employee not covered by (a) or (b).

(2) PROCEDURAL operational errors/deviations are those where one or more of the following results in an error or deviation:

(a) Facility misinterpretation of national and/or regional policies, procedures, or instructions;

(b) Regional misinterpretation of national policies, procedures, or instructions; or

(c) Inadequate national/regional/facility policies, procedures, or instructions.

(3) EQUIPMENT operational errors/deviations are those where the failure, malfunction and/or substandard performance of pertinent NAS equipment and/or aircraft avionics results in an error or deviation.

e. Recommendations/Corrective Actions. Specific recommendations/corrective actions should be developed for each operational error/deviation occurrence. These recommendations/corrective actions should be in accord with the causal factors and system problems identified in the analysis.

(1) Recommendations/corrective actions dealing with equipment and procedural elements should include such items as new and revised procedures, equipment changes and modifications, facility layouts, environmental conditions, etc. National changes shall be coordinated and reviewed by the regional office prior to transmittal to the Associate Administrator for Air Traffic for consideration and approval. Regional changes shall be reviewed and approved by the Air Traffic Division prior to implementation.

(2) Recommendations/corrective actions concerning the "HUMAN" element shall be confined to the area of training.

(3) Disciplinary actions shall not be addressed in the final report. Guidance on discipline is contained in Order 7210.3, Facility Operational and Administration, and Order 3750.4, Conduct and Discipline.

8. FORMS AND REPORTS. The following forms are used in the Operational Error/Deviation Investigation and Reporting Program:

<u>DISTRIBUTED TO</u>	<u>FORM NUMBER</u>	<u>U/I</u>	<u>NATIONAL STOCK NO.</u>
(a) Facilities	FAA Form 7210-2 (prenumbered), Preliminary Operational Error/ Deviation Report	SH	0052-00-876-5000
(b) Regions	FAA Form 7210-2.1 (unnumbered), Preliminary Operational Error/ Deviation Report	SH	0052-00-880-7000
(c) Facilities	FAA Form 7210-3, Final Opera- tional Error/Deviation Report	BK	0052-00-879-1000
(d) Facilities	FAA Form 7210-3, Section B, Operational Error/Deviation Report	SH	0052-00-880-8000
(e) Regions	FAA Form 7210-5, Operational Error/Deviation Reclassifica- tion Report	SH	0052-00-879-2000

9. OBJECTIVES.

a. To establish an effective and standard method for investigating, reporting, and analyzing causal factors of operational errors/deviations so that deficiencies in the human, procedural, and equipment elements of the air traffic system can be identified and corrected.

b. To provide guidelines which assure that necessary corrective actions are accomplished and are effective.

c. To establish a mechanism for the periodic distribution of information regarding operational error/deviation data trends, and related remedial programs/actions.

10. RESPONSIBILITIES.

a. The Associate Administrator for Air Traffic shall be responsible for the administration of the program by establishing and maintaining an analysis element within the Headquarters Quality Assurance Staff which shall be accountable for the following functions:

(1) Maintaining a central source of operational error/deviation data.

(2) Reviewing all final operational error deviation reports for the purpose of identifying systemwide deficiencies (e.g., human, equipment, and procedural) and, based upon these reviews, initiating recommendations for corrective actions to reduce the number of operational errors/deviations.

(3) Distributing, on a quarterly basis, an Operational Error/Deviation Analysis Report. This report shall, as a minimum, identify trends concerning deficiencies specified in (2) and be sent to all regions and air traffic facilities.

(4) Conducting periodic program evaluations to determine the effectiveness and efficiency of this program.

(5) Maintaining liaison with the regions, facilities, and other Headquarters air traffic offices and services to provide continuity and followup on corrective action recommendations.

(6) Providing policy interpretations concerning the administration of this program.

b. The Regional Air Traffic Division Manager shall be responsible for the administration of the regional program by establishing an analysis element within the Air Traffic Division Evaluation Branch which shall be accountable for the following functions:

(1) Completing the following actions within 10 working days after receipt of Parts I and II, of the final report, by the Air Traffic Division. (If these actions cannot be accomplished within the 10-day time period, notify AAT-60 by telephone.)

(a) Review Parts I and II of each final operational error/deviation report and complete Part III. Completion of Part III ends the investigation process.

(b) Send copies of the final report (Parts I, II, and III) to AAT-60.

(c) Send a copy of Part III to the appropriate air traffic managers.

(d) Send a copy of Part II, Section D, and Part III, to each employee involved. Employees' copies shall be mailed to their facility's address.

(2) Conducting periodic on-site facility evaluations of investigative proceedings and program administration to determine the effectiveness and uniformity of the program. The findings of these evaluations shall be forwarded to AAT-60 within 20 working days of the evaluation.

(3) Establishing a followup mechanism to determine if corrective actions contained in final operational error/deviation reports are accomplished. All corrective actions shall specify a completion deadline.

(4) Providing regional assistance to facilities as required.

c. The facility whose personnel were responsible for the separation of the aircraft involved, regardless of whether the error/deviation occurred in that facility's airspace, shall investigate and prepare the preliminary and final reports. Additionally, the air traffic manager shall be responsible for the administration of the program by:

(1) Designating the Investigator-In-Charge (IIC). The IIC may be designated on a rotational or permanent basis. The IIC's function shall be performed by supervisory personnel or the facility staff. If the only facility officer is the air traffic manager, and there are no assigned supervisors, then he/she would perform the IIC's functions.

(2) Designating an investigative team to assist the IIC when the complexity of an operational error/deviation requires such a team. The air traffic manager shall determine the size and composition of each investigative team. The purpose of the investigative team is to assist the IIC in the collection of the data regarding the occurrence.

(3) Analyzing the data submitted by the IIC in Part I of the final operational error/deviation report to determine:

(a) The classification of the occurrence; i.e., operational error, operational deviation, pilot deviation, or no occurrence;

(b) The categorization of the operational error/deviation; i.e., human, procedural, equipment, or any combination thereof;

(c) The causal factor(s) of the operational error/deviation; and

(d) The recommendations and corrective actions to be taken to prevent a recurrence of the operational error/deviation.

(4) Completing Part II of the final operational error/deviation report and submitting Parts I and II to the regional air traffic division manager within 30 days of the date when the occurrence was reported.

(a) Copies of Part II, Sections A, B, and C, shall be given to each employee involved before completing Section D and forwarding Parts I and II to the regional air traffic division manager. If the employees do not feel that the facts of the report are correct, they may submit their comments in writing to the air traffic manager within 5 days of receipt.

(b) The air traffic manager shall consider these comments in his/her deliberations before completing Section D and shall append the employee's comments to Part II.

(5) Establishing a method of followup to evaluate the effectiveness of the local recommendations/actions which result from the investigation.

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(6) If the Preliminary Operational Error/Deviation Report indicates that another facility is involved in the occurrence, the air traffic manager of the reporting facility shall confer as soon as it is feasible with the other air traffic manager to determine the following: the scope of the other facility's investigative effort and how long it will take. (This includes gathering data and completing Parts I and II of FAA Form 7210-3, Final Operational Error/Deviation Report.) If the reporting air traffic manager and the other air traffic manager cannot concur in any phase of their respective investigations, their differences shall be reported to the regional air traffic division manager for a resolution.

d. The air traffic manager of another involved facility shall be responsible for the administration of the program by providing the reporting facility with information and assistance as required. This may require an investigation on the same scale as the reporting facility. If this is necessary, the air traffic manager shall have the same responsibilities as defined under Item 8.c.(1) through (5).

e. The IIC is responsible for conducting a complete investigation of the occurrence and shall:

(1) Ensure that all pertinent data has been collected and documented in Part I of the final report and distributed as follows:

(a) Completed Part I to the air traffic manager.

(b) Each involved employee shall receive a copy of Part I.

(2) When another facility is involved, ascertain the scope of their investigation and coordinate the exchange of data and assistance as required.

(3) Assign duties to team members.

(4) Conduct interviews as required.

f. The investigation team members shall be responsible for:

(1) Assisting the IIC and performing and completing all assigned tasks.

(2) Remaining under the supervision and jurisdiction of the IIC until relieved by the IIC or the air traffic manager.

g. The facility supervisor-in-charge of the watch, or in his/her absence, the acting supervisor-in-charge, in whose area of responsibility a possible error/deviation may have occurred, is responsible for:

(1) Determining the validity of the occurrence and, if valid, completing the following:

(a) Relieve any employee(s) who appears to have been involved in the operational error/deviation from all duties, as promptly as operational and staffing conditions permit, and in accordance with Order 7210.3, Facility Operation and Administration;

(b) Ensure that the FAA Form 7210-2, Preliminary Operational Error/Deviation Report, FAA Form 7210-2, is completed within 2 hours of the time the supervisor was notified of the occurrence;

(c) Notify the FAA Washington Operations Center by telephone with the information on FAA Form 7210-2 within 2 hours of the reported occurrence; and

(d) Notify the air traffic manager and the regional air traffic division manager of the occurrence.

(2) If another facility is involved, that facility shall provide the reporting facility's supervisor with all the pertinent data necessary for the timely completion of the preliminary report.

(3) Conducting interviews as required.

h. Employee. Any employee who is aware of an occurrence that they believe to be an operational error/deviation shall immediately report that occurrence to the supervisor-in-charge or, in their absence, the acting supervisor-in-charge of the watch.

11. INTERVIEWS. Certain information which is necessary to complete the preliminary and final operational error/deviation reports must be obtained from the employee(s) involved. This information can be obtained through an interview with the employee(s). If an interview is conducted, the following shall apply:

a. An employee may elect to have another employee present during the interview.

b. Interviews shall only be conducted by supervisory personnel, designated IIC, and air traffic managers. Investigative team members may participate in the interviews.

c. Every effort shall be made to conduct interviews during the employee's regularly assigned shift and within the employee's assigned facility.

d. An employee interviewed may submit a written statement and/or recommendation(s) concerning the facts surrounding the occurrence. The statement and/or recommendation(s) shall be on FAA letterhead paper and be attached to FAA Form 7210-2. It shall include the employee's name, position function, and location of employment. The employee's signature shall be affixed at the end of the statement and dated. Recommendations should concern corrective action(s) that can be undertaken to preclude a similar occurrence. The written statement and/or recommendation(s) shall be submitted to the IIC within 5 days of the date the employee was interviewed. All written statements and/or recommendations shall become part of the investigative data and shall be attached to the final operational error/deviation report.

e. The statement in Appendix 1 shall be read or given to an employee before conducting an interview.

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12. SUPPLEMENTS. The only supplements to this order which do not require prior written approval from the Associate Administrator for Air traffic are those which provide for local instructions pertaining to the notification procedures and personnel assignments necessary to implement this program.

13. APPENDICES. User Appendices 2-4 as instructions in lieu of the instructions on the current forms.

Appendix 1 - Interview Statement

Appendix 2 - Instructional Guide for Preliminary Operational Error/
Deviation Report (RIS: AT 7210-3)

Appendix 3 - Instructional Guide for Operational Error/Deviation
Reclassification Report (RIS: AT 7210-3)

Appendix 4 - Instructional Guide for Final Operational Error/Deviation
Report (RIS: AT 7210-3)



Walter S. Luffsey
Associate Administrator for Air Traffic

3/1/86

APPENDIX 1

INTERVIEW STATEMENT

The information given by you will become a part of the records in the Privacy Act System OPM/GOV'T-1. The FAA's authority to obtain the information is contained in 49 U.S.C., Sections 1344, 1348, and 5 U.S.C. 301. Providing of this information is mandatory under Para. 31 of FAA Order 3750.4, Conduct and Discipline Handbook. The principal use of the information provided is to determine trend/causes and recommend ATC system improvement. Information provided will be disclosed as a routine use in accord with the system description of OPM/GOV'T-1. Under this authority, disclosures may be made to union representatives and to the National Transportation Safety Board. Failure to provide the information requested will result in disciplinary action under FAA regulations.

APPENDIX 2

INSTRUCTIONAL GUIDE FOR

PRELIMINARY OPERATIONAL ERROR/DEVIATION REPORT (RIS: AT 7210-3)

GENERAL INFORMATION

Any employee who is aware of an occurrence that they believe to be an Operational Error/Deviation as defined in the Air Traffic (AT) Service Operational Error/Deviation Investigation and Reporting Program Order 7210.41, shall immediately report the occurrence to their supervisor-in-charge of the watch.

If the supervisor determines that the reported occurrence is valid the Preliminary Operational Error/Deviation Report, FAA Form 7210-2, must be completed within 2 hours from the time the supervisor was advised, and called into FAA Washington Headquarters as follows:

WHEN	CALL	TELEPHONE NUMBERS
Monday - Friday 0800 1830 EST/EDT	AAT-60	FTS 426-3353 Commercial 202-426-3353
After 1830 EST/EDT Weekends and Holidays	Washington Operations Center	FTS 393-4444/4445 Commercial 202-426-3333/2145 202-393-4444-4445

REPORT NUMBER

Only air traffic field facilities will be supplied with prenumbered Preliminary Operational Error/Deviation Report forms (FAA Form 7210-2). Regional and headquarter staffs will be supplied numberless forms. The preliminary number shall be recorded on FAA Form 7210-3 (Final Operational Error/Deviation Report) and any other correspondence pertaining to this incident. If more than one facility is involved in this incident only one preliminary report shall be filed. The number of this report shall be recorded on FAA Form 7210-3 and any correspondence filed by the other facilities.

1. CLASSIFICATION

Indicate the classification of the occurrence by placing an "X" in the appropriate box.

2. DATE AND TIME OF THE OCCURRENCE

DATE: Determine the date based on Coordinated Universal Time (UTC) and enter the date as follows:

Month Day Year

Example: July 1, 1981

Enter: 07 01 81
MO DAY YR

TIME: Using the 24 hour clock enter the time of the occurrence in UTC and Local time.

Example: Time of occurrence 6:38 p.m.

Enter: 06 38 18 06 38 18
UTC LOCAL

3. RESPONSIBLE FACILITY

Enter the 3-letter location identifier.

Example: Los Angeles ARTCC

Enter: ZLA

4. WERE OTHER FACILITIES INVOLVED?

Indicate if other facilities were involved by placing an "X" in the appropriate box. If YES, enter the three-letter location identifier.

5. REPORTING FACILITY

If other than the responsible facility.

6. OCCURRENCE REPORTED BY

Indicate the person who first brought the incident to the supervisor's facility's attention by placing an "X" in the appropriate box.

7. SUMMARY OF WEATHER INFORMATION

If the weather information is not available place an "X" in the box. Otherwise describe the pertinent weather data in plain language; consider but do not limit the data to SIGMETs, PIREPs, and flight conditions reported within a 50 mile radius of the location of the occurrence.

Example:

Sky partially obscured, measured ceiling two hundred overcast, visibility one and one half, very light snow.

or

Thunderstorms throughout the area. Light chop ten west of Cleveland at flight level three one zero. Boring 727.

8. ALTITUDE/FLIGHT LEVEL OF THE OCCURRENCE

Indicate the level at which the conflict occurred as follows:

IF OCCURRENCE HAPPENED	ENTER
ON THE AIRPORT SURFACE	[SFC]
AIRPORT SURFACE TO 949 AGL	NEAREST 100 FT LEVEL Example: 849 Enter: 0005
950 AGL AND ABOVE	NEAREST 1000 FT LEVEL Example: 11200 Enter: 1100 Example: 33000 Enter: 3300

9. LOCATION OF OCCURRENCE

Indicate whether the incident occurred "in the air" or "on the surface" by placing an "X" in the appropriate box, then complete that section.

A. In the Air

FIX: The fix provides a reference as to where the occurrence happened. Enter a 3 or 5 letter location identifier whenever possible to clearly identify the fix.

Example: Cleveland VORTAC

Enter: 00CL

Next to Intersection

Enter: NEXINT

DIRECTION: If the fix used is an airport, intersection or waypoint that does not have prescribed radials or compass rose, use the 16 points of the compass to establish the direction. Specify the direction from NAVAIDS (i.e. VOR, VORTAC) in degrees using 3 digits/characters.

Example: 10° radial

Enter: 010

North northeast

Enter: NNE

DISTANCE: Specify the distance of the occurrence from the fix in nautical miles.

Example: 1 N.M.

Enter: 0101

20 N.M.

Enter: 020

B. On the Surface

INTERSECTION: Enter the airport intersection closest to the occurrence.

RUNWAY: Enter the runway(s) closest to the occurrence. Runway 9 would be entered as 00009; if it was at the intersection of runways 9 and 17 it should be entered as 000917. Runway 9L is entered as 00009L. Enter runways 9L and 17R as 09L17R. Use a slant (/) to separate single numbered runways; runways 1 and 8 would be entered 0001/8.

TAXIWAY: If the taxiway is described using the phonetic alphabet, enter the letter, not the word.

Example: Echo

Enter: 0101E

If the description is alphanumeric show it as:

Example: Hotel 1

Enter: 0101H1

10. CLOSEST PROXIMITY

Place an "X" in the appropriate box i.e., "distance in the air" or "on the surface", then complete that section.

A. Distance in the Air

VERTICAL: Vertical distance is measured in feet

Example: 1 foot

Enter: 0101011

FEET

Example: 10 feet

Enter: 0101110

FEET

HORIZONTAL: Horizontal distance may be measured in feet or miles.

Example: 1500 feet

Enter: 1151010 FEET

Example: 2 1/2 Miles

Enter: 01012 . 510 MILES

Example: 3 Miles

Enter: 01013 . 010 MILES

B. Surface

Describe, in plain language, the closest proximity to other aircraft, terrain, obstacles, or obstruction, etc.

11. AIRCRAFT DATA

Enter the aircraft data for each aircraft involved in the incident

A. Identification

Enter aircraft identification.

Example: United Airlines Flight 21

Enter: 010101U1A23

B. Type/Suffix

Enter the type of aircraft and transponder equipment capability

Example: Boeing 727 with alpha capability

Enter: 010101B7121A

C. through L. — Self Explanatory

M. Remarks

This allows for clarification of any items. Identify which aircraft the remarks pertain to.

More than Two Aircraft: There may be more than two (2) aircraft involved in the occurrence, which will require the use of the continuation page.

N. Aircraft and Obstruction/Obstacles

If the error or deviation involved an aircraft and terrain, obstruction, or obstacle place an "X" in the appropriate box.

