Results and Analysis

Joint Safety Implementation Team (JSIT)

Approach & Landing

May 17, 2001

APPROACH AND LANDING ACCIDENT REDUCTION (ALAR)

JOINT SAFETY IMPLEMENTATION TEAM (JSIT)

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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). Other participants include 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. In the summer of 1998, CAST chartered the Approach and Landing Accident Reduction (ALAR) JSAT to utilize the process for the purpose of developing and recommending interventions that will enhance commercial aviation safety during the approach and landing phase of flight.

On September 19, 1999, CAST accepted the "Results and Analysis" report submitted by the ALAR JSAT. That report identified 192 total interventions and rated the overall effectiveness of each for potentially preventing each of the reviewed accidents. CAST then chartered the CFIT Joint Safety Implementation Team (JSIT) to develop, prioritize, and coordinate an agenda to implement the interventions recommended by the ALAR JSAT. The CFIT JSIT had developed the JSIT process itself, a first-ever undertaking, and had almost concluded its efforts with respect to CFIT interventions. Many of the ALAR interventions (and subsequent projects) were similar to CFIT interventions and projects, and it was thought that keeping the same team for both accident categories would be extremely beneficial in terms of team experience and timeliness of results. Thus, the CFIT JSIT became the CFIT/ALAR JSIT.

In a little over a year, the CFIT/ALAR JSIT has produced a comprehensive agenda to reduce approach and landing 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 ALAR JSAT and developed intervention strategies and a recommended priority for implementation. Priority is based on the overall 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 5 projects that were judged to have top overall effectiveness and feasibility scores.

- Aircraft Design
- Flightcrew Training

- Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion
- Maintenance Procedures
- Policies for ALAR (Safety Culture)

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

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/ALAR JSIT members and extended members, and countless associates of those members. The CFIT/ALAR 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 approach and landing accidents.

II. INTRODUCTION

In the fall of 1999, the Commercial Aviation Safety Team (CAST) chartered the CFIT Joint Safety Implementation Team (JSIT) to develop, prioritize, and coordinate an agenda to implement the interventions recommended by the ALAR JSAT. The CFIT JSIT had almost concluded its efforts with respect to CFIT interventions. As many of the ALAR interventions (and subsequent projects) were similar to CFIT interventions and projects, it was thought that keeping the same team for both accident categories would be extremely beneficial. Thus, the CFIT JSIT became the CFIT/ALAR JSIT.

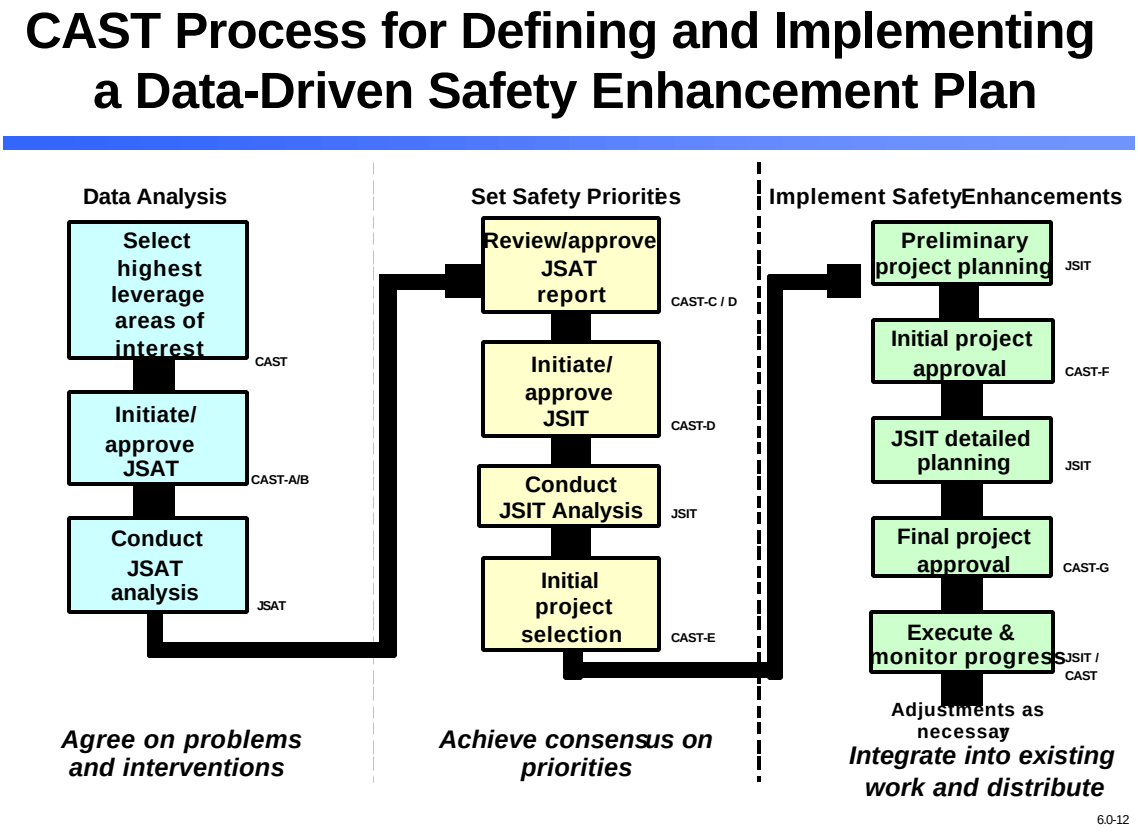
In a little over a year, the CFIT/ALAR JSIT delivered on its mission. Using the generic JSIT Process document entitled "*Process Handbook - Joint Safety Implementation Team*," February 28, 2000, the team produced this report, which is a comprehensive agenda to reduce approach and landing accidents in 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/ALAR JSIT members (See Appendix B for the list of members) and extended members, and countless associates of those members. Together the CFIT/ALAR JSIT comprised a rare cross-section of specialists from the commercial aviation community.

The CFIT/ALAR 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 approach and landing accidents.

III. APPLYING THE JSIT PROCESS TO ALAR

During the fall of 1999, the Commercial Aviation Safety Team (CAST) chartered the CFIT/ALAR JSIT to study and develop an implementation strategy for the interventions from the ALAR JSAT. The *JSIT Process Handbook*, which provides details for the various process blocks recommended by CAST (see figure below), was followed in addressing the interventions recommended by the ALAR JSAT.



IV. APPROACH AND LANDING ACCIDENT REDUCTION 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 – Rev. B*." 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 ninety-two (192) interventions developed by the JSAT. The CFIT JSAT previously presented (sixty-three (63) of these interventions.) The JSAT developed a rating of the overall effectiveness of one-hundred seventy-one interventions for preventing future approach and landing accidents based upon the analysis of the ALAR accidents selected for the JSAT study. The remaining 21 interventions were not rated by the JSAT but were presented to the JSIT for evaluation as potential research projects or incorporation into implementation plans with highly ranked interventions. Eight

(8) of the 171 interventions were rated as zero on the overall effectiveness scale. The document also contains a compilation of seven prioritized categories of interventions based upon the combination of the prioritized ranking of overall effectiveness scores and expert opinion of its membership. The charter for the CFIT/ALAR JSIT assigns the JSIT the responsibility for identifying prospective intervention strategies for implementation. Thus, the JSIT was not bound by the JSAT's suggested groupings, but none the less did refer to these as a sanity check.

The '*Master Collector Document – Rev. B*' 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 JSIT initially grouped the 192 interventions into 20 projects that had a common theme or concentration area. (An Excel spreadsheet listing the interventions and the 20 projects is provided in Appendix C.) Working groups consisting of 3-4 JSIT members with expertise in the subject area were identified for each of the 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 defined in the *JSIT Process Handbook*. The group's assessments were collated and an average feasibility value for each intervention was calculated. The entire 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/ALAR 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 overall effectiveness and feasibility ratings. This sorting identified clusters in the data where colors could be assigned. Break points for overall effectiveness and feasibility were set wherever naturally occurring breaks appeared between clusters of ratings.

The CFIT/ALAR JSIT assigned color coding as follows:

	Overall Effectiveness	**Feasibility**
Red	0 - 2	1 - 1.66
Yellow	2 - 3	1.67 – 2.32
Green	3 - 6	2.33 - 3

The analysis and visual presentation was key to visually segregating data. The spreadsheet shown in the Appendix D is an example of such data display.

Prioritization of Interventions

The next step conducted by the JSIT was to determine the product of the overall effectiveness rating (OE) and the feasibility rating (F). The simple math of multiplying the overall 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, OE times F (OExF), 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 OExF, a cutoff value for OExF was determined to identify the highest leveraged interventions to reduce accident rates. The cutoff value used in the current analysis was 5.1. All projects containing one or more interventions with an OExF value of 5.1 or greater were considered as high-priority.

This prioritization process resulted in the identification of 13 high-priority projects from the total list of 20 projects. Some of the high-priority projects had already been presented to and approved by CAST as CFIT projects. The list of 20 projects and their disposition is given in the following table.

