U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: GENERAL AVIATION CONTROLLED FLIGHT INTO TERRAIN AWARENESS
Date: 4/1/03
Initiated By: AFS-800
AC No: 61-134
Change:

1. PURPOSE. This advisory circular (AC) highlights the inherent risk that controlled flight into terrain (CFIT) poses for general aviation (GA) pilots. This AC includes the Federal Aviation Administration's (FAA) common definition of the term CFIT, identifies some, but not all, of the risks associated with GA CFIT accidents, and provides some recommendations and strategies to combat CFIT within the GA community. This AC is not an all-inclusive document on CFIT; rather, this AC is designed to help flight instructors, FAA Aviation Safety Program Managers, and other trainers develop CFIT training materials by identifying some of the factors involved in GA CFIT accidents. Some common references are included to aid instructors in preparing CFIT presentations. Pilots can benefit from reading this AC to check their own knowledge of CFIT and factors involved to avoid having a GA CFIT accident. This AC will break the study of GA CFIT into three broad categories. One will focus on visual flight rules (VFR) pilots without an instrument rating operating in marginal VFR weather conditions (visual meteorological conditions (VMC)) or instrument flight rules (IFR) weather conditions (instrument meteorological conditions (IMC)) commonly known as scud running. The second category will focus on GA IFR operations in IMC conditions on an IFR flight. The third category will focus on low-flying aircraft operating in VFR conditions. This AC does not address CFIT in Title 14 of the Code of Federal Regulations (14 CFR) part 121 or part 135 operations.

2. BACKGROUND.

a. According to FAA information, general aviation CFIT accidents account for 17 percent of all general aviation fatalities. More than half of these CFIT accidents occurred during IMC. The FAA is working in partnership with industry to develop an action plan and revise guidance material to reduce the incidence of CFIT within the GA segment of aviation. However, one of the problems in reviewing GA CFIT accidents is the lack of data, particularly human factors data. Since many of the pilots involved in GA CFIT accidents are fatalities and most GA aircraft are not equipped with data recording systems, the lack of GA CFIT accident data will continue to remain a problem for investigators.

b. Although many CFIT accidents have some common factors that are applicable for all types of aircraft, we want to stress the difference between a crewed aircraft with two pilots in the cockpit and a single-pilot aircraft. In crewed cockpits, the second pilot may make the difference between a safe flight and a CFIT accident. Conversely, a second pilot can also be a distraction in certain circumstances unless the crew has been trained to work well together and is following good crew resource management (CRM) techniques. As a general rule of thumb, whether an air carrier type aircraft or a GA aircraft, the crewed aircraft is generally better equipped with more safety equipment, such as an autopilot, radar altimeter, or ground proximity warning system (GPWS) onboard, than a typical single-pilot, small GA aircraft.

c. Because a single-piloted, small GA aircraft is vulnerable to the same CFIT risks as a crewed aircraft but with only one pilot to perform all of the flight and decisionmaking duties, that pilot must be better prepared to avoid a CFIT type accident. In some cases, a GA pilot may be more at risk to certain CFIT type accidents because the pilot does not have the company management or government oversight that a corporate or commercial operator may be exposed to. Without such oversight, such as detailed standard operating procedures and higher mandatory safety requirements, it is the responsibility of the single-pilot to ensure he or she is well trained, qualified for the intended flight, meets all regulatory requirements for the flight, and has the self-discipline to follow industry recommended safety procedures that can minimize CFIT type accidents.

3. RELATED 14 CFR REFERENCES.

a. Part 91, sections 91.103, 91.119, 91.121, 91.123, 91.155, 91.175, 91.177, 91.179, 91.181, 91.515.

b. Part 97, Standard Instrument Approach Procedures.

4. RELATED PUBLICATIONS.

a. Advisory Circulars.

(1) The current version of AC 61-23C, Pilot's Handbook of Aeronautical Knowledge, may be purchased from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954, or from U.S. Government Printing Office bookstores located in major cities throughout the United States.

(2) The current versions of the following ACs may be obtained at no cost from: Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Ave., Landover, MD 20785.

(a) AC 90-97, Use of Barometric Vertical Navigation (VNAV) for Instrument Approach Operations Using Decision Altitude.

(b) AC 120-51D, Crew Resource Management Training.

b. Manuals and Handbooks. The current versions of the following documents may be purchased from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954:

(1) Aeronautical Information Manual (AIM), especially paragraph 7-5-3, Obstructions to Flight, Appendix 2.

(2) Rotorcraft Flying Handbook (FAA-H-8083-21).

(3) Airplane Flying Handbook (FAA-H-8083-3).

c. Checklists.

(1) Personal Minimums Checklist, <http://flysafe.faa.gov/Flysafe/pclvideo/default.htm>

(2) Flight Safety Foundation, CFIT Checklist, Appendix 1, and <http://www.flightsafety.org/pdf/cfit_check.pdf>. To order a laminated copy, send a written request to

The Director of Programs, Flight Safety Foundation, 601 Madison Street, Suite 300, Alexandria, VA 22314.

d. Pilot Practical Test Standards. The current versions of the these documents may be purchased from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.