12. OPERATIONS

A. Was pre-duty familiarization properly accomplished?

Indicate by placing an "X" in the appropriate box. If NO explain why it was not properly accomplished.

B. Was involved specialist(s) operating a combined position/sector of operation?

Indicate by placing an "X" in the appropriate box. If YES explain the position combinations and why the positions were consolidated (e.g., staffing, equipment, traffic, etc.)

13. WASTRAINING INVOLVED?

Place an "X" in the appropriate box. If OTHER and space provided is insufficient, continue explanation in item 20.

14. TYPE OF AIRSPACE

Indicate the type of airspace where the occurrence happened by placing an "X" in the appropriate box.

16. PROCEDURES INVOLVED**A. Type of Control Provided**

Indicate the type of control that was being provided by placing an "X" in the appropriate box.

IF	THEN, Place an "X" In
One, or more, of the involved aircraft was identified on a radar display and could have been provided a radar service until either of the following occurred: • Radar identification was lost. • Radar service to the aircraft was terminated for any reason.	RADAR
Self Explanatory	NON RADAR

B. Specify Separation Involved

Specify the correct separation minima applicable and cite the appropriate manual handbook paragraph reference.

IF	THEN, Complete
A national procedure(s) is involved	Handbook Paragraph
A regional or local procedure(s) is involved. This includes whether the procedure(s) involved is contained in a letter of agreement, local order or directive—include the order number—date of the document—any addendums, etc.	Other

16. EQUIPMENT**A. Type**

Indicate the status/quality of the equipment at the time of the occurrence by placing an "X" in the appropriate box under each type of equipment. Provide an explanation for each type of equipment which was operating at a level of less than good (GOOD is considered satisfactory).

B. Was Radar in Use?

Indicate if radar was in use for any of the aircraft involved in the occurrence by placing an "X" in the appropriate box. If YES indicate the type of radar that was in use by placing an "X" in the appropriate box.

C. Was Radar Transition In Progress?

Indicate if a radar transition was in progress when the occurrence happened by placing an "X" in the appropriate box. If YES place an "X" in the box appropriate to the radar from which the transition was occurring and an "X" in the box appropriate to the radar to which the transition was occurring.

17. MSAW/EMSAW (Complete if applicable.)**A. Available**

Availability pertains to the capabilities of the "Automation System" NOT the transponder status of the aircraft. Indicate if MSAW/EMSAW was available by placing an "X" in the appropriate box. If NO provide an explanation.

B. Activated

This concerns the status of Mode "C" capability in the aircraft or "MIN altitudes," etc. Indicate if MSAW/EMSAW was activated by placing an "X" in the appropriate box. If NO provide an explanation.

C. Suppressed

Indicate if MSAW/EMSAW was suppressed by placing an "X" in the appropriate box. If YES provide explanation.

18. CONFLICT ALERT (Complete if applicable.)**A. Available**

Availability pertains to the capabilities of the "Automation System" NOT the transponder status of the aircraft. Indicate if Conflict Alert was available by placing an "X" in the appropriate box.

B. Activated

The Mode "C" status of the aircraft may be considered here. Indicate if Conflict Alert was activated by placing an "X" in the appropriate box. If NO provide an explanation.

C. Suppressed

Indicate if Conflict Alert was suppressed by placing an "X" in the appropriate box. If YES, provide an explanation.

19. WERE NAVAIDS A FACTOR

Indicate if NAVAIDS were a factor in the occurrence by placing an "X" in the appropriate box. If YES, provide an explanation.

20. SUMMARY OF PERTINENT EVENTS

Provide a brief chronological sequence of pertinent events leading to the error or deviation. Keep the narrative brief, and describe the factors involved. At this point, we are interested in what happened—not personal responsibility. Also include the following information:

- The name of the individual(s) involved and whether they are full performance level or a team supervisor/assistant chief.
- Experience level as a full performance level—total time.
- Time on the position prior to the incident.
- Volume of traffic being worked at the time of the incident, if a numerical value is not available, use light, moderate, or heavy.
- Weekly work schedule of individual(s) involved, i.e., third day of a 6-day week, first day back after one day off, etc.
- Number of days per week and hours per day working.

21. OFFICIAL MAKING TELEPHONE NOTIFICATION

Indicate the time the call is made. Enter the date (month, day, year), time (UTC - 24 hour clock), and name-title of person making the telephone notification.

22. RECEIVING PERSON'S NAME—Self Explanatory

3/7/86

PERSONNEL INFORMATION

PRELIMINARY OPERATIONAL ERROR/DEVIATION REPORT

This information is to be provided for each controller who may be involved, with the preliminary report and is to include all items listed below. In cases where part of the required information is not available at the time of the initial notification, it shall be provided as soon as possible to the regional air traffic division manager who will forward it to AAT-60.

1. Name
2. FPL/AS/AM/DEV/ATM/Staff
3. Total Time (years/months) Certified on the Position of Operation Assigned to at the Time of the Incident
4. Time (hours/minutes) Assigned to the Position of Operation at the Time of the Incident
5. Total Time as an ATCS
6. Traffic Volume (Number of Aircraft)
7. Date of Last Over-The-Shoulder (Prior to and Not as a Result of This Incident)
8. Date of Last Tape Talk
9. List All Other Operational Errors/Deviations Involved in Within Last 2 Years (If None, Indicate "None")
10. If Certified on the Assigned Position of Operation Less Than 1 Year, Indicate Total Training Time on the Position
11. Weekly Work Schedule (i.e., Third Day of Five)
12. Indicate if Working Overtime
13. Date of Last Controller Physical

REPORT NUMBER

(RIS: AT 7210-3)

FAA Form 7210-2.1 (7-81) SUPERSEDES WA FORM 7210-1 AND ALL LOCAL FORMS

Page 1

PRELIMINARY OPERATIONAL ERROR/DEVIATION REPORT
(RIS: AT 7210-3)

REPORT NUMBER

12. OPERATIONS

A. WAS PREDEUTY FAMILIARIZATION PROPERLY ACCOMPLISHED

- ☐ YES
☐ NO (If no, explain)

B. WAS INVOLVED SPECIALIST(S) OPERATING A COMBINED POSITION/SECTOR OF OPERATION

- ☐ YES (If yes, explain)
☐ NO

13. WAS TRAINING INVOLVED

- ☐ YES (If yes, specify type)
☐ NO

☐ TAP

☐ OJT

☐ OTHER: _____

☐ CK/OUT

14. TYPE OF AIRSPACE

☐ TERMINAL CONTROL AREA (TCA)

☐ MILITARY OPERATIONS AREA (MOA)

☐ RESTRICTED AREA

☐ TERMINAL RADAR SERVICE AREA (TRSA)

☐ POSITIVE CONTROL AREA (PCA)

☐ OTHER: _____

15. PROCEDURES INVOLVED

A. TYPE OF CONTROL PROVIDED

- ☐ RADAR
☐ NONRADAR

B. SPECIFY SEPARATION MINIMA INVOLVED

HANDBOOK [] [] [] [] [] []
PARAGRAPH [] [] [] [] [] []

OTHER (Specify): _____

16. EQUIPMENT

A. TYPE	GOOD	FAIR	POOR	OUT OF SERVICE	(If other than good, explain)
RADIO COMMUNICATIONS					
LANDLINE COMMUNICATIONS					
COMPUTER					
RADAR					

B. WAS RADAR IN USE

☐ YES (If yes, enter source)

☐ NO

☐ DARC

☐ NARROWBAND

☐ BROADBAND

☐ ARTS II

☐ ARTS III

☐ ARTS IIIA

☐ BRITE

☐ TPX-42

C. WAS RADAR TRANSITION IN PROGRESS

☐ YES (If yes, complete the following)

☐ NO

	DARC	NARROWBAND	BROADBAND	ARTS II	ARTS III	ARTS IIIA	BRITE	TPX-42
FROM	☐	☐	☐	☐	☐	☐	☐	☐
TO	☐	☐	☐	☐	☐	☐	☐	☐

17. MEAW/EMSAW (Complete if applicable)		18. CONFLICT ALERT (Complete if applicable)	
A. AVAILABLE ☐ YES ☐ NO (If no, explain)		A. AVAILABLE ☐ YES ☐ NO (If no, explain)	
B. ACTIVATED ☐ YES ☐ NO (If no, explain)		B. ACTIVATED ☐ YES ☐ NO (If no, explain)	
C. SUPPRESSED ☐ YES (If yes, explain) ☐ NO		C. SUPPRESSED ☐ YES (If yes, explain) ☐ NO	
19. WERE NAVAIDS A FACTOR ☐ YES (If yes, explain) ☐ NO			
20. SUMMARY OF PERTINENT EVENTS			
21. OFFICIAL MAKING TELEPHONE NOTIFICATION	DATE (GMT)	TIME (GMT)	NAME AND TITLE (Please type or print)
22. RECEIVING PERSON'S NAME		SIGNATURE	

REPORT NUMBER

FAA Form 7210-2.1 (7-81)

DATE _____

FACILITY _____

REPORT NUMBER _____

PERSONNEL INFORMATION

PRELIMINARY OPERATIONAL ERROR/DEVIATION REPORT

1. Name
2. FPL/AS/AH/DEV/ATM/Staff
3. Total Time (years/months) Certified on the Position of Operation Assigned to at the Time of the Incident
4. Time (hours/minutes) Assigned to the Position of Operation at the Time of the Incident
5. Total Time as an ATCS
6. Traffic Volume (Number of Aircraft)
7. Date of Last Over-The-Shoulder (Prior to and Not as a Result of This Incident)
8. Date of Last Tape Talk
9. List All Other Operational Errors/Deviations Involved in Within Last 2 Years. (If None, Indicate "None")
10. If Certified on the Assigned Position of Operation Less Than 1 Year, Indicate Total Training Time on the Position
11. Weekly Work Schedule (i.e., Third Day of Five)
12. Indicate if Working Overtime
13. Date of Last Controller Physical
14. Area of Specialization
15. Sector/Position
16. Position Function (AS,R,HO,RA,NR,C,LC,GC,CD,DEP,ARR,FD,ATA,etc.)

CONTROLLER A		CONTROLLER B		CONTROLLER C	
1. _____		1. _____		1. _____	
2. _____		2. _____		2. _____	
3. _____ (yrs) _____ (mos)		3. _____ (yrs) _____ (mos)		3. _____ (yrs) _____ (mos)	
4. _____ (hrs) _____ (mins)		4. _____ (hrs) _____ (mins)		4. _____ (hrs) _____ (mins)	
5. _____ (yrs) _____ (mos)		5. _____ (yrs) _____ (mos)		5. _____ (yrs) _____ (mos)	
6. _____		6. _____		6. _____	
7. _____ / _____ / _____		7. _____ / _____ / _____		7. _____ / _____ / _____	
8. _____ / _____ / _____		8. _____ / _____ / _____		8. _____ / _____ / _____	
9. _____		9. _____		9. _____	
10. _____ (hrs) _____ (mins)		10. _____ (hrs) _____ (mins)		10. _____ (hrs) _____ (mins)	
11. _____ Day of _____		11. _____ Day of _____		11. _____ Day of _____	
12. _____		12. _____		12. _____	
13. _____ / _____ / _____		13. _____ / _____ / _____		13. _____ / _____ / _____	
14. _____		14. _____		14. _____	
15. _____		15. _____		15. _____	
16. _____		16. _____		16. _____	

APPENDIX 3
INSTRUCTIONAL GUIDE FOR
OPERATIONAL ERROR/DEVIATION RECLASSIFICATION REPORT
(RIS: AT 7210-3)

GENERAL INFORMATION

After a Preliminary Investigation Report, FAA Form 7210-2, has been completed and telephone notification to FAA Washington Headquarters has been accomplished, a review of the data by a reporting facility official (e.g., the air traffic division manager) may result in a reclassification of an operational error or deviation to one of the following:

- Pilot Deviation
- Military Facility Deviation
- No Occurrence

The Operational Error Deviation Reclassification Report, FAA Form 7210-5, provides a means of reporting such a reclassification without the Investigator-In-Charge (IIC) completing the Final Operational Error Deviation Report.

The regional air traffic division manager must concur with the reclassification.

If a reclassification, as described above, is made, the air traffic division shall complete FAA Form 7210-6 and forward it to AAT-60 within 5 days of that determination.

This form shall not be used for a reclassification from an operational error to an operational deviation or from an operational deviation to an operational error. For these types of reclassification, Part II of FAA Form 7210-3 must be completed.

1. REPORT NUMBER

Enter the report number of the Preliminary Operational Error Deviation Report.

2. OCCURRENCE RECLASSIFIED

TO: Place an "X" in the appropriate box that represents the new classification.

3. DATE OF OCCURRENCE

Enter the date (month-day-year) of the error or deviation occurrence.

4. TIME OF OCCURRENCE (UTC)

Using the 24 hour clock, enter the time of the occurrence.

5. NAME AND TITLE OF PERSON REPORTING THE RECLASSIFICATION

Enter the name of the person at the facility who reclassified the occurrence.

6. DATE OF RECLASSIFICATION

Enter the date (month-day-year) of the reclassification. (Based on UTC)

7. TYPED OR PRINTED NAME OF AIR TRAFFIC DIVISION MANAGER

Enter the typed or printed name of the air traffic division manager or authorized representative.

8. SIGNATURE

Self-explanatory.

OPERATIONAL ERROR/DEVIATION RECLASSIFICATION REPORT
(RIS: AT 7210-3)

1. REPORT NUMBER _____													
2. OCCURRENCE RECLASSIFIED: TO: ☐ MILITARY FACILITY DEVIATION ☐ PILOT DEVIATION ☐ NO OCCURRENCE													
3. DATE OF OCCURRENCE <table border="1" style="display: inline-table; text-align: center; width: 100px;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td>MO</td><td>DAY</td><td>YR</td><td colspan="3"></td></tr> </table>								MO	DAY	YR			
MO	DAY	YR											
4. TIME OF OCCURRENCE <table border="1" style="display: inline-table; text-align: center; width: 60px;"> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table> (GMT)													
5. NAME/TITLE OF PERSON REPORTING RECLASSIFICATION JAMES R. PAYNE, A.T.M., DAYTON OH, ATCT													
6. DATE OF RECLASSIFICATION <table border="1" style="display: inline-table; text-align: center; width: 100px;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td>MO</td><td>DAY</td><td>YR</td><td colspan="3"></td></tr> </table>								MO	DAY	YR			
MO	DAY	YR											
7. TYPED OR PRINTED NAME AIR TRAFFIC DIVISION CHIEF	8. SIGNATURE												

FAA Form 7210-5 (7-81)

Instructional Guide

GENERAL INFORMATION

After a preliminary Investigation Report, FAA Form 7210-2, has been completed and telephone notification to FAA Washington Headquarters has been accomplished, a review of the data by a reporting facility official (e.g., the Facility Chief) may result in a reclassification of an operational error or deviation to one of the following:

- Pilot deviation
- Military facility deviation
- No occurrence

The Operational Error/Deviation Reclassification Report, FAA Form 7210-5, provides a means of reporting such a reclassification without the Investigator-In-Charge (IIC) completing the Final Operational Error/Deviation Report.

The Regional Air Traffic Division Chief must concur with the reclassification.

If a reclassification as described above is made, the Air Traffic Division shall complete FAA Form 7210-5 and forward it to AAT-20 within 5 days of that determination.

This form shall not be used for a reclassification from an operational error to an operational deviation, or from an operational deviation to an operational error. For these types of reclassification Part II of FAA Form 7210-3 must be completed.

1. REPORT NUMBER

Enter the report number of the Preliminary Operational Error/Deviation Report.

2. OCCURRENCE RECLASSIFIED

TO: Place an "X" in the appropriate box that represents the new classification.

3. DATE OF OCCURRENCE

Enter the date (month-day-year) of the error or deviation occurrence.

4. TIME OF OCCURRENCE (GMT)

Using the 24 hour clock enter the time of the occurrence.

5. NAME AND TITLE OF PERSON REPORTING THE RECLASSIFICATION

Enter the name of the person, at the facility, who reclassified the occurrence.

6. DATE OF RECLASSIFICATION

Enter the date (month-day-year) of the reclassification. (Based on GMT)

7. TYPED OR PRINTED NAME OF AIR TRAFFIC DIVISION CHIEF

Enter the typed or printed name of the Air Traffic Division Chief or authorized representative.

8. SIGNATURE

Self explanatory.

APPENDIX 4

INSTRUCTIONAL GUIDE FOR

FINAL OPERATIONAL ERROR/DEVIATION REPORT (RIS: AT 7210-3)

GENERAL INFORMATION

The Final Operational Error/Deviation Report, FAA Form 7210-3, has been designed to facilitate the gathering and documentation of factual information concerning the events which led to the occurrence of an operational error or deviation. It also provides a means of recording the findings, recommendations, and conclusions of the Facility Chief and Regional Air Traffic Division Chief.

Situations may arise which are not adequately accounted for in Part I of this report. However, a careful analysis of the facts should usually establish a relationship to the information required in this report. If there are exceptions, when the information cannot be adequately expressed, or there is insufficient space to answer a question — use the remarks section in Part I. Each remark should reference the section and/or item number to which it pertains.

REPORT NUMBER

Enter the number from the preliminary report describing this error/deviation on each page of the final report.

PART I
Investigative Data

GENERAL INFORMATION

Part I provides for the documentation of the factual data which is gathered by the Investigator-In-Charge (IIC), and when appointed, on investigation team.

SECTION A
General Data

1. DATE AND TIME OF OCCURRENCE

DATE: Determine the date based on Coordinated Universal Time (UTC) and enter the date as follows:

Example: July 1, 1981

Enter: 0171011811

TIME: Using the 24 hour clock, enter the time of the occurrence in UTC and local time.

Example: 6:38 p.m. (Time of occurrence)

Enter: 118138

2. RESPONSIBLE FACILITY

(Facility responsible for separation)

A. Identification

Enter the 3-letter location identifier.

Example: Los Angeles ARTCC

Enter: ZLA

B. Type

Indicate the type of facility by placing an "X" in the appropriate box.

C. Classification

Indicate the facility classification level by placing an "X" in the appropriate box.

3. WERE OTHER FACILITIES INVOLVED

Indicate if other facilities were involved in the occurrence by placing an "X" in the appropriate box. A facility does not have to contribute to the cause of the error/deviation to be considered involved. Complete the identification, type and classification level for each facility involved.

