Salety Review

Beechcralt Baron

Models 55, 58, & 58

AOPA Air Salety Foundation

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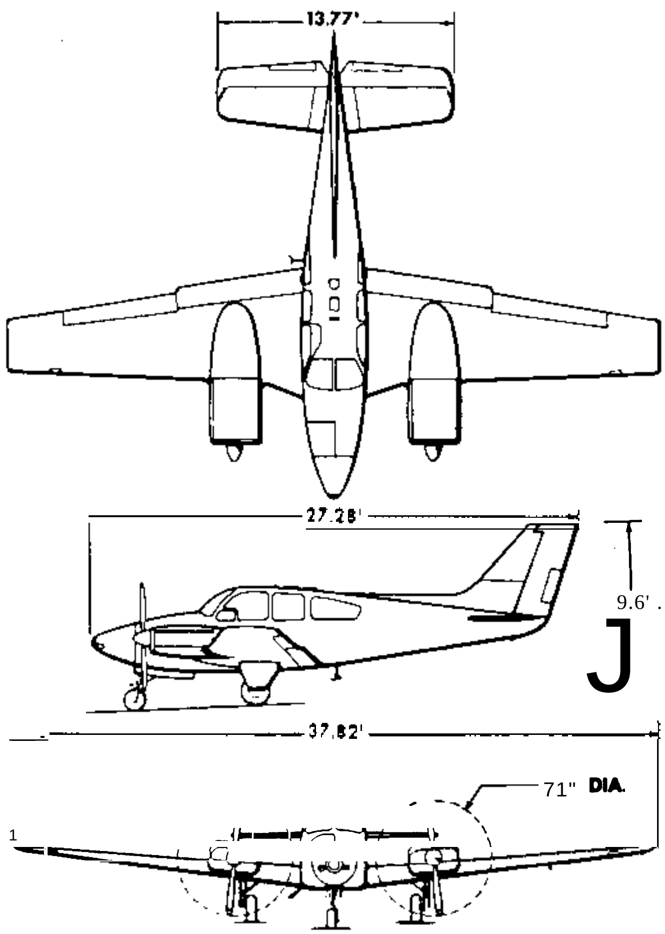

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Dear Fellow Pilot,

The AOPA Air Safety Foundation is pleased to present this Safety Review on the Beechcraft Baron models 55, 56, and 58. The Foundation, which houses the Emil Buehler Center for Aviation Safety, maintains records on more than 25,000 general aviation accidents and operates the largest nongovernment aviation accident database in the United States.

The Foundation provides information and data to educational institutions, publications, and researchers on a variety of safety topics. Additionally, it conducts more than 250 safety seminars and Flight Instructor Refresher Clinics every year throughout the nation.

The Foundation is an independent, nonprofit, nonpartisan organization that serves all pilots. Its sole purpose is to improve the aviation safety record through education, research, and dissemination of results by safety reviews, videotapes, pamphlets, newsletters, articles, and seminars. Its lifesaving work is made possible by grants from other charitable foundations, companies, and pilots like you who believe that an investment in aviation safety is a small price to pay for the joy and sense of accomplishment that flight brings to each of us.

After you have read the review, we would greatly appreciate your comments.

Respectfu lly,

Bruce Landsberg

Bruce Landsberg
Executive Director

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The NTSB is solely responsible for accident investigation. The AOPA Air Safety Foundation did not participate in any investigations contained in this review.

The accident data was collected and probable cause determinations were made by the NTSB. In Part 2 of this safety review, factual data is provided by the NTSB for the aircraft accident summary reports. ASF provided the interpretation in the field at the bottom of each report identified as ***ASF Comments.***

This safety review is intended for educational purposes only and does not contain data or information suitable for litigation.

Nothing in this review supersedes official government determinations or aircraft manufacturer recommendations. All cautions, warnings, and recommended procedures in the Pilot's Operating Handbook or approved Flight Manual should be followed at all times.

Beechcralt Baron BE55/58, BE58 Salety Review

Introduction

There are many reasons for flying twins. Operating multi-engine airplanes can be quite enjoyable. Most pilots relish the challenge of operating increasingly complex aircraft and justifiably feel a great sense of pride and accomplishment in obtaining the multi-engine rating. Career-oriented pilots find greater opportunity with some multi-engine experience in their logbooks. Many business and pleasure pilots expand their horizons with the increased range, speed, and useful load afforded by some light twins, while others like the increased safety of an additional engine and redundant systems. Whatever your reasons are, the AOPA Air Safety Foundation wants to help you fly them safely.

The Beechcraft Baron is a high-performance, versatile, light twin capable of transporting four to six people at speeds above 200 knots. Pressurized/Turbo models of the Baron routinely operate comfortably in the 20,000 foot plus regime which provides flexibility in choosing altitudes for favorable winds and avoidance of turbulence.

The Baron requires a high level of pilot skill and proficiency to ensure safety and optimum operations up to the capabi lity of the aircraft.

The FAA estimated that there were approximately 3,800 of the Beechcraft Baron models BESS/56 and BE58 in the Federal Registry during the period of this review. Of this total, 3,635 were active. This review compares 278 Baron accidents to 837 comparative aircraft accidents. High-risk areas based on actual accident history are also identified.

This study also focuses separately on serious accidents (where one or more of the aircraft's occupants sustained serious or fatal injuries) and minor accidents as follows:

Type	Serious	Minor	Total
Beechcraft Baron	87	191	278
Comparative Aircraft	304	533	837

Comparative Aircraft

Flying hours and aircraft data were derived from the FAA General Aviation Activity and Avionics Survey. Accident data is for the period 1982 through 1993 and was obtained from the NTSB aircraft accident database.

The following aircraft were used in the comparison group:

- Beechcraft 50 Twin Bonanza
- Celina 808 Crusader
- Celina 320 Skyknlght
- Piper PA-28 Apache/Aztec
- Piper PA-SO AeroSt.
- Beechcrll 95 Travel Air
- Celina 810
- Celina 885/340
- Piper PA-34 Seneca

Pilot-Induced Accidents
A Commentary

The overall 80% pilot-induced general aviation accident rate history has been of long-standing concern to the FAA and the industry. There are some fundamental reasons for this, aside from the possibility of individual psychological problems that might have required professional or medical effort to identify. Readers may find the following useful in performing a self-analysis of their piloting skills and habits. This should be done to improve levels of pilot attention and expertise, thus reducing exposure to high-risk situations.

It has been said by aviation safety experts that "flying is a discipline ... safety is an attitude." Pilots should be fully aware of their responsibilities to obey the rules that have been promulgated for safety to the general public and all airmen. So why do VFR and IFR pilots continue VFR flight into IMC? Some examples of poor safety attitudes include:

- Self-induced pressure and pressure induced by others (commonly known as "get-home-itus" or "get-there-itus") have resulted in large numbers of disastrous aircraft accidents. There is no place that anyone needs to be that is worth the loss of human life.
- Failure to obtain a weather briefing.
- Disregard or disbelief of weather warnings.
- Failure to prepare alternative courses of action before departure.
- Lack of understanding of the limitations of weather forecasting.
- Failure to maintain contact with FSS/NWS for possible changes in actual as well as forecast conditions.
- Overconfidence in personal ability and/or capability of equipment.
- Lack of knowledge, understanding, or disregard of pilot's operating handbooks.
- Complacency:
  - Failure to use checklists.
  - Lack of intimate familiarity and understanding of emergency procedures and checklists.
  - Disregard for weight and balance limitations.
  - Failure to observe density altitude limitations on aircraft takeoff performance.
  - Lack of understanding of aircraft limitations in penetrating turbulence; e.g., maneuvering speeds and aircraft control.
- Insufficient currency and proficiency:
  - Poor proficiency in partial-panel instrument flight to include unusual attitude recovery; especially applicable to non-instrument-rated pilots.
  - Too much reliance on radar vectors and autopilots.
  - Lack of proficiency in night flying.

Comprehensive training and experience add to pilot knowledge and skill, which should reduce errors in judgment. However, judgments are complex and go from simple perceptual estimates of what should be done to campi icated decisions involving the fusion of old and new habits in meeting a hazardous situation, which may demand attention to several activities at the same time. For example:

- If a pilot on takeoff, just before liftoff, senses all is not well with the engine, a nearly instantaneous decision must be made based on judgment of several factors:
  - Is the problem fuel related? If so, then what?
  - Is there enough ru nway to stop? If not, then ...
  - Can obstructions off the airport be avoided? If not, then ...
  - Is the engine developing sufficient power to permit flight and return to the airport?
  - Can V_{MC} be maintained? If not, then a landing under control in whatever space is available is far better than a crash out of control.
- Many accidents could have been prevented had the pilot understood and followed the POH normal and/ or emergency procedures. When pi lots operate different types and models of the same aircraft, it becomes ever so important that the appropriate POH checklists and procedures be thoroughly understood and (above all) used for all phases of preflight and flight operations.
- High landing accident rates offer some clues to problem areas:
  - Failure to use checklist to ensure landing gear is down and locked.
  - Inadequate understanding of the emergency gear extension system procedure.
  - Failure to positively identify the specific control before retracting the flaps after landing.
  - Better evaluation of surface winds at uncontrolled airports to avoid downwind landings.
  - Landing too far down the runway to stop the aircraft. Failure to use installed VASI aids and/or poor evaluation of obstacles on final approach to set optimum visual glidepaths.
  - Taking too long before deciding to go around.
  - Too fast or too slow final approach airspeeds. Pilots should consider using final approach airspeeds of 1.3 V_{SO} under normal conditions.
  - Loss of control during crosswind landings.
  - Better understanding of control, differential power, and braking techniques under conditions of runway snow, ice, and crosswinds.

Pilot judgment will always be a factor in aviation and is critical in impending or actual emergency operations. Pilot judgment can be improved with continuing aviation education, proficiency flying, and experience. The best reason for reading accident reports is to learn from the misfortunes of others. Pilots can condition themselves mentally to prepare for similar circumstances. For example: Some aircraft with empennage ice accumulation have crashed on final approach because flaps were used, which disrupted airflow over the tail. From these experiences, we learn that whenever ice is present, the safest procedure is to land without flaps. Experience, be it ours or learned from other pilots, leads to knowledge. Knowledge leads to safer flying.

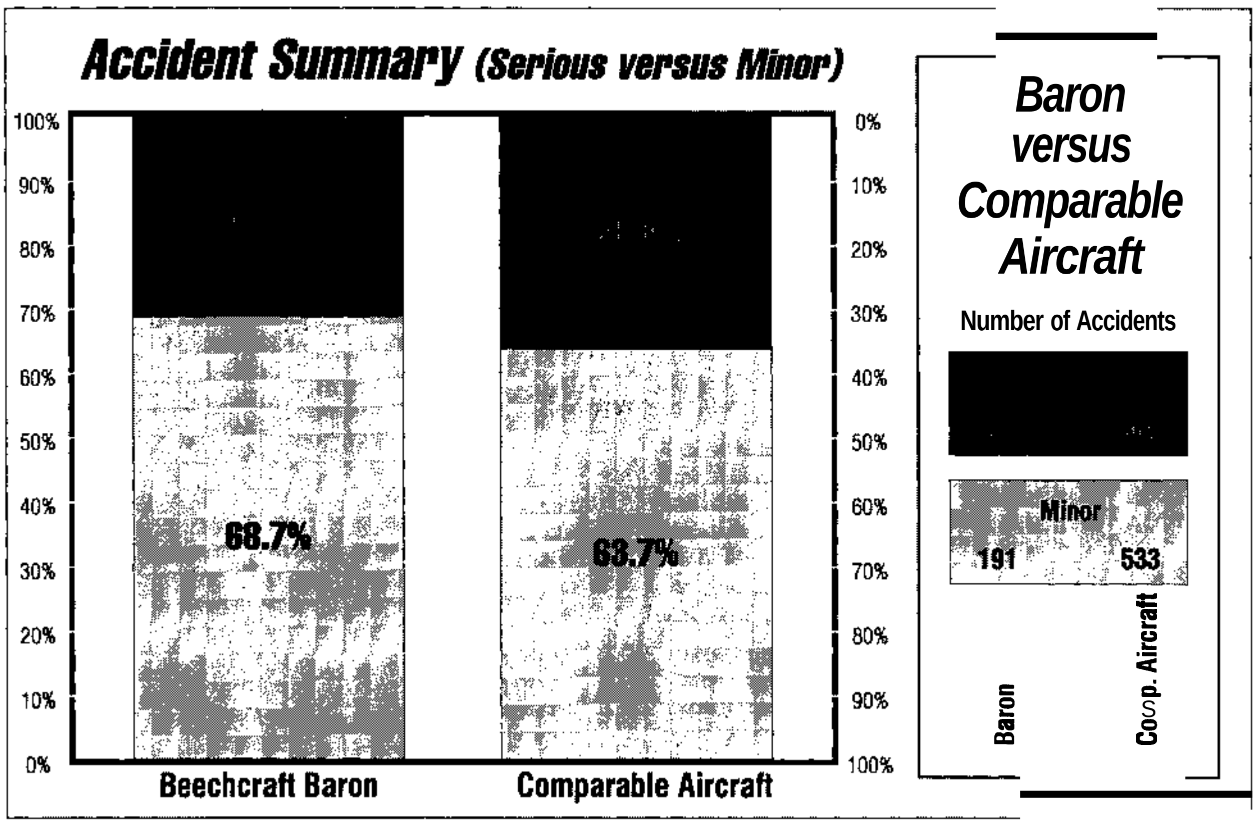
Part 1

A summary of statistical accident data and a comparison to accidents of other twin-engine aircraft of similar performance.

Accident Summary

Figure 1 is the overall, serious and minor accident percentage rates and actual numbers of accidents. Serious accidents are defined as those which result in serious or fatal injuries in accordance with NTSB Part 830 definitions. Although many minor accidents, including gear-up landings and *lor* premature landing gear retractions, result in costly damages, they are not classified as serious unless serious or fatal injuries have occurred. The differences between the Baron and comparison aircraft do not appear significant with the exception that the minor accident rate for the Baron reflects a greater number of gear-up accidents and premature gear retraction accidents on landing roll. These will be covered in greater detail in the section entitled *Landing Gear Extension/Retraction Accidents-A Commentary,* found on page 1-23.

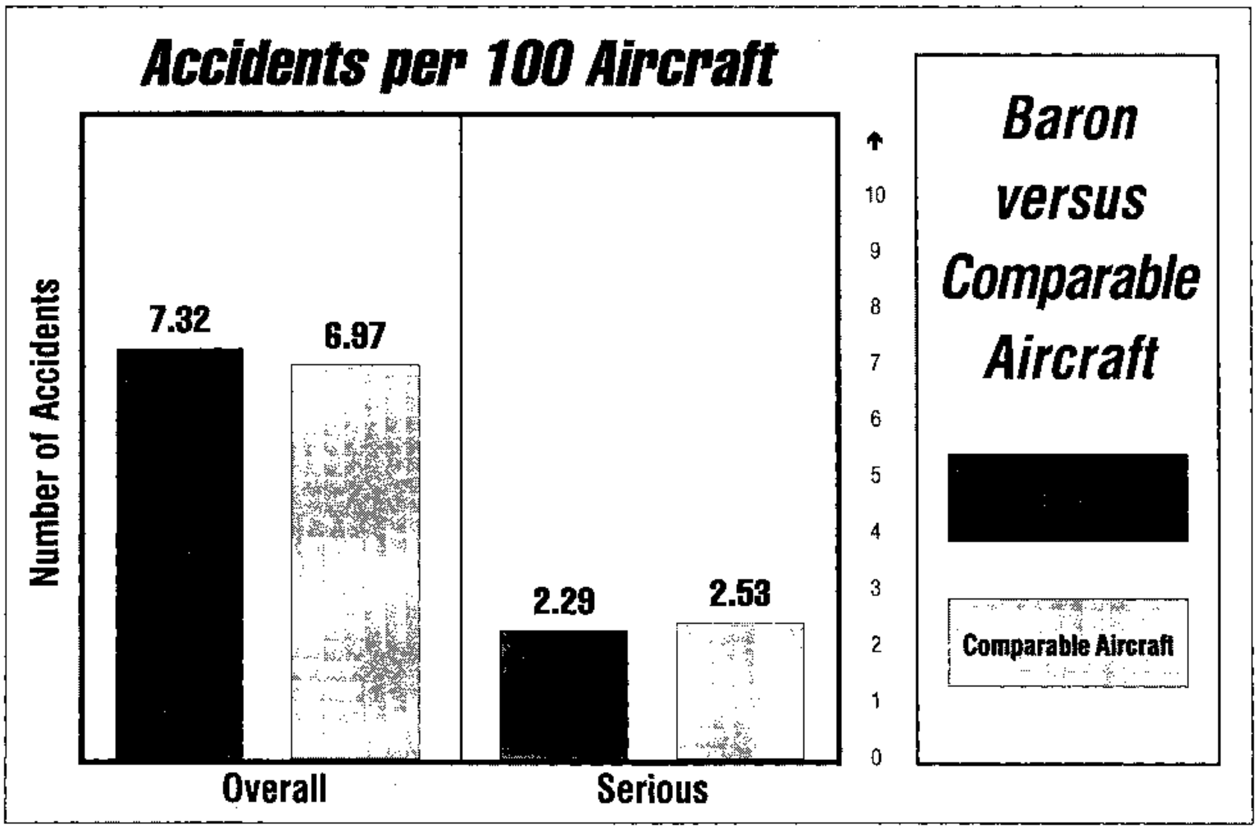
Figure 1



Accident Rate per 100 Aircraft and 100,000 Hours

In accidents per 100 aircraft, Figure 2, the Baron has a slightly higher *overall* rate than comparison aircraft. This higher percentage could be attributed to the large number, 49% , (see figure 12, page 1-15) of Baron landing accidents. Comparison aircraft landing accidents were just 33% of the total pilot-related accidents. Examples of specific Baron landing accidents can be found in part 2, pages 2-40 to 2-47.

Figure 2

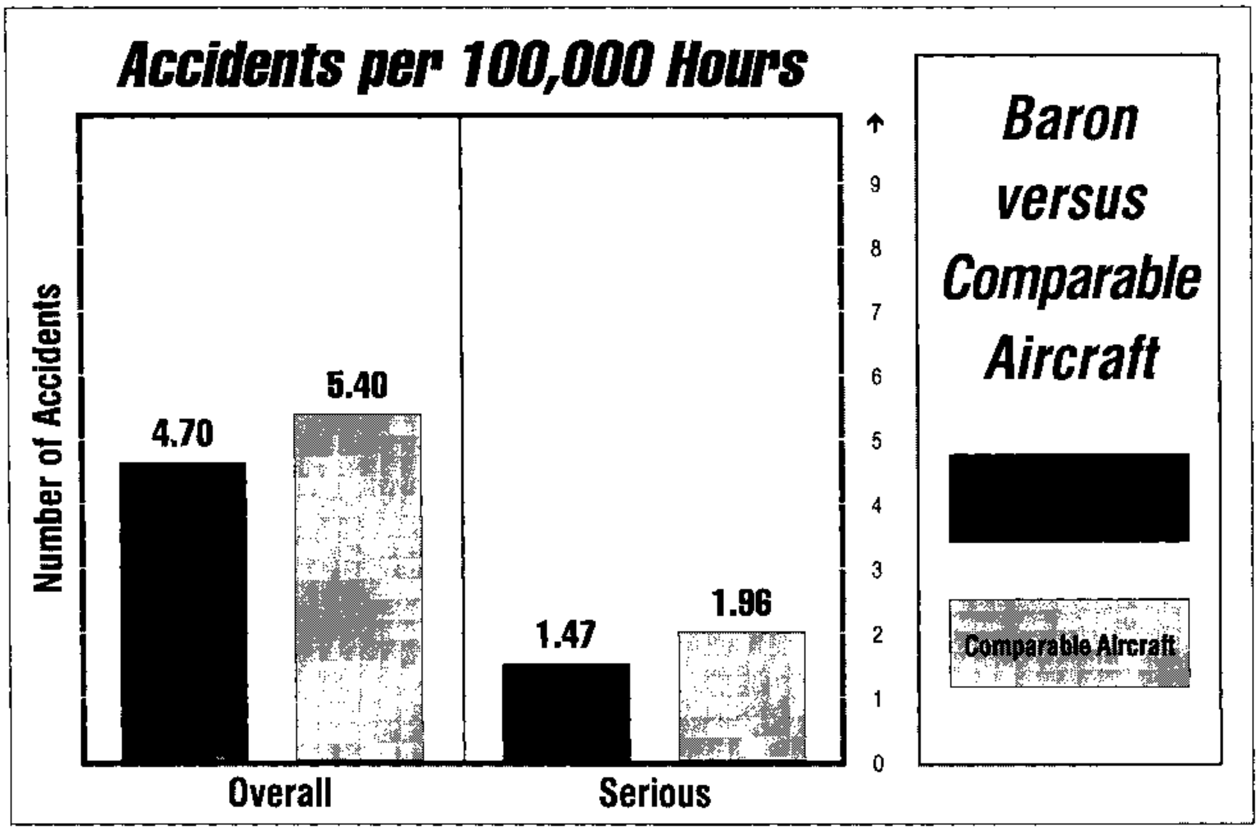


Accident Rate per 100 Aircraft and 100,000 Hours-continued

Another method of measuring accidents rates is to use the FAA 100,000 hour standard of measure. This is depicted in Figure 3 and indicates the overall accident rate for the comparison aircraft is slightly higher than the Baron. This reflects higher annual flying hours per aircraft for the Baron (173 hours) compared to 143 hours for the comparison aircraft.

The FAA estimates annual flying hours by extracting information from the annual General Aviation Activity and Avionics Survey submitted by approximately 30,000 owners of US registered general aviation aircraft. The report includes estimates of flying time, landings, fuel consumption, lifetime airframe hours, avionics, and engine hours of the active aircraft fleet by manufacturers/model group, type, state, and region of based aircraft and primary use.

Figure 3

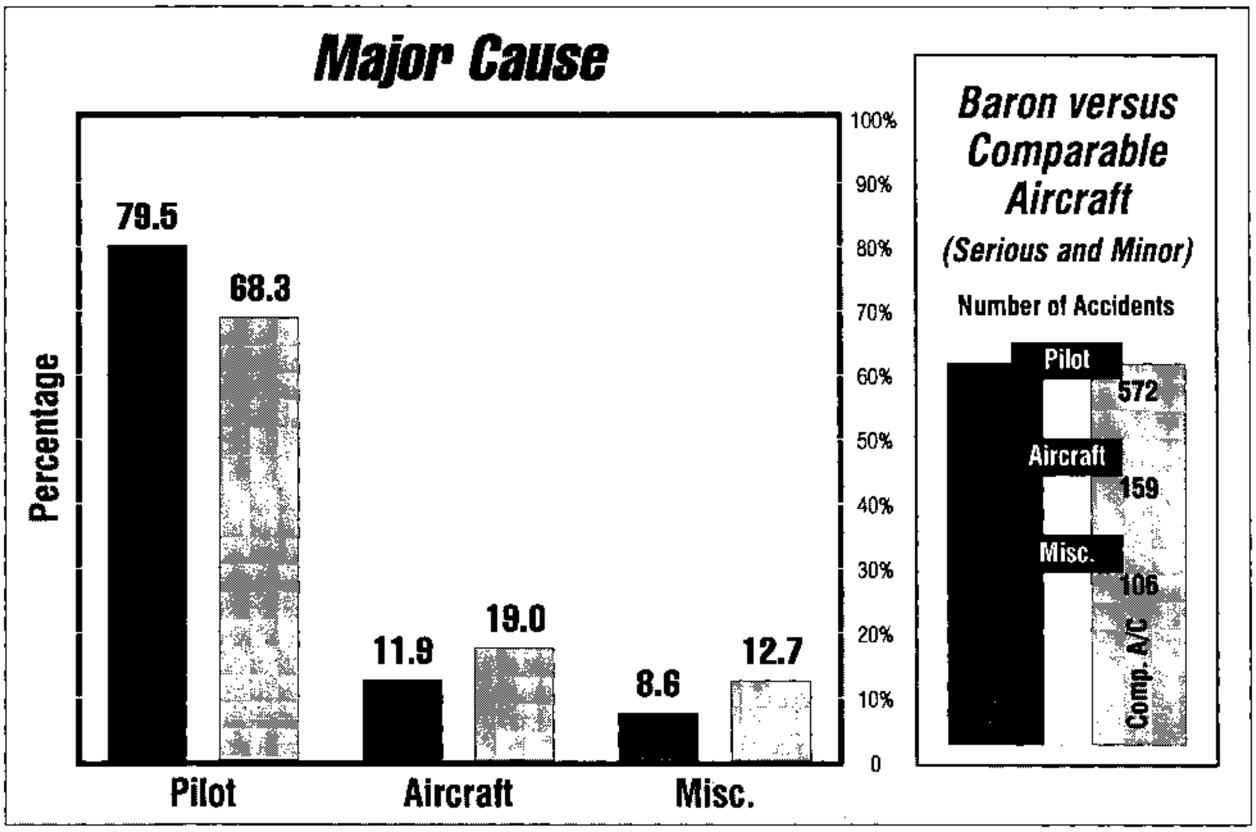


Pilot versus Aircraft Major Cause

Pilot related accidents of the Baron are consistent with general aviation historical accident data (70 to 80 percent). Figure 4 indicates the major cause percentage attributed to the pilot is higher for the Baron than comparison aircraft. As will be seen later in this study, this could be due to the higher numbers of Baron landing accidents than those experienced by comparison aircraft.

Baron landing accidents, in the subcategory Gear Retraction/Extension, (page 1-22, figure 17) shows a major disparity: 29.4% versus 6.3%, when compared to comparable aircraft. This is a major reason for the poor showing attributed to Baron pilots in figure 4.

Figure 4



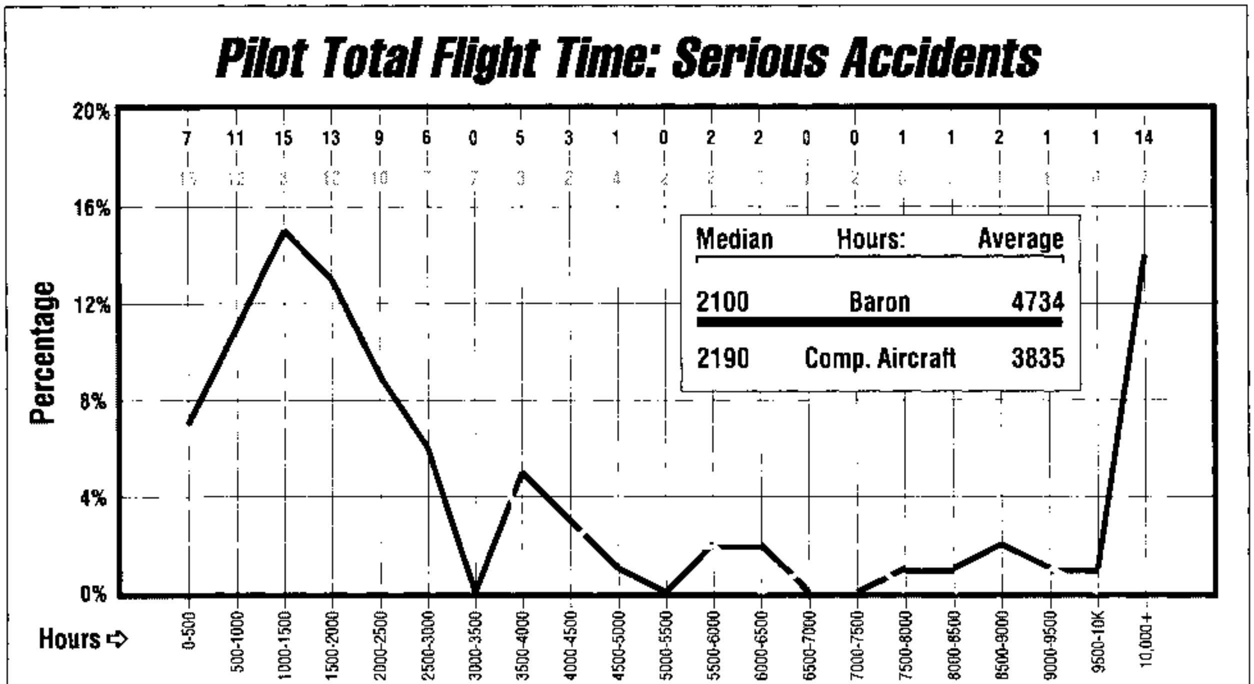
Pilot History

Figures 5, 6, 7, and 8 display the pilot level of total experience and pilot time in type for both serious and minor accidents. Please note that we have included the percentage numbers at the top of each graph.

The Baron and comparison aircraft accidents rates follow approximately the same general pattern, i.e. most accidents cluster from 1,000 to 4,000 hours total flying time. The sharp increase for Baron pilots with more than 10,000 hours was not due to any particular causal factor. These accidents were random in nature. This increase which appears at the end of charts 5, 6, 7 and 8 merely represents statistical accumulation of all accidents from the cutoff point in the chart to infinity. A somewhat smaller increase is indicated for comparison aircraft pilots.

Note also that the great majority of Baron accidents were experienced by pilots with a to 400 hours time in type.

From the data it appears that pilots with 400 hours or more time-in-type experienced fewer accidents. However, before pilots take comfort based on flight experience, remember that 26% of serious accidents and 29% of minor accidents happened to pilots with more than 5,000 hours total time. Pilots must maintain proficiency, vigilance, and pay the strictest attention to weather forecasts, endurance, preflight planning, and the use of checklists regardless of total time and/or time-in-type.

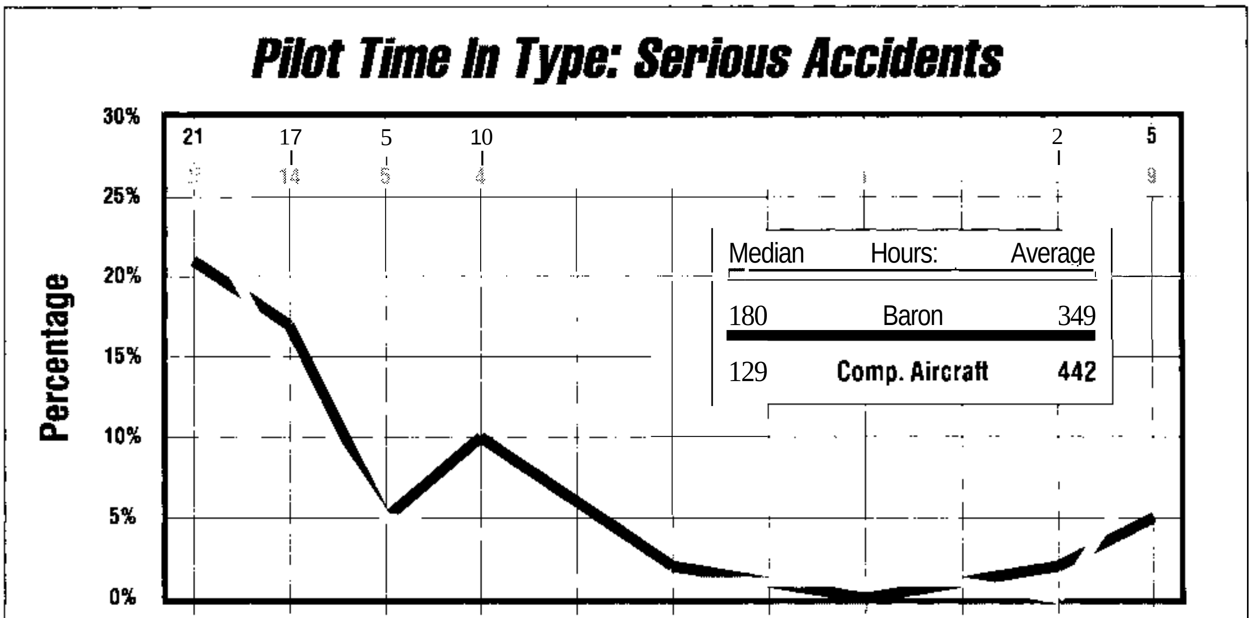


	0-500	500-1000	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000	5000-5500	5500-6000	6000-6500	6500-7000	7000-7500	7500-8000	8000-8500	8500-9000	9000-9500	9500-10K	10,000+
Baron	6	10	13	11	8	5	0	4	3		0	2	2	0	0			2			12
Comp. A/C	38	35	23	35	29	21	21	9	7	13	7	6	1	4	5			2	2		22

NumberolAccidents

Figure 5

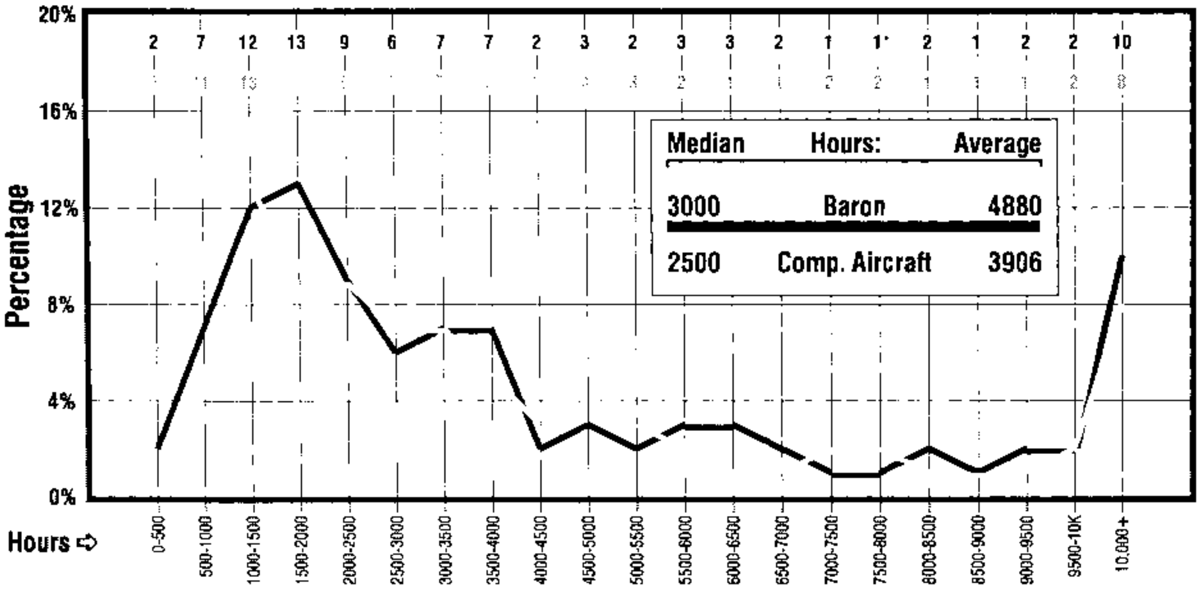
Figure 6



Hours ➪	0-100	100-200	200·300				600·700	700·800	800·900	900-1000	1000+
Baron	18	15	4	9	5	2	1	0	1	2	4
Comp. A/C	76	44	15	13	4	4	3	2	2	1	28

Number of Accidents

Pilot Total Flight Time: Minor Accidents



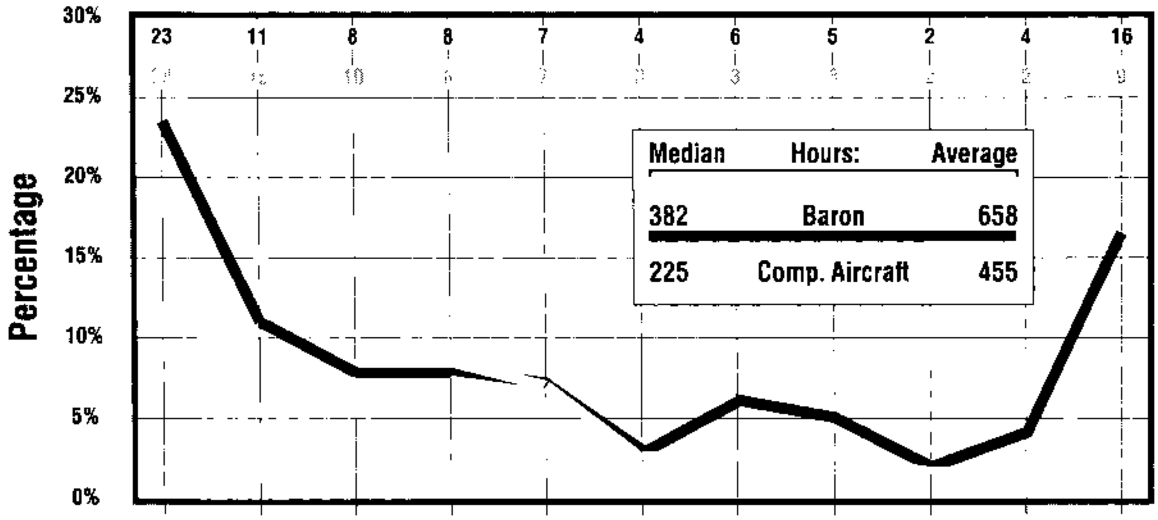
Hours ⇨	0-500	500-1000	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000	5000-5500	5500-6000	6000-6500	6500-7000	7000-7500	7500-8000	8000-8500	8500-9000	9000-9500	9500-10K	10,000+
Baron	4	14	22	24	17	12	13	14	4	6	4	6	5	3	2	2	4	2	3	3	19
Comp. A/C	33	58	68	49	48	36	37	28	15	19	14	10	6	6	9	10	3	3	4	11	43

Number of Accidents

Figure 7

Figure 8

Pilot Time In Type: Minor Accidents



Hours ⇨	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000	1000+
Baron	43	21	16	16	14	8	11	9	4	8	30
Comp. A/C	149	81	53	43	38	17	17	16	11	10	48

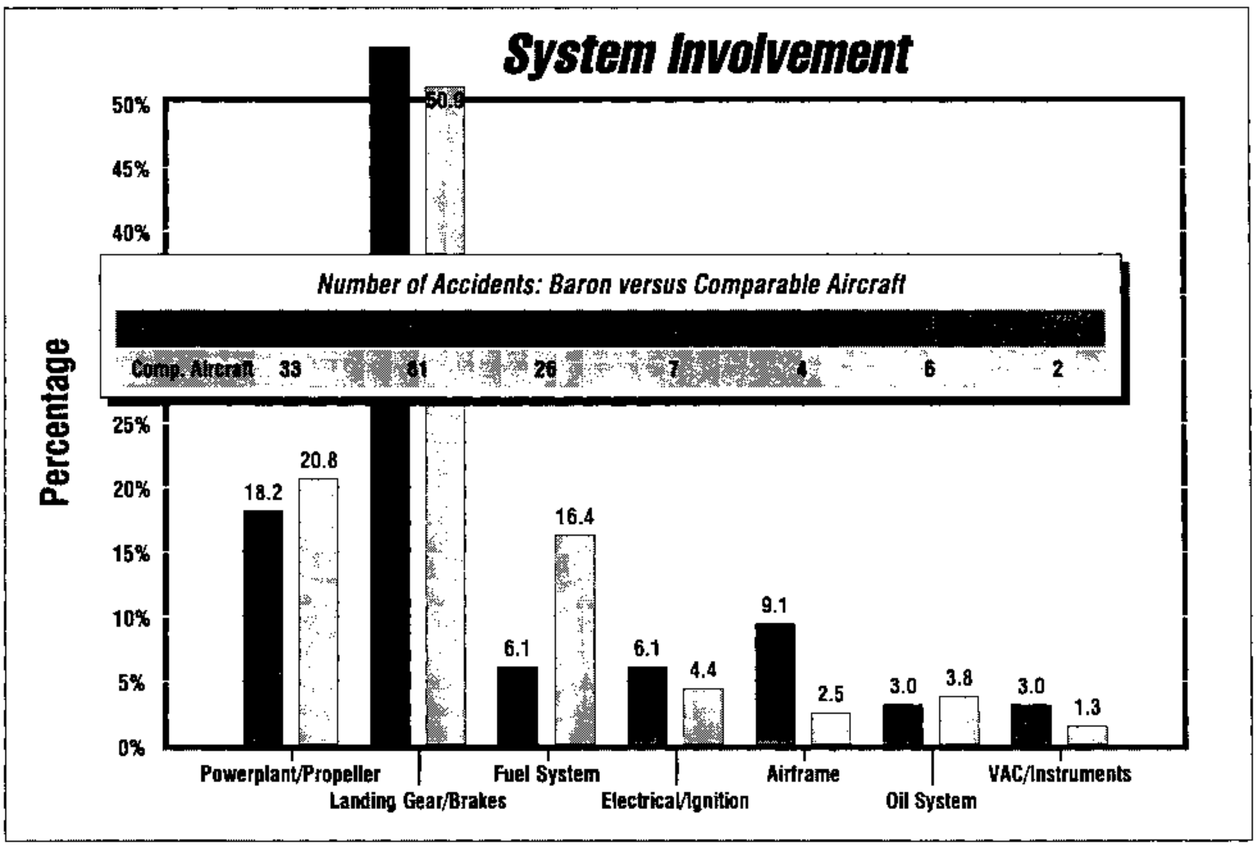
Number of Accidents

System Involvement

System involvement accident rates for the Baron and comparison aircraft are relatively comparable. In Figure 9, note that landing gear/brakes accidents are the highest for all systems. Although these numbers are mechanical/maintenance related, pilots can assist by reporting hard landings and other adverse situations affecting the landing gear to maintenance personnel for special inspections. Damage and/or wear and tear problems could thus be repaired to prevent more serious complications in the future. For more details, see SDR highlights on page 1-10 and 1-11 in this review.

The high involvement of gear and brakes for both Baron and comparable aircraft suggest that more attention be paid to these critical systems. This is especially true for owner/operators who know the maintenance history of the aircraft.

Figure 9



Service Difficulty Report (SDR) Highlights

Service Difficulty Reports, while not official government reports, may give an indication of possible maintenance problems. Repeated problems in the following areas have been identified"by aircraft maintenance technicians. SDRs are not verified by the aircraft manufacturer. These reports emphasize the importance of proper maintenance and, as aircraftage, this becomes critical.

During the period January 1,1974 through April 21,1994, there were more than 5,400 Baron SDR submissions. Because of the large database, highlights have been selected from a few of the reports of major concern to pilots and aircraft owners.

Alternator/Generator Drive System

Fourteen incidents of alternator bearing gear failures occurred which resulted in pieces of failed bearings entering the engine oil system. A few engine failures resulted, however, all other incidents required expensive engine overhauls because of foreign metals circulating throughout internal engine working parts. In two incidents, crankshafts were damaged beyond repair. Owner/operators should consider giving special attention to alternator time in service and special alternator inspections to avoid risk when operating long time-in-service alternators.

Vacuum Distribution System

Vacuum pump failures have occurred as a result of sheared drive shafts. A number of new and/or overhauled pumps have failed during initial engine runup after installation. Normal procedure before installing vacuum pumps is to blowout the lines to remove possible contamination which might shear the drive shafts prematurely. This might not be sufficient since many vacuum hoses have deteriorated and pieces of hose lining could flake off and be sucked up, causing the drive shafts to shear. Replacing vacuum hoses at the same time new and/or overhauled pumps are installed is relatively inexpensive and should guard against premature failures from long time-in-service deteriorated hoses. Baron pneumatic pressure systems have been known to throw broken vacuum pump pieces into the rest of the system-a big problem if filters are not installed.

Ignition System-Magneto/Distribution

During the reporting period there were 228 magneto 5DRs, of which 112 were related to cracked magneto cases. Corrosion from water contamination was also reported. ADs and 5Bs have specified magneto parts service limits which have been exceeded by the time failure occurred. Worn cams, cam assemblies, loose flyweights, and impulse couplings were found which exceeded Bendix 5B-549 and AD 78-09-07R3 service limits.

Engine

There were 526 Service Difficulty Reports pertaining to engines, of which 278 were cracked crankcases. Most of these incidents were discovered during maintenance inspections. Pilots should, however, be especially alert during preflight inspections for any and all signs of excessive oil consumption such as low oil levels or unusual stains which might be visible in and around engine nacelles.

Engine Mounts

A considerable number of reports have been submitted where pilots have experienced engine vibrations similar to fouled spark plugs. Some pilots reported strange unexplained vibrations. Maintenance personnel have found many lower engine mount legs/brackets broken in two, some having broken in flight. Continental SB-M92-13 addresses this problem and should be consulted by owner/operators. Until the service bulletin is implemented, pilots should very carefully inspect all engine mounts/brackets during preflight inspections. Under the right conditions, an engine could separate from the airframe if mounts and brackets have been broken due to turbulence, hard landings, or excessive vibrations.

Landing Gear

During the reporting period there were more than 600 SDRs pertaining to the landing gear and retraction system. Some of these difficulties were due to corrosion; broken, cracked, or bent rod assemblies; uplock and downlock cables broken or frayed; and loose torque links.

Emergency manual gear extension problems were reported where the gear could not be lowered manually. Seized electrical gear motors; fouled worm gear actuators, bushings, and bearings which may have resulted in the worm gear shifting forward, preventing engagement of the handcrank were causal factors. Two reports indicated the handcrank could not be engaged because (1) the crank cover was cemented down to the airframe and (2) the handle of the crank was trapped under the spar/gear box cover. This latter item was addressed by Beechcraft communique #57, dated April 10, 1981 .

Cracked brake disks and torque plates were also extensively reported.

Owner/operators can greatly assist in minimizing landing gear and brake problems by reporting hard landings or adverse stress placed on landing gear components due to crosswinds, ice, etc., to maintenance personnel. These situations would require a visual inspection of components for wear and tear, breaks, cracks, or out of adjustment problems. Repairs and preventive maintenance between annual inspections could prevent failures which might lead to more serious complications.

IMC/Night Accidents per 100,000 IMC/Night Hours

Figure 10 shows serious and minor Baron accidents that occurred in instrument meteorological conditions (IMC). Both the Baron and comparison aircraft rates are about the same. The ***ALL IMC*** bar includes all accidents under IMC. This includes 49 Baron accidents of which 12 accidents were caused by non-instrument-rated pilots or instrument-rated pilots who continued VFR flight into instrument conditions without instrument flight plans or clearances. Forty comparison aircraft accidents occurred under the same circumstances. *The IFR FLIGHTS bar shows instrument-rated pilots on IFR flight plans.*

Figure **11** shows serious and minor night accident rates to include those which occurred under IMC. Fifty-four Baron accidents occurred at night of which 27 were in VFR conditions. These rates were nearly twice the *ALL IMC* accidents indicated in Figure 10. Some pilots were involved in night IMC (five Baron and 15 comparable aircraft) not under IFR flight plans. Clearly, night operations accident data confirms that instrument training and currency is essential for safe night operations because of reduced visibility and fewer visual cues. The use of published instrument departures and approaches at night, where possible, ensures terrain and obstruction avoidance. This is good practice for both instrument-rated and non-instrument-rated pilots. Pilots entering IMC without instrument flight plans and ATC clearances, whether instrument rated or not, do so at great risk to themselves and others.