PROJECT TITLE	DISPOSITION
Aircraft Design	Combination of high overall effectiveness and high feasibility (and the resultant high values of OExF) for six of these interventions resulted in a recommendation that this project be implemented.
Air Traffic Control	Project was identified as high priority. An ATC CFIT Training project implemented by the CFIT JSIT dispositioned all high-ranking interventions and most of the others as well.
Charting	OExF value for the intervention in this project was below the cutoff value selected by the CFIT/ALAR JSIT.
Crew Resource Management (CRM) Training	OExF values for the interventions in this project were below the cutoff value selected by the CFIT/ALAR JSIT.
Datalink Enhancement	OExF values for the interventions in this project were below the cutoff value selected by the CFIT/ALAR JSIT.
Flightcrew Training	Combination of high overall effectiveness and high feasibility (and the resultant high values of OExF) for seven of these interventions resulted in a recommendation that this project be implemented.
Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion	Combination of high overall effectiveness and high feasibility (and the resultant high values of OExF) for two of these interventions resulted in a recommendation that this project be implemented.
Flight Operations Quality Assurance (FOQA)	FOQA interventions were either not rated or below the cutoff value selected by the CFIT/ALAR JSIT. The CFIT JSIT implemented a FOQA project.
Ground Equipment	OExF value for the intervention in this project was below the cutoff value selected by the CFIT/ALAR JSIT.
Health and Usage Management Systems (HUMS)	Combination of high overall effectiveness and high feasibility for three of these interventions resulted in a recommendation that this project be implemented.
Maintenance Procedures	Combination of high effectiveness and high feasibility for two of these interventions resulted in a recommendation that this project

	be implemented.
Minimum Safe Altitude Warning (MSAW)	OExF values for the intervention in this project was below the cutoff value selected by the CFIT/ALAR JSIT. MSAW project was implemented by CFIT JSIT,
Others	None of the interventions in this projected were rated for overall effectiveness.
Precision Approach Implementation (PAI)	Project was identified as high priority. PAI Project implemented by the CFIT JSIT.
Precision Approach Usage (PAU)	Project was identified as high priority. The CFIT JSIT implemented PAU intervention.
Pilot/ATC Communication Enhancement	Project was identified as high priority. The highest ranked intervention is included in another FAA program. Some of the other interventions, while having low OExF values, were included in the ATC CFIT Training project
Policies for ALAR (Safety Culture)	Combination of high overall effectiveness and high feasibility for three of these interventions resulted in a recommendation that this project be implemented.
Standard Operating Procedures (SOP's) for ALAR	Project was identified as high priority. CFIT projects or other CFIT/ALAR projects described in this report disposition all highest rated interventions and most others.
Synthetic Vision Systems	Project was identified as high priority. A research DIP, proposed by the CFIT JSIT, has been presented to and approved by CAST.
Terrain Awareness and Warning System (TAWS)	Project was identified as high priority. TAWS Project implemented by CFIT JSIT.

This left the following 7 projects to be dealt with by the CFIT/ALAR JSIT:

- Aircraft Design
- Flightcrew Training
- Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion
- HUMS
- Maintenance Procedures
- Policies for ALAR (Safety Culture)
- SOPs for ALAR

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 overall effectiveness and feasibility ratings. Research interventions, which might have potentially high future safety leverage, were included in the final JSIT recommendations to CAST. The HUMS project, while containing 3 interventions with OExF values greater than the cut-off value of 5.1, was considered by the ALAR CFIT/ALAR JSIT to require additional research before realizing the full

potential to reduce landing accidents. As such, it was recommended to CAST as a research project. Additionally, the 6 non-rated interventions assigned by the JSIT to the "Others" project were also recommended to CAST as possible research topics.

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. While the SOWs were being developed, it was determined that the interventions contained in the "SOPs for ALAR" project could be addressed by other CFIT/ALAR projects or had been included in previous CFIT projects. With this project eliminated, and the HUMS project recommended for research, 5 potential projects remained.

Development of Project Plans

The SOWs for the 5 high-priority projects were then presented to CAST as part of a "plan-for-a-plan" (see Appendix E for all SOWs 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. 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.

It should be noted that the Executive Summaries (and the Detailed Implementation Plans discussed in the following paragraph) contain references to "LOOPCs" and "LOOCs," terms not used by the previous JSIT. Following the completion of the CFIT JSIT, the JSIT recommended to CAST that the JSIT Process be amended to include identification of a Lead Organization for Overall Project Coordination (LOOPC) and the Lead Organization for Output Completion (LOOC). These organizations would have the following responsibilities:

Roles and responsibilities of the Lead Organization for Overall Project Coordination.

- Responsible for overseeing completion of necessary outputs (critical path elements, progress against plan).
- Conducts program status checks at agreed upon selected output accomplishment plan milestones to verify performance against plan and completion of tasks.
- Ensures that detailed plans are in place to achieve the project outputs.
- Responsible for identifying & communicating resource needs to CAST.
- Responsible for reporting to the JIMT the progress against the plan and the completion of tasks.

Roles and responsibilities of the Lead Organization for Output Completion

- Responsible for development and implementation of plan for accomplishment of that output.
- Responsible for identifying & communicating resource needs to the Lead Organization for Overall Project Coordination.
- Responsible for reporting to the LOOPC the progress against the plan and the completion of tasks.
- Ensures that plans for output accomplishments contain an adequate number of milestones to program status checks and recovery actions prior to program end date.

CAST approved the process change and all future projects will contain these designations.

The JSIT was asked to develop final Detailed Implementation Plans (DIP's) for all 5 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 5.1. 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. CAST shared the DIPs with their stakeholders and reconfirmed resource commitments by their agency/organization. All 5 projects were given final approval (CAST-G). Brief descriptions of each of these projects follow.

V. DETAILED PLAN SYNOPSES

AIRCRAFT DESIGN

Purpose: The purpose of this project is to ensure flight critical system components incorporate fault tolerant design principles and are subjected to critical point, flight-realistic-condition, certification testing/analysis. Changes to flight critical system components will be considered a major change unless the applicant can show the change is in fact a minor change and monitors the continued airworthiness (in-service failures) of these systems using a risk assessment focused methodology.

LOOPC: AIR-1

Actions	**Completion**	**LOOC**
Utilize definition of ARAC 25.1309 for "Flight Critical System Components" (FCSC) as basis for design guidance and maintenance.	December 2001	ARAC
Issue design guidance to ensure FCSC are fault tolerant and are subjected to critical-point, flight-realistic-condition, certification testing/ analysis for air carriers.	December 2002	AIR-1
Issue guidance to ensure continuing airworthiness processes adequately analyze fleet performance to verify design level of safety remains unchanged and safety risk management processes are applied.		
(a) FAA	December 2002	AIR-1
(b) Manufacturers/Operators	December 2003	AIR-1
Issue guidance to ensure maintenance activity on FCSC does not compromise designed safety levels and is I/A/W approved data.	June 2002	AFS-300

IMPLEMENTING ORGANIZATION (S)
FAA/Aircraft Certification/Flight Standards/ARAC 25.1309, Manufacturers, and Operators.

FLIGHTCREW TRAINING

Purpose: The purpose of this project is to ensure that Part 121 air carriers implement syllabi that train and evaluate aircrews on stabilized approaches, unusual attitudes, and upset recoveries. Specific topics related to stabilized approaches should include: crew resource management, go around criteria, approaches with system malfunctions, non-normal conditions, emphasis on basic airmanship, approach briefings, approach and missed approach procedures.

LOOPC: AFS-1

Actions	**Completion**	**LOOC**
Develop an ALAR JSIT Training Guide using the FSF CFIT and ALAR Training Guide and reference ALAR training topics.	June 2001	ATA TC
Issue HBAT strongly recommending air carriers address ALAR training topics.	August 2001	AFS-200
Conduct a review to determine those carriers not conducting training for ALAR topics.	October 2001	AFS-1/200
Industry and Employee Groups coordinate with DOS to ensure ALAR training topics are used and report to CAST on implementation.	August 2002	ATA
Conduct a re-review to ensure air carriers have addressed training topics of the ALAR Training Guide.	August 2002	AFS-1/200

IMPLEMENTING ORGANIZATION (S)
FAA/Flight Standards/POI's, ATA Training Committee, Employee Groups, and DOS's.

FLIGHT DECK EQUIPMENT UPGRADE/INSTALLATION TO IMPROVE ALTITUDE AWARENESS AND CHECKLIST COMPLETION

Purpose: The purpose of this project is to ensure altitude awareness and accomplishment of checklist items. This will be accomplished through the development of guidelines and procedures for flight deck smart-alerting-system-design and supporting operational procedures and training based upon:

- The installation of equipment to provide automatic aural altitude alert calls- -outs on final approach or other such altitude alerting systems.
- The installation of automated or mechanical checklist devices to provide a positive means for checklist completion.
- Research and assessment of existing technology in flight deck smart-alerting system design.

LOOPC: AVR-1

Actions	**Completion**	**LOOC**
NEW TYPE DESIGN AIRCRAFT		
Develop guidance for implementation of electronic checklist and smart alerting systems.		
FAA	December 2002	
Manufacturers	**N**ew type design following guidance	
Operators	Delivery of new type design	ACFT
Manufactures evaluate/consider NASA Reports during checklist design.	During development of new types	AIA
Manufactures provide automatic call-outs on final approach including MDA/DH.		
FAA: Develop advisory material.	December 2002	AIR-1
Manufacturers:	Install on new types after guidance	
Operators:	Develop training.	
EXISTING TYPE DESIGN AIRCRAFT		
Reassess checklist of the existing fleets using NASA reports and revise as necessary		
(a) FAA: Develop guidance	December 2001	AFS-1
(b) Manufactures/Operators	December 2002	AIA/ATA
Install altitude reminder systems (bugs)		
(a) FAA: Develop guidance	December 2001	AFS-1
(b) Airlines/Operators: Install	December 2002	ATA

IMPLEMENTING ORGANIZATION (S)

FAA/AFS/AIR, Manufacturers, Operators, Organizations, and Employee Groups.

MAINTENANCE PROCEDURES

Purpose: The purpose of this project is a reduction in Approach and Landing accidents by re-emphasizing current maintenance rules, policies, and procedures developed by the commercial airline operators and the FAA. The re-emphasis should specifically direct:

- That approved maintenance programs related to the servicing of components incorporate all of the OEM safety related components and procedures
- That oversight of sub-contract activity is increased by both the operators and regulators, and
- That MEL policy and procedures are strictly adhered to. The re-emphasis could be acted upon almost immediately.

LOOPC: AVR-1

Actions	**Completion**	**LOOC**
Develop and publish guidance for the servicing of nose gear struts for cold weather operations.	March 1997	AFS-300
Develop and publish guidance for the evaluation and surveillance of sub-contractor maintenance providers.	February 1998	AFS-300
Develop and publish guidance for use of MEL conditions and limitations for air carriers.	April 1998	AFS-300
DOS's internal audit to verify published guidance is being followed.	March 2001	ATA

IMPLEMENTING ORGANIZATION(S)
FAA/AVR/AFS, ATA, RAA, NACA, and DOS's

ALAR POLICIES (SAFETY CULTURE)

Purpose: The purpose of this project is to develop a strategy to promote a safety culture at each Part 121 air carrier specifically targeting approach and landing accident reduction (ALAR). Ensure that essential safety information generated by an airplane manufacturer and by the FAA is included in company operating manuals and in training programs for pilots and other appropriate employee groups. Teams within each air carrier would jointly develop manuals and training programs striving for the highest safety goals. The teams would further ensure that the content of those manuals would be rigorously followed in training programs and in day-to-day operations. It is recognized that rulemaking may be necessary to clarify existing requirements specifying the content and use of company operating manuals.

