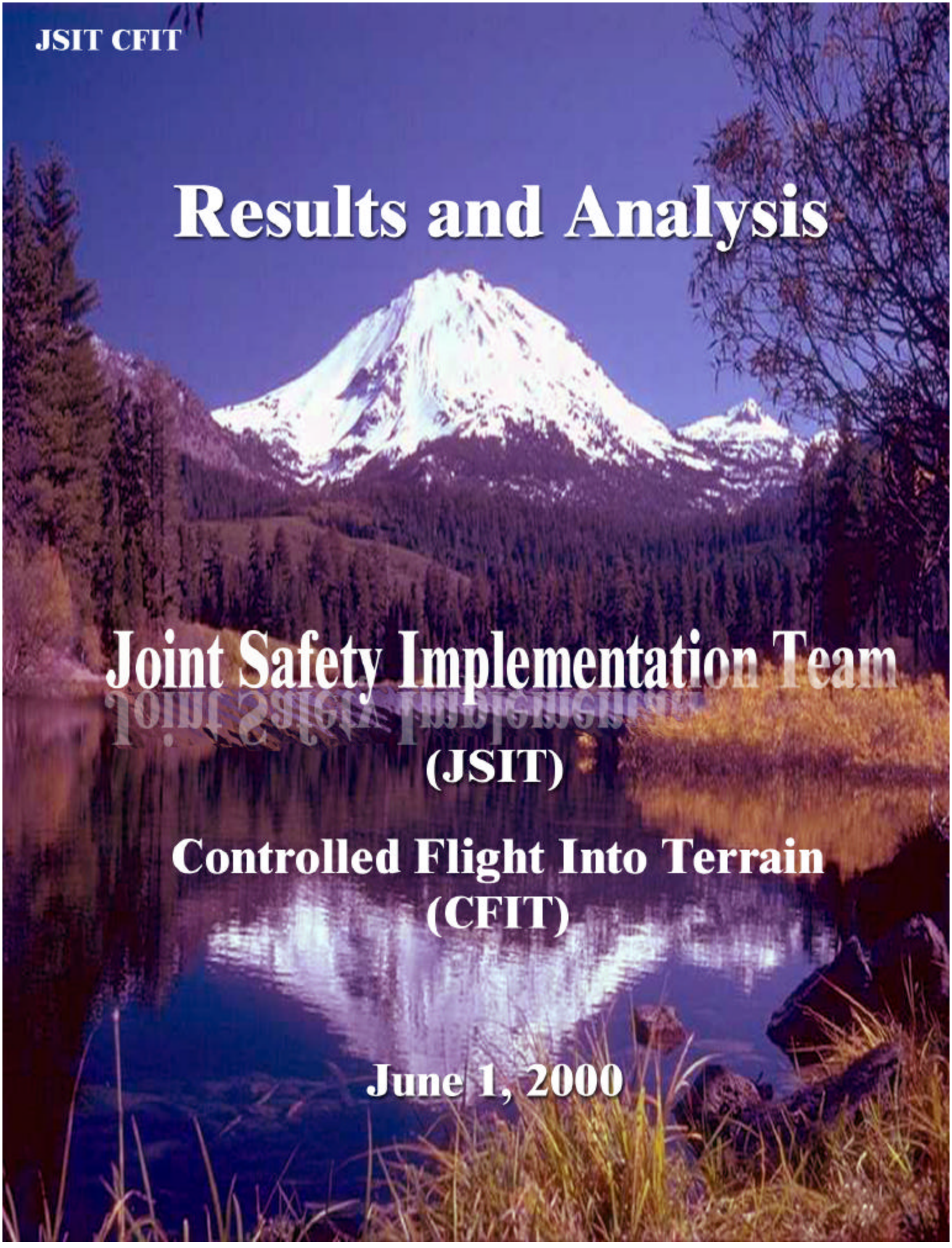
Results and Analysis

Joint Safety Implementation Team (JSIT)

Controlled Flight Into Terrain (CFIT)

June 1, 2000



CONTROLLED FLIGHT INTO TERRAIN (CFIT)

JOINT SAFETY IMPLEMENTATION (JSIT)

Results and Analysis

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Representatives of the following organizations developed the JSIT process:

1. Federal Aviation Administration:
    - Engine & Propeller Directorate, Aircraft Certification Service (ANE)
    - Flight Standards Service (AFS)
    - Air Traffic Service (AAT)
    - Aviation System Standards (AVN)
    - Research and Acquisitions (ARA)
2. The Boeing Company
3. Air Line Pilots Association (ALPA)
4. Allied Pilots Association (APA)
5. National Aeronautics and Space Administration (NASA)
6. Air Transport Association (ATA)
7. Regional Airline Association (Comair for RAA)
8. Delta Airlines (for ALPA)
9. US Airways (for ALPA)
10. Joint Aviation Authority (JAA)
11. United Parcel Service (for ATA)
12. Northwest Airlines
13. International Civil Aviation Organization (ICAO)

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I. EXECUTIVE SUMMARY

The Commercial Aviation Safety Team (CAST) is a collaboration of major organizations sharing a common aviation safety mission, to reduce the commercial aviation accident rate 80% over a ten-year period ending 2007. CAST includes the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), and the Department of Defense (DOD), representing government, and many organizations representing the aviation industry. Among those organizations are airplane and engine manufacturers, Part 121 certificate holders (airlines), and their trade organizations, such as Air Transport Association (ATA); also pilots' associations such as the Air Line Pilots Association (ALPA) and the Allied Pilots Association (APA). The general aviation community, in association with the Government, collaborates through a similar organization, the General Aviation Joint Steering Committee (GA JSC).

During the fall of 1997, CAST chartered a Joint Safety Analysis Team (JSAT) to develop and document a data-driven analytical process. That process would yield recommendations for aviation safety interventions with high potential for significant safety benefits. Those recommendations would be founded on data and on the rigor inherent in the analytical process itself. Those recommendations would carry particular weight in the commercial aviation community because they would be developed, reviewed, and ratified by all of the community's most significant stakeholders themselves. Controlled flight into terrain (CFIT) continued as a leading category of fatal commercial aviation accidents worldwide and the presence of many other CFIT studies afforded ample opportunities to validate the analysis methodology. Accordingly, CAST chose CFIT as the first major aviation hazard to be subjected to the JSAT process.

In November 20, 1998, CAST accepted the "Results and Analysis" report submitted by the CFIT JSAT. That report identified 106 total interventions and rated the effectiveness of each for potentially preventing each of the reviewed accidents. In the same month, CAST chartered a Joint Safety Implementation Team (JSIT) to develop, prioritize, and coordinate an agenda to implement the interventions recommended by the CFIT JSAT. A concurrent task would be to document the JSIT process itself, a first-ever undertaking, for the benefit of future implementation teams (JSITs) with agendas addressing other aviation hazards apart from CFIT.

In a little over a year, the CFIT JSIT delivered on its dual mission. It produced a generic JSIT Process document and a comprehensive agenda to reduce CFIT accidents in commercial aviation. Using the JSIT process contained in the document entitled "Process Handbook – Joint Safety Implementation Team," the team evaluated each intervention proposed by the JSAT and developed intervention strategies and a recommended priority for implementation. Priority is based on the effectiveness as determined by the JSAT and the feasibility of implementing each intervention in the United States as determined by the JSIT.

The JSIT delineated 8 projects that were judged to have top overall effectiveness and feasibility scores.

1. Terrain Awareness Warning System (TAWS)
2. ATC CFIT Training
3. Precision-Like Approach Implementation (PAI)
4. Training – CFIT Prevention
5. Training – Crew Resource Management (CRM)

6. Standard Operating Procedures (SOP) – CFIT Prevention
7. Minimum Safe Altitude Warning (MSAW)
8. Airline Proactive Safety Programs (ASAP & FOQA)

Detailed implementation plans for each of these projects have been presented to and approved by CAST.

The agenda detailed here includes results, conclusions and the implementation plans that are products of months of concentrated efforts by carefully chosen experts. Those experts comprise core CFIT JSIT members and extended members, and countless associates of those members. The CFIT JSIT believes that this report brings together data and ideas in a form that offers considerable value to its readers in our universal mission to reduce CFIT accidents.

II. INTRODUCTION

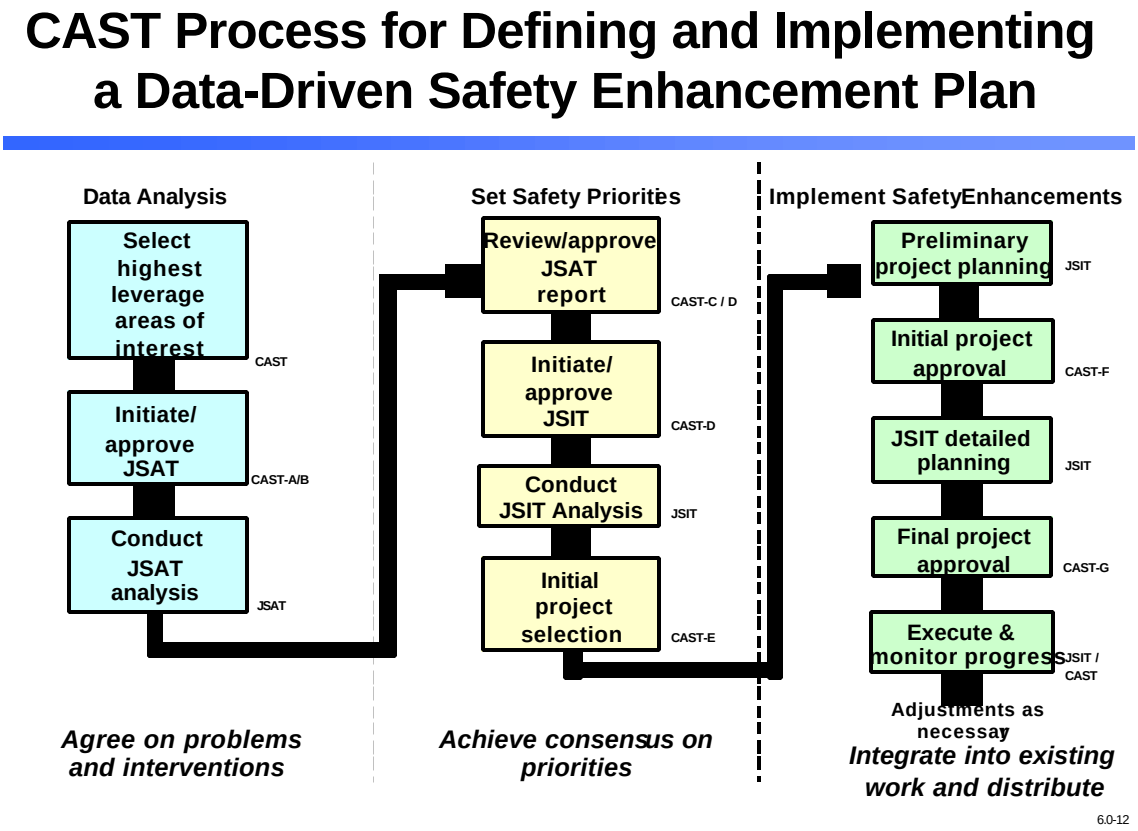
In the fall of 1998, the Commercial Aviation Safety Team (CAST) chartered the CFIT JSIT. This team was charged with a dual mission, (1) to develop, prioritize, and coordinate an agenda to implement the CFIT interventions recommended by the CFIT JSAT, and (2) to document the JSIT process itself. (See Appendix A for complete charter). Both elements of the dual mission would be first-of-its kind efforts, with no road map for guidance except for a series of process blocks developed by CAST. These process blocks described what products CAST expected from the CFIT JSIT, but did not specify how the JSIT should develop those products.

In a little over a year, the CFIT JSIT delivered on its dual mission. It produced a generic JSIT Process document entitled "Process Handbook - Joint Safety Implementation Team," February 28, 2000, and this report, which is a comprehensive agenda to reduce CFIT accidents in commercial aviation.
The agenda detailed here includes results, conclusions and implementation plans that are products of months of concentrated efforts by carefully chosen experts. Those experts comprise core CFIT JSIT members (See Appendix B for the list of members) and extended members, and countless associates of those members. Together the CFIT JSIT comprised a rare cross-section of specialists from the commercial aviation community.

The CFIT JSIT believes that this report brings together data and ideas in a form that offers considerable value to its readers in our universal mission to reduce CFIT accidents.

III. APPLYING THE JSIT PROCESS TO CFIT

During the fall of 1998, the Commercial Aviation Safety Team (CAST) chartered the JSIT to study and develop an implementation strategy for the interventions from the CFIT JSAT. The JSIT process evolved over the 12-month duration of the effort. As with the earlier JSAT effort, this was the first effort for a JSIT. As the team worked through the various stages/process blocks recommended by CAST (see figure below), the process was established and documented. The resulting JSIT Process Handbook was followed in addressing the interventions recommended by the CFIT JSAT.



IV. CONTROLLED FLIGHT INTO TERRAIN ANALYSIS

Review of JSAT Documents and Identified Interventions

The JSIT reviewed two documents furnished by the JSAT, the "Results and Analysis Document" and the "Master Collector Document." During the initial review, members of the JSIT who had also served on the JSAT presented the rationale for the events-based sequence and history and previous experience were shared. Specific examples of cause and event sequence analyses were presented to the team.

The "Results and Analysis Document" contains one hundred six (106) interventions developed by the JSAT and a rating of the effectiveness of each intervention for preventing future CFIT accidents based upon the analysis of the CFIT accidents selected for the JSAT study. The document also contains the JSAT

assessment of the feasibility of implementing the interventions within the United States and a compilation of prioritized categories of interventions based upon the combination of effectiveness and feasibility.

The charter for the CFIT JSIT assigns the JSIT the responsibility for determining implementation feasibility and overall effectiveness, and identifying prospective intervention strategies for implementation. Thus, the JSIT was not bound by the JSAT's feasibility assessments or suggested groupings, but none the less did refer to these as a sanity check.

The "Master Collector Document" contains a list of standard problem statements that were developed from the individual problem lists for each accident, the proposed interventions, and the prioritized list of grouped interventions. This document was particularly useful when the JSIT needed to identify the problem(s) and accident(s) related to individual interventions.

Grouping of Interventions into Projects

The team recognized that 106 was too large a number of interventions to individually disposition and prioritize. The JSIT initially grouped the 106 interventions into 22 sub-areas that had a common theme or concentration area. (An Excel spreadsheet listing the interventions and the 22 sub-areas is provided in Appendix C.) In order to enable team members with a particular expertise to tackle several of these sub-areas, they were further refined into 9 projects. For example, Terrain Awareness & Warning Systems, Flight Deck Equipment Upgrade, FMS Installation/Maintenance, and Aircraft Maintenance & Health Monitoring could all be combined in one project, "Aircraft Equipment." The nine (9) project areas are as follows:

1. Aircraft Equipment
2. Airline Data Collection & Analysis
3. Approach Position Awareness
4. Air Traffic Control Training
5. Charting
6. Flight Crew Training
7. Ground Equipment
8. Pilot/Controller Communication
9. Standard Operating Procedures (SOP's)

These 9 projects resulted in a manageable number of projects which could now be assigned to working groups within the JSIT. Working groups consisting of 3-4 JSIT members with expertise in the subject area were identified for each of the above projects and a group leader was selected.

Determination of Intervention Feasibility

The working groups assigned a feasibility value to each intervention in their project area using the six feasibility elements and values described in the JSIT Process Handbook. The group's assessments were collated and an average feasibility value for each intervention was calculated. The JSIT then reviewed the numerical assessments for the feasibility elements, and changes were made in order to reach consensus.

Generation of Color-coded Spreadsheets

The CFIT JSIT used the color-coding technique described in the JSIT Process Handbook to identify the high-priority projects that would be recommended for implementation. The initial step in generating color-coded spreadsheets was to numerically sort the interventions by their effectiveness and feasibility ratings. This sorting identified clusters in the data where colors could be assigned. Break points for effectiveness and feasibility were set wherever naturally occurring breaks appeared between clusters of ratings.

The CFIT JSIT assigned color coding as follows:

	Effectiveness	**Feasibility**
Red	0 to 1	1 - 1.66
Yellow	1 to 1.5	1.67 – 2.32
Green	1.5 to 3	2.33 - 3

The analysis and visual presentation was key to visually segregating data. The spreadsheets shown in the appendices are examples of such data display.

Prioritization of Interventions

The next step conducted by the JSIT was to determine the product of the effectiveness rating (E) and the feasibility rating (F). The simple math of multiplying the effectiveness value, already determined by the JSAT, by the feasibility value, determined by the JSIT, yielded a rating that was used to determine priorities of interventions. This resultant product, E times F (ExF), is captured in the spreadsheet and shown in a separate column. The interventions were then sorted by this product value to aid in the prioritization of the interventions. The sorted interventions are shown in Appendix D. Based upon the resulting sort of ExF, a cutoff value for ExF was determined to identify the highest leveraged interventions to reduce accident rates. The cutoff value used in the current analysis was 4.0. All sub-areas containing one or more interventions with an ExF value of 4.0 or greater were considered as high-priority.

This prioritization process resulted in the identification of 8 of the original 22 sub-areas:

1. Terrain Awareness Warning System (TAWS)
2. ATC CFIT Training
3. Precision-Like Approach Implementation (PAI)
4. Training – CFIT Prevention
5. Training – Crew Resource Management (CRM)
6. Standard Operating Procedures (SOP) – CFIT Prevention
7. Minimum Safe Altitude Warning (MSAW)
8. Airline Proactive Safety Programs (ASAP & FOQA)

Identification of Longer-term Research Projects

During the disposition of interventions recommended by the JSAT, consideration was given to interventions pertaining to research activities. Where technology solutions were needed, or in cases where better problem understanding might lead to future solutions, an intervention based on research might be appropriate. As research solutions tend to be longer-term actions, care was taken not to discount these potential interventions due to potential low short-term effectiveness and feasibility ratings. Research interventions, which might have

potentially high future safety leverage were considered separately and included in the final JSIT recommendations to CAST. Three research projects recommended to CAST are listed below:

1. Develop and implement capabilities that permit flight crews to operate in a day VMC-like environment, regardless of visibility.
2. Develop analytical tools and methods that both large and small operators can apply to FOQA and ASAP information.
3. Develop and implement datalink capabilities and systems for digital transmission of ATC instructions, weather, and other information to aircraft.

In addition, the Precision-Like Approach Implementation (PAI) plan contains two outputs that require research efforts.

I. Conduct research necessary to determine human factors guidelines for design of instrument procedures.

II. Develop a plan and initiate implementation for a minimum number of approach charts to runway end with multiple minima, (suitable for xLS, RNP, LNAV/VNAV, and LNAV minima). As part of this plan implementation, conduct a research project to address issues of charting, content, etc.

Development of Statements of Work

Once the high-priority project areas were identified, project leads from the JSIT team were identified. The project leads generated Statements of Work (SOW), with the assistance of the JSIT team, for their respective projects.

Development of Project Plans

The SOWs for the high-priority projects were then presented to CAST as part of a "plan-for-a-plan" (see Appendix E for all 8 SOW's and plans-for-a-plan) for CAST initial approval (CAST-E) and direction to proceed with a detailed implementation plan. CAST requested detailed plans for all of the projects. Some referenced projects have existing programs that can be leveraged for implementation. CAST approved these as "Immediate Actions". CAST identified the appropriate organizations to support the projects and resource implications/availability. CAST gave the JSIT approval to pursue Initial Implementation Plans. CAST then approved the initial project implementations based on the Executive Summary presented for each project. The Executive Summaries include estimated schedule and resources for each project and are shown in Appendix F.

The JSIT was asked to develop final Detailed Implementation Plans (DIP's) for all 8 projects. The JSIT's minimum requirement for the detailed plans was that they contain strategies for implementing the interventions in the selected projects that were above the ExF cutoff value of 4.0. As much as possible, the lower ranked interventions were included in the detailed plans unless the inclusion would result in activities that required excessive resources or time to implement. Also, for the DIP for SOP, the JSIT included recommended interventions from the Approach and Landing JSAT in the development of the template. This template is to be included in an FAA Advisory Circular and the inclusion of the Approach and Landing interventions will negate an early revision of this document. CAST shared the DIPs with their stakeholders and reconfirmed resource commitments by their agency / organization. All 8 projects were given final approval (CAST-G). Brief descriptions of each of these projects follow.

V. DETAILED PLAN SYNOPSES

TERRAIN AVOIDANCE WARNING SYSTEM (TAWS) INSTALLATION

PURPOSE:
The purpose of this project is to substantially reduce or eliminate the Control Flight into Terrain (CFIT) accident rate through improving pilot situation awareness with respect to terrain avoidance. The intervention establishes procedures for the installation and use of TAWS by all air carriers. Procedures include proper flight crew reaction to TAWS aural and visual warnings.

ACTION	COMPLETION	PRIMARY ORGANIZATION(S)
Prepare and publish rule requiring TAWS in all air carrier aircraft	March 2000	FAA
Prepare and publish TAWS TSO	December 1999	FAA
Install TAWS in new air carrier aircraft	March 2001	Manufacturers
Install TAWS in existing air carrier aircraft	March 2005	Operators Manufacturers FAA
Develop support program for installation, maintenance, training, and use of TAWS		
Operating guidance:		
-Airplane Flight Manual (AFM) revisions/approvals		
new aircraft	March 2001	FAA
existing aircraft	March 2005	FAA
-Publish Advisory Circular (AC)	March 2002	FAA
-Publish Handbook Bulletin	March 2002	FAA
Maintenance guidance:		
-Publish AC for part 25 aircraft	March 2001	FAA
-Publish AC for part 23 aircraft	March 2004	FAA
Develop metrics to validate TAWS effectiveness	September 1999	FAA, Operators Associations

IMPLEMENTING ORGANIZATION (S):
FAA/Aircraft Certification, FAA/Flight Standards, FAA/Chief Counsel, FAA/Aviation Policy & Plans, Air Transport Association, Regional Airline Association, Manufacturers, and Operators

AIR TRAFFIC CONTROL (ATC) - CFIT TRAINING

PURPOSE:
The purpose of this project is to improve aviation safety by reinforcing current safety alert procedures and good Air Traffic operating practices.

ACTION	COMPLETION	PRIMARY ORGANIZATION
Publish an Air Traffic Bulletin (ATB) which includes mandatory briefing information re-emphasizing CFIT prevention procedures.	December 1999	FAA
Provide a mandatory briefing to all enroute and terminal Air Traffic Controllers on the history of CAST and handbook paragraphs for review	February 2000	FAA
Provide all enroute and terminal Air Traffic Controllers annual refresher training on safety alert procedures	Annually	FAA

IMPLEMENTING ORGANIZATION (S)

FAA/Air Traffic Service

PRECISION-LIKE APPROACH IMPLEMENTATION (PAI)

PURPOSE:
The purpose of this plan is to improve aviation safety by enabling all flight crews and aircraft to fly a stabilized vertical path to the runway end for all instrument approach procedures.

ACTION	COMPLETION	PRIMARY ORGANIZATION(S)
Develop plans and initiate action to put the structure (policies and infrastructure) in place to promote instrument approaches with a stabilized vertical path to all runway ends	3 to 7 years	FAA
Educate and train operators and regulators in the understanding and use of 21st Century Instrument Approach Procedures	1 to 3 years	Industry

IMPLEMENTING ORGANIZATION (S):

FAA/Flight Standards Service, FAA/Aircraft Certification, FAA/ Airways Facilities Service, FAA/Aircraft Evaluations Group, FAA/ Aviation Systems Standards, FAA/Air Traffic Service, FAA/ Airports, National Oceanic and Atmospheric Administration, National Oceanic Survey, Jeppesen Company, Air Transport Association, Air Line Pilots Association, Regional Airline Association, Aircraft Manufactures, Air Carriers, Joint Aviation Authority, and Harmonization Groups.

TRAINING - CONTROLLED FLIGHT INTO TERRAIN (CFIT) PREVENTION

PURPOSE:
The purpose of this project is to substantially reduce the CFIT accident rate by insuring the inclusion of CFIT prevention training and procedures into the approved training curricula of all air carriers operating in the United States. The training will emphasize pilot situational awareness and escape procedures for flight crews to use in the event of a terrain warning indication.

ACTION	COMPLETION	PRIMARY ORGANIZATION(S)
Post CFIT Education & Training Aid on the World Wide Web	April 1999	FAA
Conduct a review of all air carrier training programs	November 1999	FAA
Publish Handbook Bulletin encouraging incorporation of the training	October 1999	FAA
Provide copy of CFIT training to FAA Principle Operations Inspectors (POI's) whose carriers do not have approved programs	March 2000	FAA
Conduct CFIT prevention training	July 2000	Part 121 & Part 142 training centers

IMPLEMENTING ORGANIZATION(S)

FAA/Flight Standards, and Air Transport Association

TRAINING - CREW RESOURCE MANAGEMENT (CRM)

PURPOSE:
The purpose of this project is to reduce controlled flight into terrain (CFIT) accidents substantially by emphasizing flight crewmembers' situation awareness and crew coordination in the Crew Resource Management training provided by air carriers. CRM training, standard operating procedures (SOP's), and CFIT prevention training are all closely linked. This project will reduce CFIT accidents by promoting comprehensive SOP's as a key element of every air carrier's CRM training program.

ACTION	COMPLETION	PRIMARY ORGANIZATION(S)
Promote CFIT prevention training in all air carrier's training programs	December 2000	FAA Associations
Reference the SOP template in next revision of CRM Advisory Circular (AC)	December 2000	FAA
CFIT prevention training added to all CRM training programs	December 2000	Air Carriers ATA, RAA, ALPA Associations

IMPLEMENTIING ORGANIZATION(S)

FAA/Flight Standards, Air Line Pilots Association, Allied Pilots Association, Air Transport Association, Regional Airline Association, and Operators

STANDARD OPERATING PROCEDURES (SOP) – CFIT PREVENTION

PURPOSE:
The purpose of this project is to improve aviation safety by recommending that all air carriers establish, document, train and follow Standard Operating Procedures according to a jointly developed template. Crew Resource Management (CRM) training, Standard Operating Procedures (SOP's), and Control Flight into Terrain (CFIT) prevention training are all closely linked.

ACTION	**COMPLETION**	**PRIMARY ORGANIZATION(S)**
Develop and publish the SOP template	September 1999	ATA, Operators Associations
Prepare and publish guidance material		
-Publish Advisory Circular (AC)	June 2000	FAA
-Publish Handbook Bulletin	June 2000	FAA
Air carriers adopt SOP's and revise training programs/manuals	September 2000	Operators ATA, RAA, APA, ALPA Manufacturers Associations

IMPLEMENTING ORGANIZATION (S)

FAA/Flight Standards, Air Transport Association, Regional Airline Association, Air Line Pilots Association, Allied Pilots Association, Operators, and Manufactures

MINIMUM SAFE ALTITUDE WARNING PLAN (MSAW)

PURPOSE:

The purpose of this project is to improve aviation safety by:

III. Ensuring that ground-based radars' associated by-products provide the necessary levels of terrain avoidance protection to aircraft operating domestically within the United States.

IV. Ensuring that Air Traffic Controller's MSAW training is adequate and appropriate to operate and use MSAW systems.

ACTION	COMPLETION	PRIMARY ORGANIZATION
Review existing data on all MSAW system's periodic reviews and flight checks.	April 1999	FAA
Follow-up periodic reviews and Flight checks	On-going	FAA
Publish an Air Traffic Bulletin (ATB) that includes mandatory briefing information re-emphasizing minimum safe altitude alerts.	December 1999	FAA
Provide mandatory briefings to all enroute and terminal Air Traffic Controllers on handbook paragraphs for review.	February 2000	FAA
Provide all enroute and terminal Air Traffic Controllers annual refresher training on minimum safe altitude alerts.	Annually	FAA

IMPLEMENTING ORGANIZATION(S)

FAA/Operational Support, FAA/Air Traffic Services, FAA/Airway Facilities, FAA/Aviation System Standards

AIRLINE PROACTIVE SAFETY PROGRAMS (ASAP & FOQA)

PURPOSE:
The purpose of this project is to give operators the tools to identify safety issues and trends. This information will enable operators to identify and initiate corrective actions prior to an accident or incident occurrence.