The NTSB once determined that 28 percent of the accidents experienced by VFR flight into IMC were by instrument-rated pilots; all without ATC clearances. These pilots were probably not current, had equipment problems, could not transition from VFR to IFR flight plans, did not want to bother obtaining ATC clearances, or had not thoroughly evaluated the weather situation. Instrument proficiency and currency should be regularly maintained by concentrated practice and study. The use of flight simulators is highly recommended for developing scan patterns and situational awareness. The more sophisticated the simulator, the higher the degree of learning transfer.

Compare figures 10 and **11** to figure 3 on page 1-4. Note that the *total* night accident rate is nearly 30% higher than the overall Baron accident rate. However, the night IFR in IMC rate (1.29 per 100,000 hours) is the lowest depicted. This indicates that on the whole, Baron instrument pilots flying IFR at night are doing a reasonably good job. In Part 2 of this report there are some unfortunate exceptions.

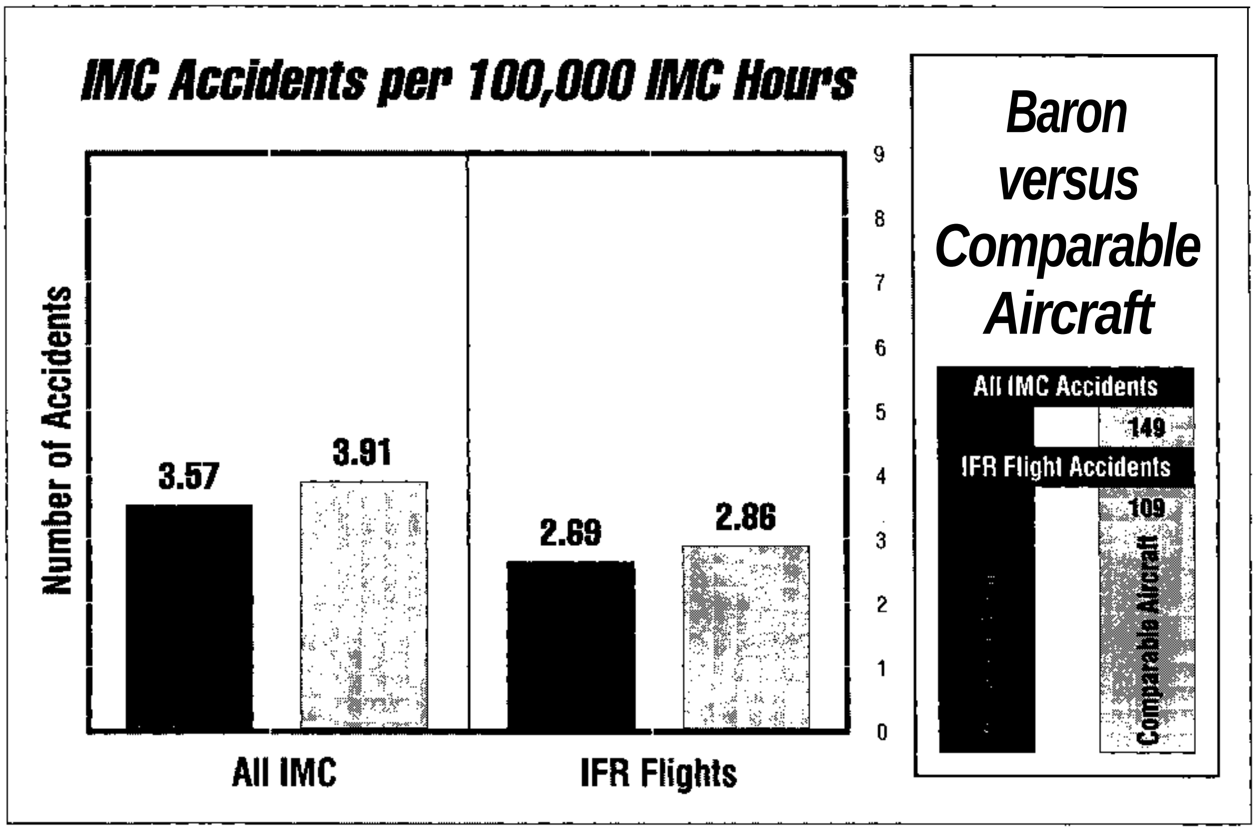
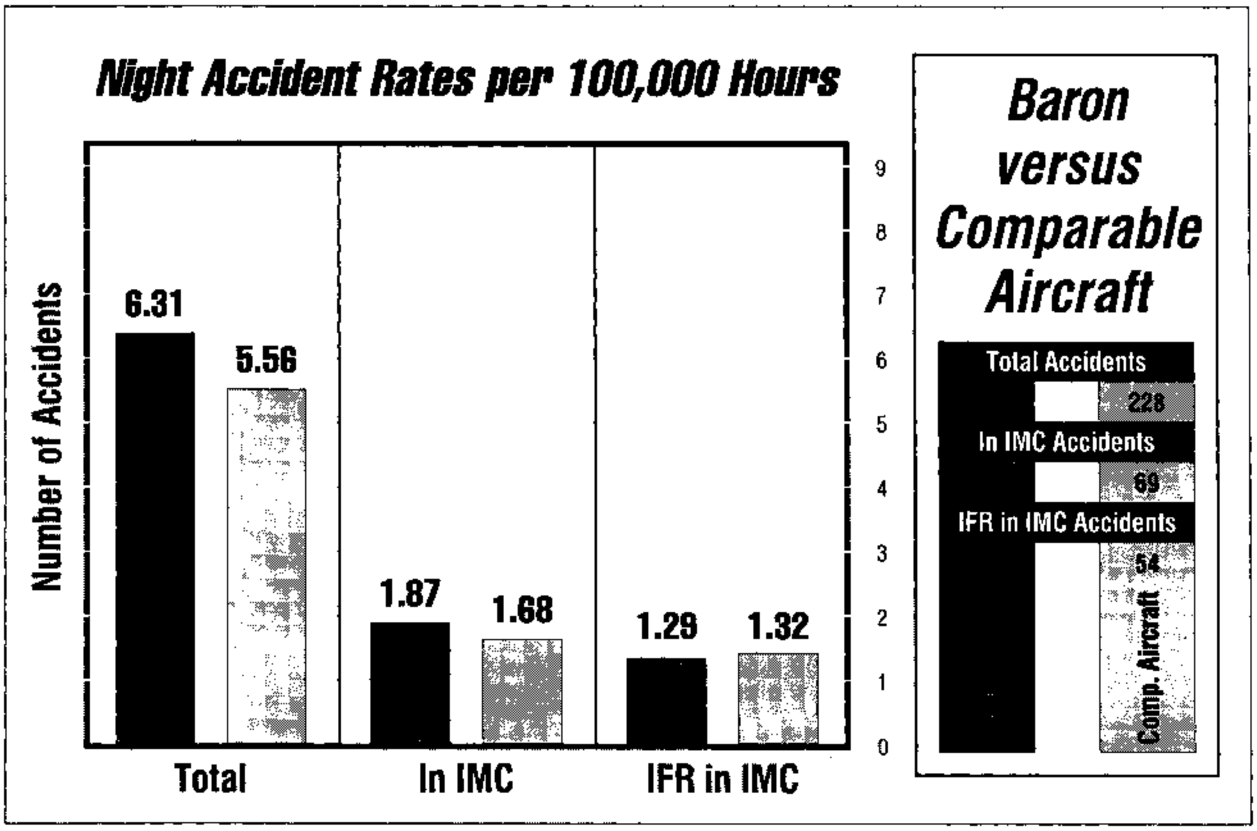


Figure 10

Figure 11



Pilot Related Accidents (All Accidents)

Further study focused on the phase of flight which the accidents occurred. (Figure 12) Both serious and minor accidents were considered. There were 278 accidents of which 221, or 79.4 percent, were pilot related. The majority, or 88.2 percent, of these accidents were in the following phases of flight categories:

Phase	Number	Percent
Takeoff:	27	12.2
Cruise:	41	18.6
Approach:	18	8.1
Landing:	109	49.3
Total:	**195**	**88.2**

Because these accidents comprise more than 88 percent of the total pilot-related accidents, some examples of the most prevalent principal causes in the takeoff, cruise, approach, and landing phases are highlighted:

Takeoff: 27 Total Accidents

➢ Attempted takeoff on empty tank, improper selector position	4
➢ Attempted takeoff from wet, soft, grass, sod, snow surface	1
➢ Attempted intersection takeoff, insufficient runway available	1
➢ Attempted takeoff with full nose-down trim	1
➢ Loss of control attempting to close door during takeoff	4
➢ Loss of directional control during takeoff	3
➢ Premature rotation/liftoff, over-rotation, stall/mush, hit object	1
➢ Improper high density altitude takeoff procedure	1
➢ Excessive nose-up trim, stall/mush	1
➢ Delayed abort after power loss	1
➢ Takeoff abort due to blocked pitot static port	1
➢ Flew into ground/water, dark night	1
➢ Power loss, fuel contamination	1
➢ Improper mixture/fuel booster pump setting	1
➢ Attempted takeoff with gust lock installed	1
➢ Loss of control, aft CG, over gross weight	1
➢ Abort, overshoot, one engine failed at rotation, loss of control	3
Total	27

Cruise: 41 Total Accidents

➢ Fuel starvation, improper tank, failed to switch tanks, improper preflight planning, fuel monitoring	10
➢ Attempted flight on partially filled tanks, failed to check visually	5
➢ Failed to refuel during interim stops	1
➢ Water in system, lines, ice, improper booster pump selection	2
➢ IFR flight into reported adverse weather, improper IFR procedures	5
➢ VFR into known IMC, deteriorating weather, dark night	6
➢ Flew into mountainous terrain, at night	1
➢ Lost control, turbulence, ice	2
➢ Attempted VFR under overcast, mountains, IMC	4
➢ Other	5
Total	**41**

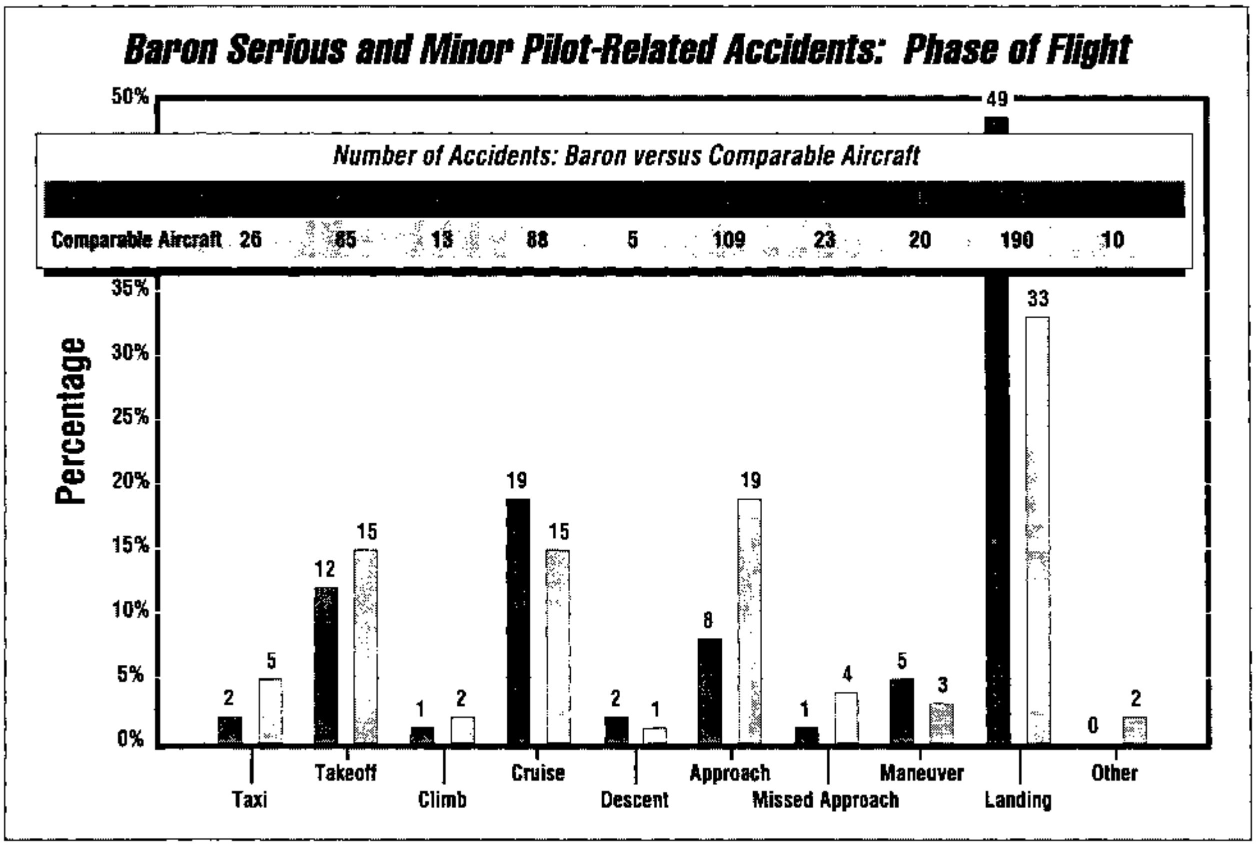
Approach, VFRIIMC: 18 Total Accidents

➢ Descended into terrain during night VFR landing pattern	1
➢ Attempted VFR approach in IMC/fog	2
➢ Mid-air during approach at uncontrolled airport	1
➢ Fuel exhaustion during approach, failed to fill tanks before departure	2
➢ Descended below minimums during instrument approach	6
➢ Improper IFR procedures in IMC	3
➢ Lost control in icing conditions	1
➢ Descended into terrain during circling approach	2
Total	**18**

Landing: 109 Total Accidents

➢ Failed to extend or check gear down and locked	39
➢ Delayed gear extension, collapsed during landing	4
➢ Inadvertent gear retraction during landing roll	15
➢ Improper emergency gear extension, failed to use system	6
➢ Overload, swerve, skid, gear collapse	1
➢ Hard landing, improper flare, high sink rate, gusts, stall/mush	12
➢ Landing long, high, fast, delayed go around, overshoot	14
➢ Landing, other	18
Total	**109**

Figure 12



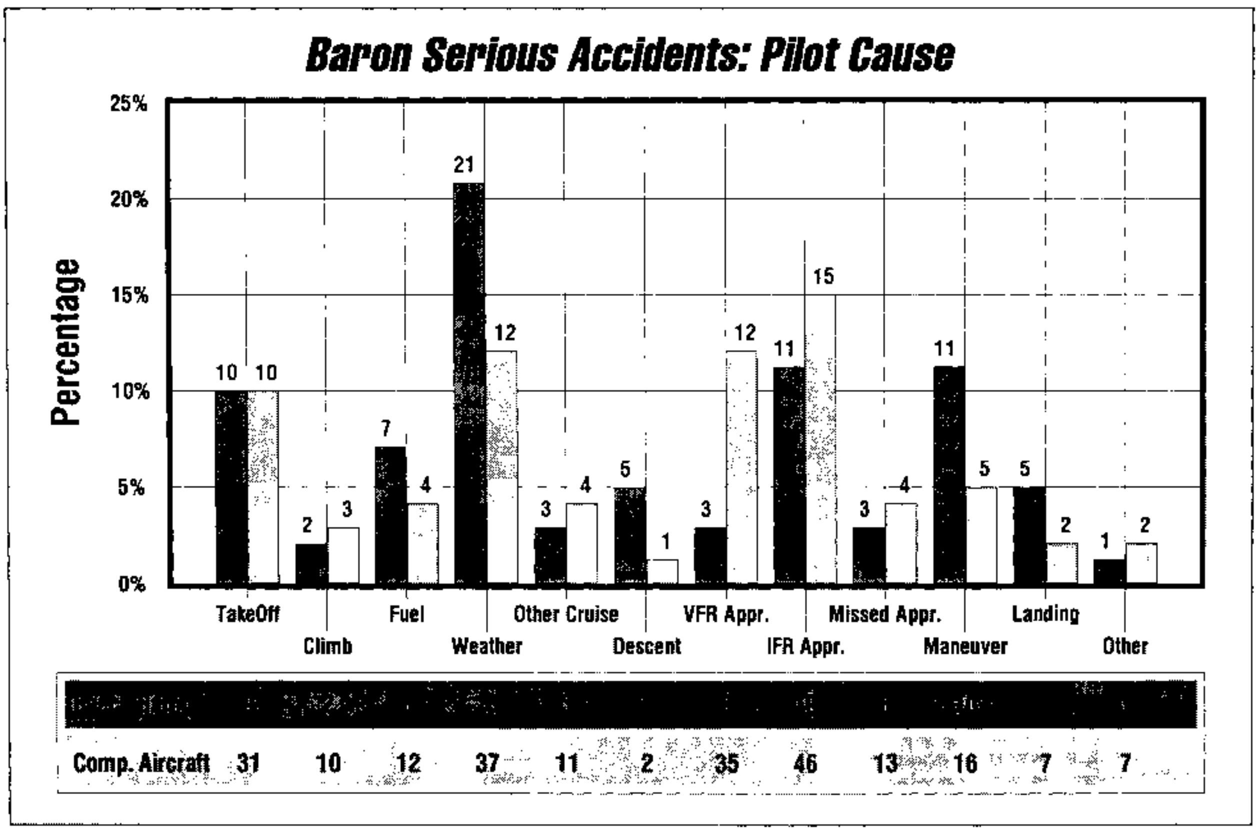
Pilot-Related Causes
Baron Serious Accidents

There were 87 serious accidents of which 73 had pilot-related causes. Five were mechanical/machine related and nine were undetermined. Figure **13** is the distribution of the Baron pilot-related causes, serious accidents. The following are the numbers and percent by primary cause category.

	Number	Percent
Pilot:	73	83.9%
Mech/Maint:	5	5.7%
Undetermined:	9	10.4%
Total:	**87**	**100%**

Total Accidents	Serious Injuries/Fatalities	Aircraft Destroyed	Substantial Damage	Minor Damage	No Damage
278	224	91	173	12	2

Figure 13



Beechcralt Baron Serious Accidents By Primary Cause & Phase 01 Flight

Accidents		FataVSerious Injuries		Aircraft Damage Destroyed		Substantial		Cause
%	#	%	#	%	#	%	#	**Pilot**
10.3	9	13.4	30	11.5	9	0.0	0	Takeoff/Initial Climb
2.3	2	1.8	4	2.6	2	0.0	0	Climb
6.9	6	5.8	13	7.7	6	0.0	0	Cruise-Fuel Starvation/Exhaustion
20.7	18	17.4	39	21.8	17	12.5	1	Cruise-Weather
3.4	3	3.1	7	2.6	2	0.0	0	Cruise-Other
4.6	4	3.6	8	3.8	3	12.5	1	Descent
3.4	3	3.6	8	3.8	3	0.0	0	Approach-VFR
11.5	10	19.2	43	10.3	8	25.0	2	Approach-IFR
3.4	3	4.0	9	3.8	3	0.0	0	Go-Around/Missed Approach
11.5	10	10.3	23	11.5	9	12.5	1	Maneuvering/Low-Level Flight
1.1	1	0.4	1	1.3	1	0.0	0	Landing Gear Extension/Retraction
3.4	3	3.6	8	1.3	1	25.0	2	Landing-Other
1.1	1	0.4	1	1.3	1	0.0	0	Other Causes
83.9%	**73**	**86.6%**	**194**	**83.3%**	**65**	**87.5%**	**7**	**Subtotal: Pilot**
								Mechanical Maintenance
1.1	1	0.4	1	1.3	1	0.0	0	PowerplantiPropeller
3.4	3	3.1	7	3.8	3	0.0	0	Control/Airframe
1.1	1	0.9	2	1.3	1	0.0	0	Vacuum System/Instruments
5.7	**5**	**4.5**	**10**	**6.4**	**5**	**0.0**	**0**	**Subtotal: Mechanical Maintenance**
10.3	**9**	**8.9**	**20**	**10.3**	**8**	**12.5**	**1**	**Subtotal: Other/Undetermined**
100%	**87**	**100%**	**224**	**100%**	**78**	**100%**	**8**	**Grand Total: All Causes**

Note:
Some figures rounded off
for ease of computation.

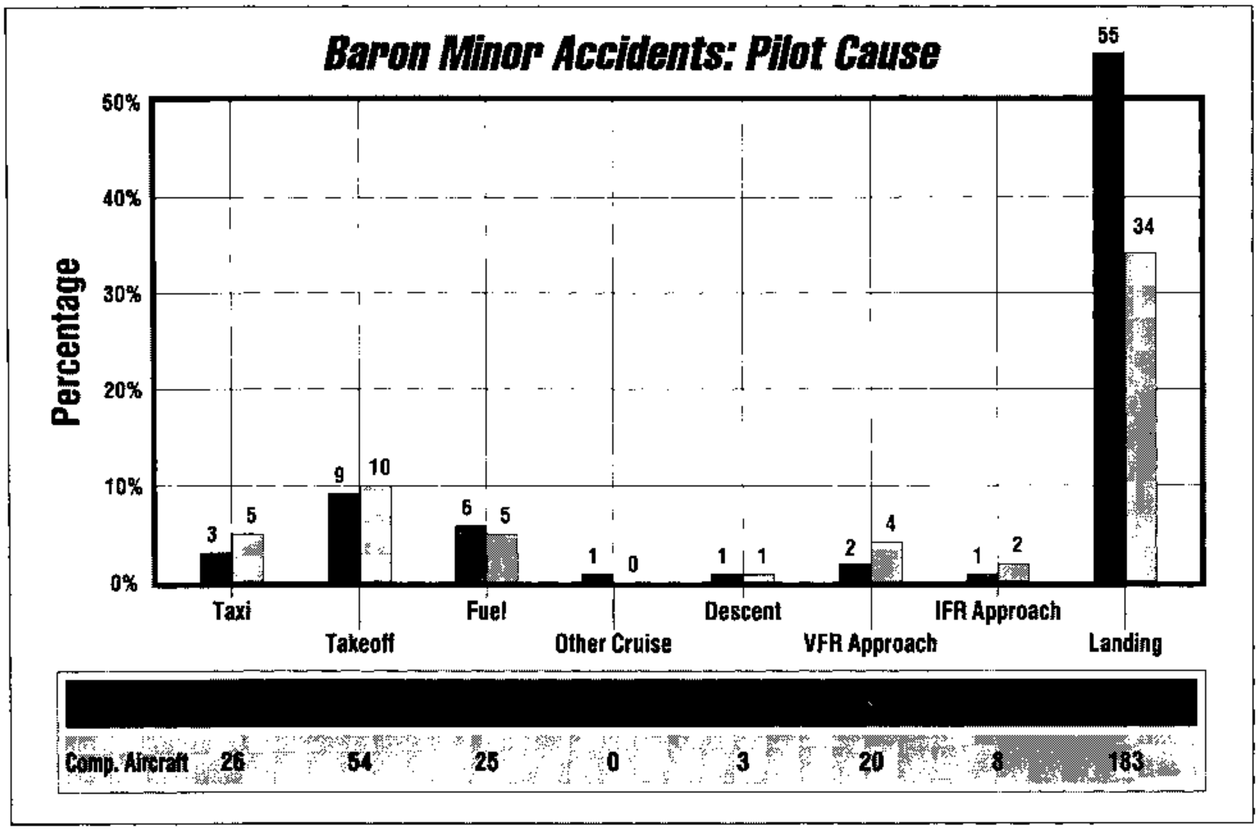
Pilot-Related Causes
Baron Minor Accidents

During the reporting period, there were 191 minor accidents of which 148 had pilot-related causes. Twenty-eight were mechanical/machine related and 15 were miscellaneous, other, or unknown. Figure **14** is the distribution of the Baron pilot-related causes, minor accidents.

The Baron and the comparison aircraft were just about comparable except for landing accidents. The Baron had nearly twice the percentage rate of landing accidents than comparison aircraft. This is covered in-depth by a special analysis of Baron landing accidents in Part 1, page 1-23. The following are the numbers and percent by primary cause category.

	Number	**Percent**
Pilot:	148	77.5 %
Mech/Maint:	28	14.7%
Miscellaneous:	15	7.9%
Total:	**191**	**100 %**

Figure 14



Beechcralt Baron Minor Accidents By Primary Cause & Phase 01 Flight

Accidents		Aircraft Destroyed		Aircraft Damage Substantial		Minor		Cause
%	#	%	#	%	#	%	#	**Pilot**
2.6	5	0.0	0	2.4	4	8.3	1	Taxi
9.4	18	7.7	1	10.3	17	0.0	0	Takeoff/Initial Climb
6.3	12	23.1	3	5.5	9	0.0	0	Cru ise-Fuel Starvation/Exhaustion
1.0	2	0.0	0	0.6	1	0.0	0	Cruise-Other
0.5	1	0.0	0	0.0	0	8.3	1	Descent
1.6	3	0.0	0	1.2	2	8.3	1	Approach-VFR
1.0	2	0.0	0	1.2	2	0.0	0	Approach-IFR
33.5	64	38.5	5	33.9	56	25.0	3	Landing Gear Extension/Retraction
6.3	12	0.0	0	7.3	12	0.0	0	Landing-Hard
7.3	14	0.0	0	7.9	13	8.3	1	Land ing-Long
0.5	1	0.0	0	0.6	1	0.0	0	Land ing-Short
7.3	14	15.4	2	6.7	11	8.3	1	Land ing-Other
77.5%	**148**	**84.6%**	**11**	**77.6%**	**128**	**66.7%**	**8**	**Subtotal: Pilot**
								Mechanical Maintenance
2.6	5	0.0	0	1.2	2	25.0	3	Powerplant/Propeller
9.4	18	0.0	0	10.3	17	8.3	1	Landing Gear/Brakes/Wheel
1.0	2	7.7	1	0.6	1	0.0	0	Fuel System
1.0	2	0.0	0	1.2	2	0.0	0	Electricallign ition
0.5	1	0.0	0	0.6	1	0.0	0	Oil System
14.7	**28**	**7.7**	**1**	**13.9**	**23**	**33.3**	**4**	**Subtotal: Mechanical Maintenance**
7.9	**15**	**7.7**	**1**	**8.5**	**14**	**0.0**	**0**	**Subtotal: Other/Undetermined**
100%	**191**	**100%**	**13**	**100%**	**165**	**100%**	**12**	**Grand Total: All Causes**

Note:
Some figures rounded off
for ease of computation.

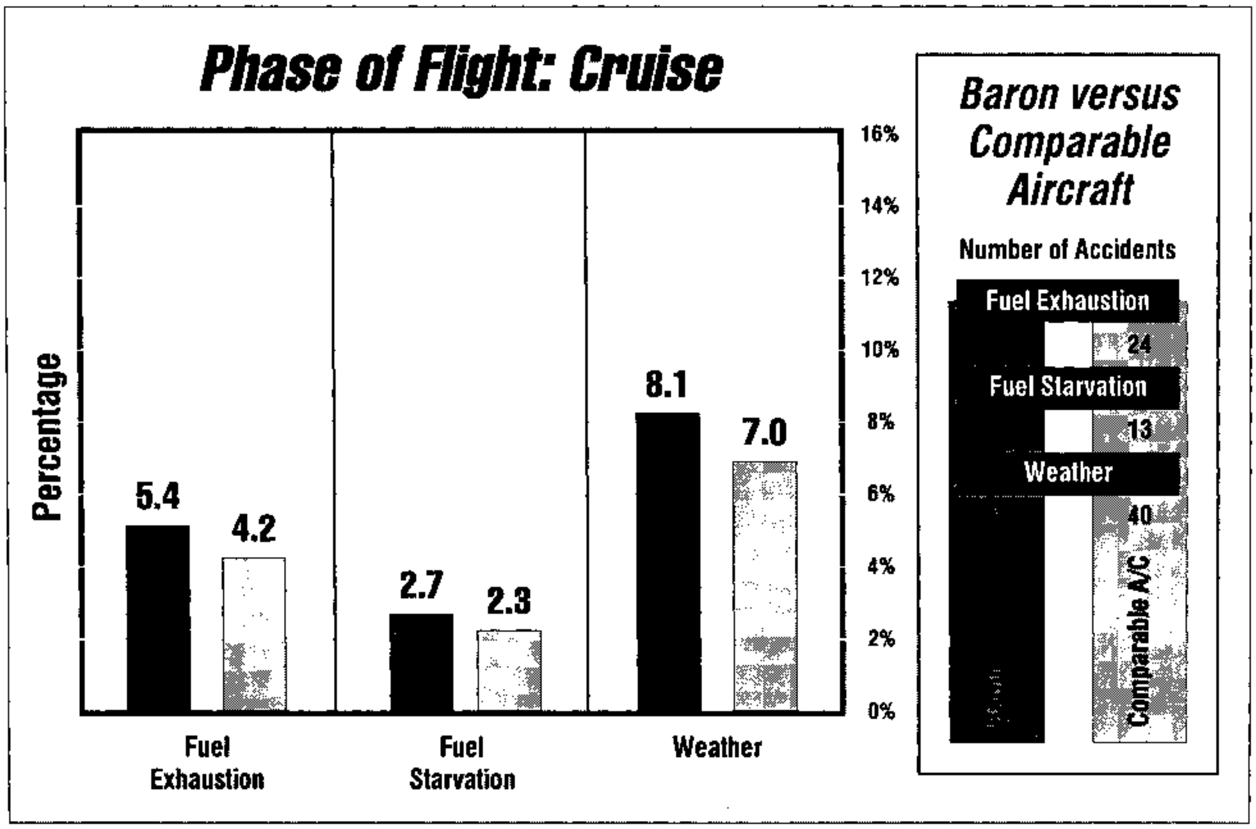
Critical Phase 01 Flight-Cruise
All Accidents-Pilot Cause

Figure **15** depicts the percentage of Baron and comparison aircraft pilot-related accidents that occurred during the cruise phase of flight.

Fuel starvation and fuel exhaustion (see glossary) accidents are preventable with pilot vigilance. The management of fuel resources and the planning for fuel requirements is up to the pilot. The fuel system, fuel consumption, and endurance, is explained in the Performance Section of each POH. Some pilots fail to visually check fuel, relying on fuel gauges for flight planning and in-flight endurance. Preflight checklists specify that fuel is to be checked visually. Pilots should become familiar with the fuel burn of their particular aircraft. A good rule of thumb is to maintain a minimum of one hour reserve on landing. On marginal weather trips this will restrict the range somewhat but is a smart alternative to running out of fuel.

Weather accidents for both the Baron and comparison aircraft are high. This is probably caused by inadequate preflight planning and the disregard of potential adverse weather. Pilots must make sure adequate planning is done for alternative courses of action when the possibility of adverse weather may affect the plan. A way to escape trouble should be available and the pilot must be willing to use it. From the accident data it is impossible to know if these pilots had encountered dangerous weather before. It's probable that many of them made poor decisions before and were able to escape unharmed but apparently no wiser.

Figure 15

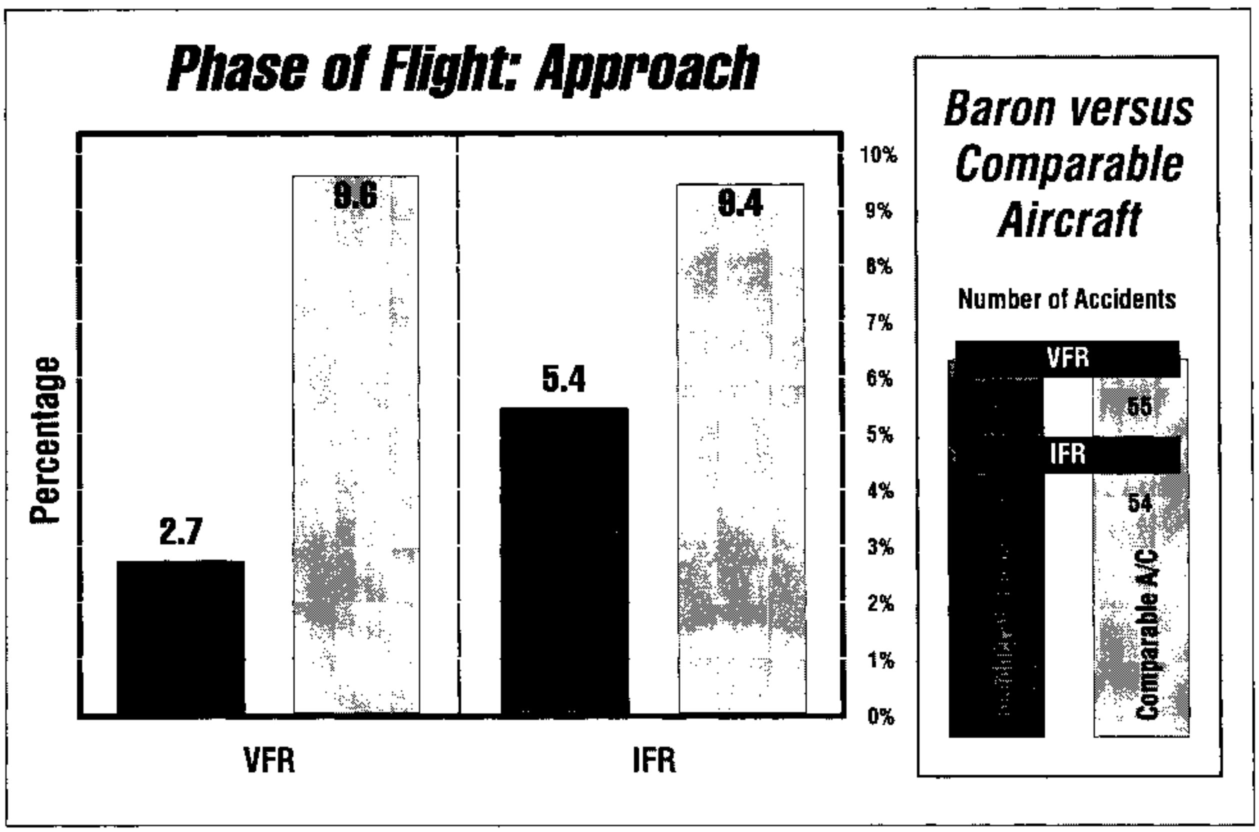


Critical Phase 01 Flight-Approach
All Accidents-Pilot Cause
Beechcralt Baron

Figure **16** reflects the percentage of Baron and comparison aircraft pi lot-related accidents that occurred during the approach phase of flight. The higher comparison aircraft VFR rate could be caused by the higher rates of attempted VFR approaches in IMe, descending into terrain during night landing patterns/approach, and fuel exhaustion during approaches.

Improper IFR procedures and descending below approach minimums during instrument approaches are the basis for the comparison aircraft higher IFR accident approach rate.

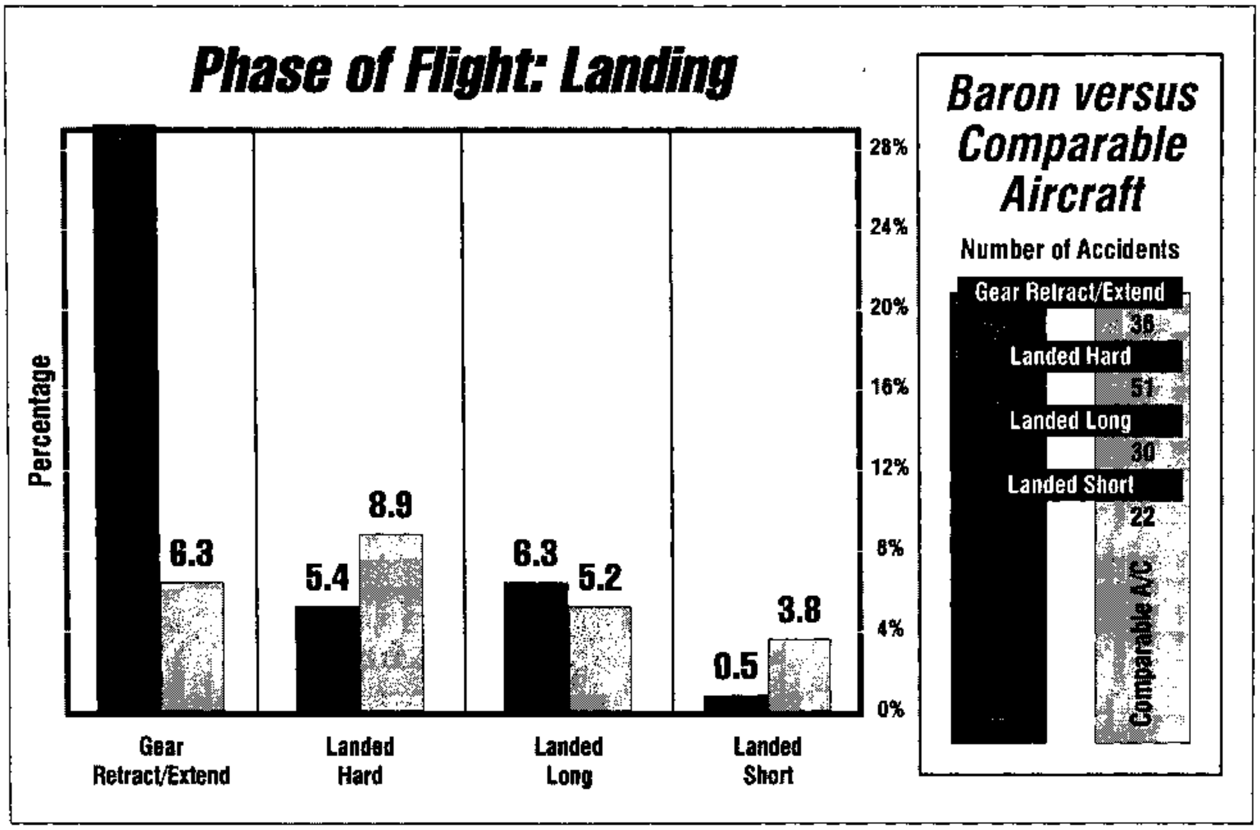
Figure 16



Critical Phase 01 Flight-Landing
All Accidents-Pilot Cause
Beechcralt Baron

Figure **17** displays the percent of Baron and comparison aircraft pilot-related accidents which occurred during landing. The Baron 29.4 percent rate compared to the 6.3 percent comparison aircraft rate relates to the large number of gear-up Baron landings and the premature retraction of the landing gear on the landing roll. (See next page.) This is discussed together with reference to a special NTSB study which was conducted in 1980 entitled "Design-Induced Landing Gear Retraction Accidents in Various Beechcraft Aircraft." The NTSB report is appended to this study in Part 4.

Figure 17



Landing Gear Extension/Retraction Accidents-A Commentary

Of the 221 total pilot-related Baron accidents, 65 or 29.4 percent were due to failure to extend the landing gear or inadvertent gear retraction during the landing roll. In the comparison aircraft group there were 572 pilot-related accidents of which only 36 or 6.3 percent were due to failure to extend the landing gear or inadvertent gear retraction. Clearly, the Baron's accident record in this area deserves special attention.

The majority of pilots involved in landing gear extension/retraction, by and large, have been experienced. The following chart reflects the total pilot flight experience of the 65 landing gear extension/retraction Baron accidents:

Hours Total Flight Time	Number 01 Accidents
0-1,000	6
1,000-3,000	28
3,001-5,000	12
5,001-7,000	7
7,001-9,000	3
9,001-12,000	3
12,001-15,000	3
over-l 5,000	3
Total:	**65**

The 65 landing gear accidents fall within the following cause groups. Selected accidents within these groups can be found in Part 2.

- Failed to extend landing gear (14 BEs8, 11 BESS/56) 25
- Failed to check gear down/locked (4 BEs8, 8 BESS/56) 12
- Inadvertent gear retraction during landing roll (6 BEs8, 8 BESS) 14
- Improper emergency gear extension, gear collapse 2
- Delayed gear extension, collapsed during landing 4
- Failed to use emergency gear extension system 4
- CFI failed to ensure student extended gear 2
- Passenger (owner) inadvertently retracted gear, landing roll 1
- Gear collapsed, overload failure, swerve, skid 1

With respect to the Baron experience of inadvertent gear retraction, the NTSB conducted a detailed review in 1980 of all inadvertent landing gear retraction accidents occurring from 1975 to 1978. The Baron comprised only 16 percent of the light-twin fleet, but they were involved in 54 percent of this type of accident. It was determined these accidents occurred because the pilot was attempting to put the flap control up after landing and moved the landing gear control instead. The inadvertent movement of the landing gear control was often attributed to pilots being more accustomed to flying aircraft in which the landing gear and flap controls were in exactly opposite locations. The conventional gear switch location is to the left of the throttle quadrant. The Baron's is to the right. In 1984 Beech changed this configuration in the 58 series.

The NTSB report recommended to the FAA that the Baron landing gear and flap controls have installed an adequate latch or guard to minimize inadvertent landing gear retraction, and pre-1963 Baron models have their landing gear control knobs modified to incorporate a wheel-shaped knob. The NTSB report (NTSB-SR-80-1) has been reproduced and included in Part 4 of this review.

The following 14 inadvertent gear retraction accidents occurred after the NTSB report was issued. All accidents were during daylight hours, and with few exceptions, the pilots had considerable multi-engine time and time-in-type.

1987	BE55/58	1,840	628	124
1988	BE58	5,800	3,500	700
1986	BE55/58	1,082	704	115
1985	BE55/58	1,911	65	55
1985	BE55/56	3,991	1,434	880
1985	BE68	6,025	2,000	88
1984	BE55/58	18,560	1,550	100
1984	BE55/56	786	865	848
1983	BE55/56	1,551	866	504
1983	BE58	6,025	2,000	88
1982	BE58	3,000	885	885
1982	BE55/58	3,000	UNK	250
1982	BE55/56	1,033	862	86
1982	BE58	2,105	1,711	1,178

Pilots can reduce or eliminate inadvertent landing gear retraction accidents by:

- Not performing *touch-and-goes.*
- Not raising the flaps until exiting the runway after landing and not activating any cockpit control without first visually identifying the control before moving the switch.
- Not performing after-landing checks until the aircraft is brought to a stop.

Failure to extend the landing gear results from failure to use checklists before landing. Although distractions may have diverted attention, pilots should always restart a checklist that has been interrupted.

Six accidents were caused by failure to use the emergency manual gear extension system when needed, or lack of understanding on how to lower the landing gear manually. To gain familiarity with the system, pilots should lower the landing gear at least once manually in accordance with the POH procedure to be confident in using the system when needed.

The pilot-related landing gear extension/retraction accidents need not have occurred had the pilot's involved used the checklists as supplied by the aircraft manufacturer. With respect to inadvertent retraction of the gear instead of the flaps on the landing roll, in accordance with the BES8 after landing checklist, for example, the flaps are not to be retracted until clear of the runway. This is the safest procedure to use in all retractable airplanes. lOn any event, except in an emergency, do not move any control without first visually identifying that control. After landing, checks are best done when clear of the runway so that the pilot can pay strict attention to directional control during the landing roll.

Engine Failure on Takeoll-A Commentary

Engine failure on takeoff is a major concern to all pilots flying piston twins. As *shown in figure* **18** *fuel mismanagement is the leading cause of most of the emergencies.* Climb capability decreases by approximately 80% when an engine fails and directional control can be challenging. The proper handling of flight controls with accurate decision making is essential.

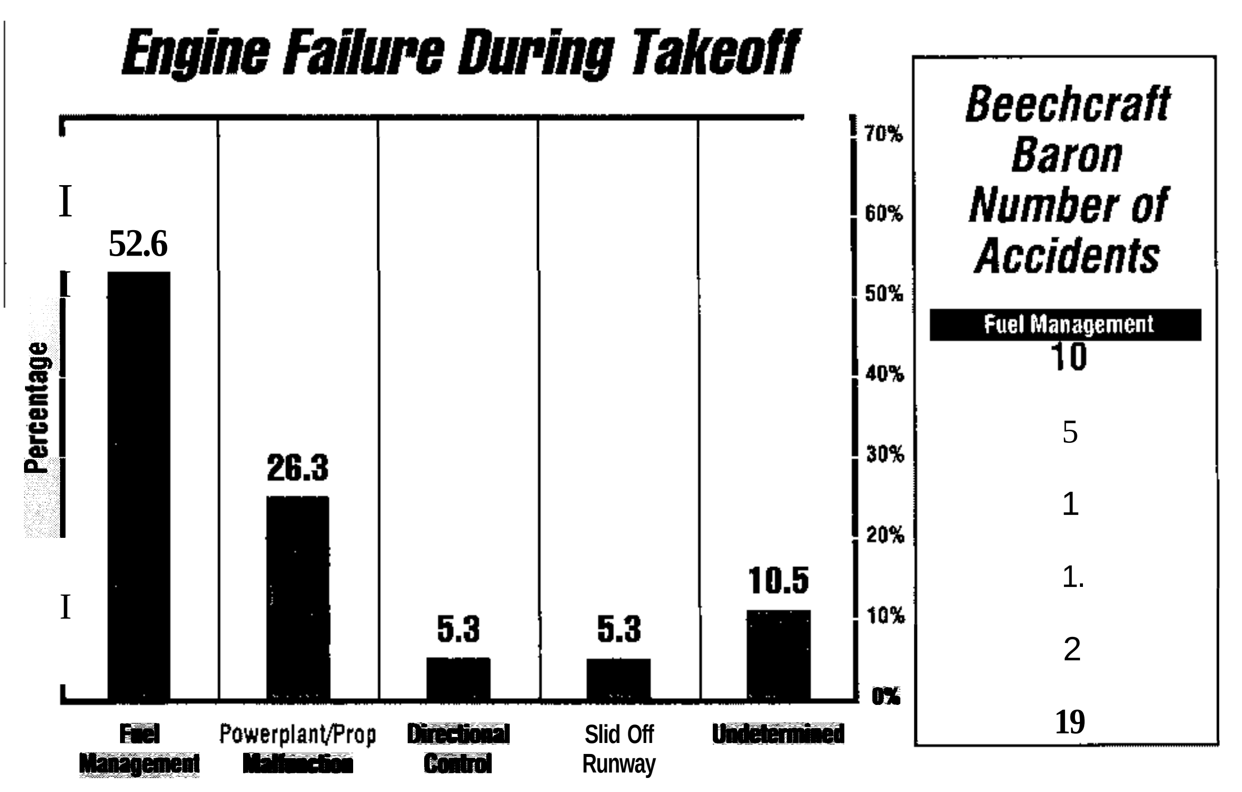
Under the heading of fuel mismanagement is improper boost pump operation, improper use of mixture, and inadequate fuel or improper fuel tank selection which may cause unporting. Unporting occurs when there is not enough fuel in the tank or it is moved by centrifugal force in a turn, away from the fuel pickup point in the tank. Air is then introduced into the line and this bubble typically reaches the engines a few seconds after the takeoff roll has begun. The timing on the subsequent engine failure due to fuel starvation cou ld not be worse!

Two of the accidents resulted from pilots aborting takeoffs due to perceived powerplant failure.* While unfortunate, it represents a conservative approach to a potentially catastrophic situation where the decision to stop or continue must be made very quickly.