LOOPC: ATA (LOOPC), RAA, NACA

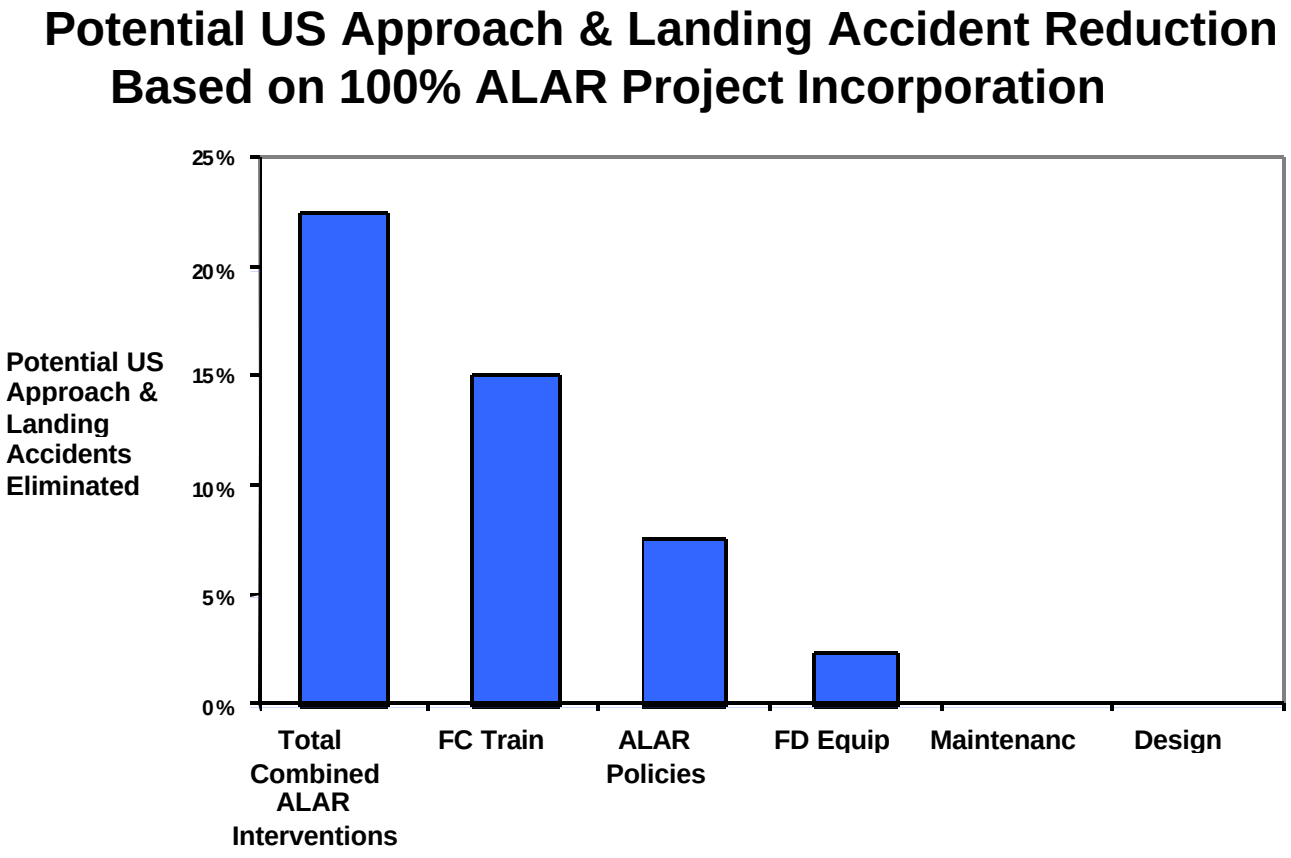
Actions	**Completion**	**LOOC**
CEO's and other key officers made more visible and more effective in promoting Safety Culture.	May 2001	ASY-1
Directors of Safety are made more visible and more effective in promoting Safety Culture.	January 2001	ATA
Directors of Safety ensure the establishment of a process to identify, review, analyze, and include appropriate safety information in training programs and in manuals used by flight crews and maintenance staff.	May 2001	ATA
FAA fully implements the Aircraft Flight Manual database for inspector's use.	March 2001	AFS-600

IMPLEMENTING ORGANIZATION(S)
FAA/AFS-1/AFS-600/AEG's/ANM-100, AIA, ATA, Manufacturers, Airline CEO's, Operators, AOA-1, CAST, RAA, NACA, ALPA, CAA, APA, and DOS's

Executing Projects and Monitoring Progress

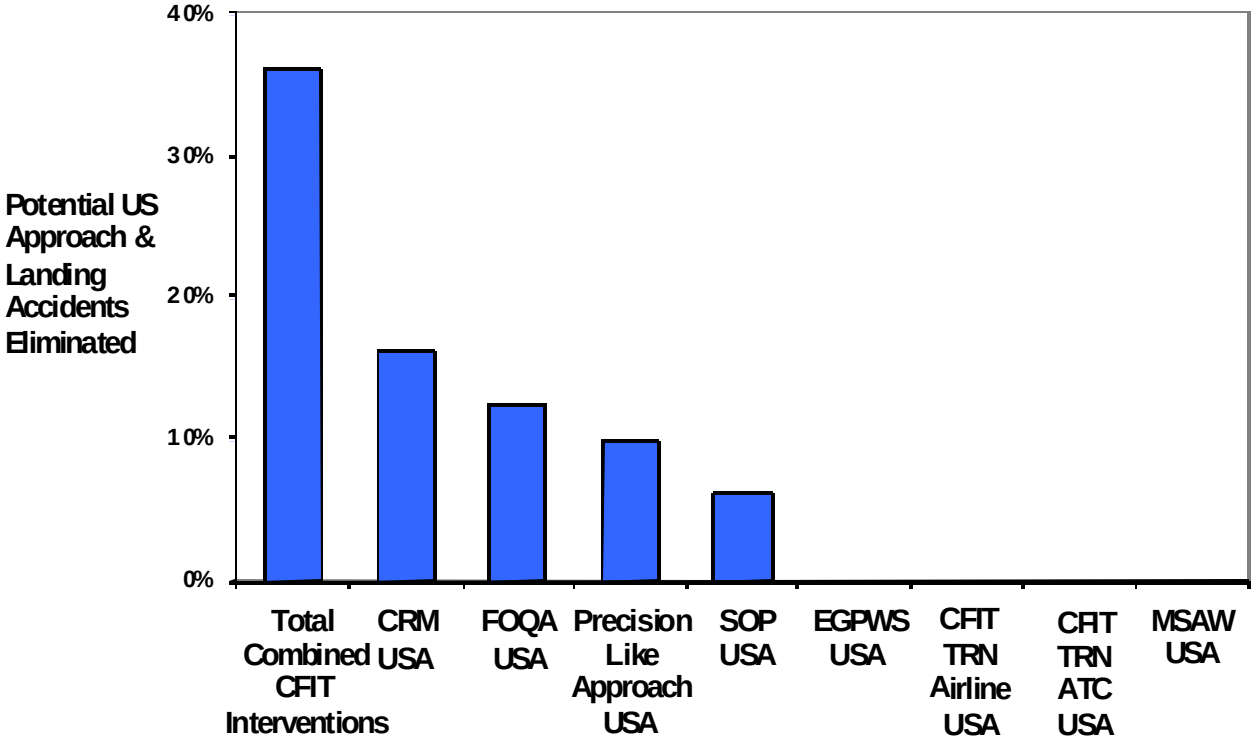
Once CAST-G approval has been obtained for the Project's DIP, the responsible organizations in the plan are expected to begin implementation strategies. CAST has created a Joint Implementation Measurement Team (JIMT) to monitor the project implementation and effectiveness and provide information to CAST. 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 approach and landing accidents assuming all interventions are 100% implemented. The JSIT recognized that some projects that were implemented by the CFIT JSIT may also contribute to a reduction in approach and landing accidents. Therefore, an attempt was made to incorporate the CFIT interventions in the approach and landing accident reduction.

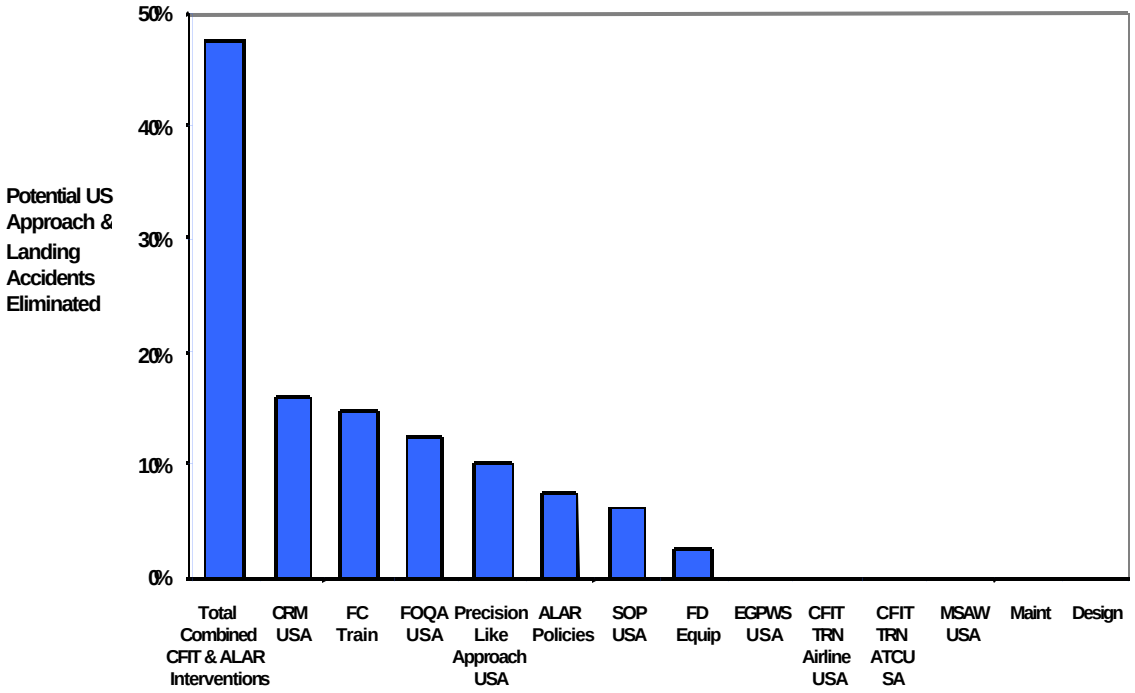


Potential US Approach & Landing Accident Reduction Based on 100% ALAR Project Incorporation

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



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



The JSIT has also identified the primary problems each of the projects is intended to correct. The following Table lists the 5 selected projects against the problem statements generated by the CFIT/ALAR JSAT. The complete list of problem statements is given in Appendix G.