ACTION	**COMPLETION**	**IMPLEMENTING ORGANIZATION(S)**
Publish Notice of Proposed Rule Making (NPRM) that protects FOQA and ASAP data	May 2000	FAA, ATA, RAA Employee Groups
Prepare and publish guidance material		
-Draft FOQA & ASAP Advisory Circulars (AC's)	February 2000	FAA
-Publish Handbook Bulletin	April 2000	FAA
Form Steering Committees to oversee program issues, mentor, and document standards	February 2000	ATA, FAA, Associations, Operators
Develop analytical processes and tools	May 2001	NASA, FAA Associations
Develop voluntary procedures and protocols (information sharing)	May 2002	Operators, Associations, Employee Groups, FAA

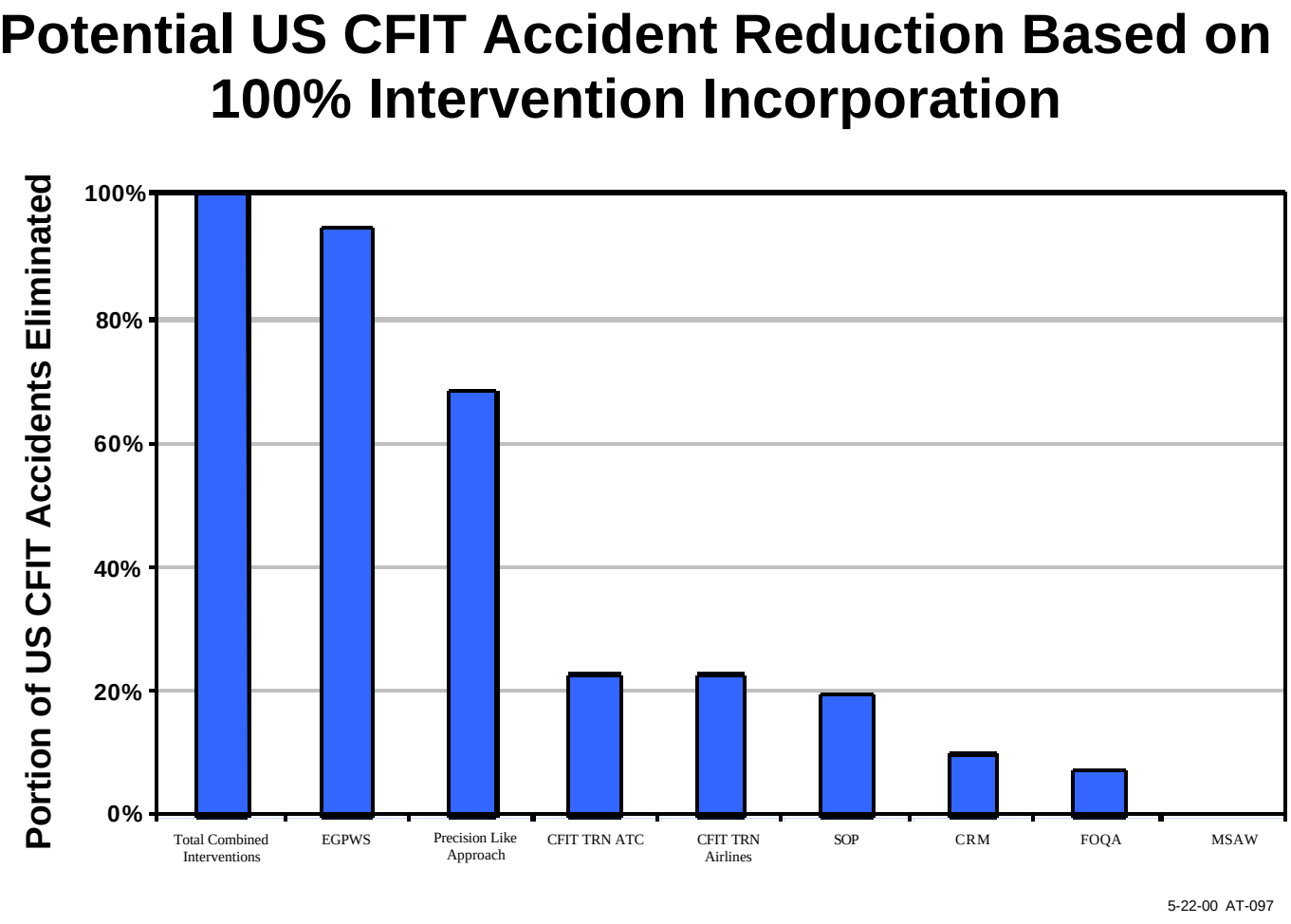
IMPLEMENTING ORGANIZATION (S)

FAA/Flight Standards, FAA/General Counsel, FAA/Systems Safety, Air Transport Association, Regional Airline Association, Allied Pilots Association, Air Line Pilots Association, Flight Safety Foundation, National Aeronautics & Space Administration, Operators, and Manufacturers

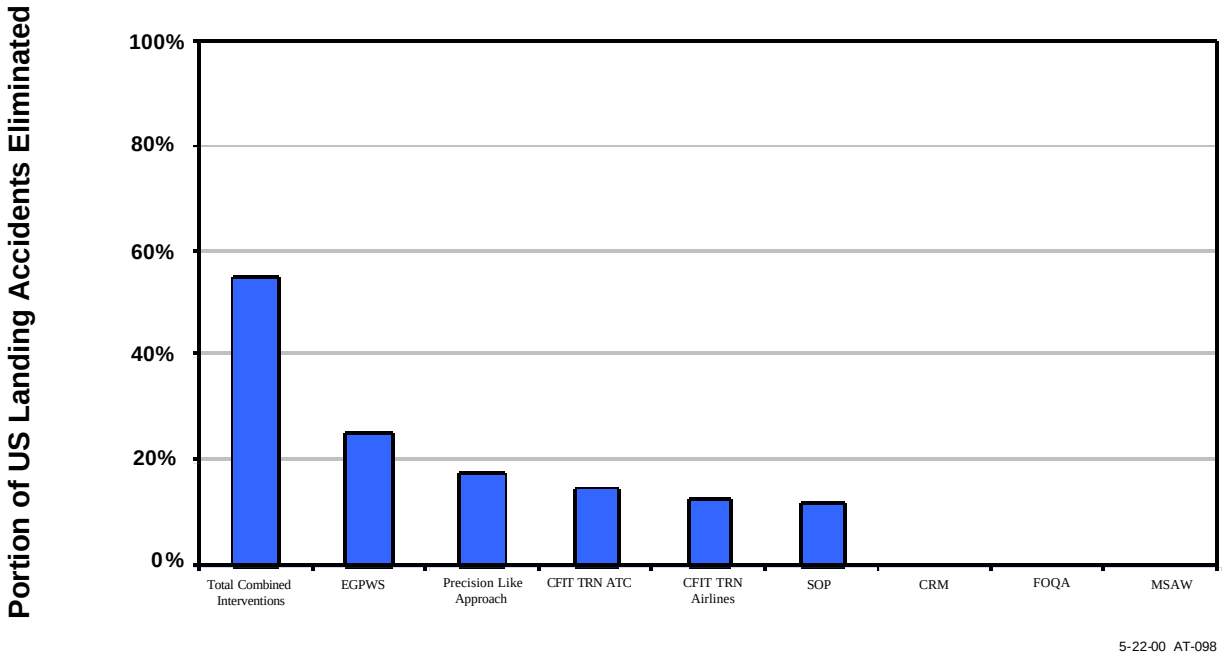
Executing Projects and Monitoring Progress

Once CAST-G approval has been obtained for the Project's DIP, the responsible organizations in the plan are expected to begin implementation strategies. CAST has created a Joint Implementation Measurement Team (JIMT) to monitor the project implementation and effectiveness and provide information to CAST. In order to accomplish this task, the JIMT requires that the JSIT provide the predicted effectiveness of each of the projects, the primary problem statements the project is intended to address, and the project implementation milestones.

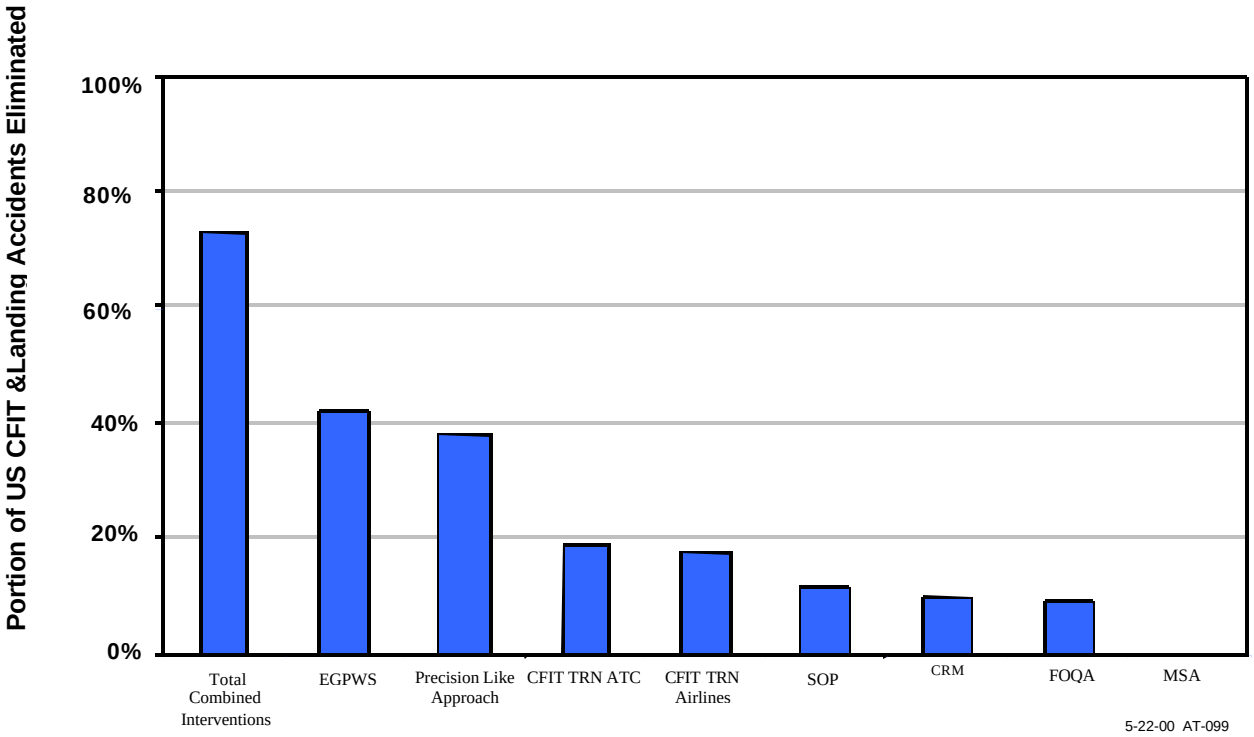
Using the methodology contained in the JIMT, the JSIT determined the number of accidents that the project would be expected to prevent during the measurement period. The following charts depict the potential to prevent CFIT accidents, Landing accidents and the combination of CFIT and Landing accidents, assuming all interventions are 100% implemented. Although the primary focus of this JSIT is to prevent CFIT accidents, where it was practicable, interventions from the Approach and Landing JSAT were incorporated in the CFIT interventions and some reduction in Landing accidents will be achieved.



Potential US Landing Accident Reduction Based on 100% Intervention Incorporation



Potential US CFIT & Landing Accident Reduction Based on 100% Intervention Incorporation



The JSIT has also identified the primary problems each of the projects is intended to correct. The following Table lists the 8 selected projects against the problem statements generated by the CFIT JSAT. The complete list of problem statements is given in Appendix G.

JSIT PROJECT NAME	JSAT PROBLEM STATEMENT(S) ADDRESSED
Terrain Awareness Warning System (TAWS)	11, 13, 21, 23
ATC CFIT Training	6, 7, 8, 27, 33
Precision-Like Approach Implementation (PAI)	11, 12, 18, 28
Training – CFIT Prevention	11, 20, 31
Training – Crew Resource Management (CRM)	16, 22, 34
Standard Operating Procedures (SOP) – CFIT Prevention	9, 21, 22, 29, 31, 34
Minimum Safe Altitude Warning (MSAW)	7, 28, 30
Airline Proactive Safety Programs (ASAP & FOQA)	2, 5, 9, 10, 11, 12, 17, 19, 23, 25, 29, 32, 34, 35

Project implementation milestones are listed in the individual DIPs shown in Appendix H.

VI. CONCLUSIONS

In accordance with the charter creating the CFIT JSIT, CAST provided input at every step of the CFIT JSIT process. At various points in the process, CAST also gave approval to the CFIT JSIT on interim steps and products. It should be noted that the Detailed Implementation Plans (DIPs) found in Appendix H of this report have been accepted by CAST and given CAST's final approval for implementation. Final approval signifies that the various CAST representatives and their organizations have reviewed, commented and concurred to implement each project as presented in its respective DIP.

In developing the process to address the interventions recommended by the CFIT JSAT, the JSIT considered numerous factors. Among those factors was the large number of interventions (106) recommended by the JSAT. The CFIT JSIT and CAST itself recognized at an early point that such a large number of interventions would be constrained by limited resources and time, and could not all be implemented effectively under any implementation agenda.

The CFIT JSIT devised and applied a selection methodology consisting of two steps, grouping and prioritizing. Grouping would reduce the number of interventions to a manageable number while meeting the challenge of reducing the commercial aviation CFIT accident rate by 80% over a ten-year period. Prioritization would identify some recommended initiatives in favor of others to afford the greatest possible safety benefit using the limited resources available.

As outlined in the JSIT Process document, the JSIT's selection methodology resulted in product-oriented groups containing all of the 106 interventions identified by the CFIT JSAT. Within each of those groups, the interventions were prioritized based upon their effectiveness (as determined by the CFIT JSAT) and their feasibility (as determined by the CFIT JSIT) in precluding a particular event, problem or accident. Based upon each intervention's priority and a mathematical cutoff (as outlined in the Process Document), the CFIT JSIT identified as high-priority 8 projects which contained well over half of the CFIT JSAT's recommended interventions and selected them for implementation under the CFIT JSIT agenda.

The remainder of the interventions identified by the CFIT JSAT, those not selected for implementation, were then assessed against related activities apart from the JSIT agenda. Such activities include the safety work in progress or in planning by the Aviation Rulemaking Advisory Committee, by various other government/industry working groups, and by other groups completely apart from government. The JSIT notes that the majority of the interventions not selected for implementation by the CFIT JSIT, while not high-priority items under the JSIT's relatively short-term agenda, are, nevertheless, already being addressed by other organizations for implementation. (See Appendix I). The JSIT notes on the other hand, that a large number of the interventions selected for implementation to reduce CFIT accidents will also pay off in the reduction of accidents related to other hazards apart from CFIT. It is difficult to quantify those incidental safety benefits until other JSAT's report on those other hazards.

The CFIT JSAT interventions regarding research and development (R & D) are a small but important subset of the worthwhile interventions not selected by the JSIT and recommended to CAST for immediate implementation. However, the CFIT JSIT strongly recommends that CAST encourage the continuation of the 3 R & D projects identified in Section IV of this report that could lead to significant reductions in the commercial aviation accident rate.

VII. RECOMMENDATIONS

The unifying goal of the CFIT JSIT was to produce a practical agenda yielding significant safety benefits, not for a selected group of organizations but for the entire commercial aviation community. Because not all organizations comprising the commercial aviation community are represented on CAST, the CFIT JSIT recommends:

1. that this report be treated as a public document and
2. that CAST ensure prompt distribution of this report to all major organizations comprising the U.S. commercial aviation community, the presidents of IATA and IFALPA, the Chairman of the JAA Board, and the President of the Council of ICAO.

Most important, the CFIT JSIT recommends that CAST and its member organizations implement the eight projects identified in Section IV as soon as possible.

APPENDICES

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CFIT/Approach and Landing

Charter for Joint Safety Implementation Team (JSIT)

I. Purpose. To develop prioritized implementation strategies and action plans and after CAST approval to coordinate the implementation of the strategies and plans.

II. Background. Industry and government, through CAST, have jointly agreed to pursue a data-driven approach to identify high priority safety initiatives. Industry and government have further agreed that cooperatively and selectively pursuing implementation of the high leveraged safety intervention strategies will maximize safety benefit. Implementation of some intervention strategies may be international in scope.

III. Tasks.

A. Intervention strategies identified by the CFIT/A&L JSAT will be analyzed by the CFIT/A&L JSIT for the purposes of determining implementation feasibility and overall effectiveness, and identifying prospective intervention strategies for implementation.

B. The CFIT/A&L JSIT will present the prospective interventions identified for implementation to CAST for review and approval. Rationale for how all the CFIT/A&L JSAT intervention strategies were dispensed will be included in the plan report.

C. For those CAST-approved CFIT/A&L interventions identified for implementation, develop an implementation plan.

D. The CFIT/A&L implementation plan will contain:
- prioritized implementation strategies
- identification of responsible parties
- a list of major implementation milestones
- metrics to monitor progress in meeting these milestones.
- metrics for tracking success of the interventions..

E. The CFIT/A&L implementation plan will include a communications strategy aimed at gaining "stakeholder" buy-in.

F. For CFIT/A&L implementation strategies which are international in scope, the CFIT/A&L JSIT implementation plan will consider how best to utilize the assistance of ICAO, IATA, FSF, IFALPA, and other international organizations and appropriate international certificating authorities.

G. The CFIT/A&L JSIT will present this detailed implementation plan to CAST for review and approval.

H. As directed by CAST, the CFIT/A&L JSIT will make periodic progress reports on implementation status to CAST.

IV. Products. The CFIT/A&L JSIT deliverables include:

- a JSIT process description,
- an initial implementation plan,
- a detailed implementation plan, and
- reports to CAST documenting progress, including implementation and established metrics.

V. Membership. The CFIT/A&L JSIT team membership will include "senior" representatives from those stakeholders who will be affected by the intervention strategies and those who may be responsible for implementation of those strategies.

VI. Resources. CAST participating organizations agree to provide appropriate financial, logistical and personnel resources necessary to carry out this charter and approved implementation strategies.

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CFIT JSAT Interventions - Grouped by Potential Projects

Intervention#		Project Identifier
Terrain Awareness and Warning System (TAWS)		
35	Manufacturers should install TAWS-EGPWS in all new aircraft, airlines/operators should retrofit TAWS-EGPWS into the existing fleet and international regulators should require the installation of TAWS-EGPWS. (United States)	TAWS
35	Manufacturers should install TAWS-EGPWS in all new aircraft, airlines/operators should retrofit TAWS-EGPWS into the existing fleet and international regulators should require the installation of TAWS-EGPWS. (International)	TAWS
60	Avionics manufacturers should improve GPWS capability to reduce GPWS false warnings. (60)	TAWS
Flight Deck Equipment Upgrade/Installation		
16	Manufacturers should ensure that automated systems provide the flight crew with sufficient information (automation feedback) to prevent mode confusion. (16)	FDEU
4	Ensure FMS depiction is consistent with approach plate presentation. (4)	FDEU
14	Install aural warning devices on aircraft to alert flight crew of arrival at MDA/DH. (14)	FDEU
45	Manufacturers should ensure that all equipment failures that may affect the safe operation of the flight are properly enunciated to the flight crew. (45)	FDEU
3	Ensure that failure of the aircraft system to capture glideslope (or VNAV) is adequately enunciated to the flight crew. Visual (3)	FDEU
3	Ensure that failure of the aircraft system to capture glideslope (or VNAV) is adequately enunciated to the flight crew. Aural (3)	FDEU
76	The manufacturer of the FMS should ensure that the FMS logic displays NAVAIDís with the same identifier in a progressive distance manner. (76)	FDEU
FMS Installation/Maintenance		
53	Airlines/operators should install FMS equipment (logic) which has the capability to depict previously entered waypoints that are between the current present position and the current "to" way point. (53)	FMS
73	Airlines/operators should ensure that the aircraft is equipped with all expected NAVAID frequencies. United States (73)	FMS
127	Airlines/operators should install FMS equipment (logic) which has the capability to depict previously entered waypoints behind the aircraft's flight path. (127)	FMS
51	Airlines/operators should ensure the currency of the FMS database and update as appropriate. (51)	FMS
73	Airlines/operators should ensure that the aircraft is equipped with all expected NAVAID frequencies. International (73)	FMS
Aircraft Maintenance & Health Monitoring:		

27	Airlines/operators should implement maintenance procedures to ensure proper functioning of the CVR at all times. (Note: This intervention was recorded as a potential intervention for future accidents; it would not have prevented the subject accidents.)	HUMS
103	Manufacturers should develop and implement system failure annunciation capabilities to alert flight crews of pending failures (e.g., HUMS). (103)	HUMS
49	Regulatory agencies should establish criteria for, and manufacturers should evaluate and improve, the reliability and failure tolerance of flight systems. (49)	HUMS
68	Manufacturers should implement a system to identify the recommended implementation schedule and priority of aircraft and operational changes. (68)	HUMS
98	Airlines/operators and regulatory agencies should review procedures to ensure that design changes (service bulletins) to flight critical systems are incorporated in a timely manner. (98)	HUMS

FOQA

56	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs to identify systemic procedural deviations. USA (56)	FOQA
54	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs. USA (54)	FOQA
55	Airlines/operators should implement a Flight Operations Quality Assurance (FOQA) program to identify flight crew failure to respond to GPWS warnings. USA (55)	FOQA

Other Data Collection

1	Airlines/operators should implement an Airline Safety Incident Reporting System (e.g., BASIS, ASAP). (1)	Other
57	Airlines/operators, regulatory agencies, and manufacturers should implement a program designed for sharing of safety related information within the aviation community. (57)	Other

Precision Approach Implementation

59	Enable all FMS equipped aircraft to utilize LNAV/VNAV in stabilized (constant angle/constant rate) approach procedures.	PAI
59	Amend all non-precision approach plates to incorporate stabilized constant angle/constant rate approach procedures.	PAI
59	Implement precision approach capability (glideslope guidance) for all runways without established precision approach procedures (e.g., ILS, DGPS, etc.). (59)	PAI
77	Eliminate non-precision approaches where possible. (77)	PAI
32	In the absence of GPS, regulatory agencies should install DME equipment at all appropriate airports. (32)	PAI

Precision Approach Usage

125	Moved to ATC CFIT Training
126	Moved to Operational Procedures for CFIT Prevention

Synthetic Vision

85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in new production aircraft. (85)	Syn

85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in non-glass aircraft. (85)	Syn
85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in existing glass aircraft. (85)	Syn

ATC CFIT Training

124	ATC should implement a Quality Assurance program to ensure adherence to established procedures. (124)	ATC CFIT-T
12	Air Traffic service providers should emphasize in ATC training the controllers' potential in assisting the flight crew in improving their situation awareness. (12)	ATC CFIT-T
126	ATC should prioritize the use of precision approaches (glideslope guidance) when available and appropriate. (126)	ATC CFIT-T
10	Air Traffic service providers should train Air Traffic Controllers to use all available tools to establish aircraft position (example: don't fixate on just DME). (10)	ATC CFIT-T
13	Air Traffic service providers should enhance ATC training to emphasize the dangers of rushed approaches and performance characteristics of modern jet transports. (13)	ATC CFIT-T
108	Air Traffic service providers should implement and/or review procedures to ensure ATC training does not create a hazard to flight operations. (108)	ATC CFIT-T
11	Air Traffic service providers should implement procedures that ensure that ATC trainees are always supervised. (11)	ATC CFIT-T

Charting

5	Regulatory agencies should mandate that approach plates show color contours for terrain. Paper Charts USA (5)	Chart
5	Regulatory agencies should mandate that approach plates show color contours for terrain. Electronic Charts USA(5)	Chart
8	Standardized information included and contained on approach plates. Paper charts, USA	Chart
5	Regulatory agencies should mandate that approach plates show color contours for terrain. Paper Charts International (5)	Chart
8	Standardized information included and contained on approach plates. Paper charts, Intl.	Chart
8	Standardized information included and contained on approach plates. Electronic charts, USA.	Chart
5	Regulatory agencies should mandate that approach plates show color contours for terrain. Electronic Charts International (5)	Chart
8	Standardized information included and contained on approach plates. Electronic charts, Intl.	Chart
6	Standardized depiction of the information on all approach plates by the publishers. Paper Charts, USA (6)	Chart
6	Standardized depiction of the information on all approach plates by the publishers. Electronic Charts, USA (6)	Chart
6	Standardized depiction of the information on all approach plates by the publishers. Paper Charts, Intl (6)	Chart
6	Standardized depiction of the information on all approach plates by the publishers. Electronic Charts, Intl (6)	Chart
74	Regulatory agencies should review and where appropriate eliminate duplicate NAVAID identifiers within the same geographic area. (74)	Chart

Training - Approach & Missed Approach

7	Airlines/operators should ensure that their training/standardization programs emphasize review of approach and missed approach procedures. (7)	A&MA-T
96	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate approach preparation and contingency review prior to commencing an approach. (96)	A&MA-T
89	Airlines/operators and regulatory agencies should ensure that the frequency and effectiveness of proficiency checks for non-precision approaches are adequate. (89)	A&MA-T
115	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of rushed approaches. (115)	A&MA-T
116	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of high rate of descent and unstable approaches. (116)	A&MA-T

Training - CFIT Prevention

47	Airlines/operators should ensure that their training/standardization programs direct the flight crews to use all available tools (charts) to establish aircraft position. (47)	CFIT-T
64	Airlines/operators should ensure that their training/standardization programs direct the flight crews to regularly cross check all instrumentation. (64)	CFIT-T
75	Airlines/operators should ensure that their training/standardization programs direct that flight crews use all available tools to establish aircraft position. (75)	CFIT-T
100	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adhering to MDA/DH. (100)	CFIT-T
110	Airlines/operators and regulatory agencies should ensure that their training/standardization and monitoring programs emphasize the importance of adherence to standard operating procedures and identify the rationale behind those procedures. (110)	CFIT-T
17	Airlines/operators should ensure that their training/standardization programs emphasize the importance of all flight-related briefings. (17)	CFIT-T
111	Airlines/operators should ensure that their training/standardization programs emphasize basic airmanship skills and knowledge during initial and recurrent training. (111)	CFIT-T
112	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for simulated instrument failures (partial panel) are adequate. (112)	CFIT-T
113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning. (113)	CFIT-T
105	Airlines/operators should train flight crews on how flight delays (weather, maintenance, ATC, etc.) can effect their subsequent decision making relative to the safe conduct of the flight. (105)	CFIT-T
67	Airlines/operators should require flight crews to perform non-FMS (raw data) approaches during proficiency/recurrent check rides. (67)	CFIT-T
62	Airlines/operators should ensure that their training/standardization programs establish flight crew proficiency in all uses of the HSI display. (62)	CFIT-T
15	Airlines/operators should ensure that their training/standardization programs instruct when to disengage automated systems and fly manually. (15)	CFIT-T
52	Airlines/operators should ensure that their training/standardization programs establish flight crew proficiency in the use of the FMS system. (52)	CFIT-T
114	Airlines/operators should ensure that their training/standardization programs provide an appropriate minimum amount of standard training. (114)	CFIT-T
117	Airlines/operators should ensure that their training/standardization programs instruct that ground proximity escape maneuvers are to be conducted with the aircraft properly configured (e.g., speedbrakes retracted). (117)	CFIT-T

Training - CRM

107	Airlines/operators should ensure that their CRM training/standardization program emphasizes the importance of the team concept. (107)	CRM-T
82	Airlines/operators should clearly define, train and check the specific PF/PNF duties. (82)	CRM-T
25	Airlines/operators should establish a CRM training program. (25)	CRM-T
23	Airlines/operators should ensure that regularly scheduled recurrent training (e.g., LOFT) emphasizes crew cooperation and working together to maximize safe operations. (23)	CRM-T
20	Airlines/operators should ensure that command oversight training for captains is provided during the upgrade process and in recurrent training. (20)	CRM-T
26	Airlines/operators should ensure that CRM training is provided prior to line flying. (26)	CRM-T