4. OCCURRENCE REPORTED BY

Indicate the person who first brought the incident to the supervisor's facility's attention by placing an "X" in the appropriate box.

5. ALTITUDE/FLIGHT LEVEL OF OCCURRENCE

Indicate the level at which the conflict occurred as follows:

IF OCCURRENCE HAPPENED	ENTER
On the Airport Surface	SFC
Airport Surface to 949 AGL	Enter altitude above surface to nearest 100 ft. level. Example: 1 ft — 149 ft. Enter: <u>0101</u>
950 AGL and above	MSL of flight level to nearest 1000 ft. level. Example: 1180 Enter: <u>0112</u> Example: 17800 Enter: <u>180</u>

If not on airport surface complete A & B.

A. Was the Altitude/Flight Level ABOVE Available

B. Was the Altitude/Flight Level BELOW Available

Place an "X" in the appropriate box indicating whether either of the aircraft could have been assigned the Altitude/Flight Level above or below and have avoided the conflict.

6. SUMMARY OF WEATHER INFORMATION

Provide pertinent weather data in plain language. The reported weather conditions at the time of the occurrence should be described. This includes, but is not limited to, the SIGMETs and PIREPs in effect within a 30 mile radius of the location of the occurrence and any reported flight conditions. If the weather is not available or if weather is determined to be no factor, place an "X" in the appropriate box.

Example:

Sky partially obscured, measured ceiling two-hundred overcast, visibility one and one-half, very light snow.

or

Thunderstorm throughout the area. Light chop ten west of Cleveland at Flight Level three-one-zero, Boeing 727.

7. TYPE OF AIRSPACE

Indicate the type of airspace where the occurrence happened by placing an "X" in the appropriate box.

8. LOCATION OF OCCURRENCE

Indicate whether the incident occurred in the air or on the surface by placing an "X" in the appropriate box, then complete that section.

A. In the Air

FIX: The fix provides a reference as to where the occurrence happened. Enter a 3 or 5 letter location identifier whenever possible to clearly identify the fix.

Example: Cleveland VORTAC

Enter:

Example: NESTO Intersection

Enter:

DIRECTION: If the fix used is an airport, intersection or waypoint that does not have prescribed radials or compass rose, use the 16 points of the compass to establish direction. Specify the direction from NAVAID, i.e., VOR VORTACs, in degrees using 3 digits.

Example: 10 Degree Radial

Enter:

Example: North-Northeast

Enter:

DISTANCE: Specify the distance of the occurrence from the fix in nautical miles.

Example: 1 N M

Enter:

Example: 20 N M

Enter:

B. On the Surface

INTERSECTION: Enter the airport intersection closest to the occurrence.

RUNWAY: Enter the runway(s) closest to the occurrence. Runway 9 would be entered as 00009H, if it was at the intersection of runways 9 and 17 it should be entered as 000917. Runway 9L is entered as 00009L. Enter runways 9L and 17R as 09L17R. Use a slash (/) to separate single numbered runways, runways 1 and 8 would be entered 0001/8.

TAXIWAY: If the taxiway is described using the phonetic alphabet, enter the letter and the word.

Example: Echo

Enter:

If the description is alphanumeric, use the letter and number.

Example: Hotel 1

Enter:

9. SUMMARY OF PERTINENT EVENTS

(Do not fill in this form until Sections II through J have been completed.)

Provide a chronological narrative of pertinent events leading to the operational error, deviation, and any subsequent information relevant to the incident. The summary shall start 10 minutes prior to the time of the occurrence and end 5 minutes after. The time parameters may be exceeded when it is necessary to fully describe the relevancy of the event.

CONTINUATION PAGE: Continuation pages may be necessary to describe all the pertinent events. Each continuation page is completed in the same manner as described below with the following additional requirement:

• Enter the appropriate sequential page number in the space provided.

COLUMN	YOU PROVIDE	
a. Time	Coordinated Universal Time (UTC)	
b. Data Source	Describes the source of information. Abbreviate as follows:	
	R D I S C	Recording Flight progress strips or display Interviews Statements Computer Generated
c. Employee	Use employee identifier (described in Section II, Item 1 a.) or individuals associated with the event as shown below.	
	IF	ENTER
	Pilot Employee A No individual	P A Leave blank
d. Event	Provide a brief, but meaningful, description of the factors involved in the event.	

SECTION B Personnel Involved

GENERAL INFORMATION

There should be one Section B (pages 3-4-5-6) completed for each employee directly involved in the occurrence. Personnel directly involved in an operational error, deviation are defined as an individual whose action(s) or lack of action(s) contributed to the operational error or deviation.

Number of Personnel Involved

Indicate the total number of personnel involved in the error or deviation.

1. PERSONAL DATA

a. Employee: Each employee involved shall be assigned a letter (e.g., A., B., C., etc.) which will be used as the employee's identification or key whenever it is required in other parts of this report form (e.g., Section A, item 9) and any narrative replies submitted. The only place within this report that the name and/or Social Security Number (SSN) of an individual involved in an operational error/deviation is to be provided is in Section B.

b. Name: List the last name, first name, and middle initial of the employee.

c. Date of Birth: Enter the month, day, year.

d. Social Security Number: Enter only the last four digits of the employee(s) social security number.

2. EMPLOYMENT HISTORY

List the employee's FAA work experience starting with the date of the incident and work back 5 years.

- Do not include work experience for another employer.
- Make one entry for each position, grade and or facility.

a. Dates: Enter the date that the employee began working a particular position under "From." Enter the last date that the employee worked on a given position under "To." Both dates should be in the following format:

Example: June 1973

Enter: 061713

b. Position (Title-Service-Grade): enter the employee's title, series, and grade for each position.

Example: Full performance level, GS-13

Enter: SUPREVISOR
211512 GS 13

Example: First level supervisor, GS-14

Enter: SUPERVISOR
211512 GS 14

c. Facility Identifier: Enter the 3-letter location identifier of the facility where the employee works.

Example: Los Angeles ARTCC

Enter: ZLA

d. Classification Level: Enter the facility's classification level e.g., 1-2-3-4-5.

Enter: 5

e. Performance Level: Indicate the performance level of the employee for the corresponding dates in the space provided. Enter one of the following:

- | | |
|--------------------|--------------------|
| • Trainee | • Facility Officer |
| • Developmental | • FPL |
| • Supervisor | • AATH |
| • Staff Specialist | • ATH |

3. POSITION CERTIFICATION

a. Last Date of Certification/Recertification on Position: Enter the most recent of either the date that the employee was initially certified, or the last date that the employee was recertified on the position that he/she was working at the time of the occurrence. Indicate whether the date provided is the certification or recertification date by placing an "X" in the appropriate box.

Example: Employee certified June 1, 1972;

Recertified August 12, 1980

Enter: 0812180

b. Was the Employee Qualified on the Position? Place an "X" in the appropriate box.

c. Employee's First Level Supervisor: Enter the last name, first name, and middle initial and last four digits of Social Security Number (SSN) of the employee's first level supervisor at the time of the occurrence.

d. Employee's Second Level Supervisor: Enter the last name, first name, and middle initial and last four digits of Social Security Number (SSN) of the employee's second level supervisor at the time of the occurrence.

4. PERFORMANCE EVALUATION

a. Date of Last Technical Approval Program (TAP): (Center or Terminal Option): Enter the date of the most recent over-the-shoulder training review administered within the past 12 months. If none - explain and move to item 5.

b. Date of Last Technical Performance Appraisal (TPAP): (Flight Service Station Option): Enter the date of the most recent over-the-shoulder performance evaluation administered within the past 12 months. If none - explain and move on to item 5.

c. Were Any Deficiencies Identified? If YES, list all deficiencies identified during the most recent TAP or TPAP.

d. Was Remedial Training Administered? If YES, list the remedial training administered as the result of the most recent TAP or TPAP.

5. PROFICIENCY TRAINING

Enter the type of proficiency training received within the past 12 months, that is directly related to the type of control being used at the time of the occurrence. If none - place an "X" in the box labeled "NONE." Place an "X" in the box labeled "N/A" if the training received was not related to the type of control being provided.

a. What Type of Refresher Training Has Been Received? List the type and date of the last refresher training which relates to the type of control being provided.

b. What Type of Supplemental Training Has Been Received? List the type and date of the last supplemental training which relates to the type of control being provided.

c. What Type of Remedial Training Has Been Received? List the type and date of the last remedial training which relates to the type of control being provided.

d. Date of Last Tape Monitor (Tape Talk): Enter the date of the most recent tape monitor session (tape talk) during which the employee's application of procedures, good operating practices and phraseology were reviewed. If none - place an "X" in the box labeled "NONE."

6. MEDICAL CERTIFICATION

a. **Date of Last Airman Medical Examination:** Enter the month-day-year of the last airman medical examination.

b. **Are There Any Waivers and/or Restrictions?** If YES — list all waivers and/or restrictions.

c. **Were Restrictions Being Complied With?** If there are no restrictions, place an "X" in the box labeled "N. A." If NO — provide an explanation.

7. WORK SCHEDULE

Beginning with the day of the occurrence and working backward, show the employer's work schedule for the past four (4) weeks (i.e., 28 days). Under the column heading "Week Ending", enter the date of the occurrence. In the same column below that date enter the date one week prior to the occurrence, then enter the next week, etc. After completing the "Week Ending" column, fill in the work schedule as follows:

Use the first two digits of the 24 hour clock (local) time to indicate the shift worked. Use "RDO" to show regular day off. Use "A. L." for annual leave and "S. L." for sick leave. Underline shifts if other than regular scheduled shifts. Use "O. T." for overtime and "C. T." for compensatory time.

The following example shows how the work schedule would be recorded for an operational error/deviation which occurred on Thursday, July 16, 1981.

7. WORK SCHEDULE							
WEEK ENDING (Mo/Da/Yr)	SUN	MON	TUE	WED	THU	FRI	SAT
07-16-81	07-15	00-08	RDO	RDO	16-00		
07-09-81	A/L	00-08	RDO	RDO	16-00	16-23	08-16
07-02-81	07-15	00-08	RDO	RDO	16-00	16-23	A/L
06-25-81	S/L	00-08	RDO	O/T 07-15	07-15	08-16	08-16

8. ACTIVITY PROFILE

Using local time, provide a detailed profile of the employee's activity on the day shift of the occurrence.

- Use 4 digits of the 24 hour clock to describe the breakdown.
- Under description include such items as: positions worked, relief breaks (coffee, lunch, etc.), training, details, etc.
- The profile should be completed for the entire shift — including removal from operational duty.

Example: Shift worked: 1600-0000. Error Occurs 1910 EST.

8. ACTIVITY PROFILE			
HOUR	TIME (LOCAL)		DESCRIPTION OF ACTIVITY
	FROM	TO	
1ST	1600	1700	R 34
2ND	1715	1730	Coffee Break
	1731	1800	R 34
3RD	1815	1845	Training — Briefing
	1846	1900	R 34
4TH	1900	1920	R 34
	1920	2000	Removed from Position Operational Error
5TH	2000	2100	Removed from Position Operational Error
	2100	2200	Removed from Position Operational Error

9. DID THE EMPLOYEE REQUIRE ASSISTANCE PRIOR TO THE OCCURRENCE?

Response to this question should be obtained from the employee's assigned supervisor. If the supervisor was not assigned, place an "X" in the box labeled "Not Available." If a supervisor was assigned, but not in the area, place an "X" in the box labeled "Not in Area." An explanation is required for either a yes or no response. When answering the question, consider the following:

- Was the supervisor aware of the traffic volume and complexity?
- Was the supervisor aware of anything that may have indicated that the employee needed assistance?
- If in the supervisor's opinion, assistance was required, what type of assistance was given?

10. DID THE EMPLOYEE REQUEST ASSISTANCE PRIOR TO THE OCCURRENCE?

If YES, provide an explanation of the request, to whom it was directed, any action that resulted based upon the request, etc.

11. WAS THE EMPLOYEE AWARE THAT AN OPERATIONAL ERROR/DEVIATION WAS DEVELOPING?

An explanation is required for either a yes or no response. If YES, determine when. If NO, determine why.

12. DID THE EMPLOYEE CONTEMPLATE TAKING CORRECTIVE ACTION?

An explanation is required for either a yes or no response. If the answer to question 11 was YES, if the answer to question 12 was NO, place an "X" in the box labeled "N. A." and move on to question 13.

13. DID THE EMPLOYEE ATTEMPT TO TAKE CORRECTIVE ACTION?

An explanation is required for either a yes or no response. If the answer is YES, explain why the action failed to prevent the error or deviation. If the answer is NO — explain why.

14. EMPLOYEE WAS ALERTED TO THE OCCURRENCE BY

Indicate the FIRST source that alerted the employee of the occurrence by placing an "X" in the appropriate box.

15. DATE/TIME EMPLOYEE BECAME AWARE OF THE OCCURRENCE

Using the 24 hour clock, indicate date, and indicate the UTC and local time the employee became aware of the occurrence.

16. DID THE EMPLOYEE IDENTIFY ANY DISTRACTIONS WHICH INFLUENCED THE OCCURRENCE?

If YES, explain. (Consider presence of visitors, confusion or installation of equipment, volume of nearby radio speaker, loud or hysterical behavior of coworkers, etc.)

• Was the Employee Providing His/Her Own Distraction? If YES, explain. (Consider extraneous conversation with coworkers, working with an equipment malfunction, etc.)

17. DID ANYTHING OCCUR IN THE WORK AREA ENVIRONMENT WHICH DISTRACTED FROM THE EMPLOYEE'S PERFORMANCE?

If YES, explain. (Consider training sessions and discussions, interpersonal discussions, etc.)

SECTION C
Pilot/Aircraft Data**GENERAL INFORMATION**

Enter the total number of aircraft involved in the box provided

Each aircraft shall be assigned a number (e.g. 1-1-1-4 etc.) which will be used as the aircraft identification or key whenever it is required in other parts of this report form (e.g. Section A, Item 9), and any narrative replies submitted

1. IDENTIFICATION

Enter aircraft identity using combinations not to exceed 7 alphanumeric characters (REFERENCE: Handbook 7110.63, Aircraft Identity, and Appendix 2)

2. TYPE/SUFFIX

Enter aircraft type suffix using combinations not to exceed 8 alphanumeric characters (REFERENCE: Handbook 7110.63, Aircraft Type, Aircraft Equipment Suffix and Appendix 2)

3. DEPARTURE AIRPORT

Enter the 3-letter location identifier of the departure airport

4. DESTINATION AIRPORT

Enter the 3-letter location identifier of the destination airport

5. FLIGHT PROFILE AT THE TIME OF OCCURRENCE

Indicate the flight profile of the aircraft at the time of the occurrence by placing an "X" in the appropriate box

6. FLIGHT PLAN ROUTE

Should be sufficient enough to describe the route leading to the point of occurrence

7. EVASIVE ACTION

Self explanatory

8. RESERVED**9. UNDER RADAR CONTROL**

Self explanatory

10. FUNCTIONING TRANSPONDER

Self explanatory

11. FUNCTIONING MODE C

Self explanatory

12. AIRCRAFT AND OBSTRUCTION/OBSTACLES

If the error or deviation involved an aircraft and terrain, obstruction, or obstacle place an "X" in the appropriate box

SECTION D
Procedures Involved**1. TYPE OF CONTROL PROVIDED**

Indicate the type of control that was being provided by placing an "X" in the appropriate box. If nonradar control was being provided, indicate if airport surface or oceanic flight was involved by placing an "X" in the appropriate box

As a guide in completing this item, consider radar control was being applied if one or more of the involved aircraft was identified on a radar display and could have been provided a radar service until either of the following occurred:

- radar identification was lost
- radar service to the aircraft was terminated for any reason

2. TYPE OF PROCEDURES INVOLVED

Indicate the type of procedures that were being provided when the occurrence happened by placing an "X" in the appropriate box. Indicate local or regional procedures when special procedures supplementary to those in the air traffic control procedures handbooks are involved in the error or deviation.

3. SPECIFY SEPARATION MINIMA INVOLVED

If a national procedure is involved specify the correct separation minima applicable by citing the appropriate manual handbook paragraph reference. Otherwise, indicate the local or regional procedure in the space labeled "OTHER"

4. APPLIED SEPARATION — DIFFERENT THAN LISTED IN ITEM 3 ABOVE

Indicate by placing an "X" in the appropriate box whether the type of separation the controller was attempting to apply at the time of the occurrence was different than listed in item 3 above. If YES, explain

5. DESCRIPTION OF PROCEDURES USED

Briefly describe the procedure actually used. When directives other than manuals or handbooks are involved, submit a copy of the pertinent directives, orders, etc.

Example: Specialist "A" had correctly set up vertical separation between aircraft #1 and #2 but failed to detect that aircraft #1 had taken a clearance issued to aircraft #3

6. WERE ANY PROCEDURAL DEFICIENCIES NOTED AS RESULT OF THE OCCURRENCE

Indicate if any procedural deficiencies were noted as a result of this occurrence by placing an "X" in the appropriate box. If YES, identify the procedure(s) and deficiency

7. WERE ANY SPECIAL PROCEDURES IN EFFECT AT THE TIME OF THE OCCURRENCE

Indicate if there were any special procedures in effect at the time of the occurrence by placing an "X" in the appropriate box. If YES, describe the procedures which may include procedures established for airport or runway construction or because of radar or approach NAVIAD outages

SECTION E Closest Proximity

Place an "X" in the appropriate box i.e. "IN THE AIR" or "SURFACE", then complete that section.

A. In the Air

VERTICAL: Vertical distance measured in feet

Example: 1 foot

Enter: 00001

Example: 100 feet

Enter: 0100

Example: 1000 feet

Enter: 1000

HORIZONTAL: Horizontal distance may be measured in feet or miles

Example: 1500 feet

Enter: 1500

Example: 2 1/2 miles

Enter: 025 . 50

Example: 3 miles

Enter: 030 . 00

B. Surface

Describe, in plain language, the closest proximity to other aircraft, terrain, obstacles or obstructions.

SECTION F Workload

1. TRAFFIC ACTIVITY

a. **Number of Aircraft Being Worked:** Enter the number of aircraft that were being worked at the time of the occurrence. This is not to be confused with the number of aircraft involved in the occurrence. Count those aircraft that have been radar identified, and/or have established radio communication with the controller.

b. **Traffic Complexity:** Indicate the traffic complexity by placing an "X" on the scale as appropriate.