JSIT PROJECT NAME	JSAT PROBLEM STATEMENT(S) ADDRESSED
Aircraft Design	14, 39, 57
Flightcrew Training	2, 5, 10, 11, 14, 16, 17, 19, 20, 21, 22, 23, 29, 34, 38, 39, 41, 42, 43, 44, 45, 47, 48, 50, 51, 53, 102, 204, 305
Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion	10, 11, 17, 22, 38, 101
Maintenance Procedures	23, 45, 101, 305
Policies for ALAR (Safety Culture)	14, 15, 20, 21, 32, 45, 50, 51, 53, 57, 100, 101, 105, 305, 308, 309

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

VI. CONCLUSIONS

In accordance with the charter creating the CFIT/ALAR JSIT, CAST provided input at every step of the JSIT process. At various points in the process, CAST also gave approval to the CFIT/ALAR 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 ALAR JSAT, the JSIT considered numerous factors. Among those factors was the large number of interventions (192) recommended by the JSAT. The CFIT/ALAR 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/ALAR JSIT 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 approach and landing 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 projects containing all of the 192 interventions identified by the ALAR JSAT. Within each of those groups, the interventions were prioritized based upon their overall effectiveness (as determined by the ALAR JSAT) and their feasibility (as determined by the CFIT/ALAR 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/ALAR JSIT identified as high-priority 5 projects which contained well over half of the CFIT JSAT's recommended interventions and selected them for implementation under the CFIT/ALAR JSIT agenda.

The remainder of the interventions identified by the ALAR 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/ALAR 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 ALAR 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 2 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/ALAR 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/ALAR JSIT recommends:

- that this report be treated as a public document and
- 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 importantly, the CFIT/ALAR JSIT recommends that CAST and its member organizations implement the five projects identified in Section IV as soon as possible.

APPENDICES

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CFIT/ALAR

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

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

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

D. The CFIT/ALAR 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/ALAR implementation plan will include a communications strategy aimed at gaining "stakeholder" buy-in.

F. For CFIT/ALAR implementation strategies which are international in scope, the CFIT/ALAR 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/ALAR JSIT will present this detailed implementation plan to CAST for review and approval.

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

IV. Products. The CFIT/ALAR 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/ALAR 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.

TEAM CO-CHAIRPERSONS:

TED MALLORY
Director, Flight Training Center
General Manager, NATCO
Northwest Airlines

GREG MICHAEL
Manager, Air Transportation Division
Flight Standards Service
Federal Aviation Administration

TEAM LEADER:

JERRY TEGEN
Central Regional Flight Standards Division
Federal Aviation Administration

TEAM MEMBERS:

KATHY ABBOTT
National Resource Specialist - Flight Deck Human Factors
Federal Aviation Administration

DALE ANDERSON
Aviation Systems Standards
Federal Aviation Administration

DAVE BALDERSON
Office of System Safety
Federal Aviation Administration

MICHAEL BASEHORE
Office of Aviation Research
Federal Aviation Administration

GARY CHESNUTT
Captain, American Airlines
Allied Pilots Association

KEVIN COMSTOCK
Staff Engineer
Air Line Pilots Association

JERRY DAVIS
Consultant

Airbus Industrie

JORGE FERNANDEZ
Engine and Propeller Directorate
Federal Aviation Administration

CHUCK HAWKINS
Aviation Systems Standards
Federal Aviation Administration

JIM MCKIE
Director, Operations
Air Transport Association

TOM MONFORTE
Director, Safety
COMAIR Airlines

CARL MOORE
Flight Standards Division
Federal Aviation Administration

JAY PARDEE
Manager, Aircraft Certification Service
Engine and Propeller Directorate
Federal Aviation Administration

PAUL RUSSELL
Chief Engineer, Airplane Safety Engineering
Boeing Commercial Airplanes Company

HOP POTTER
Flight Standards Division
Federal Aviation Administration

DICK SLATTER
Consultant, Operations/Airworthiness
Air Navigation Bureau
ICAO Montreal, Canada

ROBERT WAYNE
Captain, Delta Airlines
Air Line Pilots Association

ARDY WILLIAMS
Air Traffic Services
Federal Aviation Administration

RICK WILLIAMS
Delta Airlines
Air Line Pilots Association

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INTERVENTIONS

Intervention No.		Project Designation

Aircraft Design

209	To improve survivability, manufacturers should improve design, installation and inspection schedules of emergency equipment to increase reliability (e.g. escape slides). (see 45, 138, 201, 202)	A/C-DZ
260	To prevent uncommanded in-flight flat pitch, research should be conducted into prop brake designs.	A/C-DZ
261	To improve passenger and flightcrew survivability, research should be conducted to explore new methods to increase crash survivability.	A/C-DZ
262	To improve passenger and flightcrew survivability, regulators should require and operators should implement existing knowledge of crash survivability.	A/C-DZ
304	Manufacturers should improve the design for an error tolerant ground spoiler deployment system.	A/C-DZ
332	Manufacturers should design ground sensing systems that are tolerant to adverse conditions without degrading in-flight safety features (e.g. which prevent deployment of ground spoilers and reverse in-flight). (see 16)	A/C-DZ
248	To ensure adequate testing of equipment, manufacturers' testing should be conducted under worst case scenarios taking into account new technologies and testing under simulated flight realistic conditions.	A/C-DZ
249	To ensure the accuracy and safety of computer modeling used for design and failure analysis, the modeling must be adequately re-validated on a continuing basis to account for new technology.	A/C-DZ
252	To prevent loss of control in flight, all changes to flight critical components, such as primary propeller pitch controller components, should be considered major changes.	POL
254	To avoid the isolated incident syndrome and to ensure on-going assessment of flight critical control system reliability, a focused safety or risk assessment of all in-service failures or problems should be conducted to determine the need for immediate resolution.	A/C-DZ
250	To ensure test components are representative of the final product, manufacturers should test the final component and regulators should require this type testing.	POL
256	To prevent loss of aircraft control in-flight, all propeller pitch control systems must be designed to positively feather in the event of pitch control loss. Propeller pitch control system malfunctions must be positively annunciated to the flightcrew.	A/C-DZ
158	Develop technology to provide real time assistance to flightcrews with onboard system failures and diagnostics (e.g. data link transmittal to ground support) (see 103).	A/C-DZ
251	To preserve the original intended level of airworthiness, there should be a better definition and classification of subsequent in-service major and minor critical component changes. The definition of critical component should be more specific.	MAIN
253	To prevent loss of control, there should be redundancy and failure tolerance features for all flight critical components, such as dual path design, fail operational redundant systems, with fault annunciation.	A/C-DZ
159	Manufacturers should incorporate an "input rudder" indicator or automatic yaw compensation to ensure that adequate yaw control is provided.	A/C-DZ

49	Regulators should establish criteria for, and manufacturers should evaluate and improve, the reliability and failure tolerance of flight systems. (see 332)	A/C-DZ
203	Airlines/operators should provide crews with in-flight rest periods and adequate facilities. (see 31, 130, 315)	A/C-DZ
138	Manufacturers should ensure that design logic for warnings and equipment failures to be annunciated to the crew do not cause nuisance warnings which would contribute to crew complacency. (see 45, 243)	A/C-DZ
245	To recover aircraft in unusual attitude, manufacturers should develop systems to return aircraft to normal attitude with one pilot button push (pilot initiated auto-recovery systems).	A/C-DZ
235	Manufacturers should provide a more positive means of external strut pre-flight inspections.	A/C-DZ
259	Regulators should set engineering standards requiring propeller manufacturers to provide positive prevention designs, to eliminate all flight critical failure modes (e.g. flat pitch).	A/C-DZ
137	Manufacturers should ensure cockpit design that does not interfere with or distract the flightcrew from executing their duties (e.g. rain in the cockpit, location of switches in cockpits).	A/C-DZ

Air Traffic Control

126	Air Traffic service providers should prioritize the use of precision approaches (glideslope guidance) when available and appropriate.	ATC
327	Air Traffic service runway selection policies should be based on the most current wind available.	ATC
157	Airlines/operators, regulators, Air Traffic service providers should establish policies or programs to address rushed approaches, including elimination of rushed approaches, recognition and rejection of rushed approaches and training for those encountered.	ATC
13	Air Traffic service providers should enhance ATC training to emphasize the dangers of rushed approaches and performance characteristics of modern jet transports. (see 115, 157)	ATC
124	Air Traffic service providers should implement a Quality Assurance program to ensure adherence to established procedures.	ATC
12	Air Traffic service providers should emphasize in ATC training the controllers' potential in assisting the flightcrew in improving their situation awareness.	ATC
106	Air Traffic service providers should train and monitor ATC adherence to established communications procedures including hearback problems. (see 240)	ATC
324	Air Traffic services should ensure proper/close supervision of controllers undergoing training so that all outages, construction, airport hazards, etc. are reported to flightcrews in a timely and accurate manner. (see 11)	ATC
108	Air Traffic service providers should implement and/or review procedures to ensure ATC training does not create a hazard to flight operations.	ATC
320	Air Traffic service providers should institute an ATC "Crew Resource Management Program" similar to those required of flightcrews. (FAA AC 120-51b)	ATC
241	To eliminate hearback errors, ATC should re-examine and implement improvements to address hearback problems. (see 240)	ATC

Charting

6	Regulators should establish standardized approach plate depiction/information requirements for approach plate publishers.	CHART

CRM - Training

237	Airlines/operators should provide guidance to crew concerning evaluation of all options prior to decision making as part of CRM training. (see 25, 26, 131, 132, 133, 308)	CRM
23	Airlines/operators should ensure that regularly scheduled recurrent training (e.g. LOFT) emphasizes crew cooperation and working together to maximize safe operations. (see 308, 314)	CRM