e. Controlled Flight Into Terrain, Education and Training Aid. Historically, most of the research related to CFIT accidents and the development of recommended safety practices have been done for air carrier type operations. The Controlled Flight Into Terrain, Education and Training Aid, is a good example of such research done by industry and government. Produced by the Flight Safety Foundation, the International Civil Aviation Organization (ICAO), and the FAA, the aid provides a good history, lists common dangers, and provides some recommended means of combating CFIT accidents for air carrier operations. In addition, the document is a valuable resource for anyone developing a CFIT training course. The document is available on the FAA's Internet website at: <www.faa.gov/avr/afs/cfit/volume1/titlepg.pdf>

5. DEFINITIONS.

a. Controlled Flight into Terrain (CFIT). CFIT occurs when an airworthy aircraft is flown, under the control of a qualified pilot, into terrain (water or obstacles) with inadequate awareness on the part of the pilot of the impending collision.

b. Loss of Control. The term, loss of control, refers to emergency situations from which a pilot may have been able to recover but did not, such as problems with situation awareness, recovery from windshear, mishandling of an approach, and recovery from a stall.

c. Situational Awareness. As used in this AC, situational awareness means the pilot is aware of what is happening around the pilot's aircraft at all times in both the vertical and horizontal plane. This includes the ability to project the near term status and position of the aircraft in relation to other aircraft, terrain, and other potential hazards.

d. Crewed Aircraft. In this AC, crewed aircraft refers to an aircraft or flight operation in which more than one pilot is required by aircraft certification or type of operation.

e. Single-Pilot Aircraft. In this AC, single-pilot means only one pilot is required by the aircraft certification. Normally, only one pilot flies such an aircraft.

6. SCOPE.

a. In visual meteorological conditions, the pilot in command (PIC) is responsible for terrain and obstacle clearance (See and Avoid) whether operating under VFR or IFR. Although this AC addresses the issue of pilots operating under VFR in marginal VMC or IMC conditions, the FAA does not endorse or approve of pilots operating under VFR in IMC. The paragraphs dealing with such operations are only designed to highlight the risks of such operations. The FAA expects pilots to comply with the appropriate flight rules for all flight operations.

b. This AC addresses CFIT operations in the United States, only. Flight operations outside of the United States have added risks that can contribute to a CFIT accident. These risks include air traffic control (ATC) instructions from controllers to whom English is a second language or controllers with a limited ATC vocabulary. Other international factors include different types of altimeter settings, terrain elevation, runway data in units other than feet, and a general lack of knowledge with the international ICAO standards and country specific operating standards. U.S. pilots planning on operating outside the

United States need to carefully review the appropriate international requirements and operating procedures to ensure that an inadvertent mistake or failure to comply with local procedures does not result in a GA CFIT accident.

7. TOP 10 RECOMMENDED INTERVENTION STRATEGIES.

a. The following is a list of 10 safety recommendations from the FAA's and industry's Safer Skies: A Focused Safety Agenda, General Aviation Controlled Flight Into Terrain Joint Safety Implementation Team Report, February 2000. The list was derived from 55 ideas the CFIT Joint Safety Analysis Team (JSAT) developed after reviewing 195 GA CFIT accidents from 1993 and 1994. As the report noted, GA includes everything from pilot training, corporate, agricultural and external-load operations, fire-fighting, airborne surveillance, air shows, aircraft maintenance related flights, to personal and recreational flying. Types of aircraft vary from single-place home-builts to helicopters to business jets. GA aircraft also includes gliders, balloons, and aerial application aircraft. As the report says, GA is "...basically everything except the military and scheduled air carriers." Although some of the safety recommendations go beyond the capability of instructors or trainers interested in developing training materials for GA CFIT safety presentations or CFIT lesson plans, they all contain information that will improve CFIT safety in flight, on or near airports and obstructions.

b. The CFIT JSAT's Top 10 Recommended Intervention Strategies.

(1) Increase pilot awareness on accident causes.

(2) Improve safety culture within the aviation community.

(3) Promote development and use of a low cost terrain clearance and/or a look ahead device.

(4) Improve pilot training (i.e., weather briefing, equipment, decision-making, wire and tower avoidance, and human factors.

(5) Improve the quality and substance of weather briefs.

(6) Enhance the flight review and/or instrument competency check.

(7) Develop and distribute mountain-flying technique advisory material.

(8) Standardize and expand use of markings for towers and wires.

(9) Use high visibility paint and other visibility enhancing features on obstructions.

(10) Eliminate the pressure to complete the flight where continuing may compromise safety.

8. VFR-ONLY PILOTS OPERATING IN MARGINAL VFR/IMC CONDITIONS.

a. Operating in marginal VFR/IMC conditions is more commonly known as scud running. According to National Transportation Safety Board (NTSB) and FAA data, one of the leading causes of GA accidents is continued VFR flight into IMC. As defined in 14 CFR part 91, ceiling, cloud, or visibility conditions less than that specified for VFR or Special VFR is IMC and IFR applies. However, some pilots, including some with instrument ratings, continue to fly VFR in conditions less than that specified for VFR. The result is often a CFIT accident when the pilot tries to continue flying or maneuvering beneath a lowering ceiling and hits an obstacle or terrain or impacts water. The accident may or may not be a result of a loss of control before the aircraft impacts the obstacle or surface. The importance of complete weather information, understanding the significance of the weather information, and being able to correlate the pilot's skills and training, aircraft capabilities, and operating environment with an accurate forecast cannot be emphasized enough.

b. Continued flight in reduced visual conditions compounded by night operations and/or overwater flight poses some risks. VFR pilots in reduced visual conditions may develop spatial disorientation and lose control, possibly going into a graveyard spiral, or descend to an unsafe altitude while trying to maintain visual contact with the surface. The pilot then impacts terrain, the surface, or an obstacle while trying to maneuver. The following are some of the CFIT risks associated with such flight.