MSAW

71	Review the engineering standards for the sighting of future Terminal Radar Systems to ensure the maximum effectiveness of MSAW is available. (71)	MSAW
72	Install MSAW-like capabilities world-wide with emphasis on high-risk airports. (72)	MSAW

Surveillance Radar

121	Implement worldwide surveillance radar (example: ADS/B). (121)	Radar

DME

32	In the absence of GPS, regulatory agencies should install DME equipment at all appropriate airports.	DME

Pilot/ATC Communication Enhancement

41	Airlines/operators and air traffic service providers should train flight crews and controllers to ICAO standards to ensure fluency/proficiency in the use of the ICAO phraseology. Intl.(41)	Pilot/ATC
106	Train and monitor ATC adherence to established communications procedures. USA (106)	Pilot/ATC
106	Train and monitor ATC adherence to established communications procedures. Intl. (106)	Pilot/ATC
42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology. USA (42)	Pilot/ATC
42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology. Intl. (42)	Pilot/ATC
21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flight crews is occurring. USA (21)	Pilot/ATC
21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flight crews is occurring. Intl. (21)	Pilot/ATC
83	Develop additional ICAO phraseology for flight crew/air traffic service to address communication regarding aircraft position, equipment status, and communication which is not consistent with the situation or with expected responses. Intl. (83)	Pilot/ATC

40	Airlines/operators and air traffic service providers should ensure fluency/proficiency in the use of basic English language. USA (40)	Pilot/ATC
40	Airlines/operators and air traffic service providers should ensure fluency/proficiency in the use of basic English language. Intl. (40)	Pilot/ATC
88	Airlines/operators should train and monitor flight crew compliance with established communication phraseology guidelines. Intl. (88)	Pilot/ATC
83	Develop additional ICAO phraseology for flight crew/air traffic service to address communication regarding aircraft position, equipment status, and communication which is not consistent with the situation or with expected responses. USA (83)	Pilot/ATC
88	Airlines/operators should train and monitor flight crew compliance with established communication phraseology guidelines. USA (88)	Pilot/ATC
41	Airlines/operators and air traffic service providers should train flight crews and controllers to ICAO standards to ensure fluency/proficiency in the use of the ICAO phraseology. USA (41)	Pilot/ATC
93	Improve the real time radio communication of critical airport and weather information. Intl. (93)	Pilot/ATC
93	Improve the real time radio communication of critical airport and weather information. USA (93)	Pilot/ATC

Datalink Enhancement

58	Establish GPS datalink to relay aircraft position to ATC. USA (58)	Data
58	Establish GPS datalink to relay aircraft position to ATC. Intl. (58)	Data
122	Implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications. USA (122)	Data
122	Implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications. Intl. (122)	Data
28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft. Intl. (28)	Data
29	Implement transmission of ATC instructions (between the ground and aircraft) via a computer link that would allow downloading to the FMS. Intl. (29)	Data
28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft. USA (28)	Data
29	Implement transmission of ATC instructions (between the ground and aircraft) via a computer link that would allow downloading to the FMS. USA (29)	Data
94	Implement real time (digital) transmission of airport and weather information to the aircraft. USA (94)	Data
94	Implement real time (digital) transmission of airport and weather information to the aircraft. Intl. (94)	Data

Operational Procedures for CFIT Prevention

19	Airlines/operators should implement a procedure to climb to a minimum safe altitude when position uncertainty exists by at least one crew member. Flight crew must advise ATC of intentions. (19)	SOP-CFIT
61	Airlines/operators (and manufacturers in the airplane flight manual) should implement procedures that call for an immediate execution of the escape maneuver following a GPWS warning unless there is visual confirmation of terrain. (61)	SOP-CFIT
99	Airlines/operators should ensure that standard operating procedures are published and enforced. (99)	SOP-CFIT
95	Airlines/operators should establish procedures for flight crews to review/cross check instructions, clearances, etc., to ensure consistency with expected procedures or practices. (95)	SOP-CFIT

125	Airlines/operators should encourage flight crews to use precision approaches (glideslope guidance) when available and appropriate. (125)	SOP-CFIT
30	Airlines/operators should adopt the "delegated" approach to standard operating procedures (e.g., monitored approach procedures). (30)	SOP-CFIT
79	Airlines/operators should implement a reliable process to communicate information to the flight crew that may effect flight or aircraft operations. (79)	SOP-CFIT
120	Airlines/operators should ensure procedures do not increase pilot workload during critical phases of flight. (120)	SOP-CFIT
24	Airlines/operators should implement procedures to ensure appropriate crew pairing. (Reference FSF corporate crew scheduling and fatigue evaluation.) (24)	SOP-CFIT
91	Airlines/operators and regulatory agencies should standardize on usage of QNH altimeter settings. (91)	SOP-CFIT
36	Airlines/operators should establish and implement the use of electronic checklists or other aids to ensure completion of all checklist items. (36)	SOP-CFIT
78	Airlines/operators and regulatory agencies should improve the availability, clarity, and prioritization of NOTAM information. (78)	SOP-CFIT
90	Airlines/operators and regulatory agencies should prohibit engineering flight tests during revenue flights following maintenance of critical systems. (90)	SOP-CFIT

Policies for CFIT Prevention

123	Airlines/operators should implement a true no-fault go around policy (learning vs. blame). (123)	Pol-CFIT
22	Airlines/operators should encourage a culture that emphasizes safe arrivals over timely arrivals. (22)	Pol-CFIT
50	Airlines/operators and regulatory agencies should emphasize that only published route segments should be flown in non-radar environments. (50)	Pol-CFIT
48	Airlines/operators and regulatory agencies should strictly enforce flight/duty time limitations. (48)	Pol-CFIT
31	Airlines/operators should ensure that crew rest considerations (cabin crew and flight crew) are calculated and administered by dispatch/crew scheduling rather than burdening crews with these considerations. (31)	Pol-CFIT
101	Airlines/operators should establish a policy that supports the reporting of substance abuse. (101)	Pol-CFIT
2	Airlines/operators and regulatory agencies should strictly enforce the regulations pertaining to alcohol use/abuse and the use of prescription and non-prescription medication and encourage the reporting of such abuse. (2)	Pol-CFIT
80	Airlines/operators should ensure, and regulatory agencies should check, that operators who create their own AOM's include all procedures prescribed by original equipment manufacturers Airplane Flight Manual (AFM). (80)	Pol-CFIT
37	Regulatory agencies should discontinue on-time arrival tracking for airlines. (37)	Pol-CFIT
63	Airlines/operators should implement a culture that encourages flight crew voluntary removal from flight status due to illness. (63)	Pol-CFIT
70	Airlines/operators and regulatory agencies should strictly enforce the regulations pertaining to flight crew use of prescription and non-prescription medication. (70)	Pol-CFIT

Maintenance Procedures

66	Airlines/operators should implement procedures to avoid simultaneous maintenance on redundant flight critical systems. (66)	Main
46	Airlines/operators should implement procedures to increase flight crew awareness of recent aircraft maintenance actions. (46)	Main

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JSAT Effectiveness	Average Feasibility	Intervention#	Interventions Proposed by the CFIT JSAT	Project Identifier	Effectiveness X
2.20	3.00	59	Enable all FMS equipped aircraft to utilize LNAV/VNAV in stabilized (constant angle/constant rate) approach procedures.	PAI	6.6
2.20	3.00	59	Amend all non-precision approach plates to incorporate stabilized constant angle/constant rate approach procedures.	PAI	6.6
2.93	2.17	35	Manufacturers should install TAWS-EGPWS in all new aircraft, airlines/operators should retrofit TAWS-EGPWS into the existing fleet and international regulators should require the installation of TAWS-EGPWS. (United States)	TAWS	6.3
2.09	3.00	124	ATC should implement a Quality Assurance program to ensure adherence to established procedures. (124)	ATC CFIT-T	6.3
2.18	2.83	47	Airlines/operators should ensure that their training/standardization programs direct the flight crews to use all available tools (charts) to establish aircraft position. (47)	CFIT-T	6.2
1.98	3.00	71	Review the engineering standards for the sighting of future Terminal Radar Systems to ensure the maximum effectiveness of MSAW is available. (71)	MSAW	5.9
1.99	2.83	64	Airlines/operators should ensure that their training/standardization programs direct the flight crews to regularly cross check all instrumentation. (64)	CFIT-T	5.6
1.95	2.83	75	Airlines/operators should ensure that their training/standardization programs direct that flight crews use all available tools to establish aircraft position. (75)	CFIT-T	5.5
1.90	2.83	7	Airlines/operators should ensure that their training/standardization programs emphasize review of approach and missed approach procedures. (7)	A&MA-T	5.4
1.89	2.67	19	Airlines/operators should implement a procedure to climb to a minimum safe altitude when position uncertainty exists by at least one crew member. Flight crew must advise ATC of intentions. (19)	SOP-CFIT	5
1.73	2.83	96	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate approach preparation and contingency review prior to commencing an approach. (96)	A&MA-T	4.9
1.73	2.83	100	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adhering to MDA/DH. (100)	CFIT-T	4.9
1.73	2.83	107	Airlines/operators should ensure that their CRM training/standardization program emphasizes the importance of the team concept. (107)	CRM-T	4.9
1.67	2.83	110	Airlines/operators and regulatory agencies should ensure that their training/standardization and monitoring programs emphasize the importance of adherence to standard operating procedures and identify the rationale behind those procedures. (110)	CFIT-T	4.7
1.64	2.83	17	Airlines/operators should ensure that their training/standardization programs emphasize the importance of all flight related briefings. (17)	CFIT-T	4.6
1.63	2.83	82	Airlines/operators should clearly define, train and check the specific PF/PNF duties. (82)	CRM-T	4.6
2.22	2.00	58	Establish GPS datalink to relay aircraft position to ATC. USA (58)	Data	4.4
2.20	2.00	59	Implement precision approach capability (glideslope guidance) for all runways without established precision approach procedures (e.g., ILS, DGPS, etc.). (59)	PAI	4.4
1.65	2.67	25	Airlines/operators should establish a CRM training program. (25)	CRM-T	4.4
2.93	1.50	35	Manufacturers should install TAWS-EGPWS in all new aircraft, airlines/operators should retrofit TAWS-EGPWS into the existing fleet and international regulators should require the installation of TAWS-EGPWS. (International)	TAWS	4.4
1.50	2.83	23	Airlines/operators should ensure that regularly scheduled recurrent training (e.g., LOFT) emphasizes crew cooperation and working together to maximize safe operations. (23)	CRM-T	4.3
1.50	2.83	61	Airlines/operators (and manufacturers in the airplane flight manual) should implement procedures that call for an immediate execution of the escape maneuver following a GPWS warning unless there is visual confirmation of terrain. (61)	SOP-CFIT	4.3

1.81	2.33	56	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs to identify systemic procedural deviations. USA (56)	FOQA	4.2
1.46	2.83	41	Airlines/operators and air traffic service providers should train flight crews and controllers to ICAO standards to ensure fluency/proficiency in the use of the ICAO phraseology. Intl.(41)	Pilot/ATC	4.1
1.51	2.67	99	Airlines/operators should ensure that standard operating procedures are published and enforced. (99)	SOP-CFIT	4
1.39	2.83	106	Train and monitor ATC adherence to established communications procedures. USA (106)	Pilot/ATC	3.9
1.39	2.83	106	Train and monitor ATC adherence to established communications procedures. Intl. (106)	Pilot/ATC	3.9
1.45	2.67	42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology. USA (42)	Pilot/ATC	3.9
1.45	2.67	42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology. Intl. (42)	Pilot/ATC	3.9
1.33	2.83	89	Airlines/operators and regulatory agencies should ensure that the frequency and effectiveness of proficiency checks for non-precision approaches are adequate. (89)	A&MA-T	3.8
1.61	2.33	54	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs. USA (54)	FOQA	3.8
1.32	2.83	21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flight crews is occurring. USA (21)	Pilot/ATC	3.7
1.40	2.67	95	Airlines/operators should establish procedures for flight crews to review/cross check instructions, clearances, etc., to ensure consistency with expected procedures or practices. (95)	SOP-CFIT	3.7
1.38	2.67	111	Airlines/operators should ensure that their training/standardization programs emphasize basic airmanship skills and knowledge during initial and recurrent training. (111)	CFIT-T	3.7
1.33	2.67	115	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of rushed approaches. (115)	A&MA-T	3.5
1.32	2.67	21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flight crews is occurring. Intl. (21)	Pilot/ATC	3.5
2.33	1.50	72	Install MSAW-like capabilities world-wide with emphasis on high-risk airports. (72)	MSAW	3.5
1.18	2.83	20	Airlines/operators should ensure that command oversight training for captains is provided during the upgrade process and in recurrent training. (20)	CRM-T	3.3
2.22	1.50	85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in new production aircraft. (85)	Syn	3.3
2.22	1.50	58	Establish GPS datalink to relay aircraft position to ATC. Intl. (58)	Data	3.3
1.33	2.50	83	Develop additional ICAO phraseology for flight crew/air traffic service to address communication regarding aircraft position, equipment status, and communication which is not consistent with the situation or with expected responses. Intl. (83)	Pilot/ATC	3.3
1.20	2.67	123	Airlines/operators should implement a true no-fault go around policy (learning vs. blame). (123)	Pol-CFIT	3.2
1.20	2.67	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Paper Charts USA (5)	Chart	3.2
1.19	2.67	12	Air Traffic service providers should emphasize in ATC training the controllers' potential in assisting the flight crew in improving their situation awareness. (12)	ATC CFIT-T	3.2
1.41	2.17	122	Implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications. USA (122)	Data	3.1
1.39	2.17	77	Eliminate non-precision approaches where possible. (77)	PAI	3
1.06	2.83	22	Airlines/operators should encourage a culture that emphasizes safe arrivals over timely arrivals. (22)	Pol-CFIT	3
1.20	2.50	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Electronic Charts USA(5)	Chart	3
1.20	2.50	8	Standardized information included and contained on approach plates. Paper charts, USA	Chart	3
2.22	1.33	85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in existing glass aircraft. (85)	Syn	3

2.22	1.33	85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in non-glass aircraft. (85)	Syn	3
1.26	2.33	55	Airlines/operators should implement a Flight Operations Quality Assurance (FOQA) program to identify flight crew failure to respond to GPWS warnings. USA (55)	FOQA	2.9
1.08	2.67	40	Airlines/operators and air traffic service providers should ensure fluency/proficiency in the use of basic English language. USA (40)	Pilot/ATC	2.9
1.08	2.67	40	Airlines/operators and air traffic service providers should ensure fluency/proficiency in the use of basic English language. Intl. (40)	Pilot/ATC	2.9
0.99	2.83	1	Airlines/operators should implement an Airline Safety Incident Reporting System (e.g., BASIS, ASAP). (1)	Other	2.8
1.02	2.67	88	Airlines/operators should train and monitor flight crew compliance with established communication phraseology guidelines. Intl. (88)	Pilot/ATC	2.7
0.95	2.83	126	ATC should prioritize the use of precision approaches (glideslope guidance) when available and appropriate. (126)	ATC CFIT-T	2.7
1.00	2.67	10	Air Traffic service providers should train Air Traffic Controllers to use all available tools to establish aircraft position (example: don't fixate on just DME). (10)	ATC CFIT-T	2.7
0.92	2.83	125	Airlines/operators should encourage flight crews to use precision approaches (glideslope guidance) when available and appropriate. (125)	SOP-CFIT	2.6
1.20	2.17	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Paper Charts International (5)	Chart	2.6
1.20	2.17	8	Standardized information included and contained on approach plates. Paper charts, Intl.	Chart	2.6
1.20	2.17	8	Standardized information included and contained on approach plates. Electronic charts, USA.	Chart	2.6
1.03	2.50	50	Airlines/operators and regulatory agencies should emphasize that only published route segments should be flown in non-radar environments. (50)	Pol-CFIT	2.6
1.20	2.00	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Electronic Charts International (5)	Chart	2.4
1.20	2.00	8	Standardized information included and contained on approach plates. Electronic charts, Intl.	Chart	2.4
0.90	2.67	112	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for simulated instrument failures (partial panel) are adequate. (112)	CFIT-T	2.4
0.84	2.83	113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning. (113)	CFIT-T	2.4
0.86	2.67	13	Air Traffic service providers should enhance ATC training to emphasize the dangers of rushed approaches and performance characteristics of modern jet transports. (13)	ATC CFIT-T	2.3
0.85	2.67	105	Airlines/operators should train flight crews on how flight delays (weather, maintenance, ATC, etc.) can effect their subsequent decision making relative to the safe conduct of the flight. (105)	CFIT-T	2.3
0.79	2.83	57	Airlines/operators, regulatory agencies, and manufacturers should implement a program designed for sharing of safety related information within the aviation community. (57)	Other	2.2
1.33	1.67	83	Develop additional ICAO phraseology for flight crew/air traffic service to address communication regarding aircraft position, equipment status, and communication which is not consistent with the situation or with expected responses. USA (83)	Pilot/ATC	2.2
0.78	2.83	67	Airlines/operators should require flight crews to perform non-FMS (raw data) approaches during proficiency/recurrent check rides. (67)	CFIT-T	2.2
1.41	1.50	122	Implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications. Intl. (122)	Data	2.1
1.02	2.00	88	Airlines/operators should train and monitor flight crew compliance with established communication phraseology guidelines. USA (88)	Pilot/ATC	2
0.81	2.50	26	Airlines/operators should ensure that CRM training is provided prior to line flying. (26)	CRM-T	2
0.93	2.17	6	Standardized depiction of the information on all approach plates by the publishers. Paper Charts, USA (6)	Chart	2
0.93	2.17	6	Standardized depiction of the information on all approach plates by the publishers. Electronic Charts, USA (6)	Chart	2
1.46	1.33	41	Airlines/operators and air traffic service providers should train flight crews and controllers to ICAO standards to ensure fluency/proficiency in the use of the ICAO phraseology. USA (41)	Pilot/ATC	1.9

0.68	2.83	116	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of high rate of descent and unstable approaches. (116)	A&MA-T	1.9
0.66	2.83	62	Airlines/operators should ensure that their training/standardization programs establish flight crew proficiency in all uses of the HSI display. (62)	CFIT-T	1.9
0.66	2.83	30	Airlines/operators should adopt the "delegated" approach to standard operating procedures (e.g., monitored approach procedures). (30)	SOP-CFIT	1.9
0.93	2.00	6	Standardized depiction of the information on all approach plates by the publishers. Paper Charts, Intl (6)	Chart	1.9
0.93	2.00	6	Standardized depiction of the information on all approach plates by the publishers. Electronic Charts, Intl (6)	Chart	1.9
0.69	2.67	15	Airlines/operators should ensure that their training/standardization programs instruct when to disengage automated systems and fly manually. (15)	CFIT-T	1.8
0.89	2.00	79	Airlines/operators should implement a reliable process to communicate information to the flight crew that may effect flight or aircraft operations. (79)	SOP-CFIT	1.8
1.17	1.50	121	Implement worldwide surveillance radar (example: ADS/B). (121)	Radar	1.8
0.61	2.83	53	Airlines/operators should install FMS equipment (logic) which has the capability to depict previously entered waypoints that are between the current present position and the current "to" way point. (53)	FMS	1.7
0.60	2.83	52	Airlines/operators should ensure that their training/standardization programs establish flight crew proficiency in the use of the FMS system. (52)	CFIT-T	1.7
0.53	3.00	93	Improve the real time radio communication of critical airport and weather information. Intl. (93)	Pilot/ATC	1.6
0.55	2.83	114	Airlines/operators should ensure that their training/standardization programs provide an appropriate minimum amount of standard training. (114)	CFIT-T	1.6
0.58	2.67	120	Airlines/operators should ensure procedures do not increase pilot workload during critical phases of flight. (120)	SOP-CFIT	1.5
0.53	2.67	117	Airlines/operators should ensure that their training/standardization programs instruct that ground proximity escape maneuvers are to be conducted with the aircraft properly configured (e.g., speedbrakes retracted). (117)	CFIT-T	1.4
0.53	2.67	93	Improve the real time radio communication of critical airport and weather information. USA (93)	Pilot/ATC	1.4
0.56	2.50	24	Airlines/operators should implement procedures to ensure appropriate crew pairing. (Reference FSF corporate crew scheduling and fatigue evaluation.) (24)	SOP-CFIT	1.4
0.93	1.50	28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft. Intl. (28)	Data	1.4
0.61	2.17	16	Manufacturers should ensure that automated systems provide the flight crew with sufficient information (automation feedback) to prevent mode confusion. (16)	FDEU	1.3
0.48	2.67	4	Ensure FMS depiction is consistent with approach plate presentation. (4)	FDEU	1.3
0.73	1.67	14	Install aural warning devices on aircraft to alert flight crew of arrival at MDA/DH. (14)	FDEU	1.2
0.52	2.33	45	Manufacturers should ensure that all equipment failures that may affect the safe operation of the flight are properly enunciated to the flight crew. (45)	FDEU	1.2
0.42	2.83	27	Airlines/operators should implement maintenance procedures to ensure proper functioning of the CVR at all times. (Note: This intervention was recorded as a potential intervention for future accidents; it would not have prevented the subject accidents.)	HUMS	1.2
0.42	2.83	48	Airlines/operators and regulatory agencies should strictly enforce flight/duty time limitations. (48)	Pol-CFIT	1.2
0.87	1.33	29	Implement transmission of ATC instructions (between the ground and aircraft) via a computer link that would allow downloading to the FMS. Intl. (29)	Data	1.2
0.40	2.83	108	Air Traffic service providers should implement and/or review procedures to ensure ATC training does not create a hazard to flight operations. (108)	ATC CFIT-T	1.1
0.39	2.83	31	Airlines/operators should ensure that crew rest considerations (cabin crew and flight crew) are calculated and administered by dispatch/crew scheduling rather than burdening crews with these considerations. (31)	Pol-CFIT	1.1
0.60	1.83	32	In the absence of GPS, regulatory agencies should install DME equipment at all appropriate airports. (32)	PAI	1.1

0.73	1.50	3	Ensure that failure of the aircraft system to capture glideslope (or VNAV) is adequately enunciated to the flight crew. Visual (3)	FDEU	1.1
0.93	1.17	28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft. USA (28)	Data	1.1
0.40	2.67	101	Airlines/operators should establish a policy that supports the reporting of substance abuse. (101)	Pol-CFIT	1.1
0.87	1.17	29	Implement transmission of ATC instructions (between the ground and aircraft) via a computer link that would allow downloading to the FMS. USA (29)	Data	1
0.37	2.67	91	Airlines/operators and regulatory agencies should standardize on usage of QNH altimeter settings. (91)	SOP-CFIT	1
0.33	2.83	2	Airlines/operators and regulatory agencies should strictly enforce the regulations pertaining to alcohol use/abuse and the use of prescription and non-prescription medication and encourage the reporting of such abuse. (2)	Pol-CFIT	0.9
0.56	1.67	60	Avionics manufacturers should improve GPWS capability to reduce GPWS false warnings. (60)	TAWS	0.9
0.70	1.33	3	Ensure that failure of the aircraft system to capture glideslope (or VNAV) is adequately enunciated to the flight crew. Aural (3)	FDEU	0.9
0.39	2.33	80	Airlines/operators should ensure, and regulatory agencies should check, that operators who create their own AOM's include all procedures prescribed by original equipment manufacturers Airplane Flight Manual (AFM). (80)	Pol-CFIT	0.9
0.42	2.17	36	Airlines/operators should establish and implement the use of electronic checklists or other aids to ensure completion of all checklist items. (36)	SOP-CFIT	0.9
0.35	2.50	78	Airlines/operators and regulatory agencies should improve the availability, clarity, and prioritization of NOTAM information. (78)	SOP-CFIT	0.9
0.51	1.67	127	Airlines/operators should install FMS equipment (logic) which has the capability to depict previously entered waypoints behind the aircraft's flight path. (127)	FMS	0.9
0.28	3.00	51	Airlines/operators should ensure the currency of the FMS database and update as appropriate. (51)	FMS	0.8
0.53	1.50	94	Implement real time (digital) transmission of airport and weather information to the aircraft. USA (94)	Data	0.8
0.34	2.33	37	Regulatory agencies should discontinue on-time arrival tracking for airlines. (37)	Pol-CFIT	0.8
0.28	2.67	90	Airlines/operators and regulatory agencies should prohibit engineering flight tests during revenue flights following maintenance of critical systems. (90)	SOP-CFIT	0.7
0.28	2.67	66	Airlines/operators should implement procedures to avoid simultaneous maintenance on redundant flight critical systems. (66)	Main	0.7
0.31	2.33	73	Airlines/operators should ensure that the aircraft is equipped with all expected NAVAID frequencies. International (73)	FMS	0.7
0.31	2.33	74	Regulatory agencies should review and where appropriate eliminate duplicate NAVAID identifiers within the same geographic area. (74)	Chart	0.7
0.53	1.33	94	Implement real time (digital) transmission of airport and weather information to the aircraft. Intl. (94)	Data	0.7
0.49	1.33	103	Manufacturers should develop and implement system failure annunciation capabilities to alert flight crews of pending failures (e.g., HUMS). (103)	HUMS	0.7
0.48	1.33	49	Regulatory agencies should establish criteria for, and manufacturers should evaluate and improve, the reliability and failure tolerance of flight systems. (49)	HUMS	0.6
0.19	2.83	11	Air Traffic service providers should implement procedures that ensure that ATC trainees are always supervised. (11)	ATC CFIT-T	0.5
0.19	2.83	63	Airlines/operators should implement a culture that encourages flight crew voluntary removal from flight status due to illness. (63)	Pol-CFIT	0.5
0.18	2.83	68	Manufacturers should implement a system to identify the recommended implementation schedule and priority of aircraft and operational changes. (68)	HUMS	0.5
0.19	2.67	46	Airlines/operators should implement procedures to increase flight crew awareness of recent aircraft maintenance actions. (46)	Main	0.5
0.26	1.83	98	Airlines/operators and regulatory agencies should review procedures to ensure that design changes (service bulletins) to flight critical systems are incorporated in a timely manner. (98)	HUMS	0.5

0.15	2.83	70	Airlines/operators and regulatory agencies should strictly enforce the regulations pertaining to flight crew use of prescription and non-prescription medication. (70)	Pol-CFIT	0.4
0.00	1.67	76	The manufacturer of the FMS should ensure that the FMS logic displays NAVAIDís with the same identifier in a progressive distance manner. (76)	FDEU	0

Terrain Awareness & Warning System (TAWS)

SOW: Rulemaking, in time, (max. 4 years) will require manufactures and operators to have TAWS equipment installed on the entire U.S. fleet of part 121 air carrier aircraft. TAWS and CFIT training are the most significant tools in eliminating CFIT accidents, world wide. Although the rulemaking process is underway, it must not be subject to delays.

OPTIONS: Rulemaking will mandate requirements for all U.S. Part 121 carriers world wide. International concerns will be sent to ICAO, JSSI, and other international entities for consideration.

STAKEHOLDERS: Regulatory agencies (FAA, ICAO, JAA)

POTENTIAL IMPACT: None to U. S. carriers, final rule to be issued in January, 2000. World wide adoption will meet resistance without help from ICAO or other international entities.

CURRENT STATUS: Awaiting adoption of final rule. Addressing international issues will be the next step.

PROJECT PLANNING LEADERS: Jerry Tegen, ACE-203

DETAILED PLAN BY: May 21, 1999

ATC CFIT Training

SOW: Training procedures are presently in effect, re-emphasis to current procedures and or slight modifications to current procedures could be acted upon almost immediately.

OPTIONS:

STAKEHOLDERS: ATC and ATC providers.

POTENTIAL IMPACT: Will be a tremendous additional tool in the elimination of CFIT accidents.

CURRENT STATUS: Most procedures presently in effect, re-emphasis will be required.