308	Airlines/operators should ensure their formal CRM training emphasizes the following management skills: decision making, workload management, crew coordination, planning, communication, situational awareness, and advocacy. (IAW AC120-51b). (See 133)	CRM
227	Airlines/operators should ensure that their training/standardization program emphasizes the benefits of inter-crew/company communications. (see 131)	CRM
25	Airlines/operators should establish a CRM training program and regulators should require and insure that the initial training is provided prior to line flying and require recurrent CRM training. (see 131, 132, 349)	CRM
228	Regulators should require airlines/operators to modify their training to maximize benefits of inter-crew/company communications.	CRM
349	Airlines/operators should ensure training for instructors and check airmen includes objective criteria to be used in evaluating crew CRM performance. (see 25,131)	CRM

Datalink Enhancement

28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft.	DATA
122	Air Traffic service providers should implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications.	DATA
94	Implement real time (digital) transmission of airport and weather information to the aircraft.	DATA

Flightcrew Training

116	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of high rate of descent and unstable approaches. (see 142)	F/C-T
111	Airlines/operators should ensure that their training/standardization programs emphasize basic airmanship skills and knowledge during initial and recurrent training.	F/C-T
300	Airlines/operators should adopt, implement and train a risk assessment tool to enhance flightcrew awareness of hazards associated with all approaches and airports (see risk analysis tactical checklist).	F/C-T
328	Airlines/operators should ensure that flightcrews are trained to think in terms of "I will go-around unless" rather than "I will land unless". Regulatory policy should support this approach. (see 142, 311)	F/C-T
331	Airlines/operators and manufacturers should train crews to understand the capabilities and limitations of systems, conditions which would cause systems to not function as the crew anticipates, and how to detect those conditions (e.g. lack of brakes, spoil).	F/C-T
350	Airlines/operators should ensure that adequate approach briefings are conducted that include descriptions of normal approach, non-normal conditions and the results of risk assessment analysis. (see 300)	F/C-T
163	Airlines/operators should ensure that their training/standardization programs address common misperceptions that could lead to unsafe practices (i.e. ATC always wants high-energy approaches).	F/C-T
100	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adhering to MDA/DH.	F/C-T
165	Airlines/operators should provide training scenarios that match realistic situations (i.e. stall recoveries during approach, in landing configuration at flight idle with the autopilot on (in simulator)).	F/C-T
153	Airlines/operators should ensure that flightcrews are adequately trained in a level D simulator for dynamic characteristics before assignment to the line. (see 312)	F/C-T
7	Airlines/operators should ensure that their training/standardization programs emphasize review of approach and missed approach procedures. (see 329)	F/C-T
64	Airlines/operators should ensure that their training/standardization programs direct the flightcrews to regularly cross check all instrumentation.	F/C-T

131	Airlines/operators should ensure that their training/standardization program emphasizes the importance of the team concept, cross cultural issues, evaluation of options and the obligation of the FO to effectively communicate any concerns (CRM) (see 237)	F/C-T
20	Airlines/operators should ensure that command oversight training for captains is provided during the upgrade process and in recurrent training and first officer responsibility for monitoring is reviewed during recurrent training.	F/C-T
147	Airlines/operators should require training/standardization programs which teach situation awareness. (the knowledge and understanding of the relevant elements of the pilot surroundings, including aircraft systems, and the pilots intentions)	F/C-T
322	Airlines/operators should develop and implement a ground school and simulator training program similar to the Advanced Aircraft Maneuvering Program.	F/C-T
316	Regulators should require airline/operators to train flightcrews to recognize and counteract acute and chronic fatigue. (see 31, 130, 203, 257,315)	F/C-T
314	Airlines/operators should develop simulator training scenarios that require flightcrews to learn multi-tasking abilities and appropriate prioritization abilities in concert with CRM skills (see Red Flag LOFT scenarios).	F/C-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.	F/C-T
136	Airlines/operators should ensure that their training/standardization programs emphasize the importance of the sterile cockpit environment.	F/C-T
162	Airline/operators should include in their training programs the awareness of potential safety risks due to complacency when operating at a very familiar airport (e.g. home base).	F/C-T
325	Airline/operators should emphasize during initial and recurrent training the importance of maintaining systems status awareness during non-normal events and hazardous approaches (goal to avoid tunnel vision/narrowed attention).	F/C-T
133	Airlines/operators training of Captains and Chief Pilots should include management practices that promote team building and effective human relations (leadership training beyond current CRM programs). (see 308)	F/C-T
17	Airlines/operators should ensure that their training/standardization programs emphasize the importance of all flight-related briefings. (see 342)	F/C-T
144	Airlines/operators and regulators should ensure that their training/standardization programs clarify the differences between vertical and slant range visibility.	F/C-T
312	Airline/operators should ensure flightcrews are trained in operations involving low light and poor visibility, on wet or otherwise contaminated runways, and with the presence of optical or physiological illusions before they are assigned line duties. (re ???????????	F/C-T
15	Airlines/operators should ensure that their training/standardization programs instruct when to disengage automated systems and fly manually. (see 246)	F/C-T
113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning.	F/C-T
105	Airlines/operators should train flightcrews on how flight delays upon departure or enroute (weather, maintenance, ATC, etc.) can affect their subsequent decision making relative to the safe conduct of the flight.	F/C-T
154	Airlines/operators should improve/increase training to increase awareness of icing effects on airplane type including dynamic simulator training.	F/C-T
47	Airlines/operators should ensure that their training/standardization programs direct the flightcrews to use all available resources (charts, ATC, inter/intra crew) to establish aircraft position. (see 75)	F/C-T
88	Airlines/operators should train and monitor flightcrew compliance with established communication phraseology guidelines. (see 240)	F/C-T
141	Airlines/operators and regulators should require that training/standardization programs include training regarding physiological effects on aircrew performance, (e.g. low blood sugar).	F/C-T
75	Airlines/operators should ensure that their training/standardization programs direct that flightcrews to use all available tools to establish aircraft position. (see 45)	F/C-T

Flight Deck Equipment Upgrade/Installation

305	Regulators should require airlines/operators to outfit aircraft with electronic checklists. If unable to install electronic checklists, use mechanical checklists or, at a minimum, develop a process to reinforce challenge and response checklists.	FDEU
211	Airlines/operators should retrofit equipment to provide automatic altitude callouts on final approach. If unable, other altitude alerting or reminder systems (such as altimeter bugs) should be installed.	FDEU
14	Install aural warning devices on aircraft to alert flightcrew of arrival at MDA/DH.	FDEU
306	Regulators should require manufacturers to equip all new aircraft with electronic checklists.	FDEU
343	Airlines/operators should install radio altimeters in all aircraft and develop procedures for their use on approach as recommended by FSF ALAR.	FDEU
352	Airlines/operators should equip aircraft with autopilots to reduce crew workload during critical phases of flight.	FDEU

FOQA

54	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs. (not rated)	FOQA
55	Airlines/operators should implement a Flight Operations Quality Assurance (FOQA) program to identify flightcrew failure to respond to GPWS warnings. (not rated)	FOQA
56	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs to identify systemic procedural deviations and unsafe trends. (see 54, 55)	FOQA
57	Airlines/operators, regulators, and manufacturers should implement a program designed for sharing of safety related information within the aviation community. (not rated)	FOQA
128	Airlines/operators and regulators should implement a no-blame safety reporting and data sharing system with appropriate protections from litigation and prosecution concerns.	FOQA
348	Airlines/operators should utilize a self-audit process (such as FSF ICARUS recommendation), operational risk management programs and accident cost analysis to proactively identify and mitigate safety concerns. (see 318)	FOQA
129	Regulators should establish criteria to ensure operators overall quality assurance and compliance procedures are effective rather than reliance on spot checks of individual components	FOQA
202	Airlines/operators should develop a quality assurance program to ensure compliance with regulations.(see 145, 146, 201)	FOQA

Ground Equipment

150	Regulators or other governing authorities should establish policies that ensure that surrounding lights are distinguishable from airport lighting in order to avoid confusion (safety process, policy).	GE

Health & Usage Monitoring Systems (HUMS)

45	Manufacturers should ensure that all impending equipment failures or inappropriate settings that may affect the safe operation of the flight are properly annunciated to the flightcrew by use of dual source sensing. (see 103, 138)	FDEU
158	Develop technology to provide real time assistance to flightcrews with onboard system failures and diagnostics (e.g. data link transmittal to ground support). (see 103)	HUMS
243	To prevent alerting overload, flight deck designs should consider smart alerting systems such as those with prioritization schemes or cancelable nuisance alerts.	FDEU
103	Manufacturers should develop and implement system failure annunciation capabilities to alert flightcrews of pending failures (e.g. HUMS). (see 45, 138)	HUMS

Maintenance Procedures

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 of future accidents, it would not have prevented the subject accidents.)	MAIN
232	Airlines/operators should ensure all nose gear struts are serviced for cold weather operation are in accordance with OEM recommendations.	MAIN
145	Airlines/operators and regulators should establish appropriate operational restrictions when equipment is inoperative (MEL)	POL
213	Airlines/operators and regulators should provide additional inspectors/inspection of sub-contract activity. (see 201, 202)	MAIN
146	Regulators should establish/enforce reasonable limitations on dispatch with safety related equipment inop. (MEL)	MAIN
233	Regulators should require operators to incorporate OEM strut servicing recommendations in mandatory maintenance procedure and survey compliance.	MAIN
353	Airlines/operators should establish and enforce a clear MEL policy to aid flightcrews in making maintenance-related decisions.	MAIN

MSAW

72	Air Traffic service providers should install MSAW-like capabilities worldwide with emphasis on high-risk airports.	MSAW

Others

204	Research should be conducted to better understand the underlying reasons/causes for procedural noncompliance.	OTHER
208	Research should be conducted to understand the phenomenon of flightcrew overload. (e.g. why do flightcrews ignore GPWS warnings)	OTHER
244	To prevent plan continuation errors (e.g. press-on-itis), research should be conducted to develop directive information systems for go-around situations.	OTHER
318	Flight Safety Foundation should develop a cost analysis tool to educate CEO's about the high economic and psychological costs of accidents and serious incidents. (not rated)	OTHER
337	Airlines/operators should establish a process (which includes an interdisciplinary team) to document and investigate high-risk behavior and poor judgement as evidenced by on-the-job performance. (see 151, 152, 335)	OTHER
356	Research should be done to develop an effective tactical decision-making model for flightcrews in time critical situations.	OTHER