(1) Loss of aircraft control.

(2) Loss of situational awareness.

(3) Reduced reaction time to see and avoid rising terrain or obstacles.

(4) Inability of the pilot to operate the aircraft at its minimum controllable airspeed.

(5) Getting lost or being off the preplanned flightpath and impacting terrain or obstacle.

(6) Reduced pilot reaction time in the event of an aircraft maintenance problem because of a low or lowering altitude.

(7) Failure to adequately understand the weather conditions that resulted in the reduced conditions.

(8) Breakdown in good aeronautical decisionmaking.

(9) Failure to comply with appropriate regulations.

(10) Failure to comply with minimum safe altitudes.

(11) Increased risk of hitting one of many new low altitude towers installed for cellular telephones and other types of transmissions. This risk is especially great along major highways if VFR pilots try to follow a highway when lost or trying to stay under a lowering ceiling.

(12) Failure to turn around and avoid deteriorating conditions when first able.

9. GA IFR OPERATIONS IN IMC CONDITIONS ON AN IFR FLIGHT. These operations also pose special risks. Whether it is failure to follow safe takeoff and departure techniques, recommended en route procedures — which includes loss of situational awareness — or failure to maneuver safely to a landing, IFR operations can be dangerous for those not prepared to operate or not current and proficient in the IMC and IFR environments. Many of these accidents result in fatalities. Techniques or suggestions for avoiding some of these IFR risk factors include:

a. Importance of the pilot in command being qualified, current, and proficient for the intended flight.

b. Importance of the aircraft being properly equipped for the intended flight.

c. Having the proper charts and approach plates for the intended flight. VFR charts, although not required, should be onboard because they can provide important obstacle and terrain data for an IFR flight.

d. Knowing the planned procedure well enough to know if air traffic is issuing an unsafe clearance or if the pilot flying, when a crewed aircraft, is not following the published procedure.

e. If in a crewed aircraft, both pilots have adequately briefed the flight and operation of the aircraft, including shared responsibilities.

f. Having complete weather data for the flight, including knowing where visual meteorological conditions exist or a safe alternative is since many GA aircraft flown IFR have limited range or speed to fly out of un-forecasted weather conditions.

g. Importance of maintaining situational awareness, both horizontal and vertical, throughout the flight to avoid flying into hazardous terrain or known obstacles.

h. Complete knowledge on how to operate all equipment onboard the aircraft. This includes the limitations and operations of new types of navigation equipment.

i. If a crewed aircraft, the crew is aware of and follows FAA and industry recommended crew resource management principles. If a single-piloted flight, the pilot knows to use all available resources including air traffic control to help ensure a safe flight as well as any onboard resource such as a passenger or onboard charts or manuals.

j. Pilot in command follows the rules for making a missed approach and is prepared to make a missed approach when conditions fall below minimums as specified in the regulations, company policy, pilot's personal minimums checklist, or the approach becomes destabilized.

k. Knowledge of minimum safe or sector altitudes and of the highest terrain in the area.

l. Pilot in command is aware of the risks involved when transitioning from visual to instrument or from instrument to visual procedures on takeoff or landing.

m. Pilot in command uses all available safety equipment installed in the aircraft and on the ground.

n. Pilot in command is aware of the risks involved in setting the aircraft's altimeter including inherent limitations of barometric altimeters.

o. Knowing the air traffic control system well enough to be proficient in it.

p. Knowing when not to fly.

q. Properly using an installed autopilot, if so equipped, to reduce pilot workload.

r. Proper use of checklists as outlined in the aircraft manual or if not listed, before reaching 1,000 feet above ground level (AGL) to minimize any distractions when operating close to the ground.

s. The importance of flying a stabilized approach. A common definition of a stabilized approach is maintaining a stable speed, descent rate, vertical flightpath, and configuration throughout the final segment of the approach. Although originally designed for turbojet aircraft, a stabilized approach is also recommended for propeller-driven aircraft. The idea is to reduce pilot workload and aircraft configuration changes during the critical final approach segment of an approach. The goal is to have the aircraft in the proper landing configuration, at the proper approach speed, and on the proper flightpath before descending below the minimum stabilized approach height. The following are recommended minimum stabilized approach heights.

(1) 500 feet above the airport elevation during VFR weather conditions.

(2) MDA or 500 feet above airport elevation, whichever is lower, for a circling approach.

(3) 1,000 feet above the airport or touch down zone elevation during IMC.

t. The increased CFIT risk of nonprecision approaches.

u. The increased CFIT risk of high descent rates near the ground.

v. The importance of good communications between the pilot and air traffic control concerning any flight instruction or clearance. The old rule of asking for clarification whenever in doubt about any instruction or clearance applies.

w. The dangers of complacency for the single-pilot, as well as multi-piloted crews, when making routine flights.

x. The dangers of misunderstanding air traffic control instructions or accepting an incorrect clearance.

y. The dangers of not knowing the safe altitudes for your en route as well as your terminal area.