PROJECT PLANNING LEADERS: Ardy Williams, ATO-110

DETAILED PLAN BY: May 21, 1999

Precision-Like Approach Implementation (PAI)

SOW: Establish procedures for the use of LNAV/VNAV for FMS equipped aircraft and constant rate decent tables for non-FMS equipped aircraft allowing precision like approaches to all airports not equipped with electronic glide slope guidance.

OPTIONS: Install ILS equipment at all runways utilized by air carriers or move toward precision-like approaches for runways utilized by air carriers.

STAKEHOLDERS: Manufacturers, operators, chart publishers, regulatory agencies, ATA, and RAA

POTENTIAL IMPACT: The assurance of stabilized, constant angle, constant rate capability at all air carrier airports would assist in the prevention of CFIT accidents.

CURRENT STATUS: A few operators are presently using procedures.

PROJECT PLANNING LEADERS: Rob Wayne, Delta Airlines

DETAILED PLAN BY: May 21, 1999

Training - CFIT Prevention

SOW: Develop and implement CFIT training modules to be added to approved air carrier training curriculums stressing position awareness and escape maneuvers in the event of a warning indication. Presently this project assumes compliance by air carriers through policy guidance to Principal Operations Inspectors in the form of Handbook Bulletins.

OPTIONS: If unsuccessful with policy approach, rulemaking must be initiated similar to the wind shear requirements.

STAKEHOLDERS: Operators, employee associations, regulatory agencies.

POTENTIAL IMPACT: Minimal to operators, will reduce CFIT accidents.

CURRENT STATUS: Prototype CFIT training is available in a CFIT Education and Training Aid prepared by the Flight Safety Foundation and distributed to air carriers and ICAO. Many carriers train in CFIT, exact numbers world wide is unknown at this time. Training Aid will also be put on Internet.

PROJECT PLANNING LEADER: Jerry Tegen, ACE-203

DETAILED PLAN BY: May 21, 1999

Training - Crew Resource Management (CRM)

SOW: CRM training, standard operating procedures, situation awareness and CFIT prevention are closely linked. Work must accomplish the following:

(1) Develop and implement a model for training in SOP's

(2) Expand CRM training in the U.S. apart from part 121 air carriers, and

(3) Emphasize in all CRM training the crucial importance of adhering to SOP's and maintaining situation awareness to prevent CFIT accidents.

(4) Pass on recommendations to ICAO, JSSI, and other international entities.

OPTIONS: There are no effective options

STAKEHOLDERS: Operators, trade associations, pilot associations, regulators

POTENTIAL IMPACT: The impact will be evolutionary, not revolutionary, since culture changes are involved. But the impact will be cumulative and will be considerable over time, with a big payoff in approach and landing accidents.

CURRENT STATUS: CRM training is already required of all part 121 certificate holders, affecting pilots, flight attendants, and aircraft dispatchers. SOP's, S/A, and ground proximity escape are specifically named in FAA guidance material. CFIT training and the specific ground proximity escape maneuver recommended by the aircraft manufacturer are included in sweeping rule changes proposed in part 121. NPRM expected some time in CY 2000.

PROJECT PLANNING LEADERS: Hop Potter, AFS-200,
John Long, ALPA

DETAILED PLAN BY: May 21, 1999

Standard Operating Procedures - CFIT Prevention

SOW: All operators should have standard operating procedures/training manual/ chapter. This manual/chapter should address all projected normal situations crews/company personnel will encounter. This manual will address: use of checklists, individual's responsibilities, use of available equipment, and expected procedures to be used during preflight, taxi, take-off, climb, cruise, descent, approach, missed approach, landing, taxi and parking. Use of line crews to develop new procedures increase acceptance and understanding of these procedures. Standard operating procedures for any new equipment will be developed, published, and trained before any new equipment is used/installed. Operators will train proficiency in their SOP's and crews will use published company SOP's.

OPTIONS: Create Template SOP's and a possible Advisory Circular as end products.

STAKEHOLDERS: Operators, Unions & Regulators.

POTENTIAL IMPACT: Large potential safety benefit, this was the largest problem group in the JSAT CFIT report "Flight Crew Failure to Follow Procedures." Note, FSF Final report, "Approach and Landing" identifies omission/inappropriate SOP's as the second highest causal factor.

CURRENT STATUS: Collecting examples of Best Business Practices SOP's from ICAO, FSF, etc.

PROJECT PLANNING LEADERS: John Long, ALPA

DETAILED PLAN BY: May 21, 1999

Minimum Safe Altitude Warning (MSAW)

SOW: In an attempt to preclude future CFIT accidents, design an implementation plan to ensure that ground - based radars, their by products (surveillance, MSAW, etc..) are adequate and provide altitude protection in all phases of flight in and around all US controlled radar facilities. Also, ensure that controller training and guidance in the use of MSAW is adequate, current and uniformly conducted.

OPTIONS: Install MSAW-Like Capabilities World-Wide with Emphasis on High-Risk Airports.
Review and Ensure that US Coverage is Adequate.
Review the Engineering Standards for the Sighting of Future Terminal Radar Systems.
Establish policy and procedures for the use of MSAW.

STAKEHOLDERS: ICAO, ECAC, AOS, ATC, AVN

POTENTIAL IMPACT: More Extensive Radar / MSAW Coverage to Provide Increased Radar Coverage In & Around High-Risk Areas and High-Risk Airports.

CURRENT STATUS: All MSAW Polygons Have Been Flight-Checked in the US. MSAW is Part of ATC Radar. Radar Coverage in US is 87% for altitudes > 6000'. Radar Coverage in US is 57% for Altitudes < 6000' to Ground Level. MSAW is Effective Wherever Radar Exists. MSAW is 100% Operational at All FAA Radar Facilities With MSAW.

Currently Unsure of International Coverage and Ease of Implementing Statement Of Work.

PROJECT PLANNING LEADERS: Joe Bracken, ALPA

DETAILED PLAN BY: May 21, 1999

Airline Proactive Safety Programs (FOQA/ASAP)

SOW: Develop and implement a mutually agreed upon methodology to use de-identified FOQA and ASAP information for the purpose of proactively identifying safety related issues and corrective actions. This project assumes that legislative, regulatory and contractual actions have occurred which put protective provisions in place to prevent misuse of information. Included in this development and implementation of proactive safety programs are the development of analytical tools which will enable the identification of system safety deficiencies and corrective actions.

OPTIONS: Safety Partnership Programs (ASAP), FOQA Programs

STAKEHOLDERS: Operators, employee associations, regulatory agencies

POTENTIAL IMPACT: Identification of system safety deficiencies and corrective actions prior to accident occurrence

CURRENT STATUS: Trial programs underway at a number of US airlines. Work underway to draft acceptable rulemaking for data protection and advisory material for FOQA and ASAP program implementation.

PROJECT PLANNING LEADERS: Keith Hagy, ALPA

DETAILED PLAN BY: May 21, 1999

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

Terrain Avoidance Warning System (TAWS)

Executive Summary

The purpose of this project is to substantially reduce or eliminate the CFIT accident rate through improving pilot situation awareness with respect to terrain avoidance by establishing appropriate procedures for the installation, and use of TAWS by all Part 121 air carriers. Procedures must include proper flight crew reaction in regard to TAWS aural and visual warnings.

OUTPUT 1:

- FAA (AIR-100) will draft a rule to require TAWS in all Part 121 aircraft.

Resources: FAA (ARM, AIR, AFS, AGC, APO), Associations, Manufacturers
Timeline: Final Rule expected 1st Quarter 2000

OUTPUT 2:

- FAA (AIR-130) will draft and publish a TAWS TSO.

Resources: FAA (ARM, AIR, AFS, AGC, APO), Associations, Manufacturers
Timeline: Final TSO expected 4th Quarter 1999.

OUTPUT 3:

- A manufacturing standard practice of installing TAWS equipment in all newly manufactured aircraft used under FAR Part 121.

Resources: Manufacturers, FAA (AIR, AFS)
Timeline: 1st Quarter 2001
Actions: Manufacturers will apply for TC's and get approval by FAA (AIR)

OUTPUT 4:

- A completed retrofit program including certification and installation of TAWS equipment in existing aircraft.

Resources: Operators (ATA, RAA, NACA, CAA member airlines, and others), Manufacturers, FAA (AIR)
Timeline: 1st Quarter 2005
Actions: Operators and Manufacturers apply for STC's/amended TC's and receive approval by FAA (AIR).

OUTPUT 5:

- Organizations will develop a comprehensive system to support TAWS including installation, maintenance, training and use of TAWS equipment in FAR Part 121 air carrier operations.

Resources: FAA (AIR, AFS) Manufacturers, Operators, Associations

Timeline: As depicted

Actions: System to support TAWS

- Certification of EGPWS — 4th Quarter 1997
- STC's granted — As Required
- No FAA field approvals (AFS-300 Policy Letter) — 2nd Quarter 1999
- Operating guidance issued
  - AFM requirements
    - Newly Mfg. Aircraft. — 1st Quarter 2001
    - Existing Aircraft — 1st Quarter 2005
  - Advisory Circular AFS-200 — 1st Quarter 2002
  - Handbook Bulletin AFS-200 — 1st Quarter 2002
- Maintenance guidance issued
  - Advisory Circular Part 25 ANM-100 — 1st Quarter 2001
  - Advisory Circular Part 23 ACE-100 — 1st Quarter 2004

OUTPUT 6:

- FAA (AIR-130/ANM-100) will develop metrics and reporting methodology for validation of TAWS project effectiveness .

Resources: FAA (AIR, ANM), Associations, Airlines

Timeline: 3rd Quarter 1999

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

ATC Controlled Flight Into Terrain (CFIT) Training

Executive Summary

The purpose of this project is to improve aviation safety and reduce CFIT accidents by reinforcing current ATC safety alert procedures and good Air Traffic operating practices.

OUTPUT 1:

- ATC will draft and publish an Air Traffic Bulletin (ATB) re-emphasizing current safety alert procedures

Resources: FAA (ATO-100)
Timeline: December 31, 1999
Actions: The ATB will require specific handbook paragraphs to review and a verbal briefing on the history of the Commercial Aviation Safety Team (CAST) for both initial and recurrent training for all enroute and terminal Air Traffic Controllers.

OUTPUT 2:

- Conduct the training specified in the published ATB

Resources: FAA (ATC)
Timeline: February 29, 2000
Actions: Complete the specified training to all enroute and terminal Air Traffic Controllers.

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

Precision-Like Approach Implementation
21 st Century Instrument Approaches

Executive Summary

The purpose of this project is to greatly reduce the possibility of Controlled Flight Into Terrain and Approach and Landing Accidents by providing a means for all instrument approaches to be flown in a similar manner --essentially a stabilized vertical path to the runway end.

- Restructuring of the way we fly, train, check and certify pilots regarding instrument approach procedures.

- Flying all approaches with the same basic profile—a stabilized constant 3D path in the final segment.

NAVIGATION PERFORMANCE:
The operational capabilities of the worldwide fleet may be represented as a continuum but, for the purpose of this project, the airplanes have been categorized as "Classic", "Standard" and "Advanced".

Classic airplanes - airplanes typically equipped with electromechanical flight instruments, basic navigation capability (i.e., VOR, DME, ADF and possibly first generation Inertial Navigation System (INS)). B-727, B-737-200, DC-9. Constant Angle Rate Descent

Standard airplanes - airplanes with multi-sensor RNAV Flight Management Systems (FMS), Electronic Flight Instruments and Electronic Map Displays (the majority of airplanes produced during the past fifteen years). B-757, A-320, B-747-200. 3D Approach- VNAV – RNAV

Advanced airplanes - similar to the Standard airplanes but with advanced navigation capabilities (e.g., GPS augmentation and RNP) and possibly enhanced situation awareness systems such as Terrain Awareness Warning System [a.k.a., E-GPWS]. B-777, A-330, B-737-800. RNP/RNAV

- Using the full capabilities of the equipment installed on our fleet.
  - Classics (B-737-200, B-727, DC-9) Constant angle approach, Charts changed to accommodate this. British Airways has been doing this for 30 years. It works great. All of our fleet can/should start with this method NOW.

  - Standard (MD-80, B-757/767) VNAV usage along with underlying navaid, (LOC, VOR, NDB).

  - Advanced (B-737-800, B-777, A-330) RNP/RNAV approaches. Stand alone RNAV. Optimum geometry-- and capacity enhancements as a side benefit.

- Simplification of training requirements. FAR's re-write will accommodate use of these procedures in-lieu of Sub Parts N & O with Part 121 carriers. (Hopefully, one ILS and one OTHER approach required.)

Although all aircraft can use the procedures outlined in the "Classic" fleet with no significant changes immediately, (constant vertical angles), this plan encourages the additional operational and safety enhancements that are available in the "Standard" and "Advanced" fleets. The underlying strategy is to use the capabilities that are already available in the airplane to the greatest extent while creating operational benefits to encourage equipage with more capable functionality. All strategies need to be promulgated internationally if the full safety benefits are to be realized. This plan is built with a human factors perspective of "what the pilot sees" (display, depiction) and "what the pilot does" (procedures, training).

These two Outputs oversimplify a complex task that will challenge all stakeholders involved. The underlying benefit to the Safer Skies goal is the greatest of the projects approved in this endeavor.

Output 1: Put the structure (policy and infrastructure) in place to promote instrument approaches with a stabilized vertical path to all runway ends.
Resources: FAA, Industry, Employee Groups
Timeline: 3 to 7 years
Actions: Update FAR Parts 1,61,91,and 121. Charting modifications and revisions. Guidelines established and defined for certification, training, qualifications and evaluations. Airports improved with lighting and distant measuring equipment (DME). See DIP Outputs 1, 2, 3, 5, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24, 25, 26, 27, 28, 29, and 30

Output 2: Educate and train operators and regulators in 21st Century Instrument Approaches.
Resources: FAA, Industry, Employee Groups
Timeline: 1 to 3 years
Actions: Educate and train flight crews, ATC operators, and FAA evaluators, of operational and safety benefits derived. See DIP Outputs 4, 6, 11, 21, and 22

Controlled Flight into Terrain
Joint Safety Implementation Team

Implementation Plan
For

Training - CFIT Prevention

Executive Summary

The purpose of this project is to substantially reduce the CFIT accident rate by insuring the inclusion of CFIT prevention training and procedures to all Part 121 air carriers approved training curriculums, emphasizing pilot situational awareness and escape procedures for flight crews to use in the event of a terrain warning indication.

Output 1:

- Principal Operations Inspectors (POI's) will conduct a review of their assigned Part 121 air carriers to ascertain which of the carriers do not have substantive CFIT prevention training and procedures within their approved Part 121 training program.

Resources: FAA (AFS-1, AFS-200, POI's) and ATA.

Timeline: 60 days.

Actions: Through Regional Flight Standards Division Managers, AFS-1 and AFS-200 will request POI's to conduct a review of their assigned air carriers and identify those carriers that do not provide CFIT prevention training and procedures in their approved Part 121 training programs.

Output 2:

- Issue a Handbook Bulletin strongly recommending substantive CFIT prevention training and procedures in all Part 121 air carrier training programs along with guidance to POI's for training program contents.

Resources: FAA (AFS-1, AFS-200, POI's) and Air Carriers..

Timeline: 90 days.

Actions: AFS-200 will draft and issue a Handbook Bulletin, training programs should be revised, if needed, by respective air carriers and submitted to their assigned POI for approval.

Output 3:

- Issue a copy of the CFIT Education and Training Aid to each POI whose assigned air carrier does not incorporate CFIT prevention training and procedures in their approved training program.

Resources: FAA (AFS-1, AFS-200, AFS-500, POI's).

Timeline: 120 days after POI review.

Actions: POI's will present the copy of the CFIT Education and Training Aid to their assigned air carrier requesting a revision to the carriers approved training program incorporating CFIT prevention training and procedures.

Output 4:

- Post the CFIT Education and Training Aid on the World Wide Web.

Resources: FAA (AFS)

Timeline: Completed.

Actions: AFS-20 posted the training aid on the " Web" in April of 1999.

Output 5:

- All Part 121 Air Carriers and Part 142 training centers will incorporate the CFIT Education and Training aid or similar training to their approved training program.

Resources: FAA (POI's), Air Carriers and Training Centers.

Timeline: 120 days after receiving the training aid.

Action: All Part 121 Air Carriers and Part 142 training centers submit a revised training program to their POI incorporating CFIT prevention training and procedures.

Controlled Flight into Terrain
Joint Safety Implementation Team

Implementation Plan
For

Training - CRM

Executive Summary

The purpose of this project is to substantially reduce CFIT accidents by emphasizing flight crewmembers' situation awareness and crew coordination in CRM training provided by part 121 air carriers.

Output 1:

Promote CFIT prevention in the CRM training programs of all Part 121 air carriers.

Resources: FAA (AFS-1, AFS-200, POI's), air carriers, ATA, RAA, ALPA, and other industry.
Timeline: 4th Quarter 2000.
Actions: The SOP template and AC (currently under development) will contain CFIT prevention procedures.

Output 2:

Emphasize the importance of SOP's, and recommend the SOP template and the SOP AC in planned revisions of AC 120-51C, Crew Resource Management Training.

Resources: FAA (AFS-1, AFS-200)
Timeline: 4th Quarter 2000.
Actions: When developed, AFS-200 will reference the SOP template and AC in the CRM AC, AC 120-51C.

OUTPUT 3:

All part 121 Air Carriers will have CFIT training incorporated in their approved CRM training programs.

Resources: FAA (POI) and Air Carriers.
Timeline: 4th Quarter 2000
Actions: All part 121 Air Carriers submit revised CRM training programs to POI's for approval.

Controlled Flight Into Terrain (CFIT)
Joint Safety Implementation Team

Implementation Plan
For

"Standard Operating Procedures (SOP) – CFIT Prevention"

Executive Summary

The purpose of this project is to improve aviation safety by recommending that all FAR Part 121 operators establish, document, train and follow Standard Operating Procedures according to a jointly developed template.

OUTPUT 1:

- ATA Training committee will facilitate, in conjunction with air carrier and association training committees, development of SOP Templates for use by all FAR Part 121 operators in generating SOP's for each particular airline.

Resources: ATA, Manufacturers, Operators, and member associations
Timeline: 3rd Quarter 1999

OUTPUT 2:

- FAA will write an Advisory Circular (AC) to publish the template for use in establishing each operator's SOP.

Resources: FAA (AFS-200), ATA, Operators, and member associations
Timeline: 2nd Quarter 2000

OUTPUT 3:

- FAA will write a Handbook Bulletin for Air Transportation (HBAT) to provide guidance to the FAA Principal Inspectors on incorporating the Advisory Circular SOP template into the Operator's training and operations manuals.

Resources: FAA (AFS-200), ATA, Operators and member associations
Timeline: 2nd Quarter 2000

OUTPUT 4:

- Air carriers should adopt SOP's and revise training programs/manuals to incorporate proposed template items as appropriate for the equipment in the aircraft.

Resources: ATA, Manufacturers, Operators and member associations
Timeline: 3rd Quarter 2000

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

Minimum Safe Altitude Warning (MSAW)

Executive Summary

The purpose of this project is to preclude future CFIT accidents by ensuring that ground based radars and their by-products (surveillance, MSAW, etc) are adequate and provide altitude protection in all phases of flight and in and around as many US controlled airports as practicable including all domestically identified "high risk/special airports". Also to ensure that Controller training and guidance is adequate, current and uniformly conducted.

Output 1:

- Compare new and old NOAA Digital Terrain Maps (DTM) and flight-check each terminal MSAW facility

Resources: FAA (AOS, AVN)
Timeline: April 30, 1999
Actions: After validation and initial flight check, re-check each MSAW facility every 540 days to maintain accuracy

OUTPUT 2:

- **ATC will draft and publish an Air Traffic Bulletin (ATB) re-emphasizing**

Current safety alert procedures
Resources: FAA (ATO-100)
Timeline: December 31, 1999
Actions: The ATB will require specific handbook paragraphs to review and a verbal briefing on the history of the Commercial aviation safety Team (CAST) for both initial and recurrent training for all enroute and terminal Air Traffic Controllers.

OUTPUT 3:

- Conduct the training specified in the published ATB

Resources: FAA (ATC)
Timeline: February 29, 2000
Actions: Complete the specified training to all enroute and terminal Air Traffic Controllers

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

AIRLINE PROACTIVE SAFETY PROGRAMS
(FOQA & ASAP)

Executive Summary

The purpose of this project is to give operators the tools to enable them to identify safety issues and trends, then identify and initiate corrective actions prior to an accident occurrence.

OUTPUT 1:

- Draft and issue FOQA & ASAP NPRM's to prevent FAA use of the data collected under FOQA and ASAP in enforcement actions against airlines or their employees.
- Employee groups (ALPA, APA, IAM) will work with operators and member associations to draft contractual language to prevent the use of FOQA or ASAP data as the basis for disciplinary actions.
- Operators, member associations and employee groups will draft and promote legislative language to prevent the misuse of FOQA and ASAP information.

Resources: FAA (AFS, AGC, ASY), ATA, RAA, Employee Groups

Timeline: 270 Days

OUTPUT 2:

- Industry will form FOQA and ASAP Steering Committees comprised of government and industry representatives to provide oversight of program issues, mentoring, and documentation of standards.
- FAA will draft FOQA and ASAP Advisory Circulars

Resources: FAA (AFS-200), ATA, Operators, and member associations, manufacturers, vendors

Timeline: 180 Days

OUTPUT 3:

- FAA will write a Handbook Bulletin for Air Transportation (HBAT) to provide guidance to the FAA Principal Inspectors on incorporating the Advisory Circular referencing approval of FOQA and ASAP programs (consistent application of advisory material).

Resources: FAA (AFS-200), ATA, Operators, member associations, employee groups

Timeline: 60 days after completion of FOQA and ASAP program guidance

OUTPUT 4:

- ATA will facilitate these organizations to develop a Process to communicate "Hot Topic" items of focus and draft guidance material regarding voluntary sharing of trend information.

Resources: Operators, manufacturers, member associations, employee groups, FAA (ASY)

Timeline: 24 months after protective legislation is passed.

OUTPUT 5:

- Flight Safety Foundation will continue to promote and advertise FSF FOQA overview documentation.
- ATA and RAA, through the FOQA Task Force, will draft and coordinate documentation outlining suggested methods and procedures regarding key components of analysis and trend identification programs and suggested items to monitor in FOQA and ASAP programs.
- FAA and NASA will publish the results of studies reviewing existing FOQA and ASAP programs and the analysis tools that those existing programs employ.
- NASA will undertake studies to develop analytical tools and methods that both large and small operators could apply to FOQA and ASAP information.

Resources: NASA, Operators (ATA, RAA), Employee Groups, Flight Safety Foundation (FSF), FAA (AFS, ASY, ATC), Airframe Manufacturers and Equipment Suppliers

Timeline: 270 Days

Performance Goals & Indicators for Outcomes/Outputs:

For these Outputs to be successful in achieving the 2007 goal, Airlines operating under FAR 121 and the FAA need to establish FOQA and/or ASAP type programs by January 2003.

Note: Some operators may not have the capability necessary to implement both.

	Problem Statement	Definition
1	FLIGHT CREW - INSUFFICIENT ENGLISH LANGUAGE SKILLS	Inability of the flight crew to understand and communicate English language instructions
2	FLIGHT CREW - FAILURE TO FOLLOW PROCEDURES (COMMUNICATIONS)	Failure of the flight crew to provide complete responses (callbacks, position reports, etc.) in accordance with established procedures(FAA, ICAO, Company, etc.)
3	AIR TRAFFIC SYSTEM - LACK OF STANDARDIZATION (APPROACH/ DEPARTURE PLATES)	Lack of standardized departure and approach plate depiction among approach plate publishers (example: 5 mile vs. 10 mile circle depiction)
4	ATC – INSUFFICIENT ENGLISH LANGUAGE SKILLS	Inability of ATC to understand and communicate English language instructions
5	ATC / FLIGHT CREW INADEQUATE COMMUNICATIONS	Inability of ATC and the flight crew to effectively communicate
6	ATC – FAILURE TO FOLLOW PROCEDURES (COMMUNICATIONS)	Failure of ATC to provide instructions/information/clearances using standard phraseology in accordance with appropriate regulatory directives
7	ATC – INADEQUATE SITUATION AWARENESS (HORIZONTAL)	Failure of ATC to correctly identify aircraft position over the ground
8	ATC – FAILURE TO FOLLOW PROCEDURES (SOP)	Failure of ATC to follow established procedures
9	AIRLINE OPERATIONS - PF/PNF FLYING PROCEDURES (INCREASED WORKLOAD AT A CRITICAL PHASE)	Airline/operator procedures caused a disruption in crew activities and contributed to an increased flight crew work load during a critical phase of flight
10	FLIGHT CREW – FAILURE TO FOLLOW PROCEDURES (SOP)	Failure of flight crew to follow established procedures

	Problem Statement	Definition
11	FLIGHT CREW – INADEQUATE SITUATION AWARENESS (VERTICAL)	Failure of flight crew to correctly identify aircraft height above ground
12	FLIGHT CREW - INADEQUATE SITUATION AWARENESS (HORIZONTAL)	Failure of flight crew to correctly identify aircraft position over the ground
13	FLIGHT CREW - MISINTERPRETED PRESENTATION	Flight crew misinterpreted instrument presentation and failed to cross check other available instruments
14	AIRCRAFT EQUIPMENT - EQUIPMENT FAILURE	Failure of instrument and/or warning system during critical phase of flight (approach/landing)
15	AIRLINE OPERATIONS - CORPORATE "ON-TIME" CULTURE	Airline/operator culture unduly emphasizes on-time performance
16	FLIGHT CREW – CRM FAILURE	Lack of CRM training or failure to follow CRM practices.
17	AIRLINE OPERATIONS - LACK OF STANDARDIZED PROCEDURES	Failure of the airline/operator to provide adequate standard operating procedures that address situations and environments that the flight crews operate in
18	AIR TRAFFIC SYSTEM - LIMITED NAVAID AVAILABILITY	NAVAIDs not available, inadequate or out of service
19	FLIGHT CREW – LACK OF BASIC PILOTING SKILLS OR KNOWLEDGE	Lack of sufficient skill or knowledge required to successfully perform a flight maneuver or a procedure or understand its consequences
20	AIRLINE OPERATIONS - LACK OF TRAINING (FLIGHT CREW)	Airline/operator training failed to adequately address operational requirements necessary for the flight crew to safely operate the airplane
21	FLIGHT CREW - "PRESS-ON-ITUS"	Flight crew disregard of, or failure to recognize, cues to terminate current course of action or maneuver
22	FLIGHT CREW – PNF DUTIES NOT PERFORMED	Pilot Not Flying (PNF) failed to perform monitoring function and other PNF responsibilities

	Problem Statement	Definition
23	FLIGHT CREW - DISREGARD FLIGHTDECK WARNING	Flight crew intentional disregard of and failure to respond to flight deck warning
24	FLIGHT CREW/ AIRLINE OPERATIONS – AEROMEDICAL, CREW MEDICAL / FATIGUE CONCERNS	Disregard of aeromedical factors (fatigue, sleep cycles, medications, alcohol, etc.)
25	AIRCRAFT EQUIPMENT - DESIGN SHORTCOMINGS (AVIONICS)	Failure to provide annunciation of a critical failure condition or an incompatibility of the airplane equipment with required NAVAIDS
26	AIRCRAFT EQUIPMENT - CVR INOPERATIVE (for future accident prevention)	CVR not fully functional during the accident
27	AIR TRAFFIC SYSTEM - INADEQUATE TRAINING/ SUPERVISION	Inadequate supervision of a trainee controller
28	AIR TRAFFIC SYSTEM – INADEQUATE INFRASTRUCTURE (EQUIPMENT/ DESIGN)	The ATC system lacked equipment that might have helped prevent the accident (DME, radar, etc.)
29	AIRLINE OPERATIONS - NO-FAULT GO-AROUND POLICY	Failure of the airline/operator to establish a no-fault go-around policy
30	ATC – INADEQUATE SITUATION AWARENESS (VERTICAL)	Failure of ATC to correctly identify aircraft height above the ground
31	FLIGHT CREW - PREOCCUPATION WITH AUTOMATED NAVIGATION (FMS)	Preoccupation with automated systems to the exclusion of alternative navigation systems

	Problem Statement	Definition
32	AIRLINE OPERATIONS – INADEQUATE INFORMATION DISSEMINATION	Failure of or inadequate airline/operator procedures for disseminating flight-critical information within the organization
33	AIR TRAFFIC SYSTEM – INADEQUATE INFORMATION DISSEMINATION	Failure of or inadequate air traffic system procedures for disseminating flight-critical information
34	FLIGHT CREW – FAILURE TO EXERCISE COMMAND (CAPTAIN) RESPONSIBILITY	Failure of captain to exercise command authority
35	AIRLINE OPERATIONS - INADEQUATE SAFETY DATA SHARING	Safety significant data were not being shared between airlines/operators

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

Terrain Avoidance Warning System (TAWS)

Statement of Work:

Controlled flight into terrain (CFIT) - accidents, where a properly functioning aircraft under the control of a fully qualified and certificated crew is flown into terrain with no apparent awareness on the part of crew, could be substantially reduced or eliminated with the installation of TAWS equipment. Manufacturers of turbine aircraft and air carriers operating turbine aircraft under FAR Part 121 should install TAWS equipment on the entire U.S. air carrier fleet and establish procedures for its use.

