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OPERATIONAL PROBLEMS EXPERIENCED BY SINGLE PILOTS IN INSTRUMENT METEOROLOGICAL CONDITIONS

By Stacy Weislogel

August 5, 1981

Prepared under Contract No. NAS2-10060 by
BATTELLE COLUMBUS LABORATORIES
ASRS OFFICE
Mountain View, California

for
AMES RESEARCH CENTER
NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

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16. Abstract

Conclusions regarding single pilot IFR operational problems emerged from a study of 124 ASRS reported occurrences where difficulties were experienced by single pilots on IFR flight plans in IMC. Ten problem categories observed, in decreasing order of reporting frequency, were: (1) pilot allegations of inadequate service, (2) altitude deviations, (3) improperly flown approaches, (4) heading deviations, (5) position deviations, (6) below minimums operations, (7) loss of airplane control, (8) forgot mandatory report, (9) fuel problem, and (10) improper holding.

Examination of pilot experience data showed no correlation between inexperience and SPIFR problems suggesting experience may not be a primary factor. This led to a hypothesis that a solution to SPIFR problems may not lie in improving SPIFR capabilities but rather in changing the nature of the task. Safety, efficiency, and workload factors were present in the occurrences with over half involving an act or condition likely to lead to serious consequences and a third involving ignorant or imprudent departures from acceptable procedures. Human factors significant in many occurrences were: pilot "mind set", lack of pilot proficiency, lack of position awareness, distraction, and inadequate planning -- especially preflight.

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AC	Premature altitude change
AD	Altitude deviation
AE	Altitude excursion
AIM	Airman's Information Manual
AM	Altitude maintained
ANG	Air National Guard
AO	Altitude overshoot
APR	Approach
ARR	Arrival
ARTCC	Air route traffic control center
ASRS	(NASA) Aviation Safety Reporting System
ATA	Airport traffic area
ATC	Air traffic control
ATP	Air transport pilot
ATX	Air taxi
AU	Altitude undershoot
BC	Back course
CA	Conflict alert
CFII	Instrument flight instructor
CHR	Charter
CIV	Civil
CLB	Climb
CPR	Corporate
CRS	Cruise
DEN	Denver, Colorado
DEP	Departure
DME	Distance measuring equipment (airborne)
DOT	Department of Transportation
EDT	Eastern daylight time
EJ	Turbojet engine

ENR	Enroute
ER	Reciprocating engine
ET	Turboprop engine
EU	Engine type unknown
FAA	Federal Aviation Administration
FAF	Final approach fix
FAR	Federal Aviation Regulations
FBO	Fixed base operator
FRT	Freight
FSS	Flight service station
GS	Glide slope
HC	Premature heading change
HD	Heading deviation
HE	Heading excursion
HI	Intentional heading change
HLD	Holding
HM	Heading maintained
HO	Heading overshoot
HR	Heading reversal
HU	Heading undershoot
IAS	Indicated airspeed
ICB	Initial climb
IFR	Instrument flight rules
ILS	Instrument landing system navigation facility
IMC	Instrument meteorological conditions
LOC	Localizer
LOM	Locator outer marker (outer compass locator)
LTSS	Less than standard separation
MAP	Missed approach point
MDA	Minimum descent altitude
MSA	Mind set assigned to another aircraft
MSF	Mind set flight planned
MSH	Mind set habit
MSL	(Altitude with respect to) mean sea level
MSR	Mind set requested

NA	Not authorized
NASA	National Aeronautics and Space Administration
NAVAID	Radio navigational facility
NDB	Nondirectional beacon
NM	Nautical miles
NOAA	National Oceanic and Atmospheric Administration
NoPT	No procedure turn
NTSB	National Transportation Safety Board
OCA	Other controlled airspace, continental control area
OM	Outer marker
PAX	Passenger
PER	Personal
PLS	Pleasure
PRB	Personal business; probably
RNT	Renter
RVR	Runway visual range
SMA	Small aircraft (less than 5,000 lb gross weight)
SMT	Small transport (FAR - 135 limit, 5,000-14,000 lb)
SPIFR	Single pilot operating under instrument flight rules
TCA	Terminal control area
TRN	Training
TRS	Terminal radar service area
U.S.	United States
UNK	Unknown
USAF	U.S. Air Force
VFR	Visual flight rules
VOR	VHF omnidirectional range navigation facility
VORTAC	Collocated VOR and TACAN (tactical air navigation) transmitters
VSI	Vertical velocity indicator
XYZ	Code letters used to avoid identifying a location or navigation facility

OPERATIONAL PROBLEMS EXPERIENCED BY SINGLE PILOTS IN INSTRUMENT METEROLOGICAL CONDITIONS

by

Stacy Weislogel*

INTRODUCTION

The Aviation Safety Reporting System (ASRS) provides a unique resource for identifying operational problems experienced by different classes of pilots operating in various environments. This report presents the results of a study of the operational problems experienced by general aviation pilots flying alone on instrument flight rules (IFR) in instrument meteorological conditions (IMC).

General aviation's generation of IFR flight operations is impressive. Instrument operations at airports with FAA Traffic Control Service included 10.6 million air carrier and 19.6 million general aviation operations in 1980. By 1992 the FAA forecasts 12.8 million air carrier (21 percent increase) and 30.5 million general aviation (56 percent increase) instrument operations. The number of instrument rated pilots is expected to increase 48 percent during the same period.(1)

Presently, many IFR single pilot (SPIFR) operations are conducted by highly trained and experienced pilots flying modern, well equipped airplanes. However, a large proportion of the general aviation IFR operations involve relatively inexperienced single pilots, often with limited equipment, who are expected by the ATC system to perform at the same level of competency as the

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professional air carrier crews. Aviation agencies and user organizations have expressed concern that the level of competency expected to be demanded of the future SPIFR will not be attained unless significant improvements in the design of the aviation system are achieved. As a result, NASA is conducting a research effort independent of this study to provide the background research and to develop the technology required to improve the safety and utility of the single pilot general aviation aircraft operating under instrument flight rules.

This report illustrates how the ASRS database can be used to contribute to a current aviation research effort being conducted by NASA.

OBJECTIVE

The objective of this study was to identify and analytically describe the operational problems reported to the ASRS by the general aviation airman operating as a single pilot in instrument meteorological conditions. A further interest was to understand the nature and type of operational problems being experienced by this class of airman, referred to as single pilot IFR, or SPIFR.

SCOPE

This study is based on a review of reports in the ASRS-2 database as of December 10, 1980, for small aircraft, and as of March 18, 1981, for small transport aircraft. For any particular occurrence to be pertinent to this study, it must have met the following requirements. The aircraft must be (1) the type usually flown by a single pilot, (2) operating on an IFR flight plan in instrument meteorological conditions, and (3) experiencing an operational problem.

An operational problem is defined as any occurrence included in the ASRS-2 database in which the safe and/or efficient conduct of a SPIFR flight was adversely affected. With two exceptions*, the occurrences consist of a pilot's report about his own performance, reports by a pilot about the system performance, or reports by an air traffic controller about a pilot's performance.

Although the operational problems identified in this study were reported to be experienced by the SPIFR, they may not be peculiar to this class of airman. Multiple-pilot crews may experience the same operational problems to a greater or lesser extent.

APPROACH

The approach to the study encompassed the following steps: (1) develop and implement a search strategy to extract pertinent reports from the ASRS-2 database, create a document set for analysis, (2) develop a meaningful classification framework in which to fit the reports, and (3) document and analyze the reports.

Two SPIFR document sets were created: one concerning small (SMA) aircraft, the other concerning small transport (SMT) aircraft. In the ASRS, SMA are defined as less than 5,000 pounds maximum allowable gross weight, and SMT aircraft as 5,000 to 14,000 pounds. Although the nature of the reports does not always permit a determination of single versus multiple pilot crews, SMA are most often flown by a single pilot. By applying carefully selected criteria to filter out SMT reports likely to involve multiple pilot crews, a SMT single pilot document set was was created. In addition, by limiting the search to IFR flight plan trips that encountered instrument meteorological conditions, operational problems experienced by IFR single pilots were more readily identified. Further, numerous reports of traffic conflicts occurring in the see-and-avoid environment were eliminated.

An analysis of the narrative information in each of the reports led to the development of a classification framework of operational problem

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*One by the USAF, the other by a passenger/pilot.

categories into which each report was fitted. This procedure also eliminated those reports found not to be a SPIFR operational problem.

A first step in the documentation and analysis of the reports in each operational problem category was the preparation of a data table summarizing the relevant descriptive characteristics of each occurrence. Included in each of these data tables is information used in the assessment of the safety, efficiency, and workload characteristics of SPIFR operation. This information is presented later in this report. The analyses of the descriptive characteristics of each operational problem category and its safety, efficiency, and workload characteristics were conducted simultaneously, but are shown separately for the purposes of effective results' presentation.

For example, Table 11* indicates the type of altitude deviation for each occurrence. Information on Evasive Action, Conflict Alert (CA), Potential Conflict (PC), and Less than Standard Separation (LTSS) is presented and used later in an assessment of the impact on safety of altitude deviations by the SPIFR. Mission Phase data is used in a later assessment of SPIFR workload, and has been recoded using terminology more appropriate to workload assessment. The Number of Aircraft Involved determines what efficiency impact measure will be applied.

During the analysis of each occurrence by operational problem category, an attempt was made to determine why the problem occurred as a first step in solving the problem.

RESULTS AND DISCUSSION

Table 1* summarizes the search strategies which resulted in the SPIFR document set. The SMA document set was formed by applying a search strategy which simultaneously satisfied the following criteria applied to the ASRS-2 fixed field data: (1) Type of Aircraft: SMA, (2) Leg Flight Plan: IFR, (3) Flight Conditions: IMC. This strategy produced 310 reports, 91 involving only one SMA, and 219 more than one aircraft, at least one of which was SMA.

*All statistical tables are presented in Appendix A.

An analysis of the 91 reports revealed that 29 should be deleted, leaving 62 reports suitable for analysis. Of the 29 deleted, 20 concerned controller coordination in which the pilot was not a factor, and 9 were not IFR operational problems. Analysis of the narrative information in each of the 62 reports resulted in nine operational problem categories. A separate analysis was made of the 219 reports involving more than one aircraft, at least one of which was SMA. In 31 of the 219 reports, the SMA was involved in one of the nine operational problem categories. Two reports were added because they were referenced by one or more of the 31 reports, for a total of 33 reports. The final SMA document set consists of 95 reports representing 88 occurrences. An occurrence is an independent event which can be reported by more than one observer.

The SMT document set was formed by applying a search strategy which simultaneously satisfied the following criteria applied to the ASRS-2 fixed field data: (1) Type of Aircraft: SMT, (2) Leg Flight Plan: IFR, (3) Flight Conditions: IMC, (4) Airframe Characteristics (Engine): ER or ET (Reciprocating or Turboprop). EJ (Turbojet) aircraft were filtered out using the last criterion, because of the multiple-pilot crew requirement. This strategy produced 302 reports, 101 involving only one SMT, and 201 involving more than one aircraft, at least one of which was SMT. To insure a high likelihood that the the SMT document set would contain single pilot reports, additional criteria were applied to the ASRS-2 fixed field data to filter out those reports probably involving multiple-pilot crews. The additional document criteria were: (5) Operator Class: Civil (CIV), and (6) Operator Organization: Air Taxi (ATX), Fixed Base Operator (FBO), Renter (RNT), Corporate (CPR), and Personal (PER). Criteria (5) and (6) were applied during an analysis of the narrative information in the 302 reports which also deleted reports not considered an IFR operational problem. The analysis resulted in the deletion of 265 reports and the addition of one operational problem category. Four reports were added because they were referenced by one or more of the reports to be included in the SMT document set. The final SMT document set consists of 41 reports representing 36 occurrences. The SPIFR document set combines the SMA and SMT document sets and consists of 136 reports representing 124 occurrences.

An analysis of each report narrative led to a characterization of the occurrence in terms of how the safe and/or efficient conduct of the SPIFR flight was affected adversely. On the basis of researcher judgement, ten categories of operational problems experienced by single pilots in instrument meteorological conditions were identified. Each of the categories is examined in detail in the Operational Problems section.

Although ASRS data cannot accurately establish the prevalence of a problem, they can often provide convincing evidence that a problem exists. ASRS was designed to provide insights into problems present in the National Aviation System and why such problems exist, thereby pointing to possible solutions for such problems. Thus, ASRS is primarily an analytical, rather than a descriptive, tool.(2)

Tables 2 through 8 present a statistical profile of the SPIFR, SMA, and SMT document sets. Where the occurrence concerns more than one aircraft, the data describe the key pilot and aircraft variables involved. Where the occurrence is described by more than one report, the data are from the pilot's report and the report indicating more than one aircraft involved, as applicable.

Table 2 summarizes the number of reports and occurrences in the SMA and SMT document sets by Operational Problem Category and number of aircraft involved. The ordering of the Operational Problems is essentially the same for both sets. Seven of the ten operational problems are common to both. In the SMA set, the CIV operator class accounted for 86 of the 88 occurrences. In the SMT set, all of the 36 occurrences concerned the CIV operator class.