If the pilot reacts promptly and properly the chance for injury is reduced. In 11 out of the 19 accidents shown below there were no serious injuries. *Only one quarter of the accidents were actually identified* as *bona fide engine mechanical failure.* While it represents a relatively small risk, pilots must always be prepared since the potential for a serious accident is possible.

* One of the two aircraft departed the runway due to loss of directional control. The other slid off the end of the runway when it was unable to stop.

Figure 18



• Notes •

Part!

Acompilation 01 selected accident briels. Accident briels in the lollowing categories were selected lor roeview and comments:

Landing Gear Extension/Retraction

Reference Number: 88-0477 D'ata Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
88.04.21 1925 EDT	BESS/56 (MER) 285 HP	N81893	INSTRCTNL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	0	2
Pass:	O	O	0	O
Other:	O	O	0	O

Location: Pahokee, FL — Flight Plan: NONE
Itinerary: Miami, FL, to Pahokee, FL
Airport: Palm Beach Co Glades — Runway: 35, 4,620/75, Asphalt, Dry

Weather:	VMC			Clouds:	Clear
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	None
Wind:	090/1 0,	Gusts:	O	Lighting:	Dusk
Briefing:	Co.	Type:	TV/Radio	Complete:	U

Pilot:	ATP/CFI/SMEL			Hours: Last 24 Hrs - a	Total: 3,000
Age:	34 Yrs.	Instrument:	Y	Last 30 Dys - 0	Type: 100
Medical:	Y	Waivers:	N	Last 90 Dys - 50	Instmt: 200
BFR:	Y	Months Since:	22	Aircraft: UNK	M. Eng: 400

Emergency Occurred During: LANDING

While on an instructional flight practicing short and soft field landings, the aircraft was landed gear up. The instructor pilot stated there was no failure or malfunction of the landing gear warning horn and that when the throttle was retarded fully the horn sounded.

Probable Cause: PIC (CFI) - Checklist not followed, Inadequate supervision.

Factors: Dual Student - Wheels up landing - Inadvertent.

ASF Comments:

Cockpit resource management must always be considered when two pilots are at the controls of any aircraft. Preflight discussions should cover the use of checklists and the role of the CFI, as in this accident, or other pilot in accomplishing specific tasks called for in the checklists. It is a good idea to ask other pilots/passengers to call attention to anything they might think the pilot should be aware of. Inadequate supervision as a factor in the report means the CFI should not have permitted flight without strict use of the checklists and should have directed the student to go-around when he/she entered the final approach without extending the landing gear.

Landing Gear Extension/Retraction

Reference Number: 83-1725 Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
83.04.13 1615 CST	BE58 (MER) 285 HP	N4657A	AIR TAXI PASSENGER	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	O	1
Pass:	O	O	O	2
Other:	O	O	O	O

location: Little Rock, AR — Flight Plan: IFR
Itinerary: Memphis, TN, to Little Rock, AR
Airport: Adams Field — Runway: 22, 7172/1 50, Asphalt, Wet

Weather:	IMC			Clouds:	700 ft. Part Obs.
Visibility:	.500 SM, Fog	Precip:	R. Showers	Ceiling:	Obscured
Wind:	270/09	Gusts:		Lighting:	DAY
Briefing:	FSS	Type:	Telephone	Complete:	Y

Pilot:	COM/ATP/CF/SMEL			Hours:	Last 24 Hrs - 2	Total:	9,500
Age:	61 Yrs.	Instrument:	Y		Last 30 Dys - UNK	Type:	765
Medical:	Y	Waivers:	Y		Last 90 Dys - 152	Instmt:	657
BFR:	Y	Months Since:	2	Aircraft:	LEARJET	M. Eng:	8,000

Emergency Occurred During: LANDING

The pilot reported that prior to glide slope interception he placed his hand on the landing gear selector switch and was simultaneously told to contact the tower, which he did. As the aircraft approached the threshold, the throttles were retarded and propellers pushed full forward. The pilot does not recall hearing the warning horn. The aircraft touched down on its belly and stopped on the runway. Weather at the time of the accident was reported as approximately 800 feet overcast, visibility 1¼ miles. There was heavy rain throughout the approach.

Probable Cause: PIC - Gear extension not performed, Checklist not used, Wheels up landing performed.

Factors: Terrain condition - Runway. PIC - Improper use of equipment/aircraft, diverted attention, Excessive workload (task overload). Weather condition - Rain, Low ceiling.

ASF Comments:

Instructions to contact the control tower or any other ATC facility takes a back seat to flying the airplane first. Plenty of time is available to contact the facility after the 'before landing checklist' is completed.

Landing Gear Extension/Retraction

Reference Number: 84-2945 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
84.10.09 2025 EDT	BE58 (MER) 285 HP	N9918A	PERSONAL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Orlando, FL Flight Plan: NONE
Itinerary: Savannah, GA, to Tampa, FL
Airport: Orlando Executive Runway: 07,5998/150, Asphalt, Dry

Weather:	VMC			Clouds:	Clear
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	None
Wind:	030/06	Gusts:	0	Lighting:	Night
Briefing:	FSS	Type:	UNK	Complete:	U

Pilot:	PVT/SEL			Hours: Last 24 Hrs - 2	Total:	660
Age:	45 Yrs.	Instrument:	N	Last 30 Dys - UNK	Type:	201
Medical:	N	Waivers:	N	Last 90 Dys - 4	Instmt:	18
BFR:	U	Months Since:	UN	Aircraft: UNKNOWN	M. Eng:	417

Emergency Occurred During: CRUISE

Pilot noted decreasing oil press on right engine and diverted to suitable airport for precautionary landing. Pilot received night vector to runway, arrived high for final approach and received tower clearance for descending 360-degree turn to lose altitude. During turn, right engine oil press went to zero, engine stopped. Pilot feathered propeller and continued approach. Pilot cited pre-occupation with approach and single engine operation as cause for neglecting to lower landing gear. Inspection revealed oil sump plug missing from right engine rear case accessory section and resultant oil exhaustion.

Probable Cause: Lubricating system, oil seal - Other. Other Maintenance Personnel - Inadequate maintenance. Fluid, oil - Exhaustion. PIC - Inadvertent wheels up landing.

Factors: Lubricating system - Pressure too low. Light condition - Night. PIC - Improper use of equipment/aircraft, diverted attention.

ASF Comments:

The pilot demonstrated good presence of mind in managing the aircraft during an actual engine failure. However, whenever an aircraft is lined up on final approach, another look for the landing gear selector switch position and green lights is a good habit to develop even after the before landing checklist is completed.

Landing Gear Extension/Retraction

Reference Number: 87-1962 — Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.11.08 2250 EST	BESS/56 (MER) 285 HP	N616G	AIR TAXI POSITIONING	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	O	1
Pass:	O	O	O	O
Other:	O	O	O	O

location: Atlanta, GA — Flight Plan: NONE
Itinerary: Griffin, GA, to Atlanta, GA
Airport: William B. Hartsfield — Runway: 08I, 9,000/150, Concrete, Dry

Weather:	VMC			Clouds:	UNK Broken
Visibility:	15.0 SM, None	Precip:	None	Ceiling:	5,500 ft.
Wind:	060/03,	Gusts:	O	lighting:	NIGHT
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	ATP/SMEl			Hours: last 24 Hrs - 0	Total:	5,500
Age:	35 Yrs.	Instrument:	Y	last 30 Dys - 45	Type:	130
Medical:	Y	Waivers:	N	last 90 Dys - 123	Instmt:	450
BFR:	Y	Months Since:	1	Aircraft: DC-3	M. Eng:	2,500

Emergency Occurred During: APPROACH

Aircraft was being positioned to begin cargo revenue flight. As aircraft turned final and landing gear handle was put in down position, Pilot-In-Command noted dimming of all lights and communications were lost. Pilot-In-Command unaware gear were still retracted until propeller tips contacted runway. During landing slide left inboard fuel tank drain sheared away, fuel leaked from tank, and was ignited. Pilot-In-Command reported he elected to land instead of a go-around because he was in a TCA with no communications and no lights. Investigation failed to reveal electrical malfunction. Operator stated it was normal practice to start engines with alternators off. Circumstances were consistent with loss of alternators and battery only operation. Alternators tested ok during post accident check.

Probable Cause: PIC - Inadequate preflight planning/preparation, Checklist not followed.

Factors: PIC - Emergency procedure not performed.

ASF Comments:

The operator had stated it was normal practice to start engines with alternators turned off. This was contrary to the starting procedure in the POH. Had the pilot followed the checklist, the alternators would have been turned on before starting and the accident would not have occurred. The pilot stated he had never operated the emergency gear extension system. All pilots should extend the landing gear using the emergency system at least once to gain familiarity with the procedure and to be aware of the time it takes for the landing gear to reach the down and locked position. The NTSB report did not mention if this aircraft had manual gear indicators or not.

Landing Gear Extension/Retraction

Reference Number: 82-2849 Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.10.08 1320 EDT	BE58 (MER) 285 HP	N958MC	AIR TAXI PASSENGER	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	1
Other:	0	0	0	0

Location: Allendale, SC
Flight Plan: NONE
Itinerary: North Myrtle Beach, SC, to Destin, FL
Airport: Allendale County
Runway: 17, 3,200/75, Asphalt, Dry

Weather:	VMC			Clouds:	3,100 ft. Overcast
Visibility:	7.0 SM, None	Precip:	None	Ceiling:	3,100 ft.
Wind:	150/06	Gusts:		Lighting:	DAY
Briefing:	UNK	Type:	UNK	Complete:	U

Pilot:	COMM/SMEL			Hours: Last 24 Hrs - 2	Total: 2,262
Age:	33 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type: 175
Medical:	Y	Waivers:	Y	Last 90 Dys - 11	Instmt: 558
BFR:	Y	Months Since:	UN	Aircraft: BE58	M. Eng: 1,762

Emergency Occurred During: CRUISE

About 30 minutes after departure, electrical equipment began to fail. The pilot turned off the alternator and reset with no change. He then switched to the #1 regulator which did not correct the problem. While turning on downwind the gear handle was placed down and all electrical power was lost. The pilot then cranked the gear down until resistance was met, but did not count the number of revolutions. The aircraft touched down with partially extended landing gear. Both batteries were found dry. The left alternator had no output and right alternator current limiter was burned open. The pilot indicated during a subsequent interview that he did not turn off any electrical equipment. He also stated that he had not exercised the emergency landing gear system in flight prior to this mishap.

Probable Cause: Electrical system - Failure, total. PIC - Emergency procedure not followed, Improper use of electrical system, Gear down and locked - Not attained, Improper use of procedure, inadequate training (emergency procedure(s).

Factors: Electrical system, battery - Inadequate, Deteriorated. Electrical system, alternator - Inoperative. Electrical system - Output low. Company maintenance personnel - Inadequate maintenance, inspection of aircraft.

ASF Comments:

The POH provides specific guidance for practicing lowering the landing gear with the emergency manual gear extension system. No pilot should be considered qualified to fly the Baron as PIC unless this has been done. Since the electrical system had failed and the pilot began to extend the landing gear manually, making sure the hand crank was turned 50 revolutions as stated in the POH became vitally important to ensure the gear was down and locked. At the first sign of electrical failure all non-essential electrical equipment must be turned off to conserve battery power for the landing gear and flaps.

Landing Gear Extension/Retraction

Reference Number: 89-0127 — Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
89.04.19 1810 PDT	BESS/56 (MER) 260 HP	N6866Q	MAINT TEST	TAKEOFF	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	2
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Arlington, WA — Flight Plan: NONE
Itinerary: Arlington, WA, to Everett, WA
Airport: Arlington — Runway: 16, 5,333/100, Asphalt, Dry

Weather:	VMC			Clouds:	Clear
Visibility:	7.0 SM, None	Precip:	None	Ceiling:	None
Wind:	00/00,	Gusts:	0	Lighting:	Day
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	ATP/CFI/MI/SMEL/HEL			Hours: Last 24 Hrs - 0	Total: 9,500
Age:	43 Yrs.	Instrument:	Y	Last 30 Dys - 56	Type: 100
Medical:	Y	Waivers:	N	Last 90 Dys - 84	Instmt: 445
BFR:	Y	Months Since:	7	Aircraft: BE90	M. Eng: 600

Emergency Occurred During: TAKEOFF

The owner (an experienced pilot) accompanied the Pilot-in-Command to assist in a maintenance test flight. The Pilot-in-Command reported that while he was making a touch-and-go landing, the owner raised the landing gear handle, while the aircraft was still on the ground. The landing gear retracted and the aircraft settled to the ground and slid to a stop. A fire erupted and subsequently destroyed the aircraft.

Probable Cause: Copilot/second pilot - Premature gear retraction.

Factors:

ASF Comments:

Cockpit resource management again. The owner/pilot should not have retracted the flaps unless by command of the PIC; and if commanded to do so should have first visually checked the control switch before activating. This should be discussed by both pilots before.departure.

Landing Gear Extension/Retraction

Reference Number: 82-3107 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.07.28 1705 PDT	BESS/56 (MER) 260 HP	N455HC	PERSONAL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	0	1
Pass:	O	O	0	2
Other:	O	O	0	O

Location: Henderson, NV
Itinerary: Henderson, NV, to Local,
Airport: Sky Harbor

Flight Plan: NONE
Runway: 18, 5000/50, Asphalt, Dry

Weather:	VMC			Clouds:	9,000 ft. Scattered
Visibility:	75.0 SM, None	Precip:	None	Ceiling:	9,000 ft.
Wind:	170/06	Gusts:		lighting:	DAY
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	PVT/MEL			Hours: Last 24 Hrs - 15	Total:	1,033
Age:	46 Yrs.	Instrument:	N	Last 30 Dys - UNK	Type:	86
Medical:	Y	Waivers:	Y	Last 90 Dys - 93	Instmt:	34
BFR:	N	Months Since:	NA	Aircraft: N/A	M. Eng:	862

Emergency Occurred During: LANDING

Pilot raised landing gear instead of flaps on a touch and go landing. Pilot owns a C-411 and a BE-B55. Switches are reversed on these aircraft.

Probable Cause: PIC - Inadvertent gear retraction.

Factors:

ASF Comments:

Touch-and-go landings are good candidates for actuating controls too quickly without visually verifying the control to be activated. All the more justification for positive visual verification exists when pilots fly various aircraft with differing control configurations.

Landing Gear ExtensionlRetraction

Reference Number: 82-2121 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.10.16 1030 EDT	BESS/56 (MER) 260 HP	N4186S	PERSONAL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	0	1
Pass:	O	O	0	3
Other:	O	O	0	O

Location: Camden, SC
Itinerary: Cheraw, SC, to Camden, SC
Airport: Woodard
Flight Plan: NONE
Runway: 07,5,000/100 Asphalt

Weather: VMC
Visibility: 15.0 SM, None
Wind: 040/15
Briefing: None
Precip: None
Gusts:
Type: N/A
Clouds: None None
Ceiling: None
Lighting: DAY
Complete: N

pilot: PVT/SMEL
Age: 51 Yrs.
Medical: Y
BFR: Y
Instrument: Y
Waivers: N
Months Since: UN
Hours: Last 24 Hrs - 2
Last 30 Dys - UNK
Last 90 Dys - 5
Aircraft: BOEING 75
Total: 3,000
Type: 250
Instmt: UNK
M. Eng: 5

Emergency Occurred During: LANDING

According to the pilot, he received landing information from the unicom operator for runway seven. He was advised to keep the pattern tight to accommodate heavy traffic at the airport. While expediting to get off the runway after landing, he reached to retract the wing flaps and inadvertently retracted the landing gear before the weight of the aircraft was completely settled on the gear.

Probable Cause: PIC - Inadvertent gear retraction.

Factors:

ASF Comments:

Pressure from any source should never be allowed to influence decisions in the safe operation of the aircraft. Keeping 'the pattern tight' because of heavy traffic as requested by the UNICOM operator in no way transfers the pilot's responsibility for the safe operation of the aircraft. The pilot must take the time to operate the aircraft in an orderly, safe, and efficient fashion in accordance with good judgment. There is seldom urgency to retract the flaps on the runway.

Landing Gear Extension/Retraction

Reference Number: 87-0272 Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.03.06 0900 CST	BE58 (MER) 285 HP	N9025V	BUSINESS	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	0	1
Pass:	O	O	0	2
Other:	O	O	0	O

Location: Bismarck, NO Flight Plan: NONE
Itinerary: Fargo, NO, to Spearfish, SO
Airport: Bismarck Municipal Runway: 13, 8788/150, Asphalt, Ory

Weather:	VMC			Clouds:	25000 ft. Thin Bkn.
Visibility:	12.0 SM, None	Precip:	None	Ceiling:	None
Wind:	080/04	Gusts:		Lighting:	OAY
Briefing:	FSS	Type:	Telephone	Complete:	Y

Pilot:	COMM/SMEL			Hours: Last 24 Hrs - UN	Total:	5,029
Age:	41 Yrs.	Instrument:	Y	Last 30 Oys - UNK	Type:	85
Medical:	Y	Waivers:	Y	Last 90 Oys - UNK	Instmt:	210
BFR:	Y	Months Since:	6	Aircraft: CE1 72	M. Eng:	2,149

Emergency Occurred During: CRUISE

The pilot, while at cruise, detected an odor he suspected to be overheated electrical wiring. He diverted to a nearby airport for a precautionary landing. The pilot shutdown all electrical power after communication with the tower. Prior to landing, the pilot turned on electrical power to lower the landing gear by normal procedures. He assumed that the gear was down and locked but did not have a positive indication. The pi lot did not use the hand crank to verify that the gear was locked. The gear collapsed on touchdown.

Probable Cause: PIC - Gear down and locked not obtained, Unsafe/hazardous condition warning not identified, Remedial action not performed.

Factors:

ASF Comments:

With an electrical problem such as experienced by this pilot, one could not assume the landing gear was down and locked without positive identification of the gear-down lights and absence of the warning horn. The emergency manual gear extension system should have been activated for verification in the absence of the gear-down lights.

Landing Gear Extension/Retraction

Reference Number: 85-0520 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
85.05.07 1245 EST	BE58 (MER) 285 HP	N29CP	PERSONAL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	0	1
Pass:	O	O	0	1
Other:	O	O	0	O

Location: Terre Haute, IN
Flight Plan: NONE
Itinerary: Terre Haute, IN, to Local
Airport: Holman Field
Runway: OS, 9025/150, Asphalt, Dry

Weather: VMC
Clouds: 6,000 ft. Broken
Visibility: 8.0 SM, None
Precip: None
Ceiling: 6,000 ft.
Wind: 140/07
Gusts:
Lighting: DAY
Briefing: FSS
Type: UNK
Complete: U

Pilot: COMM/CFI/SMEL
Hours: Last 24 Hrs - 4
Total: 1,021
Age: 23 Yrs.
Instrument: Y
Last 30 Dys - UNK
Type: 2
Medical: Y
Waivers: N
Last 90 Dys - 231
Instmt: 105
BFR: Y
Months Since: 6
Aircraft: UNKNOWN
M. Eng: 53

Emergency Occurred During: LANDING

The pilot was practicing touch-and-go landing on runway 13, then elected to make another on runway five. He stated that the gear was extended on downwind and a safe gear indication was received. However, the aircraft was landed with the gear retracted. The pilot stated that there was no warning horn when the throttles were retarded to idle just before touchdown. An exam of the aircraft revealed no preimpact gear problems, except the warning horn was inoperative due to a bad micro-switch and a broken electrical wire.

Probable Cause: PIC - Gear extension not performed.

Factors: Landing gear, gear warning system - Inoperative. PIC - Improper use of procedure, lack of total experience in type of aircraft.

ASF Comments:

The landing gear warning horn should be tested periodically by pilots. Throttles can be retarded until the horn is activated. The gear is then lowered and when the gear is down and locked the horn will cease and the green lights will appear.

Fuel Exhaustion/Starvation

Reference Number: 86-2622 Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.10.23 1303 COT	BE58 (MER) 285 HP	N7305R PASSENGER	AIR TAXI	DESCENT	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	1	O
Pass:	O	1	1	O
Other:	O	O	0	O

Location: Chicago,IL Flight Plan: IFR
Itinerary: Jefferson City, MO, to Chicago, IL
Airport: Midway Runway: N/A

Weather:	VMC			Clouds:	2,300 ft. Overcast
Visibility:	5.0 SM, Haze	Precip:	None	Ceiling:	2,300 ft.
Wind:	270/06	Gusts:	O	Lighting:	DAY
Briefing:	FSS	Type:	In Person	Complete:	U

Pilot:	COMM/CFI/SMEL		Hours: Last 24 Hrs - 3	Total:	1,511
Age:	22 Yrs.	Instrument: Y	Last 30 Dys - UNK	Type:	77
Medical:	Y	Waivers: N	Last 90 Dys - 91	Instmt:	196
BFR:	Y	Months Since: 1	Aircraft: BE58	M. Eng:	252

Emergency Occurred During: APPROACH

The pilot departed home base with an undetermined amount of available fuel, after being advised by the lineman/refueler of the uncertainty of the amount of fuel onboard. The pilot assumed the aircraft had been refueled the previous evening and departed on this flight. The aircraft had not been refueled the previous evening. Fuel exhaustion was experienced five miles short of the pilots intended destination airport.

Probable Cause: PIC - Poor aircraft preflight, Inadequate refueling. Fuel system - Exhaustion.

Factors: PIC - Poor judgment.

ASF Comments:

When a pilot files an IFR flight plan, he/she makes a statement the fuel onboard is sufficient to fly to the destination, then to the alternate (if required) with an additional 45 minutes. The fuel onboard must be verified by the pilot-not line personnel.

Fuel Exhaustion/Starvation

Reference Number: 87-1048 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.01.24 1602 EST	BESS/56 (MER) 260 HP	N9555Y	PERSONAL	LANDING	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	O	1
Pass:	O	O	O	3
Other:	O	O	O	O

location: Babylon, NY | Flight Plan: VFR
Itinerary: No. Myrtle Beach, SC, to Farmingdale, NY
Airport: Republic | Runway: N/A

Weather:	VMC			Clouds:	UNK Broken
Visibility:	15.0 SM, None	Precip:	None	Ceiling:	5,500 ft.
Wind:	300/15,	Gusts:	0	Lighting:	Day
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	ATP/SMEL			Hours: Last 24 Hrs - 4	Total:	32,200
Age:	UNK Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	1,560
Medical:	Y	Waivers:	Y	Last 90 Dys - 60	Instmt:	2,500
BFR:	Y	Months Since:	3	Aircraft: L-1 011	M. Eng:	3,020

Emergency Occurred During: DESCENT

The Beech Baron had been cruising at altitude for approximately two hours when it started a descent with the OAT well below freezing. During the descent the pilot attempted to add power and there was no response. The pilot turned on the boost pumps to high and still the fuel pressure gauge did not respond. The pilot made a forced landing on a wide road, the aircraft clipped a guard rail, spun around and was destroyed by fire. The pilot and three passengers escaped uninjured. Investigation of the fuel system showed water in both fuel manifolds. A small piece of ice was found in the bottom of the right fuel strainer. The pilot stated that he drained the main fuel tank drain and the crossfeed drain. The auxiliary fuel tank drain and the fuel strainer drains were not drained.

Probable Cause: Fuel system - Ice. Fuel system, line, Strainer - Blocked (total). PIC - Improper aircraft preflight.

Factors: Object - Fence.

ASF Comments:

The four persons aboard this aircraft were indeed fortunate to have escaped injury in the forced landing and fire which destroyed the aircraft. Although the highly experienced pilot stated he had drained the main tank and crossfeed drains, investigation revealed the auxiliary tank and fuel strainer drains were not drained and ice and water were found in the fuel system. The POH pre-flight inspection checklist was not followed. In addition the BESS/56 POH cold weather operation preflight inspection section contains the following paragraph: "Conditions for accumulating moisture in the fuel tanks are most possible at low temperatures due to the condensation increase and the moisture that enters as the system is serviced.Therefore, close attention to draining the fuel system will assume particular importance during cold weather." Beechcraft Safety Communique number 81, dated July, 1989, also addresses the problem of water in the fuel system.

Fuel Exhaustion/Starvation

Reference Number: 85-1016 | Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
85.05.02 1307 EST	BESS/56 (MER) 285 HP	N9442S	PERSONAL	APPROACH	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	O	1	0	O
Pass:	O	O	0	O
Other:	O	O	0	O

Location: Jacksonvilie, FL — Flight Plan: IFR
Itinerary: Crestview, FL, to Jacksonville, FL
Airport: Off Airport — Runway: N/A

Weather:	VMC			Clouds:	4,000 ft. Broken
Visibility:	7.0 SM, None	Precip:	None	Ceiling:	25,000 ft.
Wind:	230/08	Gusts:		lighting:	DAY
Briefing:	FSS	Type:	Telephone	Complete:	U

Pilot:	ATP/CFI/SMEL			Hours: Last 24 Hrs - 4	Total:	8,519
Age:	49 Yrs.	Instrument:	Y	Last 3a Dys - 11	Type:	124
Medical:	Y	Waivers:	Y	Last 90 Dys - 59	Instmt:	523
BFR:	Y	Months Since:	5	Aircraft: AC500	M. Eng:	4,388

Emergency Occurred During: DESCENT

The aircraft was on the last leg of a flight that originated that morning at Jacksonville, then proceeded to Daytona Beach, then on to Crestview, Florida. While on the return flight to Jacksonville, the right engine lost power as the aircraft was approaching its destination. The pilot stated that he tried to restart the right engine, but was unable, so he secured it. A short time later, the left engine also lost power and the pilot elected to land in an open field. However, during the approach, the pilot was unable to clear trees at the edge of the field. After impacting the trees, the aircraft crashed in the field. No fuel was observed in the wreckage. The pilot reported that he used only the fuel quantity indicators to check the fuel prior to the flight.

Probable Cause: PIC - Inadequate aircraft preflight and Fuel supply. Fluid, fuel - Exhaustion.

Factors: Object - Tree(s).

ASF Comments:

Fuel quantity gauges by themselves should never be used as a basis for deciding if sufficient fuel is available for flight planning. The POH preflight inspection checklist specifies: *check fuel quantity and secure cap*. This means check fuel visually. The pilot had used only the fuel quantity gauges to check the fuel prior to the flight. Some Barons have sight gauges on the tanks.

Fuel Exhaustion/Starvation

Reference Number: 83-1797 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
83.04.20 1324 CST	BESS/56 (MER) 260 HP	N599VK	PERSONAL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	3
Other:	0	0	0	0

location: Gage, OK — Flight Plan: NONE
Itinerary: Los Angeles, CA, to Gage, OK
Airport: Gage Shattuck — Runway: 17, 5,435/150, Asphalt, Dry

Weather:	VMC			Clouds:	Clear
Visibility:	7.0 SM, None	Precip:	None	Ceiling:	None
Wind:	150/12	Gusts:		Lighting:	DAY
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	PVT/SEL			Hours: Last 24 Hrs - 6	Total:	1,549
Age:	52 Yrs.	Instrument:	N	Last 30 Dys - UNK	Type:	337
Medical:	Y	Waivers:	Y	Last 90 Dys - 12	Instmt:	7
BFR:	Y	Months Since:	15	Aircraft: UNKNOWN	M. Eng:	337

Emergency Occurred During: APPROACH

The aircraft made a forced landing off airport after the engine quit. The weather was VMC and no flight plan was filed. This was a cross-country flight from Los Angeles, California to Bolivar, Missouri with a fuel stop at Gage, Oklahoma. The flight crashed 900 feet short of the runway at Gage, Oklahoma. Postcrash investigation by the airport manager revealed an undetermined amount of fuel in the tanks. An on scene investigation by a Continental Representative revealed no fuel in the spider valve and no drainable fuel in any of the fuel lines. The airport manager visually checked the cockpit fuel gauges finding the left tank indicating empty and the right 1/8 full. The aircraft had flown about 5 hours and 24 minutes which would indicate fuel consumption of about 138 gallons of fuel. The aircraft holds 142 gallons of fuel, of which 136 is considered useable.

Probable Cause: PIC - Inadequate preflight planning/preparation, Inadequate in-flight planning/decision, Inadequate fuel supply, Inaccurate fuel consumption calculations.

Factors: Fluid, fuel - Exhaustion. Terrain condition - Ground.

ASF Comments:

Investigation revealed this aircraft consumed all but about two gallons of the usable fuel, yet one of the fuel gauges indicated one tank was empty and the other 1/8th full. The gauge error may have trapped the pilot into thinking he had sufficient fuel inasmuch as he crashed 900 feet short of the runway at his destination. He had not, as provided by the FAR's, planned his VFR flight so as to have sufficient fuel to his destination plus 30 minutes reserve. A far safer practice would have been to plan using POH performance chart power settings for fuel consumption, TAS, and endurance. An hour of reserve fuel would have provided ample time to select an enroute fuel stop in the event winds and flight plan groundspeed estimates were not up to expectations.

Fuel Exhaustion/Starvation

Reference Number: 90-2117 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
90.04.20 0111 COT	BES8 (MER) 285 HP	N770X	AIR TAXI CARGO	MANEUVER	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	O	O	O
Pass:	O	O	O	O
Other:	O	O	O	O

Location: Dallas, TX Flight Plan: IFR
Itinerary: Dallas, TX, to Abilene, TX
Airport: Love Field Runway: 31 L, 8800/1 50, Concrete, Dry

Weather:	VMC			Clouds:	N/A Overcast
Visibility:	7.0 SM, None	Precip:	None	Ceiling:	4000 ft.
Wind:	160/12,	Gusts:	a	Lighting:	Night
Briefing:	FSS	Type:	Telephone	Complete:	U

Pilot:	COM/ATP/CFI/SMEL			Hours: Last 24 Hrs - 3	Total:	3,631
Age:	36 Yrs.	Instrument:	Y	Last 30 Dys - 63	Type:	120
Medical:	Y	Waivers:	N	Last 90 Dys - 120	Instmt:	1,1 02
BFR:	Y	Months Since:	5	Aircraft: CE402	M. Eng:	1,612

Emergency Occurred During: TAKEOFF

The pilot started to take off on Runway 13R, but aborted, taxied off the runway and went to the engine run-up area. About two minutes later, he announced again that he was ready to depart and was cleared to take off. During the initial climb after lift-off, the pilot stated that he needed to return for landing. He was cleared to land on any runway and he decided to land on Runway 31 L. Witnesses observed the aircraft in a sharp descending turn from about 800 feet above ground level as it was maneuvered back toward the runway. However, the descent rate increased, then the aircraft crashed about 1,000 feet short of the runway. During impact, it hit a lamp pole and power line, then came to rest and burned. The fuel boost pump switches were found in the "high" boost positions and the right propeller control was found in the feather position. The flight manual recommended that the boost pump be in the "low" position for takeoffs and landings. A test of the use of the high boost position in a similar aircraft resulted in a rough running engine and engine stoppage. A witness to the accident reported that he heard the engine sputtering and misfiring before the aircraft crashed.

Probable Cause: PIC - Improper fuel boost pump selector position, Airspeed (VMC) not maintained.

Factors:

ASF Comments:

The POH of the BE58 provides that the fuel boost pumps are to be off during takeoff unless the ambient temperature is above 32 degrees C (87 degrees F). High boost is normally used for starting to prime the engines. In the accident, the use of high fuel boost probably resulted in excessive fuel causing the engines to flood. The secondary cause indicated airspeed (V_{MCA}) was not maintained. Altitude must always, no matter how little is available, be sacrificed to maintain airspeed at YMCA or above if power is insufficient to do so. It is far better, from a survival standpoint, to place the aircraft on the ground/water under control than out of control.

Fuel Exhaustion/Starvation

Reference Number: 93-0180 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
93.01.14 1230 MST	BE58 (MERP) 325 HP	N550TH	FERRY	CRUISE	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	0
Other:	0	0	0	0

location: Hanksville, UT Flight Plan: IFR
Itinerary: Woodland, CA, to Pueblo, CO
Airport: Hanksville Airport Runway: UNK, UNK/UNK, Dirt, Soft

Weather:	VMC			Clouds:	UNK Overcast
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	1,000 ft.
Wind:	00/00	Gusts:	0	lighting:	Day
Briefing:	FSS	Type:	Telephone	Complete:	U

Pilot:	ATP/CFI/SMEL			Hours: Last 24 Hrs - 3	Total:	3,758
Age:	30 Yrs.	Instrument:	Y	Last 30 Dys - 43	Type:	211
Medical:	Y	Waivers:	N	Last 90 Dys - 151	Instmt:	300
BFR:	Y	Months Since:	01	Aircraft: BE 76	M. Eng:	2,049

Emergency Occurred During: CRUISE

While in cruising flight, the pilot noticed that the gauges indicated a fuel imbalance. As the imbalance indication became greater, the pilot began to search for a suitable nearby alternate. Finding the nearest alternate to be below approach minimums, and being convinced that the imbalance was only an indication problem, he elected to continue on to the original destination. When both engines quit, the left gauge was at zero, and the right gauge was indicating near full. During the restart attempts, the pilot failed to select either engine to the right fuel tank, which was later found to contain fuel. When examined at the scene of the accident, the position of both fuel valves correctly matched the position of the corresponding fuel selector lever. Further investigation revealed no malfunction, damage, or discrepancies with either valve.

Probable Cause: PIC - Improper fuel tank selector position, Inadequate remedial action. Fluid, fuel-starvation.

Factors:

ASF Comments:

In this particular accident it is hard to understand why the pilot, given the indication that something was not as it should be, did not consider that the problem might be due to the fuel tank that was selected. In most aircraft you can do a simple test to check if you have used more fuel from one tank than another. You trim the aircraft to center and then release the control wheel. If a wing starts to drop this is usually the indication that you have more fuel in that wing tank. There are other light twins that have less complicated fuel systems than the Baron series aircraft, but a thorough knowledge of the way that an aircraft's fuel system operates is essential for the safe operation of all aircraft.

Maneuvering-Dther Flight

There were eight stall/spin accidents with 15 fatalities, all as a result of practicing emergency procedures or V_{MCA} demonstrations. Check pilots/CFls were aboard five of the aircraft.

Four of the accidents were flat spins, three of which had a propeller feathered and one with a fuel valve in the OFF position. Flat spins are extremely dangerous and are considered unrecoverable.

When feathering an engine to perform a V_{MCA} demonstration an actual emergency has been created. Feathering can be simulated by throttling an engine to zero thrust as provided for in the POH, thus making the engine available for any real emergency. Sufficient altitude (at least 5,000 feet AGL) should be maintained to provide a good margin of safety while demonstrating V_{MCA}. If an approaching stall is detected before V_{MeA} is reached, the demonstration must be discontinued or there is a very good chance a spin will develop. Pilot Operating Handbooks provide adequate safety procedures for performing V_{MCA} maneuvers.

V_{MCA} demonstrations are not mandatory for multi-engine checkouts. They may, however, be required for the initial multi-engine pilot certificate. Great caution must be exercised in operating close to $V_{MCA'}$ as a spin is likely to develop as the aircraft approaches a stall.

This is an area where the use offlight simulators is strongly recommended. It is impossible to safely duplicate critical engine-out situations in the aircraft. The airlines discovered this in the early 1960s when they lost many more aircraft in training than in actual emergencies.

The u.S. Army did extensive tests on their T-42s (BE55s) and recommended changes to the FAA and Beechcraft. Beechcraft then established V_{SSE} (see glossary) and issued new POHs to all owners. Beechcraft also abolished the short-field takeoff flap setting of 15° which more than doubled the T.O. distances in the P.O.H.

Reference Number: 87-2358 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.11.28 1100 CST	BESS/56 (MER) 300 HP	NS9345	INSTRCTNL	DESCENT	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	2	O	O	O
Pass:	O	O	O	O
Other:	O	O	O	O

Location: Commerce, TX
Flight Plan: NONE
Itinerary: McKinney, TX, to Local
Airport: Off Airport
Runway: N/A, Dirt, Dry

Weather:	VMC			Clouds:	Clear
Visibility:	20.0 SM, None	Precip:	None	Ceiling:	None
Wind:	300/12	Gusts:	O	Lighting:	DAY
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	PVT/SMEL			Hours: Last 24 Hrs - 1	Total: 724
Age:	48 Yrs.	Instrument:	Y	Last 30 Dys - 18	Type: 0
Medical:	Y	Waivers:	N	Last 90 Dys - 54	Instmt: 110
BFR:	Y	Months Since:	11	Aircraft: UNKNOWN	M. Eng: 182

Emergency Occurred During: MANEUVER

The purpose of the flight was to satisfy an insurance requirement that the owner receive 10 hours of dual instruction in this aircraft. The dual controls had been removed and the single control was on the left side. The aircraft was observed in a clockwise flat spin up to impact. The landing gear was down as were the flaps. The left engine was at full power while the right throttle was in the idle position and the propeller control was in the feather position. The propeller was against the start lock pins. No malfunctions were found. The CFI, who was in the right seat, had 0.5 hours of flight time in Beech 95-B55's. FARs prohibit the CFI from acting as the Pilot-In-Command in multiengine aircraft without dual controls installed.

Probable Cause: Dual Student - Airspeed (VMC) and Directional control not maintained, Inadvertent stall/spin.

Factors: Dual Student - Lowering of flaps and Gear down and locked - Intentional. PIC (CFt) - Poor judgment, Disregarded procedures/directives.

ASF Comments:

In multi-engine aircraft with an engine throttled or feathered, YMCA airspeed must be maintained or a stall/spin is inevitable. If any indication of an approaching stall is observed, power on the operating engine and the angle of attack must be simultaneously reduced without delay to regain sufficient airspeed to assist in maintaining control. Recovery should never be made by increasing power on the simulated failed engine. The landing gear and fl"aps should be retracted at the same time. In this accident both the owner and the CFI should have been aware that dual controls were required by the FARs for this operation.

Maneuvering-Other Flight

Reference Number: 87-2655 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.08.23 1130 PDT	BESS/56 (MER) 285 HP	N3784Q	INSTRCTNL	DESCENT	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	2	O	O	O
Pass:	O	O	O	O
Other:	O	O	O	O

Location: Salton City, CA | Flight Plan: NONE
Itinerary: Palm Springs, CA, to Local
Airport: Off Airport | Runway: N/A

Weather:	VMC			Clouds:	Clear
Visibility:	30.0 SM, None	Precip:	None	Ceiling:	None
Wind:	140/06	Gusts:	O	Lighting:	DAY
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	COMM/CFI/SMEL		Hours: Last 24 Hrs - UN	Total:	12,000
Age:	60 Yrs.	Instrument: Y	Last 30 Dys - UNK	Type:	UNK
Medical:	Y	Waivers: Y	Last 90 Dys - UNK	Instmt:	UNK
BFR:	U	Months Since: UN	Aircraft: UNKNOWN	M. Eng:	UNK

Emergency Occurred During: MANEUVER

A ground witness observed the aircraft at a low altitude, climbing, with the landing gear extended. He stated that he heard the engine sounds decrease and observed the aircraft roll over into a spin. The witness said the aircraft rolled inverted during one spinning turn but returned to an upright attitude before colliding with the terrain. Examination of the propellers indicated that the left propeller was feathered. Examination of the engines did not disclose any malfunctions.

Probable Cause: PIC (CFt) - Inadequate supervision, Stall/spin not corrected. Dual Student - Airspeed (VMC) not maintained.

Factors: PIC (CFt) - Emergency procedure simulated.

ASF Comments:

V_{MCA} airspeed was not maintained. Climbing with one engine feathered with the landing gear and flaps extended, under normal conditions would be difficult if not impossible. Possibly in an attempt to climb, airspeed was allowed to decay until the aircraft stalled and entered a spin at an altitude too low for recovery.

Maneuvering-Approach

Reference Number: 84-2313 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
84.11.03 0130 CST	BESS/56 (MER) 260 HP	N1S91S	PERSONAL	MANEUVER	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	1	0	O
Pass:	O	1	0	O
Other:	O	O	0	O

Location: Sonora, TX
Flight Plan: NONE
Itinerary: Lancaster, TX, to Sonora, TX
Airport: Off Airport
Runway: N/A

Weather:	VMC			Clouds:	Clear
Visibility:	15.0 SM, None	Precip:	None	Ceiling:	None
Wind:	00/00	Gusts:		Lighting:	NIGHT
Briefing:	FSS	Type:	UNK	Complete:	U

Pilot:	COMM/SEL			Hours: Last 24 Hrs - 2	Total:	1,077
Age:	41 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	225
Medical:	Y	Waivers:	N	Last 9a Dys - 12	Instmt:	93
BFR:	Y	Months Since:	17	Aircraft: UNKNOWN	M. Eng:	293

Emergency Occurred During: MANEUVER

Pilot stated that he intended to land at Sonora, Texas, but patchy ground fog obscured the airport. He circled the airport one time and then departed northward. He turned back to attempt another visual approach to the airport when the aircraft struck a tree on the highest point of land in the immediate area.

Probable Cause: PIC - Proper altitude not maintained.

Factors: Weather condition - Fog. Light condition - Dark night.

ASF Comments:

This instrument-rated pilot attempted to land VFR at night in patchy ground fog conditions without maintaining a safe maneuvering altitude in the immediate airport area. An excellent guide to use for maneuvering around the airport is the published circling minimums for the instrument approach. In this case it is 3,240 feet (11/4). At the time that this review was written, an NDB approach was not authorized at night.

Pilot Cruise-Weather

There were eighteen pilot-related accidents due to cruise weather conditions. All thirty-nine persons aboard were killed.

Six instrument-rated pilots continued VFR flight into IMC without instrument flight plans or ATC clearances. Four non-instrument-rated pilots continued VFR flight into IMC.

Eight instrument-rated pilots on IFR flight plans flew into known adverse weather, i.e., icing, thunderstorms, turbulence. Problem areas included preflight planning and preparation, improper IFR procedures, and spatial disorientation.

When a non-instrument-rated pilot tries to fly in instrument weather conditions, it can be compared to firing a pistol into a crowded room with hopes of not hitting anybody. There may be a time in a pilot's career that they may unintentionally encounter instrument meteorological conditions. This is the time to return to visual flight conditions as soon as possible. It might require a IBO-degree turn, a climb, a call to ATC for assistance, or all of the above. The point is, it's dangerous and illegal to fly a multi-engine aircraft in instrument weather conditions without the proper clearances, training, and certificates.

Pilot Cruise-Weather

Reference Number: 84-2021 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
84.05.30 2130 MDT	BESS/56 (MER) 260 HP	N6757Z	PERSONAL	CRUISE	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Duchesne, UT
Flight Plan: NONE
Itinerary: Salt Lake City, UT, to Englewood, CO
Airport: Off Airport
Runway: N/A

Weather: VMC
Clouds: 700 ft. Broken
Visibility: 40.0 SM, None
Precip: None
Ceiling: 700 ft.
Wind: 0/0
Gusts:
Lighting: NIGHT
Briefing: None
Type: N/A
Complete: N

Pilot: PVT/SMEL
Hours: Last 24 Hrs - UN
Total: 1,012
Age: 46 Yrs.
Instrument: Y
Last 30 Dys - UNK
Type: 199
Medical: Y
Waivers: N
Last 90 Dys - 20
Instmt: 66
BFR: Y
Months Since: 12
Aircraft: BESS/56
M. Eng: 227

Emergency Occurred During: CRUISE

Aircraft collided with a mountain at an elevation of 12,000 feet MSL. Weather at Roosevelt, Utah, 42 nautical mile southeast of the accident site at 2030 MDT was estimated 7,000 feet broken, 25,000 feet broken, 40 miles visibility, 70 degrees Fahrenheit, with cumulo-nimbus clouds northeast and southeast. Radar summary charts show numerous scattered showers and thunderstorms throughout the area as were forecast. Accident occurred approximately 6 miles north of victor airway 101. Minimum en route altitude for V101 is 15,000 feet MSL with a minimum obstruction clearance altitude of 14,600 feet MSL. No flight plan was filed for the flight and the aircraft was not under radar contact. No record of the pilot obtaining a weather briefing before the flight could be found.

Probable Cause: PIC - VFR procedures not followed, Inadequate altitude.

Factors: Terrain condition - Mountainous/hilly. Weather condition - Clouds. Light condition - Dark night. PIC - Preflight briefing service not obtained.

Comments: This instrument-rated pilot (1,012 TT, 199 Type) attempted to circumnavigate forecast weather under VFR at night without filing a flight plan or obtaining weather briefing before departure. The pilot obviously did not pay attention to altitude with respect to the terrain. The accident occurred at 12,000 feet MSL six miles from the airway where the MOCA was 14,600 feet MSL.

Pilot Cruise-Weather

Reference Number: 87-0904 — Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.02.08 1800 EST	BESS/56 (MER) 260 HP	N973E	PERSONAL	CRUISE	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	3	0	0	0
Other:	0	0	0	0

Location: Lanesville, NY — Flight Plan: NONE
Itinerary: Richmond, VA, to Morrisville, VT
Airport: Off Airport — Runway: N/A

Weather:	VMC			Clouds:	UNK Broken
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	3,500 ft.
Wind:	140/06	Gusts:		Lighting:	DUSK
Briefing:	UNK	Type:	UNK	Complete:	U

Pilot:	COMM/SMEL/SES/GLI			Hours: Last 24 Hrs - UN	Total:	12,192
Age:	56 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	UNK
Medical:	Y	Waivers:	Y	Last 90 Dys - UNK	Instmt:	1,056
BFR:	U	Months Since:	UN	Aircraft: UNKNOWN	M. Eng:	4,929

Emergency Occurred During: CRUISE

The pilot and his family departed 2/8/87 on a ski trip to Vermont. The flight did not arrive. The aircraft was found on a mountain plateau on 5/2/87. Weather conditions reportedly deteriorated and darkness was approaching at the estimated time of the accident, shortly after sunset. The aircraft impacted in a level attitude and in cruise configuration. No mechanical malfunctions were found.

Probable Cause: PIC - Poor in-flight planning/decision, Inadvertent VFR flight into IMC.

Factors: Terrain condition - Mountainous/hilly. Weather condition - Obscuration. Light condition - Dusk. PIC - Improper use of equipment/aircraft, over confidence in personal ability, Self-induced pressure.

Comments: Night operations require more attention to detail, particularly in mountainous terrain. A 3,500 foot ceiling may be adequate in flat country but mountain ridges can easily be obscured. From the narrative it appears that the pilot never saw the plateau. Under these circumstances it is much safer to file an IFR flight plan.