Lead Organization for Overall Coordination:

AVR-1

Outcomes:

Substantially reduce or eliminate the CFIT accident rate by improving pilot situational awareness with respect to terrain avoidance by establishing appropriate procedures for the installation and use of TAWS. Procedures must include proper flight crew reaction in regard to TAWS aural and visual warnings.

Outputs:

- A rule to require TAWS in all FAR Part 121 aircraft
  - Resources: FAA (ARM, AIR, AFS, AGC, APO), Associations, Manufacturers
  - Timeframe: Final Rule expected 1st Quarter 2000
  - Actions: AIR-130 to draft and publish final rule
- A TAWS TSO
  - Resources: FAA (ARM, AIR, AFS, AGC, APO), Associations, Manufacturers
  - Timeframe: Final TSO expected 4th Quarter 1999
  - Actions: AIR-130 to draft and publish final TSO
- A manufacturing standard practice of installing TAWS equipment in all newly manufactured aircraft used under FAR Part 121
  - Resources: Manufacturers, FAA (AIR, AFS)
  - Timeframe: 1st Quarter 2001
  - Actions: Manufacturers apply for TC's / amended TC's and approval by AIR
- A completed retrofit program including certification and installation of TAWS equipment in existing aircraft

  - Resources: Operators (ATA, RAA, NACA, CAA member airlines, and others), Manufacturers, FAA (AIR)
  - Timeframe: 1st Quarter 2005
  - Actions: Operators and Manufacturers applying for STC's / amended TC's and approval by AIR
- A comprehensive system to support TAWS including installation, maintenance, training and use of TAWS equipment in FAR Part 121 air carrier operations
  - Resources: FAA (AIR, AFS) Manufacturers, Operators, Associations
  - Timeframe: 4th Quarter 2000
  - Actions: System to support TAWS
    - Certification of EGPWS — 4th Quarter 1997
    - STCs granted — As Required
    - No FAA field approvals (AFS-300 Policy Letter) — 2nd Quarter 1999
    - Operating guidance issued
      - AFM requirements — 1st Quarter 2001(newly manufactured); 1st Quarter 2005 (existing)
      - Advisory Circular AFS-200 — 1st Quarter 2002
      - Handbook Bulletin AFS-200 — 1st Quarter 2002
    - Maintenance guidance issued
      - Advisory Circular FAR Part 25 ANM-100 — 1st Quarter 2001
      - Advisory Circular FAR Part 23 ACE-100 — 1st Quarter 2004
- Metrics for validation of TAWS project effectiveness (metrics)
  - Resources: FAA (AIR, ANM), Associations, Airlines
  - Timeframe: 3rd Quarter 1999
  - Actions: AIR-130/ANM-100 to develop metrics and reporting methodology

Relationship to Current Aviation Community Initiatives:

- TAWS rule now in final development stages, public comments being resolved
- TAWS TSO now in final development stages, public comments being resolved
- Aircraft manufacturers including Boeing and Airbus now including TAWS as standard equipment on new production airplanes
- ATA member airlines currently implementing voluntary program to equip all of their airplanes with TAWS equipment. (The program is expected to be substantially completed during 2003, affecting approximately 4300 aircraft, over 90% of all passenger and cargo aircraft in the US operating under FAR Part 121.)
- Voluntary TAWS equipage of airplanes operated by non-ATA members and by operators subject to rules other than FAR Part 121 also underway (FAR Parts 91, 135, 125 and U.S. Registered Aircraft operating under FAR Part 129)

Performance Goals & Indicators for Outcomes/Outputs:

- Goal: Elimination of CFIT accidents in U.S. and for all U.S. operators
- Indicator: FAR Part 121 air carrier CFIT accident rate drops to zero

- Goal: Installation of TAWS equipment in all aircraft operated under FAR Part 121
- Indicator: Certification of TAWS equipment for all FAR Part 121 aircraft
- Indicator: 100% equipage of FAR Part 121 aircraft fleet

- Goal: Final TSO
- Indicator: Final TSO issuance

- Goal: Final rule
- Indicator: Final rule issuance

- Goal: Compliance with final rule
- Indicator: Annual reports showing percentage of fleet in compliance

- Goal: A comprehensive system to support TAWS in FAR Part 121 air carrier operations
- Indicator: FAA feedback regarding field approval process
- Indicator: FAA and industry feedback regarding TAWS implementation

Programmatic Approach:

Organizational strategy

The CFIT JSIT identified Jerry Tegen ACE-203 (816-426-5003) as the JSIT project lead for TAWS. The project lead will continue to work with the TAWS rulemaking team until the final rule is issued. Thereafter, the project lead will coordinate implementation activities outlined in the Implementation Plan and will provide progress reports to the CFIT JSIT. Implementation is viewed as a shared responsibility and tasks will be divided between the FAA and organizations in industry. The FAA offices of primary responsibility (OPR) for the regulatory and certification tasks are AFS-200 and AIR-100, respectively. The office of primary responsibility for industry should be ATA.

Implementation activities

In collaboration with industry the FAA will monitor FAR Part 121 air carrier installation and operation of TAWS equipment through the existing certification and approval processes. The FAA will invite feedback from FAA and industry in respect to TAWS implementation. Taking advantage of the experiences and lessons learned in the field, the FAA and its industry partners will generate guidance as appropriate in support of TAWS. An essential part of the monitoring process will be that the FAA and its industry partners implement reporting processes. Periodic reports will provide data for meaningful measures against project goals (metrics).

Key Products and Milestones:

- TAWS equipment certification - *COMPLETED*
- TAWS NPRM - *Issued August 26, 1998*
- NPRM public comments resolved - *Spring, 1999*
- OST review – *4th Quarter 1999*
- OMB review – *1st Quarter 2000*
- TAWS final rule issued – *1st Quarter 2000*
- Advisory Circular AC-20.xx for TAWS – *1st Quarter 2002*
- TAWS final rule, 100% compliance – *1st Quarter, 2005*
- FAA STC approval process: *Approximately 95% complete*
- Industry feedback regarding TAWS implementation progress: develop uniform reporting format – *3rd Quarter 1999*
- TAWS TSO issued for public comment – *2nd Quarter 1998*
- TSO public comments resolved – *2nd Quarter 1999*
- TSO issued - *4th Quarter 1999*
- Validation of TAWS project effectiveness - *Metrics to be developed 3rd Quarter 1999*
- Advisory Circular AC-25.xx for TAWS- *1st Quarter 2001*
- Advisory Circular AC-23.xx for TAWS – *1st Quarter 2004*
- Final TAWS report – *2nd Quarter 2006*

Plan and Execution Requirements:

FAA, ATA, and other stakeholders must commit to adequate levels of staffing and funding to support TAWS implementation. In particular, budget must address manpower needs created by meeting TAWS implementation requirements. Permanent or temporary staff must be added to backfill where the TAWS project has caused vacancies; travel must be funded; and new processes associated with metrics must be funded, such as contract support for handling feedback and analysis of data. If additional guidance materials become necessary for FAA inspectors or industry users, manpower and funding must be adequate to meet those needs. People and funds allocated to TAWS implementation must not be reassigned apart from TAWS.

The total FAR Part 121 cost—including certification costs, retrofit costs, and incremental TAWS costs for newly manufactured aircraft delivered between 1999 and 2008—would be approximately $328.3 million.

Risk Description:

1. Delay of Final Rule - mixing various levels of users with competing interest.
- Economic burden for low end users
- Challenging validity of FAA Safety Data
- Alternative means - potential use of other technologies
- Delay of final rule compliance
- Lack of FAR Part 145 Repair Stations capacity
- Lack of TAWS equipment

Risk Mitigation Plan:

Pending successful completion of rulemaking that would require TAWS, the FAA and industry will continue to encourage voluntary equipage with TAWS of all FAR Part 121 air carrier airplanes.

The TAWS rulemaking team is examining every practical means of achieving the safety gains promised by TAWS within the rule proposed. The team is considering possible adjustments to address the valid concerns expressed in comments from conscientious writers.

Impact on Non-FAR Part 121 or International Applications:

The rule prescribes criteria for other than FAR Part 121 operators.

Coordination with international organizations such as ICAO and JAA is continuous. While those organizations have their own agendas addressing CFIT accident reduction, they stay in touch with the CFIT JSIT and routinely exchange safety agenda information with the CFIT JSIT.

Impacts and risks identified by the CFIT JSIT are conveyed to other organizations as appropriate, such as the general aviation CFIT JSAT.

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

ATC Controlled Flight Into Terrain (CFIT) - Training

Statement of Work:

Training procedures are presently in effect, re-emphasis to current procedures and or slight modifications to current procedures could be acted upon almost immediately.

Outcomes:

To improve aviation safety by reinforcing current safety alert procedures and good Air Traffic operating practices.

Outputs:

Publish an Air Traffic Bulletin (ATB) article (Appendix A). A verbal briefing will be given to all enroute and terminal Air Traffic Controllers on the history of the Commercial Aviation Safety Team and handbook paragraphs to review.

Relationship to Current Aviation Community Initiatives:

Flight Safety Foundation has published an article on ATC communications. It does not specifically address this issue, and it is a related topic.

Performance Goals & Indicators for Outcomes/Outputs:

Goal: Provide consistent issuance of Safety Alerts.
Goal: Provide quality On The Job Training (OJT) while not impacting the safety of the flying public.
Indicators: Initial Action: The use of Air Traffic Bulletins have been proven to be a reliable method to raise awareness of critical rules and regulations. Follow-up Action: Use of safety alerts is covered yearly in refresher training and OJT operating practices are covered during facility evaluations, if improvement is needed follow-up action and management controls are required.

Goal: Increase the awareness of flight crew workload during departure/landing by using FMS fixes and precision approaches.

Indicators: User comments and a reduction in CFIT Accidents.

Lead Organization for Coordination:

Air Traffic Operations (ATO-100)

Programmatic Approach:

A review of the current regulations and orders was conducted. All of the initiatives were covered in current regulations and orders. It was determined that the best way to reinforce and review the orders was an Air Traffic Bulletin. This vehicle requires that every person controlling air traffic be verbally briefed on the content of the ATB.

Key Products and Milestones:

Review of current regulation and orders – [Jan-Feb 99] *COMPLETED*
Update current regulations and orders – [Feb 99-Feb 00] *NOT REQUIRED*
Initial Implementation Plan Considerations (Appendix B)– [March 99] *COMPLETED*
Write ATB – [March-April 99] *COMPLETE*
Coordinate ATB – [April 20, 1999] *On Schedule*
Publish ATB – [July 1, 1999] *On Schedule*

Plan / Execution Requirements:

NATCA Representative [Identified and on board]
ATO – Coordination [Identified and on board]
ATX – Produce the ATB [Identified]

Risk Description:

Low Risk. Only concern possible slip in ATB publishing schedule.

Risk Mitigation Plan:

Consulted with NATCA before the ATB was put out for coordination. NATCA concurs with the ATB and does not have any major concerns.

Impact on Non-FAR Part 121 or International Applications:

We will share the information and associated successes with our counterparts in the FAA International office.

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

Precision-Like Approach Implementation
"21st Century Instrument Approaches"

Statement of Work:

The purpose of this plan is to identify the means by which all flight crews can fly an appropriate stabilized vertical path to the runway end, for all instrument approach procedures, thereby reducing the possibility of a controlled flight into terrain accident. The Plan will direct or encourage the aviation community to:

- Identify criteria for the development of appropriate stabilized continuous descent approach procedures to the runway end for all instrument approaches and air carrier aircraft types,
- Address any changes necessary to ensure adequate training and certification of flight crews,
- Address any changes necessary for certification and authorization of aircraft and procedures,
- Take advantage of existing aircraft capabilities to improve approach and landing safety to the maximum extent practical, and
- Transition to use of new and evolving aircraft capabilities that can further improve approach and landing safety at the earliest practical time.

In the interest of safety, the industry should discontinue the use of step-down or "dive-and-drive" Non-Precision* approach procedures as soon as, and wherever, possible. It should be made clear to all pilots and operators that the industry should, at the earliest possible date, develop procedures and train pilots to fly a stabilized continuous descent approach procedure. This would include procedures such as the constant rate descent that can be flown by all types of aircraft and use of the modern vertical navigation capability (VNAV) by some existing and most new aircraft types.

Further safety and operational enhancements can be achieved through the appropriate use of features and functionality available now or in the near future on the commercial aircraft fleet. Existing airplanes used in commercial operations worldwide have varying operational capabilities and limitations. These various capabilities should be utilized and the limitations accounted for. Various strategies must be developed and employed to improve the overall safety of approach operations.

The operational capabilities of the worldwide fleet may be represented as a continuum but, for the purpose of this project, the airplanes have been categorized as "Classic," "Standard" and "Advanced."

Classic airplanes - airplanes typically equipped with electromechanical flight instruments, basic navigation capability (i.e., VOR, DME, ADF and possibly first generation Inertial Navigation System (INS)).

Standard airplanes - airplanes with multi-sensor RNAV Flight Management Systems (FMS), Electronic Flight Instruments and Electronic Map Displays (the majority of airplanes produced during the past fifteen years).

Advanced airplanes - airplanes equipped similar to the Standard airplanes but with advanced navigation capabilities (e.g., GPS sensors and RNP) and possibly enhanced situation awareness systems such as Terrain Awareness Warning System [TAWS - a.k.a., E-GPWS].

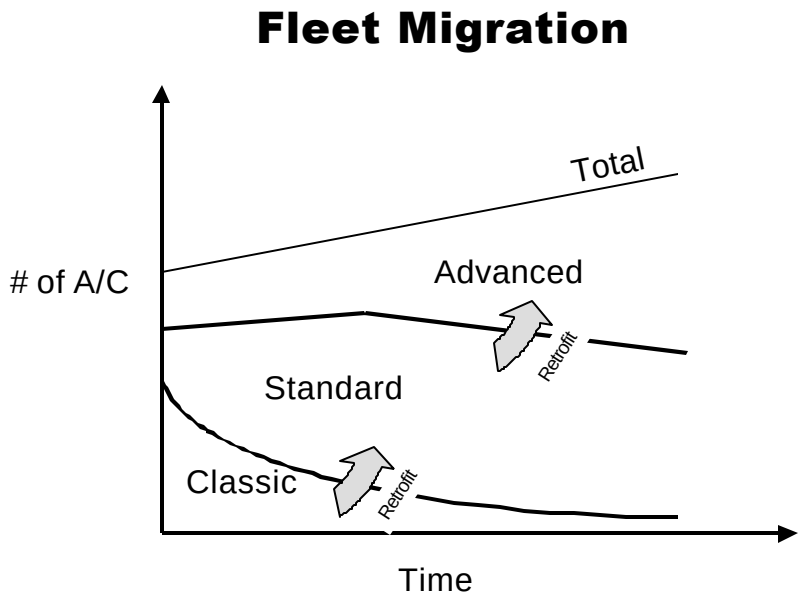
The underlying strategy is to use the capabilities that are already available in the airplane to the greatest extent while creating operational benefits to encourage equipage with more capable functionality. All strategies need to be promulgated internationally if the full safety benefits are to be realized.

Lead Organization for Overall Coordination: AFS-1

The primary thrust of this safety initiative is to introduce and utilize operational capabilities that are already available. The increased capabilities will occur naturally over time, because new production airplanes will come with better equipment installed and standard and classic airplanes will be retrofitted or retired. The challenge is to accelerate the introduction of increased capability and to operationally authorize the more capable equipment. The timeline for the elements described below will contribute to the safety goal of an 80% reduction in the commercial accident rate by 2007.

Outcomes:

Figure 1.



Operators are able to fly stabilized approaches with better vertical situation awareness and improved vertical descent path tracking capability in the final instrument approach segment.

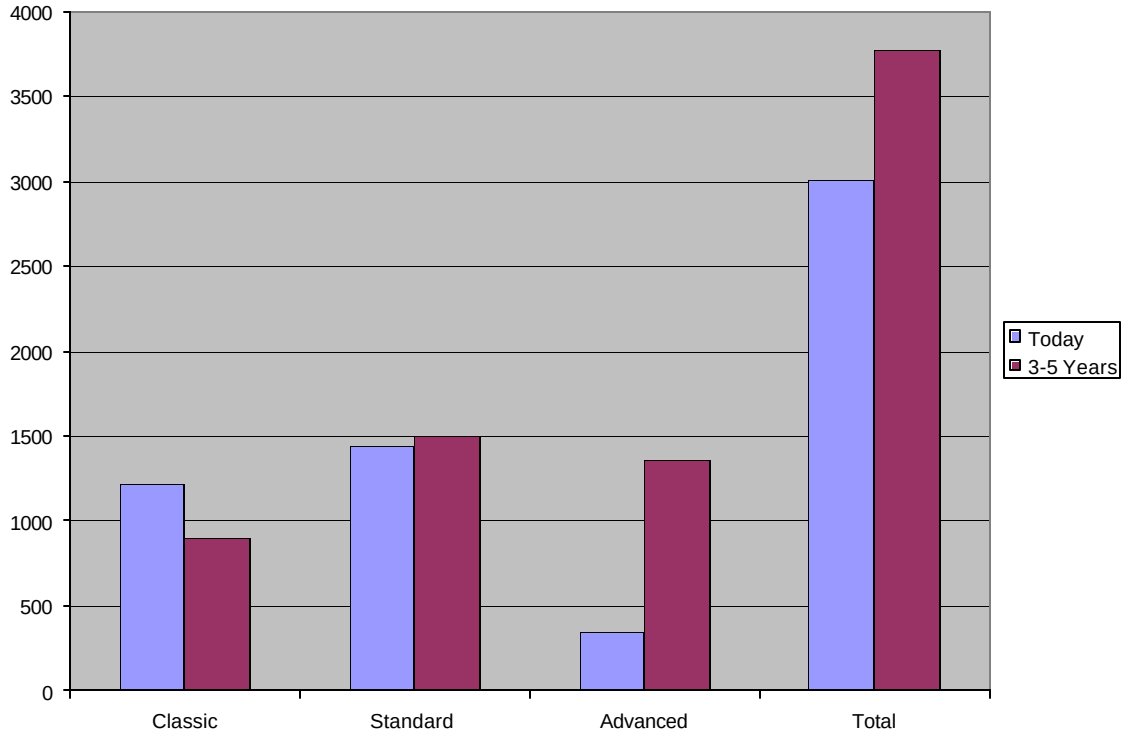


Figure 2. Current and Projected Number of Air Carrier Classic, Standard, and Advanced Aircraft Types.

Outputs:

For the purpose of this initiative, instrument approaches and navigation capability can be broadly categorized in the following table. The table shows current or potential aircraft approach navigation capability for each of the Classic, Standard or Advanced aircraft types:

AIRCRAFT NAVIGATION CAPABILITY			
Instrument Approach Type	CLASSIC	STANDARD	ADVANCED
NPA* with Vertical Angles	X	X	X
RNAV-3D		X	X
RNP-RNAV			X
xLS (ILS, MLS, GLS)	X	X	X

Table 1.

For example, all types of air carrier aircraft can potentially fly procedures such as current VOR or NDB approaches using some type of constant vertical descent rate (or angle) method, even though the particular method may or may not be the same for each aircraft class. All aircraft types are capable of flying a VOR approach with a published vertical angle, using open loop constant vertical speed. The Standard aircraft can fly the VOR approach and the RNAV-3D approaches using barometric vertical navigation (VNAV) based on a published vertical angle. Only the **advanced** aircraft are capable of using the better RNAV method of flying an instrument approach using an accurate level of RNP combined with an associated specific VNAV defined path. **All types** of aircraft can currently fly the ILS and could also fly the equivalent best method GLS (e.g., xLS) procedures, if a GPS capable Multi-mode receiver (MMR) is installed, and a Ground Based GNSS Augmentation System (GBAS) is available.

> ***Note**:
> The terms Precision Approach (PA) or Non-precision approach (NPA) used in this plan are used only for historical and continuity reasons, as a convenience to readers familiar with traditional U.S. and ICAO instrument approach classification. The use of the terms PA and NPA are being considered for eventual phase-out from operational use as authorities and operators are each able to develop and use more modern and a better suited classification schema and terminology. The phase-out is necessary to properly address the wide variety of instrument approach operations now possible with increasing use of RNAV, multi-sensor NAV systems, RNP, GNSS, and various forms of GNSS augmentation (GLS). The FAA/JAA/Industry All-Weather-Operations Harmonization effort, and related updates to FAA AC 120-28 and AC 120-29 and JAA JAR OPS-1 and JAR AWO, are evolving this concept.

The outputs of this plan are described below based on the category of instrument approach as described in the table above. Additionally, a set of the outputs that apply across categories of approach is described under the General heading. These are specific outputs that may need to be integrated to form a cohesive set of products and a consistent time scale.

Several of the outputs can (and should) be broken down into more detail. The more detailed portions are likely to be accomplished by different organizations, depending on their roles and responsibilities. For each of the outputs, it is intended that the first organization listed under Resources will be responsible for coordination of the output completion.

For some issues, the item is shown even though it is already considered to be "complete," in order to provide a comprehensive description of related actions that are expected to happen within both FAA and industry.

General (applies to all categories of instrument flight procedures)

1. Develop criteria to support the inclusion of vertical angles on existing procedures.
   - **Resources:** AFS-400
   - **Timeframe:** Complete
   - **Actions:** In Change 17 of TERPS.

2. Develop NOS Charting Specs to depict angles and TCH:

- **Resources:** AFS-400, ATA-100, NOAA
- **Timeframe:** Complete
- **Actions:**

3. Update pilot and ATS information to explain the revised instrument procedures

   - **Resources:** AFS-400, NOS, Jeppesen, ATA, Employee groups, ATS
   - **Timeframe:** 90 days
   - **Actions:** AIM, Informational/charting bulletins, and other documents as appropriate.

4. Develop a plan and initiate implementation for procedure production/revision to address criteria described above – (e.g., start with Part 139 airports, runways>5000', then all others), including:

   - Determine which vertical angle (vertical paths) and visual guidance slope indicators (VGSI) do not coincide, and revise the VGSI or specified path so that they do coincide.
   - Determine which instrument procedures do not accommodate a nominal 3 degree slope between FAF and Runway threshold + TCH. Move FAF altitude, adjust step-down constraints or fixes, or adjust descent angles, altitudes, or waypoint/fix/navaid locations as necessary so that the procedures can best provide for a continuous descent at an appropriate angle (above 3 degrees).
   - For every instrument approach, define an appropriate vertical angle and code it in the navigation database and depicted on the charts.

   - **Resources:** AVN, AFS-400, AVR (Human Factors), AAF, ARP, ATA-100, NOS, Jeppesen, NIMA - (Aeronautical Information Services)
   - **Timeframe:** 120 days
   - **Actions:** Produce the plan that includes the elements below, and initiate implementation:

     a. Ensure appropriate operational (i.e., pilot) input in the design of instrument procedures.

     b. Conduct research necessary to determine human factors guidelines for design of instrument procedures.
     c. Appropriately apply technology, including high precision terrain/obstacle databases and high speed automated procedure design tools, to produce instrument procedures in a more timely manner with less error.
     d. Make greater use of electronic means to transmit and distribute instrument procedures.
     e. Implement instrument procedure development priorities that reflect the needs of the entire aviation community. Priorities should be set at a national level with input from general, business, military and commercial aviation.
     f. Instrument procedure program staffing and funding levels should accurately reflect the flight procedure workload, i.e. maintenance of current procedures, development/flight inspection of new three-dimensional RNAV procedures, and responding to special industry requests.
     g. Deal effectively and proactively with private developers of instrument procedures.

5. Develop a plan and initiate implementation for organizational processes to ensure that appropriate (developed in accordance with agreed-upon FAA standards and criteria) privately-developed "special" procedures are made available for public use (as public procedures or equivalent mechanism) in a timely manner.

- **Resources:** AFS-400, AVN, ATA, Employee Groups
- **Timeframe:** 120 days
- **Actions:** Produce the plan and initiate implementation.

6. Crew Procedures/Training. Develop crew procedures and training program to promote new instrument procedures in lieu of existing procedures. The training and crew procedures should address current issues (examples: notifying the pilot when the aircraft reverts out of VNAV Path, the integrity of navigation database).

   - **Resources:** ATA, Air Carriers, Employee Groups, AFS
   - **Timeframe:** one year
   - **Actions:** Carriers update training programs.

7. Crew certification/qualification and checking: Develop standards for FAA evaluation of compliance with new training and procedures.

   - **Resources:** AFS-200, AFS-600, AFS-800
   - **Timeframe:** 120 days.
   - **Actions:** Revise Handbook for Aviation Safety Inspectors, and update appropriate PTS (Practical Test Standards) if needed.

8. Develop a plan and initiate implementation to install VGSI at each runway end used by air carriers (priority for highest risk runways).

   - **Resources:** AAF (Airways Facilities), Airports (Headquarters), ATA, Employee groups, AFS, AND
   - **Timeframe:** 120 days.
   - **Actions:** Determine human resource and budgetary requirements. Determine prioritized site selection and time phase plan for installation.

9. Complete, issue and implement AC120-29A, Criteria For Approval Of Category I And Category II Weather Minima For Approach.

   - **Resources:** AFS-400/200
   - **Timeframe:** 120 days for AC completion and issuance.
   - **Actions:** Complete draft of AC, complete coordination internally within FAA, issue finalized AC, and issue all necessary implementing instructions to field offices (e.g., FAA Order 8400.10 associated HBATs), TERPS guidance.

10. Assess and refine the crew interface and interaction requirements for use of these instrument procedures. This should include consideration of flight instrumentation (e.g., PFD/ND, FMS/CDU), status (e.g., ANP or other data for monitoring when ANP (or equivalent) is not available), deviations (e.g., RNAV/LNAV/VNAV), and alerting (e.g., system performance degradation, mode reversions, deviations, etc). Based on these requirements, develop/update and implement operational and airworthiness criteria/guidance for design, training/qualification, and crew procedures.

- **Resources:** AFS-200, AFS-400, AVR (Human Factors), AEG, AIR-100, Transport Airplane Directorate, ATA, NBAA, manufacturing industry (e.g., AIA, AECMA), Employee Groups, appropriate ARAC committees
- **Timeframe:** Three years
- **Actions**: Conduct analysis or research necessary to identify requirements. Develop, update and implement operational and airworthiness criteria and guidance.

Nonprecision Approach with Vertical Angles (may apply to classic, standard or advanced airplanes)

11. Crew Procedures/Techniques: Develop crew procedures/techniques to fly stabilized approach procedures that replace "dive and drive" procedures.

    - **Resources:** ATA, employee group, AFS-200, AFS-400, AFS-600, AFS-800
    - **Timeframe:** 6 months
    - **Actions:** Tailor existing crew procedures/techniques to individual carriers operational requirements.