- 1 indicates traffic was not complex
- 5 indicates traffic workload was extremely complex

Consider the overall difficulty of the controller's task e.g. weather, traffic mix, variety of operations, limited use of altitudes, airspace available for radar vectoring, coordination requirements, etc.

c. **Explanation of Traffic Complexity:** Provide a brief explanation of the traffic complexity rated in b.

2. POSITION/SECTOR OF OPERATION

a. **Were Duties and Responsibilities of Each Position Assignment Clearly Defined:** Indicate if the duties and responsibilities of each position in multi-position sectors or functions were adequately and clearly defined by placing an "X" in the appropriate box. If NO, explain each position which was not clearly and/or adequately defined and why.

b. **Combined Sector (Centers and where applicable)**

(1) **Were Any Sectors Combined?** Indicate if any sectors involved in the occurrence were combined by placing an "X" in the appropriate box.

IF	THEN
YES	• List each sector that was combined into one sector. • Enter the employee key of the employee who was working the combined sector.
NO	Proceed to item c

(2) **Did the Supervisor Approve the Combination?** Indicate if a supervisor approved the combination of the sectors by placing an "X" in the appropriate box.

(3) **Did the Traffic Warrant the Combination?** Indicate if the traffic workload and complexity warranted the combination of the sectors by placing an "X" in the appropriate box.

c. **Combined Positions**

(1) **Were Any Positions Combined?** Indicate if any positions were combined by placing an "X" in the appropriate box. (This would include positions within a sector.)

IF	THEN
YES	• List each position that was combined into one position. • Enter employee key of the employee who was working the combined position.
NO	Complete item 3

(2) **Did the Supervisor Approve the Combination?** Indicate if the supervisor approved the combination of the positions by placing an "X" in the appropriate box.

(3) **Did the Traffic Warrant the Combination?** Indicate if the traffic workload or complexity warranted the combination of the positions by placing an "X" in the appropriate box.

3. SUPERVISOR

a. **Does the Facility Staffing Provide for an Area or Shift Supervisor to Oversee the Involved Position/Sector?** Indicate if the facility staffing provides for an area or shift supervisor by placing an "X" in the appropriate box.

b. **Was the Assigned Supervisor Present in the Operational Area at the Time of the Occurrence?** Indicate if the assigned supervisor was present in the operational area at the time of the occurrence by placing an "X" in the appropriate box. If NO, proceed to item 3d.

c. **Was the Assigned Supervisor Aware of:** Indicate if the assigned supervisor was aware of any of the items by placing an "X" in the appropriate box.

d. **What Activity was the Assigned Supervisor Engaged in at the Time of the Occurrence?** Indicate the activity the supervisor was engaged in at the time of the occurrence by placing an "X" in the appropriate box. If "Other" is marked specify the activity as briefly and clearly as possible.

SECTION G
Task Environment**1. INDICATE IF ANY OF THE FOLLOWING MAY HAVE INFLUENCED THE OCCURRENCE (Provide an explanation of each)**

Place an "X" in each box which is applicable. If there is any other factor(s) which may have influenced the occurrence within the task environment which is not covered elsewhere in the report, place an "X" in the box labeled "Other" and list it. Provide an explanation for each item checked and/or listed.

Consider all of the factors listed under this item to ensure that they were definitely not a factor in the occurrence before they are discarded. The following examples illustrate additional factors to be considered:

- When communications are not heard or otherwise acted upon, investigate the possibility of a noise level too high for reasonable reception.
- When information is not accurately posted or forwarded to another individual or position, investigate the possibility of inadequate lighting or the presence of a glare condition in the area from which the information was read.

SECTION H
Equipment**1. DID EQUIPMENT LAYOUT OR DESIGN INFLUENCE THE OCCURRENCE**

Indicate if the equipment layout or design influenced the occurrence by placing an "X" in the appropriate box. If YES, provide an explanation.

2. WAS ANY PERTINENT EQUIPMENT OPERATED BY THE CONTROLLER(S) REPORTED AS FUNCTIONING UNSATISFACTORILY BEFORE THE OCCURRENCE

Indicate if any problems were reported by placing an "X" in the appropriate box. If NO, proceed to item 3.

a. **Date of Report:** Enter the date of the report in the following format: Month, Day, Year.

b. **Time of Report (UTC):** Enter the time the report was filed using 24 hour clock UTC.

c. **Describe Equipment Problem(s):** Provide a description of all reported problems for each piece of equipment.

d. **Was Any Action Undertaken to Correct the Problem(s)?** Indicate if corrective action was undertaken prior to the occurrence to correct the problem(s) by placing an "X" in the appropriate box. If NO, provide an explanation.

3. TYPE

Indicate the status/quality of the equipment at the time of the occurrence by placing an "X" in the appropriate box under each type of equipment. Provide an explanation for each type of equipment which was operating at a level of less than GOOD. If maintenance was scheduled, why had it not been started?

4. WAS RADAR IN USE

Indicate if radar was in use for any of the aircraft involved in the occurrence by placing an "X" in the appropriate box. If YES, indicate the type of radar that was in use by placing an "X" in the appropriate box(es).

5. WAS RADAR TRANSITION IN PROGRESS

Indicate if radar transition was in process when the occurrence happened by placing an "X" in the appropriate box. If YES, place an "X" in the box(es) appropriate to the radar from which the transition was occurring and an "X" in the box(es) appropriate to the radar to which the transition was occurring.

SECTION I
Remarks

Include any additional pertinent information not adequately covered in the space provided. Include identifying information (e.g., section item number, etc.) so that the remark can be related back to the appropriate question. This section also provides space for additional information not covered in the report but relevant to the occurrence.

If more than two continuation pages are necessary, use plain bond paper (8 1/2" x 11"). Place an "X" in the box labeled "Continuation page attached" located at the bottom of the page. Enter the sequential page number in the upper right hand corner of each page, also enter the report number of the error or deviation.

SECTION J
Checklist of Attached Documents

The following provides a checklist of documents which are a part of this report. Indicate the documents which are attached by placing an "X" in the appropriate box. Special attention is directed to the following items:

TRANSCRIPTS

At facilities that have a rerecording capability, the region shall determine whether a transcript is necessary. Facilities that do not have rerecording capability shall provide a transcript. Transcriptions submitted need not be certified and should only include those pertinent conversations related to the occurrence. The transcription time period shall be the same as the summary covered in Part I, Section A-9.

TAPE VOICE RECORDINGS

Tape voice recordings need not be removed from the original reel. At facilities that have rerecording capability, a cassette rerecording shall be made of the voice communications recorded at the position(s) involved in the incident. The rerecording shall cover the same time period as the summary of pertinent events of this report (Section A-9). The cassette rerecording(s) shall be submitted to the region, unless a transcript has been requested, with Part I and II. After the Regional Air Traffic Division has completed Part III, the cassettes shall be returned to the appropriate facility. Field facilities shall retain the original full tapes until they have been released by the Regional Air Traffic Division or Part III is received from the Regional Air Traffic Division. At that time, return the original reels to service. Cassette recording(s) shall become part of the operational error/deviation records retained in the facility's file.

EXCEPTION

In the event the occurrence is associated with an National Transportation Safety Board (NTSB) or Flight Standards aircraft accident/incident investigation, follow transcript/tape retention instructions contained within Handbook 8020.11, Aircraft Accident and Incident Notification, Investigation, and Reporting and Handbook 7210.3, Facility Operation and Administration.

IMPORTANT:
At this time complete Section A, Item 9, Summary of Pertinent Events.

SECTION K
Investigators

Self explanatory. If an investigation team was not appointed, only the IIC information should be completed.

PART II Air Traffic Manager's Action

GENERAL INFORMATION

The air traffic manager's signature indicates that he/she has reviewed and concurs with the data submitted by the IIC and the investigation team (if applicable), and is satisfied that Part I of the final report is complete and sufficient to determine the following:

- The classification of the occurrence;
- The category of the operational error/deviation and the rationale for the categorization;
- Recommendations and actions to be taken to prevent a recurrence of the operational error/deviation;
- The causal factor(s) of the operational error/deviation.

SECTION A Classification

Indicate the classification of the occurrence by placing an "X" in the appropriate box. Sections B through D are only completed for an operational error or operational deviation.

SECTION B Categorization

1. WHAT WAS THE CATEGORY OF THE OPERATIONAL ERROR/DEVIATION

Indicate the category by placing an "X" in the appropriate box(es). It is possible to have more than one category for an occurrence.

2. RATIONALE FOR CATEGORIZATION

Provide a brief rationale for the categorization listed in item 1 above.

SECTION C Causal Factors

GENERAL INFORMATION

This section is to be completed as follows: Enter the employee key, for each employee involved in the error or deviation, under the column heading "Employee" — one key per box, total 7 employees. If there are more than 7 employees involved, a continuation section will be required. The continuation section should be completed in the same manner as described below — with the following additional requirements:

- Place an "X" in the box labeled "continuation section attached"
- Enter the next set of employee keys e.g., H, I, J, etc. — one per box

If "1. DATA POSTING" is not a causal factor, place an "X" in the box labeled "NO" and proceed to item "2. RADAR DISPLAY."

If the response is YES proceed as follows. Each item requires a yes or no response. For example, if "a. COMPUTER ENTRY" is not a causal factor but "b. FLIGHT PROGRESS STRIP" is — place an "X" in the "NO" box next to "a. COMPUTER ENTRY," and complete the appropriate "b. FLIGHT

PROGRESS STRIP" causal factor for each employee. Only place an "X" in a "YES" box for a causal factor which relates to a given employee.

Example: Employee C was determined to have not prepared a required flight progress strip.

Enter:

EMPLOYEE KEY		YES					NO				
100211		A	B	C	D	E					
SECTION C CAUSAL FACTORS											
1. DATA POSTING											
a. Computer Entry											
b. Flight Progress Strip											
c. Radar Display											
d. Inappropriate Use of Displayed Data											
e. Aircraft Observation											
f. Other											
g. Continuation section attached											
h. Employee key											
i. Employee key											
j. Employee key											
k. Employee key											
l. Employee key											
m. Employee key											
n. Employee key											
o. Employee key											
p. Employee key											
q. Employee key											
r. Employee key											
s. Employee key											
t. Employee key											
u. Employee key											
v. Employee key											
w. Employee key											
x. Employee key											
y. Employee key											
z. Employee key											

CAUSAL FACTORS

1. DATA POSTING

A data posting error is any error of calculation, omission or incomplete data, erroneous entries, handling or subsequent revisions to this data. This includes errors in posting and recording data. It does not include errors involved in receiving, transmitting, coordinating, or otherwise forwarding this information. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other", and provide a brief explanation.

2. RADAR DISPLAY

a. **Misidentification:** Radar misidentification means a failure to properly identify the correct target and includes subsequent errors committed after the original identification was properly accomplished. Indicate the listed item(s) which most closely describes the reason for misidentification. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

b. **Inappropriate Use of Displayed Data:** A data or display information error occurs due to a failure to maintain constant surveillance of a flight data display or traffic situation and to properly present or utilize the information presented by the display or situation. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

3. AIRCRAFT OBSERVATION (Towers Only)

An aircraft observation error means a failure to maintain constant surveillance of aircraft and the movement area, and to properly react to, interpret, or otherwise utilize, in a timely manner, the information being viewed. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

4 COMMUNICATIONS

A communications error is a causal factor associated with the exchange of information between two or more people (e.g., pilots and specialists). It refers to the failure of human communication, not communications equipment.

- a. **Phrasiology:** Use of incorrect or improper phrasiology.
- b. **Transposition:** Errors due to transposition of words, numbers or symbols by either oral or written means. This involves writing/saying one thing while thinking/hearing something else.
- c. **Misunderstanding:** The failure to communicate clearly and concisely so that no misunderstanding exists for any actions contemplated or agreed upon.
- d. **Readback:** The failure to identify improper or incorrect readback of information.
- e. **Acknowledgement:** The failure to obtain an acknowledgement for the receipt of information.
- f. **Other:** If the causal factors listed above do not adequately describe the factor involved, list the factor and provide a brief explanation.

5 COORDINATION

Any factor associated with a failure to exchange required information. This includes coordination between individuals, positions of operation, and facilities for the exchange of information, such as APREQs, position reports, forwarding of flight data, etc. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

6 POSITION RELIEF BRIEFING DEFICIENCIES NOTED

Relief briefing errors are special errors of both communication and coordination which occur as the result of position relief. They include such things as: failure to give a relief briefing, failure to request a briefing, incomplete or erroneous briefing, etc. If one of the causal factors listed does not adequately describe the factor involved, list the factor under "Other" and provide a brief explanation.

SECTION D**Recommendations and Corrective Actions**

List the recommendation(s) and corrective action(s) that will be taken to prevent a recurrence of a similar operational error or deviation.

One or more continuation pages may be necessary. Use plain bond paper (8 1/2" x 11"). Place an "X" in the box labeled "Continuation page attached" located at the bottom of the page. Enter the sequential page number in the upper right hand corner of each page, also enter the report number of the error or deviation.

DATE/TITLE/SIGNATURE

Give the date (month-day-year) that the air traffic manager, or his/her authorized representative signed the report.

PART III
Air Traffic Division Manager

GENERAL INFORMATION

The air traffic division manager's signature indicates that the information in Parts I and II has been reviewed and is complete and sufficient to determine the following:

- Concurrence with Parts I and II of the final report.
- Recommendations and actions to be taken to prevent a similar recurrence of the operational error/deviation.

SECTION A
Conclusions/Recommendations

List any conclusions or recommendations.

One or more continuation pages may be necessary. Use plain bond paper (8 1/2" x 11"). Place an "X" in the box labeled "Continuation page attached" located at the bottom of the page. Enter the sequential page number in the upper right hand corner of each page, also enter the report number of the error or deviation.

DATE/TITLE/SIGNATURE

Give the date (month-day-year) that the air traffic division manager, or his/her authorized representative signed the report.

FINAL OPERATIONAL ERROR/DEVIATION REPORT
(RIS: AT 7210-3)

PART I. INVESTIGATIVE DATA

REPORT NUMBER

SECTION A. GENERAL DATA			
1. DATE AND TIME OF OCCURRENCE		DATE MO DAY YR GMT LOCAL	TIME
2. REPORTING FACILITY			
A. IDENTIFICATION 	B. TYPE ☐ TOWER/CAS ☐ RAPCON/RATCF ☐ ARTCC ☐ TRACON ☐ FSS		C. CLASSIFICATION LEVEL ☐ I ☐ II ☐ III ☐ IV ☐ V
3. WAS ANOTHER FACILITY INVOLVED ☐ YES ☐ NO (If yes, complete the following)			
A. IDENTIFICATION 	B. TYPE ☐ TOWER/CAS ☐ RAPCON/RATCF ☐ ARTCC ☐ TRACON ☐ FSS		C. CLASSIFICATION LEVEL ☐ I ☐ II ☐ III ☐ IV ☐ V
4. OCCURRENCE REPORTED BY ☐ SPECIALIST ☐ SUPERVISOR ☐ PILOT			
5. ALTITUDE/FLIGHT LEVEL OF OCCURRENCE 		A. WAS THE ALTITUDE/FLIGHT LEVEL ABOVE AVAILABLE ☐ YES ☐ NO	
		B. WAS THE ALTITUDE/FLIGHT LEVEL BELOW AVAILABLE ☐ YES ☐ NO	
6. SUMMARY OF WEATHER INFORMATION ☐ NOT AVAILABLE ☐ NOT A FACTOR			
7. TYPE OF AIRSPACE ☐ TERMINAL CONTROL AREA (TCA) ☐ POSITIVE CONTROL AREA (PCA) ☐ RESTRICTED AREA ☐ TERMINAL RADAR SERVICE AREA (TRSA) ☐ MILITARY OPERATIONS AREA (MOA) ☐ OTHER (Specify)			
8. LOCATION OF OCCURRENCE			
A. ☐ IN THE AIR FIX DIRECTION DISTANCE 		B. ☐ ON THE SURFACE INTERSECTION RUNWAY TAXIWAY 	

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SUPERSEDES FAA FORM 8020-7

PAGE

PAGE 2

REPORT NUMBER

SECTION B. PERSONNEL INVOLVED <i>Complete Section B for Each Employee</i>		☐ NUMBER OF PERSONNEL INVOLVED		
1. PERSONAL DATA				
a. EMPLOYEE <i>(Identify)</i>	b. NAME (Last, First, M.I.)	c. DATE OF BIRTH MO DAY YR	d. SOCIAL SECURITY NUMBER - - - - -	
2. EMPLOYMENT HISTORY (Begin with present position)				
DATES (a) FROM TO MO YR MO YR	POSITION (Title, Series, Grade) (b)	FACILITY ID (c)	CLASSIF. LEVEL (d)	PERFORMANCE LEVEL (e)
3. POSITION CERTIFICATION				
a. LAST DATE OF CERTIFICATION/RECERTIFICATION ON POSITION MO DAY YR ☐ CERTIFICATION ☐ RECERTIFICATION				
b. WAS THE EMPLOYEE QUALIFIED ON THE POSITION ☐ YES ☐ NO 				
c. EMPLOYEE'S FIRST LEVEL SUPERVISOR	NAME (Last, First, M.I.)	SOCIAL SECURITY NUMBER		
d. EMPLOYEE'S SECOND LEVEL SUPERVISOR	NAME (Last, First, M.I.)	SOCIAL SECURITY NUMBER		