Pilot Cruise-Weather

Reference Number: 86-1957 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.12.10 0745 EST	BESS/56 (MER) 285 HP	N7975M	AIR TAXI POSITIONING	MANEUVER	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	O	O	O
Pass:	O	O	O	O
Other:	O	O	O	O

Location: Ivel, KY | Flight Plan: NONE
Itinerary: Huntington, WV, to Pikeville, KY
Airport: Off Airport | Runway: N/A

Weather:	IMC			Clouds:	Broken
Visibility:	2.000 SM, Fog	Precip:	None	Ceiling:	500 feet
Wind:	280/07	Gusts:		Lighting:	DAY
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	COMM/SMEL/HEL			Hours: Last 24 Hrs - 1	Total:	14,500
Age:	57 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	1,000
Medical:	Y	Waivers:	Y	Last 90 Dys - 250	Instmt:	1,500
BFR:	Y	Months Since:	1	Aircraft: BE58	M. Eng:	4,500

Emergency Occurred During: MAN EUVER

The pilot who was originally scheduled to make the charter flight to pick up the passenger was reluctant to do so due to low ceilings in the mountainous area at the destination. The owner of the company took the flight and the flight was observed by witnesses near the destination to be flying in and out of the clouds between and below the mountain tops. Witnesses estimated the altitude to be between 150 and 300 feet above ground level. The destination airport three miles from the crash site was completely fogged in, with visibility under 100 yards. The aircraft struck the top of a cloud covered mountain. The pilot had been previously cited by FAA for violations including careless and reckless operation of aircraft.

Probable Cause: Object - Tree(s). PIC - Attempted VFR flight into IMC, Initiated flight intoknown adverse weather.

Factors: Weather condition - Clouds, Fog. PIC - Poor preflight planning/preparation and In-flight planning/decision, Improper use of procedure, over confidence in personal ability and Self-induced pressure.

ASF Comments:

The company pilot who refused to make the charter flight evidently had checked the enroute weather. The owner of the company (14,500 TT, 1,000 Type) took the flight instead but did not receive a weather briefing and attempted to 'scud run' (observed by witnesses) and struck the top of a cloud covered mountain. It's obvious that this pilot did not give any consideration to weather or terrain. He had no alternative and a single course of action in flight must be considered extremely risky.

Pilot Cruise-Weather

Reference Number: 86-1031 | Data Provided By NiSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.06.02 1045 EDT	BESS/56 (MER) 300 HP	N3001S	PERSONAL	MANEUVER	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Elizabethtown, KY — Flight Plan: NONE
Itinerary: Owensboro, KY, to Elizabethtown, KY
Airport: Elizabethtown — Runway: N/A

Weather:	IMC			Clouds:	500 ft. Overcast
Visibility:	.750 SM, Fog	Precip:	None	Ceiling:	500 ft.
Wind:		Gusts:		lighting:	DAY
Briefing:	FSS	Type:	Telephone	Complete:	N

Pilot:	PVT/SMEL			Hours: Last 24 Hrs - 2	Total: 862
Age:	58 Yrs.	Instrument:	N	Last 30 Dys - 7	Type: 64
Medical:	Y	Waivers:	Y	Last 90 Dys - 13	Instmt: 56
BFR:	Y	Months Since:	10	Aircraft: BE95	M. Eng: 64

Emergency Occurred During: MANEUVER

Aircraft observed in level flight in Instrument Meterological Conditions just below 500 foot overcast estimated visibility about 3⁄4 mile. Left wing struck 15/16 inch diameter steel guy cable 534 feet above ground level shearing outer 118 inches. Aircraft impacted earth fill dam 1,169 feet from 650 foot tall TV antenna tower. Top of tower obscured by clouds. Pilot had departed airport 63 nautical mile west just after the weather at the departure field reached Visual Flight Rules minimums.

Probable Cause: PIC - Weather evaluation and In-flight planning/decision - Poor, Continued VFR flight into IMC, Inadequate visual lookout, Disregarded procedures/directives.

Factors: Weather condition - Low ceiling, Fog. Object - Guy wire. PIC - Improper use of equipment/aircraft, over confidence in personal ability and Lack of total instrument time.

ASF Comments:

A non-instrument-rated pi lot having received a FSS weather briefing attempted to remain VFR below a 500 foot overcast in deteriorating weather conditions and struck a TV antenna guy wire. Although the pilot delayed his/her departure until the airport reached VFR minimums, he/she neglected to take alternative action to avoid IMC when the enroute weather deteriorated. Non-instrument-rated pilots who elect to takeoff under marginal VFR conditions take on a grave risk if they do not have an escape procedure when the weather begins to deteriorate. Pilots should assume that weather at VFR minimums at a departure point will deteriorate once away from the reporting station. Tall towers are always a serious threat at low altitude. The danger doubles when the visibility goes down.

Pilot Cruise-Weather

Reference Number: 86-0409 — Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.01.22 1445 CST	BESS/56 (MER) 260 HP	N7948K	PERSONAL	CRUISE	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Anniston, AL — Flight Plan: NONE
Itinerary: Natchitoches, LA, to Atlanta, GA
Airport: Off Airport — Runway: N/A

Weather:	IMC			Clouds:	UNK Broken
Visibility:	5.0 SM, Haze	Precip:	None	Ceiling:	1,500 ft.
Wind:	230/05,	Gusts:		Lighting:	DAY
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	PVT/SMEL			Hours: Last 24 Hrs - UN	Total:	76
Age:	33 Yrs.	Instrument:	N	Last 30 Dys - UNK	Type:	UNK
Medical:	N	Waivers:	N	Last 90 Dys - UNK	Instmt:	UNK
BFR:	U	Months Since:	UN	Aircraft: UNKNOWN	M. Eng:	UNK

Emergency Occurred During: CRUISE

The aircraft observed flying through the base of the low level cloud layer prior to its impact on the side of a mountain. The pilot was not instrument rated, had not filed a flight plan nor obtained a weather briefing. The impact point was several hundred feet below the maximum elevation figure shown on the aeronautical chart for the section in which he was flying.

Probable Cause: PIC - Inadequate preflight planning/preparation, Poor in-flight planning! decision and judgment, Intentional VFR flight into IMC, Proper altitude not maintained.

Factors: Weather condition - Low ceiling. Terrain condition - Mountainous/hilly.

ASF Comments:

Ask any pilot for a definition of 'scud running' and they will probably give you an answer that is very close to the events of this accident. We are at a loss to explain why a low-time pilot (76 hours total time), would attempt this flight without, at the very least, obtaining a weather briefing. As the graphs in Part One of this Safety Review highlights, you should be *extra* cautious until you achieve 400-500 hours Pilot Time in Type. As a philosophical observation, it is unlikely that a pilot with this low level of experience has the skill and judgment to safely operate an aircraft like the Baron.

Pilot Cruise-Weather

Reference Number: 88-1029 | Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
88.04.27 1318 ADT	BESS/56 (MER) 28S HP	N2730T	FERRY	MANEUVER	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	2	o	o	o
Pass:	o	o	o	o
Other:	o	o	o	o

Location: Tyonek, AK | Flight Plan: IFR
Itinerary: Galena, AK, to Anchorage, AK
Airport: Off Airport | Runway: N/A

Weather:	IMC			Clouds:	UNK
Visibility:	UNK, Snow	Precip:	Snow	Ceiling:	UNK
Wind:	0/0,	Gusts:	a	Lighting:	Day
Briefing:	FSS	Type:	Telephone	Complete:	U

Pilot:	COMM/SMEL/SES		Hours: Last 24 Hrs - 2	Total:	17,600
Age:	46 Yrs.	Instrument: Y	Last 30 Dys - UNK	Type:	32
Medical:	Y	Waivers: N	Last 90 Dys - UNK	Instmt:	UNK
BFR:	Y	Months Since: 1	Aircraft: CE 207	M. Eng:	6,300

Emergency Occurred During: MANEUVER

The two pilots were operating the aircraft under the authority of a ferry permit which allowed flight only during day VFR conditions and with a single pilot. They requested and received just the weather at the destination airport, which was VMC. Enroute the flight encountered IMC over a mountain range. Radar returns indicated that as the weather was encountered, the flight deviated from the assigned airway, and followed mountain passes. Attempts to contact the pilot shortly after he left the assigned airway were unsuccessful. The aircraft was found at the 10,600 elevation of a 11,413 foot mountain, 300 miles south of course. Weather in the area was IMC with moderate to heavy icing reported shortly after the accident.

Probable Cause: PIC - Improper IFR procedure, Poor in-flight planning/decision.

Factors: Terrain condition - High terrain. Weather condition - Clouds. PIC - Over confidence in personal ability, Inadequate preflight planning/preparation.

ASF Comments:

The ferry permit for this flight authorized day VFR, single pilot operation. The pilot violated the ferry permit by allowing another person aboard the aircraft and entering IMC enroute. Just obtaining destination weather without regard for enroute conditions placed the flight at grave risk especially in mountainous terrain. Attempting to follow mountain passes to avoid encountering weather is only successful if the weather conditions are thoroughly evaluated to assure the passes will remain open to provide an escape route to return to the departure or an alternate airport. It is a gamble to fly through a mountain pass unless visual conditions are apparent from one end of the pass to the other. A deviation of 300 miles from the planned course shows a mindset to complete the flight regardless of the obstacles.

Pilot Cruise-Weather

Reference Number: 83-3325 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
83.12.27 1230 MST	BE58 (MER) 285 HP	N9121 S	PERSONAL	DESCENT	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	O	O	O
Pass:	3	O	O	O
Other:	O	O	O	O

location: Marquez, NM Flight Plan: IFR
Itinerary: Pueblo, CO, to Prescott, AZ.
Airport: Off Airport Runway: N/A, Snow

Weather:	VMC			Clouds:	5,000 ft. Broken
Visibility:	50.0 SM, None	Precip:	None	Ceiling:	5,000 ft.
Wind:	290/16	Gusts:		lighting:	DAY
Briefing:	NWS	Type:	Telephone	Complete:	Y

Pilot:	COMM/SMEL			Hours: Last 24 Hrs - 10		Total:	1,313
Age:	41 Yrs.	Instrument:	Y	Last 30 Dys - 26		Type:	26
Medical:	Y	Waivers:	N	Last 90 Dys - 28		Instmt:	84
BFR:	Y	Months Since:	1	Aircraft: BE58		M. Eng:	26

Emergency Occurred During: CRUISE

The aircraft was flown at altitudes up to 15000 feet in areas of forecast icing. The aircraft was not equipped with oxygen. The aircraft was flown above 14000 feet for about 20 minutes after which it descended into icing conditions. Shortly thereafter, the aircraft made a climb under Air Traffic Condition directions and then radar showed it making a rapid descent. The pilot had told the controller that the aircraft had picked up about ½ inch of rime ice. Radar contact was lost shortly after a readout at 10,400 feet. Further attempts at communications failed. Later, the aircraft was found where it had crashed in a steep, vertically banked dive at a high rate of speed. Rime ice was found in the snow next to the elevator counterweight. The elevator trim was found trimmed to a nose-up position. The aircraft was equipped with deicing/anti-icing equipment and an autopilot.

Probable Cause: PIC - Performed flight into known adverse weather, Improper in-flight planning/ decision. Wing - Ice.

Factors: Weather condition - Icing conditions.

ASF Comments:

The pilot should have been aware of the requirement (FAR 91.211) to use supplemental oxygen above 14,000 feet MSL during the entire flight at those altitudes. This could have affected his judgment. An escape route/destination was needed in the event moderate to heavy icing was encountered. The aircraft was equipped with deicing/anti-icing equipment, and may have been approved, per the POH, for flight in light to moderate icing conditions. Prudence dictates that preflight planning provide for alternate courses of action in the event aircraft performance might be seriously degraded due to ice accumulation. Low instrument experience level and time in type could have been contributing factors.

Pilot Cruise-Weather

Reference Number: 87-2496 | Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.09.12 1100 COT	BE58P (MERP) 310 HP	NI158T	PERSONAL	DESCENT	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	3	0	0	0
Other:	0	0	0	0

Location: Austin, TX
Flight Plan: IFR
Itinerary: Houston, TX, to Gunnison, CO
Airport: Off Airport
Runway: N/A

Weather:	UNK			Clouds:	UNK Overcast
Visibility:	UNK, None	Precip:	R. Showers	Ceiling:	1,500 feet
Wind:	/18	Gusts:	32	Lighting:	DAY
Briefing:	FSS	Type:	Telephone	Complete:	Y

Pilot:	COMM/CFI/SMEL			Hours: Last 24 Hrs - UN	Total:	2,100
Age:	28 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	UNK
Medical:	Y	Waivers:	Y	Last 90 Dys - UNK	Instmt:	UNK
BFR:	Y	Months Since:	18	Aircraft: UNK	M. Eng:	UNK

Emergency Occurred During: CRUISE

The pilot received a full weather briefing at 0540 CDT and a weather update at 0737 when he filed an IFR flight plan. The flight was without incident with a final cruise altitude of 16,000 feet until 1055:43, when the pilot required a "left turn for deviation." About three minutes later, the controller noticed an altitude alert when the aircraft deviated below the assigned altitude. The controller tried to contact the pilot, but lost radio and radar contact. Shortly thereafter, witnesses saw the aircraft come out of clouds in a steep right wing low, nose down attitude. It crashed with a high rate of speed and disintegrated during impact; parts of the wreckage went into a nearby lake. No preimpact part failure/malfunction was found. An investigation revealed there was a line of thunderstorms moving through the area at 35 knots with tops to 34,000 feet. The pilot received a detailed briefing of thunderstorms at 0540, but the update briefing at 0737 didn't include pertinent information in severe thunderstorm watch #516 (issued at 0611) or Convective Sigmet 18C. Pilot didn't ask for update of weather he was approaching, but the aircraft was radar equipped. The 1102 Austin weather was, in part: thunderstorms, wind 010 degrees at 18 gusting 32 knots.

Probable Cause: PIC - Continued flight into known adverse weather.

Factors: ATC Personnel(FSS) - Inadequate preflight briefing service. PIC - In flight briefing service not used. Weather condition - Thunderstorm.

ASF Comments:

The PIC didn't ask for an update of the weather he was approaching. The FSS failed to provide the pilot with information from a special thunderstorm watch when he filed his IFR flight plan. When severe weather becomes a factor during preflight planning, pilots should request specific, detailed information, such as PIREPS, the nature of the thunderstorms, where they have been observed; whether the storms are isolated, scattered, or in lines; whether squall lines are indicated and if hail has been reported. National Weather Service and FSS radar data should also be requested. Before the decision is finally made to fly in the vicinity of severe weather areas, an alternate course of action should be planned to avoid encountering adverse weather. If no alternate option appears feasible or practicable, considering fuel endurance, suitable enroute airports, or the extent of the severe weather, postpone the flight until conditions improve.

Pilot-Approach/lFR

Reference Number: 83-3260 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
83.11.27 0130 EST	BE58TC (MERT) 310 HP	N2131L	PERSONAL	APPROACH	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	0	1	0	0
Pass:	4	1	0	0
Other:	0	0	0	0

Location: Knoxville, TN
Itinerary: Atlanta, GA, to Knoxville, TN
Airport: Knoxville Dwntwn Is.
Flight Plan: NONE
Runway: 08,3500/75, Asphalt, Dry

Weather: UNK
Visibility: UNK, Fog
Wind: 060/04
Briefing: None
Precip: None
Gusts:
Type: N/A
Clouds: UNK
Ceiling: UNK
Lighting: NIGHT
Complete: N

Pilot: PVT/SMEL
Age: 42 Yrs.
Medical: Y
BFR: Y
Instrument: N
Waivers: Y
Months Since: 4
Hours: Last 24 Hrs - 2
Last 30 Dys - UNK
Last 90 Dys - UNK
Aircraft: PA 44
Total: 1,700
Type: 155
Instmt: UNK
M. Eng: 170

During arrival, the pilot checked in with Knoxville Approach Control and stated that he was proceeding to the downtown airport for landing. At that time, the weather at McGhee-Tyson Airport (approximately 10 miles south-southwest) was clear with seven miles visibility. About 10 minutes later, the pilot reported that he was encountering fog in the vicinity of the downtown airport and "might have to go over to McGhee-Tyson to land." A few minutes later, he reported that he had executed a missed approach from runway 26, due to fog, but that he saw some lights and was going to try to land on runway eight. He made a procedure turn to align the aircraft to that runway. During the second approach, he encountered fog again and initiated a go-around. Shortly after that, the left wing hit trees and the aircraft crashed in the river next to the airport. Rescue Personnel reported that the fog was so thick that they had trouble finding their way across the field to located the wreckage. There was evidence that the left wing began burning after it collided with the trees. The trees were located along the river bank north of runway eight.

Probable Cause: PIC - continued flight into known adverse weather, Delayed go-around, Proper alignment and altitude not maintained.

Factors: Light condition - Dark night. Weather condition - Fog. PIC - Improper decision, lack of total instrument time.

ASF Comments:

A non-instrument-rated pilot with no instrument experience attempted to land at night at two fog shrouded airports. The pilot was apparently fooled by the 'clear and seven miles visibility' report. At 1:30 in the morning the temperature/dew point spread should be of keen interest. Ground fog can form in a matter of minutes and should always be considered when there is a lot of moisture in the air.

Pilot-Approach/IFR

Reference Number: 85-2985 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
85.12.23 2036 PST	BESS/56 (MER) 260 HP	N1494G	PERSONAL	APPROACH	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	1	0	0
Pass:	2	1	0	0
Other:	4	17	62	0

Location: Concord, CA — Flight Plan: NONE
Itinerary: San Luis Obispo, CA, to Concord, CA
Airport: Buchanan Field — Runway: 19R, 4712/150, Asphalt, Dry

Weather:	IMC			Clouds:	400 feet
Visibility:	.75 SM, Fog	Precip:	None	Ceiling:	400 feet
Wind:	030/09	Gusts:		Lighting:	NIGHT
Briefing:	FSS	Type:	Telephone	Complete:	Y

Pilot:	COMM/CFI		Hours: Last 24 Hrs - U	Total:	15,351
Age:	67 Yrs.	Instrument: N	Last 30 Dys - 1	Type:	1
Medical:	Y	Waivers: Y	Last 90 Dys - 1	Instmt:	860
BFR:	Y	Months Since: 4	Aircraft: BESS/56	M. Eng:	1

During arrival, the aircraft was vectored for an LDA runway 19R approach. After being cleared for the approach, the pilot was advised that radar service was terminated and told to contact the tower. At 2033 PST, he reported inbound at the final approach fix and was cleared for the approach. Approximately two minutes later, he declared a missed approach. The tower controller instructed the pilot to contact Travis Departure Control, but only a garbled reply was heard. There was no further radio contact with the aircraft. After crossing the airport on a SSE heading, the aircraft entered a left climbing turn as if to begin the missed approach procedure, then it turned right as if to begin a downwind and base leg for runway 1L. Witnesses reported the aircraft entered clouds and, shortly thereafter, it reappeared in a steep, descending, right turn. It then crashed into a department store approximately one mile south of the airport while in a 32 degree right bank, six degree nose low attitude. No preimpact part failure or malfunction was found that would have led to the accident. The weather (in part) was: 400 feet obscured, visibility 3/4 mile with fog; same as LDA minimums. Minimums for circling approach were 600 feet and 1 mile. No cockpit voice recorder was installed nor required.

Probable Cause: PIC - aircraft handling not maintained, imporper use of equipment/aircraft, spatial disorientation, spiral inadvertent.

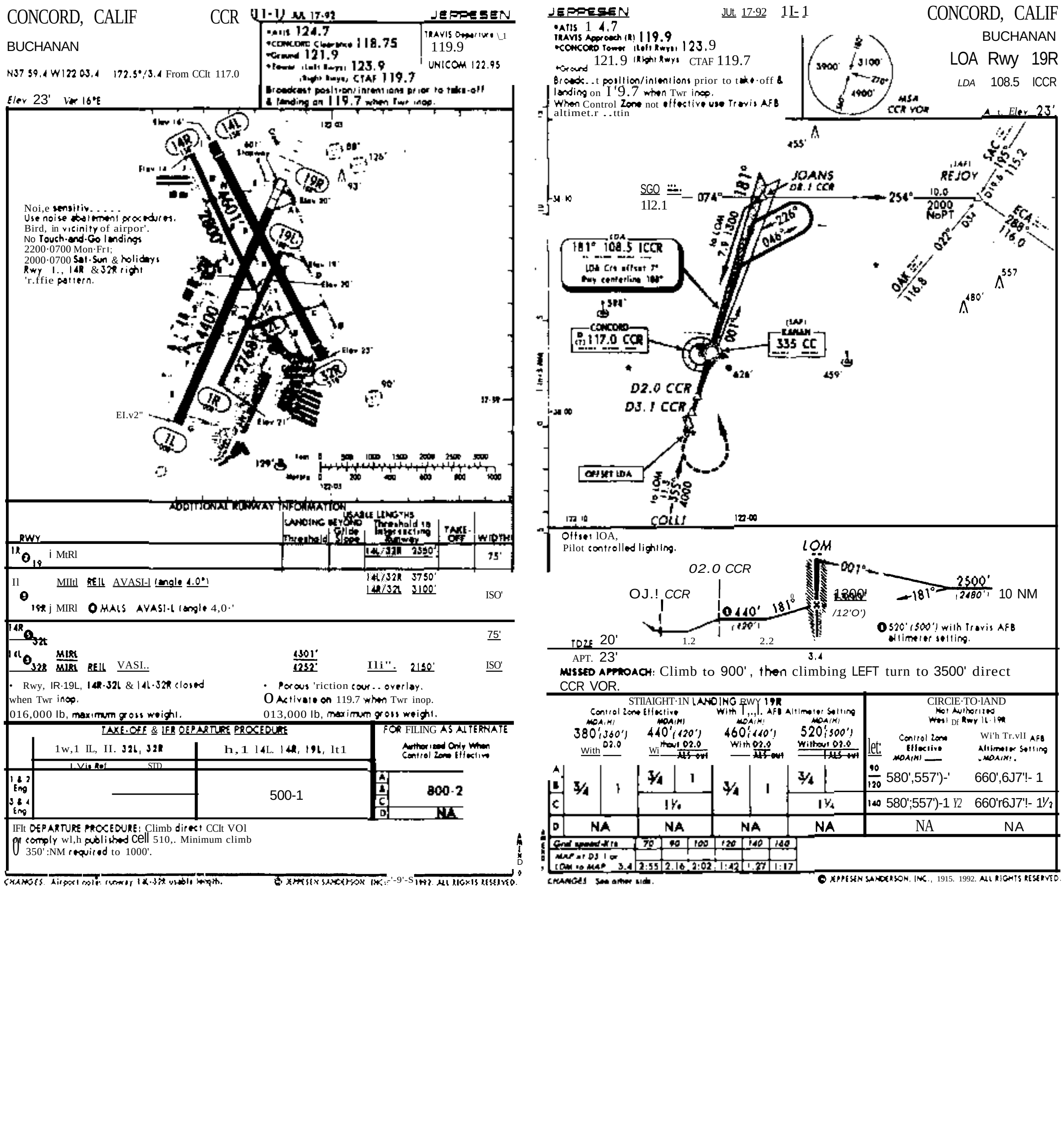
Factors: Light condition - Dark night. Weather - low ceiling. PIC - IFR procedure not followed.

ASF Comments:

From the witness observations it appears that the pilot had ground contact after declaring the missed approach. At night, it is not unusual to have ground lights shine up through fog. The-only safe way to operate in these conditions is to adhere to published minimums. A straight-in approach was the only option since the weather was below circling minimums. With a nine knot tailwind, this would have decreased the stopping margin on the 4,712 foot runway. This particular accident had exceptionally tragic consequences with many ground injuries and fatalities. Night circling approaches carry a high risk.

85-2985
Concord, CA

Note: The approach chart shown was the current edition at press time. It may differ from the one in use at the time of the accident.



Pilot-Approach/lFR

Reference Number: 84-0437 — Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
84.02.10 1927 MST	BE58P (MERP) 325 HP	N6400E	PERSONAL	APPROACH	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	1	0	0	0
Other:	0	0	0	0

Location: Durango, CO — Flight Plan: IFR
Itinerary: Eden Prairie, MN, to Durango, CO
Airport: Durango-La Plata — Runway: 20,9200/150, Asphalt, Dry

Weather:	IMC			Clouds:	UNK Obscured
Visibility:	2.000 SM, B.Snw	Precip:	Snow	Ceiling:	300 ft.
Wind:	200/05,	Gusts:	12	Lighting:	NIGHT
Briefing:	FSS	Type:	Telephone	Complete:	N

pilot:	PVT/SMEL			Hours: Last 24 Hrs - UN	Total:	1,819
Age:	51 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	320
Medical:	Y	Waivers:	Y	Last 90 Dys - UNK	Instmt:	395
BFR:	U	Months Since:	UN	Aircraft: UNKNOWN	M. Eng:	320

Emergency Occurred During: APPROACH

When the pilot called the FSS at 1341 MST, he stated he had already received some "real time" weather and requested only the weather at Durango and Farmington, New Mexico. He filed an IFR flight plan to Durango and took off at 1437. During arrival, the pilot attempted to get into VFR conditions to land at Pagosa Springs, about 30 miles east northeast of Durango. However, he was unable, so he continued to the filed destination. An ILS/DME runway 2 approach was made to circle and land on runway 20 at Durango. At 1925:44, the pilot radioed that he had the airport in sight. The aircrew of Sunwest Flight 204 saw N6400E break out in the clear and enter a left downwind for runway 20. However, they lost sight of N6400E as it was abeam of the approach end of runway 20. Approximately five seconds later, the copilot of flight 204 saw the lights of N6400E break out of the clouds, and approximately one second later, he saw a large green ball of fire. An exam of the crash site revealed the aircraft struck a power line about 30 to 35 feet above ground level while configured for landing, then crashed. The elevation of the uncontrolled airport was 6,685 feet, the circling MDA was 7,100 feet. Wind was gusiting at 12 knots.

Probable Cause: PIC - Minimum descent altitude not maintained.

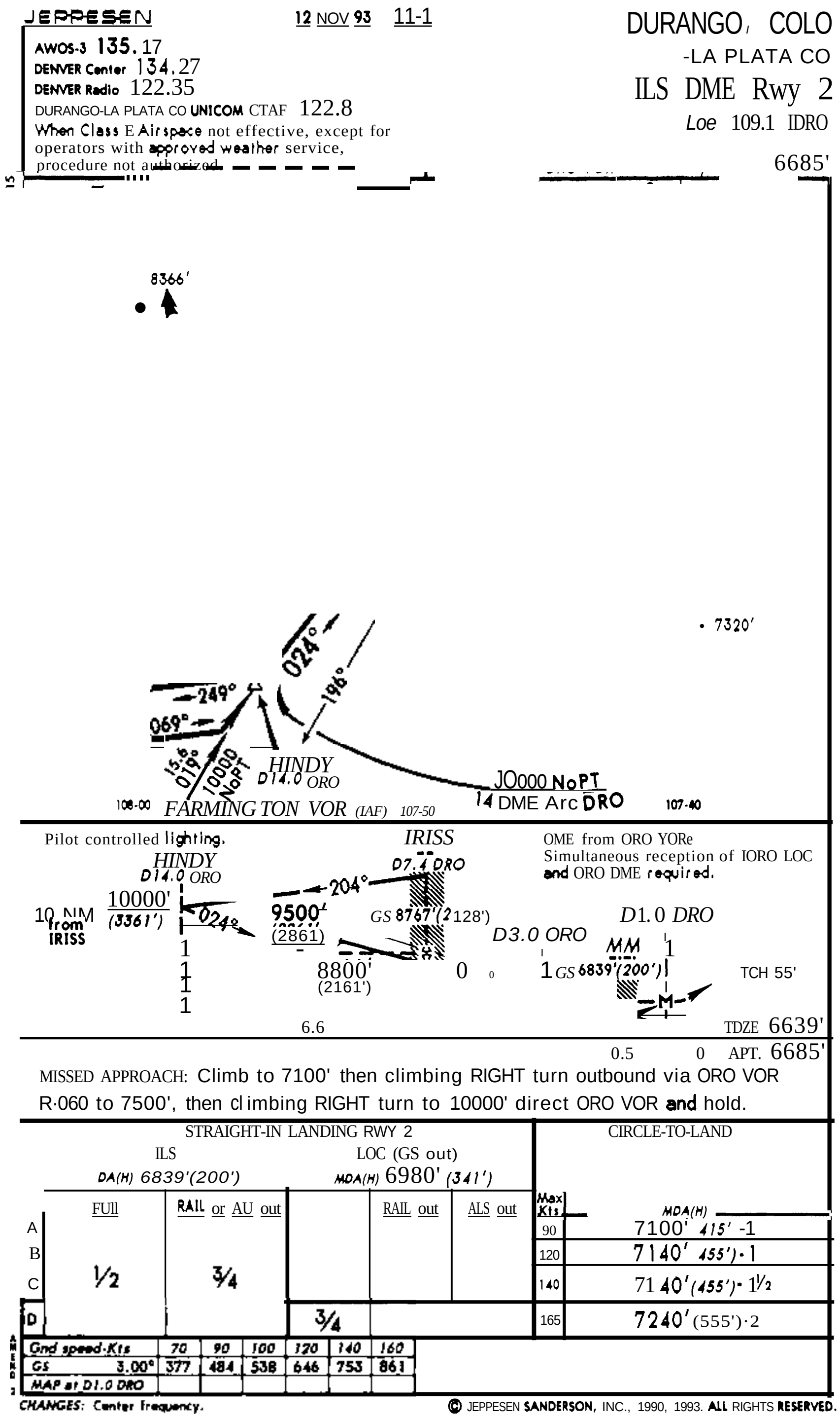
Factors: PIC - Improper in-flight planning/decision, Missed approach not performed. Light condition - dark night. Weather condition - High density altitude, Low ceiling, Unfavorable wind, Snow obscuration, Below approach minimums.

ASF Comments:

Circling approach minimums must be followed to ensure obstruction clearance to the runway. Under normal circumstances, if the ceiling and visibility do not permit VFR at circling minimums, a missed approach is mandatory, with no exceptions. Night circling approaches carry additional risks. Many professional flight crews will not execute circling approaches at night.

84·0437
Durango, Colorado

Note: The approach chart shown was the current edition at press time. It may differ from the one in use at the time of the accident.



Pilot-Approach/lFR

Reference Number: 83-2886 Data Provided By NiSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
83.11.11 2238 PST	BESS/56 (MER) 380 HP	N911 SC	PERSONAL	APPROACH	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	O	O	O
Pass:	3	O	O	O
Other:	O	O	O	O

Location: San Diego, CA
Flight Plan: IFR
Itinerary: Los Angeles, CA, to UNKNOWN,
Airport: Montgomery Field
Runway: 28R, 3400/1 50, Asphalt, Wet

Weather:	IMC			Clouds:	Part Obs. Overcast
Visibility:	1.000 SM, Fog	Precip:	Rain	Ceiling:	300 ft.
Wind:	180/06	Gusts:		Lighting:	NIGHT
Briefing:	FSS	Type:	Telephone	Complete:	Y

Pilot:	PVT/COM/CF/SMEL/SES		Hours: Last 24 Hrs - UN	Total:	4,000
Age:	38 Yrs.	Instrument: Y	Last 30 Dys - UNK	Type:	550
Medical:	Y	Waivers: N	Last 90 Dys - UNK	Instmt:	45
BFR:	U	Months Since: UN	Aircraft: UNKNOWN	M. Eng:	1,000

Emergency Occurred During: APPROACH

During arrival, the pilot was cleared for an ILS approach to runway 28R. About 3 minutes later, he commenced a missed approach and requested another ILS to runway 28. At that time, the Air Traffic Control Controller advised the pilot that the five preceding aircraft had made ILS Approaches and all had executed missed approaches without obtaining visual contact with either the approach or runway lights. However, the pilot elected to make another approach. During the second approach, the aircraft collided with high tension power lines located about 10,400 feet from the approach end of runway 28 at approximately 108 feet above ground level. Witnesses reported a flash of light and a fireball were noted as the aircraft struck the power lines. The aircraft then impacted the ground in a vacant field and slid about 400 feet across the field and a four-lane, divided street before knocking down a fence and coming to rest in a residential backyard and burning. The two front seat passengers egressed from the aircraft, but died later from burns. Witnesses said the engines sounded normal until impact. Annual inspection of aircraft and VOR receiver check overdue.

Probable Cause: PIC - Improper IFR procedure, Below proper altitude.

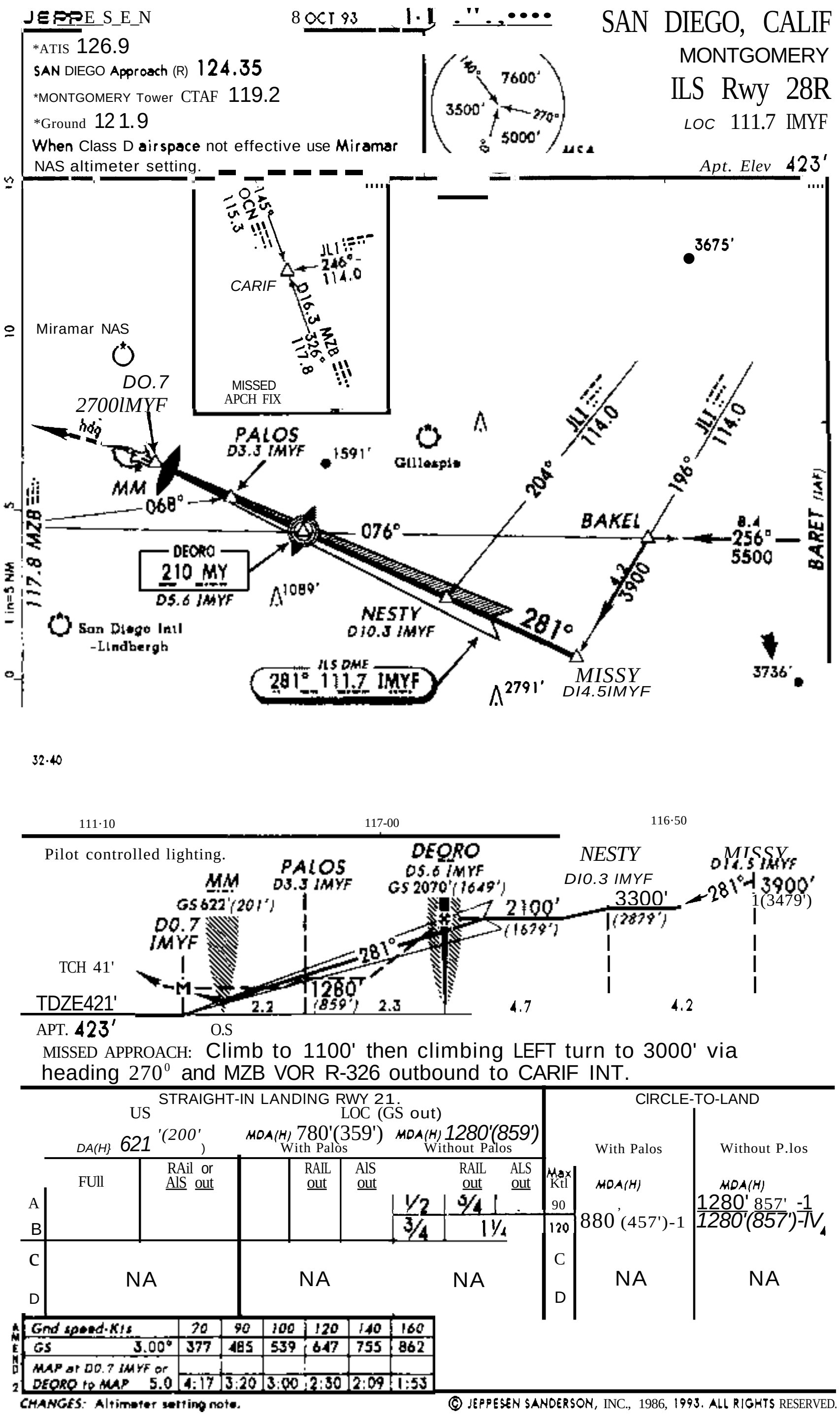
Factors: Light condition - Dark night. Weather condition - Low ceiling, Fog, Below approach minimums. PIC - Continued flight into known adverse weather, Flight to alternate destination not performed. Object - Wire, transmission.

ASF Comments:

Striking power lines 108 feet AGL almost two miles from the approach end of an ILS runway indicates the pilot had decided he/she could make the airport under VFR. If the glide slope had failed, and there was no indication it had, the MDA for the localizer approach would have provided sufficient altitude to clear the power lines. Self-induced pressure and pressure from others must be ignored in the interests of safety. The pilot was advised that five other aircraft had previously executed missed approaches. As a general rule, once an approach is missed it's time to divert to an alternate. Despite the reported weather above landing minimums nothing beats a recent pirep.

83-2883
San Diego, California

Note: The approach chart shown was the current edition at press time. It may differ from the one in use at the time of the accident.



Pilot-Approach/lFR

Reference Number: 86-2746 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.07.01 2339 EDT	BESS/56 (MER) 260 HP	N133P	PERSONAL	APPROACH	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	3	0	0	0
Other:	0	0	0	0

Location: Lynchburg, VA
Flight Plan: IFR
Itinerary: Buffalo, NY, to Lynchburg, VA
Airport: Lynchburg Municipal
Runway: 03, 5,799/150, Asphalt, Wet

Weather:	IMC			Clouds:	UNK Overcast
Visibility:	2.000 SM, Fog	Precip:	Rain	Ceiling:	300 ft.
Wind:	040/03	Gusts:		Lighting:	NIGHT
Briefing:	FSS	Type:	In Person	Complete:	N

Pilot:	PVT/SEL			Hours: Last 24 Hrs - 3	Total:	275
Age:	32 Yrs.	Instrument:	N	Last 30 Dys - UNK	Type:	79
Medical:	N	Waivers:	N	Last 90 Dys - UNK	Instmt:	48
BFR:	Y	Months Since:	22	Aircraft: BESS/56	M. Eng:	79

Emergency Occurred During: APPROACH

The non-instrument rated pilot filed an IFR flight plan. During his second instrument landing system approach to the airport, after the control tower had closed, he failed to utilize the aircraft radio to illuminate the approach lighting system. The pilot failed to locate the runway environment in sufficient time to complete the instrument landing system landing. Thereafter, he lost control of the aircraft while attempting to circle underneath the 300 foot ceiling on the dark night and the aircraft crashed into trees on the airport.

Probable Cause: PIC - Missed approach and IFR procedure - Improper, Procedures/directives not followed, Poor in-flight planning/decision and judgment. PIC-Improper use of equipment/aircraft, overconfidence in personal ability.

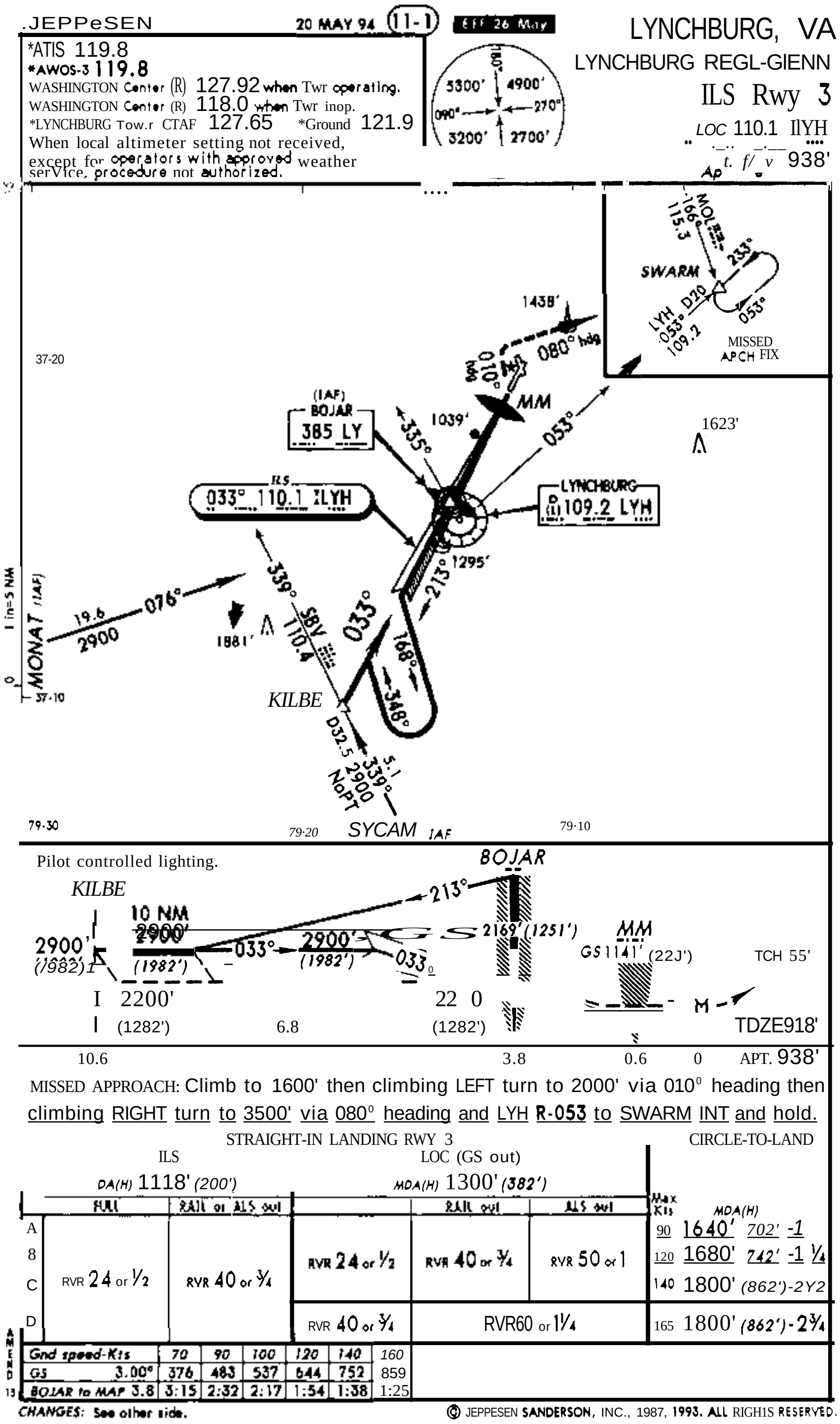
Factors: Weather condition - Low ceiling, Fog. PIC - Improper use of equipment/aircraft, self-induced pressure.

ASF Comments:

A little knowledge is a dangerous thing. This pilot had extremely limited experience in flying. His multi-engine time was low and he was only partially familiar with IFR procedures. Night IFR is the toughest environment and attention to detail is essential. The inability to key the runway lights would have been evident at decision height and a diversion to an alternate would have saved the day. Landing without runway lights is an impossible task, at night in rain and fog. Circling minimums were 1680 MSL (742 AGL) which doomed this ill-conceived approach to failure.

86-2746
Lynchburg, Virginia

Note: The approach chart shown was the current edition at press time. It may differ from the one in use at the time of the accident.



Landing Long

Reference Number: 90-0260 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
90.05.02 2210 EDT	BE58P (MERP) 325 HP	N91 EE TEST	MAINT	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Auburn, IN
Itinerary: Auburn, IN, to Local
Airport: Dekalb County
Flight Plan: NONE
Runway: 27, 3,652/70, Asphalt, Dry

Weather:	VMC			Clouds:	12,000 ft. Scattered
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	None
Wind:	180/04	Gusts:	0	Lighting:	Night
Briefing:	UNK	Type:	UNK	Complete:	U

pilot:	COMM/SMEL			Hours: Last 24 Hrs - 1	Total: 797
Age:	22 Yrs.	Instrument:	Y	Last 30 Dys - 37	Type: 219
Medical:	Y	Waivers:	N	Last 90 Dys - 141	Instmt: 187
BFR:	Y	Months Since:	6	Aircraft: BE58P	M. Eng: 263

Emergency Occurred During: LANDING

After making an operational check of the aircraft's pressurization system, the pilot began an approach to land at the airport. He reported that his approach was "a little high, and about 15 knots fast" and that the aircraft touched down about 2/5 of the way down the runway. He was unable to stop the aircraft before the end of the runway. Subsequently, it skidded off the departure end and struck a ditch. Tire skid marks on the runway and damage/wear to the tires supported the pilot's statements.

Probable Cause: PIC - Misjudged airspeed/Distance.

Factors: Light condition - Night. Terrain condition - Ditch.

ASF Comments:

Recommended approach airspeeds of 130% V_{SO} should provide adequate airspeed for normal operations. Visual clues are in many instances absent during night operations. Night proficiency and currency should prove helpful in avoiding long, high, and fast approaches. The runway, at 3,652 feet, was not exceptionally short. However, it obviously was not long enough to tolerate the pilot's poor airspeed control.

Landing Long

Reference Number: 93-0281 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
93.01.22 1336 PST	BE58P (MERP) 310 HP	N4458S	BUSINESS	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	0	1
Pass:	O	O	0	1
Other:	O	O	0	O

Location: Pacoima, CA
Flight Plan: NONE
Itinerary: Santa Maria, CA, to Pacoima, CA
Airport: Whiteman
Runway: 12, 3960/40, Asphalt, Dry

Weather:	VMC			Clouds:	Part Obscured
Visibility:	2.500 SM, Haze	Precip:	None	Ceiling:	None
Wind:	00/00,	Gusts:	O	Lighting:	Day
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	PVT/SMEL			Hours: Last 24 Hrs - 2	Total:	7,000
Age:	54 Yrs.	Instrument:	Y	Last 30 Dys - 3	Type:	25
Medical:	Y	Waivers:	Y	Last 90 Dys - 20	Instmt:	31 0
BFR:	Y	Months Since:	02	Aircraft: BE58P	M. Eng:	25

Emergency Occurred During: LANDING

The accident was witnessed by both air traffic Controllers in the Tower cab and various pilots and mechanics at the airport. According to their observations, the aircraft's final approach was "hot, high and long." The aircraft touched down about two thirds of the way down the runway and shortly thereafter began to skid. The aircraft began to skid sideways and a main landing gear collapsed. The pilot said that he encountered a tail wind on final which caused his airspeed to be excessive and the aircraft to float. He further reported that just after touchdown when the aircraft was skidding he reached for the flap control lever. The aircraft traffic Controllers in the Tower cab reported that the winds were calm at the time of the aircraft's approach and landing.

Probable Cause: PIC - Poor planned approach, Excessive airspeed (VREF), Improper use of brakes (norma!).

Factors: PIC - Lack of total experience in type of aircraft.

ASF Comments:

Touchdown in the last third of a 4,000 foot runway leaves about 1,300 feet to stop the aircraft. If the approach airspeed was well above 130% V_{SO} it would have been difficult to impossible with no headwind to stop within the remaining runway according to the landing distance performance chart (flaps 30 degrees) for the BE58. This new multi-engine pilot obviously had not adapted to the more precise requirements of flying heavier equipment.