10. LOW-FLYING AIRCRAFT OPERATING IN VFR CONDITIONS. Although many of the factors listed previously apply to low-flying aircraft operating in VFR conditions, this is a special category for those pilots flying below minimum safe altitudes. Such operators include agriculture applicators and helicopter pilots who routinely operate near trees, telephone lines and power lines, or other such obstacles. In many cases, the pilot was aware of the obstacles but environmental factors such as time of day, minimal light, shadows, darkness, sun glare, cockpit blind spots, fatigue, or other such factors resulted in the pilot losing situational awareness and hitting an obstacle or impacting the ground. In some cases, pilots may have been aware of an obstacle, but because of some of these environmental factors, they were unable to avoid a collision because they did not see the danger in time or they saw the danger but failed to react in time to avoid an accident. Density altitude and aircraft performance limitations may also pose risk factors for such flights. These same factors can also result in a CFIT accident for someone flying in mountainous terrain. Some common low altitude CFIT factors are:

a. Windshear and loss of flying speed.

b. Density altitude.

c. Failure to operate aircraft within operating limitations.

d. Failure to check an area from a safe altitude before descending into it (high reconnaissance and low reconnaissance).

e. Flying between hills or over rivers below hill tops can result in a CFIT accident if a power line or cable is strung between the hills. Not all such lines are marked or charted.

f. Flying up a box canyon and not being able to fly up and out of it before impacting terrain.

g. Flying over rising terrain that exceeds an aircraft's ability or performance to climb away from the terrain.

h. Errors in pilot judgement and decisionmaking.

i. Diversion of pilot attention.

j. Buzzing.

k. Crew distractions or a breakdown in crew resource management.

l. Operating in an unsafe manner.

m. Failure to maintain control of the aircraft when taking off or landing.

n. Failure to properly pre-plan the flight.

o. Operating in unfamiliar areas or depending upon untrained people to provide important flight data.

p. Not having an objective standard to make go-no go decisions for launching.

q. Failure to review all available data for the flight (particularly applicable to medical evacuation flights).

r. Lack of terrain knowledge and elevation of the highest obstacles within your immediate operating area.

s. Failure to properly plan your departure route when departing from unprepared areas such as helicopters or aircraft operating off an airport. Such factors include weight and balance, aircraft performance, height of obstacles, wind direction, trees, density altitude, rising terrain, length of takeoff area, and safe abort areas.

11. AERONAUTICAL INFORMATON MANUAL (AIM), SECTION 5. Potential Flight Hazards, paragraph 7-5-1, Accident Cause Factors, lists the following 10 most frequent cause factors for general aviation accidents that involve the PIC. The following list contains many of the same factors listed for CFIT accidents. This listing of major reasons why GA pilots continue to have accidents has remained constant over time. With the possible exception of subparagraph f, these factors can all be CFIT factors.

a. Inadequate preflight preparation and/or planning.

b. Failure to obtain and/or maintain flying speed.

c. Failure to maintain directional control.

d. Improper level off.

e. Failure to see and avoid objects or obstructions.

f. Mismanagement of fuel.

g. Improper in-flight decisions or planning.

h. Misjudgment of distance and speed.

i. Selection of unsuitable terrain.

j. Improper operation of flight controls.

12. DECIDE MODEL. Many CFIT accident reports discuss the lack of good decisionmaking on the part of the pilot or flight crew. The following D-E-C-I-D-E model is included in many manuals and books on decisionmaking.

a. Detect change (or identify problem).

b. Estimate significance (of the change).

c. Choose the (best) objective or outcome.

d. Identify options (that meet objective or desired outcome).

e. Do best option.

f. Evaluate (the outcome--if the outcome is not what is desired then do a new DECIDE model).

13. TECHNICAL SOLUTIONS.

a. The development of the first Ground Proximity Warning Systems (GWPS) has contributed to a marked decline in CFIT accidents in air carrier operations. The use of GWPS and the newer generation Terrain Awareness and Warning Systems (TWAS) in GA aircraft has the potential to provide a similar savings in lives and loss of GA aircraft. As noted in various CFIT documents, the proper use of terrain awareness and warning systems is important to their effectiveness. Pilots are expected to execute the proper emergency escape maneuvers when their ground warning system activates.

b. Title 14 CFR sections 91.223, 121.354, and 135.154 mandate the installation of terrain awareness warning systems in turbine-powered aircraft as outlined in the appropriate section. The type of operation also includes specific passenger seat requirements/limitations for the operations involved as well as the required type of equipment.

c. As digital-mapping systems combined with satellite positioning data become less expensive, GA pilots may soon be able to graphically see their horizontal and vertical location at all times. Expanded situational awareness should help pilots avoid some types of CFIT accidents. Then the challenge will be to eliminate descent type CFIT accidents during the landing phase of flight.

14. SUMMARY.

a. Controlled flight into terrain, normally occurs at speed with the result that many such accidents are fatal. A common thread throughout this AC is the importance of proper planning, good decisionmaking, and being able to safely operate the aircraft throughout is entire operating range. Since CFIT implies that the aircraft is operating properly, the main reason for such accidents is what is commonly called pilot error. Therefore, it is the pilot's responsibility to ensure that he or she is qualified for the flight, that the aircraft is properly equipped for the flight, and that the flight is flown according to the appropriate regulations and aircraft operating limitations. According to the CFIT, Education and Training Aid*,* about 25.0 percent of all accidents occur during the takeoff and initial climb segment of flight. Approximately 7.0 percent of the accidents occur during the climb portion. Only about 4.5 percent occur during cruise. About 19.5 percent occurs during descent and initial approach. But 41.4 percent of the accidents occur during final approach and landing. Takeoff, initial climb, final approach, and landing represent only about 6.0 percent of the total flight time of a given flight. But as these numbers point out, that 6.0 percent of a flight's total time can be deadly. Ground proximity warning systems and the newer terrain awareness and warning systems using GPS have the potential to reduce CFIT accidents on takeoffs and landings. These systems provide one more tool for pilots to use to increase their safety margin when operating close to terrain and obstacles. However, every pilot must know the limitations of his or her database and what objects are included in the database.