4. PERFORMANCE EVALUATION (Review past 12 months)													
a. DATE OF LAST TECHNICAL APPRAISAL PROGRAM (TAP) - Center Terminal Option													
<table border="1"><tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td>MO</td><td>DAY</td><td>YR</td><td></td><td></td><td></td></tr></table>							MO	DAY	YR				☐ NONE (Explain)
MO	DAY	YR											
b. DATE OF LAST TECHNICAL PERFORMANCE APPRAISAL PROGRAM (TPAP) - FSS Option													
<table border="1"><tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td>MO</td><td>DAY</td><td>YR</td><td></td><td></td><td></td></tr></table>							MO	DAY	YR				☐ NONE (Explain)
MO	DAY	YR											
c. WERE ANY DEFICIENCIES IDENTIFIED													
☐ YES (If yes, list all)													
☐ NO													
d. WAS REMEDIAL TRAINING ADMINISTERED													
☐ YES (If yes, explain)													
☐ NO													
5. PROFICIENCY TRAINING (Review past 12 months)													
a. WHAT TYPE OF REFRESHER TRAINING HAS BEEN RECEIVED													
☐ NONE													
☐ N/A													
b. WHAT TYPE OF SUPPLEMENTAL TRAINING HAS BEEN RECEIVED													
☐ NONE													
☐ N/A													
c. WHAT TYPE OF REMEDIAL TRAINING HAS BEEN RECEIVED													
☐ NONE													
☐ N/A													
d. DATE OF LAST TAPE MONITOR SESSION (Tape talk)	☐ NONE												
<table border="1"><tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td>MO</td><td>DAY</td><td>YR</td><td></td><td></td><td></td></tr></table>							MO	DAY	YR				
MO	DAY	YR											
6. MEDICAL CERTIFICATION													
a. DATE OF LAST AIRMAN MEDICAL EXAMINATION	b. ARE THERE ANY WAIVERS AND/OR RESTRICTIONS												
<table border="1"><tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td>MO</td><td>DAY</td><td>YR</td><td></td><td></td><td></td></tr></table>							MO	DAY	YR				☐ YES (If yes, explain)
MO	DAY	YR											
	☐ NO												
c. WERE RESTRICTIONS BEING COMPLIED WITH													
☐ YES													
☐ NO (If no, explain)													
☐ N/A													

REPORT NUMBER

7. WORK SCHEDULE

WEEK ENDING (Mo Day Yr)	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY

8. ACTIVITY PROFILE

HOUR	TIME (LOCAL)		DESCRIPTION OF ACTIVITY
	FROM	TO	
1ST			
2ND			
3RD			
4TH			
5TH			
6TH			
7TH			
8TH			
9TH			
10TH			

9. DID THE EMPLOYEE REQUIRE ASSISTANCE PRIOR TO THE OCCURRENCE

- ☐ YES (Provide explanation for either, yes or no)
- ☐ NO
- ☐ NOT AVAILABLE
- ☐ NOT IN AREA

10. DID THE EMPLOYEE REQUEST ASSISTANCE PRIOR TO THE OCCURRENCE

- ☐ YES (If yes, explain)
- ☐ NO

11. WAS THE EMPLOYEE AWARE THAT AN OPERATIONAL ERROR/DEVIATION WAS DEVELOPING

- ☐ YES (Provide explanation for either, yes or no)
- ☐ NO

12. DID THE EMPLOYEE CONTEMPLATE TAKING CORRECTIVE ACTION

- ☐ YES (Provide explanation for either yes or no)
- ☐ NO
- ☐ N/A

13. DID THE EMPLOYEE ATTEMPT TO TAKE CORRECTIVE ACTION

- ☐ YES (Provide explanation for either yes or no)
- ☐ NO
- ☐ N/A

14. EMPLOYEE WAS ALERTED TO THE OCCURRENCE BY

- ☐ CONFLICT ALERT ☐ PILOT ☐ MSW/EMSW
- ☐ SELF-IDENTIFIED ☐ FACILITY PERSONNEL
- ☐ OTHER THAN FACILITY PERSONNEL: _____

15. DATE/TIME EMPLOYEE BECAME AWARE OF THE OCCURRENCE

DATE

GMT

LOCAL

16. DID THE EMPLOYEE IDENTIFY ANY DISTRACTION(S) WHICH INFLUENCED THE OCCURRENCE

- ☐ YES (If yes, explain)
- ☐ NO

17. DID ANYTHING OCCUR IN THE WORK ENVIRONMENT WHICH DISTRACTED FROM THE EMPLOYEE'S PERFORMANCE

- ☐ YES (If yes, explain)
- ☐ NO

		REPORT NUMBER	
SECTION C. PILOT/AIRCRAFT DATA (Complete Additional Sections If More than Two Aircraft Involved)		☐ NUMBER OF AIRCRAFT INVOLVED	
	AIRCRAFT NO. 1	AIRCRAFT NO. 2	
1. IDENTIFICATION			
2. TYPE/SUFFIX			
3. DEPARTURE AIRPORT			
4. DESTINATION AIRPORT			
5. FLIGHT PROFILE AT TIME OF OCCURRENCE	☐ DESCENDING ☐ CLIMBING ☐ LEVEL FLIGHT ☐ TOUCHING DOWN ☐ AIRPORT MOVEMENT AREA ☐ TAXIING - RUNWAY ☐ TAXIING - TAXIWAY ☐ MAKING APPROACH ☐ RADAR VECTOR	☐ DESCENDING ☐ CLIMBING ☐ LEVEL FLIGHT ☐ TOUCHING DOWN ☐ AIRPORT MOVEMENT AREA ☐ TAXIING - RUNWAY ☐ TAXIING - TAXIWAY ☐ MAKING APPROACH ☐ RADAR VECTOR	
6. FLIGHT PLAN ROUTE			
7. EVASIVE ACTION	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN	
8. DID THE PILOT FILE A NEAR MID-AIR COLLISION REPORT	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN	
9. UNDER RADAR CONTROL	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN	
10. FUNCTIONING TRANSPONDER	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN	
11. FUNCTIONING MODE C	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN	
12. AIRCRAFT AND OBSTRUCTION/OBSTACLES ☐ TERRAIN ☐ OBSTRUCTION ☐ VEHICLE(S) ☐ EQUIPMENT ☐ PERSONNEL ☐ PROTECTED AIRSPACE ☐ AIRPORT MOVEMENT AREA			

REPORT NUMBER

SECTION C. PILOT/AIRCRAFT DATA (Complete Additional Sections If More than Two Aircraft Involved)		
	AIRCRAFT NO. _____	AIRCRAFT NO. _____
1. IDENTIFICATION	_____	_____
2. TYPE/SUFFIX	_____	_____
3. DEPARTURE AIRPORT	_____	_____
4. DESTINATION AIRPORT	_____	_____
5. FLIGHT PROFILE AT TIME OF OCCURRENCE	☐ DESCENDING ☐ CLIMBING ☐ LEVEL FLIGHT ☐ TOUCHING DOWN ☐ AIRPORT MOVEMENT AREA ☐ TAXIING - RUNWAY ☐ TAXIING - TAXIWAY ☐ MAKING APPROACH ☐ RADAR VECTOR	☐ DESCENDING ☐ CLIMBING ☐ LEVEL FLIGHT ☐ TOUCHING DOWN ☐ AIRPORT MOVEMENT AREA ☐ TAXIING - RUNWAY ☐ TAXIING - TAXIWAY ☐ MAKING APPROACH ☐ RADAR VECTOR
6. FLIGHT PLAN ROUTE		
7. EVASIVE ACTION	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN
8. DID THE PILOT FILE A NEAR MID-AIR COLLISION REPORT	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN
9. UNDER RADAR CONTROL	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN
10. FUNCTIONING TRANSPONDER	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN
11. FUNCTIONING MODE C	☐ YES ☐ NO ☐ UNKNOWN	☐ YES ☐ NO ☐ UNKNOWN
12. AIRCRAFT AND OBSTRUCTION/OBSTACLES ☐ TERRAIN ☐ VEHICLE(S) ☐ PERSONNEL ☐ AIRPORT MOVEMENT AREA ☐ OBSTRUCTION ☐ EQUIPMENT ☐ PROTECTED AIRSPACE		

SECTION D. PROCEDURES INVOLVED

1. TYPE OF CONTROL PROVIDED

☐ RADAR

☐ NONRADAR (Specify): ☐ AIRPORT SURFACE

☐ OCEANIC

☐ NONRADAR (Specify): ☐ AIRPORT SURFACE
☐ OCEANIC

2. TYPE OF PROCEDURES INVOLVED ☐ NATIONAL ☐ REGIONAL ☐ LOCAL

☐ REGIONAL ☐ LOCAL

3. SPECIFY SEPARATION MINIMA INVOLVED

HANDBOOK [] . [] OTHER (Specify):

PARAGRAPH [] . []

OTHER (Specify):

4. APPLIED SEPARATION - DIFFERENT THAN LISTED IN ITEM 3 ABOVE

☐ YES (If yes, explain)

☐ NO

☐ YES (If yes, explain)

☐ NO

5. DESCRIPTION OF PROCEDURES USED

6. WERE ANY PROCEDURAL DEFICIENCIES NOTED AS A RESULT OF THE OCCURRENCE

☐ YES (If yes, explain)

☐ NO

☐ YES (If yes, explain)

☐ NO

7 WERE ANY SPECIAL PROCEDURES IN EFFECT AT THE TIME OF THE OCCURRENCE

☐ YES, if yes, explain:

☐ NO

☐ Yes, self-explanatory
☐ No

SECTION E. CLOSEST PROXIMITY

A. ☐ IN THE AIR (Distance)

VERTICAL. FEET

HORIZONTAL. FEET MILES

HORIZONTAL

0 1 1 1 1 1 FEET 0 1 1 1 . 1 1 MILES

B.	☐ SURFACE (Description)

SECTION F. WORKLOAD

1. TRAFFIC ACTIVITY

 A. NUMBER OF AIRCRAFT
BEING WORKED

 B. TRAFFIC
COMPLEXITY

1	2	3	4	5
EASY		AVERAGE		COMPLEX

C. EXPLANATION OF TRAFFIC COMPLEXITY

2. POSITION/SECTOR OF OPERATION

A. WERE DUTIES AND RESPONSIBILITIES OF EACH POSITION ASSIGNMENT CLEARLY DEFINED

- ☐ YES
☐ NO (If no, explain)

B. COMBINED SECTOR (Centers and where applicable)

 (1) WERE ANY SECTORS COMBINED ☐ YES (If yes, identify)
☐ NO

 1.

 2.

 3.

LIST EMPLOYEES WORKING EACH COMBINED SECTION

 1. 2. 3.

(2) DID THE SUPERVISOR APPROVE THE COMBINATION

- ☐ YES ☐ NO

(3) DID THE TRAFFIC WARRANT THE COMBINATION

- ☐ YES ☐ NO

C. COMBINED POSITIONS

 (1) WERE ANY POSITIONS COMBINED ☐ YES (If yes, identify)
☐ NO

 1.

 2.

 3.

LIST EMPLOYEE WORKING EACH COMBINED POSITION

 1. 2. 3.

(2) DID THE SUPERVISOR APPROVE THE COMBINATION

- ☐ YES ☐ NO

(3) DID THE TRAFFIC WARRANT THE COMBINATION

- ☐ YES ☐ NO

3. SUPERVISOR

a. DOES THE FACILITY STAFFING PROVIDE FOR AN AREA OR SHIFT SUPERVISOR TO OVERSEE THE INVOLVED POSITION/SECTOR

- ☐ YES ☐ NO

b. WAS THE ASSIGNED SUPERVISOR PRESENT IN THE OPERATIONAL AREA AT THE TIME OF THE OCCURRENCE

- ☐ YES ☐ NO

c. WAS THE ASSIGNED SUPERVISOR AWARE OF

 TRAFFIC VOLUME ☐ YES ☐ NO

 DISTRACTIONS ☐ YES ☐ NO

 TRAFFIC COMPLEXITY ☐ YES ☐ NO

 REQUEST(S) FOR ASSISTANCE ☐ YES ☐ NO

d. WHAT ACTIVITY WAS THE ASSIGNED SUPERVISOR ENGAGED IN AT THE TIME OF THE OCCURRENCE

- ☐ SUPERVISING THE OPERATION
☐ DIRECT OPERATIONAL SUPERVISION
☐ WORKING A POSITION OF OPERATION
☐ OTHER (Specify):
☐ TRAINING
☐ ADMINISTRATION OF
☐ RECEIPT OF

SECTION G. TASK ENVIRONMENT

1. INDICATE IF ANY OF THE FOLLOWING MAY HAVE INFLUENCED THE OCCURRENCE (Provide an explanation of each)

- ☐ AMBIENT AIR ☐ PILOT ACTION ☐ NOISE ☐ LIGHTING
☐ WORK AREA LAYOUT ☐ ERRONEOUS INFORMATION ☐ NONE
☐ OTHER (Specify):

SECTION H. EQUIPMENT

1. DID EQUIPMENT LAYOUT OR DESIGN INFLUENCE THE OCCURRENCE

- ☐ YES (If yes, explain)
☐ NO

2. WAS ANY PERTINENT EQUIPMENT OPERATED BY THE CONTROLLER(S) REPORTED AS FUNCTIONING UNSATISFACTORILY BEFORE THE OCCURRENCE

- ☐ YES
☐ NO (If no, proceed to item 3, below)

a. DATE OF REPORT

b. TIME OF REPORT (GMT)

c. DESCRIBE EQUIPMENT PROBLEM(S)

 MO DAY YR
 | | | |
 | | | |

 | | | |
 | | | |

d. WAS ANY ACTION UNDERTAKEN TO CORRECT THE PROBLEM(S)

- ☐ YES
☐ NO (If no, explain)

3. TYPE	GOOD	FAIR	POOR	OUT OF SERVICE	SCHO MAINT	(If other than good, explain)
RADIO COMMUNICATIONS						
LANDLINE COMMUNICATIONS						
COMPUTER						
RAOAR						

4. WAS RADAR IN USE

☐ YES (If yes, enter source)☐ NO
☐ DARC ☐ NARROWBAND ☐ BROADBAND ☐ ARTS II ☐ ARTS III ☐ ARTS IIIA ☐ BRITE ☐ TPX-42

5. WAS RADAR TRANSITION IN PROGRESS

☐ YES (If yes, complete the following)☐ NO

	DARC	NARROWBAND	BROADBAND	ARTS II	ARTS III	ARTS IIIA	BRITE	TPX-42
FROM	☐	☐	☐	☐	☐	☐	☐	☐
TO	☐	☐	☐	☐	☐	☐	☐	☐

REPORT NUMBER

SECTION I, REMARKS

SECTION I. REMARKS (Continued)

☐ Continuation page(s) attached

SECTION J. CHECKLIST OF ATTACHED DOCUMENTS

- | | | |
|--|---|--|
| ☐ STATEMENT(S) | ☐ AIRWAY/AIRPORT CHART | ☐ CONFIGURATION CHART |
| ☐ FLIGHT PROGRESS STRIP | ☐ TRANSCRIPT | ☐ DIRECTIVES |
| ☐ ORDERS | ☐ OTHER (Specify) | ☐ PLOT/TRACE DATA |

SECTION K. INVESTIGATORS

DATE	TYPED OR PRINTED NAME	SIGNATURE (Investigator-in-charge)
DATE	TYPED OR PRINTED NAME	SIGNATURE (Team member)
DATE	TYPED OR PRINTED NAME	SIGNATURE (Team member)
DATE	TYPED OR PRINTED NAME	SIGNATURE (Team member)
DATE	TYPED OR PRINTED NAME	SIGNATURE (Team member)
DATE	TYPED OR PRINTED NAME	SIGNATURE (Team member)

PART II. FACILITY CHIEF ACTION

REPORT NUMBER

SECTION A. CLASSIFICATION

- ☐ OPERATIONAL ERROR ☐ OPERATIONAL DEVIATION ☐ PILOT DEVIATION ☐ NO OCCURRENCE
☐ MILITARY FACILITY DEVIATION

SECTION B. CATEGORIZATION

1. WHAT IS THE CATEGORY OF THE OPERATIONAL ERROR/DEVIATION ☐ PROCEDURAL ☐ EQUIPMENT ☐ HUMAN

2. RATIONALE FOR CATEGORIZATION

SECTION C. CAUSAL FACTORS

☐ Continuation section(s) attached

NO

YES

EMPLOYEE

1. DATA POSTING
- a. COMPUTER ENTRY
- (1) Incorrect input
- (2) Incorrect update
- (3) Premature termination of data
- (4) Other (Explain) _____
- b. FLIGHT PROGRESS STRIP
- (1) Not prepared
- (2) Not updated
- (3) Posted incorrectly
- (4) Repeated incorrectly
- (5) Updated incorrectly
- (6) Sequenced incorrectly
- (7) Resequenced incorrectly
- (8) Interpreted incorrectly
- (9) Premature removal
- (10) Other (Explain) _____
2. RADAR DISPLAY
- a. MISIDENTIFICATION
- (1) Overlapping data blocks
- (2) Acceptance of incomplete or difficult to correlate position information
- (3) Improper use of identifying turn
- (4) Failure to reidentify aircraft when the accepted target identity becomes questionable
- (5) Failure to confirm aircraft identity after accepting a radar handoff
- (6) Other (Explain) _____
- b. INAPPROPRIATE USE OF DISPLAYED DATA
- (1) Conflict alert
- (2) BRITE
- (3) Quick look
- (4) Mode C
- (5) MSAA/EMSAW
- (6) ARTS scratch pad
- (7) Other (Explain) _____
3. AIRCRAFT OBSERVATION (Towers only)
- a. ACTUAL OBSERVATION OF AIRCRAFT
- b. IMPROPER USE OF VISUAL DATA
- (1) Ground operation
- (a) Taxiing across runway
- (b) Holding in position for takeoff
- (2) Taking off
- (3) Landing
- (4) Traffic pattern
- (5) Missed approach
- (6) Touch and go
- (7) Other (Explain) _____

	NO	YES				
		EMPLOYEE				
4. COMMUNICATIONS ERROR						
a. PHRASEOLOGY						
b. TRANSPOSITION						
c. MISUNDERSTANDING						
d. READBACK						
(1) Altitude						
(2) Clearance						
(3) Identification						
e. ACKNOWLEDGEMENT						
f. OTHER (Explain) _____						
5. COORDINATION						
a. AREA OF OCCURRENCE						
(1) Inter-position						
(2) Intra-position						
(3) Inter-sector						
(4) Inter-facility						
b. AN AIRCRAFT PENETRATED DESIGNATED AIRSPACE OF ANOTHER POSITION OF OPERATION OR FACILITY WITHOUT PRIOR APPROVAL						
c. COORDINATION WAS EFFECTED AND ONE OR BOTH CONTROLLERS DID NOT UTILIZE INFORMATION EXCHANGED IN THE COORDINATION						
(1) Aircraft identification						
(2) Altitudes/Flight Level						
(3) Route of flight						
(4) Clearance limit						
(5) Speeds						
(6) APREQS						
(7) Special instructions						
(8) Other (Explain) _____						
d. FAILURE TO COORDINATE BETWEEN GROUND AND LOCAL CONTROL						
(1) Crossing active runway						
(2) Vehicle, equipment or personnel on active runway						
(3) Runway change						
(4) Use of other than active runway for arrivals and departures						
(5) Aircraft identification and/or landing/departing runway when runways in use are not visible from tower or aircraft using them are not visible on radar						
(6) Runway closure						
(7) Other (Explain) _____						
6. POSITION RELIEF BRIEFING DEFICIENCIES NOTED						
a. EMPLOYEE DID NOT USE POSITION RELIEF CHECKLIST						
b. EMPLOYEE BEING RELIEVED GAVE INCOMPLETE BRIEFING						
c. RELIEVING EMPLOYEE DID NOT MAKE USE OF PERTINENT DATA EXCHANGED AT BRIEFING						
d. OTHER (Explain) _____						