As illustrated in Table 3, the number of occurrences is about equally divided between pilot and controller reports, which is also true of the total ASRS-2 database. Passenger (PAX), Freight (FRT) and Charter (CHR) operations are typically flown by professional pilots. Of the occurrences in which the Operation is identified, 9 percent of the SMA set and 50 percent of the SMT set are in these three categories consistent with the tendency for SMT aircraft to be flown by professional pilots. The Training (TRN) operation in which both a pilot and an instrument flight instructor are aboard the airplane was not removed from the study because the instructor usually permits the pilot to make mistakes typical of a SPIFR operation.

Taken together, Tables 2 and 3 suggest that professional and nonprofessional pilots are experiencing generally the same types of problems in SPIFR flight.

That the SMT is typically flown by a professional pilot is again illustrated by Table 4, in which the largest number of identified Operator Organization/Operation (Mission) type pairs in the SMA set are PER/Pleasure (PLS) and PER/Personal Business (PRB) compared to the pairs ATX/Passenger (PAX), PER/PRB, and CPR/PAX in the SMT set.

The effect of workload on SPIFR operational problems appears in Table 5. Eighteen percent of SMA and 31 percent of SMT occurrences are in the Initial Climb (ICB) and Climb (CLB) Phases of Flight, which include the high workload departure phase. The highest proportion of general aviation IFR accidents occurs in the high workload approach phase. Thirty-six percent of SMA and 31 percent of SMT occurrences are in the Approach (APR) and Missed Approach (MAP) Phases of Flight. Although 27 percent SMA and 19 percent SMT occurrences are in the Cruise (CRS) Phase of Flight, the CRS Phase is not considered high workload. However, a large percentage of the flight time is in CRS with more time for an operational problem to develop.

Information on pilot total flight time and recency of experience is presented in Tables 6 and 7. Taken together, the data in these tables suggest that the pilot reporters are experienced pilots, lending additional credibility to the reports which they have contributed to the ASRS. Although the SMT reports are few in number, the SMT pilot reporter has more flight time and a higher level of recency of experience than the SMA pilot. Over half the SMA pilots who reported their flight time have 2000 hours or more total time, and 50 hours or more in the last 90 days. Similarly, half of the SMT pilots have 4000 hours or more total time, and over half have 150 hours or more in the last 90 days.

A Chi-square statistical test of significance of the SMA and SMT parts of Tables 2 and 4 was performed by the ASRS staff. It was concluded that there is no significant difference in the types of operational problems experienced by SMA pilots versus SMT pilots. However, there is a very significant difference in the operation (mission) type performed by SMA versus SMT pilots. A similar test of Table 6, total flight time, was judged to be not meaningful because of the small number of SMT total flight time reports. These findings further support the suggestion that the more experienced pilot is experiencing the same type of SPIFR operational problems as is the less experienced pilot. The significance of this hypothesis, if confirmed, would be that the operational problems experienced by the SPIFR are independent of experience. Effective remedies, therefore, do not lie in improving SPIFR capabilities through more training and experience, but rather in changing the nature of the SPIFR task by redesigning cockpit systems and ATC procedures. An independent study of the general aviation SPIFR operational profile, now in progress, will provide a source of information to test this hypothesis more completely.(3)

Table 8 presents information on the airframe characteristics of the aircraft contained in the SPIFR document set. Low wing airplanes appear in the set more than twice as often as high wing airplanes. The difference between the SMT and SMA document sets in the other characteristics is expected, with the SMT having a greater proportion of retractable landing gear (92 percent vs 57 percent), turboprop engines (25 percent vs 0 percent), and two engines (100 percent vs 16 percent). This table again illustrates that the SMT is more likely to be flown by a professional pilot.

In summary, the statistical profile of the SPIFR document set presented by Tables 2 through 8 suggests that: (1) the operational problem categories appear to be reasonable, (2) the SMT aircraft are more likely to be flown by experienced professional pilots, (3) the operational problems tend to occur in the high workload phases of flight, and (4) both SMA and SMT pilots are experiencing the same types of operational problems in approximately the same ranking, suggesting that SPIFR operational problems are independent of experience.

Operational Problems

The foregoing general findings suggest that the potential for developing insights into the operational problems experienced by single pilots in instrument meteorological conditions is possible through an analysis of the document sets by operational problem category.

Pilot allegations of inadequate service. - Pilots and air traffic controllers hold certain expectations about each other's performance and how the various components of the ATC system operate. When a pilot's handling by an air traffic controller is not what he had expected, he is likely to consider the ATC service inadequate. Similarly, the pilot is likely to consider the ATC system inadequate if a certain service component does not perform to his expectations.

The reports showed that pilots' expectations about the performance of controllers and the system are not being satisfied. Pilot allegations of inadequate service comprise the largest category of SPIFR operational problems identified in ASRS-2. Of the 124 occurrences in the document set, 37 (30 percent) concern inadequate service. These 37 occurrences are distributed among four subcategories, as shown in Table 9. Table 10 summarizes the pilot expectation which was not satisfied in the 37 occurrences.

Pilot expectation is a complex matter related to each individual's accumulation of aeronautical experience, knowledge, and skill. Whether a certain expectation is reasonable, valid, or justified must be measured against the system standard of performance, if indeed one exists that can be applied to a specific occurrence. Table 10 lists researcher judgements regarding the reasonableness of each expectation. Overall, the pilot's expectations were thought reasonable three times out of four. Although in many cases, the pilot may appear merely to be expressing annoyance that his expectations were not satisfied, the safety implications of each can be inferred. Instances where pilot's expectations were judged not reasonable suggest topics for airmen refresher courses and other continuing education programs for pilots.

Overall, 23 of the 37 inadequate service occurrences (62 percent) concerned pilot allegations of inadequate service from ATC, with about the same proportion of occurrences reported in both SMA and the SMT document sets. Allegations of inadequate service because of problems with radio communications reception (5, 14 percent), aviation weather reporting (5, 14 percent), and NAVAIDS (4, 11 percent), make up the balance of the 37 occurrences.

Altitude deviation. - Altitude deviation occurrences are the second most common category of SPIFR operational problems identified in ASRS-2, accounting for 20 percent of the document set. Reports of altitude deviations have been submitted by pilots and controllers, although predominantly by the latter (20 of 25 occurrences, or 80 percent). The operational characteristics of these occurrences are summarized in Table 11.

The following definitions, contained in the ASRS Third Quarterly Report(4), have been applied to the SPIFR altitude deviation occurrences:

- An altitude overshoot (AO) is an occurrence in which an aircraft either climbs above, or descends below, an altitude to which it has been cleared.
- An altitude undershoot (AU) exists when an aircraft terminates a climb at an altitude below that to which it has been cleared, or terminates a descent at an altitude above that to which it has been cleared.
- An altitude excursion (AE) is a deviation (of greater than 300 feet) above or below an altitude at which an aircraft has been cleared and which it was maintaining prior to the excursion. (Note: the part of the definition in parentheses was not applied in this study.)
- An altitude deviation (AD) is a generic term incorporating all of the above, and the following two definitions added for purposes of this study.
- An altitude maintained (AM) exists when an aircraft fails to leave its presently assigned altitude for a newly assigned altitude.
- A premature altitude change (AC) occurs when an aircraft initiates a premature climb or descent from its presently assigned altitude.

Concerning altitude deviations, the problem of misunderstood clearances is particularly disturbing, given the "readback" redundancy purposely designed into the system to compensate for possible misunderstandings. During the analysis of altitude deviation occurrences, the phenomenon of "mind set" emerged, wherein the pilot apparently selected an altitude from a preconditioning or subsequent intervening event, other than that which was assigned. Examples of the mind set phenomenon include pilots climbing to a flight planned or requested altitude, and seeking an altitude assigned to another aircraft.

When it appeared through a close reading of a narrative that a contributing factor, including mind set, could explain why an altitude deviation occurred, it was classified in Table 11 using the following abbreviations. The mind set phenomenon was identified in 68 percent of the altitude deviation occurrences.

MSF: mind set, flight planned - pilot seeks altitude which he filed in flight plan rather than assigned altitude.

MSA: mind set, assigned to another aircraft - pilot seeks altitude which he likely overheard assigned to another aircraft.

MSR: mind set, requested - pilot seeks requested rather than assigned altitude.

MSH: mind set, habit - pilot seeks altitude by habit rather than assigned altitude.

UNK: reason for altitude deviation unknown.

Of the 25 SPIFR aircraft involved in altitude deviation occurrences, 15 involved SMA aircraft and 10 SMT aircraft. Altitude overshoots accounted for the greatest number of deviations, 17 (68 percent); followed by premature altitude changes, 3 (12 percent); altitude undershoots, 2 (8 percent); altitude maintained, 2 (8 percent); and altitude excursions, 1 (4 percent). These results are comparable to the earlier ASRS study of altitude deviations.(4) An evasive action, conflict alert, potential conflict, or less than standard separation was reported in 19 (76 percent) of the AD occurrences.

Nineteen (76 percent) involved the relatively high workload phases Departure (DEP), Holding (HLD), Arrival (ARR), Approach (APR), and Missed Approach (MAP).

Personal business and pleasure flights accounted for more than half (69 percent) of the operations identified.

Controllers reported 80 percent of the ADs. In each case, the controller alleged that the pilot had erred. Since ASRS reports are not verified, it is possible that in some cases the controller erred, and the pilot was merely complying with an incorrect altitude assignment.

Human error is clearly evident in the ADs. Over half (13) involve pilot perception as the enabling factor, and 10 involve pilot technique. A factor in an occurrence is classified as "enabling" if its absence would probably have precluded the occurrence.

That the mind set phenomenon is the dominant predisposing condition for the human errors leading to ADs shows clearly in the Table 11 data with almost half of the ADs, 12 (48 percent) classified in the MSA category; 2 (8 percent) in the MSF category; 2 (8 percent) in the MSR category; and one coded MSH. The phenomenon is illustrated in these narratives:

> "Pilot of small aircraft was assigned 3000 feet after departure from Ft. Lauderdale Executive Airport. Pilot was observed climbing through 4600 feet at which time I questioned his assigned altitude. Pilot had filed for 8000 and was climbing to that altitude. No other traffic involved." (077)*

> "Aircraft A that departed Chattanooga Aiport was given vectors to on course and was told to maintain 5000 feet. Aircraft A requested 7000 feet due to other aircraft going in the same direction. Later on Aircraft A was given instructions to climb to 6000 and he advised that he was at 7000 feet." (099)

The data do not support the belief that many altitude deviations occur in the high density terminal areas, inasmuch as only 4 (16 percent) of the occurrences were in ATA or TRS airspace. However, liberal coding of OCA airspace for mission phases typical of terminal areas may explain this result.

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*Numbers at the ends of quotations are sequence numbers of items in the study data set.

In summary, ADs account for a significant portion of SPIFR operational problems with overshoots being reported several times more often than the other types. Human error and workload appear to be the main factors leading to ADs. Increased emphasis on the importance of the following pilot actions: altitude readback and verification of altitude when in doubt, seem to have the greatest potential for reducing the incidence of ADs. In a period when the use of altitude encoding transponders is increasing, it is surprising that ADs rank so high on the list of SPIFR operational problems. A pilot leaving an assigned altitude is required to report to ATC. If altitude deviations are judged to be a severe safety problem, the benefit of mandatory reporting of arrival at a newly assigned altitude, thereby placing that altitude at a higher level in the pilot's consciousness, could be weighed against the costs of increased frequency congestion.

<u>Improperly flown approach.</u> - Improperly flown approach occurrences are the third most common category of SPIFR operational problems identified in the study data set, accounting for 15 percent of the combined SMA and SMT document sets. Reports of improperly flown approaches have been submitted by pilots and controllers, although more often by the latter (12 of 18 occurrences, or 67 percent). The characteristics of improperly flown approach occurrences are summarized in Table 12.

The instrument approach phase of a SPIFR flight generally subjects the pilot to his greatest workload and often tests his instrument flying skill to the limit. Accident data continue to demonstrate the high percentage of aviation accidents which occur in the landing phase, including the instrument approach. A study of NTSB accident files for the period 1964 through 1975 revealed 877 single-pilot pilot error accidents, 446 (51 percent) of which occurred during the landing phase; 335 of the 446 had filed an IFR flight plan. Detailed examination of the 335 reports revealed that 96 (29 percent) happened during an ILS approach, 90 (27 percent) during a VOR approach, 30 (9 percent) during a LOC approach, and 21 (6 percent) during an NDB approach.(5)

Of the 18 improperly flown approach occurrences described in this study's data set, 9 (50 percent) occurred during an ILS approach, 4 (22 percent) during a VOR approach, 2 (11 percent) during a LOC BC approach, and 2

(11 percent) during an NDB approach. Radar assistance was available in 67 percent of the occurrences, and it is likely that it was also available in an additional 16 percent. An evasive action, conflict alert, potential conflict, or less than standard separation was reported in 7 (39 percent) of the occurrences. Three of the five pilots who reported flight time had a relatively high amount. The role of ATC in assisting pilots having difficulty in flying an instrument approach is clear, with ATC being credited as the recovery factor in all but one of the nine occurrences in which the factor was identified.

The operational problem experienced by the pilot in each of the six occurrences reported by pilots is summarized below. Lack of IFR single pilot proficiency may be inferred in each of the occurrences.