12. Establish a plan to ensure installation of DME at airports where significant numbers of classic air carrier aircraft are still expected to operate, or where particularly vulnerable procedures are located.

    - **Resources:** AAF, Airport (Headquarters), ATA, Employee groups, AFS, AND
    - **Timeframe:** 3 years.
    - **Actions:** Implement.

RNAV 3-D Instrument Approach Procedures (applies to standard and advanced airplanes):

13. FAA Order 8260.48 criteria for charts that include 3D RNAV minima and charting specs for publication of charts which include 3D RNAV minima

    - **Resources:** AFS-400
    - **Timeframe:** Complete.
    - **Actions:** Implement.

14. Provide procedure development criteria to support FMS equipped aircraft to use LNAV and VNAV.
    - **Resources:** AFS-400, AVN-200, AVN-100, ATA, Employee Groups
    - **Timeframe:** Complete.
    - **Actions:** Implement.

15. Revise the various PTS, FSB reports, and pending FAR Part 1 (definitions), 14 CFR Part 61, 91, and 121 Subparts N & O to address use of modern navigation systems and revised instrument procedures.

    - **Resources:** AFS-200, AFS-400, AFS-600, AFS-800, AEG
    - **Timeframe:** 3 years
    - **Actions:** Criteria updated to reflect new approach procedure terminology.

16. Implement general-purpose use of "harmonized" approach minima developed by the FAA/JAA AWO Harmonization Working Group.

- **Resources:** AFS, AWO HWG
- **Timeframe:** 14 months
- **Actions:** Revise applicable TERPS sections.

17. Develop production plan and initiate implementation for 3D RNAV approach procedures, prioritized based on risk for Part 139 runways, runways>5000, all others.

    - **Resources:** AVN, AFS-400, ATA-100, NOS, Jeppesen, NIMA
    - **Timeframe:** 6 months
    - **Actions:** Team to produce plan.

18. Rename GPS procedures at Part 139 airports as RNAV procedures and include vertical guidance.

    - **Resources:** AVN, AFS
    - **Timeframe:** Currently in progress, complete in 3 years.
    - **Actions:** Implement.

19. Issue policy to allow POIs to authorize operators to fly GPS procedures as RNAV in properly equipped airplanes.

    - **Resources:** AFS-400, AFS-200, ATA, Employee Groups
    - **Timeframe:** 6 months.
    - **Actions:** Implement.

20. Develop a plan and initiate implementation for a minimum number of approach charts to runway end with multiple minima, (suitable for xLS, RNP, LNAV/VNAV, and LNAV minima). As part of this plan implementation, conduct a research project to address issues of charting, content, etc.

    - **Resources:** AFS-400, AVN-1, AVR (Human Factors), ATA-100, NOS, Jeppesen, NIMA**,** ARINC, ATA
    - **Timeframe:** 12 months
    - **Actions:** Produce the plan and initiate implementation.

21. Develop and initiate implementation of a plan to educate FAA inspectors, check airmen, and designated examiners on approved use of advanced instrument flight procedures.

    - **Resources:** AFS-200, AFS-600, AFS-800, Employee Groups, ATA
    - **Timeframe:** 12 months
    - **Actions:** Plan will include implementation timetable, revise guidance material.

22. To ensure that operators can get the most out of current equipage, develop and initiate implementation of a plan for operational approval of VNAV and RNAV as appropriate. Qualification for use of RNAV by Standard aircraft must be carefully considered and approval must consider whether the aircraft is suitably equipped and whether pilot information, display, and annunciation requirements are met.
    - **Resources:** AFS-400, Employee Groups, ATA
    - **Timeframe:** 12 months
    - **Actions:** Develop guidance to address VNAV and RNAV usage.

RNP-RNAV Instrument Approach Procedures (applies to advanced airplanes)

23. Add RNP criteria/guidance to FAA Order 8260.48 (or other document as appropriate), revise OA P 8200.1 Flight Inspection Manual, and other support criteria to provide public use procedures for RNAV/RNP minima.
    - **Resources:** AFS-400, AVN-200, ATA, Employee groups
    - **Timeframe:** 9 months
    - **Actions:** Revise order or other documents as needed.

24. Develop plan and initiate implementation to develop and update RNP policy and criteria for operational and airworthiness approval, as needed, building on AC 120-29A.
    - **Resources:** AFS-400, AFS-200, AFS-300, AIR, ATA, Employee groups
    - **Timeframe:** 6 months
    - **Actions:** Develop the plan and initiate implementation.

25. Transition to RNAV/RNP procedure production.
    - **Resources:** AVN, AFS, AVR, industry procedure development resources
    - **Timeframe:** Start within 12 months, complete majority of needed procedures within 7 years.
    - **Actions:** Implement. Consider alternate ways to produce procedures.

26. Revise the various PTS, FSB reports, and pending updates to FAR 121 Subpart N & O to address use of modern RNP based navigation systems and appropriate use of RNP based instrument procedures
    - **Resources:** AFS-200, AFS-600, AFS-800, AEG
    - **Timeframe:** 36 months
    - **Actions:** Implement.

27. Issue internal FAA directives (e.g., Notice, Orders and/or HBATs) to communicate RNP procedures and operational approval processes, and address any necessary CMO/operator coordination on implementation of RNP.
    - **Resources:** AFS-200, AFS-400
    - **Timeframe:** 6 months
    - **Actions:** Implement based on AIM material, relevant NOTAMs, etc.

xLS (ILS, MLS, GLS)

An xLS laterally and vertically guided approach type is generally the preferred instrument approach method. Nearly all air carrier airplanes are capable of conducting an ILS approached where ILS service is provided. ILS is expected to remain in use for a very long time, and where necessary, may need to continue to be installed (e.g., at newly constructed HUB airport air carrier runways). MLS and GLS capability is being accommodated in the airplane by the introduction of multi-mode receivers. MLS may be needed by certain operators to provide interim capability at particular sites. GLS is expected to provide a long term world wide landing capability. Expeditious implementation of GLS to provide a 3D path to every possible significant air carrier runway end should be an industry wide goal. This is particularly important for significant airports and runways not already served by ILS. The safety benefits from MLS and GLS can only be realized when service is provided, airplanes are equipped and operational authorization is achieved.

28. Support the development of ICAO SARPS for Satellite Based Augmentation System (SBAS) and Ground Based Augmentation System (GBAS).
    - **Resources:** AFS, AIR, Industry
    - **Timeframe:** Service to support Category I – 9 months
      Service to support Category II/III – 3 years
    - **Actions:** Participate in the ICAO GNSSP

29. Refine and validate the international operational concept for GLS.
    - **Resources:** AFS, FAA/JAA All Weather Operations Harmonization Working Group [AWOHWG]
    - **Timeframe:** Two years
    - **Actions:** Refine and update AC 120-29A, AC 120-28D, JAR-OPS 1 and JAR AWO based on AWOHWG Future Work Program and initial application of criteria

30. Develop the business case for the integration of SBAS and GBAS capability into current airplanes and for retrofit into in-service airplanes.
    - **Resources:** Operators, Manufacturers and Suppliers with support from AFS, AIR and ASD
    - **Timeframe:** Five Years
    - **Actions:** Develop a Roadmap for progressive migration to GLS
      Identify the constraints and enablers for implementation

Relationship to Current Aviation Community Initiatives:

Coordination is needed among many groups, including the following groups:

- ATA FMS/RNAV Task Force
- ATA Chart and Data Display Committee
- FAA/JAA All Weather Operations Harmonization Working Group
- ALPA Engineering & Air Safety
- Government/Industry Aeronautical Charting Forum
- CAFT: - CNS/ ATM Focus Team

- RTCA SC-181: Navigation Standards
- RTCA SC-159: GPS (Global Positioning System)/GLONASS
- RTCA/DO-229 Wide Area Augmentation System
- ICAO Obstacle Clearance Panel
- ICAO Global Navigation Satellite System Panel
- Certification Select Committee
- Human Factors Harmonization Working Group

As this long list illustrates, there are a number of groups addressing different aspects of the goal. However, the groups are not always moving in concert, or working to the same set of principles.

Airline Activity with RNAV - a few airlines are implementing these approaches (US Airways, Alaska, and Continental), and are seeing benefits already. US Airways is using over 300 approved RNAV approaches in lieu of traditional non-precision* approaches. Alaska is using beneficial RNAV/RNP approaches in many cases because of operational necessity.

For example, Continental has been using VNAV on the 777 and 757 fleets, since summer ’99, as the standard approach method. They are transitioning the 737 fleet to RNAV. They are actively pursuing RNAV at airports such as Houston (KIAH), Midway (PMDY), Anchorage (PANC), and Newark (KEWR), all with VNAV guidance. KEWR is seen as a definite capacity maintenance program with ultimate added flights per hour with existing facility. This procedure will start as visual, then provide improved minima as experience is gained.

Other operators are very interested in using these approaches to gain the safety benefits realized by the airlines using them.

Performance Goals & Indicators for Outcomes: (all by 2007)

Performance goals are target levels of performance expressed as a tangible, measurable objective against which actual performance can be compared within specified time frames, including goals as quantitative standards, values, or rates. Performance goals may be applied to processes, outputs, and outcomes. An example of a performance goal is "reduce the rate of landing accidents resulting in personal injuries to fewer than 1 in 10 million landings by the year 2001."

Measure the number of commercial carriers that have adopted these new procedures:

- all ATA member carriers will use approach procedures outlined in this project.
- all NACA member carriers will use approach procedures outlined in this project.
- all non-ATA, and non-NACA member carriers will use approach procedures outlined in this project.
- all new instrument procedures will be either xLS, or RNAV.

All new instrument procedures will be developed as either xLS, or RNAV. In the unusual event that a new traditional approach is needed for use by Classic aircraft (e.g., at a newly constructed runway), when necessary, it will be developed as a combined procedure (e.g., "RNAV or VOR", with a suitable VNAV path defined. The procedure should have RNP based minima available for use by suitable qualified RNP capable

aircraft).

All new instrument procedures (arrival, approach, and departure) will be designed with RNP criteria.

Compare CFIT accident rate to rates over similar time periods.

Crews using these new procedures to have "no fault" reporting system to gather data to determine effectiveness, missed approach rate, and other pertinent data to evaluate effectiveness and preference over previous methodology. (NASA ASRS, ASAP, etc.). Data use (or is it "used") can verify reduction in incident rate equal to or greater than overall effectiveness values.

Flight crews and operators should have an available means to note necessary refinements or improvements in flight deck navigation systems or displays, to better support instrument procedures flown or expected future procedures (e.g., refinements pertaining to FMS, EADI, PFD, ND, Alerting systems, or Annunciations). Similarly, flight crews and operators should have available a means to note necessary refinements or improvements to instrument procedure depiction (e.g., charts). This feedback means would permit timely adjustments or improvements to be made using an iterative process, for flight deck or navigation system design, instrument procedure formulation, charting development, or for development of flight crew operational procedures.

Performance Goals & Indicators for Outputs: (all by 2007)

- Use FOQA data to verify the incident rate of CFIT accidents is reduced by the amounts predicted (overall effectiveness) in CFIT JSAT report for the interventions assigned to this project. Air carriers should report results periodically.
- Compare rates of usage of advanced equipment to utilize these procedures.
- Complete changes to regulations by 2003.
- Complete changes to notices by 2002.
- Complete changes to Advisory Circulars by 2002.
- Complete changes to 8400.10 Aviation Inspectors Handbook by 2002
- Complete changes to Flight Inspection Manual by 2002.
- Develop feedback on industry compliance with new procedures through cooperative reporting program by 2001.

Programmatic Approach:

Organizational Strategy:

Small group (plan development team) to establish implementation plan—this plan. Team members of development plan will represent all stakeholders in process and have skill sets to craft a viable plan with minimized cost and maximum effectiveness.

Stakeholder buy in will be solidified by CAST process. (Key element)

Lead Organization will establish Specific Structure for Implementation and Process Control. Performance ratings tied to project objectives. Key people from different parts of FAA should work in one coordinated effort, until project completion.

Stakeholders outside corporate structure of lead organization will also commit people to work in a similar structure - either on temporary assignment to lead organization or under their authority at another location.

An oversight Group is needed to ensure review of progress – a group that can ensure the product is produced, in concert with Certification Select Committee and with the principles described in this document.

Implementation Activities:

Organize events in time related context.
Determine which events are serial/parallel in context with others.
Determine requirements (people/costs) to develop plan within timeframe.
Obtain necessary resources to accomplish goals.
Use operations research techniques and process control to monitor progress.
Use information-sharing tools to maximize knowledge of ongoing efforts within implementation team.
Scheduled conference calls, internet usage, scheduled project updates with target goals.

Accountability:

To ensure the recommendations that are adopted by the CAST are implemented as intended, an oversight function should instituted as a subgroup of the JIMT to provide technical review of the DIP products. This oversight function should include the appropriate expertise from industry and government.

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For
Training - CFIT Prevention

Statement of Work:

Controlled Flight Into Terrain (CFIT) - accidents are the leading cause of commercial aviation equipment loss and fatalities, worldwide. CFIT accidents could be substantially reduced if all air carriers operating under Part 121 and Part 142 training centers developed CFIT prevention training and procedures to be added to their approved training curriculums stressing position awareness and escape maneuvers in the event of a terrain warning indication.

Lead Organization for Overall Coordination:

AVR-1

Outcomes:

Substantially reduce the CFIT accident rate by the addition of CFIT prevention training and procedures to all Part 121 air carriers approved training curriculums, emphasizing pilot situational awareness and escape procedures for flight crews to use in the event of a terrain warning indication.

Outputs:

- Conduct a review of all Part 121 air carriers by their assigned Principal Operations Inspectors (POI's) to ascertain which air carriers do not have substantive CFIT prevention training and procedures in their approved Part 121 training programs.

Resources: FAA (AFS-1, AFS-200, POI's) and ATA.
Timeline: 60 days.
Actions: Through Regional Flight Standards Division Managers, AFS-1 will request POI's to conduct a review of their assigned Part 121 air carriers and identify those carriers that do not provide CFIT prevention training and procedures within their approved Part 121 training programs.

- A Handbook Bulletin strongly recommending substantive CFIT prevention training and procedures in all Part 121 air carrier approved training programs with guidance to POI's for minimum training program contents.

Resources: FAA (AFS-1, AFS-200, POI's) and ATA.
Timeline: 180 days

Actions: Handbook Bulletin issued by AFS-200, training programs revised by air carriers and approval by the assigned POI.

- Issue a copy of the CFIT Education and Training Aid to each POI whose air carrier does not incorporate CFIT prevention training and procedures in their approved Part 121 training program.

Resources: FAA (AFS-1, AFS-200, AFS-500, POI's).
Timeline: 120 days.
Actions: POI's will present the copy of the CFIT Education and Training Aid to their assigned air carrier requesting a revision to the carriers approved training program incorporating CFIT prevention training and procedures.

- CFIT Education and Training Aid posted on the Worldwide Web (www).

Resources: FAA (AFS).
Timeline: Completed.
Actions: AFS-20 posted the CFIT Education and Training Aid on the "Web" in April of 1999.

- All Part 121 Air Carriers and Part 142 Training Centers will incorporate the CFIT Education and Training Aid or similar training to their approved training programs.

Resources: FAA (POI's), Air Carriers and Training Centers
Timeline: 120 days after receiving the training aid.
Action: All Part 121 Air Carriers and Part 142 training centers submit revised training programs incorporating CFIT prevention training and procedures.

Relationship to Current Aviation Community Initiatives:

- CFIT Education and Training Aid previously distributed on two prior occasions, most recently by FAA/Flight Safety Foundation in September of 1997.
- CFIT Education and Training Aid was posted on the "Web" in April 1999.

- ATA member air carriers currently implementing a voluntary program to incorporate CFIT training into they're members approved training programs.

- When signed (expected first quarter of 2000), the TAWS rule will require CFIT training for all Part 121 air carriers. Newly manufactured aircraft will have one year after signing of the rule to comply; existing aircraft will have four years.

- The international aviation community has similar training programs underway; ICAO and JAA are represented on the CFIT JSIT.

Performance Goals & Indicators for Outcomes/Outputs:

- Goal: A substantial reduction of CFIT accidents involving Part 121 air carriers worldwide
    - Indicator: Part 121, air carrier CFIT accident rate, worldwide, drops to zero.

- Goal: CFIT training aid provided to all Part 121 air carriers and Part 142 training centers not conducting CFIT training. The Training aid should be revised incorporating new technologies and making it more user friendly.
    - Indicator: A review of training programs indicates all Part 121 air carriers and Part 142 training centers conducting CFIT training.

- Goal: Handbook Bulletin issued.
    - Indicator: Necessary training programs are revised and approved, all Part 121 air carriers and Part 142 training centers conducting CFIT training.

- Goal: Post the CFIT Education and Training Aid on the "Web".
    - Indicator: CFIT training aid posted on the "Web" in April of 1999.

Programmatic Approach:

Organizational Strategy

The CFIT JSIT identified Jerry Tegen, ACE-203, (816-426-5003) as the JSIT project lead for CFIT Prevention Training. The project lead will continue to work with AFS-1, AFS-200, AFS-500, and ATA until the Handbook Bulletin is issued. Thereafter, the project lead will coordinate implementation activities outlined in the implementation plan and will provide progress reports to the CFIT JSIT. Implementation is viewed as a shared responsibility between the FAA and the Part 121 air carriers. The FAA offices of primary responsibility (OPR) for this plan are AFS-1, AFS-200, AFS-500, and the POI's respectively. The primary responsibility for industry is shared between ATA and the Part 121 air carriers.

Implementation Activities

A review of their assigned Part 121 air carriers will identify to the Principal Operations Inspectors those air carriers that do not presently provide CFIT training to their flight crews. A Handbook Bulletin will be prepared by AFS-200, in collaboration with industry partners specifying guidance to the POI's and minimum training expectations. The CFIT Educational and Training Aid should be used as a minimum module content. The training aid needs to be revised to incorporate new technologies and to make it more user friendly. When the training aid has been revised, it should be distributed to all Part 121 air carriers so revisions to existing training modules, if needed, can be made. The training aid in its present form has been posted on the World Wide Webb.

Key Products and Milestones:

• CFIT Education and Training Aid developed.	September, 1997
• CFIT Education and Training Aid distributed.	November, 1997
• CFIT Education and Training Aid revision.	June, 1999
• Handbook Bulletin requiring CFIT training drafted.	October, 1999
• Handbook Bulletin requiring CFIT training issued.	December, 1999
• Survey of Part 121 air carriers and Part 142 training centers by POI's.	February, 2000
• Redistribution of training aid to specific Part 121 air carriers and Part 142 training centers.	May, 2000
• Training program revision by air carriers.	July, 2000
• Approval of revised training programs by POI's.	August, 2000
• All Part 121 air carriers and Part 142 training centers conducting CFIT training.	September, 2000

Plan and Execution Requirements:

The Training Aid should be updated and made more user friendly. ATA and other industry partners should continue to encourage all air carriers to voluntarily conduct CFIT prevention training. The review and Handbook Bulletin will ensure the training aid is directed at specific air carriers, those not presently providing CFIT prevention training to their flight crews. Short of rulemaking, this plan is the most expeditious method to include CFIT prevention training in all Part 121 air carrier and Part 142 training center training programs.

Risk Description:

- The training aid is not user friendly and needs updating.
- Challenging of Handbook Bulletin and POI by the air carriers and Part 142 training centers.
- CFIT training requirement by all Part 121 air carriers and Part 142 training centers may require a rule.
- Will significantly delay CFIT training by all Part 121 air carriers.

Risk Mitigation Plan:

Pending successful completion of Handbook guidance that would require CFIT prevention training and TAWS rulemaking, the FAA and ATA continue to encourage voluntary CFIT prevention training by all Part 121 air carriers and Part 142 training centers.

Impact on Non Part 121 or International Applications:

The TAWS rule in itself will require CFIT training for all turbine engine equipped aircraft within four years after signature of the rule.
Coordination with international organizations such as ICAO and JAA continues. Those organizations have their own agendas addressing CFIT accident reduction, both organizations are represented on the CFIT JSIT. Impact and risks identified by the CFIT JSIT are conveyed to other organizations as appropriate, such as the General Aviation CFIT JSAT and the Approach and Landing JSAT.

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For
Training - CRM

Statement of Work

CRM training, standard operating procedures (SOP's), situation awareness, and CFIT prevention are closely linked. This project will reduce CFIT accidents by promoting comprehensive SOP's as a key element of every part 121 air carrier's CRM training program. Under a related project, a template for comprehensive SOP's is being developed, including SOP's which specifically address CFIT accident prevention.

Lead Organization for Overall Coordination

AVR-1

Outcome

Reduce the CFIT accident rate by promoting CFIT prevention in CRM training programs and SOP's. SOP's, in turn, will be emphasized as an integral part of the CRM training required of flight crewmembers of all part 121 air carriers

Outputs

1. Promote CFIT prevention in the CRM training programs of all Part 121 air carriers.

   Resources: FAA (AFS-1, AFS-200, POI's), air carriers, ATA, RAA, ALPA, and other industry organizations.
   Timeline: 4th Quarter, 2000.
   Actions: The SOP template and AC (currently under development) will contain CFIT prevention procedures.

2. Emphasize the importance of SOP's, and recommend the SOP template and the SOP AC in planned revisions of AC 120-51C, Crew Resource Management Training.

   Resources: FAA (AFS-1, AFS-200)
   Timeline: 4th Quarter, 2000.
   Actions: When developed, AFS-200 will reference the SOP template and AC in the CRM AC, AC 120-51C.

3. All Part 121 Air Carriers will have CFIT training incorporated in their approved CRM training program.

Resources: FAA (POI's) and Air Carriers.
Timeline: 4th Quarter 2000
Actions: All Part 121 Air Carriers submit revised CRM training programs to POI's for approval.

Relationship to Current Aviation Community Initiatives

- AC 120-51, Crew Resource Management Training, issued December, 1989 (revised annually)
- Crew Resource Management: Introductory Handbook, issued August, 1992
- Training rules revised to require CRM training for part 121 pilots, December, 1995
- CRM pilot training compliance deadline, March, 1998
- Controlled Flight into Terrain (CFIT) Education and Training Aid, fall 1997
- CFIT Training Aid distributed to part 121 operators, FAA field offices, and ICAO member states, fall 1998
- CFIT Training Aid posted on a public FAA website, April, 1999
- SOP's template under development, spring 1999
- SOP's AC, fall 1999

Performance Goals & Indicators for Outcomes/Outputs

Goal: Substantial reduction or elimination of CFIT accidents involving part 121 air carriers worldwide

- Indicator: Part 121 air carrier CFIT accident rate drops to zero.

Goal: All part 121 CRM training includes CFIT prevention among SOP's

- Indicator: CRM AC revised to recommend CFIT prevention SOP's

Programmatic Approach

Organizational Strategy

The CFIT JSIT identified Hop Potter, AFS-210 (202-267-3723), as the JSIT project lead for CRM training addressing CFIT prevention. The project lead will continue to work with industry organizations until the SOP's template and an SOP's AC are developed. Thereafter, the project lead will coordinate implementation activities outlined in the project implementation plan and will provide progress reports to the CFIT JSIT. Implementation is viewed as a responsibility shared between the FAA and part 121 air carriers.

Implementation Activities

One of the Project Areas of the CFIT JSIT recognizes the need for CFIT prevention procedures in the SOP's of all air carriers. A template containing standard SOP's and an AC recommending the use of the template,

are being developed for reference by all operators in providing their own comprehensive SOP's to their flight crews. Once developed, the template and the AC will be cross-referenced in AC 120-51, as revised, Crew Resource Management Training.

If the template and AC are not completed by the next revision of the CRM AC (fall 1999), the CRM AC will nevertheless be revised to emphasize the crucial importance of SOP's in effective crew resource management. The CRM AC will further stress that operators should develop and implement SOP's specifically relating to CFIT accident prevention.

Key Products and Milestones

- CRM AC issued – December, 1989
- Crew Resource Management: An Introductory Handbook, issued – August, 1992
- Part 121 training rules revised to include CRM – December, 1995
- CRM training compliance deadline – March, 1998
- CFIT training aid developed – Fall of 1997
- CFIT training aid distributed – Fall of 1998
- CFIT training aid posted on FAA public web site – April, 1999
- SOP template developed – September, 1999
- CRM AC revised to emphasize SOP's and CFIT prevention – November, 1999
- SOP AC issued – September, 2000
- SOP template cross-referenced in AC 120-51– November, 2000
- Air carriers revise SOP's incorporating CFIT prevention – January, 2001

Plan and Execution Requirements

CRM can not succeed apart from SOP's. FAA and its industry partners must encourage all operators to develop and implement comprehensive SOP's. Both SOP's and CRM training should include CFIT prevention procedures to realize a reduction in CFIT accidents.

Risk Description

Even with a revised CRM AC, an SOP template, and an SOP AC, some operators may still fail to effect adherence to SOP's by their flight crews. Lack of adherence to SOP's will reduce or nullify any gains in CFIT accident prevention.

Risk Mitigation Plan

Development of the SOP's template and the SOP's AC will provide a useful model for operators in developing their own comprehensive SOP's. The CRM AC will emphasize the crucial importance of SOP's in CFIT accident prevention and will cross-reference the template and the AC when those products are completed.

Impact on Non - Part 121 or International Applications

Any operator would benefit from the use of the SOP's template, SOP's AC , and the CRM AC.

International organizations are also addressing CFIT prevention and will benefit from the use of the AC's.

Controlled Flight Into Terrain (CFIT)
Joint Safety Implementation Team

Implementation Plan
For

"Standard Operating Procedures (SOP)"

Statement of Work:
All operators should have standard operating procedures/training manual/chapter. This manual/chapter should address all projected normal situations crews/company personnel will encounter. This manual will address: use of checklists, what each person's responsibilities are, use of available equipment, and expected procedures to be used during preflight, taxi, take-off, climb, cruise, descent, approach, missed approach, landing, taxi and parking. Use of line crews to develop new procedures increase acceptance and understanding of these procedures. Standard operating procedures for any new equipment will be developed, published, and trained before any new equipment is used/installed. Operators will train proficiency in their SOP's and crews will use published company SOP's.

Outcomes:
To improve aviation safety by:
1. Recommending that all operators establish flight crew Standard Operating Procedures (SOP's) that fit that operator's particular operation.
2. Recommending that all operators train their SOP's and encourage all SOP's be utilized in all normal operations.

Outputs:
In order to provide guidance to the operators in establishing SOP's for their particular airline, the following activities will need to occur:

1. ATA Training committee will facilitate, in conjunction with air carrier and association training groups, development of SOP templates for use by all FAR Part 121 operators in generating SOP's for each particular airline.
   Resources: ATA, RAA, Manufacturers, Operators, and member associations.
   Timeline: 3rd Quarter 1999
   Actions: Obtain a representative sample of air carrier SOP's and other appropriate material for review. Review for standardization and generate a proposed SOP template.
2. An Advisory Circular (AC) will need to be written to publish the template for use in establishing each operator's SOP's.
   Resources: FAA (AFS-200), ATA, Operators and member associations
   Timeline: 2nd Quarter 2000
   Actions: AFS-200 to write AC describing specific subject areas to be addressed by air carrier SOP's. The AC will not contain specific wording for the SOP's, but will only contain guidance to the air carriers.

3. A Handbook Bulletin for Air Transportation (HBAT) will need to be written to provide guidance to the FAA Principal Operations Inspectors (POI's) in incorporating the AC SOP template into the operators training and operations manuals.

Resources: AFS-200, ATA, operators and member associations
Timeline: 2nd Quarter 2000
Actions: AFS-200 will write HBAT to provide guidance to all POI's as it relates to oversight of air carrier operations and training programs.

4. Air carriers should adopt SOP's and revise their training manuals and programs to incorporate the proposed SOP template items as appropriate for the technology of the equipment in the aircraft.

Resources: ATA, RAA, Manufacturers, Operators and Member Associations

Timeline: 3rd Quarter 2000

Actions: Operators should revise their company training manuals and programs to incorporate as many SOP template items as appropriate for the technology of the equipment in the aircraft.