Precision Approach Implementation

77	Eliminate non-precision approaches where possible. (see 59)	PAI
59	Implement precision approach capability (glideslope guidance) for all runways without established precision approach procedures (e.g. ILS, DGPS, etc.). (see 77)	PAI
115	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of rushed approaches. (see 13, 157)	PAI
355	Non-precision approaches should be conducted as constant angle, stabilized approaches. (see 59)	PAI

Precision Approach Usage

125	Airlines/operators should encourage flightcrews to use precision approaches (glideslope guidance) when available and appropriate.	PAU

Pilot/ATC Communication Enhancement

93	Air Traffic service should provide real time (most current) radio communication of critical airport and weather information.	PILOT/ATC
21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flightcrews is occurring.	PILOT/ATC
42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology.	PILOT/ATC
240	To reduce the possibility of error, confusion and workload increase related to ATC clearances, regulators should require, and operators ensure, that flightcrews utilize proper phraseology and readbacks. (see 88)	PILOT/ATC
296	To mitigate confusion regarding ATC clearances, operators should develop procedures to ensure flightcrews query ATC whenever uncertainty exists.	PILOT/ATC

ALAR Policies (Safety Culture)

303	Regulators should implement the NTSB recommendations to increase DFDR parameters. (not rated)	POL
143	Airlines/operators should, and regulatory agencies must, encourage a culture that enhances safety in their daily operations. (safety culture) (see 22, 63, 348)	POL
225	Airlines/operators and regulators should ensure necessary manuals (operational & maintenance) are complete, accurate, available and appropriately used.	POL
238	To preclude conducting flight training during operational flights, when a need for training is identified, operators should conduct training in accordance with their approved training program.	POL
132	Airlines/operators and regulators should ensure that disciplinary and prosecution policies don't adversely affect or countermand safety gains of good CRM practices. (see 308)	POL
151	Regulators should establish policies that require additional monitoring of flightcrew members that have repeatedly failed check rides. (see 152, 335, 337)	POL
255	To prevent catastrophic failures, the manufacturers should issue immediate telegraphic information to all operators, and regulators should require an immediate mandatory action (AD), following the initial failure report of any critical component malfunct.	POL
130	Regulators should account for realistic rest scenarios when developing and implementing crew rest requirements during travel segments (see 31, 203, 257, 315, 316)	POL
89	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for non-precision approaches are adequate.	POL
112	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for simulated instrument failures (partial panel) are adequate.	POL
223	Regulators should ensure POIs are properly qualified and trained to approve appropriate company operational procedures.	POL
345	Ensure regulators have adequate funding, training and processes to accomplish their oversight responsibilities. (see 201)	POL
214	Regulators should enforce timely incorporation of appropriate manufacturers recommendations. (see 98, 201)	POL
219	Regulators should ensure company training program is in accordance with approved training program.(see 110, 201)	POL
231	Regulators should require and airlines/operators should promptly close out all regulatory safety audit findings.	POL
321	Regulators and military agencies should ensure procedures are in place to share information pertaining to operations at joint use airports. (Special Use Airports)	POL
315	Regulators should update flight time/duty time regulations to counteract present commercial aviation environmental stressors. (e.g. crew rest requirements) (see 31, 130, 203, 257, 316)	POL

310	Regulators should not allow noise abatement procedures that reduce the level of safety that existed prior to their implementation.	POL
339	Regulators should require that both captains and first officers have identical approach charts for reference.	POL
201	Regulators should develop adequate oversight as appropriate to ensure compliance with regulations.(see 145, 146, 202, 345)	POL
152	Airlines/operators and regulators should raise standards (e.g. crew pairing, approach minimums, etc.) for flightcrew members that meet minimum qualifications but have demonstrated specific weaknesses. (see 151, 335, 337)	POL
218	Airlines/operators should properly surveill contractor training programs for adequacy of training.(see 110, 202)	POL
340	Airlines/operators should implement procedures to ensure flightcrews are aware of appropriate Airworthiness Directives, Certification and flight testing standards. (see 76, 46)	POL
37	Regulators should discontinue on-time arrival tracking for airlines.	POL
311	Airlines/operators should ensure their "reward system" does not penalize flightcrews for executing missed approaches. (see 217)	POL
317	Regulators should ensure one level of safety exists for all commercial transport operations (whether passenger or freighter operations).	POL
22	Airlines/operators should encourage a culture that emphasizes safe arrivals over timely arrivals. (see 63, 143)	POL
334	Regulators should require airports to comply with International standards for airport construction.	POL
48	Airlines/operators and regulators should strictly enforce flight/duty time limitations.	POL
217	Airlines/operators should ensure their "reward system" is not related to the completion of a route segment. (see 311)	POL
347	Parent airlines/operators should adopt a program to ensure the same level of safety in regional partners including, but not limited, to recruitment, training, operations and maintenance.	POL
354	Organizations responsible for developing approach/arrival/departure procedures should not report to the organization responsible for Air Traffic service (e.g. In the FAA AVN-100 not reporting to AAT)	POL
63	Airlines/operators should implement a culture which encourages flightcrew voluntary removal from flight status due to illness and/or emotional distress (including the use of a self-assessment tool). (see 70)	POL
222	Regulators should require PMI's to have expertise in the assigned carrier's equipment.	POL
220	Regulators should ensure that all POIs are current and qualified in one model of the companies equipment.	POL
242	To prevent excessive fatigue, airlines/operators should consider circadian rhythm in crew scheduling to compensate for the effects of rhythm interruptions.	POL
247	To ensure timely dissemination of navaid anomalies, airlines/operators and ATC should re-emphasize the requirement that flightcrews report and ATC disseminate any navigation anomalies.	POL
257	To eliminate loop holes in crew rest requirements and to ensure adequate crew rest, regulators should clarify crew rest regulations. (see 31, 130, 203, 315, 316)	POL
258	To facilitate the FAA awareness of safety related problems; there should be improved dissemination of the FAA hotline numbers.	POL
346	Airlines/operators should ensure better-educated regulators by providing intern programs.	POL

Standard Operating Procedures for ALAR

297	To prevent CFIT, operators should develop procedures to ensure that flightcrews do not descend when confusion exists concerning aircraft position.	SOP
134	Airlines/operators and regulators should ensure check list designs prioritize critical items as recommended by NASA study, and that items are arranged in a manner to enhance checklist implementation	SOP

142	Airlines/operators should establish policies, parameters, and training to recognize unstabilized approaches and other factors and implement a go-around gate system. (see FSF - "defined gates" p. 193) (see 116, 123)	SOP
24	Airlines/operators should implement procedures to ensure appropriate crew pairing. (reference FSF corporate crew scheduling and fatigue evaluation.)	SOP
224	Airlines/operators should ensure that all airline operations include compliance with all/seasonal guidance from the OEM.	SOP
329	Airlines/operators should incorporate in initial and recurrent training ways to recognize multiple cues that will require go-around. Including CFIT training aid 2.1.9, FSF definition of stabilized approach, risk assessment tool, and windshear training aids.	SOP
80	Airlines/operators should ensure, and regulators should check, that operators who create their own AOM's include all procedures prescribed by original equipment manufacturers Airplane Flight Manual (AFM).	SOP
156	Require that autothrottles be used with all autopilot coupled approaches.	SOP
110	Airlines/operators and regulators 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. (see 99)	SOP
123	Airlines/operators should implement a true no-fault go around policy (learning vs. blame).	SOP
135	Airlines/operators and regulators should ensure checklist design and implementation of procedures to promote effective crew coordination and distribution of PF and PNF tasks. (see 82)	SOP
319	Regulators should require a Special Qualification Airport Briefing guide be incorporated with approach charts. (Subject matter must include aircraft specific local operational procedures)	SOP
207	Airlines/operators should develop procedures to specify how transfer of control is formally accomplished.	SOP
342	Airlines/operators should establish an SOP to ensure that flightcrews should not begin the approach until adequate briefing is completed for the expected runway. (see 17)	SOP
30	Airlines/operators should adopt the "delegated" approach to standard operating procedures. (e.g. monitored approach procedures)	SOP
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.	SOP
246	To reduce pilot overload, airlines/operators policies should stress using the appropriate level of automation.	SOP
309	Airlines/operators should require flightcrews to fly precision instrument approach procedures during periods of reduced visibility and night operations. (see 59, 355)	SOP
99	Airlines/operators should ensure that clear, concise, accurate, appropriate standard operating procedures are published and enforced. (see 110)	SOP
79	Airlines/operators should implement a reliable process to communicate information to the flightcrew that may affect flight or aircraft operations.	SOP
82	Airlines/operators should clearly define, train and check the specific PF/PNF duties. (see 135)	SOP
19	Airlines/operators should implement a procedure to climb to a minimum safe altitude when position uncertainty exists by at least one crewmember. Flightcrew must advise ATC of intentions.	SOP
161	Airlines/operators should implement procedures that call for an immediate recovery maneuver following a flight control warning (e.g. stall warning) (see 61)	SOP
113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning.	SOP
95	Airlines/operators should establish procedures for flightcrews to review/cross check instructions, clearances, etc. to ensure consistency with expected procedures or practices.	SOP
236	Airlines/operators should develop/publish appropriate procedures for radio communications restoration.	SOP

Synthetic Vision

85	The aviation industry should develop and implement synthetic vision capability (e.g. Precision Approach Terrain Information (PATI)).	SYN
295	To enhance flightcrew performance in low visibility operations, the aviation industry should continue to develop and implement HUD capability. (see 149)	SYN
149	Manufacturers should install a HUD as standard equipment. (see 85)	SYN

Terrain Awareness and Warning System (TAWS)

35	Manufacturers should install TAWS (EGPWS) in all new aircraft, airlines/operators should retrofit TAWS into the existing fleet and international regulators should require the installation of TAWS.	TAWS
60	Avionics manufacturers should improve GPWS capability to reduce GPWS nuisance warnings. (See 243)	TAWS