> Cleared for an ILS approach, pilot reports following GS but never intercepting LOC, and overflying airport. (004)
>
> After an IFR proficiency flight, pilot reports that his CFII executed a missed VOR approach incorrectly. (010)
>
> Pilot reports having incorrectly tracked his LOC on a BC approach due to fatigue, resulting in a missed approach. (035)
>
> Pilot reports experiencing vertigo during night ILS approach, resulting in missed approach. (109)
>
> After being radar vectored to the VOR/DME final approach course, pilot reports incorrectly turning outbound in order to fly a procedure turn. (053)
>
> After missing first attempt at an NDB approach, pilot reports landing out of an approach when not in a normal position to do so. (119)

Twelve improperly flown instrument approaches were reported by air traffic controllers. Each revealed a severe lack of IFR single pilot proficiency. The performance of the pilot, as reported by the controller in each occurrence, is summarized as follows:

> SMA was vectored for a VOR approach five times. Nonradar approach was then issued. (003)
>
> SMA did not report a missed ILS approach in a timely manner, and did not comply with published missed approach procedure. Disruption resulted in coordinating three other aircraft operations. (022)

SMT tuned in wrong NDB in order to fly an NDB approach. (101)

Inbound on an ILS approach, SMA made a 180 degree turn at the OM. (043)

Radar vectored for third attempt at an ILS approach; upon intercepting final approach course, SMA reversed course and flew outbound. (051)

After being cleared for a nonradar ILS approach, it was determined that the SMA pilot did not know his position and had descended below the minimum IFR altitude. (056)

SMA did not report a missed ILS approach in a timely manner and overflew the airport. (060)

SMT did not perform contact approach properly and missed the airport. (113)

SMA made two 360 turns on the final approach course of an ILS approach during simultaneous parallel ILS approach operations. (070)

SMT lands out of an ILS approach on the wrong parallel runway over a wide body transport holding in position for takeoff. (116)

SMA missed two LOC(BC) approaches and one ILS approach. Radar vectors were then given to the airport. (083)

Cleared for a VOR approach, SMA incorrectly initiates a 180 degree course reversal to perform a procedure turn. (086)

The pilot's lack of awareness of his position during an instrument approach was a factor in at least three of the improperly flown approach occurrences (003, 056, 113), as illustrated by the following narrative:

"...Vectors were issued to VOR A approach circle to land Rwy 32. During the next 25 minutes the aircraft was within 12 miles of the airport but did not land until 1210 EDT. Five different times Aircraft A was vectored to intercept the Deer Park 066 degree radial for the approach and all five times he couldn't find it. Finally radar service was terminated and he was issued a nonradar clearance for the VOR approach. This all took 15 minutes and was within 6 miles of VOR. After Aircraft A reported Deer Park on the approach it took him another 10 minutes to go 6 miles on final and land. The pilot seemed to know nothing about instrument flight..." (003)

The seriousness of the possible consequences of improperly flown approaches can be appreciated through a reading of the following narratives:

"Small Aircraft A was vectored to a Rwy 27L simultaneous approach to Chicago O'Hare with a restriction to hold short of Rwy 32L on landing roll out. I was monitoring the 27L final and noticed a drift off the localizer to the right. I made a transmission on the local control position override to have A stop descent and to turn left immediately. No immediate response was received from A. The aircraft made two 360 degree turns on the final. Aircraft B on the right final had to be given an emergency descent. Wide body transport C was pulled off the 27R final to avoid traffic and small transport D on the left was also pulled off and descended. This pilot is obviously unaware of the approach procedures and the area including the airport since he subsequently got lost on the ground." (070)

"Small Aircraft A executed two erratic Back Course approaches to Rwy 11, missing both. A then executed ILS Rwy 29 approach, during which pilot stated 'I lost it'. A period of intermittent communications followed. A rescue crew was dispatched. A established contact with St. Louis Approach Control and declared critical fuel. Approach Control vectored the aircraft to the airport. A landed Rwy 11 without reported damage or injury. Upon servicing the aircraft, the FBO advised Alton tower that A took on 36 gallons (38 gallon capacity). Alton weather was: SP XX09 local -X M3 OVC 3/4 F 0912. SA XX49 local -X M4 OVC 1F 0915/997." (083)

There is evidence that some pilots do not understand when NOT to execute a procedure turn maneuver as part of a published instrument approach procedure. A procedure turn is not to be performed if one of the following conditions is present: (1) the instrument approach procedure chart indicates "NoPT" (no procedure turn), or "procedure turn NA" (not authorized), or (2) the approach clearance issued reads "radar vectors to final approach course," or "cleared for a straight in approach," or (3) when the approach can be made from a properly aligned holding pattern. A recent issue of the DOT/FAA Airman's Information Manual Basic Flight Information and ATC Procedures Manual reveals a certain lack of information on this subject under the index heading "Procedure Turn".(6) The FARs contain little about the matter.(7) The following excerpt from a report narrative illustrates that some IFR single pilots think that they must fly a procedure turn.

"Approach Control cleared me for a VOR/DME approach to Rwy 20L at Nashville. I apparently was being vectored to intercept the 204 degree radial to track inbound when

> Approach directed me to contact the tower. I immediately did so, initiated a turn outbound on a heading of 024 degrees and advised the tower of my turn to the right and that I was heading outbound. The tower did not acknowledge. Approximately 30-40 seconds later as I was steady on the 024 degree radial outbound, the tower inquired 'where are you going?' I advised that I was headed outbound for a procedure turn. Tower instructed me to standby. I interpreted this to mean continue on present heading and altitude. The tower also instructed me to contact Approach Control. Approach vectored me back in to intercept the 204 degree radial and to track inbound. I was also admonished that procedure turns are used only upon instruction or acceptance by the controlling facility..." (053)

In summary, there are IFR single pilots who are having difficulty flying instrument approach procedures properly. The consequences can be serious. There appears to be a variety of reasons for the performances described during this crucial phase of an instrument flight. Lack of skill in flying and knowledge of how to fly the instrument approach procedure probably contribute most to the incidence of these occurrences. Lack of skill results from lack of proficiency and/or lack of thorough instrument flight training. Lack of knowledge may be a result of inadequate training and/or the absence of recent familiarization with the important aeronautical information required of a competent instrument pilot. As to unnecessary procedure turns, a more thorough treatment of the subject in the AIM and on the instrument rating written examination would have the potential for reducing the frequency of these occurrences.

Heading deviation. - Heading deviation occurrences are the fourth most frequent category of SPIFR operational problems identified in ASRS-2, accounting for 13 percent of the combined document set. There were 1.5 times as many altitude deviation occurrences by SMA as by SMT, and 3 times as many heading deviations. Reports of heading deviations have been submitted by pilots and controllers, although overwhelmingly by the latter (15 of 16 occurrences, or 94 percent). The characteristics of heading deviations in the study data set are presented in Table 13.

The following definitions were applied to the SPIFR heading deviation occurrences:

A heading overshoot (HO) is an occurrence in which an aircraft flies through a heading to which it has been cleared.

A heading undershoot (HU) is an occurrence in which an aircraft terminates a heading change short of the heading to which it has been cleared.

A heading excursion (HE) is a deviation left or right of the heading on which the aircraft has been cleared and which it was maintaining prior to the excursion.

A heading reversal (HR) is a change of heading opposite in direction to the heading to which the aircraft has been cleared.

A heading maintained (HM) exists when an aircraft fails to leave its presently assigned heading for a newly assigned heading.

A premature heading change (HC) occurs when an aircraft initiates a premature change of heading from its presently assigned heading.

An intentional heading change (HI) occurs when the pilot reported intentionally deviating from his assigned heading.

A heading deviation (HD) is a generic term incorporating all of the above, and used to code occurrences not having sufficient information to be assigned a more detailed code.

Where it appeared through a close reading of the narrative that the mind set contributing factor could explain why the heading deviation occurred, it was coded using the following abbreviations:

> MSF: mind set, flight planned - pilot seeks heading which will take him to his flight planned route rather than assigned heading.
>
> MSA: mind set, assigned to another aircraft - pilot seeks heading which he likely overheard assigned to another aircraft.

MSR: mind set, requested - pilot seeks requested rather than assigned heading.

MSH: mind set, habit - pilot seeks heading by habit rather than assigned heading.

UNK: reason for heading deviation unknown.

Like altitude deviation occurrences, it is likely that some heading deviations occur because of misunderstood clearances. Again, given the read-back redundancy available to compensate for misunderstandings, heading deviations, like altitude deviations, are particularly disturbing. The following is a clear example of a misunderstood heading clearance:

> "Aircraft A departed heading 255 degrees climbing to 4000 MSL. Aircraft B departed heading 210 degrees climbing to 4000 MSL. Aircraft A accepted an instruction issued to a third aircraft and turned left into Aircraft B...." (006)

Unlike altitude deviation occurrences, the mind set phenomenon did not emerge as a possible reason for heading deviations. However, workload is clearly a factor, with 69 percent (11 of 16) heading deviation occurrences taking place during the departure phase of an IFR flight, versus only 28 percent of the altitude deviations. Another 3 (19 percent) happened during APR and MAP phases. Only 2 were in the ENR phase. The data do support the belief that heading deviations occur in the high workload terminal areas, with 11 (69 percent) coded in Aiport Traffic Area (ATA), Terminal Radar Service Area (TRS), and Terminal Control Area (TCA) airspace.

Of the 16 SPIFR aircraft involved in heading deviation occurrences, 12 involved SMA aircraft and 4 SMT aircraft. Heading excursions accounted for the greatest number of deviations, 7 (44 percent); followed by heading reversal and heading maintained with 3 (19 percent) each, and heading overshoot, heading deviation, and intentional heading change with only 1 (6 percent) each. An evasive action, conflict alert, potential conflict, or less than standard separation was reported in 14 (88 percent) of the occurrences.

Controllers reported 94 percent of the heading deviations. In each case the controller perceived that the pilot had erred. Since ASRS reports are not verified, it is possible that in some occurrences the controller erred, and the pilot was merely complying with an erroneous heading assignment.

Human error appears in heading deviation occurrences, with 6 (38 percent) involving pilot perception as an enabling factor, and 3 involving pilot technique.

The following excerpt illustrates that sometimes pilots turn right when they have been asked to turn left:

> "...Aircraft A was assigned 320 degrees then 150 degrees then left to 020 degrees for vector around Aircraft B. Aircraft A turned right, which took him into the path of Aircraft B on final resulting in 300 feet and maybe 1 1/2 miles separation...". (027)

Three of the occurrences (19 percent) involved IFR training operations, suggesting that instrument flight instructors may be permitting their students to proceed too far into a heading deviation before correcting them, to the extent that a potential conflict and/or less than standard separation occurs, requiring evasive action:

> "...I believe this situation occurred because of bad flight instructor technique in allowing the student to deviate from ATC instructions. This seems to be a more common occurrence all the time. In my opinion the flight instructors are letting their students go too far to see if they can discover and recover from errors they have made in navigating or following ATC instructions. Flight instructors are still responsible for the flight and to make certain that ATC instructions and FARs are complied with. I feel the quality of IFR training is certainly in question in many accidents." (033)

In summary, the heading deviation occurrence is one of the more frequently reported SPIFR operational problems, with heading excursions being reported most often. Human error and workload are identifiable factors in heading deviation occurrences. Efforts to emphasize the importance of heading readback and verification of heading, when in doubt, have the potential for reducing the incidence of heading deviation occurrences. The instrument flight instructor practice of letting students experience the consequences of their errors could be examined with a focus on their effect on the ATC system, with advice disseminated to the instructor population.

Position deviation. - A position deviation occurs when either a controller or the pilot reports that an aircraft has been determined to be somewhere other than where ATC expected it to be. Position deviation occurrences represent 7 percent of the SPIFR document set. There were 7 SMA occurrences (2 reported by pilot and 5 by controller) and 2 SMT occurrences (1 each reported by pilot and controller). Characteristics of position deviations are shown in Table 14.

All but one of the occurrences happened during the enroute phase of flight, an anticipated characteristic of position deviations. In all but two pilot-reported occurrences, the enabling aircraft had not been acquired on radar before the position deviation took place. More often than not, the pilot either was not aware of his position deviation, or knowing it, did not advise ATC. The operational mission (operation) was not likely to be flown by a professional pilot.