Landing Long

Reference Number: 85-0208 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
85.02.11 0615 CST	BE58 (MER) 285 HP	N912L	POSITIONG	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Natchez, MS — Flight Plan: IFR
Itinerary: Jackson, MS, to Natchez, MS
Airport: Adams County — Runway: 17, 5000/150, Asphalt, UNK

Weather: VMC — Clouds: UNK Broken
Visibility: 7.0 SM, None — Precip: None — Ceiling: 1,200 ft.
Wind: 320/12 — Gusts: — Lighting: NIGHT
Briefing: FSS — Type: Telephone — Complete: U

Pilot: COMM/CFI/SMEL — Hours: Last 24 Hrs - 4 — Total: 15,708
Age: 52 Yrs. — Instrument: Y — Last 30 Dys - UNK — Type: 6,800
Medical: Y — Waivers: Y — Last 90 Dys - 138 — Instmt: 1014
BFR: Y — Months Since: 1 — Aircraft: UNKNOWN — M. Eng: 1,260

Emergency Occurred During: LANDING

Pilot descended below MDA to 720 feet MSL until observing the runway during a local 17 approach at night. An airport attendant said pilot did not call unicom for wind information. Pilot acknowledged touchdown at midfield with a 30 knots tailwind on the 5,000 foot runway. The pilot said braking was ineffective. Attendant said runway was damp but standing water was not present. Aircraft ran off south end of the runway and continued 800 feet more before it hit a ditch and stopped. The pilot stated he was "in a hurry and just fouled up."

Probable Cause: PIC - Misjudged distance, Missed approach.

Factors: Weather condition - tailwind. PIC - Wind information not received, Improper use of procedure, self-induced pressure.

ASF Comments:

According to the landing distance chart with 30 degrees flaps, and a 20-30 knot tailwind under normal circumstances, this aircraft with average gross weight would have required 3-4,000 feet of dry runway over a 50 foot obstacle to stop. The highly experienced pilot (15,708 TT, 680 Type) succumbed to self-induced pressure by not requesting wind information and touching down at midfield of the 5,000 foot runway with a 20-30 knot tailwind. The POH does not show tailwinds above 10 knots and this should be considered the maximum acceptable. The bottom line is: don't ignore basic airmanship.

Landing Hard

Reference Number: 86-1682 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.09.28 1900 EST	BESS/56 (MER) 260 HP	NS62T	INSTRCTNL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	2
Pass:	0	0	0	2
Other:	0	0	0	0

Location: Shelbyville, IN
Flight Plan: NONE
Itinerary: S1. Louis, MO, to Shelbyville, IN
Airport: Shelbyville Municipal
Runway: 18, 3737/50, Asphalt, Dry

Weather:	VMC			Clouds:	Clear
Visibility:	7.0 SM, None	Precip:	None	Ceiling:	None
Wind:	0/0	Gusts:		Lighting:	DUSK
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	COMM/CFI!SMEL		Hours: Last 24 Hrs - 5	Total:	1,193
Age:	38 Yrs.	Instrument: N	Last 30 Dys - UNK	Type:	6
Medical:	Y	Waivers: Y	Last 90 Dys - 11 5	Instmt:	89
BFR:	U	Months Since: UN	Aircraft: UNKNOWN	M. Eng:	92

Emergency Occurred During: CRUISE

While at cruise after sunset, the pilots discovered that the left panel lights and the overhead light were not operating. A white beam flashlight was used to observe the airspeed indicator, however, continued use of the flashlight blinded the pilot's vision of the runway, according to the instructor pilot. Additionally, the instructor stated that on short final power was reduced to the point that the aircraft's airspeed dropped over the touchdown point and the aircraft made a hard landing. During a phone conversation the instructor pilot stated the panel lights were not checked during preflight inspection.

Probable Cause: PIC - Poor preflight planning/preparation, Inadequate airspeed, Improper flare.

Factors: Instrument lights and Flight compartment lights - Inoperative. PIC - Improper use of procedure, complacency.

ASF Comments:

The preflight and before starting checklists in the POH includes the statements: check operation of lights if night flight is anticipated, and check all circuit breakers, switches, and equipment controls. The CFI and the pilot failed to perform these checks. A safe procedure under normal conditions would be to plan a final approach to arrive about 50 feet over the runway threshold at 130% V_{SO}. Some power should have been immediately applied when the airspeed was observed dropping well above the runway. In this accident the power was apparently reduced to the point where the aircraft stalled on the runway before it was in position to land. The instructor had very low time in type and not much multi-engine experience.

Landing-Other

Reference Number: 88-1452 | Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
88.12.19 1740 CST	BE58 (MER) 285 HP	N18434	PERSONAL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	0	1
Pass:	O	O	0	3
Other:	O	O	0	O

Location: Elkhart, KS
Flight Plan: NONE
Itinerary: Wichita, KS, to Elkhart, KS
Airport: Elkhart
Runway: 17, 4,900/60, Asphalt, Dry

Weather: VMC
Clouds: Clear
Visibility: 8.0 SM, Dust
Precip: None
Ceiling: None
Wind: 190/35,
Gusts: 60
Lighting: Day
Br·iefing: FSS
Type: ACFT Radio
Complete: U

Pilot: PVT/SMEL
Hours: Last 24 Hrs - UN
Total: 2,273
Age: 58 Yrs.
Instrument: Y
Last 30 Dys - UNK
Type: 713
Medical: Y
Waivers: N
Last 90 Dys - UNK
Instmt: 196
BFR: Y
Months Since: 18
Aircraft: UNKNOWN
M. Eng: 1,378

Emergency Occurred During: LANDING

While attempting to land in strong crosswind conditions, the pilot lost directional control. The aircraft veered off the runway and was substantially damaged. The winds were gusting over 40 knots, with occasional gusts of 60 knots.

Probable Cause: PIC - Poor in-flight planning/decision. Compensation for wind conditions - Not possible - . Exceeded aircraft performance, landing capability.

Factors: Weather condition - Crosswind, Gusts. Ground loop/swerve - Uncontrolled

ASF Comments:

The pilot made a poor choice attempting to land in a strong crosswind with gusts up to 60 knots. Wind conditions at this airport far exceeded the BE58 twenty-two knot demonstrated crosswind component in the applicable POH performance chart.

Landing-Olher

Reference Number: 87-0284 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.03.24 0130 CST	BE58 (MER) 285 HP	N38077	BUSINESS	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	1
Other:	0	0	0	0

Location: Houston, MO Flight Plan:IFR
Itinerary: Ft. Worth, TX, to Houston, MO
Airport: Memorial Runway: 33,2400/60, Asphalt, Wet

Weather:	VMC			Clouds:	UNK Overcast
Visibility:	5.0 SM, UNK	Precip:	Rain	Ceiling:	1,500 ft.
Wind:	0/0	Gusts:		Lighting:	NIGHT
Briefing:	FSS	Type:	UNK	Complete:	Y

Pilot:	ATP/SMEL/HEL			Hours: Last 24 Hrs - 2	Total:	6,554
Age:	45 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	346
Medical:	Y	Waivers:	N	Last 90 Dys - 126	Instmt:	643
BFR:	Y	Months Since:	13	Aircraft: UNKNOWN	M. Eng:	3,523

Emergency Occurred During: LANDING

The airplane was on an IFR flight plan and five miles from the airport, the airplane broke out of the clouds and proceeded VFR to the airport. It was a dark night and light rain was falling. The pilot stated he flew over the airport twice looking for a wind direction indicator but could not find one. He elected to touch down on the end of the runway closest to the town lights. He landed downwind and by the time he found out the braking action was so poor, it was too late to make a go-around and too late to stop. He went off the end, crossed a road, went through a pond and stopped against small trees. A city official said the runway is lighted but the windsock and wind tee are not.

Probable Cause: PIC - Inadequate in-flight planning/decision.

Factors: Light condition - Dark night. Weather condition - Rain. Inadequate airport facilities, wind direction indicator. Airport Personnel - Inadequate wind information. PIC - Misjudged wind information, Wrong runway selected.

ASF Comments:

The pilot's decision to land at night in the rain on a 2,400 foot runway without wind direction information was risky and left little room for error. The POH estimates landing distance on a level dry runway at around 1,700 feet, with maximum braking. Add in obstacle clearance and only five knots of tailwind and the distance increases to almost 2,300 feet. Using a more conservative landing estimate of 1.6 times the minimum distance would require a runway of nearly 3,700 feet.

Reference Number: 91-0200 Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
91.01.15 0900 PST	BE58P (MERP) 325 HP	N3826K BUSINESS	AIR TAXI	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	0	0	1
Pass:	O	0	0	2
Other:	O	0	0	O

Location: Chelan, WA — Flight Plan: IFR
Itinerary: Seattle, WA, to Chelan, WA
Airport: Chelan Municipal — Runway: 02, 3539/60, Asphalt, Ice

Weather:	VMC			Clouds:	6,000 ft. Scattered
Visibility:	20.0 SM, None	Precip:	None	Ceiling:	20,000 ft.
Wind:	00/00,	Gusts:	O	Lighting:	Day
Briefing:	FSS	Type:	Telephone	Complete:	Y

Pilot:	ATP/SMEL/HEL		Hours: Last 24 Hrs - 3	Total:	6,148
Age:	43 Yrs.	Instrument: Y	Last 30 Dys - 28	Type:	40
Medical:	Y	Waivers: Y	Last 90 Dys - 111	Instmt:	742
BFR:	Y	Months Since: 04	Aircraft: BE58P	M. Eng:	1,648

Emergency Occurred During: LANDING

The pilot lost directional control while landing on a runway with patchy ice and poor braking action. The aircraft slid sideways off the end of the runway, impacted a dirt berm, and collapsed the nose landing gear.

Probable Cause: Airport facilities, runway/landing area condition - Icy.

Factors: PIC - Directional control not maintained.

ASF Comments:

Landing on icy runways is always a gamble when the braking action is poor to unknown. Directional control after landing can normally be maintained with differential power on multi-engine aircraft, however this would be counterproductive on a 3,500 foot icy runway. Another airport should have been selected. Low time in type should be considered a factor.

Landing-Other

Reference Number: 84-2848 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
84.10.26 0015 COT	BE58P (MERP) 310 HP	N187DA	BUSINESS	LANDING	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	0	1	0	0
Pass:	1	0	1	0
Other:	0	0	0	0

Location: Beeville, TX Flight Plan: IFR
Itinerary: Chattanooga, TN, to Beeville, TX
Airport: Off Airport Runway: N/A, N/NN/A, Dirt, HiVeg

Weather:	IMC			Clouds:	400 ft. Overcast
Visibility:	7.0 SM, None	Precip:	None	Ceiling:	400 ft.
Wind:	060/10	Gusts:		lighting:	NIGHT
Briefing:	FSS	Type:	Telephone	Complete:	N

Pilot:	ATP/CFI/SMEL			Hours: Last 24 Hrs - 6	Total: 2,583
Age:	27 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type: 450
Medical:	Y	Waivers:	N	Last 90 Dys - 170	Instmt: UNK
BFR:	Y	Months Since:	9	Aircraft: UNKNOWN	M. Eng: 1,995

Emergency Occurred During: LANDING

When the pilot called the FSS at 1426 EDT and filed an IFR flight plan, the FSS person began providing a weather briefing. The pilot interrupted the weather briefing and said he would check back later. He called back at 2016 EDT, but talked to another briefer and only asked for thunderstorm information at the Houston Terminal Forecast. At that time, Beeville Municipal Airport, his destination, was NOTAMed closed. The pilot took off at 2044 CDT and did not ask for NOTAM information, either before departing or while en route. During arrival, the pilot was cleared for an approa.ch to Beeville at 2355 COT. However, the lights were out and the pilot could not see the airport. He then elected to divert to NAS Chase Field, but it too was closed and its lights were out. By this time, the fuel level was low and the pilot elected to make a controlled off-airport landing. He picked a field, but during the night landing, the aircraft collided with a pile of railroad ties and a small tree. The aircraft had been airborne approximately 4½ hours. When he filed a flight plan, he reported five hours of fuel on board.

Probable Cause: PIC - Flight to alternate destination delayed, Improper in-flight planning/decision. Fluid, fuel - Low level.

Factors: PIC - Inadequate preflight planning/preparation, Notams not obtained. Light condition - Dark night. Airport facilities, runway/landing area condition - Not operating. Object - Tree(s).

ASF Comments:

FAR 91-103 required each pilot before beginning a flight to become familiar with all available information concerning that flight. Had the pilot checked for NOTAMS he would have learned the proposed destination airport was closed. When reserve fuel is being consumed, decisions to divert to alternate airports should not be delayed until an emergency occurs otherwise the choice of options could be dangerously limited.

Mech./Maint.-Landing Gear/Brakes

Reference Number: 83-0687 Data Provided By NiSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
83.02.15 1200 PST	BESS/56 (MER) 260 HP	N704CC	PERSONAL	TAXI	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	2
Other:	0	0	0	0

Location: San Francisco, CA Flight Plan: IFR
Itinerary: Unknown, to Rosenberg, OR
Airport: San Francisco Runway: UNK, Concrete, Dry

Weather:	VMC			Clouds:	8,000 ft. Broken
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	14,000 ft.
Wind:	180/15	Gusts:		Lighting:	DAY
Briefing:	UNK	Type:	UNK	Complete:	U

pilot:	ATP/SMEL			Hours:Last24Hrs-UN	Total: 15,312
Age:	61 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type: 400
Medical:	Y	Waivers:	Y	Last 90 Dys - 125	Instmt: UNK
BFR:	Y	Months Since:	4	Aircraft: CE 335/340	M. Eng: 1,431

Emergency Occurred During: STANDING

The pilot was preparing to taxi when he noticed a loose fuel cap on the aircraft's left wing. He set the parking brake, exited the aircraft with both engines operating, placed a chock on the right wheel and was securing the loose fuel cap when the aircraft started to move. He tried to hold the aircraft by the wing but it continued to turn and struck a parked Commander 690C, N155WP. The pilot stated that prior to exiting the cockpit he asked the front seat passenger to hold the brakes in case the aircraft moved. The passenger was familiar with the brakes. The passenger's attempts to stop the aircraft were not successfu l. Post accident examination disclosed that the parking brake valve did not hold pressure and the left brake linings were at minimum thickness.

Probable Cause: Landing gear, emergency brake system - Inoperative, Worn. PIC - Aircraft unattended/engine(s) running - Intentional.

Factors: Fuel system, cap - Loose. PIC - landequate aircraft preflight.

ASF Comments:

The loose fuel cap which the pilot failed to notice on his pre-flight inspection set up this accident. Although the worn brake linings/pads were the reasons the passenger could not keep the aircraft from moving, the pilot should have radioed for assistance or shut the engines down to secure the fuel cap.

Mech./Maint.-Landing Gear/Brakes

Reference Number: 87-2142 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
87.12.15 1415 EST	BE55/56 (MER) 285 HP	N707CC	PERSONAL	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	1
Other:	0	0	0	0

Location: Marathon, FL
Flight Plan: NONE
Itinerary: Keywest, FL, to Marathon, FL"
Airport: Marathon Flt. Strip
Runway: 01, 5,000/150, Asphalt, Dry

Weather:	VMC			Clouds:	N/A Broken
Visibility:	10.0 SM, None	Precip:	None	Ceiling:'	8,000 ft.
Wind:	160/14,	Gusts:	0	lighting:	DAY
Briefing:	NWS	Type:	UNK	Complete:	U

Pilot:	COMM/SMEL/SES/HEL			Hours: Last 24 Hrs - 2	Total: 1,550
Age:	32 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type: 8
Medical:	Y	Waivers:	N	Last 90 Dys - 111	Instmt: 325
BFR:	Y	Months Since:	2	Aircraft: CE172	M. Eng: 25

Emergency Occurred During: LANDING

While on a personal flight after the pilot lowered the landing gear for landing, the left main landing gear did not extend. The pilot continued the approach, and after touchdown, the aircraft veered off the runway, collided with trees, then came to rest. According to FAA Personnel, the left main landing gear did not extend possibly due to a frozen uplock roller. As a result after the pilot lowered the landing gear, the push-pull rod failed. According to Beech Aircraft Personnel, the push-pull rod could fail if the uplock roller failed. According to the owner, the aircraft and engine logbooks could not be located.

Probable Cause: Landing gear, normal retraction/extension assembly - Failure, partial.

Factors:

ASF Comments:

Aircraft and engine logbooks are essential for maintenance personnel and aircraft owners and operators to determine historical maintenance performed, failure rates, and airworthiness directives compliance. It could be considered a careless practice if aircraft and engine logbooks could not be located. The FAR's provide that logbooks be available for inspection by the Administrator and NTSB authorized personnel. Proper operation of the uplock rollers should be checked on the preflight inspection.

Mech./Maint.-Landing Gear/Brakes

Reference Number: 84-0939 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
84.07.19 1513 EDT	BESS/56 (MER) 260 HP	N4E PASSENGER	AIR TAXI	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	1
Other:	0	0	0	0

Location: North Myrtle Beach, SC Flight Plan: VFR
Itinerary: North Myrtle Beach, SC, to Columbia, SC
Airport: Grand Strand Runway: 23,5996/150, Asphalt, Dry

Weather: VMC Clouds: 2,500 ft. Broken
Visibility: 7.0 SM, None Precip: None Ceiling: 8,000 ft.
Wind: 160/10 Gusts: Lighting: DAY
Briefing: FSS Type: UNK Complete: U

Pilot: COMM/SMEL/HEL Hours: Last 24 Hrs - 3 Total: 3,884
Age: 40 Yrs. Instrument: Y Last 30 Dys - UNK Type: 426
Medical: Y Waivers: N Last 90 Dys - 122 Instmt: 697
BFR: Y Months Since: 10 Aircraft: UNKNOWN M. Eng: 1,670

Emergency Occurred During: LANDING

When the pilot extended the gear, the landing gear motor circuit breaker popped. He reset the circuit breaker and after a cool down period attempted to extend the gear again, but with the same results. The pilot was not able to extend the gear fully down and locked with the emergency extension system. The aircraft was subsequently landed with the landing gear partially extended and the gear collapsed. Exam revealed that several PIN 5201 KD bearings were broken and had become jammed between the worm gear and the gear box housing of the landing gear actuating system. There was little gear lubricant in the actuator. The actuator had been operated 4,538 hours since new and had not been overhauled. The manufacturer's recommended overhaul period is 2,000 hours.

Probable Cause: Landing gear, normal retraction/extension assembly, Emergency extension assembly - Jammed. Company Maintenance Personnel - Inadequate maintenance, lubrication, Maintenance, replacement not performed.

Factors:

ASF Comments:

Owners and operators should maintain records of when overhaul and/or parts replacements are due. Manufacturers recommended parts overhaul rates are normally based on historical failure rates and should be carefully monitored for compliance. Additionally, checking the actuator for gear lubricant is an annual inspection item.

Mech./Maint.-Landing Gear/Brakes

Reference Number: 83-2977 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
83.06.20 1709 COT	BESS/56 (MER) 260 HP	N7712R	BUSINESS	LANDING	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Pineville, LA Flight Plan: NONE
Itinerary: Monticello, AR, to Pineville, LA
Airport: Esler Regional Runway: 08, 6000/1 50, Asphalt, Dry

Weather:	VMC			Clouds:	4,000 ft. Scattered
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	None
Wind:	080/05	Gusts:		Lighting:	DAY
Briefing:	FSS	Type:	Telephone	Complete:	Y

Pilot:	PVT/SMEL			Hours: Last 24 Hrs - 1	Total: 3,067
Age:	54 Yrs.	Instrument:	N	Last 30 Dys - UNK	Type: 1,544
Medical:	Y	Waivers:	Y	Last 90 Dys - 15	Instmt: UNK
BFR:	Y	Months Since:	13	Aircraft: UNKNOWN	M. Eng: 1,576

Emergency Occurred During: APPROACH

Prior to landing, the pilot moved the gear switch to the extend position and noted that the gear indicated down. However, the left main gear did not extend. While landing with the left gear retracted, the aircraft settled on the left wing and propeller. The aircraft spun 180 degree to the left and came to rest in a grassy area off the runway. An exam revealed the left main gear cable was loose, the respective uplock was worn and the left gear was stuck in the up position. The last annual inspection was performed on May 12, 1982. The gear position indicator indicated the landing gear actuator arm position rather than the actual gear position.

Probable Cause: Company/operator MGMT - Inadequate maintenance, inspection of aircraft. Landing gear, normal retraction/extension assembly - Loose, Worn.

Factors:

ASF Comments:

Pilots are responsible, in accordance with FAR 91.409, to ensure that an aircraft is not operated unless within the preceding 12 calendar months it has had an annual inspection or such other periodic inspection as may be appropriate and authorized by that FAR. The accident occurred 20 days after the annual inspection was due. Generally aircraft insurance is invalid unless annual or other approved periodic inspections are performed. One must also keep in mind that on older model Barons, the illumination of the green landing gear light does not necessarily mean that all the gear is down and locked. It only indicates that the down limit switch was tripped.

Mech./Maint.-Vacuum System Instruments

Reference Number: 82-1445 Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.04.06 0923 EST	BESS/56 (MER) 280 HP	N4375A	BUSINESS	CRUISE	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	0	0	0
Pass:	1	0	0	0
Other:	0	0	0	0

Location: Scandia, PA
Itinerary: Bradford, PA, to Alton, IL
Airport: Off Airport
Flight Plan: IFR
Runway: N/A

Weather: IMC
Visibility: UNK, Snow
Wind: 005/15
Briefing: None
Precip: Snow
Gusts:
Type: N/A
Clouds: UNK Indefinite
Ceiling: UNK
Lighting: DAY
Complete: N

Pilot: COMM/CFI/SMEL
Age: 49 Yrs.
Medical: Y
BFR: Y
Instrument: Y
Waivers: N
Months Since: UN
Hours: Last 24 Hrs - 1
Last 30 Dys - UNK
Last 90 Dys - 68
Aircraft: UNKNOWN
Total: 1,273
Type: 353
Instmt: UNK
M. Eng: UNK

Emergency Occurred During: CLIMB

At 0834 EST, the pilot departed Bradford Airport on an IFR flight to Alton, Illinois. About four minutes later, he advised that he was having difficulty with his flight instruments while in IFR conditions. He attempted to return to the departure airport by using direction finder steers, but was unable. He then contacted Cleveland Center and was cleared to climb to 8,000 feet MSL. The center recommended that the pilot proceed to Toronto, Canada to the nearest airport with acceptable weather. However, the pilot was unable to control his altitude and heading, and subsequently, entered a dive and crashed. The HSI (attitude indicator), directional gyro and turn coordinator were found to be pneumatic pressure instruments, all operating from the same system. The pneumatic pressure system incorporated two pressure pumps, one on each engine. An inspection of the pumps revealed that both pump drives were sheared. Radio calls from the pilot had identified that all pressure instrument readings were faulty. Weather: Turbulence, low ceiling, snow.

Probable Cause: Pneumatic system - Failure, total. PIC - Improper use of equipment/aircraft, spatial disorientation.

Factors: Weather condition - Snow, Low ceiling, Turbulence in clouds.

ASF Comments:

Without a turn coordinator or a turn and bank indicator, partial panel instrument flying would be just about impossible. Normally, except for this aircraft, the HSI and the turn coordinator are electrically powered. With the failure of both vacuum pumps, there was little, if anything, the pilot could have done to prevent spatial disorientation under IMC. It would be prudent for owner/operators who may have all pneumatic operated flight instruments, to consider installing an electric turn coordinator or turn and bank indicator for use in similar emergencies. The instrument should be installed in close proximity to the other flight instruments. If panel space allows, an electrical attitude indicator is a good investment. There is some doubt that the pilot did not check the pumps on runup as the probability of dual failure is very low.

Reference Number: 82-3217 | Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.12.06 1748 MST	BEs8 (MER) 285 HP	N18HM	BUSINESS	TAKEOFF	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	1
Pass:	0	0	0	0
Other:	0	0	0	0

Location: Lovington, NM
Flight Plan: NONE
Itinerary: Lovington, NM, to Santa Fe,'NM
Airport: Lovington
Runway: 21,4,000/80, Asphalt, Dry

Weather: VMC
Visibility: 20.0 SM, None
Precip: None
Wind: 170/1 0
Gusts:
Briefing: UNK
Type: Radio
Clouds: None None
Ceiling: None
Lighting: DAY
Complete: Y

Pilot: PVT/MEL
Age: 52 Yrs.
Medical: Y
BFR: Y
Instrument: N
Waivers: N
Months Since: UN
Hours: Last 24 Hrs - 2
Last 30 Dys - UNK
Last 90 Dys - 44
Aircraft: UNKNOWN
Total: 6,216
Type: 4,652
Instmt: 58
M. Eng: 4,607

Emergency Occurred During: TAKEOFF

The pilot reported that while taking off with a light crosswind, the right passenger door opened. While trying to catch papers and hold the door, the right propeller struck the runway and the right main gear began collapsing. By this time, the pilot decided there was insufficient runway remaining to abort, so he continued the takeoff. An emergency landing was made on the same runway by setting the plane down on the left main and nose gear. As the speed reduced, the right wing settled and a propeller blade separated and penetrated the fuselage. No discrepancy was reported concerning the door latch.

Probable Cause: PIC - Inadequate aircraft preflight, Improper use of equipment/aircraft, diverted attention.

Factors:

ASF Comments:

The pilot allowed his attention to be diverted from flying the airplane trying to hold the unlatched door and prevent papers from exiting the aircraft. Proper attention to the preflight checklist would have insured the door was secured. As a precaution, charts and other documents should be secured in the cockpit with clipboards or other devices. There is a Beechcraft Service Bulletin (SB) which addresses cabin doors.

Reference Number: 82-0678 Data Provided By NTSH

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.04.25 1300 EDT	BESS/56 (MER) 260 HP	N38198 DUAL	INSTRCTNL	TAKEOFF	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	0	0	0	2
Pass:	0	0	0	2
Other:	0	0	0	0

Location: Gainesvilie, FL
Flight Plan: NONE
Itinerary: Gainesville, FL, to Local
Airport: Gainesvilie Regional
Runway: 10, 6,502/150, Macadam, Dry

Weather: VMC
Clouds: 1,200 ft. Overcast
Visibility: 7.0 SM, None
Precip: None
Ceiling: 1,200 ft.
Wind: 150/1 3
Gusts:
Lighting: DAY
Briefing: None
Type: N/A
Complete: N

Pilot: ATP/CFI/SMEL
Hours: Last 24 Hrs - 1
Total: 4,720
Age: 37 Yrs.
Instrument: Y
Last 30 Dys - UNK
Type: 30
Medical: Y
Waivers: N
Last 90 Dys - 128
Instmt: 593
BFR: Y
Months Since: UN
Aircraft: UNKNOWN
M. Eng: 1,100

Emergency Occurred During: TAKEOFF

The purpose of the flight was to give dual instruction to the owner/student whose multi-engine rating was limited to centerline thrust models. The student was flying the aircraft on the takeoff roll when the cockpit door became ajar. The aircraft was near lift-off speed and the student intended to continue taking off. The instructor reported that he gave two commands to abort, but they were not heard by the student due to noise coming from the open door. The instructor retarded the throttles to idle power; however, the aircraft became airborne and bounced on the runway before the student reapplied the power and regained control of the aircraft. Thereafter, the student landed from a full circuit approach without further incident. However, the right propeller was damaged and wrinkles were found on right wing and fuselage.

Probable Cause: PIC (CFI) - Inadequate instructions, written/verbal, Improper supervision.

Factors: Door - Not engaged, Open. Dual student - Inadequate aircraft preflight, Improper use of procedure, diverted attention, Visual/aural perception. Aborted takeoff not performed. PIC (CFI) - Crew/group coordination not attained.

ASF Comments:

If there ever was an example of the importance of cockpit resource management, this accident fills the bill. Prior to takeoff, both the pilot and the CFI should have visually verified the door engagement. According to the POH an unlatched door in flight does not affect the flight characteristics of the airplane except for a reduction in performance. Return to the airport in a normal manner is advised. The owner/student correctly intended to continue the takeoff, but the CFI intervened and retarded the throttles until the student reapplied power and regained control. The question of who was pilot-in-command prior to and during this accident remains in question. This should be thoroughly discussed and determined before flight.

Takeoll/initial Climb

Reference Number: 86-2433 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.11.12 1755 PST	BESS/56 (MER) 285 HP	N8386N	BUSINESS	TAKEOFF	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	O	O	O
Pass:	1	O	O	O
Other:	O	O	O	O

Location: Livermore, CA Flight Plan: IFR
Itinerary: Livermore, CA, to Colusa, CA
Airport: Livermore Runway: 07, 4,000/1 00, Asphalt, Dry

Weather:	VMC			Clouds:	20,000 ft. Scattered
Visibility:	10.0 SM, None	Precip:	None	Ceiling:	None
Wind:	070/10	Gusts:		lighting:	NIGHT
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	PVT/SMEL			Hours: Last 24 Hrs - UN	Total:	2,425
Age:	46 Yrs.	Instrument:	Y	Last 30 Dys - 21	Type:	256
Medical:	Y	Waivers:	N	Last 90 Dys - 52	Instmt:	UNK
BFR:	Y	. Months Since:	11	Aircraft: BESS/56	M. Eng:	256

Emergency Occurred During: TAKEOFF

Witnesses stated that the aircraft started the takeoff roll, became airborne at about 1,000 feet down the runway, climbed to an altitude of about 50 feet, rolled to the left and crashed inverted onto a parallel taxiway at about mid-field. There was no fire. Exam of wreckage revealed that the fuel selector for the right engine was on right main while the selector for the left engine was on the auxiliary fuel tank. OP manual states they should both be on mains for takeoff. Left propellers were found nearly straight while right propellers were found bent rearward.

Probable Cause: PIC - Airspeed (V_{MC}) not maintained, inadvertent stall.

Factors:

ASF Comments:

The aircraft had just enough fuel to become airborne before crashing. The POH preflight check list provides that fuel is to be checked visually. V_{MCA} must always be maintained at the expense of altitude to avoid a stall/spin situation. The proper procedure in this accident would have been to reduce power on the operating engine and land. The airspeed must never be allowed to decay below V_{MCA}. It is far better from a survival standpoint to place the aircraft on the ground under control than to allow it to crash out of control. Continued takeoff is possible in certain circumstances and may be successful if the pilot is proficient.

Takeoff/Initial Climb

Reference Number: 85-0577 Data Provided By NTSH

Date & Time	Ai.rcraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
85.06.30 1030 EDT	BESS/56 (MER) 260 HP	N2781 F	PERSONAL	TAKEOFF	SUBSTNTL

Injuries:	Fatal	Serious	Minor	None
Crew:	O	O	O	1
Pass:	O	O	O	2
Other:	O	O	O	O

Location: Savannah, GA Flight Plan: IFR
Itinerary: Savannah, GA, to Vidalia, GA
Airport: Savannah Runway: 36,3,800/150, Macadam, Dry

Weather: VMC Clouds: 1,200 ft. Broken
Visibility: 10.0 SM, None Precip: None Ceiling: 1,200 ft.
Wind: 270/07 Gusts: Lighting: DAY
Briefing: FSS Type: Telephone Complete: Y

Pilot: PVT/SMEL Hours: Last 24 Hrs - 0 Total: 515
Age: 34 Yrs. Instrument: Y Last 30 Dys - UNK Type: 55
Medical: Y Waivers: Y Last 90 Dys - 55 Instmt: 93
BFR: Y Months Since: 2 Aircraft: BE 55/56 M. Eng: 55

Emergency Occurred During: TAKEOFF

Before taking off, the pilot checked the trim and the auto-pilot. During the takeoff run, he noted that the "Aircraft felt heavy on rotation/takeoff aborted." The aircraft continued off the end of the runway, hit a mound of dirt and was damaged. A post-accident exam revealed that both the auto-pilot and electrical trim were on and the elevator trim was in the full nose down trim position. According to the operator's manual, the auto-pilot should have been in the off position for take-off. Not all of the runway was available for takeoff; the pilot had 3,800 feet remaining from where he began his takeoff roll.

Probable Cause: PIC - Improper aircraft preflight, Trim setting not identified. Autopilot! flight director - Engaged.

Factors: Terrain condition - Dirt bank.

ASF Comments:

There is nothing wrong with engaging the flight director for takeoff to provide heading and pitch commands for departure and climb out. In fact this would enhance safety. What the pilot failed to do in this situation was to follow the preflight and before takeoff checklist which provides that trim tabs are to be set to zero and the electric elevator trim operation is to be checked. Flight controls are to be checked for freedom of movement, proper direction, and full travel. Despite not catching the trim problem until late in the takeoff roll, the pilot made the correct decision to reject the takeoff. He accepted damage to the aircraft rather than lose control with probable serious injuries or fatalities.

Reference Number: 86-2763 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
86.12.27 0632 PST	BESS/56 (MER) 285 HP	N111 FC	PERSONAL	DESCENT	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	O	O	O
Pass:	5	O	O	O
Other:	O	O	O	O

Location: East Palo Alto, CA Flight Plan: VFR
Itinerary: East Palo Alto, CA, to Tijuana, Mexico
Airport: Palo Alto Runway: 30, 2500/65, Asphalt, Dry

Weather: VMC Clouds: Part Obs. Broken
Visibility: 5.0 SM, Haze Precip: None Ceiling: 12,000 ft.
Wind: Gusts: Lighting: NIGHT
Briefing: FSS Type: Telephone Complete: N

Pilot: PVT/SMEL Hours: Last 24 Hrs - UN Total: 1,870
Age: 44 Yrs. Instrument: Y Last 30 Dys - UNK Type: UNK
'Medical: Y Waivers: Y Last 90 Dys - UNK Instmt: UNK
BFR: U Months Since: UN Aircraft: UNKNOWN M. Eng: UNK

Emergency Occurred During: TAKEOFF

The pilot and five passengers departed for a planned vacation in Mexico in dark light conditions. The aircraft was observed to depart from runway 30, turn from the crosswind to the downwind leg and the aircraft "Lost altitude rapidly" and impacted in the San Francisco Bay. A pilot who is familiar with the Palo Alto Airport stated that when making a right crosswind from runway 30 "The bay waters and the horizon can blend as one." The pilot must "reference flight instruments for a short period. It can catch a pi lot by surprise." The pilot received his instrument rating in 1975. No record of instrument currency could be found.

Probable Cause: PIC - Improper use of equipment/aircraft, spatial disorientation, Improper use of fl ight controls.

Factors: Light condition - Dark night. Weather condition - Haze. PIC - Improper use of procedure, over confidence in personal ability and Lack of recent instrument time.

ASF Comments:

Instrument proficiency and currency has been well established as the safest procedure for night operations.When non-instrument-rated pilots operate at night, they should at least have basic instrument proficiency to avoid possible spatial disorientation. Periodic night local takeoffs and landings, and traffic pattern operations with a flight instructor should provide the non-instrument-rated pilot with the requisite night flying skills. Five miles in haze over water must be considered an instrument operation although it meets VFR minimums.

Takeon/lnitial Climb

Reference Number: 82·0470 — Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.06.03 1630 EDT	BESS/56 (MER) 260 HP	N677F	EXEC/CORP	TAKEOFF	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	1	O	0	O
Pass:	4	O	0	O
Other:	O	O	0	O

Location: Ithaca, NY — Flight Plan: IFR
Itinerary: Harrisburg, PA, to Ithaca, NY
Airport: Tompkins County — Runway: 32,5801/150, N/A, N/A

Weather:	VMC			Clouds:	Unk
Visibility:	5.0 SM, Fog	Precip:	Rain	Ceiling:	Unk
Wind:	033/04	Gusts:		Lighting:	DAY
Briefing:	None	Type:	N/A	Complete:	N

Pilot:	ATP/CFI/SMEL			Hours: Last 24 Hrs - UN	Total:	8,589
Age:	37 Yrs.	Instrument:	Y	Last 30 Dys - UNK	Type:	397
Medical:	Y	Waivers:	N	Last 90 Dys - UNK	Instmt:	UNK
BFR:	Y	Months Since:	UN	Aircraft: UNKNOWN	M. Eng:	UNK

Emergency Occurred During: TAKEOFF

The takeoff was observed to appear normal for 2,500 feet. At about 150 feet in the air the aircraft rolled sharply left. The roll continued to an inverted position, after which the aircraft descended in a near vertical attitude. The aileron-elevator control locking pin was found engaged in the underside of the control column.

Probable Cause: PIC - Inadequate aircraft preflight, Removal of control/gust lock(s) not performed. Flight control, gust lock engaged.

Factors:

ASF Comments:

The very first POH preflight inspection checklist item for the BE 55/56 aircraft is 'remove and stow gust lock.' Later, the before takeoff checklist specifies: 'check proper direction, full travel and freedom of movement of flight controls.' The highly experienced instrument-rated pilot may have been anxious to depart on his/her IFR flight.

Reference Number: 82-3337 Data Provided By NTSB

Date & Time	Aircraft Data	Registration No.	Type Operation	Phase Occurred	Aircraft Damage
82.09.24 1355 COT	BE58P (MERP) 310 HP	N2027C	PUBLIC USE	TAKEOFF	DESTROYD

Injuries:	Fatal	Serious	Minor	None
Crew:	0	1	0	0
Pass:	1	2	0	0
Other:	0	1	0	0

Location: Midland, TX Flight Plan: NONE
Itinerary: Midland, TX, to Baton Rouge, LA
Airport: Midland Airpark Runway: 25, 581 0/150, Macadam, Dry

Weather: VMC Clouds: 25,000 ft. Overcast
Visibility: 25.0 SM, None Precip: None Ceiling: 25,000 ft.
Wind: 070/08 Gusts: Lighting: DAY
Briefing: None Type: N/A Complete: N

Pilot: COMM/SMEL Hours: Last 24 Hrs - 4 Total: 3,730
Age: 56 Yrs. Instrument: Y Last 30 Dys - 62 Type: 115
Medical: Y Waivers: Y Last 90 Dys - 135 Instmt: 73
BFR: Y Months Since: UN Aircraft: UNKNOWN M. Eng: 836

Emergency Occurred During: TAKEOFF

An intersection takeoff was started near the middle of runway 25 with 2,096 feet remaining. The pilot stated the takeoff was normal until he started making an initial power reduction to 34 inches and 2,400 RPM. At that time, the left engine reportedly continued to lose power and manifold press. The pilot attempted to restore power momentarily, then moved "All handles" forward and lowered the nose as long as he could to build up speed. As he approached an apartment building, he pulled up, but the plane hit the roof, then impacted in a parking lot and burned. The pilot, passengers and a resident of the apartment were burned. During the investigation, no mechanical defects were found that would cause a loss of power. The 1419 CDT weather was (in part): temperature 85 degree, wind 070 degree at eight knots, altimeter 30.07, and the elevation was 2,805 feet. The distance from the intersection to the apartment building was 2,477 feet. The distance to clear a 50 foot obstacle would have been 4,000 feet at the maximum gross weight limit. The estimated gross weight was 195 pounds over the 6,100 pound limit. The maximum weight to achieve single engine rate of climb at lift off wou ld have been 5,050 pounds.

Probable Cause: Undetermined. PIC - Inadequate preflight planning/preparation, Improper emergency procedure, Gear retraction not performed, Airspeed not maintained, Inadvertent stall/mush.

Factors: Weather condition - High density altitude. Object - Residence.

ASF Comments:

The decision to takeoff above the maximum gross weight to achieve safe single engine rate of climb at liftoff indicates the pilot did not refer to the performance charts for the density altitude of the departure airport. The intersection departure with only 2,096 feet of runway remaining and, conditions that day requiring 4,000 feet to clear a 50 foot obstacle with both engines at maximum gross weight, made the accident quite predictable. Failure to retract the landing gear and secure the failed engine, and deteriorating airspeed contributed to the inevitability of an uncontrolled contact with the ground.

• Notes •

Part 3

Atraining outline 'or instructors and pilots to use in incorporating risk management techniques into transition and recurrent training.

Emphasis is given to those areas that have historically been shown to have a high risk 'actor.

Beechcraft Baron Training Course Outline

Introduction

This outline is a training guide for pilots and flight instructors. Because of variables involving pilot experience and proficiency, the training should be flexible. For example, a thorough discussion of IFR procedures and regulations is recommended for pilots who are not current. For more proficient pilots this much instruction may not be necessary and training should be adjusted accordingly. Pilots undergoing this training should be multi-engine rated. If the pilot is obtaining a multi-engine rating or has little experience in twins, much more time will be required.

Portions of this program are derived from the General Aviation Manufacturers Association (GAMA) Transition Training Master Syllabus and their support is gratefully acknowledged.

At the satisfactory conclusion of training the pilot should receive an Instrument Competency Check (ICC) if instrument rated and a Biennial Flight Review (BFR). This Training Course Outline is divided into four blocks of instruction. The first block consists of three hours of ground orientation concentrating on the Baron, its systems, and pilot procedures. The second block reviews normal and emergency VFR procedures and elementary IFR procedures. The third block reviews instrument flight operations while the fourth block concentrates on cross-country flight. The time required to complete this training will vary with pilot proficiency. Average time to complete each block is indicated in the table below and in some instances blocks may be combined for efficiency:

Block	Ground	Flight
1. Ground Orientation	3.0 Hours	-0-
2. General Flight Operations	1.5 Hour	2.5 Hours
3. IFR Operations	2.0 Hours	2.0 Hours
4. Cross Country	1.0 Hour	2.0 Hours
Total: 14 hours	7.5 Hours	6.5 Hours

A suggested lesson content for each block is presented in an orderly sequence. Individual instructors will determine what order of presentation works best for them but they should ensure that all items are covered. To aid in this, a checklist of lesson content items is provided. Using this checklist, instructors will evaluate pilot proficiency in each item. All lesson items should be completed by transitioning pilots. The instructor and pilot will determine which items to cover in recurrency training.

While this training course outline is comprehensive, there are certain emergencies that should be discussed only. Simulator training, where possible, should be used to practice these maneuvers and procedures safely.

Questions from the open-book test should be assigned as appropriate during the course of training.

AWord About Simulator Training

A study done by Flight Safety International (a simulator training organization) once revealed that only about 25% of the multi-engine emergency procedures could be safely and effectively trained in the aircraft. The other 75% were either too dangerous to do or impossible to duplicate realistically. Pilots and instructors should approach the corners of the multi-engine aerodynamic envelope very cautiously. Far more aircraft are lost in "training situations" than in actual emergencies. Typically the scenario will involve a practice engine failure on takeoff, a practice single-engine landing or an exploration of minimum control airspeed.

These cases allow little or no margin for error. It is not safe to fully load the aircraft and practice engine failures on takeoff at high density altitudes and yet pilots do operate their aircraft in those conditions. This is why it is essential for pilots of multi-engine aircraft to periodically participate in simulator training.

The simulators available today have varying degrees of fidelity. Some closely duplicate the physical and flight characteristics of a particular aircraft while others serve only as procedure trainers. Either way, there is a definite benefit to exploring the absolute maximum performance that can be expected from the typical light twin. In many cases pilots are surprised by the lack of performance under adverse conditions. The simulated training environment will clearly demonstrate aircraft and pilot limitations.

One of the most valuable skills that pilots learn in simulation is what cannot be done. A rejected takeoff is probably the most undertrained lifesaving maneuver in the aircraft. Why? It entails wear and tear on the aircraft and carries the potential for loss of control on or near the runway. This is unacceptable in practice yet may be the only way to avoid a serious accident in reality. Rejected takeoffs can be practiced constantly in the simulators with no downside consequences. The major benefit is the mental and physical conditioning that the pilot develops. This provides the judgment and confidence to make the right decision in a hurry when it's needed.

The following information on simulator training was supplied by Flight Safety International. At time of publication, Flight Safety International of Wichita, Kansas and Sim Com International, Inc. of Orlando, Florida were the only two companies which operated Baron simulators available for commercial use.

Most pilots could fly almost any general aviation airplane from point A to point B with minimal training. As long as nothing unexpected happens, a pilot may accumulate hundreds of hours of "normal" flying. During this time, the pilot develops procedures and habits which are oriented toward "normal" flying. This works fine until the pilot confronts an abnormal or emergency condition which requires a response outside of the "normal" range.

What happens when a pilot confronts an emergency? The answer will be determined largely by how well prepared the pilot is. Pilots are normally thinking, judging, and calculating as they fly. However, situations do occur where the pilot begins to fall behind in processing all the needed information. Accidents are more likely to occur when pilots get into this mode, which could be called operation with limited, or loss of, situational awareness.

Complete training combines a strong base of aircraft knowledge with the experience of handling critical emergencies in a realistic situation. Training pushes the threshold of situational awareness loss further out. An untrained pilot may become overloaded with a relatively minor problem that a trained pilot can handle with ease. A well-trained pilot should maintain situational awareness even when the going is really tough.

Aircraft instruction has limitations which interfere with effective training. An instructor in the front seat limits .realism and contaminates the learning process. The pilot's behavior is altered during instruction because he is flying and trying to listen to the instructor. An instructor often short-circuits real learning in an airplane because the lesson might conflict with ATC or cause an accident. Just about the time the pilot is about to get the education of his life, the instructor interrupts the process to avert the disaster. ➤

Beechcralt Baron Test Questions

This is an open book test. Please complete the questions by referring to the POH for *your* aircraft and review them with a qualified instructor with experience in the Baron. Questions should be modified and/or deleted if non-applicable to the specific model to be used for checkout, i.e., the Pressurized/Turbo, etc. These test questions were based on a POH for a BE5S with serial numbers of TH1472 and later (except for a select few).

1. What is the total fuel capacity? Usable? .
2. What is the correct fuel grade? .
3. Where are the fuel drains located and when are they drained? .
4. What is the recommended grade and type of oil? .
5. What is the minimum operating oil level? .
6. What is the empty weight? Useful load? .
7. What is the maximum takeoff gross weight? .
8. What are the recommended airspeeds and flap settings for:

   Normal takeoff Flaps .
   Normal landing Flaps .
   One engine inoperative Flaps .

9. How much fuel would be required and what power settings would you use to hold at 9,000 feet for 1 hour?

10. List the following airspeeds:

    Liftoff .
    Two-engine best rate of climb (V_y) ....
    Two-engine best angle of climb (V_X) ....
    Single engine best rate of climb (V_{YSE}) ....
    Intentional one-engine inoperative (V_{SSE}) ....
    Maneuvering speed, maximum gross weight (VA) .
    Minimum control (V_{MCA}) ....
    Turbulent air penetration .
    Maximum flap extension (V_{FE}) ....
    Maximum gear extension (V_{LE}) ....
    Stalling speed, clean (V_S) .
    Stalling speed, landing configuration (V_{SO}) .
    Best glide .
    Never exceed (V_{NE}) ....

11. What is the maximum demonstrated crosswind component? .

12. What are the unsafe gear indications? .

13. What is the procedure for emergency gear extension? .

14. What would be the indication of alternator or generator malfunction? .

15. What would you do if unable to restore the alternator/generator power? .

16. What flight instruments are electrically powered? .

17. In the event the electrical system failed, what flight instruments would be available? .

18. Where is the alternate static source located? .

19. What is the power setting, fuel flow, and TAS for the following at 5,200 lbs. gross weight?

20° lean of peak EGT, 7,000 feet, standard temperature: .
Manifold pressure/RPM: .
Fuel consumption: TAS: .

20. What aircraft documents must be onboard during flight? .

21. What is the engine failure procedure after liftoff and in flight if an immediate landing straight ahead is not possible? .

22. Explain use of the fuel cross-feed system: .

23. Compute the takeoff distance:

Pressure Altitude: 4,000 feet; OAT: +20 degrees C; Gross Weight 5,300 lbs.; Wind: 10 knots
Ground roll: .
Total distance over 50 foot obstacle: .