Relationship to Current Aviation Community Initiatives:

The following documents provided recommendations to the aviation industry for the establishment and usage of SOP's related to CFIT:

1. CFIT Training Aid (CD) sponsored by Boeing/FSF. Distributed internationally and posted on World Wide Web.
2. CFIT Training document published in 1997
3. Flight Safety Foundation (FSF) CFIT ALAR Report of November 1998
4. ICAO cover letter AN 11/37 of 3 December 1998

Lead Organization for Overall Coordination

Lead: Operators (ATA, RAA, etc.), Member Associations (ALPA, APA, etc.)
Supporting: FAA Flight Standards (AFS-200)

Programmatic Approach:

The SOP Project team will first review a representative sample of company manuals (SOP, training, etc.) From that review, a template will be generated to include a compilation of the most important and pertinent aspects of each operators manuals as they relate to SOP's. This template will then be provided to all operators via a newly written AC for their use in amending or establishing their own SOP's. In addition, an HBAT will be generated to provide guidance to all POI's to oversee their respective airline operation to ensure that company training programs and manual implementation are complied with in a standardized, uniform manner.

The goal of the SOP Project Team is to provide guidance to the operators through an SOP Template for the establishment of an airline's respective manuals. The project team will not write or revise company manuals nor recommend one procedure over another. The intent of the team and the SOP template is to identify areas that should be addressed.

Key Products and Milestones:

Activity	Estimated completion date
Develop Statement of Work	first quarter 1999
Identify Membership on Team	first quarter 1999
Identify Skills Needed	first quarter 1999
Determine Deliverables	first quarter 1999
Identify Resources Needed	first quarter 1999
Identify Follow-On Actions	third quarter 1999
Identify Ongoing Programs	third quarter 1999
Obtain Necessary Documentation	fourth quarter 1999
Review Operator Manuals	fourth quarter 1999
Assemble SOP Template	fourth quarter 1999
Review SOP Template	first quarter 2000
Write Advisory Circular (AC)	first quarter 2000
Write HBAT	first quarter 2000
Review AC	second quarter 2000
Review HBAT	second quarter 2000
Publish Final AC	second quarter 2000
Publish Final HBAT	second quarter 2000
Revise Company SOP's	fourth quarter 2000
Monitor Implementation	first quarter 2001
Determine Impact on Non-121 & Int'l Apps	first quarter 2001

Schedule and Resources Graphic:
See Attached Gantt Chart (in progress)

Plan & Execution Requirements:
To implement the associated CFIT SOP tasks identified within this implementation plan requires resources from the following organizations:

- FAA Flight Standards (AFS-200)
- Airline / Operators
- Airline Member Associations

Risk Description:
Medium Risk. The development of the SOP template is a relatively low-risk activity. The only medium-risk items that can be identified at this point is the timeframe involved in coordinating, writing and implementing AC's and HBAT's and the willingness of the operators to review and revise their manuals based upon a new set of guidelines.

Risk Mitigation Plan:

The intent of the project is to include the operators as team-members of the template design process. This will provide them the opportunity to voice concerns at the early stages of template design to hopefully mitigate and risks later in the process. The use of SOP's has been encouraged through other industry activities such as the CFIT Training Aid, CFIT Training Document, Flight Safety Foundation CFIT ALAR report and the ICAO cover-letter accompanying the CFIT Training Document.

Impact on Non-FAR Part 121 or International Applications:

Any SOP recommendations will improve the integrity of company manuals and training programs. Therefore, any International or Non FAR-121 operators will benefit from the SOP template, AC and HBAT 4/21/99

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

"Minimum Safe Altitude Warning (MSAW)"

Statement of Work:
In an Attempt to Preclude Future CFIT Accidents, Design an Implementation Plan to Ensure that Ground-Based Radars, their By-Products (Surveillance, MSAW, etc) are Adequate and Provide Altitude Protection in all Phases of Flight in and Around as many US Controlled Airports as Practicable Including All Domestically Identified High Risk / Special Airports. Also ensure that Controller Training and guidance in the use of MSAW is adequate, current and uniformly conducted.

Outcomes:
To improve aviation safety by:
1. Ensuring that ground-based radar and their associated by-products provide the necessary levels of terrain avoidance protection to aircraft operating domestically within the United States.
2. Ensuring that Air Traffic Controller MSAW training is adequate and appropriate to operate, and use MSAW systems.

Outputs:
To correct any deficiencies identified in the above analysis, the following documents may need to be revised:

1. Advisory Circular AC 121.445-1D (Pilot in Command Qualifications for Special Area / Routes and Airports)
2. 14 CFR Part 121.445 (Pilot in Command Airport Qualification: Special Areas and Airports.)
3. Air Traffic Technical Training Order 3120.4
4. FAA Order 6310.6 (Terminal Radar Siting)
5. FAA Order 6340.15 (Enroute Radar Siting)
6. The terms of the AOS / AVN periodic MSAW review to include identification of any additional MSAW coverage needed.

Relationship to Current Aviation Community Initiatives:
The current FAA Operations Support Service (AOS) / Aviation System Standards (AVN) program to streamline the process of comparing new and old NOAA Digital Terrain Maps (DTM) and flight-checking each terminal MSAW facility [every 540 days] will complement this MSAW Implementation Plan effort.

Performance Goals & Indicators for Outcomes / Outputs:
Goal: Provide Adequate US domestic MSAW coverage at all identified High-Risk / Special airports.

Indicator: Results of revised AOS / AVN periodic MSAW review does not identify any areas of non-coverage.

Goal: Provide the necessary level of MSAW training to all US Domestic Air Traffic Controllers regarding MSAW operation, and usage.

Indicator: The number of occurrences of MSAW nuisance warnings and MSAW system deactivations is either reduced to a minimum or corrected so as to ensure zero occurrences.

Goal Ensure that all current MSAW systems are checked, operational and comply with all MSAW system requirements.

Indicator: As of 4/13/99, all MSAW polygons in the domestic US have been flight-checked and are operational.

Lead Organization for Overall Coordination

Lead: FAA Operational Support Service (AOS)

Supporting: Air Traffic Services (ATS), Airways Facilities (AF), and Aviation System Standards (AVN).

Programmatic Approach:

A number of documents will need to be obtained and reviewed. These will include, but may not be limited to, the associated NTSB recommendations and their action status, FAA Orders and Regulations, Air Traffic Training Bulletins, and the AOS/AVN MSAW status program. Each document will need to be reviewed for applicability to MSAW and how it relates to achieving the goal identified in the Statement of Work. In the event a deficiency is identified in any document, the necessary processes must be put into place to revise the documents and implement any system modifications to correct the deficiencies.

Key Products and Milestones:

NOTE: The Plan Lead for coordinating the development of this Implementation Plan is Joe Bracken (ALPA).

The Implementation Plan Lead (Impl Team Lead) will be the lead agency responsible for coordinating the activities of this Implementation Plan.

Activity	#Days	Start Date	End Date	COG
Implementation Plan Development	24	3/16/99	4/16/99	Plan Lead
Develop Statement of Work	3	3/16/99	3/18/99	Plan Lead
Identify Membership on Team	3	3/22/99	3/24/99	Plan Lead
Identify Skills Needed on Team	3	3/22/99	3/24/99	Plan Lead
Determine Deliverables	14	3/16/99	4/2/99	Plan Lead
Identify Resources Needed	14	3/16/99	4/2/99	Plan Lead
Obtain Necessary Documentation	7	4/5/99	4/13/99	Plan Lead
Historical NTSB MSAW Rec Status	7	4/5/99	4/13/99	Plan Lead
Current MSAW Requirements	7	4/5/99	4/13/99	Plan Lead
Current MSAW Status	7	4/5/99	4/13/99	Plan Lead
US Coverage Documentation	7	4/5/99	4/13/99	Plan Lead

Part 139 Airport Info (121 Operations)	7	4/5/99	4/13/99	Plan Lead
ATC MSAW Training Documentation	7	4/5/99	4/13/99	Plan Lead
Engineering Siting Standards for MSAW	7	4/5/99	4/13/99	Plan Lead
Identify Follow-On Actions	7	3/16/99	3/24/99	Plan Lead
Identify Ongoing Programs / Activities	7	3/16/99	3/24/99	Plan Lead
Assemble Implementation Plan Team	10	4/5/99	4/16/99	Plan Lead
IMPLEMENTATION PLAN ACTIVITIES	**14**	**4/16/99**	**5/5/99**	**Impl Team**
Review NTSB MSAW Rec Status	7	4/16/99	4/26/99	Impl Team
Review of current MSAW Requirements	14	4/16/99	5/5/99	Impl Team
"High risk airports" determination	14	4/16/99	5/5/99	Impl Team
Usage requirements	7	4/16/99	4/26/99	Impl Team
Review of Current MSAW Status	7	4/16/99	4/26/99	Impl Team
Review of Current U.S. Coverage	14	4/16/99	5/5/99	Impl Team
Review of 14 CFR Part 139 Airports	7	4/16/99	4/26/99	Impl Team
Review of CFR Part 121 Operators	7	4/16/99	4/26/99	Impl Team
Review Airports for MSAW Coverage	7	4/16/99	4/26/99	Impl Team
Review of Controller Training Guidelines	7	4/21/99	4/29/99	Impl Team
Review of Siting Stds for radar facilities	7	4/21/99	4/29/99	Impl Team
Produce Gantt Chart	3	4/19/99	4/21/99	Impl Team
Determine Impact on Non-121 & Int'l Apps	3	4/19/99	4/21/99	Impl Team

Activity	**#Days**	**Start Date**	**End Date**	**COG**
Follow-On Activities (If Necessary):	51	4/27/99	7/6/99	Impl Team
Update of Current MSAW Requirements	30	5/6/99	6/16/99	Impl Team
"High risk airports" Determination	30	5/6/99	6/16/99	Impl Team
Usage Requirements	30	5/6/99	6/16/99	Impl Team
Update of Controller Training Guidelines	30	4/30/99	6/10/99	Impl Team
Update of Siting Stds for Radar Facilities	30	4/30/99	6/10/99	Impl Team
Update Plan for New Installations	30	4/27/99	6/7/99	Impl Team
Coordinate Results w/ Int'l Authorities	14	6/17/99	7/6/99	Impl Team Lead

Schedule and Resources Graphic:

Reference Attached MSAW Implementation Plan Gantt Chart.

Plan & Execution Requirements:

To implement the associated MSAW tasks identified within this implementation plan requires resources from the following organizations:

FAA Operational Support Service (AOS)
Air Traffic Services (ATS)
Airways Facilities (AF)
Aviation System Standards (AVN)

Risk Description:

Low Risk. At this point in time, most of the identified required activities have been completed or are already in progress. At this time, it is unclear whether all of the ongoing activities will ensure compliance with the identified Statement of Work. The only concern would be any required revisions to any of the subject documentation, corrections of systemic deficiencies and the associated timeframes involved. Since domestic MSAW usage / coverage has not historically been a major point of concern, this is a low-risk concern.

Risk Mitigation Plan:

Any discrepancies found should be identified early in the documentation review process. Whatever documentation changes will then be coordinated with the necessary cognitive personnel / offices to determine the most effective way to institute the change(s). Again, there are not any concerns at this time.

Impact on Non-FAR Part 121 or International Applications:

Any changes to MSAW coverage or training program requirements will be shared with the necessary International individuals / agencies. It is unclear at this time, how the goals identified in the MSAW Statement of Work will impact the international (non-US) aviation community.

Controlled Flight Into Terrain
Joint Safety Implementation Team

Implementation Plan
For

"Airline Proactive Safety Programs (FOQA & ASAP)"

Statement of Work:

Develop and implement a mutually agreed upon methodology to use de-identified Flight Operations and Quality Assurance (FOQA), and Aviation Safety Action Partnership (ASAP) information for the purpose of proactively identifying safety related issues and corrective actions. Key to the development and implementation of this project is to ensure that legislative, regulatory and contractual actions are taken which prevent misuse of information. Included in this development and implementation of proactive safety programs are the development of analytical tools which will enable the identification of system safety deficiencies and corrective actions.

Outcomes/Benefits:

Give operators the tools to enable them to identify safety issues and trends, and identify and initiate corrective actions prior to an accident occurrence.

Outputs:

1. Standards of Appropriate Data Use - As outlined in the "Statement of Work", the key to implementation of this plan is to ensure that legislative, regulatory and contractual actions occur which prevent the use of collected information for punitive or legal purposes. It is recognized that rulemaking may be required in order to establish appropriate standards for use of collected data. Further, while some of these actions may be outside the direct responsibility of CAST, it may be up to CAST to exercise its' influence in order to develop and establish those standards.
   Resources: FAA (AFS, AGC, ASY), Operators (ATA, RAA), Employee Groups
   Time to Complete: 270 days
   Actions: FAA AFS and AGC to work with industry groups to draft and issue a NPRM preventing use of data collected under FOQA and ASAP programs in certificate actions against the airlines or their employees.
   Employee groups (ALPA, APA, IAM) to work with operators (ATA, RAA) to draft contractual language to prevent the use of FOQA or ASAP information as a basis for disciplinary actions.

Operators (ATA, RAA) to work with Employee groups (ALPA, APA, IAM) to develop on push legislative language to exempt FOQA and ASAP information from FOIA disclosure and prevent misuse of FOQA and ASAP information.

2. Guidance material outlining standards for the establishment of FOQA and ASAP programs. This material must include adequate guidance regarding the establishment and implementation of the program, an outline for the role of the regulatory agency and employee groups in the program, and minimum standards and components for the analytical tools and methods that could be used to identify safety trends. Also included is a method and process to recommend and obtain approval for corrective actions.
   Resources: FAA (AFS, ASY, AGC), Operators (ATA, RAA), Employee Groups, aircraft manufacturers & equipment vendors
   Time to Complete: 180 days
   Actions: Industry - Form FOQA and ASAP Steering Committees comprised of government and industry representatives, endorsed by FAA, which would be available to provide guidance to operators regarding the implementation of FOQA and ASAP programs (mentoring). Each steering committee would be responsible for the development and establishment of standards for FOQA and ASAP programs. In addition, each steering committee is to document those standards for FOQA and ASAP programs.
   FAA – Convene a group of the referenced organizations to draft and coordinate Advisory Circulars for FOQA and ASAP. Lead organization for FOQA AC is AFS-230 and for ASAP AC is ASW-201B. A draft FOQA AC exists but is tied to the FOQA final rule. A re-draft of the ASAP AC began in April 1999 with scheduled completion in September 1999.

3. Guidance material for FAA Flight Standards personnel in the form of Handbook Bulletins (HBAT) to insure consistent application of the advisory material regarding the approval of and participation in proposed FOQA & ASAP programs.
   Resources: FAA AFS, Operators (ATA, RAA), Employee Groups
   Time to Complete: 60 days after completion of FOQA and ASAP program guidance documentation
   Actions: FAA – Convene a group of the referenced organizations to draft HBAT guidance regarding approval of FOQA & ASAP programs. FAA AFS-1 is the lead organization for HBAT development.

4. Guidance documentation outlining voluntary procedures and protocols for the sharing of trend information or corrective actions amongst the user community. Progress on this product is extremely dependent on the development and implementation of the protective provisions outlined earlier.
   Resources: Operators (ATA, RAA), Employee groups, FAA ASY
   Time to Complete: 24 months after data protections are implemented
   Actions: Operators (ATA, RAA) and Manufacturers (AIA) develop a process to identify and communicate "Hot Topic" items of focus or review that could be monitored for a specific time frame.
   The GAIN steering committee, in conjunction with NASA and FAA AFS, should draft and coordinate guidance material regarding the sharing of trend information and corrective actions developed from FOQA and ASAP programs. This guidance material should also identify potential

venues that could be used to facilitate the sharing of this information. An example would include the ATA FOQA Task Force.

5. During the course of the CFIT JSAT and JSIT it became clear that had FOQA or ASAP data been available for analysis, more detailed root cause analysis may have been possible. This in turn may have resulted in the development of additional interventions, and greater substantiation for the interventions identified. While a number of FOQA and ASAP programs have matured to the point where useful information is being developed, additional software tools are needed that can be applied to FOQA and ASAP data to more easily extract and analyze safety trend information. Importantly, these programs could and should be able to be readily conducted by both large and small operators for a continual assessment of flight operations. Further, guidance material should be developed that outlines the basic considerations needed for an operator to tailor FOQA and ASAP programs and tools for that operators' equipment, operating environment, and available resources.

   Resources: NASA, Operators (ATA, RAA), Employee groups, Flight Safety Foundation (FSF), FAA (AFS, ASY, ATC), Airframe Manufacturers and Equipment Suppliers
   Time to Complete: 270 days
   Actions: Flight Safety Foundation – Continue to promote and advertise FSF FOQA overview documentation.

   ATA & RAA – Through the FOQA task force draft and coordinate documentation outlining suggested methods and procedures regarding key components of analysis and trend identification programs and suggested items to monitor in FOQA and ASAP programs.

   FAA & NASA - Publish results of studies reviewing existing FOQA and ASAP programs and the analysis tools those existing programs employ.

   NASA - Undertake studies to develop analytical tools and methods that both large and small operators could apply to FOQA and ASAP information.

Relationship to Current Aviation Community Initiatives:

A number of years ago, as US aviation industry began exploring the potential safety benefits of FOQA and ASAP programs, an industry/government FOQA and ASAP Task Forces were formed. In the years since its formation, this task force has been active in initiating and promoting the majority of the activities outlined below.

Standards of Appropriate Data Use

- Administrators policy letter issued December 2, 1998. Industry found this policy letter acceptable until it can be replaced by more formal actions precluding the FAA from using FOQA and ASAP data in enforcement actions against airlines or their employees.
- In 1998 legislation was passed giving the FAA Administrator the ability to designate that information voluntarily submitted to FAA could be exempted from FOIA.
- Draft legislation attached to the FAA re-authorization bill would require rulemaking eliminating punitive use of information collected by FOQA and ASAP programs.
- FOQA NPRM prohibiting punitive use of FOQA and ASAP information by FAA. Draft rule held up in legal review by DOT legal conducting cross agency coordination. Justice Department is afraid that FOQA rule would be precedent setting.
- NTSB re-authorization legislation gives NTSB the option of non-disclosure of safety information voluntarily submitted to NTSB during the investigation of an accident.
- Through funding made available by the FOQA Demonstration project, 6 to 8 airlines have developed and implemented FOQA programs. Based on experience with these programs, these airlines have developed procedures and guidelines regarding control, access, and retention of information collected in order to protect and prevent potential misuse of the information.
- Flight Safety Foundation undertook a study of FOQA programs and outlined in a report the key components of any program and the necessity for data retention standards at various levels and how those standards can be maintained.
- Draft contractual language preventing use of FOQA and ASAP information as a basis for disciplinary action has been developed and is available for use.

Guidance Material for establishment of FOQA and ASAP Programs

- In 1994, one airline developed and implemented an ASAP program, as this program matured and evolved it has become the model for an ideal program.

- On January 8, 1997, FAA released Advisory Circular 120-66 regarding ASAP programs. Unfortunately, industry found this AC unacceptable since it outlined certificate action steps the FAA could follow if any incidents or reports involved possible FAR violations. Provisions in this AC to allow FAA to use voluntarily submitted safety reports as evidence in enforcement proceedings makes programs established under this AC unacceptable. As a result, no new, formal, ASAP programs have been approved by FAA or implemented by operators.
- In April 1999, FAA Administrator announced a commitment to draft a new ASAP Advisory Circular.
- FAA has drafted a FOQA Advisory Circular. The release of this AC is tied to the release of the FOQA NPRM discussed previously.

Guidance Material for FAA Flight Standards Personnel regarding approval of, and participation in, proposed programs.

- Advisory Circular 120-66 issued January 8, 1997. See above.
- FAA is currently drafting a handbook bulletin regarding ASAP and the key components and benefits of the program.
- With the issuance of AC 120-66, FAA AFS also issued a HBAT to flight standards personnel providing guidance for the approval of ASAP programs.
- With the April 1999 commitment to re-draft the ASAP AC, FAA also committed to revise the HBAT guidance material for Flight Standards approval of ASAP programs.

Analytical Tool Development

- A number of industry organizations (example FSF) have studied operational FOQA programs and have reported on the key analytical tools used to identify safety trends.
- The FOQA Demonstration Program referred to previously has given participating operators an opportunity to develop and refine data analysis tools and tailor those tools to the airlines specific operation. The lessons learned by these operators are available to others considering FOQA program implementation.
- A number of FOQA equipment vendors have developed analytical tools which are available for purchase.
- NASA has initiated a number of programs under their Aviation Safety Program which are tasked with the development of analytical tools and monitoring methods to identify safety trends.

Sharing of Trend Information

- During the past few years industry and government have been active in a number initiatives regarding data protection, data de-identification, data analysis and trend identification, and the possible sharing of safety related information. Examples include GAIN, ASRS, BASIS SIE and APMS.
- NASA has been attempting to develop an infrastructure that would facilitate the sharing of safety information.

Performance Goals & Indicators for Outcomes/Outputs:

For these Outputs to be successful in achieving the 2007 goal, Airlines operating under FAR 121 and the FAA need to establish FOQA and/or ASAP type programs by January 2003.

Note: Some operators may not have the capability necessary to implement both.

Responsible Organizations for Coordination:

The development and implementation of FOQA and ASAP programs to date have been accomplished by a cooperative partnership process. The continual development and implementation of these programs, because

of the sensitive nature of the information collected, is dependent on the continued use of this partnership approach.

Programmatic Approach:

A review of current, formal, programs underway within and outside the US was undertaken in order to identify the key components, issues, and benefits of implementing FOQA and ASAP programs. In addition, with each of these programs, both the regulatory and philosophical environment were also reviewed. Based on this review it was found that legislative actions and rulemaking to ensure the appropriate use of the data collected and prohibit misuse was needed. In addition, because of the complexity of each of these programs, detailed advisory material would have to be developed which provides sufficient guidance regarding the establishment and conduct of any proposed program and the analysis and use of the data retained.

Key Products and Milestones:

Develop Statement of Work	3d	Tue 03/16/99	Thu 03/18/99	Hagy
Identify Interested Parties	1d	Wed 03/17/99	Wed 03/17/99	Hagy/JSIT
Identify Membership on Team	3d	Tue 03/16/99	Thu 03/18/99	Hagy
Obtain Membership Commitment	25d	Tue 03/22/99	Fri 04/23/99	Hagy/CAST
Obtain Membership Commitment	25d	Mon 03/22/99	Fri 04/23/99	Hagy/CAST
Identify Skills Needed	3d	Tue 03/16/99	Thu 03/18/99	Hagy/JSIT
Determine Deliverables	3d	Wed 03/16/99	Thu 03/18/99	Hagy/JSIT
Identify Assumptions	3d	Tue 03/16/99	Thu 03/18/99	Hagy/JSIT
Identify Constraints/Obstacles	3d	Tue 03/16/99	Thu 03/18/99	Hagy/JSIT/ CAST
Identify # Meeting Needed	1d	Fri 04/30/99	Fri 04/30/99	Impl Team
Identify Follow-on Actions	1d	Fri 04/30/99	Fri 04/30/99	Impl Team
Ongoing Programs/Activities	3d	Fri 04/30/99	Thu 05/06/99	Impl Team
Identify (Imple) Resources Needed	3d	Fri 04/30/99	Thu 05/06/99	Impl Team
Determine Timeline	3d	Fri 04/30/99	Thu 05/06/99	Impl Team

Plan/Execution Requirements

Industry and government must be willing to commit the staffing, costs and political leverage resources to support ASAP and FOQA development and implementation. Key to this development and implementation is establishing the appropriate data use standards necessary to facilitate the collection of useful ASAP and FOQA data. These standards may also facilitate the open sharing of information.

Plan Development

The following organizations participated in the development of the Detailed Implementation Plain (DIP).

FAA	ALPA	USAirways
- AFS		
- ASY		
NASA	APA	United Airlines
ATA	American Airlines	Comair Airlines
FSF	CFIT JSIT	

Plan Implementation

To implement the "Airline Proactive Safety Programs" detailed plan requires resources from the following organizations.

FAA	Labor Assn	Airlines
- AFS	- Pilots	ATA
- AGC	- Mechanics	RAA
- ASY	- Controllers	
- ATC		
NASA	FSF	Equipment Vendors
DOT GC		

Risk Description:

High risk. Without the ability to implement these programs, industry will lose the opportunity to perform proactive safety analysis on a full range of operational issues. Given the current "legal" environment regarding data collection and use, and potential punitive actions coupled with the resistance within some organizations of the government, the probability of widespread implementation of detailed FOQA and ASAP programs is low.

Risk Mitigation Plan:

Identify ways, procedures and protocols, to implement components of FOQA and ASAP programs that are not reliant on data use restrictions. Efforts could be undertaken to identify which components could be implemented, or what procedures could be employed to mitigate the lack of data restrictions. This will be difficult and will result in limiting the quality of data collected. This in turn will narrow the scope of the usefulness of the program.

Impact on Non-FAR Part 121 or International Applications:

Lessons learned from FOQA and ASAP programs by airlines can, and should be, transferred to code sharing partners if applicable. The code sharing partners should be encouraged to review those corrective actions for applicability and implement the "lessons learned" were appropriate.

JSAT Effectiveness	Average Feasibility	Intervention #		Project Identifier	Effectiveness X Feasibility
			CFIT JSAT Interventions - Grouped by Potential Projects		
Aircraft Equipment (3, 4, 14, 16, 27, 35, 45, 49, 53, 60, 73, 76, 103, 127)					
			Terrain Awareness and Warning System (TAWS)		
			Intervention #35 from this project has the second highest ExF value of all interventions. While the JSIT was instructed to focus on U.S. interventions, this should positively effect foreign carriers and operations.		
2.93	2.17	35	Manufacturers should install TAWS-EGPWS in all new aircraft, airlines/operators should retrofit TAWS-EGPWS into the existing fleet and international regulators should require the installation of TAWS-EGPWS. (United States)	TAWS	6.35
			NPRM issued. Final rule to be drafted and published by AIR-130. Final rule expected by 1st Quarter 2000. 5 years after signing of the final rule all US carriers will meet TAWS requirements		
2.93	1.50	35	Manufacturers should install TAWS-EGPWS in all new aircraft, airlines/operators should retrofit TAWS-EGPWS into the existing fleet and international regulators should require the installation of TAWS-EGPWS. (International)	TAWS	4.40
			No formal action. However, carriers operating under Part 121 which also fly international routes will be equipped with TAWS. Also, code-sharing agreements with foreign airlines may contain safety equipment provisions. ICAO suppotrs our TAWS rule and will inact similar mearsures.		
0.56	1.67	60	Avionics manufacturers should improve GPWS capability to reduce GPWS false warnings. (60)	TAWS	0.93
			TAWS TSO is expected by 2nd Quarter 2000. Should reduce or eliminate the false warning problem experienced in the past will older GPWS equipment. When TAWS rule is introduced, the GPWS Mark I-IV will be removed from service.		
			Flight Deck Equipment Upgrade/Installation		
			ExF values for all interventions in this project were in the bottom one-third of the total list. All interventions were characterized by low effectiveness ratings.		
0.61	2.17	16	Manufacturers should ensure that automated systems provide the flight crew with sufficient information (automation feedback) to prevent mode confusion. (16)	FDEU	1.32
			Addressed by Flight Guidance WG and ATA Automation Subcommittee. NASA Aviation Safety Program activity within Single Aircraft Accident Prevention Project.		
0.48	2.67	4	Ensure FMS depiction is consistent with approach plate presentation. (4)	FDEU	1.28
			Chart Database and Avionics Harmonization an ATA FMS/RNAV taskforce subgroup has identified over 120 inconsistencies and plan to identify responsible organizations for corrections.		
0.73	1.67	14	Install aural warning devices on aircraft to alert flight crew of arrival at MDA/DH. (14)	FDEU	1.22
			These devices exist in some aircraft models, however, their use is dependent upon the operators.		