Although the pilot appears to be the cause of most position deviations, ATC can contribute to the occurrence by issuing a nonradar, no-direct-communications clearance to a NAVAID out of service because of maintenance:

> "....Aircraft A was given a clearance from Jacksonville Center from Swainsboro, Georgia, Emanuel Co. Aiport to Dummy intersection, which is made up by the Dublin 210 degree radial and the Vienna 138 degree radial, 21 DME. Dublin VORTAC was out for maintenance. Non-radar at 6000 feet was approved from Swainsboro to Dummy. This flight path crossed approximately 40 miles southeast of Macon at the closest point, just cutting Macon Approach Control Airspace southeast of Dublin VOR. Aircraft A was radar identified approximately 15-20 miles east southeast of Macon out of 2900 feet climbing to 6000 feet. Aircraft B had just gone through the area at 2000 feet in the radar pattern at Robins AFB. No direct radio contact had been established with Aircraft A to this point. All clearances and pilot position reports were relayed by MDA 200 to Jacksonville Center. Aircraft A was on a west northwest course when he should have been southwest bound and he was approximately 25 miles north of course." (001)

The importance of a clearance confirmation in preventing a position deviation is illustrated by the following occurrence:

> "Pilot had filed for an IFR clearance from Oklahoma City Expressway Airpark to Oklahoma City VORTAC, then V14 to Hobart and Childress VORTACS. Clearance received was Oklahoma City VORTAC to V272, to intercept the 360 degree radial of Hobart VORTAC then direct to Hobart VORTAC then to Childress VORTAC and on to Midland, Texas, via original IFR flight plan requested. After departure and after passing Oklahoma City VORTAC on the V272 airway, the pilot was notified to 'resume own navigation,' correction, 'assume original flight plan.' Pilot assumed his request for V14 from Oklahoma City to Hobart to Childress legs were now approved..." (007)

As shown in the next example, the position deviations can sometimes be large. Of course, the controller may have heard "Evansville" when the pilot actually said "Louisville".

> "Aircraft A called VFR at 6500 feet and gave his position as approximately 20 DME west of Evansville tracking inbound to Evansville on the 225 radial and requested IFR to Charlotte at 9000 feet. After appropriate coordination with Evansville Approach Control who owns 8000 feet in the area, I cleared Aircraft A direct Evansville V4 Louisville flight plan and told him to report Evansville, as he was below radar coverage in the area. Standiford Approach Control (the next facility the flight would enter) called and asked where the flight was as they had acquired a track on it over the Louisville VOR (approximately 105 DME east of Evansville VOR)..." (012)

Pilots who do not maintain airways as cleared can cause potential conflicts requiring evasive action:

> "...At this time I told Aircraft A that he was in radar contact 1 1/2 miles northwest of Lafayette VOR, 12-13 miles east of V128 -- as he was cleared (which I confirmed with the pilot). Commuter Aircraft B was departing Lafayette Airport northbound, over Lafayette VOR climbing to 6000. B was stopped at 4000 feet in time, but would not have been if I had not seen A when I did. This situation occurred because the pilot could not navigate V128 or was cutting the corner." (068)

If ATC tells a pilot he is somewhere other than where he thinks he is, he might not agree:

> "I frequently fly to MHT Aiport (Manchester, NH) via Boston VOR 343 degree radial to Pelan intersection, direct MHT. Consistently Boston Approach Control tells me I'm 6 miles south of Pelan intersection when my own navigation tells me I'm at Pelan. Pelan is formed by the Boston 343 degree radial and MHT Localizer. I suspect the MHT LOC has a kink that sends it more southeast than it should. Since the angle between 343 degrees and 352 degrees is so small, a small kink could result in a substantial error in Pelan's location. It's a small thing, but I thought I'd mention it. Incidentally, my navigation receivers are properly aligned, so I don't think the problem is in my radios." (021)

One position deviation occurrence was reported by both controller and pilot. (124) The controller's analysis suggests that the pilot reported over an NDB (7.2 NM from Rwy threshold) when inbound on an ILS approach when he was instead over the OM FAF (3.8 NM from Rwy threshold). The pilot's narrative is somewhat confusing and irrelevant in content suggesting that the FAF was an LOM, when in fact the NDB was not collocated with the OM in this approach:

> "...Tower controller was trained by FAA to believe that pilots always (must) report passing Final Approach Fix (LOM) and predicated separation for departing IFR small transport Airplane B on this mis-training. Near miss occurred. The problem is that a pilot report over the final approach fix (FAF) is only a recommended practice. However FAA has led people to believe that a report over the FAF (maltese cross) is required, therefore expected by controllers when providing separation, creating an insidious potential hazard for a midair collision." (124)

Experienced instrument flight instructors have noted that one important characteristic of a skilled instrument pilot is his "positional awareness" -- knowing at all times and without doubt where he is, where he is going, and how he will get there. This concept of how to operate more safely and efficiently as an instrument pilot is rarely explicitly presented in instrument flight training programs. Pilots who understand and can consistently apply the concept of positional awareness are not likely to experience position deviations, or heading and altitude deviations. It would appear that instrument flight training programs, both initial and refresher, could place increased emphasis on the concept, with the result that IFR single pilots might indeed operate more safely and efficiently. It is suggested that most IFR single pilots operate in a first order mode of heading, altitude, and present position. Positional awareness, however, is a higher order mode of operation, consisting of an accurate mental picture of one's present and future location in three dimensional space, and an ability to work with time, speed, distance, and rates of change of heading, altitude, and position.

In summary, some IFR single pilots are not where ATC thinks they are, whether or not the pilots know where they are themselves. Emphasis on positional awareness during instrument flight training could produce safer, more efficient IFR single pilots.

Below minimums operation. - Seven below minimums operation occurrences were identified in the SPIFR document set, six involving SMA and one SMT. A below minimums operation is one in which the actual weather is lower than the minimums prescribed for the particular operation and a pilot performs a takeoff (2 occurrences), or lands an airplane (4 occurrences), or must divert to an alternate (1 occurrence). The characteristics of the below minimums operations are in Table 15.

All three of the below minimums occurrences reported by pilots were air taxi flights flown by relatively experienced pilots. Cognition encompasses the behaviors by which a person becomes aware of, and obtains knowledge about, his relationship to his environment.(8) In both of the takeoff occurrences, the pilot's cognitive process was involved:

> "I departed Rwy 12R thinking that I had my departure minimum of 1800 feet RVR. Ground Control gave me the RVR as 1400 but I failed to read back and my misunderstanding was not detected." (023)

> "...I read the takeoff minimums listed on page XII of the U.S. Government Instrument Approach Procedures -- U.S. South Central Volume 1 of 2 (NOAA) prior to takeoff and noted them as being 1/2 mile. Although I took off on

> Runway 22, I did not realize until later in the day, that the published minimums only applied to Runway 4 and not Runway 22..." (029)

A decision is the formulation of a course of action (from a limited number of alternatives) with the intent of executing it.(8) A pilot's decision making process resulted in landing an air taxi flight out of an instrument approach when the weather was reported indefinite ceiling three hundred, sky obscured, one-eighth mile surface visibility:

> "...During the approach I experienced constant missing in both engines. Upon reaching the Outer Marker I could clearly see a portion of the Approach Light System due to breaks in the obscuration. I continued with the approach, momentarily losing sight of the approach lights but regaining sight once again one hundred feet above the Decision Height. Rather than head to another aiport and have the engines possibly quit somewhere enroute, I decided to continue the approach since I clearly had the approach lights in sight and could, at one hundred feet above Decision Height, see the Runway 5 threshold." (117)

The importance of proper preflight planning in making the important weather go/no go decision also involves the pilot's decision-making process, and could prevent "getting into a situation he was very fortunate to survive:"

> "At 2:36 PM a Small Aircraft declared a missed approach at Akron-Washington Co. Airport, Colorado, to Akron Radio. He advised that he was encountering moderate icing conditions, and was unable to climb above 5600 feet MSL (1000 feet above the terrain). Akron Radio relayed this information to Denver ARTCC Sector 15 and said that the weather had just gone to indefinite ceiling zero, sky obscured, visibility zero in fog (a fast moving winter storm was moving through the area). Sector 15 advised Akron FSS to switch aircraft to sector 15 frequency. Aircraft reported on frequency and advised that he was unable to climb, had lost his Gyro vacuum system and airspeed indicator and needed help. A check of alternates showed that Denver was the only field that had approach minimums. An emergency was declared by Denver ARTCC and the aircraft was vectored to Buckley ANG Base and landed safely at 3:31 PM. (Quite a bit transpired between Akron and Buckley. No airspeed indicator, max-

imum altitude was 6000 feet MSL, fuel gauges on empty last 15 minutes.) Cause: Pilot allowed himself to get into a situation he was very fortunate to survive. Low on fuel, moderate icing, nearest alternate almost out of range, minimum IFR equipment installed. Pilot failed to realize the severity of the fast approaching cold front." (019)

Landing out of an approach when the weather is reported to be below published minimums can have unfortunate results:

> "Small Aircraft A departed Roanoke for Bluefield. As controller, I was working the nonradar Sector for Roanoke Approach. This is beyond the radar coverage for Roanoke. The Aircraft came on my freqency and at that time the Bluefield Weather was below ILS Rwy 23 minimums. Enroute the weather decreased to ceiling zero, visibility 1/4 mile and fog. He missed on first approach. Later he was cleared for second approach and turned over to Bluefield Radio for Advisory Service, and to report his down time or missed approach to them, as he would be out of Roanoke Approach radio coverage. Later that night, I was advised the aircraft had landed, collapsed the gear and was in a snow bank and the runway was closed. Four persons were on board with no injuries and the aircraft suffered minor damage." (073)

In summary, there are SPIFR flights being conducted below minimums. The number of occurrences is too small to detect any pattern. However, better preflight weather planning coupled with more conservative go/no go decision making, and more acute cognitive processes would lessen the incidence of these occurrences.

Loss of airplane control. - Loss of airplane control during flight in IMC can have dire consequences. This SPIFR operational problem is a small but identifiable part of the document set. Characteristics of the occurrences are in Table 16. All four were reported by SMA pilots. Loss of control occurs when a pilot reports that he is no longer in control of the airplane attitude. Except for an apparent wake turbulence encounter, it is surprising that pilots with the total flight time in these four occurrences would experience the loss of airplane control reported.

The mere distraction of tuning VOR receivers has resulted in a loss of airplane control:

> "...After entering the clouds and level at 5000 feet on an easterly heading which Departure Control had given me, my No. 1 VOR indicated that the course was west of me. My No. 2 VOR had the OFF flag showing. While retuning the VOR'S, I inadvertently rolled into a right bank and turned to a heading of 180. I then rolled in to a left turn at which time Departure Control requested my intentions. I said that I was trying to intercept the airway. Both VOR'S now indicated that I was well east of course. Departure Control then gave me a right turn direct to New Hope. Having already started a left turn I requested and received a left turn direct to New Hope. I then proceeded direct with no further distractions. I momentarily forgot rule No. 1, fly the airplane." (084)

An apparent wake turbulence encounter provided an instrument flight instructor and his student with a brief, violent ride:

> "Takeoff from Rwy 24 complex, Los Angeles Ventura departure. Entered overcast at about 1000 MSL, gauges frozen, everything looking good, IAS 120. IAS went quickly to 186, VSI pegged down direction... I adjusted more and more nose up on the artificial horizon. It didn't make much difference on IAS or VSI. (Heading still OK at 255). Suddenly the IAS went up to 190 and decreasing fast -- VSI pegged up, I adjusted for more nose down than I normally like and got IAS stabilized at 90-100. Nose started drifting left, I applied more right rudder and aileron. Controller said turn right to 270 degrees. Aircraft kept yawing left, me trying to get to 270, got it stopped at 230. Aircraft suddenly stabilized and I came around to 280, OK. Scared the hell out of me. I related my situation to the controller. He stated a jumbo had passed abeam of my track at about 4000 feet a few minutes ago. He gave me a telephone number to call when I arrived at Paso Robles so we could analyze the situation. Controller told me over the telephone they had checked everything out and thought the problem may have been a medium large transport which took off about 6 minutes in front of me. I think the problem was the jumbo flying abeam of my track because of the initial pitch-up then pitch down attitude or maybe a combination of the jumbo and the medium large transport. I have done a lot of soul searching on this matter -- spatial disorientation -- I don't think so. At present wake turbulence seems to be a black art, and really little one

can do about it when flying IFR, complying with clearances, procedures, etc., in the real world." (014)

An equipment malfunction, combined with a passenger distraction, can result in abrupt loss of airplane control:

"I was 27 miles northeast of the International Airport at the Twin Cities at 4000 feet when I lost autopilot and dropped 1800 feet. I also believed I heard that I was to start the approach and was turning. I had a baby in the seat behind me and she was screaming at the top of her voice. I started to turn and I suddenly lost the autopilot and dropped 1800 feet. Then approach radar picked me up. I climbed up to 4000 feet on a vector. They called me. I explained what happened and as I did not cause any interference with other aircraft and recovered adequately, they said 'no write up'." (061)

Continuing an IFR flight into an area of turbulence after a vacuum pump failure had serious consequences:

"1. IFR on top of broken layer and VFR conditions below. 2. After departure I lost vacuum pump. 3. Continued on top, with VFR conditions below. 4. Entered tops without gyros and flew on needle ball and airspeed. 5. Entered turbulence and lost 3000 feet, then climbed 2000 feet and unable to follow instruments due to turbulence. 6. I had informed each controller that I had no gyros and was on top for one hour. 7. In rain and turbulence and rolled over and also exceeded red line airspeed by 40 MPH. 8. Finally made ground contact (visual) and saw I was inverted. 9. Rolled out straight and level at red line plus 30 MPH and requested a no gyro approach in haze with 3-5 miles visibility. 10. Landed at XYZ -- where aircraft is to be inspected for damage." (059)

To summarize, loss of airplane control, although a small but identifiable part of the SPIFR operational problem document set, can have serious consequences. The importance of basic airplane attitude control while the pilot is dealing with a problem distraction is evident in these reports. The FAA has been concerned about the ability of pilots to handle distractions, and in January, 1980 announced a policy of incorporating into all flight tests the use of certain distractions during the performance of flight test maneuvers. In an Advisory Circular, the FAA noted that at the time of their next revision, all flight test guides will be changed to include distractions appropriate to selected flight maneuvers listed under pilot operations(9). During the interim, FAA inspectors and designated pilot examiners may incorporate the use of realistic distractions during the performance of flight test maneuvers. Although the FAA's concern was a result of findings in a stall awareness study(10), on the basis of these occurrences the concept is also appropriate for instrument flight tests.