24. Describe the engine starting procedure at altitude with unfeathering accumulators installed: .

25. Describe the emergency descent procedure: .

26. What is the accelerate/stop distance at maximum gross weight? .

27. List the anti-icing and deicing protection equipment installed on your aircraft? .

28. What is the minimum speed for operating in ice conditions? .

Beechcralt Baron
Answers to Test Questions

These answers are based on a model 68. They may diner tram your POH.

1. Standard 142 gallons, with 136 gallons usable.

2. 100LL or 115/145

3. One behind each wheel well
   Wingtip tanks (if installed)
   One at each wing leading edge
   Tanks are drained at pre-flight

4. Ashless dispersant
   Below 5 degrees C: SAE 30 or 15W-50, 20W-50
   Above 5 degrees C: SAE 50 or 15W-50, 20W-50, 25W-60

5. Twelve quarts

6. Empty weight and useful load must be obtained from weight and balance documents of each individual aircraft.

7. BE58: 5,500 Ibs.; BE58A: 4,990 Ibs.

8. 85 knots no flaps, 95 knots flaps at 30 degrees

9. Twenty gallons, 21 inches Hg, and 2,100 RPM.

10. Liftoff: 85 knots
    V_y: 105 knots
    V_X: 92 knots
    V_{YSE}: 101 knots
    V_{SSE}: 88 knots
    VA: 156 knots
    VMeA: 84 knots
    Never exceed (V_{NE}): 223 knots
    Turbulent Air: 156 knots
    Maximum flap extension (V_{FE}): 15 degrees at 152 knots
    30 degrees at 122 knots
    Maximum gear extension (V_{LE}): 152 knots
    Stall speed, clean (V_S): 84 knots
    Stall speed, full flaps (V_{SO}): 74 knots
    Best glide: 11 5 knots

11. 22 knots-demonstrated crosswind

12. Landing Gear Position lights

13. Pull landing gear motor circuit breaker
    Gear switch: down
    Engage handcrank and turn counterclockwise as far as possible-about 50 turns.

14. Red annunciator light(s) will illuminate. Also, look at manual indicators.

15. Reduce electrical load to conserve battery power.

16. Turn coordinator and flight director system except for the attitude indicator which is normally vacuum powered.

17. Normally, the attitude indicator, altimeter, VSI, airspeed indicator. On some aircraft, a spare DG is available if a flight director is installed.

18. On the left sidewall adjacent to the pilot.

19. Fuel flow: 14.1 GPH per engine; TAS: 196 knots; manifold pressure: 23 inches Hg at 2,500 RPM

20. Airworthiness certificate and radio station license.

21. Landing Gear: UP
    Throttle, Inoperative, engine: CLOSED
    Propeller, Inoperative, engine: FEATHER
    Power, Operating engine: AS REQUIRED
    Airspeed: Maintain speed at engine failure (100 knots maximum) until obstacles are cleared.

22. In an emergency, to enable fuel to be used from the opposite side of a failed engine.

23. Ground roll: 1,900 feet; total distance over 50 foot obstacle: 3,200 feet

24. Move propeller control full forward of feathering detent until engine runs at 600 RPM; then back to detent to avoid overspeeding. Use starter momentarily if necessary.

25. Throttles closed; propellers 2,700 RPM; airspeed 152 knots; landing gear down; flaps 15 degrees.

26. 2,900 feet

27. Deice boots, pilot's heated windshield, electrical heated propellers, pitot heat, stall warning anti-ice, heated fuel vents.

28. 130 knots

Beechcraft Baron Training Outline

Block l-Ground Orientation

Objective:

In this lesson the pilot will review the pilot's operating handbook and all documents covering modifications to the aircraft and electronic equipment installed. In-cockpit familiarization will be accomplished 'and Baron accident history will be discussed.

Completion Standards:

This lesson will be complete when the pilot is able to accurately describe Baron operating systems and their operation, emergency procedures, aircraft limitations (including airspeeds for various operations), performance determination, and proper aircraft serv.icing. The pilot will also be familiar with the accident history of the airplane. Depending on aircraft configuration, not all of the items may be installed on all models of the Baron.

Note: *This critical phase ofpilot standardization should be completed prior* to *flight and not reduced* to a *homework assignment. The pilot must have* a *solid understanding of the aircraft before attempting* to *operate it*.

Study Assignment:

In preparation for block two, the pilot will review normal and emergency operations of the POH and will calculate weight and balance, takeoff, and landing performance data for aircraft with loading as determined by the instructor.

Ground: 3.0 Hours

Comments

o Airplane and Systems

Flight Controls
- Control locks

Installed Instruments and Avionics

Landing Gear System
- Manual extension

Brakes

Seats, Seat Belts, and Doors

Engines and Engine Instruments
- Cowl flaps

Propellers
- Synchrophaser, synchroscope, accumu lators

Fuel System
- Crossfeed
- Fuel Boost pumps

Ground: continued

Electrical System
- External power

Lighting Systems

Environmentai System
- Pressurization/air conditioning
- Cabin heating and cooling

Pitot-Static System and Instruments
- Alternate static system

Vacuum System and Instruments

Anti-ice and deice Systems
- Surface deicing
- Windshield
- Propeller
- Pitot
- Stall warning
- Heated fuel vents
- Engine ice protection

Supplemental Oxygen System

Turbocharged Engine System
- Waste gate and exhaust bypass
- Variable absolute pressure controller
- Operational characteristics

O Aircraft Servicing

Required Inspections

Ground Handling

Fueling

Oil, Hydraulic, Oxygen Replenishment

o Performance

Pressurization controller settings

Use of Performance Charts

Power settings

Takeoff Distance, Time, Fuel and Distance to Climb Charts

Accelerate-stop and accelerate-go

Cru ise Performance Charts

Comments

Ground: continued

Range and Endurance Charts

Stall speeds

Landing Distance Charts

Climb-one engine inoperative

Service ceiling-one engine inoperative

O Weight and Balance Determination

Review of Aircraft Equipment List

Determination of Weight and Balance from Sample Loadings

O Limitations

Placards

Airspeeds, altitude

Powerplants

Fuel, endurance

Operating Instrument Indications

Weight limits, center of gravity

O Normal Procedures

Speeds for Normal Operation

Preflight Inspection

Cold weather operation

Engines Start and Runup

Taxiing

Normal, Short Field and crosswind Takeoffs

Normal and Maximum Performance Climbs

Cruising Flight

Ice protection systems

Pressurization system

Oxygen system

Descents

Comments

Ground: continued

Normal, Short Field and crosswind Landings

Balked Landings and Go-Arounds

Flap Retraction Procedures

After Landing, Securing the Aircraft

V_{MCA} demonstration-not required for checkout; may be required for multi-engine certification only. CAUTION: consult POH before performing.

O Emergency Procedures

Airspeeds for Emergency Operations

Engine Failure and operation Procedures

Engine fires-ground, in-flight

Engine air starts

Emergency and Precautionary Landings

Icing

Vacuum, Pitot and Static System Failures

Electrical System Malfunctions
Smoke, fire

Emergency Landing Gear Extension

Emergency Descents

Inadvertent Door Opening in Flight

Emergency exits

O Add'l system-related areas of emphasis

Autopilot and Electric Trim Malfunctions

Relationship of Vacuum Failures to Autopilot Operation

Electrical System and What to do if Charging System fails

Load shedding and estimated time of usable battery life

Hung Starter Indications and Remedies

Emergency Checklists

Relationship between EGT and fuel flow on climb and cruise

Comments

Areas of Special Emphasis:

The Beechcraft Baron is a high-performance aircraft well suited for IFR cross-country and more advanced pilot utilization. Because of system complexities, pilots operating these aircraft should maintain a high level of proficiency and currency.

Nearly 80 percent of all Baron accidents are pilot-related. Some of the area of special emphasis which may need attention are described below:

A significant number of Baron accidents are due to fuel exhaustion/starvation and should form the basis for detailed discussions of fuel management, preflight visual inspection of fuel supply, and caution about relying on fuel gauges rather than actual consumption history.

Performance charts should be covered thoroughly with special emphasis on density altitude and weight and balance limitations.

Approximately 30 percent of the Baron's. accident history has been caused by landing gear retraction after landing and failure to extend the gear before landing. An analysis of these accidents may be found under selected accident briefs which is located in Part 2.

Stall/spin accidents should also be reviewed. See page 2-17 for a history of some of the past stall/spin Baron accidents. Flight instructors should be especially careful to cover YMCA and the dangers of stalling multi-engine aircraft with an engine out. YMCA demonstrations, although not required for checkout of multi-engine rated pilots, should not be done less than 5,000 feet AGL. Recovery must be initiated at the first indication of any stall warning.

Special attention should be given to securing the cabin door. Loss of control on takeoff is a leading cause of accidents when pilots attempt to secure an open door. The Baron's flight characteristics are not compromised with an open door. The proper procedure, if the door pops open at liftoff, is to reject the takeoff if there is more than adequate runway. Otherwise, fly the pattern, ignore the door, and return for a normal landing.

Beechcralt Baron
Training Outline

Block 2-General Right Operations

Objective:

This lesson will acquaint the pilot with the Baron aircraft. Preflight, In-flight, and Postflight operations will be discussed and practiced.

Completion Standards:

This lesson will be complete when, through questioning and evaluation, the instructor determines that the pilot is proficient in general VFR flight operations in the Baron aircraft and performs to the requirements of the Practical Test Standards.

Study Assignment:

The pilot will review instrument regulations, requirements, and local approach procedures in preparation for block three.

Ground: 1.5 Hours

- o **Review of Study Assignment**
  - Weight and Balance Calculation for This Flight
  - Takeoff, Climb, Cruise, Landing Performance Data
- O Review of Normal and Emergency **Procedures**
- O Flight Portion of Training Outline
  - Discuss Flight Lesson Items
  - Resolve Pilot Questions
- o **Determination of PIC and Transfer of Control**

Comments

Flight: 2.5 Hours

Comments

0 **Preflight Operations**

Takeoff, Climb, Landing Performance Calculations

Preflight Line Check

Starting
- Normal
- Hot
- External Power

Pre-takeoff Runup and Checks

0 **Takeoff Operations**

Normal

Rejected

Crosswind

Instrument

Short Field

Soft Field

0 **Airwork**

Climbs

Turns

Slow Flight

Approaches to Stalls

Steep Turns

Cruise Configuration

Approach/Landing Configuration

V_{MeA} demonstration (if required)

0 **Instrument**

Turns, Climbs, Descents

Slow Flight

Unusual Attitude Recovery

Recovery from Approaches to Stalls

Flight: continued

Comments

O **Emergency Procedures**

Engine Failure

Fire in Flight

Induction Ice

Alternator Failure

Fuel Pump Failure

Vacuum Pump Failure

Landing Gear Manual Extension

Pressurization Failure

Emergency Descent

O **Landings**

Normal

Crosswind

No Flap

Short Field

Soft Field

Balked (Go Around)

Failed Engine

Areas of Special Emphasis:

Proper use of engine alternate induction air should be emphasized where icing is anticipated.

Extensive training must be given to landings. The numbers of landing accidents are high: Good pilot techniques in establishing stabilized approaches, control during turbulence and crosswinds, visual glide paths, and airspeed must be developed. Pilots transitioning from single-engine aircraft should spend additional time practicing to become used to the higher speeds and potential descent rates with twins.

Beechcralt Baron Training Outline

Block 3—IFR Operations

Objective:

This lesson will review the requirements, regulations, and procedures for IFR flight operations.

Completion Standards:

This lesson will be complete when, through questioning and performance evaluation, the instructor determines that the pilot understands and is proficient in low altitude IFR procedures. The pilot's abilities should meet or exceed the FAA's Instrument Rating Practical Test Standards.

Study Assignment:

The pilot will review meteorology, equipment requirements, charts, and aircraft-specific procedures in preparation for Block 4. A cross-country flight of not less than two hours duration will be planned. The pilot will brief the flight instructor on this flight during the ground portion of Block 4. The trip may not be flown as planned. A diversion to an alternate and a thorough review of IFR procedures is recommended.

Ground: 2.0 Hours

o **Requirements for Instrument Flight**

Pilot

Certificates and Ratings

High Performance Endorsement (if required)

Six Month Currency

90 day Currency

Aircraft

Required Equipment

Equipment Certification

RNAV/LORAN/GPS

Autopilot/Flight Director

Other

Comments

Ground: continued

Periodic Inspections

Transponder

Pitot/Static System

ELT

Annual/l 00 Hour

ADs and Service Bu lletins

Recommended Service Intervals

Preflight Line Inspection

O FARs for Instrument Flight

Flight Plan/Clearance Required

Compliance with ATC Instructions

Alternate Criteria

Lost Communication Procedures

Required Reporting Points

PIC Authority and Responsibility

O **Charts/Publications**

SIDS/STARS

Low Altitude IFR Enroute

Instrument Approach Procedures

VFR Charts

AIM

Airport Facility Directory

O Preflight Briefing

Lesson Content

Instructor/Pilot Roles and Responsibilities

Transfer of Control

Collision Avoidance Procedures

Engine Out Instrument Approach

Comments

Flight: 2.0 Hours

Comments

O **Clearance Copy and Readback**

Accurate Copy and Readback

Proper Avionics Configuration

51 D (if appropriate)

Note: If ATC clearance is not available, instructor will issue clearance containing all elements of a standard departure clearance.

O **Pre-takeoff Checks**

Checklist Use

Instrument Functions

Avionics Frequencies Set

Appropriate Charts

Review Departure Procedure

O **Area Departure**

Heading and Altitude

Route Interception

Amended Clearance

Climb and Cruise Checklists

O **Holding**

Holding Clearance Copy and Readback

Aircraft Configuration Prior to Holding Fix

Appropriate Entry Procedure

Protected Airspace

ATC Report

O **NOB Approach**

Approach Clearance

Checklist, Aircraft Configuration

Tracking, Orientation

Flight: continued

Altitudes, MDA

Interception of Predetermined Magnetic Bearings

Timing, MAP Identification

ATC Coordination

O Missed Approach

Climb, Heading, Altitude

Course Interception

Climb Checklist

ATC and CTAF Coordination

O DMEArc

Arc Interception

Orientation

Lead Radial Identification and Transition To Final Approach (if appropriate)

ATC and CTAF Coordination

O VOR Approach

Approach Clearance

Checklist, Aircraft Configuration

Tracking, Orientation

Altitudes, MDA

Timing, MAP identification

ATC and CTAF Coordination

O Circling Approach

Altitude

Distance from Airport

Traffic Avoidance

MAP Procedure

ATC and CTAF Coordination

Comments

Comments

OILS Approach

Approach Clearance

Checkl ist Ai rcraft Configuration

Tracking, Orientation

Altitudes, DH

MAP Procedure

ATC and CTAF Coordination

O Partial Panel Airwork and Instrument Approach

Climbs, Descents, Approaches to Stalls

Recovery Approaches to Stalls and unusual attitudes.

Magnetic Compass Turns, Timed Turns

Approach Clearance

Checklist and Aircraft Configuration

Orientation

Altitudes, MDA

MAP

ATC and CTAF Coordination

O Inoperative Equipment

Lost Communications
- Route and Altitude
- Position Reporting
- Approach, Holding

Lost Navigational Equipment
- Revised Minima
- ATC Report
- Alternative Actions

Alternator Failure
- Load Shedding
- Flight Plan Revision
- ATC Notification, Coordination

Flight: continued

Comments

o **Emergency Procedures**

Engine Failure

Airframe Ice

Vacuum Pump/Gyro Failure

Magnetic Compass Orientation

Electrical System Failure

Fire

ATC Notification, Coordination

Areas of Special Emphasis:

Pilots must establish regular periods of personal training to insure the high state of readiness necessary for IFR operations in both low and high density airspace. Periodic evaluation of instrument competency will reveal areas where further instruction and/or practice is beneficial. Instrument-rated pilots were involved in about 28 percent of the accidents, most fatal, where IMC conditions were entered without ATC clearances and/or adequate instrument skills.

This practice is dangerous and demonstrates a flagrant disregard for the FAR's and flight safety. Flight instructors and pilots must be ever conscious of the consequences of VFR flight into IMC without proper clearances and instrument proficiency.

Beechcralt Baron
Training Outline

Block 4-Cross-Country IFRlVFR Operations

Objective:

In this lesson the pilot will gain understanding of the elements of cross-country flight and demonstrate proficiency in cross-country operations, IFR or VFR as appropriate.

Completion Standard:

This lesson will be complete when, through questioning and performance evaluation, the instructor determines that the pilot is able to plan and execute cross-country flights, with consideration given to all of the elements of such operations in accordance with the Practical Test Standards.

Ground: 1.0 Hours	Comments
O The Flight Environment Airspace Part 91 Federal Aviation Regulations	
O Weather The Atmosphere High Altitude Operations (if applicable) Winds and Clear Air Turbulence Wind Shear and Microbursts Clouds, Fog, and Thunderstorms Icing Weather products and services available for pilot use	

Note: *This training program is not intended* to *teach or review weather, but rather* to *highlight weather considerations for operations in the low and high (if applicable) flight levels. Pilots who are not thoroughly familiar with weather need* to *obtain additional training through self-study and attending the many FAA or Air Safety Foundation safety seminars which deal with the subject in detail.*

Ground: continued

O Flight Planning and Navigation

Flight planning including fuel use in situations involving unanticipated winds and ATC routings including oxygen requirements for crew and passengers

Navigation

Charts

Navaids

Planned Descents

O Physiological Training

Respiration

Hypoxia

Vision

Altitude Chamber (optional, but recommended for turbo and pressurized models)

O Emergency Operations

In-Flight Fire

Flight into Severe Turbulence

Thunderstorms

Pressurization Failure (if applicable)

Engine Out Procedures

Comments

Flight: 2.0 Hours

O Preflight Briefing

Preflight Line Check

Charts, Documents

Clearance Copy and Readback

O Area Departure

Comments

Flight: continued

Comments

O **Climb**

Climb Checklist

O **Cruise**

Checklist Use

Power Setting

O **Emergencies**

Emergency Descent (Discuss Only)

Alternator Failure

Load Shedding

Flight Plan Change

ATC Coordination

In-Flight Fire

Avionics Failures

Lost Communications Procedures

O **Descent**

Planning

Monitor Engine Temperatures

Airspeed

STAR (if appropriate)

O **Approach and Landing**

Flying Light Twin-Engine Airplanes

The following information was first published in the *Flight Instructors' Safety Report.* It is being presented in a training context, as if the reader were a multi-engine student. However, the information is also a good review for experienced pilots. It is widely acknowledged that even under conditions of precise airmanship, many multi-engine airplanes, under many scenarios, offer scant margins of engine-out performance.

Aircran Familiarization

The first step in flying any aircraft is aircraft familiarization. Learn as much as possible before starting the engines. Study the Aircraft Flight Manual and get all your questions answered. Understand all the following:

1. Aircraft layout
2. Aircraft systems
3. Preflight operations
4. Normal and emergency procedures
5. Speeds and limitations
6. Weight and balance
7. Performance
8. V_{MC} and its relationship to density altitude and stall speed
9. Minimum control speed
10. Effects of windmilling propeller, flaps, gear, and center of gravity on single-engine performance
11. Go-around procedures and capabilities under various configurations and density altitudes
12. Service and maintenance requirements

Some of these items may seem pretty basic, but they are all important. For example, an aircraft layout isn't as simple as it seems. Some twins have as many as five locations for baggage: nose, two nacelle lockers, cabin, and behind the cabin. Others may have only one or two: cabin and/or behind the cabin. These features can help you balance your aircraft or carry more cargo, but only if you are familiar with them. Spend some time sitting in the cockpit. Note where all the switches and controls are located. Learn what they do and how they do it. Using the cockpit as a procedures trainer, you can run through all the checklists for normal and emergency operations. This should be done several times and before each flight lesson. Knowing the appropriate positions for the switches and controls can be a big help in an emergency.

Now you are ready to learn the aircraft's flight characteristics. Again, start with the basics. Become proficient in flying the aircraft and operating its systems.

It is inappropriate to start instrument training with ILS approaches prior to developing basic instrument scan and control skills. Likewise, it is inefficient, and possibly unsafe, to begin multi-engine training with single-engine operations and emergencies. Let yourself become comfortable with the aircraft and its systems and gain proficiency in basic maneuvers prior to starting on emergency procedures.

Single-Engine Considerations

When it is time to start single-engine activities, do so at a safe altitude (allowing recovery from all maneuvers above 3,000 feet AGL) and near a suitable airport. Probably nothing will go wrong, but you never really know. And, considering the number of multi-engine training accidents, discretion is the better part of valor. Play it safe.

In keeping with the philosophy of starting with the basics, let's introduce single-engine training gently. Instead of suddenly cutting an engine, start with several power reductions to demonstrate the aircraft's reaction and the required pilot responses. Once you can maintain control under these circumstances, you are ready for complete, sudden engine cuts with either the mixture or the fuel valve.

When an engine loses power, the pilot's first obligation is to maintain aircraft control. You should maintain a pitch attitude that ensures at least V_{YSE} (best single-engine rate of climb speed). This speed guarantees the greatest climb or least descent per unit of time. If altitude can be maintained at a greater speed, fine. If not, maintain V_{YSE} for the minimum rate of descent. The induced turn should be stopped with the combined use of rudder and ailerons, including approximately a five degree bank into the operating engine. Use smooth but firm control inputs and use the controls in a coordinated manner. Once the turn is arrested, the original heading should be regained and held with the rudder and bank into the good engine. While regaining control, mixtures, props, and throttles, in that order, should be advanced to full to ensure maximum performance. Next, while monitoring airspeed and heading, make sure that the gear and flaps are up. Then, while still monitoring airspeed and heading, secure the failed engine. The first step is to test for power by retarding the throttle slowly. If nothing changes, it is the correct engine. The prop control should then be retarded also. If nothing changes, bring the prop control all the way back to feather the propeller. Although you should move these controls slowly, don't dawdle. The propeller must be feathered before reaching a minimum RPM, as defined in the Aircraft Flight Manual. Lastly, retard the mixture control for the dead engine. Be careful. Don't shut down the good engine.

When the situation is under control, the failed engine should be secured using the emergency check list. This will include such things as shutting off the magnetos, fuel, and alternator on the dead engine. Make sure you shut off the proper ones. Then, if possible, reduce power on the good engine to normal cruise settings and reduce the aircraft's electrical load in accordance with the capabilities of the remaining alternator. If there is no alternator on the good engine, do whatever is possible to conserve battery energy.

Obviously, in an emergency the pilot must respond in part from memory. But once the situation is under control, the appropriate check list should be completed, while monitoring attitude, heading, and airspeed.

There is no need to memorize the restart procedure. Use the check list. Also, if you fly a variety of aircraft, make sure you understand the different methods of restarting an engine, i.e., electric starter and unfeathering accumulators. An unfeathering accumulator is a cylinder filled with oil and air under pressure. It is located on the firewall and connected to the propeller via a linkage. When the propeller control is moved out of feather, this pressure moves the blades out of feather. The blade angle and airflow then rotate the engine to start. On other aircraft, the electric starter starts the engine. Then rotating counterweights move the propeller blades out of feather.

Several factors associated with the engine failure scenario require additional clarification. First we assumed a total engine failure. If the engine is producing partial power, in some circumstances it might be best to keep it running and take advantage of the extra thrust. Also, if you have some time (altitude) to play with, it could be worthwhile to determine the cause of the failure (or partial failure) to regain use of the ailing engine. *Sometimesl just changing tanksl turning on the boost pumpl* or *shutting off* a *bad magneto can return most, if not aliI lost power.*

Most engine failures are a result of fuel exhaustion or starvation. If you think this could be the problem, it would be wise to consider fuel quantity and the configuration of the fuel system prior to securing a failed engine.

There are several different fuel system designs used on light twins, particularly regarding fuel selectors and crossfeed procedures. On some you can get all the fuel if an engine or fuel pump fails. On others you can't access all the tanks following engine or pump failure. Make sure you understand the operation of your fuel system and its limitations. If an engine quits, determine what effect your reduced fuel availability may have on your flight. The design of the system may also dictate the order in which you *normally* select tanks to maximize fuel availability should a failure occur.

In an effort to reduce the number of accidents relating to single engine demonstrations, the manufacturers now publish an Intentional One-Engine Inoperative Speed (V_{SSE}). This is the minimum speed at which an engine should be intentionally failed. It provides a speed buffer, above V_{MC} (discussed shortly), designed to ensure directional control when an engine is failed. This speed should be religiously adhered to in training.

In the interest of both safety and engine longevity, it is advisable to use zero thrust settings to simulate a failed and secured engine for some maneuvers. Zero thrust involves setting the throttle and propeller control of one engine such that it yields the same performance as having that engine feathered. Some manufacturers publish zero thrust settings. If not, they can be determined by first establishing a particular aircraft configuration with one engine feathered and noting the rate of climb (or descent). Then establish the same configuration with the engine running at low to medium RPtv\ and adjust the throttle to duplicate the previous performance. Since zero thrust may vary with speed and density altitude, determinations must be made for each desired combination.

Also, note that we have not discussed doing stalls during single engine training. Although pilots are expected on flight tests to demonstrate skill in stall recognition and recovery with both engines running, there is no such requirement related to single-engine operations. Because there is no such training requirement and multi-engine airplanes are not designed to spin (and recovery is doubtful in some cases), it is inadvisable to attempt single-engine stalls.

Determining which engine has failed can be a problem. There are some catchy phrases, such as "dead foot, dead engine" or "best foot forward." But the important thing to know is that the nose will always yaw toward the failed engine and that you should always make sure you check your decision with the throttle, mixture, and prop (as previously explained). Note: On piston twins the EGT will show which engine has failed: no power-no temperature. The tachometer and manifold pressure will not provide reliable guidance on power output.

V_{MC}

V_{MC} is the single-engine minimum control speed. It will be shown on the airspeed indicator of modern twins by a red radial line. It is the slowest speed at which directional control can be maintained if the critical engine (defined later) is suddenly made inoperative and the remaining engine is developing full power. Single-engine minimum control speed (V_{MC}) determinations are made with *exactly five degrees* bank into the good engine. This is the maximum bank the FAA allows and the manufacturers use it all, because it helps lower the V_{MC} speed. (On one light twin, each degree toward the good engine decreased V_{MC} by three knots). As we have already discussed, it lowers V_{MC} by vectoring lift to counter yaw and also by reducing sideslip, which yields greater rudder effectiveness, allowing control of yaw at lower speeds.

Since the manufacturers use five degrees bank into the good engine, providing control at slower speeds than would be possible with wings level, you must use this technique if you intend to maintain control at the published V_{MC}.

The gear is retracted because an extended gear can have a stabilizing effect. Also, if the gear is still down when an engine fails on takeoff, the pilot should probably pull both throttles back and land, which eliminates the V_{MC} problem.

On most light twins the propeller will be windmilling during V_{MC} determinations. The friction and compression of the inoperative engine imparts considerable mechanical drag to the propeller, which converts it to aerodynamic drag. This increases the yawing tendency. Obviously, the aircraft must be airborne and the FAA requires that it be out of the stabilizing influence of ground effect.

By definition, V_{MC} determinations require that the critical engine be made inoperative. Contrary to some misconceptions, the critical engine is not necessarily the one with the only alternator, hydraulic pump or vacuum pump. The critical engine is the one that, if failed, would most adversely affect the aerodynamic control of the aircraft. On most u.S. manufactured aircraft, with clockwise rotating propellers (viewed from the cockpit), the left engine is critical. This is due to P-Factor. At high angles of attack, the descending propeller blade (right side on u.S. aircraft) produces more thrust than the ascending blade, which moves the propeller's center of thrust to the right. Since the lever arm (R) from the CG to the right engine's center of thrust is greater than the lever arm (L) to the left engine's center of thrust, the yawing force is greater with just the right engine operating than with just the left. Therefore, the adverse effects are worse if the left engine fails.

On some aircraft manufactured overseas, the engines rotate counterclockwise, which makes the right engine critical. Some aircraft have been manufactured with propellers turning in opposite directions to eliminate the critical engine. This in turn results in a lower V_{MC}. Such aircraft have a clockwise left engine and a counterclockwise right engine. The worst case is having a counterclockwise left engine and clockwise right engine. This puts both thrust lines far from the CG, resulting in a higher than necessary V_{MC}.

By using worst case configurations, the FAA ensures that the published V_{MC} will be the highest possible. If you stay above this speed and use five degrees bank into the good engine, you will be assured of directional control. However, V_{MC} does not guarantee any level of performance, only control. (Performance speeds are covered later.)

When doing V_{MC} demonstrations, either while training or on checkrides, it is not safe, necessary or advisable to duplicate the manufacturer's scenario for determining the published V_{MC}. You are only required to demonstrate the factors involved and the skills necessary to recognize and recover from V_{MC} incursions.

For safety's sake, it is recommended that V_{MC} demonstrations be done with the critical engine idling (instead of shutdown and windmilling) and at an altitude that allows recovery above 3,000 feet AGL. You can use the idling engine to recover from loss of control and the altitude gives a recovery buffer.

Unfortunately, the altitude also has a negative effect on V_{MC} demonstrations. Aircraft with normally aspirated engines suffer a loss of power at higher density altitudes. As power decreases with altitude, yaw is decreased, thereby decreasing V_{MC}. At some point the V_{MC} will be reduced to, or below, the stall speed. Under these conditions it will be impossible to demonstrate V_{MC} without stalling, and possibly spinning. You should know this relationship for any twin you fly. The safest means of determining this relationship for any particular aircraft would be to contact the manufacturer. Otherwise, it will have to be determined by experiment.

An instructor can still demonstrate V_{MC} at higher altitudes by limiting rudder travel with his foot. This artificially raises the V_{MC} above the stall speed, allowing the pilot to experience the loss of control.

If density altitude considerations preclude a V_{MC} demonstration on checkride day, the examiner will appreciate your bringing this to his/her attention. He/she may settle for an oral explanation of V_{MC}, or use their foot to limit rudder travel, allowing a safe demonstration.

The following procedure is recommended by the FAA for demonstrating V_{MC}:

1. Propellers set to high RPM.
2. Landing gear retracted.
3. Wing flaps set in takeoff position.
4. Cowl flaps set in takeoff position.
5. Engines set to rated takeoff power or as recommended.
6. Trim set for takeoff.
7. Power on the critical engine slowly reduced to idle.
8. Establish a single-engine climb attitude with the airspeed representative of that following a normal takeoff.
9. Establish a bank toward the operating engine as required for best performance.
10. Reduce the airspeed slowly with the elevator while applying rudder pressure to maintain directional control until full rudder is applied.

Upon the first indication of loss of directional control, reduce the angle of attack, and only if necessary, reduce the power on the operating engine enough to regain control within 15 degrees and minimum altitude loss. Reducing the angle of attack improves control both by increasing airspeed and reducing the P-Factor on the good engine. The power should only be reduced on the good engine if necessary to regain control. Remember, minimum loss of altitude is one of the objectives of this maneuver. Unless an emergency develops, the inoperative (simulated) engine is not to be used in the V_{MC} recovery.

Single-Engine Periormanci

You should understand the factors affecting single-engine performance in the twins you fly. These include the effects of the settings of the landing gear, flaps and propellers; various speeds (V_{MC}, V_{XSE}, V_{ySE}, V_y, and V_{SSE}); and density altitude. All of these factors should be explored and practiced in a variety of circumstances.

Leave the gear down so long as you can land and stop in the remaining runway and clearway. If the engine fails with the gear down, do just that, land. You must be mentally prepared to retard the throttles, land and stop anytime the gear is down. When you have reached a point where you know you are going to continue the flight regardless, retract the gear.

Two additional calculations can help with takeoff planning. The first is the accelerate/stop distance which is supplied in most modern manuals. It is the distance required to accelerate to rotation speed then brake to a stop. Again, remember to make allowances for a rolling takeoff and reaction time. If the information is not in the manual, you can experiment on a very long runway (use gross weight for worst case results).

The second useful calculation is the distance to takeoff, climb to fifty feet, descend to a landing and stop. You can approximate this by adding the normal obstacle takeoff distance to the normal obstacle landing distance, plus fudge factors. Again, this transition from climb to approach and landing should be practiced at altitude.

If both the above calculated distances are less than the available runway plus stopway, it is definitely advisable to abort the takeoff in the event of an engine failure prior to reaching fifty feet.

Even if the available runway plus stopway is less than the above calculated distances, if an engine quits on the runway or below obstacle height you are probably better off terminating the takeoff. It is always better to hit something while under control and braking, than at flying speed and possibly out of control.

When the decision is made to continue a takeoff, the aircraft must be cleaned up (gear, flaps, and propeller) and accelerated to V_{XSE} until all obstacles are cleared and then V_{YSE}. Make sure you know the aircraft attitudes for these speeds, including the importance of achieving the appropriate bank into the good engine. It will improve your performance and chances of survival.

Each takeoff is unique. One plan will not work in all cases. Consider all the factors and then formulate your takeoff plan, while on the ground. Then commit your plan to memory and be mentally and emotionally prepared to carry it out. It is also a good idea to mentally repeat your plan to yourself just before taxiing onto the runway. All good pilots have an equal number of successful takeoffs and landings. An engine failure is no reason to change your batting average.

When a single-engine landing is necessary, first try to find a nearby airport with a long runway and good weather. These two conditions permitting, you should plan your approach only *slightly high,* aiming a *little* further down the runway than usual. This allows for errors in judgment and downdrafts, which are harder to overcome with an engine out. However, do not exaggerate this extra allowance. Use the normal approach speed or V_{YSE}, whichever is greater. This reduces trim forces and increases the chances of a successful go-around, if necessary. If the desired speed and descent angle can be achieved with the gear and flaps up, do so. If not, use the gear, and then flaps as needed. When the landing is assured, adjust the flight path and bleed off any excess speed by extending the gear and flaps. Complete the final phase of your final approach stabilized on a normal glide path at the recommended speed. On some twins, particularly those with hydraulic systems, an engine failure may affect normal gear and flap operation. Know your airplane. If you expect trouble with the gear and/or flaps, allow sufficient time for emergency extension or commit in advance to a gear/flap up landing. Practicing single-engine approaches with various gear and flap configurations allows you to make these decisions in advance and prepare for this eventuality.

You must do your absolute best the first try when making a single engine landing in a light twin. As we have previously discussed, some twins have little or no single-engine climb performance, which means no go-around capability. If the manufacturer does not publish single engine climb data, you can be pretty sure there isn't any. If your aircraft does have published single-engine climb data, you should be aware of the specific capabilities before attempting a single-engine go-around.

It takes a certain amount of altitude to transition from an approach to a climb. To determine exactly how much for your aircraft, you should try it a few times at a safe altitude. Practice starting from both clean and landing configurations. Record the results for future review.

Once you know that your aircraft can make a successful go-around (if it can) and how much transition altitude is required, you can establish a decision point. No attempt at a go-around should be initiated below that point, under any circumstances. If a vehicle pulls on the runway at the last minute, land in the grass. Do not attempt an impossible go-around.

Practicing single-engine landings and go-arounds should only be done simulating engine failure by using zero thrust techniques. If you are unable to maintain altitude or climb, the zero-thrust engine can be used immediately.

In the last few seconds of the landing transition, when you retard the throttle, you must make compensating adjustments in the rudder to maintain longitudinal alignment. The same holds true when you retard the throttles on the runway. Also, try not to let the nosewheel down until the throttle is retarded and the rudder centered. Otherwise, the canted nosewheel can cause an abrupt excursion from the runway centerline.

You may also experience uneven braking with one propeller feathered. The feathered prop is not interfering with the airflow over its wing, as is the windmilling prop of the idling engine. The dead engine side, therefore, may be producing more lift than the other side. With less weight on the wheel of the dead engine side, equal application of braking pressure can cause a swerve toward the good engine or possibly a blown tire on the dead engine side if wheel rotation stops. Also, since there is much less drag on a feathered propeller than a windmilling one, expect the airplane to turn toward the operative engine-especially at the beginning of the landing roll. Make sure you don't let down your guard until the aircraft is stopped and secured.

If an engine fails on an instrument approach it may be necessary to retract the gear to make it to the airport. Also, you may want to discontinue the approach altogether in favor of a better approach, perhaps at a different airport. This is another instance of planning ahead.

Addidonal Emergency Consideradons

You would expect the enroute portion of a flight to be the safest place to have an engine failure, and it is. But there have been a few cases where pilots in this situation lost control and crashed. Make sure that you understand priorities: aviate, navigate, and then communicate. Concentrate on flying the airplane.

Once the aircraft is under control, check your position and adjust heading, as necessary.

ATC should now be made aware of your problem. Let them know if you can't maintain altitude, and have them clear the airways and altitudes you need to get to the nearest appropriate airport. Do not attempt to complete the flight to a distant destination on one engine.

Now it's time to adjust the electrical load and power settings on the good engine, if possible. If the autopilot is approved for single engine operations, use it while studying charts and approach plates. If high terrain or rate of descent preclude reaching an airport, do not attempt to prolong the inevitable. Find a place to put it down, while you still have the power and airspeed to maintain control.

In IFR conditions, the aircraft's motion due to power loss coupled with pilot distraction can easily induce spatial disorientation and vertigo. To minimize this, *methodically* regain control, add full power to maximize altitude capability, determine the cause of the power loss and restore power or secure the engine as necessary.

Other emergencies appropriate to multi-engine airplanes, such as emergency gear extension and retraction, propeller overspeed, electrical system malfunctions, etc., should be studied and practiced (if possible) utilizing the appropriate checklist.

Also, if you are flying a turbocharged airplane, remember; only the engine is turbocharged. The propeller and wings both still suffer as density altitude increases. Although turbocharging improves an aircraft's performance at any given altitude, a turbocharged airplane still loses significant performance at increasing density altitudes. This applies to both multi-engine and single-engine activities.

Recurrent Training

Those pilots fortunate enough to fly twin-engine airplanes *must* understand the importance of *regular, competent, organized* recurrent training. It is imperative to maintain your skills or renew them if degraded.

All airline pilots and many corporate pilots refresh their skills on a six month schedule. You should do the same.

When the time comes to refresh your skills, choose an organization or person in whom you have confidence. Make sure they not only have sufficient training experience, but also plenty of experience in your type of airplane. Over time, you may want to use several different organizations to experience various techniques and theories.

You may want to consider a facility with sophisticated, multi-engine simulators. They can expose you to hazardous training situations you would never try in your plane. Also, using a simulator for a lot of the engine out work can save significant wear and tear on your engines.

If your insurance policy dictates recurrent training, make sure the course you are about to take meets the insurance company requirements. It is probably best to get this in writing.

New Model Check Out

Each model, or type, of twin is different. Systems, speeds, performance, layout and handling characteristics can vary greatly, even between models from the same manufacturer. For example: a Cessna 310 has its engine controls arranged throttles, props and mixtures (left to right), whereas older Beechcraft Barons were organized props, throttles and mixtures. This may seem like a minor difference, but pushing or pulling on the props instead of the throttles can cause you a lot of grief under some circumstances and may ruin your engines. Before flying any new-to-you model, get a thorough check-out. Make sure you feel competent on all the skill and knowledge items discussed in this Safety Review as they relate to your new airplane.

Summary

Remember, the ultimate goal of any training is to leave you knowledgeable, proficient and confident. Don't quit training until you meet these criteria.

• Notes •

Part 4

ASeries 01 Selected Beechcralt Baron Models 55, 58, & 58
Articles Reprinted Irom *AOPA Pilot* Magazine

The Beechcra" Baron 855

Pilot Right Check

By Don Downie/AOPA 188441

There wasn't a cloud in the sky from Wichita all the way to the West Coast, winds were negligible, and I was in the driver's seat of a brand-new 1975 Beechcraft Baron BSS on my way to Los Angeles.

It was one of those days when it was almost sinful to be flying alone. Somebody else-up to five other "somebodies"-should have been sharing the beauties of a fine trip west in this speedster: sharing the new-plane smell and the glistening reflections of fresh paint, the unscuffed windshields, and a full-house panel of goodies that took me most of the afternoon to fu lly appreciate.

It had all begun with a phone call earlier in the day. I'd arrived in Wichita, delivered the plane I'd been ferrying, and made an airline reservation back to Los Angeles. Then I checked the local airplane factories just in case anyone needed a delivery going west. A few minutes later, Dave Cotten, assistant director of public relations for Beech Aircraft Corp., called back and asked if I'd mind bringing out a new Baron for Mike Gordon at Beech West in Van Nuys, Calif.

Mind-I was delighted!

Twenty minutes later, when Dave drove up, my bags and I were outside the Ramada Inn waiting. At Beech's delivery center, I signed for the ship, canceled my airline reservation with glee, checked the weather, and filed VFR to Albuquerque.

Factory production test pi lot Bob Buettgenbach walked out to the gleaming new Baron and gave me a personalized cockpit check. Our preflight disclosed that the right cowl flap wouldn't close, and we waited until after the lunch break so that two mechanics could check the linkage. That done, I was ready to fly.

With both the Baron's fans spinning comfortably, I taxied to the runup area, went through the printed checklist, turned on the nav/com equipment, waggled the controls for a second time, and taxied back to the takeoff area. Beech Tower gave the nod, and N878SR and I were off and running.

With one occupant, minimum baggage, and extended-range fuel tanks providing 136 gallons usable (142 total), the Baron's takeoff performance was spectacular. I had to come way back on the power, halfway through my first turn, to remain below the busy jet pattern at nearby McConnell AFB.

Once clear of the control zone, I opened my flight plan with Wichita Radio, re-scanned the en-" gine instrument panel at the right of the cockpit, and started a cruise-climb, pulling 2,400 RPM and 24 inches of manifold pressure.

Winds were reported light and variable, and I leveled off at 8,500 feet. The right cowl flap still didn't close completely, but the gauges showed little or no difference in head temperatures, exhaust gas temperatures, or oil cooling, so I could see no valid reason to turn back.

I passed over Liberal, Kansas, at 1:43 p.m. CST. With 2,300 RPM and 22 inches mp (63 percent power) and an outside air temperature of 45° F, my true airspeed was 205 m.p.h .. According to the fuel-flow meters, I was pulling nine GPH per engine.

The checkpoints went by rapidly: Guymon, Oklahoma, at 1:58; Dalhart, Texas, at 2:20; Anton Chico, New Mexico, at 3:06. At 3:43 p.m., Eight Five Romeo and I eased down to a smooth but not-too-short landing at Albuquerque International-SSO statute miles in 2 hours 50 minutes, including off-course turns at both takeoff and landing.

Cutter Flying Service pumped 88 gallons of fuel into the Baron's tanks, since I'd been running the new power-plants just a little on the rich side. Two of Cutter's mechanics took a look at the right cowl flaps and worked on them with only slightly better results than the factory mechanics had had.

The local FSS was reporting "severe clear," and I filed VFR on V-12 to Van Nuys. With an enroute time estimate of 3 hours 30 minutes, I had wheels up at 4:57 p.m. CST.

The forecast held, the winds were light, and I climbed to 10,500 feet to clear Lookout Mountain and El Morro National Monument, east of Zuni, New Mexico.

Having made deliveries of smaller, slower craft over this basic route for more than 25 years, I found it almost unreal to watch the well-known check-points pop up so quickly. At 10,500 feet (OAT 50° F), with 2,300 RPM and 21½ inches mp (that's full throttle), I was indicating 182 m.p.h., which trued out at a whopping 220 m.p.h..

Westbound out of Albuquerque, I had an added navaid that I had enjoyed on other recent trips. Air carrier jet contrails strung out above and ahead of me, as the big birds and their passengers headed for California, making transient signposts in the technicolor of an early evening sky.

The Baron's Mitchell Century IV autopilot didn't stay on for long, since 85R was plain fun to hand-fly. The 260-hp Continentals purred contentedly, and the Hartzell prop governors held near-perfect "sync." Zuni slid tailward at 5:43 p.m.; Holbrook, Arizona, at 5:59. Flagstaff and Humphrey's Peak zapped past the right wing at 6:18; Prescott at 6:36; and Needles, California, at 7:09. A Chamber of Commerce sunset was developing over the nose of the Baron as I checked in with Dagget at 7:44 p.m. Abeam Palmdale, I canceled VFR.

A quick change of frequencies gave the Van Nuys ATIS, which was calling for landing on Runway 16 Left. Inbound to Newhall Pass, I called the tower as the big-city lights began to twinkle brightly in the dusk.

Both landing lights came on as I entered the busy San Fernando Valley and slowed to 175 m.p.h. (emergency wheels-down speed is 200 m.p.h.). As the gear came down, I made a careful review of the prelanding checklist.

"Van Nuys Tower, Baron Eight Five Romeo abeam west with a light."

"Roger, Eight Five Romeo. Follow the trainer turning final. Cleared to land 16 Left."

The tires yelped briefly and the nose gear touched down at 8:17 p.m. CST-an even 3 hours 20 minutes from Albuquerque, including 180 degree turns at both ends of the trip.

When the tanks were filled the next day, 85R took 91 gallons, so I was still running on the rich side. An adjustment of the fuel-flow meters might have been in line, since in-flight photos showed the meters indicating eight to nine GPH per engine.

When I chopped the mixture in front of Beech West and looked at the deepening sunset, I couldn't suppress a smile. I was an hour and a half ahead of the scheduled airliner I'd canceled after lunch.

On a clear-day cross-country with an ETA at dark, you just don't explore the slow-flight and single-engine characteristics of any brand-new airplane. At least, I don't. Thus, a few days later, Beech West pilot Dick Babbitt and I climbed back aboard 85R to take a look at the slow-speed end of the spectrum.

The dual control yoke had been removed and a standard throwover wheel installed. The small flap handle hides behind this yoke and is a bit difficult to find on first effort. There is no preselect on the flap switch, so you must search for the small flap indicator at the left of the console. The flaps extend aft during the first 10 degrees of motion and add some additional wing area for slow-speed control.

I questioned Babbitt about the standard door latch, which had no "idiot light" to warn a careless pilot should his cabin door not be secure. Babbitt told me there has been an annunciator light on the door of the larger Model 58 Baron since 1970. (This door warning light is also standard on the A36 Bonanza.)

There's really only one set of controls that's ever given me a moment's question on any of Beech's post-World War II twins. Beech is the only twin manufacturer I know of that installs the power levers with the props on the left of the console and the throttles in the middle. (Mixture controls are standard, to the far right of the console.) Frankly, during my delivery flight west and, later, during the slow-flight exercise, I didn't touch a single lever on the B55 console without taking a second look to be doubly sure I had the control I wanted.

"Just remember to 'reach for a gauge,'" said Babbitt, and this approach does the job very well as you survey the Baron's instrument panel. The dual tachometer is on the left, directly above the prop controls; the dual manifold pressure gauge is directly above the center-mounted throttles; and the dual fuel-flow gauge is directly above the mixture controls.

There are a number of niceties about the B55 not found in some other twins. You have three trim tabs, for rudder, elevator, and aileron. The cowl flaps operate in a people-engineered manner whereby pushing down on the two controls below the throttle quadrant pushes the cowl flaps open. Fuel management is completely straightforward, with a simple "on," "off," and crossfeed selector arrangement located between the pilots' seats just forward of the spar. A spring-loaded Plexiglas cover over these selectors might make them even more goofproof.