b. The solution to combating CFIT accidents starts on the ground. Pilots need to properly prepare to safely execute the maneuvers required during takeoff, initial climb, final approach, and landing phases of flight. Whether VFR or IFR, each flight has critical flight segments. How the flight segments are planned for and handled determines, to a great extent, the safety of the flight. Appendix 1, Flight Safety Foundation's CFIT Checklist, provides one example of how to calculate CFIT risk. It states, "Use the checklist to evaluate specific flight operations and to enhance pilot awareness of the CFIT risk." Page 4 of the checklist tells how pilots can obtain copies of the checklist or reproduce it.

c. Recommendations.

(1) Noninstrument rated VFR pilots should not attempt to fly in IMC.

(2) Know and fly above minimum published safe altitudes. VFR: Fly a minimum of 1,000 feet above the highest terrain in your immediate operating area in nonmountainous areas. Fly a minimum of 2,000 feet in mountainous areas.

(3) If IFR, fly published procedures. Fly the full published procedure at night, during minimum weather conditions, or operating at an unfamiliar airport.

(4) Verify proper altitude, especially at night or over water, through use of a correctly set altimeter.

(5) Verify all ATC clearances. Question an ATC clearance that assigns a heading and/or altitude that, based upon your situational awareness, places the aircraft in a CFIT environment.

(6) Maintain situational awareness both vertically and horizontally.

(7) Comply with appropriate regulations for your specific operation.

(8) Don't operate below minimum safe altitudes if uncertain of position or ATC clearance.

(9) Be extra careful when operating outside the United States or in an area which you are not familiar.

(10) Use current charts and all available information.

(11) Use appropriate checklists.

(12) Know your aircraft and its equipment.

/s/
Louis C. Cusimano for
James J. Ballough
Director, Flight Standards Service

APPENDIX 1. CFIT CHECKLIST

Flight Safety Foundation
CFIT Checklist
Evaluate the Risk and Take Action

Flight Safety Foundation (FSF) designed this controlled-flight-into-terrain (CFIT) risk-assessment safety tool as part of its international program to reduce CFIT accidents, which present the greatest risks to aircraft, crews and passengers. The FSF CFIT Checklist is likely to undergo further developments, but the Foundation believes that the checklist is sufficiently developed to warrant distribution to the worldwide aviation community.

Use the checklist to evaluate specific flight operations and to enhance pilot awareness of the CFIT risk. The checklist is divided into three parts. In each part, numerical values are assigned to a variety of factors that the pilot/operator will use to score his/her own situation and to calculate a numerical total.

In *Part I: CFIT Risk Assessment,* the level of CFIT risk is calculated for each flight, sector or leg. In *Part II: CFIT Risk-reduction Factors,* Company Culture, Flight Standards, Hazard Awareness and Training, and Aircraft Equipment are factors, which are calculated in separate sections. In *Part III: Your CFIT Risk,* the totals of the four sections in *Part II* are combined into a single value (a positive number) and compared with the total (a negative number) in *Part l: CFIT Risk Assessment* to determine your CFIT Risk Score. To score the checklist, use a nonpermanent marker (do not use a ball-point pen or pencil) and erase with a soft cloth.

Part I: CFIT Risk Assessment

Section 1- Destination CFIT Risk Factors	**Value**	**Score**
Airport and Approach Control Capabilities:		
ATC approach radar with MSAWS	0	_____
ATC minimum radar vectoring charts	0	_____
ATC radar only	-10	_____
ATC radar coverage limited by terrain masking	-15	_____
No radar coverage available (out of service/not installed)	-30	_____
No ATC service	-30	_____
Expected Approach:		
Airport located in or near mountainous terrain	-20	_____
ILS	0	_____
VOR/DME	-15	_____
Nonprecision approach with the approach slope from the FAF to the airport TD shallower than 2 ¾ degrees	-20	_____
NDB	-30	_____
Visual night "black-hole" approach	-30	_____
Runway Lighting:		
Complete approach lighting system	0	_____
Limited lighting system	-30	_____
Controller/Pilot Language Skills:		
Controllers and pilots speak different primary languages	-20	_____
Controllers' spoken English or ICAO phraseology poor	-20	_____
Pilots' spoken English poor	-20	_____
Departure:		
No published departure procedure	-10	_____
Destination CFIT Risk Factors Total		(-)_____

APPENDIX 1. CFIT CHECKLIST – Continued

Section 2 – Risk Multiplier	**Value**	**Score**
Your Company's Type of Operation (select only one value):		
Scheduled	1.0	_____
Nonscheduled.	1.2	_____
Corporate	1.3	_____
Charter	1.5	_____
Business owner/pilot	2.0	_____
Regional	2.0	_____
Freight	2.5	_____
Domestic	1.0	_____
International	3.0	_____
Departure/Arrival Airport (select single highest applicable value):		
Australia/New Zealand	1.0	
United States/Canada	1.0	_____
Western Europe	1.3	_____
Middle East	1.1	_____
Southeast Asia	3.0	_____
Euro-Asia (Eastern Europe and Commonwealth of Independent States)	3.0	_____
South America/Caribbean.	5.0	_____
Africa.	8.0	_____
Weather/Night Conditions (select only one value):		
Night — no moon	2.0	_____
IMC	3.0	_____
Night and IMC	5.0	_____
Crew (select only one value):		
Single-pilot flight crew	1.5	_____
Flight crew duty day at maximum and ending with a night nonprecision approach	1.2	_____
Flight crew crosses five or more time zones	1.2	_____
Third day of multiple time-zone crossings	1.2	_____
Add Multiplier Values to Calculate Risk Multiplier Total		_____
Destination CFIT Risk Factors Total X Risk Multiplier Total = CFIT Risk Factors Total		(-) _____