Forgot mandatory report. - Four occurrences in which the IFR single pilot forgot to make a mandatory report were identified in the SPIFR Document Set. Two were SMA occurrences, two SMT occurrences. One was reported by the pilot, three by controllers. Characteristics of the reports are in Table 17.

The Airman's Information Manual, published by the DOT/FAA, and FAR 91.125 specify what reports should be made to ATC or FSS facilities without request. If a pilot fails to do so, he forgot to make a mandatory report without request. In addition to these reports, a pilot is expected to report on a newly assigned frequency. This category of SPIFR operational problem has too few occurrences to permit meaningful analysis. However, a close reading of the narratives indicates that each failure to make a mandatory report involved more than the pilot's simply forgetting.

A flight instructor, for example, permitted his ATP student to land out of an approach without a landing clearance:

> "... While instructing an ATP candidate in multiple approaches to Runways 8L and 4R at Honolulu, I allowed the aircraft to be landed without calling Outer Marker inbound to Tower and monitoring Tower frequency. The factors that played a part in this event were: 1. use of headset and boom microphone by the student and yoke mounted push to talk switch reduces the instructor awareness that a transmission had been made. 2. on all previous approaches for the last three nights, the controller advised OM and change of frequency lulling the student into the mode of dependence on the call to report OM." (025)

Interfacility coordination problems also seem to contribute to a pilot's tendency to omit making a mandatory report. For example, ATC terminates radar service on an IFR flight and makes a nonradar handoff; the pilot then forgets to make a report over a designated compulsory reporting point but requests an altimeter setting; the new ATC facility fails to recognize that the requesting aircraft is IFR; and the flight then proceeds through controlled airspace without being controlled or separated. (074)

If a pilot fails to report on a newly assigned frequency and ATC facilities fail to make a coordinated attempt to recontact the aircraft, flight safety can be compromised, as illustrated by the following synopsis:

> "Center controller told pilot of corporate twin to change to Approach Control. Pilot acknowledged. Controller later became concerned when the aircraft came close to another aircraft which he had also handed off to Approach. He then learned that the twin was still on his frequency. Pilot said he thought he had changed. Controller alleges a feud between Approach Control and the Center, and that Approach deliberately waited for the incident to occur before taking action." (097)

Departing aircraft operations can be adversely affected when an aircraft on an instrument approach is not handed off and the pilot forgets to report to the tower inbound on final approach. (122)

Fuel problem. - Averaging once a day, a general aviation airplane experiences either fuel exhaustion or fuel starvation(11). Apparently the SPIFR operation is not immune from the threat, for two fuel problem occurrences were identified. Characteristics of the occurrence are in Table 18.

In the first (052) a pilot experienced the effects of water contamination of fuel. He declared an emergency in order to obtain an immediate approach clearance.

In the second occurrence (087) an air taxi pilot unnecessarily declared an emergency and diverted to another airport because he perceived that he had inadequate fuel to proceed to his destination. He checked the fuel during a preflight inspection by observing fuel gauges which read full. After takeoff, the fuel gauges dropped toward empty. Subsequent inspection revealed that he did have sufficient fuel.

In both cases, a more thorough preflight inspection would have prevented the occurrence. The experience level of both pilots suggests adequate experience in preflight planning.

Improper holding. - Holding is an aspect of aeronautical knowledge that is particularly difficult for the SPIFR to grasp and apply reliably. Surprisingly, only two improper holding pattern occurrences were identified in the study dataset, both by SMT. Characteristics of the occurrences are in Table 19.

An ATC interfacility coordination problem combined with pilots being uncertain of their clearance resulted in two aircraft passing with less than standard separation, after ATC issued an evasive action turn to one of them. (093)

A pilot holding improperly can stray into adjoining airspace, becoming a hazard to other aircraft with less than standard separation. (098)

A pilot's clear understanding of an ATC holding clearance, combined with the knowledge of how to fly a holding pattern properly, would reduce the chances of similar occurrences.

Safety, Efficiency, and Workload Characteristics of the Single Pilot IFR Operation

The safety, efficiency, and workload characteristics of the SPIFR document set occurrences were analyzed in order to assess the seriousness and significance of the operational problems reported. First, each characteristic was defined in terms of an analytical scheme. Second, the analytical scheme was applied to each operational problem category. Finally, the results were tabulated and summarized.

The analytical schemes are arbitrary and to some extent subjective. However, the schemes are considered reasonable given the nature of the data and the objective of the ASRS to provide insights into what problems exist.

<u>Safety.</u> - Safety is freedom from the occurrence or risk of injury or loss. A useful analytical scheme must have the ability to discriminate the degree of risk present in a given occurrence. The general scheme for analyzing the safety characteristics of the SPIFR occurrences was suggested by Chapman (12), and consists of ascertaining which of the following terms best describes the degree of risk present in each occurrence:

> INCIDENT (HIGH RISK): an act or condition likely to lead to grave consequences. (e.g., midair collision, crash during an instrument approach, or an occurrence for which an ASRS Alert Bulletin has been issued.)
>
> ERROR (MEDIUM RISK): an act or condition of ignorant or imprudent deviation from a code of behavior. (e.g., altitude deviation or improper holding pattern procedure where no threat to another aircraft occurred.) Incident and error were considered to be mutually exclusive.
>
> ANNOYANCE (LOW RISK): a source of irritation causing or inducing displeasure, as reported by the pilot of the enabling aircraft.

These terms are further defined for each Operational Problem Category, as appropriate.

<u>Efficiency.</u> - The impact of SPIFR Operational Problems on the efficient conduct of instrument flight was assessed on the basis of the operational result of the occurrence. An efficient instrument flight is one which is performed or functions in the best possible and least wasteful manner.

Efficiency was judged to be a characteristic in each SPIFR occurrence if in:

> <u>Single Aircraft Occurrences:</u> The pilot perceived that he was receiving inadequate service, and it was judged that his expectation was reasonable.

Multiple Aircraft Occurrences: Other than the enabling aircraft was requested by ATC to change heading or altitude, or to hold.

Workload. - Workload is the amount of work that the SPIFR is required to perform. The report content in the ASRS database does not lend itself to the application of traditional human performance measures of workload. The cognitive, perceptual, and motor behavioral processes present in the single piloting of an aircraft IFR cannot be extracted from the ASRS data with any acceptable degree of accuracy. Indeed, these processes are only usefully observable in a laboratory setting under carefully controlled and instrumented experimental conditions.

As an approximation of the influence of workload in the reported occurrences, the researcher made an ad hoc decision about its presence or absence on the basis of the phases of an IFR flight which are generally regarded as high workload situations for a SPIFR. If the mission phase was a departure, arrival, approach, missed approach, or hold, then workload was deemed to have been a factor in the occurrence. Also, if a report narrative mentioned workload as a factor, the occurrence was counted as having a workload characteristic. All below minimums-operation occurrences were assumed to be workload-related.

The presence of workload as a factor can also be inferred if a pilot's perception about the real world is different than reality, and his performance based upon that perception results in an occurrence. A pilot must have both the time and the opportunity to correctly assess a real world situation and act upon it. One important cause of a pilot's perception not matching reality is because of workload and it appeared that this was the case in 28 percent of the reports in this study data set. Therefore, all reports in the data set analyzed as containing pilot perception as an enabling factor were tabulated under workload.

Safety characteristics by operational problem category.

- Inadequate Service

  INCIDENT occurred if an Alert Bulletin has been issued.

ERROR occurred if the pilot's expectation was judged to be reasonable.

ANNOYANCE occurred in each pilot allegation of inadequate service.

- Altitude Deviation

  INCIDENT occurred if any of the following factors were present: evasive action, conflict alert, potential conflict, less than standard separation.

  ERROR occurred if an incident did not occur.

  ANNOYANCE occurred if indicated by pilot reporter.

- Improperly Flown Approach

  Same as Altitude Deviation. In addition, the occurrence was classified as an incident where analyst judgement dictated.

- Heading Deviation

  Same as Altitude Deviation.

- Position Deviation

  Same as Altitude Deviation.

- Below Minimums Operation

  INCIDENT occurred if an aircraft accident ensued in some part of the approach or landing.

  ERROR existed in all below minimums operation occurrences.

- Loss of Airplane Control

  INCIDENT was determined to be applicable to each occurrence.

- Forgot Mandatory Report

  Same as Altitude Deviation.

- Fuel Problem

  INCIDENT occurred if an emergency was declared.

  ERROR occurred if an incident did not occur.

  ANNOYANCE occurred if indicated by pilot reporter.

- Improper Holding

  Same as Altitude Deviation.

A summary of the analyses of safety, efficiency, and workload characteristics of the Single Pilot IFR Operation is presented by Operational Problem Category in Tables 20 and 21.

In terms of safety, 52 percent of the SPIFR document set occurrences involved an incident, 35 percent involved an error, and 36 percent an annoyance. The efficiency of IFR flight was adversely affected in 37 percent of the occurrences. Applying the mission phase determinant of workload as a factor resulted in 73 percent of the SPIFR occurrences being categorized as workload-related. Applying the pilot perception enabling factor as a determinant resulted in 28 percent of the occurrences being categorized as workload related.

CONCLUSIONS

1. Ten SPIFR Operational Problem Categories have been identified in the ASRS-2 database. In order of decreasing frequency of occurrence, they are: Pilot Allegations of Inadequate Service (30 percent), Altitude Deviation (20 percent), Improperly Flown Approach (15 percent), Heading Deviation (13 percent), Position Deviation (7 percent), Below Minimums Operations (6 percent), Loss of Airplane Control (3 percent), Forgot Mandatory Report (3 percent), Fuel Problem (2 percent), and Improper Holding (2 percent).

2. It appears that the operational problems being experienced by the SPIFR may be independent of experience. Although this hypothesis needs to be tested more thoroughly, it is suggested that if the hypothesis were found to be valid then remedies to SPIFR operational problems do not lie in improving SPIFR capabilities through more training and experience. Rather, the nature of the SPIFR task should be changed through the redesign of cockpit systems and ATC procedures in handling the SPIFR.

3. Safety, Efficiency, and Workload factors are present in SPIFR Operational Problem occurrences. Half of the occurrences involved an act or condi-

tion likely to lead to grave consequences, and one-third involved an act or condition of ignorant or imprudent deviation from acceptable procedures. In more than one-third of the occurrences, the efficiency of IFR flight was affected. Depending upon what determinant is used to assess workload, between one-quarter and three-quarters of the occurrences involved workload as a causal factor.

4. The most frequently identified SPIFR Operational Problem was a pilot's allegation of inadequate service. Three-quarters of such allegations are deemed reasonable.

5. A pilot's "mind set" was a factor in altitude deviations, appearing in 68 percent of the occurrences.

6. Lack of pilot proficiency is apparent in improperly flown approach occurrences. In 22 percent of these occurrences, there was evidence that pilots did not understand when <u>not</u> to execute a procedure turn.

7. The pilot's lack of awareness of his position is an important factor in position deviation occurrences.

8. Takeoff below minimums occurrences were related to the pilot's cognitive processes. Landing below minimums occurrences probably could have been prevented by better preflight weather planning and more conservative decision making by the pilot.

9. Loss of airplane control generally followed the pilot being distracted. Even relatively experienced pilots lost airplane control.

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11. "Time in your Tanks", presentation prepared for FAA Accident Prevention Program by the General Aviation Manufacturers Association, October 1976.