Weather during our slow-speed evaluation differed a bit from the very-VFR afternoon delivery. After takeoff, Burbank Departure Control vectored us IFR to blue skies above 7,000 feet.

The B55 makes a solid, straightforward instrument platform, all three flight controls requiring an equal amount of pressure. With our light weight (full tanks and two people), our rate of climb approached 2,000 f.p.m. with 2,500 RPM and 25 inches mp.

We headed north toward the Mojave Desert and VFR weather for a series of straight-ahead and turning stalls, both "clean" and "dirty." There's ample lead-time with the stall warner, a steady tone on a loud horn. Add the intermittent "gear-up" audio, when the throttles are retarded below 13 inches, and the cockpit can sound like a barnyard at sunrise.

With partial power-1 5 inches, to keep the gear horn quiet, and 2,400 RPM-85R was below 60 m.p.h. indicated before it shuddered and stalled. Recovery was standard, with power, top rudder, and enough aileron to assist in rolling level. With a minimum-loss-of-altitude recovery, the stall warner reminded you promptly of any incipient secondary stall.

At 7,000 feet, we simulated an engine failure on takeoff. (With gear down, Vmc is 92 m.p.h. at full gross.) I asked Babbitt to pull a throttle and deliberately didn't watch which engine was chopped. The Baron yawed to the left and started to duck its wing slightly. Partial right rudder kept the nose in line, and partial right aileron put the wings level. (Remember, though, that at 7,000 feet, the unturbocharged engine was putting out only 73 percent of its 260 h.p., so the same situation, at full gross at sea level, would undoubtedly require all the control movement available).

Babbitt demonstrated single-engine characteristics as we shut down the left engine. Demonstration feathering procedure calls for 14 inches of manifold pressure, prop control back to the detent, mixture to idle cutoff, and prop to "feather." The Baron's single-engine ceiling, at full gross weight of 5,100 pounds, is 7,000 feet; at 4,500 pounds it goes up to 11,900 feet.

Steep turns into the dead engine are strictly no-sweat. With rudder and aileron trim adjusted, 85R flew hands-off with the left engine stopped.

Unfeathering calls for more than 120 m.p.h. to start the prop windmilling, or for a tweak on the starter. Since 85R had brand-new engines, we dropped the nose, increasing our airspeed to above 130 m.p.h., and the prop began to turn slowly. Once the prop is windmilling, the prop control goes forward to 900 RPM and back to the detent. Mixture goes forward, and the prop controls (the levers at the far left) are matched. As the engine warms up, the throttle goes forward and you're back in business.

There's a thumb switch for elevator trim on the left of the throwover wheel. It's necessary to push down on this switch to disengage the autopilot before flicking the switch fore or aft for trim.

We shot a landing at Fox Field (Lancaster, California), where 85R behaved like a well-mannered flying machine. Then it was back into the blue, with a rapid climb over undulating cloud cover before we received an IFR vector to Van Nuys along the Burbank ILS. All the black boxes worked as programmed, and we eased off the high-speed turnoff at Van Nuys.

It's easy to understand why the Baron has been Beech's most popular twin. Factory production records show that its parent, the Travel Air, was first introduced in 1958, 721 being built. The Baron came out in 1961 and, as of November 1974, more than 3,400 of the aircraft's various versions (B55s, E55s, 58s, and 56TCs) had been built.

The B55 Baron's base price of $89,000 includes two pages of standard equipment items, including a King KX170B nav/com system and an ELT. But N8785R was loaded with goodies, and the invoice was $120,670, including a $19,665 IFR avionics and autopilot package, extended-range tanks, large cargo doors, fifth and sixth seats, three-blade props, propeller anti-icing equipment, and internally lighted instruments.

Beech's promotional material for the Baron claims that an aggressive businessman pilot can probably put himself into a B55 "for about $225 per month net capital cost." Be that as it may, the businessman pilot who finally gets N8785R will have a beautiful, spirited, functional package of fast transportation. ≺

The Turbocharged Beech Baron

It can carry a ton to 26,000 leet, lor Ilying in the highest 01 style

By Berl Brechner

Beech Aircraft Corp. makes five distinctly different airplanes labeled "Baron." The newcomer to the family is a turbocharged light twin that has now been plying the air lanes for just over a year.

What makes this Baron unlike all other Barons? Load ca-rrying. An equipped B58 TC will carry about a ton of people, fuel, and cargo, and still be able to slice the air at over 220 knots.

Almost two years ago Beech brought out their Baron 58 P, a pressurized Baron that was equipped with (naturally) turbocharged engines. The 58 TC is virtually the same airplane, except it foregoes the pressurized airtight shell. The turbocharged Baron is pulled by two Continental T510-520-L engines, each rated for 301 h.p. (If only one engine is developing power, there is an extra 100 RPM available to the operating engine, bringing the maximum horsepower to 310.)

Though the 58 TC was brought out as a new offering, Beech had once before marketed a turbocharged Baron. Eighty-four copies of that airplane, with 340-horsepower Lycomings, were issued between 1967 and 1971. But, according to a Beech marketing man now working with the Baron line, the early turbo Baron had simply too much engine. Though its performance was good, it burned inordinately large amounts of fuel to achieve its capabilities; its sales dropped off as buyers opted for the next larger plane in the Beech line, the Duke.

The latest turbocharged Baron is not a remake of the older airplane. It is, in effect, a new airplane. It has undergone recertification, and meets FAA approval standards set in FAR Part 23, amendments 1 through 12. Its engines are adopted from the pressurized Baron, fuel delivery systems have been simplified, and the wing structure and landing gear are stolen from the heavier Duke.

On the outside, only minor items help distinguish a turbocharged Baron from its counterparts. Its engines extend about a foot further forward than do engines on the unblown Barons. And on the front of each engine nacelle you'll find a landing light. On the other Barons the light is found in the wing leading edge. Also, the nacelle sports a large air intake on the side, rather than across the top.

On the inside, you can load six people and close-to-full tanks with the optional fuel load of 190 gallons. The airplane flown by *Pilot,* N42555, tallied a basic empty weight of 4,149 pounds. With a 6,140 pound maximum ramp weight, the craft's load-carrying potential comes within nine pounds of an even ton.

As a luxury twin, its interior was graced with lush carpeting, buckskin cabin walls, face-to-face seating and a foldout table for the four rear occupants. Beech doesn't craft its fine-tuned machines at bargain-basement prices, however. This demonstrator spec'd out at $231,313. And though this price included most options wanted (and offered, for that matter), the plane was not equipped with weather radar, a multi-thousand-dollar piece of gadgetry many pilots might like to have aboard this high flier.

Avionics that were installed included a full complement of Collins Micro Line radios, King DME, and Edo-Aire Century IV autopilot. With the center-mounted control column and power controls above the column, weather radar would have made the panel layout in 555 uncomfortably cramped. Besides the avionics, the other big options on this Baron TC were de-ice boots, and anti-ice prop and windshield heaters. Ice protection alone for the craft costs over $12,000.

Additional extras included extended range tanks ($3,795 for 24 more usable gallons), three-light strobe system ($1,365), 115-cubic-foot-capacity oxygen system ($2,650), prop synchronizer ($1,845), the club seating ($2,460), and the little fold-out desk ($565). Higher power 1OO-amp alternators were also installed on 555, for an exchange price of $1,155. Air conditioning is not currently available.

Normally, only a single throwover-type control yoke is found on the Baron, therefore dual controls are an option. So are brakes on the copilot side, external power plug, internally lighted instruments, prop unfeathering accumulators and "super soundproofing." Combining all this gives a heavily equipped light twin that offers some exceptional capabilities, slightly tempered by its higher cost and a couple of performance limitations.

The turbo Baron, with its blowers built by Garrett AiResearch, is certified for flight up to 25,000 feet. For a check of its performance at altitude, I departed Hutchinson, Kansas, where the temperature was 65° F. The oxygen bottle was full, and masks ready for use. From a dead stop at the end of HUT's runway 13 (airport elevation 1,542 feet msl), a maximum performance climb to 17,500 feet took 9 minutes 51 seconds. Best rate-of-climb speed for the craft is 115 knots, and the climb dial showed the craft initially heading skyward at 1,800 f.p.m., and 1,400 f.p.m. passing through 17,000 feet. During this full-throttle climb, which was initiated with the aircraft lightly loaded (about 120 gallons of gas and two people aboard), the fuel flowed to engines at a rate of 64 gallons per hour.

At 17,500 feet, an efficient cruise setting is 65 percent power, or 30 inches mp and 2,200 RPM. Fuel burns at about 31 GPH. An interpolated speed from the aircraft manual for 65 percent power is 204 knots. The indicator read 166, which with the -12° C temperature, converted to 220 knots true. The difference between the book speed and actual performance likely reflected the light loading of the airplane during the flight check.

Higher power settings are attainable up high. For instance 75 percent power is easily within the airplane's grasp. But at these tightplane super speeds, it will offer only about seven knots more, in trade for a fuel consumption increase of five or six gallons per hour. Any way you look at it, one mile-per-hour-per-gallon is an expensive way to travel a tiny bit faster.

By placing the power levers at 26 inches and 2,200 RPM, the engines developed 55 percent power, which provided a true airspeed of 208 knots. That's about 18 knots above the speed the book says can be expected for this power setting, which burns about 25 gallons per hour. Range at such a speed and altitude would be over 1,200 nautical miles (assuming the airplane starts with the optional fuel load of 190 gallons) including fuel for taxi and takeoff, and a 45-minute reserve.

The turbochargers that make all this performance possible are the automatic wastegate type that theoretically cannot be overboosted. On takeoff you slowly advance the throttles to 30 inches mp, pause momentarily for the turbos to wind up, then continue advancing the throttles to the stops. Throttles could be left full forward from that point to final approach at the destination, if a pilot desired. More realistically, however, he will look to the aircraft manual for recommended cruise power configurations.

With both engines operating, they will peak at 301 hp. But special two-stage prop governors allow an operating engine, as mentioned earlier, an extra 100 RPM (nine horsepower) if the other engine shuts down. The reason for limiting rpms when both engines are running, says Beech, is to permit this airplane to meet 1980 noise limits imposed by the Environmental Protection Agency.

The engine turbocharger combination carries a time-between-overhaul of 1,400 hours.

Ruggedness of the Baron TC is apparent from its gear and flap speeds. Gear and half flaps can be lowered at 177 knots, or over 200 m.p.h. The rest of the flaps may go down at 144 knots. To slow from 170 indicated to 100, I dropped gear, pulled power back, dropped half flaps, then full flaps. Total time for the slowdown in level flight took 15 seconds.

Gear and fowler flaps are fully electric. The only hydraulic system found in the aircraft is for braking.

The undercarriage acts like a big speed brake, causing almost no pitch change with extension. Lowering of 15 degrees of flaps has no pitch effect, but the final 15 degrees causes a substantial nose-up movement. Pitch adjustments are fast and easy with the manual trim wheel, the electric trim installed in 555 was slow. It was slow enough, in fact, that its switch could be constantly held in the "up" position during round out and flare.

The Baron is a mild-mannered single-engine craft. At 10,500 feet Gary Brigham, Beech's assistant marketing manager for the Barons, pulled back the left engine to zero thrust. The published minimum safe single-engine speed (V_{SSE}) is 86 knots. At that speed there was still good control over the one-engine twin. A 5- or 6-degree bank into the good engine, plus light rudder pressure, kept the plane lined up on course, and banks of 15 degrees either direction provided no surprises. With full power on the operating engine (36 inches mp and 2,700 RPM) the turbo Baron climbed at 100 knots at about 300 f.p.m.

Published climb rate at maximum gross weight, single-engine, is 204 feet per minute. That's an unimpressive figure, compared with some light twins, but with the turbochargers aboard, the B58 TC will maintain that rate up through 5,000 feet, and-particularly welcome news for mountain fliers-its single-engine service ceiling is 14,400 feet.

Gear and flaps down, power off, and gentle nose up pressure brought this lightly loaded Baron into a stall at 70 knots indicated. Its published stall speed is 79 knots (91 m.p.h.). As the stall arrives there is good buffeting, but with firm control of the airplane you can hold it in a wings-level stalled descent falling 1,600 feet per minute. In a clean configuration the stall arrived at 81 , and the buffeting quickly increased to a point where the wing dropped sharply. Nose down and a little power brought about a speedy recovery.

The Baron's healthy sized vertical stabilizer gives a hint of potentially potent yaw characteristics. At cruise speed, a shove of rudder brought about a six-oscillation yaw cycle:

Beech has recognized this characteristic in the airplane, and offers a chance to fight back with optional yaw dampers.

The Mitchell damper installed in 42555, when switched on, reduced the yaw cycle to only one or two swings with an equivalent kick of rudder, but costs an extra $2,190.

The big tail/rudder configuration gives the Baron an edge when confronting a crosswind: it carries a demonstrated crosswind component of 30 knots.

The autopilot itself, a Mitchell Century IV, was controlled by an array of internally lit push buttons on the far left side of the instrument panel. The autopilot worked efficiently enough, but the push buttons were impossible to read in direct sunlight. A hand had to be held up as a sunshade during selection of autopilot functions.

The turbocharged Baron can offer a lot of features-quiet speed, and hauling capability. But it can't offer short-field operation as a major strength. A takeoff into a 12-knot headwind at Hutchinson consumed over 1,000 feet of pavement, while a short-field landing (approach with full flaps at 90 knots) utilized about 1,500 feet of runway. Both takeoff and landing distances over a 50-foot obstacle are reported by Beech at just a few feet under 2,500.

During takeoffs and landings the craft's relatively high gross weight stall speed, 79 knots, must be kept in mind. Also, the airplane's wing area measured against its 6,1 OO-pound gross weight creates heavy wing loading-32.4 pounds per square foot. Its actual landing characteristics, however, are quite pleasant, offering a good chance at a light touchdown, as long as the pilot remembers to use lots of up trim to ease back-pressure on the yoke.

On the ground the Baron's bungee nosewheel steering is sluggish. The rudder pedals can be pushed either direction to the full stop during taxi, with no immediate turn apparent. Differential braking is a necessity to aid in turns.

Power controls follow a traditional Beech pattern-from left to right, prop, throttle, mixture-different from the order found on planes from other manufacturers. On the turbo Baron also, you find the gear lever to the left of the center control column, and the flap lever to the right. This is exactly the reverse of the position of these two controls on the non-turbo Baron, which was certified several years earlier with the gear switch on the right side.

Though the B58 TC will carry a lot of weight, the space where cargo can be stowed is a bit less accommodating. Assuming all seats are in place and left available for people, then baggage must go in the nose, or in a compartment behind the last two seats. The nose compartment is allowed 350 pounds of stuff, and offers 18 cubic feet for it. The rear compartment has 10 cubic feet and a 120-pound capacity. Clearly, if hauling is the mission, the quick-release rear seats must be dispensed with. Overall, 1,370 pounds of cargo may be carried.

Ample doors, including cabin door and double cargo doors, make loading of people or things into the aircraft a pleasant task. The inside, though comfortable and nicely finished, cannot quite be called roomy, for the cabin width is 42 inches.

Since its introduction last year, sales of the turbocharged Baron have been steady with an average production rate of slightly more than three a month. From April of last year through March 1977, 37 turbo Barons charged forth from Beech's Wichita plant.

Baron marketing manager Brigham says that the bulk of the Baron TCs delivered so far have gone to buyers east of the Rockies. They are looking for an airplane, he said, that can carry a load on a long-haul trip-like New York to Florida nonstop. And they want an airplane that will get them up through weather and ice expeditiously.

With the proper combination of financing and flying skills, the turbocharged Baron will do either-in high style. ∢

The B55 Baron

II it works, don't change it.

By Edward G. Tripp

The approaches to the southern airport were jammed with jet transports loaded with tourists. They arrived with the predictability the railroads once had. We had to check a repair to the autopilot navigation couplers before leaving and were happy to have ATC so accommodating during a high traffic period. All they asked for was sufficient speed to fit in with the heavies.

"Please keep your speed up to the marker. Can you keep it up to the threshold?"

"How much do you want?"

"How much can you give us?"

"Is 175 enough?"

"150 knots will do."

That was fine, because it meant we could keep the gear down. Gear and Approach flaps in the Beech B55 Baron can be extended at up to 153 indicated at gross weight. Of course, a normal approach in the B55 is flown considerably slower, 11 0 to 120 knots, and racing down a glideslope is hardly recommended technique. The point is that the capability is there should conditions ever require it.

We would not do it in just any airplane, either. The smallest Baron is a combination of capabilities and qualities that generate a high degree of confidence. It is strong. Flight load factors at gross weight (5,100 pounds) are 4.4 Gs positive and 3 Gs negative with the flaps up. This and the high gear- and flap-extension speeds, the strong gear (tested to 600 feet per second) and the relative speed with which the gear retracts and extends make ATC-requested deviations from normal, sedate and well-programmed descents and approaches less work intensive than with other aircraft.

Washington National Airport often is used as an example of high-density mixed traffic. Approaching from the north or south, there are three crossing runways that regularly are used simultaneously. Fortunately, the ATC people who work the field are efficient and cooperative.

To fit into the normal flow, a pilot must know the area, the equipment, and both its limitations and his own. A typical VFR approach might include being handed *off* to the tower on a downwind leg anywhere from 3,000 to 6,000 feet above the runway. A pilot may be asked to change runways while on short final. (My personal record was made the day I was at 200 feet, heading for Runway 36, when the tower asked if I would take Runway 33 instead. After complying, I was asked if I could switch over to 3, just as I thought the flight was over. Of course, they wanted me to keep the speed up as much as possible and wanted to know if I could hold short of 36 during rollout.

If timing does not work out just right, one can get a lot of practice making go-arounds at National, too.

Being able to comply with ATC requests in such situations does not mean one is an Ace Fighter Jock. But it does mean that one or two or even more kerosene queens do not have to go around, further fouling up the approaches of several other aircraft. It does mean that one has to know, know how to use and have confidence in his airplane.

There are a lot of general aviation aircraft in which there are several decisions or even potential problems that confront a pilot being held to relatively high altitude and speed close in to an airport, then asked for a short landing to boot. Or one given a go-around after a high, hot approach in the middle of a desperate transition to someth ing-close-to-normal landing configuration and speed. Things can get out of hand. Fast.

With time and practice, the B55 is a very comfortable airplane to fly in such situations. The controls are light, well harmonized and very responsive. It does not feel like a relatively heavy airplane. In fact, quite a few pilots find it too light; the tendency is to overcontrol, particularly in pitch.

Control surfaces are balanced internally; the cables are pre-stretched; the trim tabs are' fu Ily hinged and there are tabs on each elevator. The relationship between the yoke and the rudder pedals and the control surfaces is tight and quick.

Aileron, elevator and rudder trim are standard. We used aileron trim quite a bit in the latest B55 we have flown, N6683X. The aircraft had little more than ferry time and had just had avionics installed. It was out of rig and required a lot of trimming.

The other aspect of the crisp, light controls is higher workload in turbulent air. The King KFC-200 autopilot in the airplane failed during one flight when the workload was high because of turbulence, constant communications and a lot of map reading. The Baron needed constant attention because of the turbulence and out-of-rig condition. The trip demonstrated the value of boom mikes and, at the very least, something to hold the wings level. Fortunately, the physical workload is not high because the airplane is so responsive.

The airplane is somewhat of a sleeper. The Model 55 Baron was introduced in 1961. Unlike other aircraft of that vintage, very little about the 55 series has changed since it was spawned from the Travel Air. The most apparent change to the fuselage is an extended nose, providing good avionics and baggage space up forward, which was introduced in 1964 and is practically all that differentiates the A model from the B.

Nearly 2,200 units have been produced in the 19-year production life of the Baron. For a few extra dollars, the present version is available with a few extra features, such as an extended rear baggage bay, which is particularly useful to have if the optional fifth and/or sixth seats are installed; and the large baggage door first introduced on the 285-hp Baron emulating the automobile manufacturers-the new, all-new Belchfire every single year. The all-new is usually a marketer's illusion conjured in collusion with a sheet-metal expert, with nothing changed under the skin. Nevertheless, it excites enough people to visit the showroom when the new models are on display. Possibly the relative lack of change to the B55 has made it less talked about than its more powerful variants, the E55 and the Model 58.

It also could be that pilots think of it as small or smaller and, therefore, less capable than the competition. The difference in size between the Band E model Barons is slight, as it is between them and the Piper Aztec and the Cessna 310.

Yet a lot of people considering light twins go right past the B55. Within the Beechcraft product line, the tables may have been turned a bit this year, however. Only 15 Model E55s will be built as opposed to 86 of the B55s. It seems that the 58 series, with its longer cabin and greater loading flexibility, is eclipsing the E55, while the lower initial and operating costs of the B55 is more appealing to prospective buyers who do not need the space. The $32,250 base price difference buys a lot of equipment or fuel.

Even with the high initial and operating costs of twin-engine versus single-engine aircraft, a lot of prospective operators will prefer twins for redundant systems, if for nothing else. For pilots of the twin-engine persuasion, the B55 is a compelling competitor.

The aircraft we used for the basis of this article, N6683X, is an average equipped version. No anti-icing or deicing equipment, except for alcohol anti-icing for the propellers and windshield. No radar. But six seats, a good avionics package, higher capacity alternators and batteries, 142 gallon (136 usable) fuel tanks and other utility and comfort options, including a highly desirable one-soundproofing (32 pounds and $625).

The B55 is just about as noisy as any other twin. We have flown a few with optional three-bladed propellers, which weigh an additional 46 pounds and cost $2,530. In our subjective opinion, the reduction in both noise and vibration make this option a useful investment.

The equipped price of N6683X ($201,436) includes nearly $42,000 worth of avionics and autopilot. The B55's base price, $141,500, shows what has happened in just five years to new aircraft costs when compared with the 1975 base price of $89,000. One office wag points out that a six-pack of good beer has more than doubled in that time, too, and that all things are relative. Some hurt more than others, though.

Given the various price levels of general aviation aircraft, the B55 is competitive with other twins of similar performance and capability. With full tanks (the 136-gallon usable option), 83X has a payload of 902 pounds and enough flexibility in load distribution among the cabin, nose, and aft baggage bays to use it all. There are no zero-fuel-weight or landing-weight limitations, either.

Speeds, range, and fuel flow also are competitive, and the B55 operates fairly well at higher altitudes. For instance, on a standard day at 14,000 feet, full throttle and 2,300 RPM, the airplane will cruise at 170 knots and burn about 20 GPH, which is competitive with quite a few of the larger single-engine airplanes. With the same settings at 10,000, it will true 176 knots and burn 22 GPH.

Pilots who are new to the Baron will find a few things different in the cockpit that could cause problems, particularly for those who tend to do things by rote rather than with a checklist and constant verification.

The power quadrant levers are not arranged in the standard positions of throttle, propeller and mixture; the propeller levers are on the left and the throttles in the center. Any adjustment must be verified before any movement is made, until the pilot is accustomed to the nonstandard arrangement. The task is eased because the throttle levers are longer than the propeller and mixture controls. Another good feature of the power controls is that the gauges that correspond to the controls are directly above them on the panel: tachometer above the propeller controls, manifold pr.essure above the throttles and fuel flow above the mixture levers.

The flap and gear selectors also are reversed from the standard locations, with the flap selector and indicator to the left of the power quadrant and gear on the right. Again, great care must be taken to ensure you are about to move the one you want.

Both the Band E models have this nonstandard arrangement of controls, yet the 58 series and the Model 60 Duke have the standard arrangement. So pilots moving up the line have to learn all over again.

Some people feel that Beechcraft is trapped in its own Catch 22: there are potential problems whether it leaves the controls as they are or changes them to standard. My personal opinion is that Beech should standardize, despite the potential hazard that would confront operators of several Barons or those moving from an older, nonstandard model to a new, standard version.

The rest of the cockpit arrangement very good, very logical. It is easy to learn where everything is, which is good because the control column blocks the pilot's view of much of the subpanel below the flight instruments, where the electrical subsystems and other controls are located. It also blocks ready view of the trim controls and indicators, particularly when the optional, dual-control column is installed (which is the way most B55's are ordered. The standard, single-yoke control versions are not approved for flight instruction).

The cockpit is comfortable, the seat position good and visibility about the best of any of the light twins. There is lots of space for charts, approach plates and other paraphernalia. A pull-up center armrest and adjustable pilot's seat (reclining mechanism is optional for the second, third and fourth seats) make long trips more comfortable. These, plus adjustable rudder pedals, enable pilots of varying sizes to be comfortable.

One other potential problem we uncovered in the cockpit is that it is relatively easy to hit the lower magneto switch (the outside air temperature gauge and magneto switches are mounted on a subpanel on the left cabin wall) with an errant knee, knocking it from Both to Right. It has happened enough times to make checking the mag position a regular part of the cockpit scan.

Passengers are well treated in the B55 cabin, particularly those in the third and fourth seats. The seats are high and comfortable, and legroom is very good, even with tall people up front. All the pleasant comfort touches are there: individual reading lights and air outlets, for instance; and the large side windows add a sense of space to the good view.

The optional fifth and sixth seats should be considered occasional or children's seats. Aside from the loading considerations, they are a bit hard to get to, even with the extended rear cargo door, and there is less legroom and lower chair height. They do come in handy at times and can be strapped up out of the way when they are not. However, when installed, they have headrests, reading lights, shoulder harnesses and air vents, so its not like riding steerage back there.

It is possible to customize the Baron to a greater extent than with other light twins. The list of options is long, including interior choices. While the B55 is not approved for flight into known icing conditions, even with the available package of anti-icing and deicing equipment, protection sufficient to get out of icing is available. There is enough space on the panel and in the nose bay for radar (seven different sets are factory options). And the avionics and autopilot options run for five pages. In other words, it can be equipped with all the available whistles, bells and other aids.

Shoppers who do not want a standard interior have a sufficient choice of colors, materials and little touches to please an interior designer.

For those with the need and the bank balance who do not equate quality with ostentation, the B55 is a very attractive and satisfying airplane. Good flying qualities; intelligent cockpit arrangement; quality accessories, materials and features, comfort; competitive performance with relative operating economy. All of these make the B55 a strong competitor.

Turbo Baron

At 40 GPH, this piston twin buys peace of mind and King Air speed.

By Mark M. Lacagnina

Cockpit small talk inevitably would succumb to the pervading drone of the Pratt & Whitney Wasps. The sound was reassuring, and the young copilot tried not to dwell on what might happen if the engines' duet should become a solo performance. He knew the assurances by airline management that the Boeing 2470's single-engine service ceiling was higher than the highest mountain peak along the route. He also knew this might be perfectly true under standard conditions; but conditions on the route from Cheyenne to Oakland seldom were standard. No one knew what would happen once the aircraft drifted down into the clouds and began to pick up ice. The copilot did not want to be the one to find out.

Although only 31 years old, the copilot, John MacDonald Miller, already was an experienced and seasoned aviator. He had learned to fly when flight instruction was a do-it-yourself affair. His reward for a hard summer's work assisting a barnstormer had been the barnstormer's airplane-a Curtiss IN-4 in atrocious condition. On his third flight, Miller began hopping passengers in the Jenny from a pasture near his home in Poughkeepsie, New York. After high school and a degree in mechanical engineering from Pratt Institute, he worked as a mechanic for a flying circus. He rebuilt a wrecked Standard J-l and set off on his own to barnstorm the eastern states. In the early 1930s, Miller bought a Pitcairn PCA-2 autogyro and for three years gave aerobatic exhibitions all over the country. He performed loops, rolls on top of the loops and other maneuvers that did not have names. He became the first pilot to make a round-trip, transcontinental flight in a rotary-wing aircraft. When he was not touring the autogyro, Miller managed Poughkeepsie Airport and one of the first aircraft repair shops in the country. During his early career, Miller also joined the Marine Reserve and was trained as a naval aviator.

Wasps were very reliable engines, and Miller never did find out how a Boeing 2470 would react to an engine failure over the Rockies. He left United Airlines after two years to test-fly John Kellett's "Wingless" autogyros. With Kellett, Miller logged another first-the first scheduled operation of a rotary-wing aircraft. It was a demonstration project for Eastern Airlines. Ten times each day, for a year, Miller flew a six-mile route between the Philadelphia airport and the roof of the city's post office, carrying up to 350 pounds of mail in an autogyro. World War II interrupted the project, and Miller turned to flying the line in Douglas DC-2s and -3s for Eastern and test-flying amphibious naval aircraft for Columbia Aircraft. He went on to fly DC-4s and -7s and Lockheed Constellations and Electras for Eastern. Miller retired as a DC-8 captain in 1965.

Now 78 years old, Miller (AOPA 58843) often still flies over the Rockies, but the trips are much more comfortable than they were in the right seat of a Boeing 247D. The ramifications of an engine failure are clear. If his airplane should lose an engine, he can feather it and climb.

Miller's airplane is a 1967 Beech 56TC Turbo Baron. (His other airplane is a 1951 Bonanza-the first Model C35 off the line.) The Turbo Baron is a rare bird and a hot rod. Introduced in 1967, the Model 56TC was the same size as the C55 Baron (albeit a bit heavier; 5,990 versus 5,300 pounds), had as much power as the Queen Air and was a few knots faster than Beech's flagship, the A90 King Air.

Each of the Turbo Baron's 540-cubic-inch Lycoming engines produces 380 horsepower at 41.5

inches and 2,900 RPM, maximum continuous. power. Single-engine rate of climb varies from 412 f.p.m. at sea level to 50 f.p.m. at 18,600 feet. With both engines producing 79-percent power at 12,000, true airspeed is about 222 knots and fuel consumption is about 282 pounds (47 gallons) per hour.

Only 94 Turbo Barons were built. Production dwindled from 51 airplanes in 1967 to only two produced in 1971. The hot-rod Beech Turbo Baron was eclipsed by the Duke, introduced in late 1968 with 380-hp engines and a pressurized cabin.

There were few changes to the original design of the Turbo Baron. Beech switched from vacuum pumps to pressure pumps after the first year of production. In 1970, the model designation was changed to A56TC. There were some tweaks to the panel layout and to the flap system, but the most significant change was baffled fuel tanks. The baffles were installed to prevent unporting. Beech also offered baffle kits for retrofitting earlier Turbo Barons. Unmodified 56TCs have placards prohibiting takeoff, slips and skids with less than 25 gallons of fuel in each of the main fuel tanks.

Miller bought his Turbo Baron, N516Q, in 1971 and bases it at Dutchess County Airport in Poughkeepsie. The C35 Bonanza shares aT-hangar next to the Baron's with two Mazda RX-3 automobiles that he is restoring. Miller uses an RE-5 Rotary Suzuki motorcycle when the weather is nice to make the commute between his home and his airplanes.

A certified airframe and powerplant mechanic, Miller does most of the work on his airplanes himself. His 35,000 hours of flying has left him with a strong motivation to avoid surprises, and he has installed a number of supplementary performance and hardware monitoring systems in the Baron. It has an Advanced Aero Safety low-thrust detection system, which provides aural and visual warnings of a power loss, including identification of the affected engine (see "The Which Hunter," August 1983 *Pilot,* p. 45). It also has a Teledyne angle-of-attack indicator. A Ward Aero system warns of impending alternator failure. (Miller said the device alerted him to a failing alternator while he was taxiing out, with his wife aboard, for takeoff in very low IFR weather conditions. They took the Bonanza, instead.) In the sumps of each engine is a device that, by detecting the presence and the amount of metal particles in the oil, monitors internal engine wear. The airplane also has six-probe exhaust gas temperature gauges and turbocharger turbine inlet temperature in-dicators.

Miller notes that none of this equipment is overly complicated or difficult to install, and he wonders why all multi-engine aircraft do not have all of it before they leave the factory. "The manufacturers don't seem to realize that when you're flying a twin, you need all the help you can get."

He recently took the Turbo Baron on a long trip to California, Arizona, Colorado, Texas, and Florida. One leg of the trip was very near the route he used to fly in a Boeing 2470 years ago. "That was a pretty good airplane in its day," Miller recalls, "But the Baron has more range, speed, and altitude."

"However," he adds with a chuckle, "you have to be a bit crazy to own a 56TC. It is expensive." For flight planning, Miller figures 40 gallons of fuel per hour, block to block; and the airplane requires substantial maintenance. Although he enjoys working on the airplane, the cost for parts is high. (During a recent annual, for instance, the exhaust manifolds on each engine had to be replaced, and they cost $2,000 each.) He jokes that he has discovered how manufacturers price parts: "It's easy. They put a dollar sign in front of the part number."

It is not likely that Miller will get rid of his hot rod, though. He calls it his "Baby P-38." And though he may sometimes grumble good-naturedly about how much it costs to operate the Turbo Baron, he always concludes that the airplane is worth every cent. ⋖

Beech Baron 58P

The businessman's express

By Edward G. Tripp

General aviation is still a trade-up market. Pilots continue to buy more performance and flexibility. In today's used aircraft market, it is possible to purchase very sophisticated turbine airplanes for the price of sophisticated piston singles. More than enough operational and accident information has accumulated over the years to support a general concern about the way in which people move up into complex, multiple-systems aircraft. Too many operators do not get the information they should to use the capabilities they purchase successfully and dependably.

The problem is not the lack of information: Instead, it is the failure to take advantage of what is there. For instance, I have attended many aircraft type schools, and at literally everyone there are operators who have decided to go to school after having operated a particular make and model for a period of time and getting into enough trouble to realize they need more information. Some of them have made it apparent that they had not even read the information on operations and systems contained in the pilot operating handbook (POH). It is tragic that other pilots did not come to that realization until it was too late.

For experienced pilots, the basic task of flying high-performance aircraft is comparatively easy, once the characteristics of a particular aircraft are known. It is all the add-on systems, the planning and operating decisions, the emergency procedures and the care and feeding (pre- and post-flight inspection and maintenance}-in other words, the complexities that add the capability-that can create problems for the unschooled and uninformed.

There also is the need for recurrent, or proficiency, training. The tendency toward complacency or overconfidence is strong in all of us. The longer we fly one particular make and model without problems and without periodic review and practice, the stronger the tendency becomes.

Part of that tendency comes from the way a pilot thinks about an airplane. All too often, the aircraft is rarely thought about until we are about to fly, and then it is quickly forgotten after it is tied down or pushed back into a hangar. We are more likely to get away with this attitude with simple airplanes than with complex ones, but regular features such as "Never Again" and "Safety Corner" regularly give examples of pilots who have become trapped by a casual attitude or complacency about their aircraft.

We should strive to get all the information we can, particularly when flying complex aircraft and aircraft used primarily for on-demand transportation. It starts with school, if one is available, or at least thorough grounding in the POH and a thorough flight check in the environment in which we plan to operate.

We can learn much through the experiences of others in similar aircraft and types of operation. A solid review of accident records, airworthiness directives (ADs) and service difficulty reports (SDRs) can provide useful data on the types of mechanical and operational problems others have had. SDRs, for instance, can provide data on specific systems in an aircraft to be checked regularly in a preventive maintenance schedule, so one can avoid in-flight problems.

The more you fly your airplane to keep to a schedule, which means greater exposure to weather and other conditions, the more dangerous is a casual approach to your airplane, and the more you expose yourself and your passengers to hazard.

This is not one of those "airplanes don't kill people, pilots do" lectures. Things break without any mistakes or neglect from pilots. But the more knowledge and information you have and the more care you take to inspect and fix things before they break, the less likely you are to be overcome by surprise or victimized by events.

The Beechcraft Baron S8P is a good example of a very capable high-performance aircraft. It rewards the well trained pilot who takes pains with its care and feeding, but it can extract penalties from those who are not properly trained or are careless in operation and maintenance.

Pilots call it the P-Baron, the pressurized Baron and the baby Duke. Controllers frequently call it a King Air. Whatever you call it, the pressurized Baron became the top of Beech's piston-engine aircraft line when Duke production stopped.

Now that Piper has abandoned the Aerostar line, the S8P also has become the fastest piston twin currently manufactured, edging out Cessna's 421 and Piper's Mojave by a small margin. The latter two aircraft are cabin-class twins; the S8P is close to cabin class, with its aft entry door on the left side of the fuselage and an optional club seating arrangement.

As of January, 485 S8Ps had been sold since the model was introduced as part of the 1976 product line. Most are owner-flown, and most are the first pressurized aircraft operated by the bulk of the buyers. The owner/operator profi le is close to that of the Aerostar. A study of the accident record and 5DRs for the past five years indicates that quite a few of the accidents and maintenance or reliability problems could have been avoided with better training and planning, use of available information and more regular, thorough inspections and preventive maintenance. Three principal weaknesses that were not operator-caused and were the subject of ADs showed up in early operations: cabin window and frame integrity, cracking cases on the early L series engines and propeller blade-shank cracking. Eight ADs have been issued; all but one (for fuel pump leaks) were announced before 1980.

Unlike the rest of the Baron fam ily of ai rplanes, the S8P was certificated to FAR 23 standards, even though it shares much of its design, configuration and construction with the rest of the 50 series.

Quite a few changes have been made to the model during its nine-year production cycle. In the spring of 1976, an optional wing-tip auxiliary fuel system was offered to increase usable fuel from 166 to 190 gallons. For the 1979 model year, the intercooled 31 O-hp Continental T51 0-S20-L engines were replaced with 32S-hp T51 0-S20-WBs, which also employ intercoolers to reduce induction air temperature. At the same time, maximum pressure differential was moderately increased from 3.7 to 3.9 pounds per square inch (the higher differential provides a 1O,OOO-foot cabin altitude at 22,000 feet), and maximum takeoff weight was raised from 6,100 to 6,200 pounds.

Basic empty weight increased 14 pounds. In 1982, internal corrosion proofing was made standard, time between overhauls (TBO) was increased from 1,400 to 1,600 hours, and the static discharge system was improved.

From a pilot's point of view, perhaps the biggest changes were introduced in the 1984 model. The yoke, power controls, panel and arrangement of gear and flap controls were reconfigured to what is the currently accepted layout. (FAR Part 23 contains broad requirements for the standardization of general aviation cockpits. However, there is a Notice of Proposed Rulemaking that proposes to enhance standardization.) The throttles have been moved from the center of the power quadrant to the left side, and the large throw over control column has been replaced with individual control yokes and columns on either side of the cockpit. Pilots making the transition to the reconfigured Baron 58 series will welcome the change, but pilots with Baron experience will have to be careful not to succumb to old habits when operating gear, flaps and engine controls.

The net resu It is that the lower portion of the instrument panel is much easier to see, the controls are similar in placement to most other retractable singles and twins, and-with the use of smaller engine gauges-what had been a very full panel now has lots of room for avionics and other accessories. Relocation of all engine gauges to the center left of the panel makes them much easier to monitor.

Members of the Pilot staff recently flew a new S8P for about 30 hours on a variety of business trips that ranged from relatively short dashes to long, cross-country hauls. During most of the period, the weather was poor to bad, with considerable icing, lots of turbulence and other conditions that affected flight planning and in-flight decisions. These circumstances provided opportunities-or requirements-to use every system and accessory. The only condition we did not experience was high ambient temperature. The highest temperature experienced was 100 C above standard.

The trips ranged across the eastern half of the United States and from the Canadian border to the Gulf Coast and operated into a wide mix of hub airports and small, uncontrolled fields. Many onlookers, ramp attendants and pilots consider Barons small aircraft, so the reactions to N20S8V were interesting. Comments about the exterior and interior were uniformly positive and admiring. Several pilots, including three operators of light and medium twins, said that the S8P was their ultimate twin.

Unfortunately for most pilots, ultimate connotes desired but beyond reach. And for an increasing number of us, the ability to purchase the aircraft of choice is driven by genuine business need and hard financial analysis. For those with the supportable need, the pressurized Baron is an interesting alternative, particu larly in the owner- or operator-flown category. It provides competitive performance with the smaller turboprops at about half the cost, can be equipped for all-weather operations, has the operational flexibility to mix in with other high-performance traffic at big airports or handle relatively short, rough strips. For the properly trained pilot, it is both easy and pleasant to fly. On the used market, the S8P is holding its value relatively well.

I have flown several 36-series Bonanzas and 58 Barons with the reconfigured panel and controls, and I am very impressed with the changes. Switches, gauges and controls that you had to stretch, duck or crane your neck to see are now in full view. The reorganized panel, with the smaller, turbine size engine gauges, seems bare compared to the original configuration.

During the check-out, there was no difficulty locating things in the cockpit, so we were able to concentrate on systems, operating techniques and flying. There is one arrangement in the cockpit that I would like to see changed: The switches for the fuel pumps are mounted directly above the cowl flap switches just to the left of the gear selector. They operate in opposite directions (fuel pumps up for on, cowl flaps down for open). Especially with the indicator for the cowl flaps up on the annunciator panel, the two controls should operate in the same direction.

Also, while the S8P that we flew is very well equipped, a counter-drum pointer altimeter should be part of the standard kit for any aircraft designed and equipped to fly at middle and high altitudes.

For the most part, preflight, engine start and runup are straightforward. A couple of items require extra care, however. While the S8P has a good payload with full fuel for this category of airplanes (20S8V has 709 pounds), careful planning is required to stay within limits.

Fueling should be carefully monitored, not just out of general concern to ensure that the proper grade of fuel is loaded, but also because the outboard filler port for aircraft with the auxiliary tank demands careful insertion of the nozzle to preclude damage to the tank. The sight gauges just outboard of the engine nacelles are helpful when taking on partial fuel or when fuel must be off-loaded for weight and balance/payload adjustments.

The pi lot should personally monitor passenger boarding and ensure that passengers entering the cabin step over the threshold to avoid damage to the rear door pressure seal. He shou ld personally secure the aft door, then check the visual ind icators for proper locking. (There are cockpit annunciators for the fore and aft doors.)

Pilots with experience in Bonanzas or Barons should find the transition very easy. Pilots unfamiliar with these aircraft should find it a delightful experience. The S8P, while heavier and not quite as responsive as other Barons, shares the same well-harmonized and still very responsive controls.

The only time you have to work consciously to get the 58P to do what you want is during landing, particularly with little or no weight in the cabin. The 58P's weight bias is forward, and it takes a lot of trim plus effort to keep the airplane's nosewheel off the ground.

The gear is beefy, but the nose gear is the weak link. Repeated abuse can result in maintenance problems or mechanical damage. This (or the nose heavy tendency) is not peculiar to the 58P, but it is a characteristic that requires awareness and operational care.

The fortunes-or vagaries-of weather and departure delays resulted in the first two legs being flown in what Snoopy calls "a dark and stormy night." The first approach was flown in poorer-than-forecast conditions of low ceiling and visibility with snow, turbulence and a long but contaminated runway. The second leg was even worse, with occasionally severe turbulence, multiple layers of ice and a line of thunderstorms at the destination for good measure. The only system we did not employ that night was the air conditioning. It is a tribute to the basic good flying qualities of the airplane, the layout of the cockpit and the performance of the systems that we completed the trip rather than divert.

Maximum operating altitude is 25,000 feet. Climb performance is good enough to use higher altitudes regularly for cruise. For most trips, we used a cruise climb power setting and 130 KIAS, with cowl flaps half open with an average rate of climb of slightly over 1,000 f.p.m.

At gross weight, maximum cruise power (2,400 RPM / 33 inches manifold pressure) produces speeds of from 216 knots at 12,000 feet to 241 knots at 25,000 feet. The fuel burn and the noise level at this power setting are high. We regularly used a lower setting that is between 60 and 65 percent power of 2,200 RPM / 30 inches manifold pressure that results in lower noise level, an average of nearly another hour endurance with IFR reserves (approximately 5.5 hours versus less than 4.5) and true airspeeds of from 194 knots at 12,000 feet to 218 knots at 25,000 feet. Most trips were operated at 100 to 500 pounds below maximum takeoff weight of 6,200 pounds, so average true airspeeds were higher.

The combination of relatively high never exceed, maximum structural cruising and maneuvering speeds and maximum approach flap and gear extension speeds makes descent management an easy task while maintaining good engine operating temperatures. Speed management is good and can enable jet-speed approaches to be flown; yet patterns can be flown comfortably behind much slower aircraft.

Equipped to use the full capability of the design, there are many systems, operations and procedures the pilot must know completely. That is where training-initial and recurrent-comes in. Beech provides transition training to customers in a three-day program at the Beech training facility in Wichita. The ground school program covers all systems, procedures, performance, operational considerations and emergencies; a significant portion is devoted to the powerplants. School ends with a familiarization flight in the customer's aircraft during which all flight regimes and emergency procedures are covered. The program is available to owners and operators of used 58Ps for $565. It is well worth the fee.

The POH is very informative. It provides quite a bit of performance data that should be part of the manual for any piston twin, such as accelerate/go, single engine climb gradient and takeoff and landing data for grass fields. It also contains more information on general operating and safety considerations than most manuals.

In short, the 58P has a lot of capability and flexibility and provides competitive performance. Passengers can be very comfortably taken care of, even during long trips. There are a variety of interior arrangements available to make carrying a mix of people and baggage or cargo simple.

From the pilot's point of view, it can be a useful tool to accomplish a variety of missions and, thereby, satisfy the bean counters' requirements while giving us a lot of pleasure along with the transportation.

Beech Baron 58

Areborn light twin comes up against a strong used-aircraft market

By Thomas A. Horne

Can a reasonably well-equipped new light twin with a price tag hovering near $500,000 compete with equally capable used twins costing substantially less? Beech Aircraft Corporation apparently is willing to discover the answer to this. Such a choice represents a big gamble. By putting the Baron 58 back in production when demand for new light twins has for years been marginal to nil, the company stands little to gain and much to lose.

If the sales effort is less than successful, it will not have been the airplane's fault. The B-58 has been one of Beech's most popular Barons, with total sales of more than 1,500 airplanes. More powerful and capacious than the 260-hp Baron B55, and less expensive to buy and maintain than the 325-hp B-58P, the turbocharged, pressurized, top-of-the line, the B-58 falls in the middle of the Baron line.

Several important improvements were made to the B-58 in 1984, when the airplane was certificated to Federal Aviation Regulations Part 23 standards. The engines were changed to 300-hp Teledyne Continental 10-550s (previous models were powered by 285-hp Continental 10-520 engines), and the instrument panel was redesigned. Throttle, propeller and mixture controls were changed to the left, center and right positions, respectively, on the power quadrant (previous models had their propeller controls on the left and their throttles in the center), and the engine gauges were changed to a vertically stacked arrangement, located to the immediate right of the flight instruments. In other conformations to standardization, the landing gear and flap switches were relocated to the left and right sides of the power quadrant, respectively (earlier models had these controls reversed; the National Transportation Safety Board asserted that there were many 'design-induced' inadvertent landing gear retraction accidents in Barons and Bonanzas due to this arrangement), and the center-mounted control column was eliminated in favor of separately mounted control columns. This change did away with the massive bar that connected earlier dual-control yokes and obscured the pilot's view of landing gear, flap and other controls mounted on the instrument subpanel.