REPORT NUMBER

SECTION D. RECOMMENDATIONS AND CORRECTIVE ACTIONS

☐ Continuation page(s) attached

DATE

TYPED OR PRINTED NAME
FACILITY CHIEF

SIGNATURE

PART III. AIR TRAFFIC DIVISION CHIEF

REPORT NUMBER

SECTION A. CONCLUSIONS/RECOMMENDATIONS

☐ Continuation Page(s) Attached

DATE

TYPED OR PRINTED NAME
AIR TRAFFIC DIVISION CHIEF

SIGNATURE

APPENDIX B

Data Tables for Figures

TABLE A1
OPERATIONAL ERRORS VS. TOTAL OPERATIONS 1976-1987

YEAR	TOTAL ERRORS	TOTAL INSTRUMENT OPERATIONS (ARTCC & APPR. CONT.)	TOTAL AIRPORT TOWER OPERATIONS	TOTAL ATC OPERATIONS
1976	491	53,567,508	63,974,621	117,542,129
1977	507	57,492,041	66,724,291	124,216,332
1978	571	61,512,108	67,173,434	128,685,542
1979	612	66,134,739	69,039,372	135,174,111
1980	586	68,237,921	66,195,066	134,432,987
1981	457	66,752,601	61,570,457	128,323,058
1982	353	59,517,829	50,634,988	110,152,817
1983	723	63,400,599	53,320,931	116,721,530
1984	1888	68,942,532	56,958,937	125,901,469
1985	1402	71,827,106	58,020,808	129,847,914
1986	1203	75,782,411	59,754,343	135,536,754
1987	1213	79,880,060	61,020,657	140,900,717
%CHANGE (87-86)	0.8%	5.4%	2.1%	4.0%

TABLE A2
OPERATIONAL ERROR RATES 1976-1987

YEAR	TOTAL ERRORS	TOTAL ATC OPERATIONS	OVERALL ERROR RATE
1976	491	117,542,129	0.42
1977	507	124,216,332	0.41
1978	571	128,685,542	0.44
1979	612	135,174,111	0.45
1980	586	134,432,987	0.44
1981	457	128,323,058	0.36
1982	353	110,152,817	0.32
1983	723	116,721,530	0.62
1984	1888	125,901,469	1.50*
1985	1402	129,847,914	1.08
1986	1203	135,536,754	0.89
1987	1213	140,900,717	0.86
%CHANGE (87-86)	0.8%	4.0%	-3.0%

*1984-Introduction of Automatic Error Detection System
at All Domestic ARTCCs.

TABLE A3

OPERATIONAL ERRORS/ERROR RATES BY REGION & FACILITY TYPE

GEOGRAPHIC/FAA REGION	ERRORS							
	CENTERS (ARTCCs)		APPROACH CONT.		TOWERS (ATCTs)		ALL FACILITIES	
	1986	1987	1986	1987	1986	1987	1986	1987
AAL-ALASKAN	5	7	2	2	2	4	9	13
ACE-CENTRAL	30	41	12	9	4	4	46	45
AEA-EASTERN	136	125	48	44	11	25	195	194
AGL-GREAT LAKES	225	122	55	32	24	15	304	258
ANE-NEW ENGLAND	57	51	6	8	4	7	67	66
ANW-NW MOUNTAIN	52	47	19	30	11	10	82	87
ASO-SOUTHERN	140	174	64	70	13	18	217	262
ASW-SOUTHWEST	65	72	32	35	16	10	113	117
AWP-WEST PACIFIC	98	84	34	39	37	38	169	161
TOTAL	808	812	272	269	122	131	1202	1212
AVERAGE	89.78	90.22	30.22	29.89	13.56	14.56	133.56	134.67
STANDARD DEVIATION	64.02	63.19	20.90	20.04	10.51	10.50	89.28	84.49

GEOGRAPHIC/FAA REGION	ERROR RATES							
	CENTERS (ARTCCs)		APPROACH CONT.		TOWERS (ATCTs)		ALL FACILITIES	
	1986	1987	1986	1987	1986	1987	1986	1987
AAL-ALASKAN	1.22	1.64	0.54	0.54	0.18	0.37	0.48	0.70
ACE-CENTRAL	1.71	2.37	0.65	0.49	0.17	0.17	0.77	0.90
AEA-EASTERN	3.36	3.08	0.73	0.63	0.13	0.30	1.04	1.00
AGL-GREAT LAKES	2.90	2.63	0.83	0.47	0.25	0.15	1.28	1.05
ANE-NEW ENGLAND	3.82	3.04	0.37	0.43	0.11	0.19	1.01	0.92
ANW-NW MOUNTAIN	1.53	1.29	0.73	1.10	0.22	0.19	0.75	0.76
ASO-SOUTHERN	1.96	2.30	0.67	0.69	0.12	0.16	0.80	0.91
ASW-SOUTHWEST	1.36	1.46	0.60	0.64	0.24	0.15	0.67	0.69
AWP-WEST PACIFIC	2.66	2.06	0.50	0.52	0.29	0.29	0.73	0.66
TOTAL	2.34	2.25	0.66	0.61	0.20	0.21	0.89	0.86
AVERAGE	2.28	2.21	0.63	0.61	0.19	0.22	0.84	0.84
STANDARD DEVIATION	0.88	0.62	0.13	0.19	0.06	0.08	0.22	0.14

* excluding FSSs

TABLE A4

AIR TRAFFIC OPERATIONS BY REGION AND FACILITY TYPE 1987

REGION	CENTER (ARTCC) OPERATIONS			APPROACH CONTROL OPERATIONS			TOWER (ATCT) OPERATIONS		
	no.	column %	row %	no.	column %	row %	no.	column %	row %
AAL-ALASKAN	427,209	1.2%	22.8%	367,297	0.8%	19.6%	1,075,979	1.8%	57.5%
ACE-CENTRAL	1,728,229	4.8%	28.9%	1,854,209	4.2%	31.0%	2,396,124	3.9%	40.1%
AEA-EASTERN	4,060,381	11.2%	21.0%	6,982,103	16.0%	36.1%	8,293,196	13.6%	42.9%
AGL-GREAT LAKES	8,028,015	22.2%	32.6%	6,871,021	15.7%	27.9%	9,720,868	15.9%	39.5%
ANE-NEW ENGLAND	1,676,245	4.6%	23.4%	1,864,347	4.3%	26.0%	3,630,958	6.0%	50.6%
ANM-NW MOUNTAIN	3,641,632	10.1%	31.6%	2,715,576	6.2%	23.6%	5,150,505	8.4%	44.8%
ASO-SOUTHERN	7,563,525	20.9%	26.2%	10,202,038	23.3%	35.3%	11,103,898	18.2%	38.5%
ASW-SOUTHWEST	4,915,685	13.6%	28.9%	5,440,771	12.4%	32.0%	6,653,725	10.9%	39.1%
AWP-WEST PACIFIC	4,071,258	11.3%	16.6%	7,470,519	17.1%	30.4%	12,995,404	21.3%	53.0%
TOTAL	36,112,179	100.0%	25.6%	43,767,881	100.0%	31.1%	61,020,657	100.0%	43.3%

TOTAL OPERATIONS			
REGION	no.	column %	row %
AAL-ALASKAN	1,870,485	1.3%	100.0%
ACE-CENTRAL	5,978,562	4.2%	100.0%
AEA-EASTERN	19,335,680	13.7%	100.0%
AGL-GREAT LAKES	24,619,904	17.5%	100.0%
ANE-NEW ENGLAND	7,171,550	5.1%	100.0%
ANM-NW MOUNTAIN	11,507,713	8.2%	100.0%
ASO-SOUTHERN	28,869,461	20.5%	100.0%
ASW-SOUTHWEST	17,010,181	12.1%	100.0%
AWP-WEST PACIFIC	24,537,181	17.4%	100.0%
TOTAL	140,900,717	100.0%	100.0%

TABLE A5
OPERATIONAL ERRORS BY REGION BY MONTH 1986-1987

1986													
REGION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
AAL	0	1	0	0	0	1	1	2	2	0	2	0	9
ACE	1	2	4	1	2	3	4	10	9	1	5	4	46
AEA	8	15	12	13	14	17	27	20	14	21	18	17	196
AGL	14	25	20	22	34	21	31	33	30	28	19	27	304
ANE	2	0	6	4	6	4	6	10	12	8	2	7	67
ANM	7	6	8	5	7	9	6	7	14	5	5	3	82
ASO	19	9	22	18	15	20	21	18	13	26	25	11	217
ASW	9	10	9	7	9	7	12	15	8	9	11	7	113
AWP	16	23	15	11	17	12	18	14	13	11	12	7	169
ALL	76	91	96	81	104	94	126	129	115	109	99	83	1203

1987													
REGION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
AAL	2	2	1	0	0	4	1	1	1	1	0	0	13
ACE	1	3	1	8	6	9	10	2	4	3	1	6	54
AEA	16	23	21	11	20	17	22	21	9	12	9	13	194
AGL	26	8	18	15	20	26	29	31	28	26	16	15	258
ANE	3	5	7	8	9	8	6	5	5	0	3	7	66
ANM	3	8	10	5	10	11	9	6	9	4	5	7	87
ASO	23	21	24	16	24	30	24	23	19	16	18	25	263
ASW	11	10	11	7	11	13	10	6	6	11	13	8	117
AWP	17	19	13	16	11	14	13	12	17	9	11	9	161
ALL	102	99	106	86	111	132	124	107	98	82	76	90	1213

TOTAL AIRPORT OPERATIONS (MILLIONS) BY MONTH* 1986-1987

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
1986	4.5	4.0	5.0	5.1	5.3	5.3	5.5	5.6	5.1	5.3	4.6	4.5	59.8
1987	4.4	4.5	5.2	5.2	5.4	5.4	5.6	5.6	5.2	5.4	4.7	4.4	61.0

*Data Source: FAA, Office of Aviation Policy & Plans, Forecast Branch;
"Traffic Activity - Forecast Versus Actual, Fiscal Year 1988."

TABLE A6
OPERATIONAL ERRORS BY DAY OF THE WEEK 1986-1987

1986								
MONTH	SUN	MON	TUE	WED	THU	FRI	SAT	ALL
JAN	8	10	9	11	16	11	11	76
FEB	4	15	14	15	19	16	8	91
MAR	8	17	14	12	13	18	14	96
APR	3	11	20	12	14	12	9	81
MAY	9	16	15	13	21	21	9	104
JUN	7	9	10	22	22	21	3	94
JUL	8	13	23	28	31	12	11	126
AUG	13	18	12	27	23	25	11	129
SEP	5	15	29	21	16	20	9	115
OCT	5	7	14	30	21	22	10	109
NOV	11	8	20	18	18	15	9	99
DEC	4	16	20	9	9	18	5	83
ALL	85	155	200	220	223	211	109	1203

1987								
MONTH	SUN	MON	TUE	WED	THU	FRI	SAT	ALL
JAN	11	15	13	10	18	24	11	102
FEB	12	16	14	15	22	12	8	99
MAR	13	9	15	25	18	20	6	106
APR	9	13	8	18	20	8	10	86
MAY	13	14	17	16	15	28	8	111
JUN	5	17	31	20	23	22	14	132
JUL	12	17	16	26	25	22	6	124
AUG	9	17	18	15	22	16	10	107
SEP	8	10	18	30	20	8	4	98
OCT	14	5	16	14	17	7	9	82
NOV	7	8	19	14	10	14	4	76
DEC	9	7	18	17	10	18	11	90
ALL	122	148	203	220	220	199	101	1213

TABLE A7

OPERATIONAL ERRORS BY HOUR OF THE DAY 1986-1987

1986 ----		1987 ----	
HOURS -----	ALL NO. OF ERRORS -----	HOURS -----	ALL NO. OF ERRORS -----
12 am	7	12 am	8
1	3	1	1
2	1	2	2
3	2	3	0
4	1	4	1
5	5	5	3
6	11	6	13
7	66	7	67
8	86	8	89
9	101	9	85
10	85	10	101
11	86	11	87
12 pm	72	12 pm	67
13	81	13	82
14	89	14	79
15	82	15	114
16	94	16	106
17	91	17	97
18	78	18	71
19	60	19	59
20	49	20	34
21	34	21	28
22	13	22	13
23	6	23	0
---	----	---	----
ALL	1203	ALL	1213
---	----	---	----

TABLE A8
OPERATIONAL ERRORS BY AIRSPACE BY FACILITY TYPE 1986-1987

1986					
AIRSPACE TYPE	CENTER	TOWER	APPROACH CONTROL	FLIGHT SERV STA	ALL
TCA	2	15	68	0	85
PCA	487	2	2	0	491
RESTRICTED AREA	0	0	1	0	1
TRSA	0	6	39	0	45
MOA	1	0	1	0	2
APPROACH CONTROL	3	7	34	1	45
CENTER CONTROL	103	0	5	0	108
ARSA	5	8	58	0	71
AIRPORT SURFACE	0	69	27	0	96
OCEANIC	18	1	0	0	19
OUTSIDE CONTROLLED AIRSPACE	1	0	0	0	1
OTHER	188	14	37	0	239

1987					
AIRSPACE TYPE	CENTER	TOWER	APPROACH CONTROL	FLIGHT SERV STA	ALL
TCA	3	17	78	1	99
PCA	498	0	3	0	501
RESTRICTED AREA	0	0	1	0	1
TRSA	3	2	18	0	23
MOA	4	0	0	0	4
APPROACH CONTROL	3	5	27	0	35
CENTER CONTROL	96	3	6	0	105
ARSA	2	12	78	0	92
AIRPORT SURFACE	0	83	25	0	108
OCEANIC	18	1	0	0	19
NOT REPORTED	4	0	0	0	4
OTHER	181	8	33	0	222

TABLE A9

OPERATIONAL ERRORS BY ALTITUDE BY FACILITY TYPE 1987

----- ALTITUDE -----	----- CENTER -----	----- TOWER -----	----- APPROACH CONTROL -----	----- FLIGHT SERV STA -----	----- ALL -----
LESS THAN 3,000 FEET	16	108	67	1	192
3,000 - 10,000 FEET	104	19	167	0	290
10,001 - 12,499 FEET	57	1	20	0	78
12,500 - 37,000 FEET	624	3	14	0	641
OVER 37,000 FEET	11	0	0	0	11
ALTITUDE NOT REPORTED	0	0	1	0	1
----- ALL -----	----- 812 -----	----- 131 -----	----- 269 -----	----- 1 -----	----- 1213 -----

TABLE A10

AIR vs. SURFACE ERRORS 1986-1987

TYPE OF FACILITY	1986			1987		
	AIR	SURFACE	TOTAL	AIR	SURFACE	TOTAL
CENTER	808	0	808	812	0	812
TOWER	46	76	122	46	85	131
APPROACH CONTROL	234	38	272	240	29	269
FLIGHT SERV STA	1	0	1	1	0	1
TOTAL	1089	114	1203	1099	114	1213

TABLE A11

OPERATIONAL ERRORS BY PROFILE OF AIRCRAFT INVOLVED 1986-1987

1986

PROFILE OF 2nd AIRCRAFT

PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCEND- ING	CLIMBING	LEVEL FLIGHT	TOUCHING DOWN	MAKING APPROACH	TAXIING- RUNWAY	TAXIING TAXIWAY
NOT REPORTED	3	0	0	7	0	0	0	1
DESCENDING	1	81	41	215	0	2	2	0
CLIMBING	0	52	83	188	1	9	5	2
LEVEL FLIGHT	3	113	109	150	0	3	0	0
TOUCHING DOWN	0	0	4	0	4	0	15	0
MAKING APPROACH	1	0	2	5	1	15	4	1
TAXIING-RUNWAY	0	0	3	0	13	5	16	4
TAXIING-TAXIWAY	1	0	1	0	1	1	4	2
TOTAL	9	246	243	565	20	35	46	10

1987

PROFILE OF 2nd AIRCRAFT

PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCEND- ING	CLIMBING	LEVEL FLIGHT	TOUCHING DOWN	MAKING APPROACH	TAXIING- RUNWAY	TAXIING TAXIWAY
NOT REPORTED	6	1	1	4	1	0	0	0
DESCENDING	1	76	53	218	0	2	1	0
CLIMBING	6	49	84	183	1	5	2	1
LEVEL FLIGHT	2	129	105	148	0	2	0	0
TOUCHING DOWN	4	1	3	0	4	0	6	2
MAKING APPROACH	1	2	9	0	1	9	6	1
TAXIING-RUNWAY	10	2	6	0	16	0	17	8
TAXIING-TAXIWAY	0	0	1	0	2	0	5	0
TOTAL	30	260	262	553	25	18	37	12

TABLE A12

OPERATIONAL ERRORS BY CLASSIFICATION 1986-1987

1986

FACILITY	NOT REPORTED	MAJOR	MODERATE	MINOR	OTHER	TOTAL
CENTER	0	10	134	647	17	808
TOWER	122	*	*	*	*	122
APPROACH CONTROL	272	*	*	*	*	272
FSS	1	*	*	*	*	1

1987

FACILITY	NOT REPORTED	MAJOR	MODERATE	MINOR	OTHER	TOTAL
CENTER	0	6	152	638	16	812
TOWER	131	*	*	*	*	131
APPROACH CONTROL	269	*	*	*	*	269
FSS	1	*	*	*	*	1

*Not Applicable.