Part II: CFIT Risk-Reduction Factors

Section 1- Company Culture	**Value**	**Score**
Corporate/company management:		
Places safety before schedule	20	_____
CEO signs off on flight operations manual	20	_____
Maintains a centralized safety function	20	_____
Fosters reporting of all CFIT incidents without threat of discipline	20	_____
Fosters communication of hazards to others	15	_____
Requires standards for IFR currency and CRM training	15	_____
Places no negative connotation on a diversion or missed approach	20	_____

115-130 points	Tops in company culture
105-115 points	Good, but not the best
80-105 points	Improvement needed
Less than 80 points	High CFIT risk

Company Culture Total (+)_____

APPENDIX 1. CFIT CHECKLIST – Continued

Section 2 - Flight Standards	Value	Score
Specific procedures are written for:		
Reviewing approach or departure procedures charts	10	_____
Reviewing significant terrain along intended approach or departure course	20	_____
Maximizing the use of ATC radar monitoring	10	_____
Ensuring pilot(s) understand that ATC is using radar or radar coverage exists	20	_____
Altitude changes	10	_____
Ensuring checklist is complete before initiation of approach	10	_____
Abbreviated checklist for missed approach	10	_____
Briefing and observing MSA circles on approach charts as part of plate review	10	_____
Checking crossing altitudes at IAF positions	10	_____
Checking crossing altitudes at FAF and glideslope centering	10	_____
Independent verification by PNF of minimum altitude during stepdown DME (VORNME or LOC/DME) approach	20	_____
Requiring approach/departure procedure charts with terrain in color, shaded contour formats.	20	_____
Radio-altitude setting and light-aural (below MDA) for backup on approach	10	_____
Independent charts for both pilots, with adequate lighting and holders	10	_____
Use of 500-foot altitude call and other enhanced procedures for NPA	10	_____
Ensuring a sterile (free from distraction) cockpit, especially during IMC/night approach or departure.	10	_____
Crew rest, duty times and outer considerations especially for multiple-time-zone operation	20	_____
Periodic third-party or independent audit of procedures	10	_____
Route and familiarization checks for new pilots		
Domestic.	10	_____
International	20	_____
Airport familiarization aids, such as audiovisual aids	10	_____
First officer to fly night or IMC approaches and the captain to monitor the approach	20	_____
Jump-seat pilot (or engineer or mechanic) to help monitor terrain clearance and the approach in IMC or night conditions	20	_____
Insisting that you fly the way that you train	25	_____

300-335 points	Tops in CFIT flight standards		
270-300 points	Good, but not the best	**Flight Standards Total**	(+)_____
200-270 points	Improvement needed		
Less than 200	High CFIT risk		

Section 3 - Hazard Awareness and Training	Value	Score
Your company reviews training with the training department or training contractor	10	_____
Your company's pilots are reviewed annually about the following:		
Flight standards operating procedures	20	_____
Reasons for and examples of how the procedures can detect a CFIT "trap"	30	_____
Recent and past CFIT incidents/accidents	50	_____
Audiovisual aids to illustrate CFIT traps	50	_____
Minimum altitude definitions for MORA, MOCA, MSA, MEA, etc.	15	_____
You have a trained flight safety officer who rides the jump seat occasionally	25	_____
You have flight safety periodicals that describe and analyze CFIT incidents	10	_____
You have an incident/exceedance review and reporting program	20	_____
Your organization investigates every instance in which minimum terrain clearance has been compromised	20	_____

APPENDIX 1. CFIT CHECKLIST – Continued

	Value	Score
You annually practice recoveries with GPWS in the simulator	40	_____
You train the way that you fly	25	_____

285-315 points	Tops in CFIT training	
250-285 points	Good, but not the best	**Hazard Awareness and Training Total** (+)_____
190-250 points	Improvement needed	
Less than 190	High CFIT risk	

Section 4 – Aircraft Equipment	**Value**	**Score**
Radio altimeter with cockpit display of full 2,500-foot range - captain only	20	_____
Radio altimeter with cockpit display of full 2,500-foot range - copilot	10	_____
First-generation GPWS	20	_____
Second-generation GPWS or better	30	_____
GPWS with all approved modifications, data tables and service bulletins to reduce false warnings	10	_____
Navigation display and FMS	10	_____
Limited number of automated altitude callouts	10	_____
Radio-altitude automated callouts for nonprecision approach (not heard on ILS approach) and procedure	10	_____
Preselected radio altitudes to provide automated callouts that would not be heard during normal nonprecision approach	10	_____
Barometric altitudes and radio altitudes to give automated “decision” or “minimums” callouts	10	_____
An automated excessive “bank angle” callout	10	_____
Auto flight/vertical speed mode	-10	_____
Auto flight/vertical speed mode with no GPWS	-20	_____
GPS or other long-range navigation equipment to supplement NDB-only approach	15	_____
Terrain-navigation display	20	_____
Ground-mapping radar.	10	_____