0.52	2.33	45	Manufacturers should ensure that all equipment failures that may affect the safe operation of the flight are properly enunciated to the flight crew. (45)	FDEU	1.21
			Addressed for new equipment by Regulation. Also addressed by Avionics HARM WG. NASA Aviation Safety Program activity within Single Aircraft Accident Prevention Project.		
0.73	1.50	3	Ensure that failure of the aircraft system to capture glideslope (or VNAV) is adequately enunciated to the flight crew. Visual (3)	FDEU	1.10
			No known activities.		
0.70	1.33	3	Ensure that failure of the aircraft system to capture glideslope (or VNAV) is adequately enunciated to the flight crew. Aural (3)	FDEU	0.93
			No known activities.		
0.00	1.50	76	The manufacturer of the FMS should ensure that the FMS logic displays NAVAIDís with the same identifier in a progressive distance manner. (76)	FDEU	0.00
			Addressed by FMS Task Force. Follows an NSTB safety recommendation.		
			FMS Installation/Maintenance		
			ExF values for all interventions in this project were in the bottom one-third of the total list. All interventions were characterized by low effectiveness ratings.		
0.61	2.83	53	Airlines/operators should install FMS equipment (logic) which has the capability to depict previously entered waypoints that are between the current present position and the current "to" way point. (53)	FMS	1.73
			NTSB safety recommendation. Some new aircraft configurations have this feature.		
0.31	3.00	73	Airlines/operators should ensure that the aircraft is equipped with all expected NAVAID frequencies. United States (73)	FMS	0.93
			No known activities.		
0.51	1.67	127	Airlines/operators should install FMS equipment (logic) which has the capability to depict previously entered waypoints behind the aircraft's flight path. (127)	FMS	0.85
			NTSB Safety recommendation. No known activity.		
0.28	3.00	51	Airlines/operators should ensure the currency of the FMS database and update as appropriate. (51)	FMS	0.84
			Completed by standard. FMS database is to be updated at the same time as the paper charts.		
0.31	2.33	73	Airlines/operators should ensure that the aircraft is equipped with all expected NAVAID frequencies. International (73)	FMS	0.72
			No known activities.		

		Aircraft Maintenance & Health Monitoring:			
			ExF values for all interventions in this project were in the bottom one-third of the total list. All interventions were characterized by low effectiveness ratings.		
0.42	2.83	27	Airlines/operators should implement maintenance procedures to ensure proper functioning of the CVR at all times. (Note: This intervention was recorded as a potential intervention for future accidents; it would not have prevented the subject accidents.)	HUMS	1.19
			No known activities.		
0.49	1.33	103	Manufacturers should develop and implement system failure annunciation capabilities to alert flight crews of pending failures (e.g., HUMS). (103)	HUMS	0.65
			NASA Aviation Safety Program activity within Single Aircraft Accident Prevention Project.		
0.48	1.33	49	Regulatory agencies should establish criteria for, and manufacturers should evaluate and improve, the reliability and failure tolerance of flight systems. (49)	HUMS	0.64
			NASA Aviation Safety Program activity within Single Aircraft Accident Prevention Project.		
0.18	2.83	68	Manufacturers should implement a system to identify the recommended implementation schedule and priority of aircraft and operational changes. (68)	HUMS	0.51
			No known activities.		
0.26	1.83	98	Airlines/operators and regulatory agencies should review procedures to ensure that design changes (service bulletins) to flight critical systems are incorporated in a timely manner. (98)	HUMS	0.48
			No known activities.		
Airline Data Collection & Analysis (1, 54, 55, 56, 57)					
		FOQA			
			Combination of high effectiveness and high feasibility (and the resultant high values of ExF) for two of these interventions resulted in a recommendation that this project be implemented.		
1.81	2.33	56	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs to identify systemic procedural deviations. USA (56)	FOQA	4.22
			NASA to undertake studies to develop analysis tools and methods toapply to FOQA information.		
1.61	2.33	54	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs. USA (54)	FOQA	3.76
			Draft FOQA NPRM to prevent use of data in enforcement actions to be completed in 270 days.		
1.26	2.33	55	Airlines/operators should implement a Flight Operations Quality Assurance (FOQA) program to identify flight crew failure to respond to GPWS warnings. USA (55)	FOQA	2.94
			No formal action. Data could be recorded as one parameter of FOQA.		

		Other			
			The following interventions, while having low effectiveness and low ExF values, were included in the above FOQA project because of their similarities and ease of incorporation in the project.		
0.99	2.83	1	Airlines/operators should implement an Airline Safety Incident Reporting System (e.g., BASIS, ASAP). (1)	Other	2.81
			Draft ASAP NPRM to prevent use of data in enforcement actions to be completed in 270 days.		
0.79	2.83	57	Airlines/operators, regulatory agencies, and manufacturers should implement a program designed for sharing of safety related information within the aviation community. (57)	Other	2.24
			ATA to draft guidance material regarding voluntary sharing of trend information within 24 months of passage of protective legislation.		
Approach Position Awareness (59, 77, 85, 125, 126)					
		Precision Approach Implementation			
			Intervention #59 (and the accompanying intervention generated by the JSIT) have the highest ExF value of all interventions. Therefore, the project was considered to be high priority and implementation plans developed.		
2.20	3.00	59	Enable all FMS equipped aircraft to utilize LNAV/VNAV in stabilized (constant angle/constant rate) approach procedures.	PAI	6.60
			Part of Precision-Like Approach Implementation, "21st Century Instrument Approaches."		
2.20	3.00	59	Amend all non-precision approach plates to incorporate stabilized constant angle/constant rate approach procedures.	PAI	6.60
			TERPS Order 8260.3B, Change 17.		
2.20	2.00	59	Implement precision approach capability (glideslope guidance) for all runways without established precision approach procedures (e.g., ILS, DGPS, etc.). (59)	PAI	4.40
			Part of Precision-Like Approach Implementation, "21st Century Instrument Approaches."		
1.39	2.17	77	Eliminate non-precision approaches where possible. (77)	PAI	3.01
			Instead of eliminating NPA, the PAI project will implement precision-like approaches for all runways.		
0.60	1.83	32	In the absence of GPS, regulatory agencies should install DME equipment at all appropriate airports. (32)	PAI	1.10
			Part of Precision-Like Approach Implementation, "21st Century Instrument Approaches."		
		Precision Approach Usage			
		125	Moved to ATC CFIT Training		
		126	Moved to Operational Procedures for CFIT Prevention		

		Synthetic Vision			
			While the effectiveness rating for this intervention was among the highest for all interventions, the feasibility of implementation, particularly in time to effect the safety goal, was determined to be low. Because of the potentially high safety leverages, these interventions are highly recommended as research efforts.		
2.22	1.50	85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in non-glass aircraft. (85)	Syn	3.33
			Being addressed by NASA Aviation Safety Program in the Synthetic Vision Project. Recommended by the CFIT JSIT for continued research.		
2.22	1.50	85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in new production aircraft. (85)	Syn	3.33
			Being addressed by NASA Aviation Safety Program in the Synthetic Vision Project. Recommended by the CFIT JSIT for continued research.		
2.22	1.33	85	The aviation industry should develop, certify, and implement synthetic vision capability (e.g., Precision Approach Terrain Information (PATI)) in existing glass aircraft. (85)	Syn	2.96
			Being addressed by NASA Aviation Safety Program in the Synthetic Vision Project. Recommended by the CFIT JSIT for continued research.		
ATC Training (10, 11, 12, 13, 106, 108, 124)					
		106	Moved to Pilot/ATC Communication Enhancement		
		ATC CFIT Training			
			Combination of high effectiveness and high feasibility (and the resultant high values of ExF) for the first of these interventions resulted in a recommendation that this project be implemented. The accompanying interventions, while having low effectiveness and low ExF values, were included in the above project because of their similarities and ease of incorporation in the project.		
2.09	3.00	124	ATC should implement a Quality Assurance program to ensure adherence to established procedures. (124)	ATC CFIT-T	6.27
			ATB to be issued 12/99.		
1.19	2.67	12	Air Traffic service providers should emphasize in ATC training the controllers' potential in assisting the flight crew in improving their situation awareness. (12)	ATC CFIT-T	3.17
			ATB to be issued 12/99.		
0.95	2.83	126	ATC should prioritize the use of precision approaches (glideslope guidance) when available and appropriate. (126)	ATC CFIT-T	2.69
			ATB to be issued 12/99.		
1.00	2.67	10	Air Traffic service providers should train Air Traffic Controllers to use all available tools to establish aircraft position (example: don't fixate on just DME). (10)	ATC CFIT-T	2.67
			ATB to be issued 12/99.		
0.86	2.67	13	Air Traffic service providers should enhance ATC training to emphasize the dangers of rushed approaches and performance characteristics of modern jet transports. (13)	ATC CFIT-T	2.29

			ATB to be issued 12/99.		
0.40	2.83	108	Air Traffic service providers should implement and/or review procedures to ensure ATC training does not create a hazard to flight operations. (108)	ATC CFIT-T	1.13
			ATB to be issued 12/99.		
0.19	2.83	11	Air Traffic service providers should implement procedures that ensure that ATC trainees are always supervised. (11)	ATC CFIT-T	0.54
			ATB to be issued 12/99.		
Charting (5,6,8,74)					
			ExF values for all interventions in this project were in the bottom one-third of the total list. All interventions were characterized by low effectiveness ratings.		
1.20	2.67	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Paper Charts USA (5)	Chart	3.20
			FAA evaluating AIS/MAP study group ICAO draft SARP which would require color terrain depiction on approach plates.		
1.20	2.50	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Electronic Charts USA(5)	Chart	3.00
			No known activities.		
1.20	2.50	8	Standardized information included and contained on approach plates. Paper charts, USA	Chart	3.00
			IACC Specs set standard symbology for paper charts.		
1.20	2.17	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Paper Charts International (5)	Chart	2.60
			ICAO.		
1.20	2.17	8	Standardized information included and contained on approach plates. Paper charts, Intl.	Chart	2.60
			ICAO.		
1.20	2.17	8	Standardized information included and contained on approach plates. Electronic charts, USA.	Chart	2.60
			SAE-G10 ARP document that gives standard symbology.		
1.20	2.00	5	Regulatory agencies should mandate that approach plates show color contours for terrain. Electronic Charts International (5)	Chart	2.40
			No known activities.		
1.20	2.00	8	Standardized information included and contained on approach plates. Electronic charts, Intl.	Chart	2.40
			No known activities.		
0.93	2.17	6	Standardized depiction of the information on all approach plates by the publishers. Paper Charts, USA (6)	Chart	2.02
			No known activities.		
0.93	2.17	6	Standardized depiction of the information on all approach plates by the publishers. Electronic Charts, USA (6)	Chart	2.02
			SAE-G10 ARP document that gives standard symbology.		
0.93	2.00	6	Standardized depiction of the information on all approach plates by the publishers. Paper Charts, Intl (6)	Chart	1.86
			No known activities.		
0.93	2.00	6	Standardized depiction of the information on all approach plates by the publishers. Electronic Charts, Intl (6)	Chart	1.86
			No known activities.		

0.31	2.33	74	Regulatory agencies should review and where appropriate eliminate duplicate NAVAID identifiers within the same geographic area. (74)	Chart	0.72
			FAA and ICAO.		
Flight crew Training (7, 15, 17, 20, 23, 25, 26, 47, 52, 62, 64, 67, 75, 82, 89, 96, 100,					
			105, 107, 110, 111, 112, 113, 114, 115, 116, 117)		
		Training - Approach & Missed Approach			
			These interventions initially started out as a separate Program Area. Because of their similarity with SOP, they were grouped into that Program Area.		
1.90	2.83	7	Airlines/operators should ensure that their training/standardization programs emphasize review of approach and missed approach procedures. (7)	A&MA-T	5.38
1.73	2.83	96	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate approach preparation and contingency review prior to commencing an approach. (96)	A&MA-T	4.90
1.33	2.83	89	Airlines/operators and regulatory agencies should ensure that the frequency and effectiveness of proficiency checks for non-precision approaches are adequate. (89)	A&MA-T	3.77
			FAA REWRITE		
1.33	2.67	115	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of rushed approaches. (115)	A&MA-T	3.55
0.68	2.83	116	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of high rate of descent and unstable approaches. (116)	A&MA-T	1.93
		Training - CFIT Prevention			
			Combination of high effectiveness and high feasibility (and the resultant high values of ExF) for six of these interventions resulted in a recommendation that this project be implemented. The CFIT Education and Training Aid (on the WWW)and Handbook Bulletin 99-08 will address all of these interventions as a minimum for completion of this Project Area.		
2.18	2.83	47	Airlines/operators should ensure that their training/standardization programs direct the flight crews to use all available tools (charts) to establish aircraft position. (47)	CFIT-T	6.18
1.99	2.83	64	Airlines/operators should ensure that their training/standardization programs direct the flight crews to regularly cross check all instrumentation. (64)	CFIT-T	5.64
1.95	2.83	75	Airlines/operators should ensure that their training/standardization programs direct that flight crews use all available tools to establish aircraft position. (75)	CFIT-T	5.53
1.73	2.83	100	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adhering to MDA/DH. (100)	CFIT-T	4.90

1.67	2.83	110	Airlines/operators and regulatory agencies should ensure that their training/standardization and monitoring programs emphasize the importance of adherence to standard operating procedures and identify the rationale behind those procedures. (110)	CFIT-T	4.73
1.64	2.83	17	Airlines/operators should ensure that their training/standardization programs emphasize the importance of all flight related briefings. (17)	CFIT-T	4.65
1.38	2.67	111	Airlines/operators should ensure that their training/standardization programs emphasize basic airmanship skills and knowledge during initial and recurrent training. (111)	CFIT-T	3.68
0.90	2.67	112	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for simulated instrument failures (partial panel) are adequate. (112)	CFIT-T	2.40
0.84	2.83	113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning. (113)	CFIT-T	2.38
0.85	2.67	105	Airlines/operators should train flight crews on how flight delays (weather, maintenance, ATC, etc.) can effect their subsequent decision making relative to the safe conduct of the flight. (105)	CFIT-T	2.27
0.78	2.83	67	Airlines/operators should require flight crews to perform non-FMS (raw data) approaches during proficiency/recurrent check rides. (67)	CFIT-T	2.21
0.66	2.83	62	Airlines/operators should ensure that their training/standardization programs establish flight crew proficiency in all uses of the HSI display. (62)	CFIT-T	1.87
0.69	2.67	15	Airlines/operators should ensure that their training/standardization programs instruct when to disengage automated systems and fly manually. (15)	CFIT-T	1.84
0.60	2.83	52	Airlines/operators should ensure that their training/standardization programs establish flight crew proficiency in the use of the FMS system. (52)	CFIT-T	1.70
0.55	2.83	114	Airlines/operators should ensure that their training/standardization programs provide an appropriate minimum amount of standard training. (114)	CFIT-T	1.56
0.53	2.67	117	Airlines/operators should ensure that their training/standardization programs instruct that ground proximity escape maneuvers are to be conducted with the aircraft properly configured (e.g., speedbrakes retracted). (117)	CFIT-T	1.41
			The TAWS rule specifically requires the AFM's to contain this information for new aircraft, existing aircraft AFM's will be revised to contain information.		
		Training - CRM			
			Combination of high effectiveness and high feasibility (and the resultant high values of ExF) for four of these interventions resulted in a recommendation that this project be implemented.		
1.73	2.83	107	Airlines/operators should ensure that their CRM training/standardization program emphasizes the importance of the team concept. (107)	CRM-T	4.90

1.63	2.83	82	Airlines/operators should clearly define, train and check the specific PF/PNF duties. (82)	CRM-T	4.62
1.65	2.67	25	Airlines/operators should establish a CRM training program. (25)	CRM-T	4.40
1.50	2.83	23	Airlines/operators should ensure that regularly scheduled recurrent training (e.g., LOFT) emphasizes crew cooperation and working together to maximize safe operations. (23)	CRM-T	4.25
1.18	2.83	20	Airlines/operators should ensure that command oversight training for captains is provided during the upgrade process and in recurrent training. (20)	CRM-T	3.34
0.81	2.50	26	Airlines/operators should ensure that CRM training is provided prior to line flying. (26)	CRM-T	2.03
Ground Equipment (32, 58, 71, 72, 93, 121, 94)					
		58	Moved to Datalink Enhancement		
		94	Moved to Datalink Enhancement		
		93	Moved to Pilot/ATC Communication Enhancement		
		32	Moved to Approach Position Awareness		
		MSAW			
			Combination of high effectiveness and high feasibility (and the resultant high values of ExF) for the first of these interventions resulted in a recommendation that this project be implemented.		
1.98	3.00	71	Review the engineering standards for the sighting of future Terminal Radar Systems to ensure the maximum effectiveness of MSAW is available. (71)	MSAW	5.94
			All MSAW facilities have had an initial flight-check and are on schedule for re-validation every 540 days.		
2.33	1.50	72	Install MSAW-like capabilities world-wide with emphasis on high-risk airports. (72)	MSAW	3.50
			ICAO. Where there are FAA installations, flight checks have been completed.		
		Surveillance Radar			
			ExF value for the intervention in this project was below the established cutoff.		
1.17	1.50	121	Implement worldwide surveillance radar (example: ADS/B). (121)	Radar	1.76
Pilot/Controller Communication (28, 29, 40, 122, 41, 42, 83, 88, 21)					

		Pilot/ATC Communication Enhancement			
			Some of the following interventions, while having low effectiveness and low ExF values, were included in the ATC CFIT Training project because of their similarities and ease of incorporation in the project.		
1.46	2.83	41	Airlines/operators and air traffic service providers should train flight crews and controllers to ICAO standards to ensure fluency/proficiency in the use of the ICAO phraseology. Intl.(41)	Pilot/ATC	4.14
1.39	2.83	106	Train and monitor ATC adherence to established communications procedures. USA (106)	Pilot/ATC	3.94
			ATB to be issued 12/99.		
1.39	2.83	106	Train and monitor ATC adherence to established communications procedures. Intl. (106)	Pilot/ATC	3.94
			No known activities.		
1.45	2.67	42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology. USA (42)	Pilot/ATC	3.87
			Harmonization activities underway.		
1.45	2.67	42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology. Intl. (42)	Pilot/ATC	3.87
			Harmonization activities underway.		
1.32	2.83	21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flight crews is occurring. USA (21)	Pilot/ATC	3.74
			ATB to be issued 12/99.		
1.32	2.67	21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flight crews is occurring. Intl. (21)	Pilot/ATC	3.52
1.33	2.50	83	Develop additional ICAO phraseology for flight crew/air traffic service to address communication regarding aircraft position, equipment status, and communication which is not consistent with the situation or with expected responses. Intl. (83)	Pilot/ATC	3.33
1.08	2.67	40	Airlines/operators and air traffic service providers should ensure fluency/proficiency in the use of basic English language. USA (40)	Pilot/ATC	2.88
			FAA Office of Aviation Research conducting English language proficiency study.		
1.08	2.67	40	Airlines/operators and air traffic service providers should ensure fluency/proficiency in the use of basic English language. Intl. (40)	Pilot/ATC	2.88
1.02	2.67	88	Airlines/operators should train and monitor flight crew compliance with established communication phraseology guidelines. Intl. (88)	Pilot/ATC	2.72
1.33	1.67	83	Develop additional ICAO phraseology for flight crew/air traffic service to address communication regarding aircraft position, equipment status, and communication which is not consistent with the situation or with expected responses. USA (83)	Pilot/ATC	2.22

			International harmonization effort underway through ATP 110.		
1.02	2.00	88	Airlines/operators should train and monitor flight crew compliance with established communication phraseology guidelines. USA (88)	Pilot/ATC	2.04
1.46	1.33	41	Airlines/operators and air traffic service providers should train flight crews and controllers to ICAO standards to ensure fluency/proficiency in the use of the ICAO phraseology. USA (41)	Pilot/ATC	1.95
0.53	3.00	93	Improve the real time radio communication of critical airport and weather information. Intl. (93)	Pilot/ATC	1.59
0.53	2.67	93	Improve the real time radio communication of critical airport and weather information. USA (93)	Pilot/ATC	1.41
			AWOPS program - ATB (reminder to communicate prior to approach clearance)		
		Datalink Enhancement			
			The first of these interventions has a high effectiveness and middle feasibility, resulting if a high ExF. Initial studies are being conducted as part of the SF21 program. Other interventions in this project are part of R,E&D activities in the FAA and NASA.		
2.22	2.00	58	Establish GPS datalink to relay aircraft position to ATC. USA (58)	Data	4.44
			Future introduction of ADS-B. Recently tested in Ohio Valley by FAA, NASA, and CAA.		
2.22	1.50	58	Establish GPS datalink to relay aircraft position to ATC. Intl. (58)	Data	3.33
1.41	2.17	122	Implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications. USA (122)	Data	3.06
			Part of the FAA CPDLC program which was initiated in Miami.		
1.41	1.50	122	Implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications. Intl. (122)	Data	2.12
0.93	1.50	28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft. Intl. (28)	Data	1.40
0.87	1.33	29	Implement transmission of ATC instructions (between the ground and aircraft) via a computer link that would allow downloading to the FMS. Intl. (29)	Data	1.16
0.93	1.17	28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft. USA (28)	Data	1.09
			Part of the FAA CPDLC program which was initiated in Miami.		
0.87	1.17	29	Implement transmission of ATC instructions (between the ground and aircraft) via a computer link that would allow downloading to the FMS. USA (29)	Data	1.02
			Part of the FAA CPDLC program which was initiated in Miami.		
0.53	1.50	94	Implement real time (digital) transmission of airport and weather information to the aircraft. USA (94)	Data	0.80

			Included in the FAA Aviation Weather Research Program, FAA Flight Information Services program and NASA Aviation Safety Program.		
0.53	1.33	94	Implement real time (digital) transmission of airport and weather information to the aircraft. Intl. (94)	Data	0.71
Regulatory (98, 2, 37, 48, 68, 70, 80)					
		98	Moved to Aircraft Maintenance and Health Monitoring		
		2	Moved to Policies for CFIT Prevention		
		37	Moved to Policies for CFIT Prevention		
		48	Moved to Policies for CFIT Prevention		
		68	Moved to Aircraft Maintenance and Health Monitoring		
		70	Moved to Policies for CFIT Prevention		
		80	Moved to Operational Procedures for CFIT Prevention		
Standard Operating Procedures (19, 22, 24, 30, 31, 36, 46, 50, 51, 61, 63, 66, 78, 79, 90,					
			91, 95, 99, 101, 120, 123)		
		51	Moved to FMS Installation/Maintenance		
		Operational Procedures for CFIT Prevention			
			Combination of high effectiveness and high feasibility (and the resultant high values of ExF) for three of these interventions resulted in a recommendation that this project be implemented. Some of these interventions already exist as rules.		
1.89	2.67	19	Airlines/operators should implement a procedure to climb to a minimum safe altitude when position uncertainty exists by at least one crew member. Flight crew must advise ATC of intentions. (19)	SOP-CFIT	5.04
1.50	2.83	61	Airlines/operators (and manufacturers in the airplane flight manual) should implement procedures that call for an immediate execution of the escape maneuver following a GPWS warning unless there is visual confirmation of terrain. (61)	SOP-CFIT	4.25
1.51	2.67	99	Airlines/operators should ensure that standard operating procedures are published and enforced. (99)	SOP-CFIT	4.03
1.40	2.67	95	Airlines/operators should establish procedures for flight crews to review/cross check instructions, clearances, etc., to ensure consistency with expected procedures or practices. (95)	SOP-CFIT	3.73
0.92	2.83	125	Airlines/operators should encourage flight crews to use precision approaches (glideslope guidance) when available and appropriate. (125)	SOP-CFIT	2.61
0.66	2.83	30	Airlines/operators should adopt the "delegated" approach to standard operating procedures (e.g., monitored approach procedures). (30)	SOP-CFIT	1.87

			FAA 8400.10		
0.89	2.00	79	Airlines/operators should implement a reliable process to communicate information to the flight crew that may effect flight or aircraft operations. (79)	SOP-CFIT	1.78
			United Airlines, Embry Riddle Aeronautical University, and NASA Risk Assessment Model.		
0.58	2.67	120	Airlines/operators should ensure procedures do not increase pilot workload during critical phases of flight. (120)	SOP-CFIT	1.55
0.56	2.50	24	Airlines/operators should implement procedures to ensure appropriate crew pairing. (Reference FSF corporate crew scheduling and fatigue evaluation.) (24)	SOP-CFIT	1.40
			FAA FAR 121.434 AND 438		
0.37	2.67	91	Airlines/operators and regulatory agencies should standardize on usage of QNH altimeter settings. (91)	SOP-CFIT	0.99
			ALL US 121 OPERATORS COMPLY.		
0.42	2.17	36	Airlines/operators should establish and implement the use of electronic checklists or other aids to ensure completion of all checklist items. (36)	SOP-CFIT	0.91
			INDUSTRY INITIATIVES.		
0.35	2.50	78	Airlines/operators and regulatory agencies should improve the availability, clarity, and prioritization of NOTAM information. (78)	SOP-CFIT	0.88
			ATA DISPATCH GROUP, AIR TRAFFIC MANAGEMENT COMMITTEE		
0.28	2.67	90	Airlines/operators and regulatory agencies should prohibit engineering flight tests during revenue flights following maintenance of critical systems. (90)	SOP-CFIT	0.75
		Policies for CFIT Prevention			
1.20	2.67	123	Airlines/operators should implement a true no-fault go around policy (learning vs. blame). (123)	Pol-CFIT	3.20
			FLIGHT SAFETY FOUNDATION, ALAR REPORT		
1.06	2.83	22	Airlines/operators should encourage a culture that emphasizes safe arrivals over timely arrivals. (22)	Pol-CFIT	3.00
1.03	2.50	50	Airlines/operators and regulatory agencies should emphasize that only published route segments should be flown in non-radar environments. (50)	Pol-CFIT	2.58
0.42	2.83	48	Airlines/operators and regulatory agencies should strictly enforce flight/duty time limitations. (48)	Pol-CFIT	1.19
			FAA ADMINISTRATOR, FLT & DUTY TIME RULE.		
0.39	2.83	31	Airlines/operators should ensure that crew rest considerations (cabin crew and flight crew) are calculated and administered by dispatch/crew scheduling rather than burdening crews with these considerations. (31)	Pol-CFIT	1.11
			FAA / ATA INITIATIVE.		
0.40	2.67	101	Airlines/operators should establish a policy that supports the reporting of substance abuse. (101)	Pol-CFIT	1.07

0.33	2.83	2	Airlines/operators and regulatory agencies should strictly enforce the regulations pertaining to alcohol use/abuse and the use of prescription and non-prescription medication and encourage the reporting of such abuse. (2)	Pol-CFIT	0.94
0.39	2.33	80	Airlines/operators should ensure, and regulatory agencies should check, that operators who create their own AOM's include all procedures prescribed by original equipment manufacturers Airplane Flight Manual (AFM). (80)	Pol-CFIT	0.91
			FAA INITIATIVE FOLLOWING NTSB SAFETY RECOMMENDATION		
0.34	2.33	37	Regulatory agencies should discontinue on-time arrival tracking for airlines. (37)	Pol-CFIT	0.79
0.19	2.83	63	Airlines/operators should implement a culture that encourages flight crew voluntary removal from flight status due to illness. (63)	Pol-CFIT	0.54
			CRM ADVISORY CIRCULAR.		
0.15	2.83	70	Airlines/operators and regulatory agencies should strictly enforce the regulations pertaining to flight crew use of prescription and non-prescription medication. (70)	Pol-CFIT	0.43
			REGULATORY REQUIREMENT.		
		Maintenance Procedures			
			ExF values for all interventions in this project were in the bottom one-third of the total list. All interventions were characterized by low effectiveness ratings.		
0.28	2.67	66	Airlines/operators should implement procedures to avoid simultaneous maintenance on redundant flight critical systems. (66)	Main	0.75
0.19	2.67	46	Airlines/operators should implement procedures to increase flight crew awareness of recent aircraft maintenance actions. (46)	Main	0.51