The newly certified B-58 is, in operational terms, an entirely different airplane from its predecessor. The engines are designed to operate at temperatures as high as 20 degrees Celsius lean of peak exhaust gas temperature (EGT). An altitude-compensating fuel pump automatically enriches or leans the fuel-air mixture ratio as the airplane climbs or descends. In climb and descent, the mixture levers remain at the full-rich setting. Same thing for takeoffs at high density altitudes. There is no need to manually lean the engines for optimum performance prior to a hot and/or high departure. Just leave the mixtures full rich, and the pumps make the proper adjustments. The only time the pilot makes mixture adjustments is at altitude, when establishing cruise settings.

And as far as mixture goes, there are only two choices-20° rich and 20° lean of peak EGT. The B-58's EGT gauges, located fourth down from the top row of engine gauges, are delineated in 20° increments, making leaning an easy matter.

The "lean burn" engines also allow the pilot to operate the airplane at power settings as much as four inches over square (i.e., a condition in which the manifold pressure value exceeds the value of the first two digits of the propeller RPM. In many normally aspirated engines, this condition can be undesirable, since it can subject the engine to high, damaging internal pressures it is not designed to tolerate). For example, one recommended cruise power setting for a pressure altitude of 4,000 feet is 25 inches of manifold pressure, 2,1 00 RPM and a mixture setting of 20° lean of peak EGT. The resultant airspeed is published as 171 KTAS-not much less than the

180 KTA5 published for the 20° rich of peak EGT setting. But the big difference is in fuel burn: 11.3 gallons per hour per engine for the lean setting, versus 14.2 GPH for the rich. Equally dramatic differences in fuel burn occur at all altitudes, so in the new 8-58 it makes little sense to run the engines rich. In this airplane, as with the Piper PA-46 Malibu (equipped with a 31 O-hp Teledyne Continental T510-520-BE engine), pilots must overcome the urge to run rich of peak in the mistaken belief that they are sparing their engines. The engines have been designed to run lean of peak; it does not damage them.

Yet another operational distinction of the B-58 runs counter to what many pilots have come to accept as standard practice. After takeoff, the throttles remain full forward. The pilot simply retards the propeller levers to the recommended 2,500 RPM. Remember, the mixture is leaned automatically.

Pilots transitioning to the new B-58 must take the time to learn of these and other idiosyncrasies. This Baron, like the others, is a complex airplane that demands a thorough knowledge of its systems, procedures and limitations. Particular emphasis should be placed on weight and balance; like most light aircraft, the B-58 is simply not a full-fuel! full-passenger airplane (especially when equipped with the optional 194-gallon fuel system), and it can be easy for the center of gravity to end up aft of limits, even at lighter weights.

Barons may be easy to fly, but for a pilot to be thoroughly proficient is another matter. Flight Safety International's Baron Training Center (located near the Beech factory in Wichita; telephone 800/227-5656) offers pilot initial and recurrent training in the B-58 and other Barons. F51 has seen fit to establish a one-week course for pilots transitioning to Barons. This seems like a good idea. Because the airplane handles so well under normal circumstances, complacency can easily set in. A perfunctory checkout with limited practice in single-engine procedures is simply insufficient, both for safety and, increasingly, the satisfaction of insurers.

When everything runs well in the B-58, the airplane is a pleasure to fly. Visibility inside and out is very good indeed, and the seats are comfortable. Pilots and passengers alike have plenty of head and shoulder room. The B-58's relatively high (152 KIA5) landing gear and flap extension speeds make it easy to fit in with faster traffic operating at busy airports. The controls are light and, with the exception of its well-known tendency to enter a dutch roll in turbulence, the overall feeling is one of reassuring stability. It is no wonder that Baron owners remain loyal and that these airplanes hold their value well in the used market.

Therein lies the rub. With so many good used Barons to choose from, why buy new? The sale of nine 8-58s to Lufthansa German Airlines and four to the Indonesian government (in both cases for training purposes) can be explained by the weakened dollar. The remaining 15 or so B-58s sold since production was resumed hardly constitute a strong response from the owner-flown segment of the market.

How to justify this marketing move? Part of the reason may be the perception that, as the pool of existing general aviation airplanes ages, prospective customers will be less inclined to invest in airplanes with a lengthy list of maintenance problems or high-time airframes. Airplanes, after all, do wear out, and, as has been pointed out by AOPA and other user groups, owners of older airplanes sometimes experience difficulty in obtaining replacement parts. There are still many owners and operators for whom a new light twin may hold appeal. The B-58 may not have the turbocharging or pressurization that allows certain operations, but neither does it have the associated maintenance burdens. What it does have is a tradition of quality, brand loyalty, high quality-control standards, fuel economy, comfort, a strong support network and-oh, yes-two engines. If the B-58 endures, it will be by these virtues, not its price tag. Barons have always been pricey items, but this has rarely dissuaded customers in the past-until prices began to soar in the early 1980s.

One has to admire Beechcraft for its willingness to take risks. Its investment in the Starship program, its decision to build and market the Beechjet (nee Mitsubishi Diamond II) and its price reduction of the Bonanza F33 bespeak its optimism. We have already seen the impressive effect that the Bonanza price cut has had: The F33's production run is sold out for the foreseeable future. In this there is a strong hint. If the current B-58 sales strategy is less than satisfactory, there is an alternative approach.

Beech 58 Baron

To the Manor Borne

By Richard L. Collins

When the light twin was born in the late 1950s, the first Beech effort was the Travel Air, with two 180-horsepower Lycomings. Based on the Bonanza fuselage and wing, the Travel Air was a good airplane, but other manufacturers were upping the ante on power, and Beech soon followed with the Baron, sporting two 260-hp Continentals.

There followed a long line of Barons, including the 58s, which use the same fuselage shape as the Model 36 Bonanza. The most power ever put into a Baron was in the 56TC, which shared basic nacelles and 380-hp Lycomings with the Duke. Later, the long-body 58 was built in turbocharged and pressurized versions. Today only the normally aspirated Model 58 is in production; only one other light twin (under 6,000 pounds maximum takeoff weight), the Piper Seneca, is being built, and no medium piston twins are in production. Baron production is not great-six were delivered in the first half of 1988-but the airplane is available new, and that says a lot about its staying power in the current market.

Several things adversely affected the sale of light and medium piston twins, and all are worth relating to today's Baron. Light twins consist not only of the engines and the aluminum, they are formed by a history that caused an initial popularity among pilots to fade away like a strong old soldier.

Twins were often sold to professionals with the money to buy but without a lot of flying experience. No more. Because the accident history was not good, insurance rates on twins ratcheted upward. Originally rates were lower than for singles, then they became substantially higher. Finally, insurance became basically unavailable to low-time pilots. Prices of used twins dropped: Today a 10-year-old Baron is worth about 50 percent of its price when new; a Bonanza 36 at age 10 is worth an astounding 86 percent of its new list.

Where insurance is still a tough question on light twins-one insurance executive flatly stated, "I don't like them"-there are more answers now than in the recent past. Insurance is available, and, for example, if a pilot is stepping up from a Bonanza to a Baron, the conditions are likely to be more reasonable because of the similarity between the airplanes. The Baron school operated by FlightSafety International would likely be required, along with regular proficiency flying. If the pilot has little or no multi-engine experience, 40 or 50 hours with a qualified pilot might also be required. After this, the maximum liability limits might be relatively low until the pilot gains some experience in the airplane. The days when you could get the rating in 10 hours at the local fixed-base operator and insure a twin the next day are gone forever. But the conditions under which you can buy insurance are more reasonable than a few years ago. As far as being able to buy insurance with no restrictions and no big upgrade in premium, you have to go in with 1,500 to 2,000 hours total time, SOD hours in multi-engine aircraft, and some time in type. This has all been a very real factor in the light twin market.

Are the insurance companies so sticky for a reason? Yes, a very simple one. They lost a lot of money on light twins. A member wrote recently that he was thinking about trading his F33A for a Baron and wanted to know if there was anything to the old saying that twin safety is a myth. If he shopped for insurance, he would learn that at least the insurance companies think so.

There was never a false promise on safety in the airplanes themselves. The false promise was in the minds of the people who were buying the airplanes and in the perception of the World War II-generation pilots who were in general aviation in large numbers at the time the light twin came out. To them, two engines equals safety. Period. If the engine on a single fails, you make an off-airport landing, right? Right. If one engine on a twin quits, you fly to an airport and land, right? Maybe. It certainly never proved to be automatic. All the light twins had marginal engine-out performance and demanded almost total perfection in flying technique should an engine fail. The unhappy result was that, in the heyday of the light twin, your statistical chances of being killed after one engine failed were four times greater than your chances of being killed in a single after the engine failed. This has likely improved somewhat because of pilot awareness of the problem.

The Federal Aviation Administration contributed to the safety record that led to the light twin's decline in two ways. First, for years the FM demanded that engine-out minimum control speed demonstrations be done at the lowest possible altitude, "but not below 500 feet." If this were done today in a brand new Baron 58, it would mean flying at 84 knots as low as 500 feet and pulling back one engine. Guess what the stalling speed of a Baron is with the flaps up? The same 84 knots. It was a period of idiocy in government regulation that cost a lot of lives and that cast a shadow over the viability of light tWins that endures to this very day. If you don't fly them too slowly, you don't lose control, and the FAA was promoting flight at insanely low airspeeds.

The other FAA contribution was in something not done. If a person survived the lowspeed, low-altitude shenanigans and got a rating, that was it. No further training or proficiency flying required for life. In studies of engine-out accidents in these airplanes not related to training, the pilots involved usually have a lot of multi-engine time. What this tells us is that the pilot got a rating, bought a twin, and flew it successfully until an engine failed. Engines go for a long time, and by the time the failure occurred, the pilot had forgotten everything learned on the subject. Boom.

It is very unfortunate that all this happened because there are a lot of people who would rather have a twin than a single, the choices are down to two new ones, and questions abound.

The simple fact is that if we put the failures in training and proficiency flying in the past and get with the program, a light twin can be a better deal today than ever. All it takes is a high level of skill, operation *off* relatively large airports, and limiting takeoff weight if necessary to give adequate single-engine performance. This is not totally restrictive. On a standard day at sea level a Baron 58 at gross weight can lose an engine at rotation and still clear a 50 foot obstacle 6,000 feet from the start of the takeoff roll-but only. if flown with absolute precision.

Do it right and the risk from engine failure can be managed and the other benefits of a twin can be enjoyed. They include having dual systems, having the option to continue flight to an airport if an engine fails, and enjoying the substantial rate of climb and measurable cruise speed advantage that the twin offers. In the Northeast, Baron pilots regularly take advantage of routings that go 40 miles out to sea to save a lot of miles; only strong swimmers do that in singles. Many are nervous at night in a single; a Baron soothes those nerves with the drone of two engines. If all the conditions are met, statistically a Baron may not be any "safer" than a Bonanza, but it certainly doesn't have to be any less safe. The vast majority of the twin-related accidents can be addressed with pilot skill. The rest of the wrecks-largely weather-related-have nothing to do with the number of engines on the airplane.

Cost is another item that assaulted the light twin. Higher insurance rates aside, soaring fuel prices soured the cost relationship between operating a single and a light twin. When fuel was 30 cents a gallon, a Baron burned $4.50 an hour more than a Bonanza. At two bucks, that becomes $30 per hour more to fly the twin. Two engines to overhaul, plus two props, is another factor. Probably $15,000 minimum for the Bonanza, twice that for the Baron. Another insidious factor worked on new twins. Pilots started opting for an ever-increasing list of avionics, pushing equipped prices higher. More and more started opting for a high-performance single with all the whistles and bells that came out at about the same price as a basically equipped twin.

Insurance, safety, and cost relative to singles were the big factors. While light twins may not soon sell in the same ratio to singles they once did, they are still viable for a lot of pilots. And the Baron is a classy airplane in which to travel, one that offers a good blend of handling qualities, performance, and utility. It was with all the background of the light twin in mind that I went flying in a new Baron one stormy day in Wichita.

Beech developed a new instrument panel for the Baron a few years ago. Previously the panel had an arrangement that has become nonstandard, with the throttles in the middle, the prop controls on the left, and the mixtures on the right. The gear switch was on the right and the flaps on the left. All that is standard now, which is great, but to show how ingrained one can become about Baron flying, I tried to use the prop controls to reduce the manifold pressure on the first takeoff. We do need training when something changes.

The Baron accelerates well on takeoff, and the cruise climb is quite impressive: 136 knots and 1,500 f.p.m. were the numbers this day.

The flight was conducted in moderate rain with some light turbulence, which is what enroute and maneuvering handling qualities are all about. I hand-flew, because although watching the autopilot is enjoyable, the other skill has to always be ready. The Baron's relatively light control forces are nice on the gauges, and in total it is a fingertip exercise. Barons show 200 knots as maximum cruise, and I have never heard anyone say that a Baron does anything other than meet or exceed cruise figures. Two hundred knots is a neat cruise number, and coupled with the Baron's good climb it gives greater flexibility when westbound than is found in a turbocharged single and is a real rival on an eastbound trip, even in the wintertime. At 200 knots, the Baron can take SOon the nose down low and still have a respectable number on the groundspeed. Eastbound, it will climb to 15,000 feet in 25 minutes and cruise 190 knots at that altitude while burning only 25 gallons per hour total. Having the extra power that is required to make the airplane climb 390 f.p.m. with one engine operating pays off in a lot of other areas.

Because of the weather we didn't do any single-engine work in the airplane, but the last time I had flown a Baron 58 I landed with one prop feathered because of a ruptured diaphragm in a fuel pump. Then it was a simple matter of choosing a nearby large airport and flying a normal approach to that airport, mindful of the fact that I would be committed to the landing after extending full flaps.

The approach back into Beech Field this day was a good workout because the approach had to be a circle, and the weather was right at minimums. Configuring the Baron for landing and the circle at 11 a knots to a short final was not a high-pressure event, and the Baron's pitch stability in the landing configuration made holding the airspeed a relatively simple task.

One thing twins are is louder inside than most singles. The Baron is no exception. I don't know why as pilots we put up with this when, for not many dollars, an airplane can be equipped with headsets and an intercom. To put new airplanes out without intercom systems is to emphasize one of the few real weaknesses in contemporary general aviation airplanes.

The Baron has been used for a lot of things. It serves as a military and airline trainer, is used by the U.S. Forest Service, does yeoman work in air taxi and cargo flying, and serves well as a transport for companies. But a Baron is probably at its finest in the service of an individual, a proud individual who cares enough about using fine machinery to hone skills to a high level. ∢

Appendix

A Summary 01 the 1980
NISB Special Investigation Report
01 Design-Induced Landing Gear
Retraction Accidents
in Beechcra" Baron, Bonanza,
and other Light Aircraft.

National Transportation Salety Board

Washington, D.C. 20594

Special Investigation **Report**

Adopted: June 24, 1980

Design-Induced Landing Gear Retraction Accidents In Beechcralt Baron, Bonanza, and Other Light Aircralt

Synopsis

A detailed review was made of all inadvertent landing gear retraction accidents occurring from 1975 to 1978. The data indicated that Beech Bonanza and Baron type aircraft, while comprising only one-quarter of the single-engine and light twin-engine fleets, were involved in the majority of these accidents. Pilot comments and a human engineering evaluation of contemporary light aircraft cockpits revealed that these two Beech aircraft have four design features which tend to increase the probability of inadvertent landing gear retraction accidents. Inexpensive methods of correcting these problems are recommended.

Background

During this investigation, the Safety Board reviewed its files for every inadvertent landing-gear retraction accident between 1975 and 1978. Information from these files indicated that such accidents typically occurred because the pilot was attempting to put the flaps control "uP" after landing, and moved the landing gear control instead. The inadvertent movement of the landing gear control was often attributed to the pilot's being more accustomed to flying aircraft in which these two controls were in exactly opposite locations.

The review of the Safety Board's automated data base indicated that two aircraft types, the Beech "Bonanza" (Models 33, 35, and 36), and the Beech "Baron" (Models 55, 56, 58, and 95) were involved in most of the inadvertent landing gear retraction accidents which occurred from 1975 to 1978[1]. The Bonanza and Baron[2], however, constitute only about one-quarter of the active light aircraft fleet with retractable landing gear. Inadvertent gear retraction accidents may cause extensive damage to the aircraft ($15,000 to $25,000 per occurrence) and occasionally have resulted in occupant injuries. For these reasons, the Safety Board undertook this special investigation to establish why these two aircraft were experiencing a disproportionately high number of such accidents.

1.) The last year for which complete data are available.

2.) These two aircraft were also marketed under the names "Debonair" and "Travel Air," respectively.

The Safety Board compared the details of Bonanza and Baron's cockpit features to those of other contemporary light aircraft. The comparison indicated that the cockpit design features of the various models of Bonanzas and Barons differed from those of most other contemporary light aircraft-such as the locations for the landing gear and flap controls. The human engineering problem areas documented in the report resulted largely from the fact that their basic instrument panel design is 35 years old. A great deal of knowledge about the effects of good design in preventing human error has been acquired since these aircraft were originally certificated, and more appropriate standards have been established. However, the current FAA regulations permit the continued manufacture of these aircraft under their previously issued type certificates.

This report examines how cockpit design deficiencies generated the relatively high rate[3] of inadvertent gear retraction accidents in these two airplanes. In addition, it will show how these deficiencies have contributed to accidents in other types of aircraft because the pilots were more familiar with the nonstandard arrangement in the Bonanzas and Barons. The report also clearly indicates by specific examples the fallacy of continuing to produce new aircraft to certification standards which have been bypassed by technology.

Statistics

The Bonanzas comprised only about 30 percent of the single-engine aircraft fleet with retractable gear, but they were involved in 67 percent of the accidents of this type based upon the following information. The FAA records for 1978,4 indicate that the various Beechcraft Bonanza models comprised 9,430 aircraft in a fleet of approximately 31,500 active single-engine aircraft with retractable landing gear, and Safety Board data indicate that from 1975 to 1978, these Bonanza were involved in 16 of the 24 inadvertent gear retraction accidents.

The Barons comprised only 16 percent of the light-twin fleet, but they were involved in 54 percent of the accidents of this type based upon the following information. The 1978 FAA records showed that the various Beechcraft Baron models comprised 3,441 of the approximately 21,000 active reciprocating engine light twins, and during the 1975 to 1978 period, Safety Board records indicated that the Barons suffered 21 of the 39 inadvertent gear retraction accidents. (See Table 2.)

Therefore, the Bonanza and Baron aircraft have inadvertent gear retraction accident rates that are between two to four times the average rate for aircraft in their respective categories. In fact, they were involved in over 61 percent of all these accidents from 1975 to 1978, while constituting only 25 percent of the active fleet of light aircraft having retractable landing gear. These results are similar to those reported in an earlier Safety Board Special Study, published in 1967, concerning design-induced pilot errors. That report concluded that the early Bonanzas, while comprising only 22 percent of the fleet with retractable landing gear, accounted for 48 percent of the inadvertent gear retraction accidents. The number of such accidents involving the Bonanzas and Barons, and their individual accident rates, are several times as great as those of most other similar contemporary light aircraft. Figure 1 graphically illustrates these facts. For instance, the significant differences in the rates of occurrence of inadvertent landing gear retraction accidents can be seen by comparing the Bonanza with a similar aircraft, the Cessna 210. The 4,741 Cessna 21 0s, which comprised 15 percent of the single-engine, retractable gear fleet in 1978, only had four percent (1 accident) of the inadvertent landing gear retraction accidents occurring to single engine aircraft during the 1975 to 1978

3.) These rates were derived for each type aircraft by dividing the number of inadvertent landing gear retraction accidents by the estimated number of those aircraft which were active.

4.) The last year for which complete data were available.

5.) "Aircraft Design-Induced Pilot Error," NTSB Special Study PB 175629, July 1967.

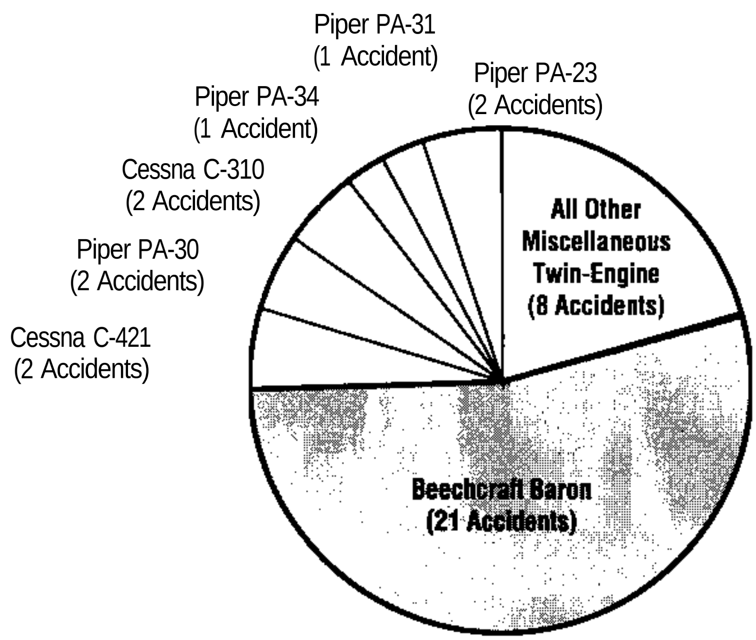
Table 2: Retractable Landing Gear Accidents
Beechcralt Barons and Other Twin-Engine Aircraft

Model	Date	Location	Pilot Total Hours in Accident Involved Model	Pilot Total Hours in All Makes &Models	Pilot AdmiUed Confusing Flaps with Landing Gear	Pilot Stated a Familiarity for a Reversed Arrangement of Gear and Flaps
Beechcralt Baron						
BE-55	2/20/75	Kansas City, MO	47	1114		
BE-58	3/5/75	Plymouth, MA	33	12586	X	X
BE-58	6/23/75	Phoenix, AZ	5	6580	X	
BE-55	1/17/75	Anchorage, AL	99	7567		
BE-58	8/20/75	Blountstown, FL	418	3308		
BE-58	9/25/75	Jacksonvilie, FL	405	12220	X	
BE-58	9/29/75	Little Rock, AR	12	872	X	
BE-55	1/31/76	Fresno, CA	27	8300		
BE-58P	7/20/76	Albuquerque, NM	15	12000	X	X
BE-95	1/3/77	Las Vegas, NV	40	700	X	X
BE-55	5/5/77	Davenport, IA	934	6841	X	
BE-58	8/7/77	San Antonio, TX	12	1412	X	X
BE-58	11/2/77	Albany, NY	3	10660	X	
BE-58	12/10/77	Laredo, TX	425	1400	X	
BE-58	5/22/78	Kalskag, AL	18	14500	X	X
BE-58	5/31/78	Little Rock, AR	194	1205	X	
BE-55	6/16/78	Walla Walla, WA	45	1232	X	X
BE-55	7/11/78	Albuquerque, NM	140	2300	X	
BE-58	8/16/78	Hickory, NC	700	8355	X	X
BE-95	9/23/78	Amarillo, TX	100	6000	X	
BE-55	12/24/78	Crosscut City, FL	1200	2200	X	
Miscellaneous Twin-Engine Models						
PA-23	6/3/75	Plattsburgh, NY	15	450	X	X
C-421	6/23/75	Chattanooga, TN	100	100		
BE-50	2/11/76	Jacksonvilie, FL	7	1633		
C-320	4/15/76	Cranbury, TX	7	5000	X	X
C-310	7/21/76	New Smyrna Beach, FL	25	904	X	
AS-600	8/17/76	West Mifflin, PA	466	1592		
C-421	9/12/76	International Falls, MN	74	2000		
PA-23	9/16/76	Denopolis, AL	187	3123		
SA-26	10/20/76	Claire, MI	70	8000		
PA-30	4/6/77	Tuscaloosa, AL	450	2040		
PA-30	4/9/77	Brooksville, FL	57	961		
PA-40	6/22/77	Ashville, NC	240	12017		
C-310	10/5/77	Cairo, GA	28	2587		
PA-34	4/4/78	Cheyenne, WY	275	3628		
E-4500	7/29/7H7	Togiac, AL		No Data		
AC-500	7/31/78	Boston, MA	27	3762		
BE(C-45)	8/8/78	Las Vegas, NV	144	9169		
PA-31	10/9/78	Concord, NC	1555	8575		

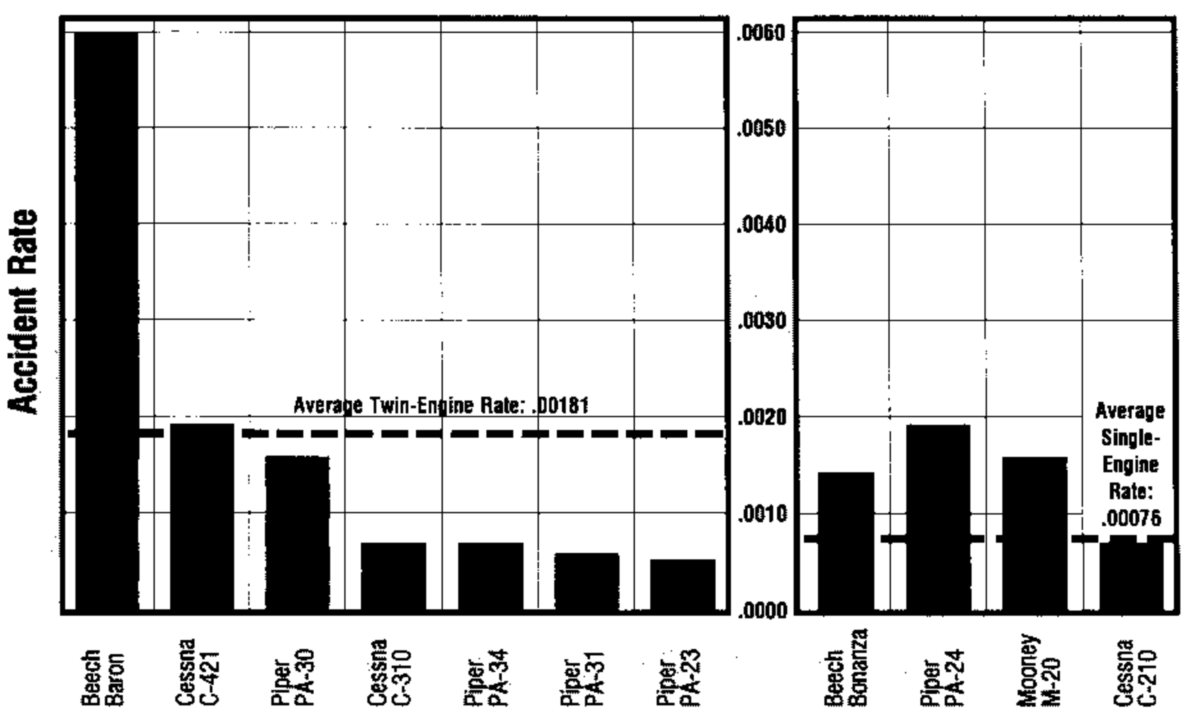
KEY:
AC-Aero Commander BE-Beech E-Evangle SA-Swearingen
AS-Aerostar C-Cessna PA-Piper

Figure 1

Numb,,. olln,I/",,.t,nt **Gear Retraction Accidents**
(7975 th,.ough 7978) In Popul,,. Ught Twln-EBgin, Ai,.c,.,ft



Inadvertent Gear Retraction Accident Rate (1975 Through 1978)



period. In contrast, the Bonanzas, comprising about 30 percent of the fleet, experienced 67 percent of these accidents (21 accidents)-an accident rate about 10 times as high as that of the Cessna 210.

Similarly, the accident rate of the Baron can be compared to the Piper PA-23 Aztec, a similar light twin. The 3,459 active PA-23s comprised about 16 percent of the 1978 light-twin fleet, but suffered only eight percent (2 accidents) of the inadvertent landing gear retraction accidents occurring to light twins from 1975 to 1978. In contrast, the Baron, also comprising 16 percent of the twin fleet, experienced 67 percent of such mishaps (16 accidents)-an accident rate of about 8 times that of the PA-23.

The Safety Board's review of its accident files for the 63 accidents from 1975 to 1978 revealed several facts. Tables 1 and 2 indicate that there is little correlation between pilot experience, either in total hours or hours in type, and the occurrence of these accidents. This is illustrated by comparing the hours of the Bonanza and Baron pilots with the hours of the pilots having such accidents in other single- and twin-engine aircraft. The data from Table 2 indicates that in 81 percent of the Baron accidents, the pilots specifically admitted that they confused the landing gear and flaps controls. In many cases, they mistakenly retracted the gear while intending to raise the flaps after landing. Such explanations usually were not offered by the pilots having this type of accident in the other aircraft.

An analysis of the NTSB data also revealed various circumstances which may have contributed to many of these accidents. Some pilots were either in stressful situations (such as in danger of running off the runways) or they were distracted (such as by a tower controller's request to clear the active runway), or they may have been inattentive (such as when returning from a fatiguing flight).

Human Factors Engineering Considerations

Design-Induced Errors

There are numerous documents which describe the use of human engineering design features to decrease design-induced pilot error accidents. For example, a classic 1947 study[6], which surveyed hundreds of 'military pilots, found that confusing the flaps and landing gear controls was the second most frequent type of pilot-error control problem. The previously noted Special Study, "Aircraft Design Induced Pilot Error," was a comprehensive document detailing many of these problems, including the increased number of inadvertent gear retraction accidents resulting from certain aircraft design features.

The accidents reviewed during this special investigation illustrate the need for rigid adherence to procedures, constant vigilance, and total familiarity with the cockpit layout on the part of the pilot. However, they also illustrate how design deficiencies can add to a pilot's burden and increase the likelihood of an accident. The following pilot statements were extracted from Safety Board accident files:

Bonanza, Elko, Nev., January 19, 1975:

"When I reached to retract the flaps, I hit the gear switch instead. I also own a PA-30 in which the switches are in reverse to the Beech."

6.) "Analysis of Factors Contributing to 460 'Pilot-Error' Experiences in Operating Aircraft Controls," by P.E. Fitts and R.E. Jones, USAF Aero Medical Laboratory, Memorandum Report, July 1947.

Baron, Plymouth, Mass., March 5, 1975:

"I have thousands of hours in aircraft in which the flap switch is located where the gear switch is on the B-58 which was a contributing factor."

Baron, Las Vegas, Nev., January 1, 1977:

"During rollout, at about 35/40 knots, pilot (me) retracted gear thinking it was the flap switch. Pilot used to flying Cessna 21 0 and flap switch is located where gear switch is located on Baron. Dumb pilot error."

Baron, San Antonio, Texas, August 7, 1977:

"More careful familiarization with the instrument panel set up. This aircraft had a reverse set up for flaps and gear handles than the operator was used to."

Baron, Hickory, N.C., August 16, 1978:

"Reached to retract flaps as for short field procedures, however, flap switch on Baron is reversed with landing switch on Cessna and Queen Air, pilot retracted landing gear instead of flaps."

Piper PA-23, Platts, New York, June 3, 1975:

"Speed on rollout down to about 30K. Pilot went for flaps and got gear handle."

"Pilot has over 100 hours recently in 310 with some landings in this type. Recently transitioned to Aztec. Position of gear and flap levers are reversed on these models. Standardization of position in aircraft might help to remove part of the hazard of transition."

Cessna 320, Granbury, Texas, April 4, 1976:

"I have been flying a Bonanza and the gear and flap switch positions on Bonanza are exactly opposite to Cessna 320."

"Require all manufacturers to place important controls consistently. Can you imagine a Cadillac and a Lincoln with brake and throttle in opposite positions?"

Regulatory Requirements

Regulatory requirements for the location and shape coding of controls were first adopted October 1, 1959, by Amendment 3-5 to the Civil Air Regulations, which revised Section 3.384. These regulations were essentially identical to the current Federal Aviation Regulations adopted in September 28, 1964, which require that the location and shape-coding of controls be standardized as follows: 14 CFR 23.777 states: "Wing flap and auxiliary lift device controls must be located-(1) Centrally, or to the right of the pedestal or power plant throttle control centerline; and (2) far enough away from the landing gear control to avoid confusion." The landing gear control gear must be located to the left of the throttle centerline or pedestal centerline. Regulation 14 CFR 23.781 states: "Cockpit controls must conform to the general shapes (but not necessarily the exact sizes or specific proportions).

The Bonanza was first type-certificated in 1945 and later recertificated in 1956. Also in 1956, the nonpressurized Barons were first type certificated. At that time, the Civil Air Regulations did not specify location or shape of the landing gear and flap controls. In 1959, the regulations were amended but the Bonanza and nonpressurized Barons were not required to meet the amended regulations and therefore continued to be produced under the earlier type certificates. The pressurized Barons were certificated in 1974 under 14 CFR 23, and therefore had to meet the requirements for the location and shape of these controls.

Design Deficiencies

An examination of cockpits of the Bonanza and Baron revealed four design deficiencies with regard to their landing gear and flap controls which can lead to design-induced pilot errors. These deficiencies include: (1) A lack of adequate "shape-coding" of these control knobs to permit the pilot to differentiate between them on the basis of feel alone; (2) an arrangement of these two controls in nonstandard locations which increases the probability that the pilot will actuate one control while intending to actuate the other; (3) the location of the horizontal bar on which the control wheels are mounted so that it obscures the pilot's view and obstructs his reach of these two controls; and (4) the lack of a guard or latch mechanism over the landing gear control to prevent the pilot from activating this control unless the guard/latch is moved first.

While various other types of modern light aircraft may have one of these four problems, the Bonanzas and Barons are the only aircraft produced in recent years with multiple combinations of these design deficiencies. (See Table 3)

Table 3: Design Deficiencies for Dinerenl Bonanza and Baron Models

Deilin Deficiency	Bonanza[1] (pre-19G3)	Bonanza (pOII-1963)	Baron (nonprellurlzed)	Baron (prellurized)
Inadequate Shape-Coding	X			
Nonstandard Location	X	X	X	
Obscuration of Controls	X	X	X	X
Lack of Guard Latch		X	X	X

1.) No longer in production.

Inadequate Shape-Coding

The significance of shape-coding to reducing pilot error was clearly recognized in the 1947 study cited above by Fitts and Jones which recommended shape-coding to prevent such errors. Classic research studies[7] have shown: (1) How certain knob shapes can be distinguished solely on the basis of touch, and (2) how by using symbolic shape associations which are similar to the function of the control (i.e. wheel-shaped knob for landing gear) the probability of misuse can be minimized.

The lack of shape-coded control knobs has been documented on the early Bonanzas by the Safety Board special study cited previously. In describing these tab-type switches this report stated that "... the landing gear control and wing flap control are included in a row of similar switches or more precisely, nearly identical switches." The accident rate of the Bonanza was more than twice the average rate for all aircraft with retractable landing gears. When Beech redesigned the Bonanza cockpit in 1963, they did incorporate full shape-coding on these controls, but they deleted the latch which had been incorporated on previous models.

Nonstandardized Control Location

The significance of standardized locations to reducing pilot error was also clearly described in the 1947 Fitts and Jones study. As with shape-coding, this document recommended standardizing the location of these controls to prevent errors. A 1977 FAA study[8] states that"... increased standardization of cockpit systems can reduce cockpit workload, reduce the potential for habit interference when transitioning to another type aircraft, and provide for application of the best and most error-resistant designs."

The detrimental effects of a nonstandardized control arrangement are illustrated by the contrasting accident rates of the Bonanza and the Cessna 21 0, which has a standard control arrangement. As shown by statistics, the Bonanza's inadvertent landing gear retraction accident rate is 10 times higher than that of the Cessna 210.

Obscuration 01 Controls

The problem of inadvertent gear retraction on the Bonanza and Baron aircraft is compounded further by a design feature of the flight control system which is unique to these two aircraft. The system utilizes a large horizontal cross-bar on which the control wheel (or wheels) is mounted. The two versions of this control system are (1) the single control wheel with a "throw-over" mechanism which allows the wheel to be placed in front of either the left or the right front seat, and (2) the dual control model where wheels are available to both seats.

There are two problems associated with this control system: (1) the horizontal bar is large enough to block the pilot's view of the gear and flap control switches forcing the pilot to rely on his sense of feel to identify the desired control, and (2) the pilot must reach around the bar to activate these controls. Both of these problems are more of a hindrance to pilots of small stature and when the wheel is relatively far forward. The control switches are relatively small in comparison to those on many other aircraft. This also tends to decrease the pilot's ability to differentiate those controls by feel.

7.) W.O. Jenkins "Tactile Discrimination of Shapes for Coding Aircraft-Type Controls." U.S. Army Air Force, Aviation Psychology Program, Research Report 19, 1947.

8.) "General Aviation (FAR 23) Cockpit Standardization Analysis" by R. J. Ontiveros, R. M. Spangler, and R. L. Sulzer, FAA, NAFEC Report No. RD-77-192, March 1978.

The pressurized Baron (S8P), which was certificated in 1974 and meets 14 CFR 23 requirements with respect to landing gear and flap control location and shape-coding, was involved in only one landing gear retraction accident during the 1975 to 1978 period. Ironically, the pilot attributed his mistake in part to the fact that he was more familiar with the nonstandard control arrangement of the unpressurized Baron and Bonanza. Hqwever, he also pointed out that his view of these controls was blocked by the wheel-mounting mechanism.

Lack 01 a Landing Gear Control Guard Latch

The advantages of incorporating a latch or guard on the landing gear control can be seen by comparing the accident rate of the Baron with that of a similar aircraft, the Piper PA-23 Aztec[9]. The PA-23 is the only other light twin currently being produced with a nonstandard gear and flap control arrangement. However, the landing gear control on this aircraft is protected from inadvertent actuation by a separate mechanical guard latch, and as noted earlier, its inadvertent landing gear retraction accident rate is only one-tenth that of the Baron.

Problem Solutions

The increased potential for inadvertent landing gear retraction accidents on the Baron was recognized by FAA in 1973, when the agency retrofitted its own Barons with a special guard over the landing gear control. This guard must be raised before the gear control can be put in the "UP" position. This FAA-developed device is a simple spring-loaded guard that is attached to the instrument panel.[10] The cost of the parts (a modified toggle switch guard and attaching screws) was minimal. The largest expense was the labor involved. FAA mechanics suggested that this was due to the prototype nature of the modification, which required removal of the control wheel bar and instrument panel cover.

If these guards were to be installed on a large number of aircraft, a well designed, easy to operate, customized guard could be developed. Ideally, this device could be installed without the removal of the yoke and instrument panel, thus the *total* cost of the device and its installation should be minimal. The landing gear controls on the early (pre-1963) models of the Bonanza could be easily modified by attaching a wheel-shaped knob to the existing switch or by replacing the existing switch with one incorporating a wheel-shaped feature. The cost of such a modification also should be minimal. On newly manufactured Bonanzas and nonpressurized Barons, the cost of installing such a guard and relocating the flap and landing gear controls to the standard configuration (as on the pressurized Baron) would be minimal, because these controls are simple electrical toggle switches which can be located in a variety of places.

9.} The early mOdels of the PA-23 were marketed under the name "Apache."

10.} "Landing Gear Switch Guard Installation," Technical Issuance Engineering Order, No. 72-20-2, FAA Aeronautical Center, November 1972.

Conclusions

The Safety Board concludes that the number of inadvertent landing gear retraction accidents in the Beech Bonanza and Baron is unnecessarily high in comparison to other contemporary general aviation aircraft. The Board also concludes on the basis of various pilot statements, a review of the human factors research literature, and a detailed analysis of the cockpit features of these aircraft that these accidents result largely from various combinations of four design deficiencies-inadequate shape-coding, nonstandard location of controls, obscuration of controls, and lack of a guard latch on the landing gear control.

Newly manufactured Baron and Bonanza aircraft could readily be made to comply with the requirements of 14 CFR 23.777 with respect to standardized control locations. Guards or latches on landing gear controls also should be installed on all newly manufactured Barons and Bonanzas (including the pressurized Baron). This is necessary because of the obscuration of these switches by the control-wheel bar and because the flap and gear switch locations could be both standard or nonstandard, depending on the model and the model year. The Board also believes that simple landing gear control guards should be retrofitted on previously produced Barons and late model'Bonanzas, and a wheer-shaped control should be added to earlier model Bonanzas. The Board believes that the costs of these simplistic modifications would be reasonable.

Finally, the Safety Board believes that the practice of permitting aircraft to be built for an unlimited time under the standards to which they were originally designed should be reconsidered. A detailed discussion of this topic is beyond the scope of this investigation. However, the Board is vitally concerned about this practice. This situation is not unique to the problem or to the types of aircraft discussed in this report. The Board intends to examine such questions in depth in the future.

Recommendations

As a result of this investigation, the National Transportation Safety Board recommends that the Federal Aviation Administration:

- Require after a specified date that all newly manufactured Beechcraft Baron and Bonanza models conform to 14 CFR 23.777 with respect to landing gear and flap control locations and that they have an adequate latch or guard to minimize inadvertent landing gear retraction. (Class II, Priority Action) *(A-8D-56)*
- Require that after a specified date, previously manufactured Beechcraft Baron and Bonanza aircraft which do not conform to the landing gear and flap control arrangements outlined in 14 CFR 23.777, be equipped with an adequate guard or latch mechanism to prevent inadvertent actuation of the landing gear controls. (Class II, Priority Action) *(A-8D-57)*
- Require that after a specified date, the landing gear control switch on the pre-1963 model Beech craft Bonanzas be modified to incorporate a wheel-shaped knob as outlined in 14 CFR 23.781 . (Class II, Priority Action) *(A-8D-58)*

By the National Transportation Safety Board, June 24, *198D*

ASF Comment: *These recommendationas were never made mandatory. Changes were made in 1984* to *the yoke and power controls. Additionally the panel and arrangement of gear and flap controls were reconfigured* to *what is the currently accepted layout. (FAR Part* 23 *contains requirements for the standardization of General Aviation cockpits.)*

Glossary 01 Terms and Abbreviations

A/C: Aircraft

AD: Airworthiness Directive

App: Approach

APU: Auxiliary Power Unit

ASR: Airport Surveillance Radar

ATC: Air Traffic Control

CHT: Cylinder Head Temperature

CG: Center of Gravity

Comp: Comparison

CRM: Cockpit Resource Management

Dest: Destroyed

DG: Directional Gyro

DH: Decision Height

DME: Distance Measuring Equipment

EFIS: Electronic Flight Information System

EGT: Exhaust Gas Temperature

Engine connecting rod: An internal engine part connecting the piston to the crankshaft.

Fatal Injury: An injury which results in death within 30 days of the accident.

FSS: Flight Service Station

Fuel Exhaustion: A condition with no fuel remaining in tanks.

Fuel Starvation: A condition with fuel in the tanks but not connected to the engine.

HI: Heading Indicator

HSI: Horizontal Situation Indicator

IFR: Instrument Flight Rules

ILS: Instrument Landing System

IMC: Instrument Meteorological Conditions

INST(S): Instrument(s)

LDG GR: Landing Gear

MAP: Missed Approach Point

MDA: Minimum Descent Altitude

Minor Injury: Any injury that does not qualify as serious or fatal.

NDB: Nondirectional Beacon

Non-Injury: No injuries were reported.

NR: Not reported

NTSB: National Transportation Safety Board

NWS: National Weather Service

PAX: Passengers

PIC: Pilot In Command

POH: Pilots Operating Handbook

Retract: Retractable Landing Gear

SDR: Service Difficulty Reports

SEF: Single-engine Fixed Gear

Serious Injury: A serious injury must meet one of the following guidelines:

1. Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received;

2: Results in a fracture of any bone (except Simple fractures of fingers, toes, or nose);

3. Involves lacerations which cause severe hemorrhages, nerve, muscle, or tendon damage;

4. Involves injury to any internal organ;

5. Involves second or third-degree burns, or any burns affecting more than five percent of body surface.

SER: Single-engine, Retractable Landing Gear

SERT: Single-engine, Retractable Landing Gear, Turbocharged

SID: Standard Instrument Departure

STAR: Standard Terminal Arrival Route

Subt: Substantial

SYS: System

TIT: Turbine Inlet Temperature

U: Unknown

UN: Unknown

UNK: Unknown

VAC: Vacuum

V_{RA}: Rough Air Speed

V_S: Stall Speed

V_{S1}: Stall Speed 'Clean', at max gross weight

V_{S0}: Stall Speed in Landing Configuration

VSI: Vertical Speed Indicator

VVI: Vertical Velocity Indicator

V_X: Best Angle of Climb Speed

V_y: Best Rate of Climb Speed

YMCA: Minimum Control Speed with the Critical Engine Inoperative

V_{FE}: Maximum Flaps-extended Speed Virga

V_{LO}: Maximum Speed for Landing Gear Extension

VA: Maneuvering Speed

V_{NE}: Never-exceed Speed

V_{NO}: Normal-operating Limit Speed

VFR: Visual Flight Rules

VMC: Visual Meteorological Conditions

VNAV: Vertical Navigation

VOR: Very High Frequency (VHF) Omnirange

Phase 01 Operation

The phase of the flight or operation is the particular phase of flight in which the first occurrence or circumstance occurred. These are the official NTSB definitions:

Standing: From the time the first person boards the aircraft for the purpose of flight until the aircraft taxies under its own power. Also, from the time the aircraft comes to its final deplaning location until all persons deplane. Includes preflight, starting engine, parked-engine operating, parked-engine not operating, and idling rotors.

Taxi: From the time the aircraft first taxies under its own power until power is applied for takeoff. Also, when the aircraft completes its landing ground run until it parks at the spot of engine shutoff. Includes rotorcraft aerial taxi. Includes taxi to takeoff and taxi from landing.

Takeoff: From the time the power is applied for takeoff up to and including the first airborne power reduction, or until reaching VFR traffic pattern altitude, whichever occurs first. Includes ground run, initial climb, and rejected takeoff.

Climb: From the time of initial power reduction (or reaching VFR traffic pattern altitude) until the aircraft levels off at its cruise altitude. Also includes enroute climbs.

Cruise: From the time of level-off at cruise altitude to the beginning of the descent.

Descent: From the beginning of the descent from cruise altitude to the IAF, FAF, outer marker, or VFR pattern entry, whichever occurs first. Also includes enroute descents, emergency descent, autorotative descent, and uncontrolled descent.

Approach: From the time the descent ends (either IAF, FAF, outer marker, or VFR pattern entry) until the aircraft reaches the MAP (IMC) or the runway threshold (VMC). Includes missed approach (IMC) and go-around (VMC).

Landing: From either the MAP (IMC) or the runway threshold (VMC) through touchdown or after touchdown off an airport, until the aircraft completes its ground run. Includes rotorcraft run-on, power-on, and autorotative landings. Also includes aborted landing where touchdown has occurred and landing is rejected.

Maneuvering: Includes the following: Aerobatics, low pass, buzzing, pullup, aerial application maneuver, turn to reverse direction (box-canyon-type maneuver), or engine failure after takeoff and pilot tries to return to runway.

Other: Examples are practice single-engine airwork, basic airwork, external load operations, etc.

Unknown: The phase of flight could not be determined.

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