Overall Effectiveness	Average Feasibility	Intervention No.	INTERVENTIONS	Overall Effectiveness x Feasibility
N	2	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 of future accidents, it would not have prevented the subject accidents.)	####
N	1.5	28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft.	####
N	2.3	54	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs. (not rated)	####
N	2.3	55	Airlines/operators should implement a Flight Operations Quality Assurance (FOQA) program to identify flightcrew failure to respond to GPWS warnings. (not rated)	####
N	2.3	56	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs to identify systemic procedural deviations and unsafe trends. (see 54, 55)	####
N	2.8	57	Airlines/operators, regulators, and manufacturers should implement a program designed for sharing of safety related information within the aviation community. (not rated)	####
N	1.7	128	Airlines/operators and regulators should implement a no blame safety reporting and data sharing system with appropriate protections from litigation and prosecution concerns.	####
N	2.3	204	Research should be conducted to better understand the underlying reasons/causes for procedural noncompliance.	####
N	2.3	208	Research should be conducted to understand the phenomenon of flightcrew overload. (e.g. why do flightcrews ignore GPWS warnings)	####
N	2	209	To improve survivability, manufacturers should improve design, installation and inspection schedules of emergency equipment to increase reliability (e.g. escape slides). (see 45, 138, 201, 202)	####
N	2.5	237	Airlines/operators should provide guidance to crew concerning evaluation of all options prior to decision making as part of CRM training. (see 25, 26, 131, 132, 133, 308)	####
N	2	244	To prevent plan continuation errors (e.g. press-on-itis), research should be conducted to develop directive information systems for go-around situations.	####
N	1.8	260	To prevent uncommanded in-flight flat pitch, research should be conducted into prop brake designs.	####
N	2.2	261	To improve passenger and flightcrew survivability, research should be conducted to explore new methods to increase crash survivability.	####
N	2	262	To improve passenger and flightcrew survivability, regulators should require and operators should implement existing knowledge of crash survivability.	####
N	2.8	297	To prevent CFIT, operators should develop procedures to ensure that flightcrews do not descend when confusion exists concerning aircraft position.	####
N	2.2	303	Regulators should implement the NTSB recommendations to increase DFDR parameters. (not rated)	####
N	2.8	318	Flight Safety Foundation should develop a cost analysis tool to educate CEO's about the high economic and psychological costs of accidents and serious incidents. (not rated)	####
N	2	337	Airlines/operators should establish a process (which includes an interdisciplinary team) to document and investigate high-risk behavior and poor judgement as evidenced by on-the-job performance. (see 151, 152, 335)	####

N	2	348	Airlines/operators should utilize a self-audit process (such as FSF ICARUS recommendation), operational risk management programs and accident cost analysis to proactively identify and mitigate safety concerns. (see 318)	####
N	2.7	356	Research should be done to develop an effective tactical decision-making model for flightcrews in time critical situations.	####
5	2.8	134	Airlines/operators and regulators should ensure check list designs prioritize critical items as recommended by NASA study, and that items are arranged in a manner to enhance checklist implementation	14.2
5	2.3	85	The aviation industry should develop and implement synthetic vision capability (e.g. Precision Approach Terrain Information (PATI)).	11.7
5	2.2	35	Manufacturers should install TAWS (EGPWS) in all new aircraft, airlines/operators should retrofit TAWS into the existing fleet and international regulators should require the installation of TAWS.	10.8
4	2.5	142	Airlines/operators should establish policies, parameters, and training to recognize unstabilized approaches and other factors and implement a go-around gate system. (see FSF - "defined gates" p. 193) (see 116, 123)	10.0
4.2	2.2	77	Eliminate non-precision approaches where possible. (see 59)	9.1
3.5	2.5	24	Airlines/operators should implement procedures to ensure appropriate crew pairing. (reference FSF corporate crew scheduling and fatigue evaluation.)	8.8
4.2	2	59	Implement precision approach capability (glideslope guidance) for all runways without established precision approach procedures (e.g. ILS, DGPS, etc.). (see 77)	8.4
2.8	3	224	Airlines/operators should ensure that all airline operations include compliance with all/seasonal guidance from the OEM.	8.4
3.3	2.5	304	Manufacturers should improve the design for an error tolerant ground spoiler deployment system.	8.3
3.5	2.3	45	Manufacturers should ensure that all impending equipment failures or inappropriate settings that may affect the safe operation of the flight are properly annunciated to the flightcrew by use of dual source sensing. (see 103, 138)	8.2
2.8	2.8	116	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of high rate of descent and unstable approaches. (see 142)	7.9
2.8	2.8	126	Air Traffic service providers should prioritize the use of precision approaches (glideslope guidance) when available and appropriate.	7.9
2.8	2.7	329	Airlines/operators should incorporate in initial and recurrent training ways to recognize multiple cues that will require go-around. (Including CFIT training aid 2.1.9, FSF definition of stabilized approach, risk assessment tool, and windshear training aid)	7.5
2.8	2.5	305	Regulators should require airlines/operators to outfit aircraft with electronic checklists. If unable to install electronic checklists, use mechanical checklists or, at a minimum, develop a process to reinforce challenge and response checklists.	7.0
2.8	2.5	327	Air Traffic service runway selection policies should be based on the most current wind available.	7.0
2.7	2.5	332	Manufacturers should design ground sensing systems that are tolerant to adverse conditions without degrading in-flight safety features (e.g. which prevent deployment of ground spoilers and reverse in-flight). (see 16)	6.8
2.5	2.7	143	Airlines/operators should and regulatory agencies must encourage a culture that enhances safety in their daily operations (safety culture) (see 22, 63, 348)	6.7
2.8	2.3	80	Airlines/operators should ensure, and regulators should check, that operators who create their own AOM's include all procedures prescribed by original equipment manufacturers Airplane Flight Manual (AFM).	6.5
2.8	2.2	156	Require that autothrottles be used with all autopilot coupled approaches.	6.1
2.1	2.8	93	Air Traffic service should provide real time (most current) radio communication of critical airport and weather information.	6.0
2.1	2.8	110	Airlines/operators and regulators 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. (see 99)	6.0

2.1	2.8	125	Airlines/operators should encourage flightcrews to use precision approaches (glideslope guidance) when available and appropriate.	6.0
2.1	2.8	225	Airlines/operators and regulators should ensure necessary manuals (operational & maintenance) are complete, accurate, available and appropriately used.	6.0
2.1	2.8	238	To preclude conducting flight training during operational flights, when a need for training is identified, operators should conduct training in accordance with their approved training program.	6.0
2.1	2.8	248	To ensure adequate testing of equipment, manufacturers' testing should be conducted under worst case scenarios taking into account new technologies and testing under simulated flight realistic conditions.	6.0
2.1	2.8	249	To ensure the accuracy and safety of computer modeling used for design and failure analysis, the modeling must be adequately re-validated on a continuing basis to account for new technology.	6.0
2.2	2.7	252	To prevent loss of control in flight, all changes to flight critical components, such as primary propeller pitch controller components, should be considered major changes.	5.9
2.2	2.7	295	To enhance flightcrew performance in low visibility operations, the aviation industry should continue to develop and implement HUD capability. (see 149)	5.9
2.1	2.7	111	Airlines/operators should ensure that their training/standardization programs emphasize basic airmanship skills and knowledge during initial and recurrent training.	5.6
2.1	2.7	123	Airlines/operators should implement a true no-fault go around policy (learning vs. blame).	5.6
2.1	2.7	135	Airlines/operators and regulators should ensure checklist design and implementation of procedures to promote effective crew coordination and distribution of PF and PNF tasks. (see 82)	5.6
2.1	2.7	300	Airlines/operators should adopt, implement and train a risk assessment tool to enhance flightcrew awareness of hazards associated with all approaches and airports (see risk analysis tactical checklist).	5.6
2.1	2.7	328	Airlines/operators should ensure that flightcrews are trained to think in terms of "I will go-around unless" rather than "I will land unless". Regulatory policy should support this approach. (see 142, 311)	5.6
2.1	2.7	331	Airlines/operators and manufacturers should train crews to understand the capabilities and limitations of systems, conditions which would cause systems to not function as the crew anticipates, and how to detect those conditions (e.g. lack of brakes, spoil	5.6
2.1	2.7	350	Airlines/operators should ensure that adequate approach briefings are conducted that include descriptions of normal approach, non-normal conditions and the results of risk assessment analysis. (see 300)	5.6
1.8	3	149	Manufacturers should install a HUD as standard equipment. (see 85)	5.4
2.1	2.5	163	Airlines/operators should ensure that their training/standardization programs address common misperceptions that could lead to unsafe practices (i.e. ATC always wants high-energy approaches).	5.3
2.1	2.5	254	To avoid the isolated incident syndrome and to ensure on-going assessment of flight critical control system reliability, a focused safety or risk assessment of all in-service failures or problems should be conducted to determine the need for immediate resolution.	5.3
2.2	2.3	158	Develop technology to provide real time assistance to flightcrews with onboard system failures and diagnostics (e.g. data link transmittal to ground support) (see 103)	5.1
2.8	1.8	211	Airlines/operators should retrofit equipment to provide automatic altitude callouts on final approach. If unable, other altitude alerting or reminder systems (such as altimeter bugs) should be installed.	5.1
2.8	1.8	243	To prevent alerting overload, flight deck designs should consider smart alerting systems such as those with prioritization schemes or cancelable nuisance alerts.	5.1
1.8	2.8	145	Airlines/operators and regulators should establish appropriate operational restrictions when equipment is inoperative (MEL)	5.1
1.8	2.8	319	Regulators should require a Special Qualification Airport Briefing guide be incorporated with approach charts. (Subject matter must include aircraft specific local operational procedures)	5.1