TABLE A13

OPERATIONAL ERRORS BY PROXIMITY 1986-1987

1986		PROXIMITY						
FACILITY TYPE	NOT REPTD	LESS THAN 1000 FEET	1000-1999 FEET	2000-2999 FEET	3000-3999 FEET	4000-4999 FEET	MORE THAN 5000 FEET	ALL
CENTER	3	4	4	3	6	7	781	808
TOWER	6	4	2	1	6	1	26	46
APPRCH CNTRL	19	13	24	4	20	15	139	234
FSS	1	0	0	0	0	0	0	1
ALL	29	21	30	8	32	23	946	1089

1987		PROXIMITY						
FACILITY TYPE	NOT REPTD	LESS THAN 1000 FEET	1000-1999 FEET	2000-2999 FEET	3000-3999 FEET	4000-4999 FEET	MORE THAN 5000 FEET	ALL
CENTER	14	3	1	3	6	8	777	812
TOWER	5	6	1	1	2	2	29	46
APPRCH CNTRL	10	29	21	6	13	13	141	240
FSS	0	0	0	0	0	0	1	1
ALL	29	38	23	10	23	23	948	1099

TABLE A14

CONTROLLER WORK FORCE 1987

FAA REGIONS	CONTROLLER WORK FORCE		OPERATIONAL ERRORS		
	CENTER (ARTCC)	Terminal Facilities: APPROACH CONTROL & TOWER (ATCT)	CENTER (ARTCC)	TOWER (ATCT)	APPROACH CONTROL
AAL-ALASKAN	146	109	7	2	4
ACE-CENTRAL	361	396	41	9	4
AEA-EASTERN	763	1361	125	44	25
AGL-GREAT LAKES	1530	1351	211	32	15
ANE-NEW ENGLAND	342	384	51	8	7
ANM-NW MOUNTAIN	782	652	47	30	10
ASO-SOUTHERN	1426	1681	174	70	18
ASW-SOUTHWEST	995	1065	72	35	10
AWP-WEST PACIFIC	729	1331	84	39	38
TOTAL	7074	8330	812	269	131

TABLE A15a

ARTCC OPERATIONAL ERRORS BY PROFILE OF AIRCRAFT INVOLVED 1986-1987

1986		PROFILE OF 2nd AIRCRAFT				
PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCENDING	CLIMBING	LEVEL FLIGHT	MAKING APPROACH	TOTAL
NOT REPORTED	3	0	0	7	0	10
DESCENDING	0	63	30	186	0	279
CLIMBING	0	34	47	152	2	235
LEVEL FLIGHT	3	89	86	104	0	282
TOTAL	6	186	163	449	2	806

1987		PROFILE OF 2nd AIRCRAFT				
PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCENDING	CLIMBING	LEVEL FLIGHT	MAKING APPROACH	TOTAL
NOT REPORTED	6	1	0	4	0	11
DESCENDING	1	57	36	182	1	277
CLIMBING	1	31	47	139	0	218
LEVEL FLIGHT	2	110	84	104	0	300
MAKING APPROACH	0	0	3	0	1	4
TOTAL	10	199	170	429	2	810

TABLE A15b

APPROACH CONTROL OPERATIONAL ERRORS BY PROFILE OF AIRCRAFT INVOLVED 1986-1987

1986

PROFILE OF 2nd AIRCRAFT

PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCEND- ING	CLIMBING	LEVEL FLIGHT	TOUCHING DOWN	MAKING APPROACH	TAXIING RUNWAY	TAXIING TAXIWAY	TOTAL
NOT REPORTED	0	0	0	0	0	0	0	0	0
DESCENDING	0	15	10	28	0	2	1	0	56
CLIMBING	0	15	19	29	1	2	0	0	66
LEVEL FLIGHT	0	23	21	43	0	3	0	0	90
TOUCHING DOWN	0	0	1	0	2	0	7	0	10
MAKING APPROACH	0	0	1	4	0	13	2	0	21
TAXIING-RUNWAY	1	0	0	0	6	1	7	2	16
TAXIING-TAXIWAY	0	0	0	0	0	0	1	0	1
TOTAL	1	53	52	104	9	21	18	2	260

1987

PROFILE OF 2nd AIRCRAFT

PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCEND- ING	CLIMBING	LEVEL FLIGHT	TOUCHING DOWN	MAKING APPROACH	TAXIING RUNWAY	TAXIING TAXIWAY	TOTAL
NOT REPORTED	0	0	0	0	1	0	0	0	1
DESCENDING	0	15	15	32	0	1	0	0	63
CLIMBING	2	12	28	35	0	2	0	0	79
LEVEL FLIGHT	0	18	18	43	0	2	0	0	81
TOUCHING DOWN	0	0	0	0	1	0	3	0	4
MAKING APPROACH	0	2	4	0	0	7	2	1	16
TAXIING-RUNWAY	2	2	3	0	2	0	7	0	16
TAXIING-TAXIWAY	0	0	0	0	0	0	1	0	1
TOTAL	4	49	68	110	4	12	13	1	261

TABLE A15c

CONTROL TOWER OPERATIONAL ERRORS BY PROFILE OF AIRCRAFT INVOLVED 1986-1987

1986

PROFILE OF 2nd AIRCRAFT

PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCEND- ING	CLIMBING	LEVEL FLIGHT	TOUCHING DOWN	MAKING APPROACH	TAXIING RUNWAY	TAXIING TAXIWAY	TOTAL
NOT REPORTED	0	0	0	0	0	0	0	1	1
DESCENDING	1	3	1	1	0	0	1	0	7
CLIMBING	0	3	17	7	0	5	5	2	39
LEVEL FLIGHT	0	1	1	3	0	0	0	0	5
TOUCHING DOWN	0	0	3	0	2	0	8	0	13
MAKING APPROACH	0	0	1	1	1	2	2	1	8
TAXIING-RUNWAY	0	0	3	0	7	4	9	2	25
TAXIING-TAXIWAY	1	0	1	0	1	1	3	2	9
TOTAL	2	7	27	12	11	12	28	8	107

1987

PROFILE OF 2nd AIRCRAFT

PROFILE OF 1st AIRCRAFT	NOT REPORTED	DESCEND- ING	CLIMBING	LEVEL FLIGHT	TOUCHING DOWN	MAKING APPROACH	TAXIING RUNWAY	TAXIING TAXIWAY	TOTAL
NOT REPORTED	0	0	1	0	0	0	0	0	1
DESCENDING	0	4	2	4	0	0	1	0	11
CLIMBING	3	6	9	9	1	2	2	1	33
LEVEL FLIGHT	0	1	3	1	0	0	0	0	5
TOUCHING DOWN	4	1	3	0	3	0	3	2	16
MAKING APPROACH	1	0	2	0	1	1	4	0	9
TAXIING-RUNWAY	8	0	3	0	14	0	10	8	43
TAXIING-TAXIWAY	0	0	1	0	2	0	4	0	7
TOTAL	16	12	24	14	21	3	24	11	125

TABLE A16

OPERATIONAL ERRORS BY MODE OF DETECTION BY FACILITY TYPE 1987

MODE OF DETECTION	CENTER	TOWER	APPROACH CONTROL	FLIGHT SERV STA	ALL
NOT REPORTED	6	0	0	0	6
CONFLICT ALERT	413	5	22	0	440
PILOT	16	23	45	0	84
SELF-IDENTIFIED	273	62	120	0	455
FACILITY PERSON	36	21	52	0	109
COMPUTER	31	0	1	0	32
SUPERVISOR	29	11	17	0	57
OTHER FACILITY	9	12	8	1	30
OTHER	0	1	1	0	2

TABLE A17a

ARTCC OPERATIONAL ERRORS BY TRAFFIC COMPLEXITY 1986-1987

AIRCRAFT HANDLED	COMPLEXITY						TOTAL
	NOT REPORTED	LIGHT	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	COMPLEX	
0	9	0	0	0	0	0	9
1	1	1	0	0	0	0	2
2	1	6	2	0	0	0	9
3	11	6	4	0	1	0	22
4	12	14	13	1	3	0	43
5	34	5	13	16	5	0	73
6	41	2	15	35	3	0	96
7	28	1	11	28	7	0	75
8	34	0	3	29	9	1	76
9	28	0	2	13	15	2	60
10	37	2	1	19	19	10	88
11	12	0	1	5	18	4	40
12	23	0	0	8	14	4	48
13	4	0	0	7	7	2	21
14	8	0	0	1	7	2	18
15	9	0	1	3	8	4	25
16	1	0	0	1	4	3	9
17	2	0	0	1	1	1	5
18	2	0	0	0	4	0	6
19	0	0	0	1	1	2	4
20	3	0	0	1	0	2	6
21	2	0	0	0	0	0	2
22	1	0	0	0	0	1	2
23+	69	0	0	1	2	1	73
TOTAL	372	37	66	170	128	39	812

TABLE A17b

APPROACH CONTROL OPERATIONAL ERRORS BY TRAFFIC COMPLEXITY 1986-1987

AIRCRAFT HANDLED	COMPLEXITY						TOTAL
	NOT REPORTED	LIGHT	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	COMPLEX	
0	0	0	0	0	1	0	1
1	0	5	1	1	0	0	7
2	0	9	2	0	0	0	11
3	0	9	12	3	1	0	25
4	0	7	11	12	6	0	36
5	1	5	5	29	9	1	50
6	2	1	3	23	15	0	44
7	2	0	0	11	15	3	31
8	0	0	0	14	12	3	29
9	0	0	0	2	7	2	11
10	0	0	0	0	7	4	11
11	0	0	0	1	4	0	5
12	0	0	0	0	1	2	3
13	0	0	0	1	0	0	1
14	0	0	0	0	0	0	0
15	0	0	0	0	2	0	2
16	0	0	0	0	0	1	1
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23+	1	0	0	0	0	0	1
TOTAL	6	36	34	97	80	16	269

TABLE A17c

CONTROL TOWER OPERATIONAL ERRORS BY TRAFFIC COMPLEXITY 1986-1987

COMPLEXITY							
AIRCRAFT HANDLED	NOT REPORTED	LIGHT	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	COMPLEX	TOTAL
0	0	1	0	1	0	0	2
1	0	5	0	1	0	0	6
2	0	7	1	2	0	0	10
3	1	6	4	0	0	0	11
4	0	7	5	11	0	0	23
5	1	2	3	6	4	0	16
6	0	1	3	6	2	1	13
7	0	0	0	7	8	0	15
8	0	0	1	2	3	0	6
9	1	0	0	1	6	1	9
10	0	0	0	4	6	1	11
11	0	0	0	0	1	0	1
12	0	0	0	0	2	0	2
13	0	0	0	0	1	0	1
14	0	0	0	0	0	0	0
15	0	0	0	1	0	1	2
16	0	0	0	0	1	0	1
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23+	1	1	0	0	0	0	2
TOTAL	4	30	17	42	34	4	131

TABLE A18
OPERATIONAL ERRORS BY NUMBER OF AIRCRAFT WORKED BY FACILITY TYPE 1986-1987

1986	NUMBER AIRCRAFT WORKED Frequency & Percent of Total					TOTAL
	1-5	6-10	11-15	16-20	21+	
CENTER	124 10.32	411 34.22	151 12.57	40 3.33	80 6.66	806 67.11%
TOWER	69 5.75	43 3.58	6 0.50	2 0.17	2 0.17	122 10.16%
APPROACH CONTROL	139 11.57	118 9.83	13 1.08	1 0.08	1 0.08	272 22.65%
FSS	1 0.08	0 0.00	0 0.00	0 0.00	0 0.00	1 0.08%
TOTAL	333 27.73	572 47.63	170 14.15	43 3.58	83 6.91	1201 100.00%

1987	NUMBER AIRCRAFT WORKED Frequency & Percent of Total					TOTAL
	1-5	6-10	11-15	16-20	21+	
CENTER	149 12.41	395 32.89	152 12.66	30 2.50	77 6.41	803 66.86%
TOWER	66 5.50	54 4.50	6 0.50	1 0.08	2 0.17	129 10.74%
APPROACH CONTROL	129 10.74	126 10.49	11 0.92	1 0.08	1 0.08	268 22.31%
FSS	1 0.08	0 0.00	0 0.00	0 0.00	0 0.00	1 0.08%
TOTAL	345 28.73	575 47.88	169 14.07	32 2.66	80 6.66	1201 100.00%

TABLE A19a

ARTCC OPERATIONAL ERROR REPORTS BY EMPLOYEE CONTRIBUTION 1986-1987

1986		1987	
FACTOR	TIMES CITED	FACTOR	TIMES CITED
DATA POSTING		DATA POSTING	
Computer Entry	33	Computer Entry	28
Progress Strip	76	Progress Strip	84
RADAR DISPLAY		RADAR DISPLAY	
Radar Misident.	78	Radar Misident.	74
Misuse of Data	259	Misuse of Data	191
AIRCRAFT OBSERVATION		AIRCRAFT OBSERVATION	
Actual Obs. of A/C*	1	Actual Obs. of A/C*	0
Misuse of Data	1	Misuse of Data	7
COMMUNICATION		COMMUNICATION	
Phraseology	15	Phraseology	12
Transposition	13	Transposition	27
Misunderstood	23	Misunderstood	27
Readback	70	Readback	64
Acknowledge	24	Acknowledge	22
Other	28	Other	37
COORDINATION		COORDINATION	
Inter-position	19	Inter-position	13
Intra-position	27	Intra-position	7
Inter-sector	34	Inter-sector	39
Inter-facility	12	Inter-facility	18
Airspace Penetration	12	Airspace Penetration	20
Info. Not Used	41	Info. Not Used	47
POSITION RELIEF		POSITION RELIEF	
Checklist	7	Checklist	5
Incomplete Brief	8	Incomplete Brief	7
Brief Not Used	1	Brief Not Used	5
Other	11	Other	10
NONE/UNKNOWN	13	NONE/UNKNOWN	405

* A/C = aircraft

TABLE A19b

APPROACH CONTROL OPERATIONAL ERROR REPORTS BY EMPLOYEE CONTRIBUTION 1986-1987

1986		1987	
FACTORS	TIMES CITED	FACTORS	TIMES CITED
DATA POSTING		DATA POSTING	
Computer Entry	7	Computer Entry	8
Progress	37	Progress	35
RADAR DISPLAY		RADAR DISPLAY	
Radar Misident.	33	Radar Misident.	43
Misuse of Data	106	Misuse of Data	94
AIRCRAFT OBSERVATION		AIRCRAFT OBSERVATION	
Actual Obs. of A/C*	8	Actual Obs. of A/C*	34
Misuse of Data	9	Misuse of Data	62
COMMUNICATION		COMMUNICATION	
Phraseology	10	Phraseology	8
Transposition	6	Transposition	15
Misunderstood	23	Misunderstood	28
Readback	29	Readback	26
Acknowledge	12	Acknowledge	20
Other	10	Other	19
COORDINATION		COORDINATION	
Inter-position	31	Inter-position	19
Intra-position	17	Intra-position	17
Inter-sector	1	Inter-sector	4
Inter-facility	13	Inter-facility	31
Airspace Penetration	42	Airspace Penetration	31
Info. Not Used	41	Info. Not Used	38
Ground/Local	2	Ground/Local	3
POSITION RELIEF		POSITION RELIEF	
Checklist	1	Checklist	7
Incomplete Brief	3	Incomplete Brief	4
Brief Not Used	4	Brief Not Used	4
Other	5	Other	2
NONE/UNKNOWN	24	NONE/UNKNOWN	30

* A/C = aircraft

TABLE A19c

CONTROL TOWER OPERATIONAL ERROR REPORTS BY EMPLOYEE CONTRIBUTION 1986-1987

1986		1987	
FACTORS	TIMES CITED	FACTORS	TIMES CITED
DATA POSTING		DATA POSTING	
Computer Entry	2	Computer Entry	0
Progress Strip	16	Progress Strip	8
RADAR DISPLAY		RADAR DISPLAY	
Radar Misident.	10	Radar Misident.	5
Misuse of Data	22	Misuse of Data	24
AIRCRAFT OBSERVATION		AIRCRAFT OBSERVATION	
Actual Obs. of A/C*	85	Actual Obs. of A/C*	62
Misuse of Data	165	Misuse of Data	132
COMMUNICATION		COMMUNICATION	
Phraseology	10	Phraseology	15
Transposition	11	Transposition	10
Misunderstood	16	Misunderstood	23
Readback	11	Readback	8
Acknowledge	18	Acknowledge	11
Other	11	Other	13
COORDINATION		COORDINATION	
Inter-position	18	Inter-position	15
Intra-position	12	Intra-position	5
Inter-sector	6	Inter-sector	0
Inter-facility	11	Inter-facility	11
Airspace Penetration	31	Airspace Penetration	11
Info. Not Used	20	Info. Not Used	20
Ground/Local	0	Ground/Local	18
POSITION RELIEF		POSITION RELIEF	
Checklist	2	Checklist	0
Incomplete Brief	4	Incomplete Brief	1
Brief Not Used	5	Brief Not Used	3
Other	6	Other	3
NONE/UNKNOWN	6	NONE/UNKNOWN	7

* A/C = aircraft

TABLE A20

OPERATIONAL ERROR REPORTS BY DAY OF EMPLOYEE WORK WEEK BY FACILITY TYPE 1986-1987

1986

DAY OF EMPLOYEE WORK WEEK

FACILITY TYPE	NOT REPORTED	1st DAY	2nd DAY	3rd DAY	4th DAY	5th DAY	6th DAY	ALL
CENTER	42	166	171	187	156	140	28	890
TOWER	3	30	27	39	26	17	2	144
APPROACH CONTROL	3	53	54	81	60	54	4	309
FSS	0	0	0	0	0	0	1	1
ALL	48	249	252	307	242	211	35	1314

1987

DAY OF EMPLOYEE WORK WEEK

FACILITY TYPE	NOT REPORTED	1st DAY	2nd DAY	3rd DAY	4th DAY	5th DAY	6th DAY	7th DAY	ALL
CENTER	79	183	174	172	146	98	20	1	873
TOWER	3	35	40	26	21	20	3	0	148
APPROACH CONTROL	1	58	63	61	62	42	5	0	292
FSS	0	0	1	0	0	0	0	0	1
ALL	83	276	278	259	229	160	28	1	1314

TABLE A21
OPERATIONAL ERROR REPORTS BY TIME INTO SHIFT
BY FACILITY TYPE 1986-1987

1986		FACILITY TYPE			
HOURS INTO SHIFT	CENTER	TOWER	APPROACH CONTROL	FSS	ALL
NR	370	10	10	0	390
1	59	16	40	0	115
2	67	22	42	1	132
3	68	19	50	0	137
4	82	24	39	0	145
5	82	19	36	0	137
6	66	12	33	0	111
7	45	14	34	0	93
8	47	8	23	0	78
9	3	0	1	0	4
10	0	0	1	0	1
11+	1	0	0	0	1