12. General Aviation Safety Problems Related to Pilot Experience or Training Factors, March 28, 1981. (Draft ASRS Report)

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APPENDIX A

STATISTICAL TABLES

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TABLE 1. SUMMARY OF SEARCH STRATEGIES USED TO FORM THE SINGLE PILOT IFR OPERATIONAL PROBLEMS DOCUMENT SET

Search Factor	Small Aircraft		Small Transport Aircraft	
	One Aircraft Present	More Than One Aircraft	One Aircraft Present	More Than One Aircraft
NUMBER OF REPORTS IN ASRS DATABASE				
Date of Search	12-10-80		03-18-81	
Reports Current as of	11-25-80		03-17-81	
Total Reports	13,961		15,246	
DOCUMENT SET CRITERIA				
ATYP	4,765		3,264	
FPLAN, IFR	10,665		11,715	
FCON, IMC	1,824		1,979	
AFRAM, ER	-		6,418	
AFRAM, ET	-		2,375	
TACFT	4,541	8,335	5,009	9,094
Reports Satisfying All Criteria	91	219	101	201
DOCUMENT SET DETERMINATION				
Reports Deleted	29	188	87	178
Reports Added	-	2	1	3
Document Set				
Reports	62	33	15	26
Occurrences	60	28	14	22
Reports	95		41	
Occurrences	88		36	
Reports	136			
Occurrences	124			

TABLE 2. SUMMARY OF OPERATIONAL PROBLEMS

Operational Problem	Number of Items						Percent Total
	One Aircraft Present		More Than One Aircraft Present		Total		
	Reports	Occurrences	Reports	Occurrences	Reports	Occurrences	Occurrences
SMA SPIFR DOCUMENT SET							
1 Inadequate Service	27	27	--	--	27	27	31
2 Altitude Deviation	5	5	11	10	16	15	17
3 Improperly Flown Approach	10	8	7	5	17	13	15
4 Heading Deviation	1	1	13	11	14	12	14
5 Position Deviation	5	5	2	2	7	7	8
6 Below Minimums Operation	6	6	--	--	6	6	7
7 Loss of Airplane Control	4	4	--	--	4	4	5
8 Forgot Mandatory Report	2	2	--	--	2	2	2
9 Fuel Problem	2	2	--	--	2	2	2
10 Improper Holding	--	--	--	--	--	--	--
Total	62	60	33	28	95	88	--
SMT SPIFR DOCUMENT SET							
1 Inadequate Service	11	10	--	--	11	10	28
2 Altitude Deviation	--	--	10	10	10	10	28
3 Improperly Flown Approach	2	2	6	3	8	5	14
4 Heading Deviation	--	--	4	4	4	4	11
5 Position Deviation	--	--	3	2	3	2	6
6 Below Minimums Operation	1	1	--	--	1	1	3
7 Loss of Airplane Control	--	--	--	--	--	--	--
8 Forgot Mandatory Report	1	1	1	1	2	2	6
9 Fuel Problem	--	--	--	--	--	--	--
10 Improper Holding	--	--	2	2	2	2	6
Total	15	14	26	22	41	36	--
COMBINED SMA AND SMT SPIFR DOCUMENT SET							
1 Inadequate Service	38	37	--	--	38	37	30
2 Altitude Deviation	5	5	21	20	26	25	20
3 Improperly Flown Approach	12	10	13	8	25	18	15
4 Heading Deviation	1	1	17	15	18	16	13
5 Position Deviation	5	5	5	4	10	9	7
6 Below Minimums Operation	7	7	--	--	7	7	6
7 Loss of Airplane Control	4	4	--	--	4	4	3
8 Forgot Mandatory Report	3	3	1	1	4	4	3
9 Fuel Problem	2	2	--	--	2	2	2
10 Improper Holding	--	--	2	2	2	2	2
Total	77	74	59	50	136	124	--

TABLE 3. OPERATIONAL PROBLEM BY REPORTER AND TYPE OF OPERATION

Operational Problem	Reported By			Operation							
	PLT	CTR	AIR	PAX	FRT	CHR	TRN	PLS	UTL	PRB	UNK
SMA DATA SET											
1 Inadequate Service	27	-	-	3	-	-	5	5	2	7	5
2 Altitude Deviation	3	11	1	1	-	-	1	4	-	4	5
3 Improperly Flown Approach	4	9	-	-	-	1	1	3	-	4	4
4 Heading Deviation	1	11	-	-	-	-	3	1	-	2	6
5 Position Deviation	2	5	-	-	-	-	-	2	1	2	2
6 Below Minimums Operation	2	4	-	1	1	-	-	2	1	-	1
7 Loss of Airplane Control	4	-	-	-	-	-	1	1	-	2	-
8 Forgot Mandatory Report	1	1	-	-	-	-	1	-	-	-	1
9 Fuel Problem	2	-	-	-	1	-	-	-	-	1	-
10 Improper Holding	-	-	-	-	-	-	-	-	-	-	-
Total Number	46	41	1	5	2	1	12	18	4	22	24
Total Percent	52	47	1	6	2	1	14	20	5	25	27
SMT DATA SET											
1 Inadequate Service	9	-	1	5	-	2	-	-	-	1	2
2 Altitude Deviation	1	9	-	2	-	-	-	1	-	3	4
3 Improperly Flown Approach	2	3	-	3	-	1	-	-	-	1	-
4 Heading Deviation	-	4	-	1	-	1	-	-	-	1	1
5 Position Deviation	1	1	-	1	-	-	-	-	-	1	-
6 Below Minimums Operation	1	-	-	-	1	-	-	-	-	-	-
7 Loss of Airplane Control	-	-	-	-	-	-	-	-	-	-	-
8 Forgot Mandatory Report	-	2	-	-	-	-	-	-	-	-	2
9 Fuel Problem	-	-	-	-	-	-	-	-	-	-	-
10 Improper Holding	-	2	-	1	-	-	-	-	-	1	-
Total Number	14	21	1	13	1	4	-	1	-	8	9
Total Percent	39	58	3	36	3	11	-	3	-	22	25

TABLE 4. OPERATOR ORGANIZATION VERSUS TYPE OF OPERATION

OPERATOR ORGANIZATION	Operation (Mission) Type								Total	
	PAX	FRT	CHR	TRN	PLS	UTL	PRB	UNK	Number	Percent
SMA DATA SET										
ATX	1	2	-	1	-	1	1	2	8	9
FBO	-	-	1	1	-	-	-	-	2	2
RNT	-	-	-	3	-	-	2	1	6	7
CPR	4	-	-	-	-	-	-	2	6	7
PER	-	-	-	4	15	-	15	-	34	39
STA	-	-	-	-	-	-	-	1	1	1
UTO	-	-	-	-	-	-	-	2	2	2
UNK	-	-	-	3	3	3	4	16	29	33
Total Number	5	2	1	12	18	4	22	24	88	-
Total Percent	6	2	1	14	20	5	25	27	-	100
SMT DATA SET										
ATX	8	1	3	-	-	-	-	2	14	39
FBO	-	-	-	-	-	-	-	-	-	-
RNT	-	-	1	-	-	-	-	-	1	3
CPR	4	-	-	-	-	-	2	6	12	33
PER	1	-	-	-	1	-	6	1	9	25
STA	-	-	-	-	-	-	-	-	-	-
UTO	-	-	-	-	-	-	-	-	-	-
UNK	-	-	-	-	-	-	-	-	-	-
Total Number	13	1	4	-	1	-	8	9	36	-
Total Percent	36	3	11	-	3	-	22	25	-	100

TABLE 5. OPERATIONAL PROBLEM BY PHASE OF FLIGHT

Operational Problem	Phase of Flight										
	PRE	TOF	ICB	CLB	CRS	DES	APR	HLD	MAP	DIV	ALL
SMA DATA SET											
1 Inadequate Service	2	2	-	2	9	1	6	-	-	-	5
2 Altitude Deviation	-	-	-	4	2	3	4	1	1	-	-
3 Improperly Flown Approach	-	-	-	-	-	-	10	-	3	-	-
4 Heading Deviation	-	-	2	6	2	-	2	-	-	-	-
5 Position Deviation	-	-	-	-	7	-	-	-	-	-	-
6 Below Minimums Operation	-	2	-	-	-	-	3	-	-	1	-
7 Loss of Airplane Control	-	-	-	1	2	-	1	-	-	-	-
8 Forgot Mandatory Report	-	-	-	-	1	-	1	-	-	-	-
9 Fuel Problem	-	-	-	1	1	-	-	-	-	-	-
10 Improper Holding	-	-	-	-	-	-	-	-	-	-	-
Total Number	2	4	2	14	24	4	27	1	4	1	5
Total Percent	2	5	2	16	27	5	31	1	5	1	6
SMT DATA SET											
1 Inadequate Service	-	-	-	1	5	1	3	-	-	-	-
2 Altitude Deviation	-	-	-	6	1	3	-	-	-	-	-
3 Improperly Flown Approach	-	-	-	-	-	-	5	-	-	-	-
4 Heading Deviation	-	-	-	4	-	-	-	-	-	-	-
5 Position Deviation	-	-	-	-	1	-	1	-	-	-	-
6 Below Minimums Operation	-	-	-	-	-	-	1	-	-	-	-
7 Loss of Airplane Control	-	-	-	-	-	-	-	-	-	-	-
8 Forgot Mandatory Report	-	-	-	-	-	1	1	-	-	-	-
9 Fuel Problem	-	-	-	-	-	-	-	-	-	-	-
10 Improper Holding	-	-	-	-	-	-	-	2	-	-	-
Total Number	-	-	-	11	7	5	11	2	-	-	-
Total Percent	-	-	-	31	19	14	31	6	-	-	-

TABLE 6. OPERATIONAL PROBLEM BY PILOT TOTAL FLIGHT TIME

Operational Problem	Total Flight Time--Hrs 250-499	500-999	1000-1999	2000-2999	3000-3999	4000-or More	Unknown or Not Reported
SMA DATA SET							
1 Inadequate Service	4	4	1	3	5	6	4
2 Altitude Deviation	-	-	-	-	1	1	13
3 Improperly Flown Approach	1	1	-	-	1	-	10
4 Heading Deviation	-	-	-	-	-	-	12
5 Position Deviation	2	-	-	-	-	-	5
6 Below Minimums Operation	-	-	1	-	-	1	4
7 Loss of Airplane Control	-	-	2	-	1	1	-
8 Forgot Mandatory Report	-	-	-	-	-	-	2
9 Fuel Problem	-	-	-	1	1	-	-
10 Improper Holding	-	-	-	-	-	-	-
Total Number	7	5	4	4	9	9	50
Total Percent	8	6	5	5	10	10	57
SMT DATA SET							
1 Inadequate Service	-	-	-	2	-	6	2
2 Altitude Deviation	-	1	-	-	-	-	9
3 Improperly Flown Approach	-	-	1	1	-	-	3
4 Heading Deviation	-	-	-	-	-	-	4
5 Position Deviation	-	-	-	-	-	-	2
6 Below Minimums Operation	-	-	1	-	-	-	-
7 Loss of Airplane Control	-	-	-	-	-	-	-
8 Forgot Mandatory Report	-	-	-	-	-	-	2
9 Fuel Problem	-	-	-	-	-	-	-
10 Improper Holding	-	-	-	-	-	-	2
Total Number	-	1	2	3	-	6	24
Total Percent	-	3	6	8	-	17	67

TABLE 7. OPERATIONAL PROBLEM BY PILOT TIME IN LAST 90 DAYS

Operational Problem	Flight Time Last 90 Days--Hrs									
	Less Than 10	10-24	25-49	50-99	100-149	150-199	200-249	250-299	300- or More	Unknown or Not Reported
SMA DATA SET										
1 Inadequate Service	1	4	5	4	-	3	3	2	-	5
2 Altitude Deviation	-	-	-	-	1	-	-	-	-	14
3 Improperly Flown Approach	1	-	-	1	-	-	-	-	-	11
4 Heading Deviation	-	-	-	1	-	-	-	-	-	11
5 Position Deviation	-	1	-	1	-	-	-	-	-	5
6 Below Minimums Operation	-	-	-	1	-	-	-	-	1	4
7 Loss of Airplane Control	-	-	2	1	1	-	-	-	-	-
8 Forgot Mandatory Report	-	-	-	-	-	-	-	-	-	2
9 Fuel Problem	-	-	1	-	-	-	-	-	1	-
10 Improper Holding	-	-	-	-	-	-	-	-	-	-
Total Number	2	5	8	9	2	3	3	2	2	52
Total Percent	2	6	9	10	2	3	3	2	2	59
SMT DATA SET										
1 Inadequate Service	-	-	-	-	2	2	3	1	-	2
2 Altitude Deviation	-	-	-	1	-	-	-	-	-	9
3 Improperly Flown Approach	-	-	-	1	-	-	1	-	-	3
4 Heading Deviation	-	-	-	-	-	-	-	-	-	4
5 Position Deviation	-	-	-	-	-	-	-	-	-	2
6 Below Minimums Operation	-	-	-	-	-	1	-	-	-	-
7 Loss of Airplane Control	-	-	-	-	-	-	-	-	-	-
8 Forgot Mandatory Report	-	-	-	-	-	-	-	-	-	2
9 Fuel Problem	-	-	-	-	-	-	-	-	-	-
10 Improper Holding	-	-	-	-	-	-	-	-	-	2
Total Number	-	-	-	2	2	3	4	1	-	24
Total Percent	-	-	-	6	6	8	11	3	-	67