175-195 points	Excellent equipment to minimize CFIT risk	
155-175 points	Good, but not the best	Aircraft Equipment Total (+)_____*
115-155 points	Improvement needed	
Less than 115	High CFIT risk	

Company Culture ______ + Flight Standards ______ + Hazard Awareness and Training ______

+Aircraft Equipment = CFIT Risk-reduction Factors Total (+)________

***If any section in Part II scores less than “Good,” a thorough review is warranted of that aspect of the company's operation.**

Part III: Your CFIT Risk

Part I CFIT Risk Factors Total (-)______+ Part II CFIT Risk-reduction Factors Total (+)_____

= CFIT Risk Score (±)______

A negative CFIT Risk Score indicates a significant threat; review the sections in Part II and determine what changes and improvements can be made to reduce CFIT risk.

 To request more information or to offer comments about the FSF CFIT Checklist, contact James M.. Burin, director of technical programs, Flight Safety Foundation, 601 Madison Street, Suite 300, Alexandria, VA 22314 U.S., Telephone: +1 (703) 739-6700 • Fax: +1 (703) 739-6708.

APPENDIX 2. AERONAUTICAL INFORMATION MANUAL, EXCERPTS

Excerpts from the Aeronautical Information Manual are reprinted below. They contain information that GA pilots should be aware of when operating at low altitude.

[Some additional editorial comments have been added to a few paragraphs to highlight certain CFIT risks or possible operating methods to reduce such risks. Aviation will always have an element of risk. A knowledgeable pilot will try to reduce these risks to an acceptable level. These additional comments are in italic and identified as AC Comments.]

7-5-3, OBSTRUCTIONS TO FLIGHT.

a. General. Many structures exist that could significantly affect the safety of your flight when operating below 500 feet AGL, and particularly below 200 feet AGL. While 14 CFR Part 91.119 allows flight below 500 AGL when over sparsely populated areas or open water, such operations are very dangerous. At and below 200 feet AGL there are numerous power lines, antenna towers, etc., that are not marked and lighted as obstructions and therefore may not be seen in time to avoid a collision. Notices to Airmen (NOTAM) are issued on those lighted structures experiencing temporary light outages. However, some time may pass before the FAA is notified of these outages, and a NOTAM issued, thus pilot vigilance is imperative.

b. Antenna Towers. Extreme caution should be exercised when flying less than 2,000 feet AGL because of numerous skeletal structures, such as radio and television antenna towers, that exceed 1,000 feet AGL with some extending higher than 2,000 feet AGL. Most skeletal structures are supported by guy wires which are very difficult to see in good weather and can be invisible at dusk or during periods of reduced visibility. These wires can extend about 1,500 feet horizontally from a structure; therefore, all skeletal structures should be avoided horizontally by at least 2,000 feet. Additionally, new towers may not be on your current chart because the information was not received prior to the printing of the chart.

[Every pilot must remember that not every tower has to be published on aeronautical charts. Chart clutter may limit the printing of some towers. Other towers are not required to be listed because they are not tall enough. A builder may simply not report a new tower. Equally dangerous is a new tower's position may be wrong. Because of these factors, pilots are cautioned to be particularly careful when operating at low altitude. The "see and avoid" rule becomes critical close to the ground. A lesson taken from the helicopter community is to fly overhead at a safe altitude and check the area for towers and hazards before descending to a lower altitude where a CFIT accident is likely to occur.]

[AC Comment: In some cases, the information is published in the next Airport/Facility Directory's Aeronautical Chart Bulletin section, but the pilot fails to make the necessary corrections to the chart.]

c. Overhead Wires. Overhead transmission and utility lines often span approaches to runways, natural flyways such as lakes, rivers, gorges, and canyons, and cross other landmarks pilots frequently follow such as highways, railroad tracks, etc. As with antenna towers, these high voltage/power lines or the supporting structures of these lines may not always be readily visible and the wires may be virtually impossible to see under certain conditions. In some locations, the supporting structures of overhead transmission lines are equipped with unique sequence flashing white strobe light systems to indicate that there are wires between the structures. However, many power lines do not require notice to the FAA and, therefore, are not marked and/or lighted. Many of those that do require notice do not exceed 200 feet AGL or meet the Obstruction Standard of 14 CFR Part 77 and, therefore, are not marked and/or lighted.

All pilots are cautioned to remain extremely vigilant for these power lines or their supporting structures when following natural flyways or during the approach and landing phase. This is particularly important for seaplane and/or float equipped aircraft when landing on, or departing from, unfamiliar lakes or rivers.

d. Other Objects/Structures. There are other objects or structures that could adversely affect your flight such as construction cranes near an airport, newly constructed buildings, new towers, etc. Many of these structures do not meet charting requirements or may not yet be charted because of the charting cycle. Some structures do not require obstruction marking and/or lighting and some may not be marked and lighted even though the FAA recommended it.

7-5-4. AVOID FLIGHT BENEATH UNMANNED BALLOONS.

a. The majority of unmanned free balloons currently being operated have, extending below them, either a suspension device to which the payload or instrument package is attached, or a trailing wire antenna, or both. In many instances, these balloon subsystems may be invisible to the pilot until the aircraft is close to the balloon, thereby creating a potentially dangerous situation. Therefore, good judgment on the part of the pilot dictates that aircraft should remain well clear of all unmanned free balloons and flight below them should be avoided at all times.

b. Pilots are urged to report any unmanned free balloons sighted to the nearest FAA ground facility with which communication is established. Such information will assist FAA ATC facilities to identify and flight follow unmanned free balloons operating in the airspace.