1987		FACILITY TYPE			
HOURS INTO SHIFT	CENTER	TOWER	APPROACH CONTROL	FSS	ALL
NR	416	7	12	0	435
1	75	21	33	1	130
2	79	23	51	0	153
3	59	20	34	0	113
4	56	27	46	0	129
5	60	15	24	0	99
6	38	17	35	0	90
7	51	9	30	0	90
8	34	7	25	0	66
9	5	1	2	0	8
10+	0	1	0	0	1

TABLE A22

OPERATIONAL ERROR REPORTS BY TIME ON POSITION BY
FACILITY TYPE 1986-1987

1986

TIME ON POSITION (Minutes)

FACILITY TYPE	NOT REPTD	1-30	31-60	61-90	91-120	120+	ALL
CENTER	47	268	261	134	77	103	890
TOWER	4	35	42	26	20	17	144
APPROACH CONTROL	5	99	93	65	23	24	309
FSS	0	0	0	1	0	0	1
ALL	56	402	396	226	120	144	1344

1987

TIME ON POSITION (Minutes)

FACILITY TYPE	NOT REPTD	1-30	31-60	61-90	91-120	120+	ALL
CENTER	86	264	213	121	54	135	873
TOWER	3	31	38	21	13	42	148
APPROACH CONTROL	3	84	63	40	30	72	292
FSS	0	0	1	0	0	0	1
ALL	92	379	315	182	97	249	1314

TABLE A23

OPERATIONAL ERROR REPORTS BY TYPE OF LAST NON-CONTROL
ACTIVITY BY FACILITY TYPE 1986-1987

1986		TYPE LAST NON-CONTROL				
FACILITY TYPE	NOT REPORTED	START OF SHIFT	BREAK	LUNCH	OTHER	ALL
CENTER	373	121	284	29	83	890
TOWER	12	40	54	22	16	144
APPROACH CONTROL	10	67	140	55	37	109
FSS	0	1	0	0	0	1

1987		TYPE LAST NON-CONTROL				
FACILITY TYPE	NOT REPORTED	START OF SHIFT	BREAK	LUNCH	OTHER	ALL
CENTER	422	129	221	28	73	873
TOWER	9	50	57	15	17	148
APPROACH CONTROL	15	76	144	36	21	292
FSS	0	1	0	0	0	1

TABLE A24

OPERATIONAL ERRORS/DEVIATIONS BY FPL TIME
BY FACILITY TYPE 1986-1987

1986					
FACILITY TYPE					
TOTAL FPL TIME	CENTER	TOWER	APPROACH CONTROL	FSS	ALL
NOT REPORTED	386	62	139	0	587
LESS THAN 1 YEAR	128	13	33	0	174
1-2 YEARS	108	34	37	0	179
3-5 YEARS	83	16	46	0	145
6-8 YEARS	68	5	22	0	95
9-11 YEARS	48	3	6	0	57
12-14 YEARS	9	3	8	0	20
15-19 YEARS	39	4	11	0	54
20+ YEARS	21	4	7	1	33

1987					
FACILITY TYPE					
TOTAL FPL TIME	CENTER	TOWER	APPROACH CONTROL	FSS	ALL
NOT REPORTED	422	62	126	1	614
LESS THAN 1 YEAR	56	10	14	0	80
1-2 YEARS	58	20	29	0	107
3-5 YEARS	121	32	67	0	220
6-8 YEARS	44	5	18	0	67
9-11 YEARS	51	8	10	0	69
12-14 YEARS	24	1	6	0	31
15-19 YEARS	59	6	12	0	77
20+ YEARS	40	4	10	0	54

TABLE A25

OPERATIONAL ERROR REPORTS BY TOTAL CERTIFICATION TIME
BY FACILITY TYPE 1987

TOTAL CERTIFICATION TIME	FACILITY TYPE				ALL
	CENTER	TOWER	APPROACH CONTROL	FSS	
NOT REPORTED	397	3	12	0	412
LESS THAN 1 YEAR	166	63	98	1	328
1-2 YEARS	86	31	70	0	187
2-3 YEARS	73	12	40	0	125
3-4 YEARS	50	15	24	0	89
4-5 YEARS	26	11	16	0	53
5-6 YEARS	16	4	3	0	23
6-7 YEARS	8	0	5	0	13
7-8 YEARS	7	0	4	0	11
8-9 YEARS	5	2	1	0	8
9-10 YEARS	7	0	5	0	12
10-20 YEARS	26	4	12	0	42
OVER 20 YEARS	6	2	2	0	10
ALL	873	147	292	1	1313

APPENDIX C

Factor Relationships of Operational Errors

Factor Relationships of Operational Errors

Using some of the data elements described previously in Chapter 4, simple linear regression illustrates the relationship between some of the prominent factors and the frequency of OE occurrences (see following Tables A26, A27, and A28). Regression is a series of statistical techniques used to assist in determining if a functional relationship exists between two or more correlated variables (such as traffic activity and the incidence of OEs). In more refined forms, regression provides a very powerful method for measuring the relationship between a dependent variable (such as OEs) and a number of independent variables (factors which may affect the frequency of OE occurrence).

The ability to estimate relationships between the dependent and independent variables would provide a tool to evaluate and estimate the impact of the proposed changes to the system (procedures, technology, personnel, etc.).

Only the most basic of the regression techniques are applied here to illustrate the utility of the process. Using the "method of least squares," data contained in the OE data base is applied to develop equations for lines which best fit the distribution of the dependent variable (OEs) in relation to the independent variables. It should be noted that there is no assurance in a regression model the dependent variable depends on independent variables in a causal or explanatory sense. For example, it is possible that both the dependent and independent variables may be simultaneously influenced by other variables not included in the model. However, with this caveat in mind, the basic equation (as follows) can be useful as a preliminary estimate:

$$y = a + b_i x_i$$

where: y = dependent variable (in this case OEs) to be estimated.

a = constant -- y intercept (the value of y when $x=0$).

b_i = the slope--coefficient of x_i -- the amount of change in y for one unit of change in x_i .

x_i = value of the independent variable used to predict the value of the dependent variable y .

TABLE A26

REGRESSION --ARTCCs OPERATIONAL ERRORS (1987)

Dependent Variable (y) = Operational Errors

Independent Variable (x1) = Operations (2 x Departures + Overflights)

" " (x2) = Ratio FPL Controllers to Total Controllers (CWF)

ID	FACILITY	OEs	OPS	Ratio FPL to Total CWF	REGRSS OE PREDICT.
ZAN	ANCHORAGE, AK	7	427209	0.4315	-2
ZKC	KANSAS CITY, MO	41	1728229	0.6897	38
ZDC	WASHINGTON, DC	73	2295370	0.6563	62
ZNY	NEW YORK, NY	52	1765011	0.6568	41
ZAU	CHICAGO, IL	64	2353192	0.4212	74
ZID	INDIANAPOLIS, IN	75	1789703	0.5956	45
ZMP	MINNEAPOLIS, MN	24	1612999	0.6755	34
ZOB	CLEVELAND, OH	48	2272121	0.6529	61
ZBW	BOSTON, MA	51	1676245	0.4941	45
ZDV	DENVER, CO	23	1309314	0.7023	21
ZLC	SALT LAKE CITY, UT	10	1084550	0.7095	12
ZSE	SEATTLE, WA	14	1247768	0.6991	19
ZJX	JACKSONVILLE, FL	45	1738742	0.7420	36
ZMA	MIAMI, FL	20	1558347	0.7148	30
ZME	MEMPHIS, TN	25	1829666	0.7062	41
ZTL	ATLANTA, GA	73	2436770	0.7707	63
ZAB	ALBUQUERQUE, NM	19	1461126	0.7985	23
ZFW	FORT WORTH, TX	24	1804095	0.7798	37
ZHU	HOUSTON, TX	29	1650464	0.7383	33
ZHN	HONOLULU, HI	2	503783	0.625	-7
ZLA	LOS ANGELES, CA	65	1905540	0.6024	49
ZOA	OAKLAND, CA	17	1612308	0.5700	39
ZUA	GUAM	0	49627		
ZSU	SAN JUAN, PR	11			

Regression Output:

Constant 0
Std Err of Y Est 12.837
R Squared 0.7083
No. of Observations 22
Degrees of Freedom 20

X Coefficient(s) 0.0000392 -43.12
Std Err of Coef. 0.0000051 13.363

t Value 1.0284316 0.8200

t Probability 0.1587719 0.2114

f Value 48.572961

f Probability 0.0000026

*Guam and San Juan excluded from the regression

TABLE A27

REGRESSION --APPROACH CONTROLS WITH THREE OR MORE OEs (1987)

Dependent Variable (y) = Operational Errors

Independent Variable (x1) = Operations (instrument)
 " " (x2) = Complexity (Subjective weighting)
 " " (x3) = Developmental Controllers/total Controllers
 " " (x4) = # of Instrument Meteorological Conditions Days(IMC)

FAA REG ID	FACILITY	OEs	OPS	COMPLEX.	DEVELMNTL TO TOT. CWF	DAYS IMC	REGRSS OE PREDICT.
ACE MCI	KANSAS CITY INTL.	5	321555	1.0	0.1556	37	5
ACE STL	ST. LOUIS INTL.	3	357236	1.0	0.1277	43	5
AEA BWI	BALT./ WASH. INTL.	4	571477	0.5	0.3125	47	6
AEA DCA	WASHINGTON NATL.	6	515754	1.0	0.2031	42	6
AEA N90	NEW YORK TRACON	16	1678941	3.0	0.3005	60	14
AEA PHL	PHILADELPHIA	8	588792	1.0	0.3333	57	7
AGL CMI	CHAMPAIGN UNIV. ILL.	3	132994	0.0	0.3333	68	4
AGL IND	INDIANAPOLIS	5	316058	0.0	0.0952	54	3
AGL ORD	CHICAGO O'HARE	9	1115266	2.5	0.2857	59	11
ANE BOS	BOSTON LOGAN	5	586968	1.0	0.1897	59	7
ANM D84	DENVER TRACON	8	594279	2.0	0.1250	24	7
ANM S46	SEATTLE TRACON	6	459948	1.0	0.0698	59	6
ANM S56	SALT LAKE CITY TRAC.	8	362676	0.5	0.1923	20	4
ASO ATL	ATLANTA INTL.	10	994567	2.5	0.1758	53	10
ASO BHM	BIRMINGHAM	3	235611	0.0	0.3750	45	4
ASO BNA	NASHVILLE	3	309749	0.0	0.1951	37	3
ASO CLT	CHARLOTTE/DOUGLAS	9	453178	0.5	0.2800	49	5
ASO CVG	CINCINNATI GRTR.	7	384706	0.5	0.3404	53	5
ASO JAX	JACKSONVILLE, FL	3	347905	0.0	0.3864	38	4
ASO MEM	MEMPHIS INTL.	3	431557	0.0	0.1887	34	4
ASO MIA	MIAMI INTL.	6	703909	1.0	0.1918	9	5
ASO PNS	PENSACOLA	3	414180	0.0	0.0667	39	3
ASO SDF	LOUISVILLE STANDIFOR	6	245812	0.0	0.4048	40	4
ASO TPA	TAMPA	4	517454	0.5	0.2029	24	4
ASW D10	DAL/FT.WTH TRACON	6	1035372	1.0	0.1053	31	7
ASW IAH	HOUSTON INTERCONT.	6	656852	1.0	0.2000	62	7
ASW MAF	MIDLAND	3	104071	0.0	0.4400	25	3
ASW SAT	SAN ANTONIO	5	360746	0.5	0.2340	64	5
ASW TUL	TULSA INTL.	4	233912	0.0	0.1613	33	3
AWP BUR	BURBANK	10	460048	2.5	0.4565	62	10
AWP EDW	EDWARDS RAPCON	4	307022	0.0	0.1724	23	3
AWP HNL	HONOLULU	3	390327	1.0	0.3171	2	5
AWP LAS	LAS VEGAS	4	407073	1.0	0.1622	1	4
AWP NZJ	COAST TRACON	5	476317	1.0	0.3556	61	7
AWP P50	PHOENIX TRACON	3	674641	0.5	0.2000	1	4

Regression Output:

Constant	0
Std Err of Y Est	1.6038354
R Squared	0.7072652
No. of Observations	35
Degrees of Freedom	31
X Coefficient(s)	0.000003 1.4927175 4.536486 0.032023
Std Err of Coef.	0.000001 0.5093584 2.133546 0.013840
t Value	3.198128 2.9305838 2.126265 2.313792
t Probability	0.001710 0.0033049 0.020971 0.013940
f Value	24.96597
f Probability	0.000000

TABLE A28

REGRESSION --CONTROL TOWERS WITH THREE OR MORE OEs (1987)

Dependent Variable (y) = Operational Errors

Independent Variables (x1) = Operations

" " (x2) = Ratio FPL Controllers to total Controllers

" " (x3) = # of Instrument Meteorological Conditions (IMC) Days

FAA REG	ID	FACILITY	OEs	OPS	Ratio FPL to Total CWF	DAYS IMC	REGRSS OE PREDICT.
AEA	ADW	ANDREWS AFB	3	145876	0.64	42	2
AEA	EWR	NEWARK INTL.	3	377902	0.75	61	4
AEA	JFK	J.F. KENNEDY	3	317900	0.70	60	3
AEA	PHL	PHILADELPHIA	4	417668	0.67	57	4
AEA	TEB	TETERBORO	3	214989	0.67	77	4
AGL	ORD	CHICAGO O'HARE	3	791886	0.72	59	5
ANE	BDL	BRADLEY/WINDSOR	3	185107	0.70	57	3
ANE	BOS	BOSTON LOGAN	4	440653	0.81	59	4
ANM	DEN	DENVER STAPLETON	3	520858	0.92	24	2
ASO	FTY	ATL. FULTON CTY.	3	159019	0.64	53	3
ASW	HOU	HOUSTON HOBBY	3	276760	0.62	53	3
AWP	LAX	LOS ANGELES INTL	11	667186	0.70	94	6
AWP	LGB	LONG BEACH	5	434995	0.78	91	5
AWP	SFO	SAN FRANCISCO	4	455874	0.74	57	4
AWP	VNY	VAN NUYS	3	476627	0.71	94	6

Regression Output:

Constant	0
Std Err of Y Est	1.748439
R Squared	0.385862
No. of Observations	15
Degrees of Freedom	12
X Coefficient(s)	0.0000040 -0.87851 0.046205
Std Err of Coef.	0.0000028 2.263337 0.022063
t Value	1.4429471 -0.38815 2.094248
t Probability	0.0876998 0.352389 0.029773
f Value	3.7697938
f Probability	0.0531951

The preceding three tables show the dependent variable (Operational Errors) and the various independent variables (e.g.; operations, the ratio of Full Performance Level Controllers to total controller work force and the ratio of Developmental Controllers to total controller work force) for ARTCCs, Approach Controls, and Control Towers having three or more OEs in 1987. Also shown are the data sets used in each regression and the output of the regression.

For the regression output, the constant of the regression equation is set to zero because there cannot be an error with zero traffic. For the factors considered in these regressions there are zero OEs ($y=0$) when the value of the independent variable is zero ($x=0$).

The standard error of the estimate is a measure of the scatter about a regression line. It has properties analogous to those of the standard deviation. For example, in a large sample, about 68 percent of the points would lie within plus and minus one standard error of the Y estimate, 95 percent of the points would lie within two standard errors, etc. Interpreted one way, R Squared can be a measure of the correlation between x_i and y or the dependency of y on x_i . In a very general sense, R Squared can also indicate how reliable a prediction can be made based on a and b_i . Yet, a high R Squared value is not necessarily an accurate indication of the predictive power of a regression model. This depends on the width of confidence or prediction interval which is determined by the Standard Error of Y. However, R Squared also shows the percent of the variability in the dependent variable which may be associated with the independent variables in the equation.

The "t" and "f" values and probabilities relate to tests of significance for the individual coefficients of the independent variables and for the regression as a whole. A "t" value is the ratio of the coefficient of an independent variable to its standard error. A loose interpretation of the "t" probability is that it is the probability that the x_i coefficient (b_i) occurs due to chance. The "f" probability interpretation is similar to the "t" probability except that it applies to the regression as a whole.

Table A26 (for ARTCCs, page C-4) indicates that there is a moderate relationship between OEs and the independent variables. That is, about 71 percent of the variation in OEs can be associated with operations and the ratio of FPLs to total controller work force. It is interesting to note that the model predicts the expected inverse relationship between FPLs (more experienced controllers) and OEs. As the ratio (FPLs to CWF) increases the number of OEs is predicted to decrease. The operations coefficient indicates a direct relationship.

However, there are other indications that the regression is not very precise. The standard error of the Y estimate is quite large (about one-third of the mean value). Consequently, the model should not be used for predictive purposes.

Tables A26 and A27 (pages C-5 & C-6) show similar regressions for Approach Controls and Towers. Additional independent variables were applied in both regressions. In the case of Approach Controls the output showed comparable results (R Squared= 0.71 and a highly significant "f" probability). However, the same limitations found in the regression for ARTCCs are also applicable here.

Probably because of the very small sample involved, the regression for Towers (Table 4.3) does not provide very useful output (R squared = 0.39). While the "f" value indicates a somewhat low probability (0.05) that the results of the regression occurred due to chance, the "t" values for two of the three individual coefficients are not significant (t probability >0.05). This frequently occurs when the independent variables are highly correlated. Yet, when considered with the other two regressions (Tables A26 and A27), it illustrates the benefit (in terms of statistical power) of small increases in the sample size.

The regressions shown consider all Centers, but only those Terminal Facilities with three or more OEs. Considering all facilities and additional factors that might be associated with the occurrence of operational errors for which data exists would most likely

improve the regressions (R Squares in the 0.8-0.9 and above range), thereby offering the potential for more accurate estimates of probable effects of proposed system changes. While a significant portion of the variability in OEs is apparently accounted for by the factors shown, the more important message from the regressions is that there are other significant factors affecting the occurrence of OEs which have not yet been considered in the regression. Also, it is apparent that other approaches should be pursued. Detailed or micro-analysis of a significant number of incidents where similar causal factors were present should uncover the existence of "common threads" (particularly human factors) contributing to the unwanted events.