TABLE 8. OPERATIONAL PROBLEM BY AIRFRAME CHARACTERISTICS

Operational Problem	Wing			Landing Gear			Engine Type			Number Engines		
	WH	WL	WU	LF	LR	LU	ER	ET	EU	1	2	U
SMA DATA SET												
1 Inadequate Service	7	19	1	10	15	2	26	-	1	23	3	1
2 Altitude Deviation	6	8	1	7	7	1	15	-	-	13	2	-
3 Improperly Flown Approach	3	10	-	5	8	-	13	-	-	12	1	-
4 Heading Deviation	6	6	-	4	8	-	12	-	-	9	3	-
5 Position Deviation	4	3	-	4	2	1	7	-	-	6	1	-
6 Below Minimums Operation	1	5	-	2	4	-	6	-	-	4	2	-
7 Loss of Airplane Control	1	3	-	1	3	-	4	-	-	2	1	1
8 Forgot Mandatory Report	1	1	-	-	2	-	2	-	-	1	1	-
9 Fuel Problem	1	1	-	1	1	-	2	-	-	2	-	-
10 Improper Holding	-	-	-	-	-	-	-	-	-	-	-	-
Total Number	30	56	2	34	50	4	87	-	1	72	14	2
Total Percent	34	64	2	39	57	5	99	-	1	82	16	2
SMT DATA SET												
1 Inadequate Service	2	8	-	-	10	-	7	3	-	-	10	-
2 Altitude Deviation	1	9	-	-	10	-	6	4	-	-	10	-
3 Improperly Flown Approach	3	2	-	1	4	-	4	1	-	-	5	-
4 Heading Deviation	1	3	-	1	3	-	4	-	-	-	4	-
5 Position Deviation	-	2	-	-	2	-	2	-	-	-	2	-
6 Below Minimums Operation	-	1	-	-	1	-	1	-	-	-	1	-
7 Loss of Airplane Control	-	-	-	-	-	-	-	-	-	-	-	-
8 Forgot Mandatory Report	-	2	-	-	2	-	1	1	-	-	2	-
9 Fuel Problem	-	-	-	-	-	-	-	-	-	-	-	-
10 Improper Holding	-	2	-	1	1	-	2	-	-	-	2	-
Total Number	7	29	-	3	33	-	27	9	-	-	36	-
Total Percent	19	81	-	8	92	-	75	25	-	-	100	-

TABLE 9. SUMMARY OF OCCURRENCES INVOLVING PILOT ALLEGATIONS OF INADEQUATE SERVICE

Occurrence of Inadequate Service	Document Set				Total	
	SMA		SMT			
	Number	Percent	Number	Percent	Number	Percent
Inadequate Service From ATC	17	63	6	60	23	62
Radio COM Reception	5	19	-	-	5	13
Aviation Weather Reporting	4	15	1	10	5	13
NAVAID	1	4	3	30	4	11
Total	27	-	10	-	37	-

TABLE 10. PILOT'S EXPECTATION EXPRESSED IN EACH ALLEGATION OF INADEQUATE SERVICE

Occurrence	Document Set	Phase of Flight	Pilot Expectation Not Satisfied	Expectation Reasonable
INADEQUATE SERVICE FROM ATC				
091	SMT	CLB	Controllers should not whistle loud enough that I can hear them over frequency.	YES
002	SMA	CRS	The next air traffic controller will know I have been handed off to him.	YES
008	SMA	CRS	ATC will inform me when radar contact is lost.	YES
011	SMA	CRS	I can obtain a timely IFR clearance in flight.	NO
013	SMA	APR	Approach control will inform me of a circling approach before being handed off to the tower.	YES
094	SMT	APR	I should be able to obtain NOTAMS during a FSS briefing.	YES
017	SMA	CRS	ATC will assign me a new frequency when I have been handed off.	YES
028	SMA	APR	ATC won't interrupt a practice instrument approach.	NO
031	SMA	DES	When I have to make a precautionary landing, ATC can try to find a suitable airport for me.	YES
104	SMT	CRS	ATC will not cancel my IFR clearance.	YES
105	SMT	APR	Approach control should not close down at quitting time and terminate my ASR approach during IMC.	YES
038	SMA	CRS	ATC radar can provide me weather avoidance.	NO
042	SMA	ALL	ATC won't forget about me in a non-radar environment.	YES
110	SMT	CRS	ATC will assign me a new frequency when I have been handed off.	YES
045	SMA	ALL	My flight plan information will be processed accurately.	YES
049	SMA	CRS	ATC will not radar vector me toward terrain.	NO
054	SMA	CLB	ATC will not clear me to an initial fix which is out of service.	YES
055	SMA	CRS	ATC won't forget about me.	YES
058	SMA	ALL	ATC should provide me radar coverage throughout the entire flight.	NO
064	SMA	APR	ATC won't radar vector me below minimum vectoring altitude in the vicinity of tall towers.	YES
066	SMA	CRS	ATC won't forget about me.	YES
114	SMT	CRS	ATC will know my intended destination.	YES
075	SMA	APR	The ATC tower should be able to turn off the sequenced flashers on an ILS approach lighting system.	NO

Occurrence	Document Set	Phase of Flight	Pilot Expectation Not Satisfied	Expectation Reasonable
			RADIO COMMUNICATIONS RECEPTION	
026	SMA	ALL	I should be able to communicate with ATC above the minimum enroute altitude.	YES
036	SMA	ALL	ATC should be able to receive my transmissions during the execution of a missed approach.	YES
044	SMA	TOF	I should be able to communicate with someone on the airport by radio when departing IFR from an airport with a closed runway.	NO
050	SMA	TOF	I should be able to get an IFR clearance by radio on the ground.	NO
057	SMA	CLB	Aircraft communications frequencies should be free from interference.	YES
			AVIATION WEATHER REPORTING	
100	SMT	DES	ATC will not vector us into a known embedded thunderstorm. (Reported by a passenger who is also a pilot.)	YES
030	SMA	APR	Timely weather information should be available for an approach into an airport without an ATC tower or FSS, but with NWS.	YES
032	SMA	PRE	When weather is known to be IMC in a terminal area, PIREPs should be available for the terminal area during a weather briefing.	YES
046	SMA	PRE	I should be able to get through to a FSS by telephone for a weather briefing.	YES
063	SMA	CRS	FSS briefers will have current information about thunderstorm activity along my proposed route of flight.	NO
			NAVAID	
090	SMT	APR	A LOC will not have a bend in it.	YES
089	SMT	CRS	An MEA gap should not exist with high terrain on both sides of it.	NO
103	SMT	CRS	A NDB frequency should be in the frequency band of a digital ADF receiver.	YES
040	SMA	APR	An NDB navigation signal will be reliable.	YES

TABLE 11. CHARACTERISTICS OF ALTITUDE DEVIATION OCCURRENCES

Occurrence	Type of Altitude Deviation	Evasive Action	CA, PC, LTSS	Factor	Mission Phase	Airspace	Operation	No. of Aircraft Involved
SMA ALTITUDE DEVIATIONS, PILOT REPORTER								
069	AO	-	-	MSF	ENR	OCA	PRB	1
079	AE	-	-	UNK	APR	OCA	PRB	1
080	AC	-	-	MSH	APR	OCA	PRB	1
SMA ALTITUDE DEVIATIONS, CONTROLLER REPORTER								
020	AO	YES	-	MSA	DEP	TRS	UNK	2
024	AO	ATC	YES	MSA	APR	PCA	PAX	2
034	AO	ATC	YES	MSA	ENR	AIR	PLS	2
039	AO	YES	YES	MSA	DEP	PCA	UNK	2
041	AO	ATC	YES	MSA	HLD	OCA	PAX	2
048	AO	-	YES	MSA	APR	OCA	PLS	2
065	AM	ATC	YES	MSA	ARR	OCA	PLS	2
072	AO	ATC	-	MSA	ENR	OCA	UNK	2
076	AU	-	-	UNK	MAP	ATA	TRN	1
077	AO	-	-	MSF	DEP	AIR	PLS	1
081	AC	-	YES	UNK	ARR	OCA	UNK	2
SMA ALTITUDE DEVIATIONS, AIR FORCE REPORTED								
082	AU	YES	YES	MSA	HLD	TRS	UNK	2
SMT ALTITUDE DEVIATIONS, PILOT REPORTER								
092	AO	ATC	-	UNK	ARR	AIR	PRB	2
SMT ALTITUDE DEVIATIONS, CONTROLLER REPORTER								
096	AO	UNK	YES	UNK	DEP	OCA	PRB	2
099	AO	ATC	-	MSR	DEP	AIR	PLS	2
106	AC	-	-	UNK	ARR	OCA	PRB	2
108	AO	ATC	YES	MSR	ENR	AIR	PAX	2
112	AO	ATC	YES	MSA	DEP	OCA	PAX	2
115	AM	-	YES	UNK	ARR	OCA	UNK	2
118	AO	ATC	YES	MSA	ENR	AIR	UNK	2
120	AO	ATC	YES	MSA	DEP	ATA	UNK	2
121	AO	-	YES	UNK	ENR	OCA	UNK	2

TABLE 12. CHARACTERISTICS OF IMPROPERLY FLOWN APPROACH OCCURRENCES

Occurrence	Evasive Action	CA, PC, LTSS	Type of Approach	Radar Available	Number of Engines	Pilot Time Total	Pilot Time Last 90 Days	Operation	Recovery Factors	No. of Aircraft Involved
SMA IMPROPERLY FLOWN APPROACHES, PILOT REPORTER										
004	-	-	ILS	YES	1	670	75	CHR	NON	1
010	-	-	VOR	UNK	1	400	1	TRN	NON	1
035	-	-	LOC BC	PRB	1	3600	UNK	PRB	NON	1
053	-	-	VOR DME	YES	1	UNK	UNK	UNK	ATC	1
SMA IMPROPERLY FLOWN APPROACHES, CONTROLLER REPORTER										
003	-	-	VOR	YES	1	UNK	UNK	UNK	NON	1
022	ATC	-	ILS	YES	1	UNK	UNK	PLS	NON	4
043	ATC	YES	ILS	YES	1	UNK	UNK	PRB	ATC	>1
051	ATC	YES	ILS	YES	1	UNK	UNK	UNK	NON	2
056	-	-	ILS	NO	1	UNK	UNK	PRB	NON	1
060	ATC	YES	ILS	YES	2	UNK	UNK	PLS	ATC	2
070	ATC	-	ILS	YES	1	UNK	UNK	PRB	ATC	4
083	-	-	LOC BC	YES	1	UNK	UNK	UNK	ATC	1
086	ATC	YES	VOR	UNK	1	UNK	UNK	PLS	ATC	2
SMT IMPROPERLY FLOWN APPROACHES, PILOT REPORTER										
109	-	YES	ILS	YES	2	2200	200	CHR	ATC	2
119	-	-	NDB	PRB	2	1262	69	PRB	NON	1
SMT IMPROPERLY FLOWN APPROACHES, CONTROLLER REPORTER										
101	-	-	NDB	YES	2	UNK	UNK	PAX	ATC	1
113	NON	-	CTC	YES	2	UNK	UNK	PAX	NON	2
116	NTM	-	ILS	PRB	2	UNK	UNK	PAX	FLC	2

TABLE 13. CHARACTERISTICS OF HEADING DEVIATION OCCURRENCES

Occurrence	Type of Heading Deviation	Evasive Action	CA, PC, LTSS	Factor	Mission Phase	Airspace	Operation	No. of Aircraft Involved
SMA HEADING DEVIATIONS, PILOT REPORTER								
071	HI	-	-	-	DEP	ATA	UNK	2
SMA HEADING DEVIATIONS, CONTROLLER REPORTER								
005	HE	ATC	YES	MSA	MAP	ATA	TRN	2
006	HE	ATC	YES	MSA	DEP	TRS	UNK	2
009	HR	-	-	UNK	DEP	ATA	UNK	1
015	HE	-	YES	UNK	ENR	OCA	PRB	2
018	HE	ATC	YES	UNK	ENR	AIR	PLS	2
027	HR	ATC	YES	UNK	APR	TRS	UNK	2
033	HE	ATC	-	MSF	DEP	ATA	TRN	2
047	HM	ATC	YES	UNK	DEP	ATA	TRN	2
062	HM	ATC	YES	UNK	DEP	OCA	PRB	2
078	HR	ATC	YES	UNK	DEP	TCA	UNK	2
085	HE	-	YES	UNK	APR	OCA	UNK	2
SMT HEADING DEVIATIONS, CONTROLLER REPORTER								
102	HD	-	YES	UNK	DEP	TRS	CHR	2
107	HE	ATC	YES	UNK	DEP	OCA	PRB	2
111	HO	ATC	YES	UNK	DEP	ATA	UNK	2
123	HM	ATC	YES	UNK	DEP	ATA	PAX	2

TABLE 14. CHARACTERISTICS OF POSITION DEVIATION OCCURRENCES

Occurrence	Evasive Action	CA, PC, LTSS	Mission Phase	Airspace	Operation	No. of Aircraft Involved	Radar ID Before Deviation
SMA POSITION DEVIATIONS, PILOT REPORTER							
007	-	-	ENR	AIR	PRB	1	YES
021	-	-	ENR	CZN	PRB	1	YES
SMA POSITION DEVIATIONS, CONTROLLER REPORTER							
001	-	YES	ENR	TRS	UNK	3	NO
012	-	-	ENR	AIR	PLS	1	NO
067	-	-	ENR	AIR	UNK	2	NO
068	YES	YES	ENR	OCA	PLS	2	NO
088	-	-	ENR	AIR	UTL	1	NO
SMT POSITION DEVIATIONS, PILOT REPORTER							
124	-	YES	APR	ATA	PAX	2	NO
SMT POSITION DEVIATIONS, CONTROLLER REPORTER							
095	-	-	ENR	OCA	PRB	2	NO