[AC Comment: In addition to unmanned free balloons, the U.S. Government operates unmarked balloons thousands of feet into the sky tethered to cables. These balloons are contained in published restricted areas. Located primarily along the southern U.S. border, pilots are advised to check their charts for the location of these unmarked tethered balloons when flying through areas they are not familiar with. These balloons may be at an altitude of more than 10,000 feet AGL.]

7-5-5. MOUNTAIN FLYING.

a. Your first experience of flying over mountainous terrain (particularly if most of your flight time has been over the flatlands of the Midwest) could be a never-to-be-forgotten nightmare if proper planning is not done and if you are not aware of the potential hazards awaiting. Those familiar section lines are not present in the mountains; those flat, level fields for forced landings are practically nonexistent; abrupt changes in wind direction and velocity occur; severe updrafts and downdrafts are common, particularly near or above abrupt changes of terrain such as cliffs or rugged areas; even the clouds look different and can build up with startling rapidity. Mountain flying need not be hazardous if you follow the recommendations below.

[AC Comment: As in all types of new flying, you should find a qualified and currently certificated flight instructor for a local area checkout.]

b. File a flight plan. Plan your route to avoid topography which would prevent a safe forced landing. The route should be over populated areas and well-known mountain passes. Sufficient altitude should be maintained to permit gliding to a safe landing in the event of engine failure.

c. Don't fly a light aircraft when the winds aloft, at your proposed altitude, exceed 35 miles per hour. Expect the winds to be of much greater velocity over mountain passes than reported a few miles from them. Approach mountain passes with as much altitude as possible. Downdrafts of from 1,500 to 2,000 feet per minute are not uncommon on the leeward side.

d. Don't fly near or above abrupt changes in terrain. Severe turbulence can be expected, especially in high wind conditions.

e. Some canyons run into a dead end. Don't fly so far up a canyon that you get trapped. ALWAYS BE ABLE TO MAKE A 180 DEGREE TURN!

f. VFR flight operations may be conducted at night in mountainous terrain with the application of sound judgment and common sense. Proper pre-flight planning, giving ample consideration to winds and weather, knowledge of the terrain and pilot experience in mountain flying are prerequisites for safety of flight. Continuous visual contact with the surface and obstructions is a major concern and flight operations under an overcast or in the vicinity of clouds should be approached with extreme caution.

g. When landing at a high altitude field, the same indicated airspeed should be used as at low elevation fields. *Remember:* that due to the less dense air at altitude, this same indicated airspeed actually results in higher true airspeed, a faster landing speed, and more important, a longer landing distance. During gusty wind conditions which often prevail at high altitude fields, a power approach and power landing is recommended. Additionally, due to the faster groundspeed, your takeoff distance will increase considerably over that required at low altitudes.

h. Effects of Density Altitude. Performance figures in the aircraft owner's handbook for length of takeoff run, horsepower, rate of climb, etc., are generally based on standard atmosphere conditions (59 degrees Fahrenheit (15 degrees Celsius), pressure 29.92 inches of mercury) at sea level. However, inexperienced pilots, as well as experienced pilots, may run into trouble when they encounter an altogether different set of conditions. This is particularly true in hot weather and at higher elevations. Aircraft operations at altitudes above sea level and at higher than standard temperatures are commonplace in mountainous areas. Such operations quite often result in a drastic reduction of aircraft performance capabilities because of the changing air density. Density altitude is a measure of air density. It is not to be confused with pressure altitude, true altitude, or absolute altitude. It is not to be used as a height reference, but as a determining criteria in the performance capability of an aircraft. Air density decreases with altitude. As air density decreases, density altitude increases. The further effects of high temperature and high humidity are cumulative, resulting in an increasing high-density altitude condition. High-density altitude reduces all aircraft performance parameters. To the pilot, this means that the normal horsepower output is reduced, propeller efficiency is reduced and a higher true airspeed is required to sustain the aircraft throughout its operating parameters. It means an increase in runway length requirements for takeoff and landings, and decreased rate of climb. An average small airplane, for example, requiring 1,000 feet for takeoff at sea level under standard atmospheric conditions will require a takeoff run of approximately 2,000 feet at an operational altitude of 5,000 feet.

NOTE: A turbo-charged aircraft engine provides some slight advantage in that it provides sea level horsepower up to a specified altitude above sea level.

[AC Comment: A turbo-charged aircraft can provide a significant operating advantage if operated within its approved limitations. In some cases, a turbo-charged, high performance aircraft may be the only safe way to fly into and out of some mountain landing areas.]

(1) Density Altitude Advisories. At airports with elevations of 2,000 feet and higher, control towers and FSSs will broadcast the advisory "Check Density Altitude" when the temperature reaches a predetermined level. These advisories will be broadcast on appropriate tower frequencies or, where available, ATIS. FSSs will broadcast these advisories as a part of Local Airport Advisory, and on TWEB.

(2) These advisories are provided by air traffic facilities, as a reminder to pilots that high temperatures and high field elevations will cause significant changes in aircraft characteristics. The pilot retains the responsibility to compute density altitude, when appropriate, as a part of preflight duties.

NOTE: All FSSs will compute the current density altitude upon request.