TABLE 15. CHARACTERISTICS OF BELOW MINIMUMS OPERATION OCCURRENCES

Occurrence	Mission Phase	Airspace	Organization	Operation	Number of of Engines	Pilot Flight Time Total	Pilot Flight Time Last 90 Days
SMA BELOW MINIMUMS OPERATION, PILOT REPORTER							
023	TOF	APT	ATX	UTL	2	4,450	65
029	TOF	APT	ATX	FRT	1	1,800	300
SMA BELOW MINIMUMS OPERATION, CONTROLLER REPORTER							
016	LDG	OCA	CPR	PAX	2	UNK	UNK
019	MAP	AIR	PER	PLS	1	UNK	UNK
037	LDG	TRS	UNK	UNK	1	UNK	UNK
073	LDG	CZN	PER	PLS	1	UNK	UNK
SMT BELOW MINIMUMS OPERATION, PILOT REPORTER							
117	LDG	ATA	ATX	FRT	2	1,875	165

TABLE 16. CHARACTERISTICS OF LOSS OF AIRPLANE CONTROL OCCURRENCES

Occurrence	Mission Phase	Airspace	Operation	Number of of Engines	Pilot Flight Time Total	Pilot Flight Time Last 90 Days
014	DEP	TCA	TRN	1	3,000	100
059	ENR	AIR	PRB	1	1,040	28
061	APR	OCA	PLS	UNK	1,550	28
084	ENR	OCA	PRB	2	4,000	75

TABLE 17. CHARACTERISTICS OF FORGOT MANDATORY REPORT OCCURRENCES

Occurrence	Evasive Action	CA, PC, LTSS	Mission Phase	Airspace	Operation	No. of Aircraft Involved
SMA FORGOT MANDATORY REPORT, PILOT REPORTER						
025	-	-	APR	TCA	TRN	1
SMA FORGOT MANDATORY REPORT, CONTROLLER REPORTER						
074	-	-	ENR	AIR	UNK	1
SMT FORGOT MANDATORY REPORT, CONTROLLER REPORTER						
097	-	-	ENR	AIR	UNK	2
122	-	-	APR	ATA	UNK	2

TABLE 18. CHARACTERISTICS OF FUEL PROBLEM OCCURRENCES

Occurrence	Mission Phase	Number of Engines	Pilot Flight Time Total	Pilot Flight Time Last 90 Days	Operation
SMA FUEL PROBLEM, PILOT REPORTER					
052	ENR	1	2,700	40	PRB
087	DEP	1	3,500	300	FRT

TABLE 19. CHARACTERISTICS OF IMPROPER HOLDING OCCURRENCES

Occurrence	Evasive Action	CA, PC, LTSS	ASRS Mission Phase	Number of Engines	Operation
SMT IMPROPER HOLDING, CONTROLLER REPORTER					
093	ATC	YES	HLD	2	PAX
098	-	YES	HLD	2	PRB

TABLE 20. NUMBER OF SPIFR OPERATIONAL PROBLEM OCCURRENCES INVOLVING SAFETY, EFFICIENCY, AND WORKLOAD CHARACTERISTICS

Operational Problem	Safety			Efficiency	Workload	
	Incident	Error	Annoyance		Mission Phase	Pilot Perception
1 Inadequate Service	5	20	37	27	21	5
2 Altitude Deviation	19	3	1	6	20	13
3 Improperly Flown Approach	14	4	3	5	18	7
4 Heading Deviation	14	2	1	5	14	6
5 Position Deviation	3	4	3	1	2	1
6 Below Minimums Operation	1	6	0	0	7	2
7 Loss of Airplane Control	4	0	0	0	3	0
8 Forgot Mandatory Report	0	4	0	1	2	0
9 Fuel Problem	2	0	0	0	1	0
10 Improper Holding	2	0	0	1	2	1
Total	64	43	45	46	90	35

TABLE 21. PERCENTAGE OF SPIFR OPERATIONAL PROBLEM OCCURRENCES INVOLVING SAFETY, EFFICIENCY, AND WORKLOAD CHARACTERISTICS

Operational Problem	Safety			Efficiency	Workload	
	Incident	Error	Annoyance		Mission Phase	Pilot Perception
1 Inadequate Service	14	54	100	73	57	14
2 Altitude Deviation	76	12	4	24	80	52
3 Improperly Flown Approach	78	22	17	28	100	39
4 Heading Deviation	88	13	6	31	88	38
5 Position Deviation	33	44	33	11	22	11
6 Below Minimums Operation	14	86	0	0	100	29
7 Loss of Airplane Control	100	0	0	0	75	0
8 Forgot Mandatory Report	0	100	0	25	50	0
9 Fuel Problem	100	0	0	0	50	0
10 Improper Holding	100	0	0	50	100	50
Total	52	35	36	37	73	28

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APPENDIX B

SUMMARY OF ASRS ACCESSION NUMBERS BY OPERATIONAL PROBLEM CATEGORY

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SMALL TRANSPORT DOCUMENT SET

INADEQUATE SERVICE (11)

Inadequate Service From ATC (6)

08981, 11265, 13329, 13707, 14708, 18077

Aviation Weather Reporting (1)

12166

NAVAID (4)

08866, 7 08948, 10591, 7 13122

ALTITUDE DEVIATION (10)

09645, 11608, 12148, 13833, 13967, 16386, 18138
18975, 19664, 19844

IMPROPERLY FLOWN APPROACH (8)

13074, 13970, 8 13996, 8 16461, 9 16462, 9 18664, 10 18665, 10
19214

HEADING DEVIATION (4)

13095, 13069, 15515, 22308

POSITION DEVIATION (3)

11593, 22375, 11 22449 11

BELOW MINIMUMS OPERATION (1)

18772

FORGOT MANDATORY REPORT (2)

11707, 20595

IMPROPER HOLDING (2)

09774, 11735

○ = same occurrence

SMALL AIRCRAFT DOCUMENT SET

INADEQUATE SERVICE (27)

Inadequate Service from ATC (17)

09203, 10343, 10750, 11145, 11697, 12897, 13151,
14154, 14574, 14907, 15536, 15878, 15928, 16145,
16564, 17464, 18503

Radio Communications Reception (5)

12742, 13944, 14903, 15627, 16130

Aviation Weather Reporting (4)

13121, 13419, 15196, 16504

NAVAID (1)

14282

ALTITUDE DEVIATION (16)

11900, 12551, 13849, 14266, 14514, 15306, 16707,⑥
16708,⑥ 17654, 18274, 18571, 18723, 18749, 18906,
19221, 19957

IMPROPERLY FLOWN APPROACH (17)

09854, 09943, 10747, 12304, 13882, 14772,② 14773,②
14774,② 15660,④ 15744,④ 15759, 16052, 16352,⑤ 16353,⑤
17692, 20221, 20567

HEADING DEVIATION (14)

10198, 10339, 10586, 11539,① 11540,① 11744, 12816,
13601, 15287,③ 15396,③ 16482, 17846, 18741, 20389

POSITION DEVIATION (7)

08873, 10342, 10965, 12247, 17614, 17642, 20872

BELOW MINIMUMS OPERATION (6)

11634, 11876, 12318, 13103, 13974, 18292

LOSS OF AIRPLANE CONTROL (4)

11206, 16209, 16477, 20313

FORGOT MANDATORY REPORT (2)

12650, 18354

FUEL PROBLEM (2)

15730, 20587

○ = same occurrence

APPENDIX C

ALERT BULLETINS ISSUED SINGLE PILOT IFR OPERATIONAL PROBLEMS

APPENDIX C
ALERT BULLETINS ISSUED
SINGLE PILOT IFR OPERATIONAL PROBLEMS

Alert Bulletins represent the ASRS program's principal means of informing the Federal Aviation Administration and the aviation community of possible current problems identified through the reporting process. Alert Bulletins are prepared when it is believed, on the basis of one or more reports, that one or more of the following conditions exists:

1. A physical hazard that poses a threat to aircraft operating within the bounds of accepted operating practices in a given location,

2. An operation, regulatory, or procedural hazard that poses a threat to aircraft operating within the bounds of accepted operating practices,

3. A regulation, procedure, or other document is unclear, ambiguous, or misleading,

4. An accepted operating practice, applied in one or more locations, contravenes generally accepted or understood rules or regulations,

5. Some device necessary to safe operation displays a persistent pattern of malfunction which poses a threat to aircraft operating with the system.

The following five Alert Bulletins have been issued on occurrences contained in the SPIFR Document Set, all of which appear in the Inadequate Service Operational Problem Category:

TEXT: AB 780038, Occurrence 090
A pilot reports that at Beverly, MA Airport (BVY) the inbound course of the SDF approach for Runway 16 has a bend which results in runway offset at a critical point in the approach. Corrective action is requested; bend is serious enough to have caused missed approaches.

KEYWORDS: NAVAID

RESPONSE TEXT: AB 780038
The Beverly, MA Airport (BVY) SDF was inspected on August 14, 1978 because of the user complaint cited in ASRS AB 780038. The bend mentioned was found by the flight

inspection crew on aircraft N-84, however, it was within the tolerances specified in the United States Standard Flight Inspection Manual. It may be significant to note that the BVY SDF is offset which, if the pilot was not aware of the offset, might tend to make the bend seem exaggerated.

TEXT: AB 790018, Occurrence 026
Denver, CO., Denver Air Route Traffic Control Center: A pilot report notes consistent difficulty in maintaining air/ground radio communication with Denver Center, the controlling facility, at flight altitudes near MEA in the mountainous area between Fairfield (FFU), Carbon (PUC), and Moab (QAB), and during approaches to airports within that area. Attempts to relay through other facilities are deemed impractical; reporter suggests installation of a remote communication (RCAG) facility in the affected sector of Denver Center.

KEYWORDS: ATC, COMMO

RESPONSE TEXT: AB 790018
Fringe area coverage difficulties will be experienced at the lower altitudes in the area described due to high terrain. Construction of a new RCAG site for the Salt Lake ARTCC (Sunnyside, Utah) will start this summer. Commissioning is anticipated in late CY-79 or early CY-80. A follow-on program is planned to provide an additional channel, from Sunnyside, to the Denver Center sometime in late CY-80. Engineering studies indicate the Sunnyside site should resolve the problems outlined above.

TEXT: AB 790032, Occurrence 103
Jacksonville, NC, HAH Non-Directional Radio Beacon: A pilot reports that HAH Non-Directional Radio Beacon, intended to define a segment of Atlantic Route 7, transmits on a frequency of 198 KHZ, which is below the 200 KHZ lower limit assigned for aeronautical frequencies, and that certain new types of radio direction finding equipment with digital control markings commencing at 200 KHZ thus cannot receive the beacon. Reporter states that inability to utilize HAH forces pilot reliance on radar vectors for navigation.

KEYWORDS: NAVAID, ATC

RESPONSE TEXT: AB 790032
The high-power for this Radio Beacon was required for overwater flight between New York and Miami. No frequency in the 200-415 KHZ band was available. Numerous lower power facilities would have had to give way (changed or eliminated) to make room for this high-powered station. Since November 22, 1977, the lower limit for aeronautical radio beacons has been 190 KHZ. The present assignment may be an inconvenience to some users but is not considered unsafe, or contributing to an unsafe condition.

TEXT: AB 790045, Occurrence 040
Connellsville, PA, Connellsville Airport: Reporting aircraft flight crew member describes apparent faulty operation of the Connellsville Non-Directional Beacon; during a recent flight usable ADF signals were not received until the aircraft was 12 miles from the airport, at which time a strong signal was received but provided highly erroneous bearing information. Reporter states that evidence of corrosion exists at the beacon antenna site, that maintenance is performed infrequently, and that the situation described is frequently encountered during periods of precipitation weather. He also reports that other pilots have reported this condition, which can be hazardous to flight in view of the mountainous terrain in the Connellsville area.

KEYWORDS: NAVAID-NDB

RESPONSE TEXT: AB 790045
The subject facility was thoroughly evaluated by an AEA-400 FAA Inspector and flight tested by an FAA flight inspection aircraft June 19 and May 2 respectively. The results of the evaluation did not reveal any facility deficiencies to support the allegation contained in the Alert Bulletin. A copy of their report is enclosed. We will continue to closely monitor the facility performance.

TEXT: AB 800003, Occurrence 066
Seattle, WA, Seattle Air Route Traffic Control Center: Reporting pilot describes recent IFR flights during which he has received vectors from Seattle Center directing him away from his flight-planned route and toward terrain higher than his flight altitude. Reporter expresses apprehension that in the absence of a vector clearance limit by ATC or instructions to return to flight-planned route,

pilots may be forced to invoke lost-communication procedures to avoid hazardous compromise of terrain-clearance requirements. He feels that standard procedures should be publicized and utilized to avert placing pilots on vectors toward high terrain with no limiting course of action indicated as a part of clearances.

KEYWORDS: ATC PROCEDURES

RESPONSE TEXT: AB 800003
Handbook 7110.65A, paragraphs 680 and 681, state the controller's responsibility for the application and methods of radar vectoring. If the pilot thinks an unsafe assigned heading or altitude has been issued he should question it per the Airman's Information Manual (AIM) paragraph 405. Based on the information provided by the reporter, we are unable to determine if these procedures were adhered to. However, we are presently reviewing existing procedures to ascertain if procedural changes can be made, without creating additional safety concerns, to provide the pilot more opportunity for advance planning, and assist in determining when to implement action required by FAR 91.127.