1.7	3	207	Airlines/operators should develop procedures to specify how transfer of control is formally accomplished.	5.1
1.7	3	232	Airlines/operators should ensure all nose gear struts are serviced for cold weather operation are in accordance with OEM recommendations.	5.1
1.7	3	342	Airlines/operators should establish an SOP to ensure that flightcrews should not begin the approach until adequate briefing is completed for the expected runway. (see 17)	5.1
1.7	2.8	30	Airlines/operators should adopt the "delegated" approach to standard operating procedures. (e.g. monitored approach procedures)	4.8
1.7	2.8	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.	4.8
1.7	2.8	100	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adhering to MDA/DH.	4.8
1.7	2.8	157	Airlines/operators, regulators, Air Traffic service providers should establish policies or programs to address rushed approaches, including elimination of rushed approaches, recognition and rejection of rushed approaches and training for those encountered	4.8
1.7	2.8	246	To reduce pilot overload, airlines/operators policies should stress using the appropriate level of automation.	4.8
2.8	1.7	14	Install aural warning devices on aircraft to alert flightcrew of arrival at MDA/DH.	4.7
2.8	1.7	250	To ensure test components are representative of the final product, manufacturers should test the final component and regulators should require this type testing.	4.7
2.1	2.2	165	Airlines/operators should provide training scenarios that match realistic situations (i.e. stall recoveries during approach, in landing configuration at flight idle with the autopilot on (in simulator)).	4.6
1.7	2.7	115	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of rushed approaches. (see 13, 157)	4.5
1.7	2.7	132	Airlines/operators and regulators should ensure that disciplinary and prosecution policies don't adversely affect or countermand safety gains of good CRM practices. (see 308)	4.5
2.7	1.7	256	To prevent loss of aircraft control in-flight, all propeller pitch control systems must be designed to positively feather in the event of pitch control loss. Propeller pitch control system malfunctions must be positively annunciated to the flightcrew.	4.5
1.8	2.5	151	Regulators should establish policies that require additional monitoring of flightcrew members that have repeatedly failed check rides. (see 152, 335, 337)	4.5
2.2	2	158	Develop technology to provide real time assistance to flightcrews with onboard system failures and diagnostics (e.g. data link transmittal to ground support) (see 103)	4.4
1.7	2.5	306	Regulators should require manufacturers to equip all new aircraft with electronic checklists.	4.3
1.7	2.5	309	Airlines/operators should require flightcrews to fly precision instrument approach procedures during periods of reduced visibility and night operations. (see 59, 355)	4.3
2.8	1.5	153	Ensure that flightcrews are adequately trained in a level D simulator for dynamic characteristics before assignment to the line. (see 312)	4.2
1.4	3	255	To prevent catastrophic failures, the manufacturers should issue immediate telegraphic information to all operators, and regulators should require an immediate mandatory action (AD), following the initial failure report of any critical component malfunct.	4.2
1.4	2.8	7	Airlines/operators should ensure that their training/standardization programs emphasize review of approach and missed approach procedures. (see 329)	4.0
1.4	2.8	13	Air Traffic service providers should enhance ATC training to emphasize the dangers of rushed approaches and performance characteristics of modern jet transports. (see 115, 157)	4.0
1.4	2.8	23	Airlines/operators should ensure that regularly scheduled recurrent training (e.g. LOFT) emphasizes crew cooperation and working together to maximize safe operations. (see 308, 314)	4.0
1.4	2.8	64	Airlines/operators should ensure that their training/standardization programs direct the flightcrews to regularly cross check all instrumentation.	4.0
1.4	2.8	131	Airlines/operators should ensure that their training/standardization program emphasizes the importance of the team concept, cross cultural issues, evaluation of options and the obligation of the FO to effectively communicate any concerns (CRM) (see 237)	4.0

1.3	3	20	Airlines/operators should ensure that command oversight training for captains is provided during the upgrade process and in recurrent training and first officer responsibility for monitoring are reviewed during recurrent training.	3.9
2.1	1.8	130	Regulators should account for realistic rest scenarios when developing and implementing crew rest requirements during travel segments (see 31, 203, 257, 315, 316)	3.9
2.5	1.5	72	Air Traffic service providers should install MSAW-like capabilities worldwide with emphasis on high-risk airports.	3.8
1.4	2.7	99	Airlines/operators should ensure that clear, concise, accurate, appropriate standard operating procedures are published and enforced. (see 110)	3.7
1.4	2.7	147	Airlines/operators should require training/standardization programs which teach situation awareness. (the knowledge and understanding of the relevant elements of the pilot surroundings, including aircraft systems, and the pilots intentions)	3.7
1.4	2.7	251	To preserve the original intended level of airworthiness, there should be a better definition and classification of subsequent in-service major and minor critical component changes. The definition of critical component should be more specific.	3.7
1.3	2.8	89	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for non-precision approaches are adequate.	3.7
1.3	2.8	308	Airlines/operators should ensure their formal CRM training emphasizes the following management skills: decision making, workload management, crew coordination, planning, communication, situational awareness, and advocacy. (IAW AC120-51b). (See 133)	3.7
1.7	2.2	322	Airlines/operators should develop and implement a ground school and simulator training program similar to the Advanced Aircraft Maneuvering Program.	3.7
1.7	2.2	343	Airlines/operators should install radio altimeters in all aircraft and develop procedures for their use on approach as recommended by FSF ALAR.	3.7
2.1	1.7	60	Avionics manufacturers should improve GPWS capability to reduce GPWS nuisance warnings. (See 243)	3.5
1.4	2.5	316	Regulators should require airline/operators to train flightcrews to recognize and counteract acute and chronic fatigue. (see 31, 130, 203, 257,315)	3.5
1.3	2.7	112	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for simulated instrument failures (partial panel) are adequate.	3.5
1.3	2.7	213	Airlines/operators and regulators should provide additional inspectors/inspection of sub-contract activity. (see 201, 202)	3.5
1.3	2.7	223	Regulators should ensure POIs are properly qualified and trained to approve appropriate company operational procedures.	3.5
1.7	2	79	Airlines/operators should implement a reliable process to communicate information to the flightcrew that may affect flight or aircraft operations.	3.4
1.7	2	129	Regulators should establish criteria to ensure operators overall quality assurance and compliance procedures are effective rather than reliance on spot checks of individual components	3.4
1.1	3	227	Airlines/operators should ensure that their training/standardization program emphasizes the benefits of inter-crew/company communications. (see 131)	3.3
1.1	3	314	Airlines/operators should develop simulator training scenarios that require flightcrews to learn multi-tasking abilities and appropriate prioritization abilities in concert with CRM skills (see Red Flag LOFT scenarios).	3.3
1.4	2.3	103	Manufacturers should develop and implement system failure annunciation capabilities to alert flightcrews of pending failures (e.g. HUMS). (see 45, 138)	3.3
1.5	2.2	253	To prevent loss of control, there should be redundancy and failure tolerance features for all flight critical components, such as dual path design, fail operational redundant systems, with fault annunciation.	3.3
1.3	2.5	345	Ensure regulators have adequate funding, training and processes to accomplish their oversight responsibilities. (see 201)	3.3
1.1	2.8	25	Airlines/operators should establish a CRM training program and regulators should require and insure that the initial training is provided prior to line flying and require recurrent CRM training. (see 131, 132, 349)	3.1
1.1	2.8	82	Airlines/operators should clearly define, train and check the specific PF/PNF duties. (see 135)	3.1

1.1	2.8	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.	3.1
1.1	2.8	228	Regulators should require airlines/operators to modify their training to maximize benefits of inter-crew/company communications.	3.1
1.1	2.7	19	Airlines/operators should implement a procedure to climb to a minimum safe altitude when position uncertainty exists by at least one crewmember. Flightcrew must advise ATC of intentions.	2.9
1	2.8	136	Airlines/operators should ensure that their training/standardization programs emphasize the importance of the sterile cockpit environment	2.8
1.7	1.7	159	Manufacturers should incorporate an "input rudder" indicator or automatic yaw compensation to ensure that adequate yaw control is provided.	2.8
1.3	2.2	6	Regulators should establish standardized approach plate depiction/information requirements for approach plate publishers.	2.8
2.1	1.3	49	Regulators should establish criteria for, and manufacturers should evaluate and improve, the reliability and failure tolerance of flight systems. (see 332)	2.8
2.1	1.3	150	Regulators or other governing authorities should establish policies that ensure that surrounding lights are distinguishable from airport lighting in order to avoid confusion (safety process, policy).	2.8
0.9	3	162	Airline/operators should include in their training programs the awareness of potential safety risks due to the complacency when operating at a very familiar airport (e.g. home base).	2.7
0.9	3	325	Airline/operators should emphasize during initial and recurrent training the importance of maintaining systems status awareness during non-normal events and hazardous approaches (goal to avoid tunnel vision/narrowed attention)	2.7
1.1	2.3	133	Airlines/operators training of Captains and Chief Pilots should include Management practices that promote team building and effective human relations (leadership training beyond current CRM programs). (see 308)	2.6
0.9	2.8	17	Airlines/operators should ensure that their training/standardization programs emphasize the importance of all flight-related briefings. (see 342)	2.6
0.9	2.8	146	Regulators should establish/enforce reasonable limitations on dispatch with safety related equipment inop. (MEL)	2.6
0.9	2.8	214	Regulators should enforce timely incorporation of appropriate manufacturers recommendations. (see 98, 201)	2.6
0.9	2.8	219	Regulators should ensure company training program is in accordance with approved training program.(see 110, 201)	2.6
0.9	2.8	231	Regulators should require and airlines/operators should promptly close out all regulatory safety audit findings.	2.6
0.8	3	144	Airlines/operators and regulators should ensure that their training/standardization programs clarify the differences between vertical and slant range visibility	2.4
0.8	3	312	Airline/operators should ensure flightcrews are trained in operations involving low light and poor visibility, on wet or otherwise contaminated runways, and with the presence of optical or physiological illusions before they are assigned line duties. (re	2.4
0.9	2.7	321	Regulators and Military agencies should ensure procedures are in place to share information pertaining to operations at joint use airports. (Special Use Airports)	2.4
1.3	1.8	202	Airlines/operators should develop a quality assurance program to ensure compliance with regulations.(see 145, 146, 201)	2.4
0.8	2.8	124	Air Traffic service providers should implement a Quality Assurance program to ensure adherence to established procedures.	2.3
0.8	2.8	233	Regulators should require operators incorporate OEM strut servicing recommendations in mandatory maintenance procedure and surveill compliance.	2.3
0.9	2.5	15	Airlines/operators should ensure that their training/standardization programs instruct when to disengage automated systems and fly manually. (see 246)	2.3
1.1	2	315	Regulators should update flight time/duty time regulations to counteract present commercial aviation environmental stressors. (e.g. crew rest requirements) (see 31, 130, 203, 257, 316)	2.2

1	2.2	310	Regulators should not allow noise abatement procedures that reduce the level of safety that existed prior to their implementation.	2.2
1	2.2	339	Regulators should require captains and first officers each have identical approach charts for reference.	2.2
0.8	2.7	161	Airlines/operators should implement procedures that call for an immediate recovery maneuver following a flight control warning (e.g. stall warning) (see 61)	2.1
0.9	2.3	201	Regulators should develop adequate oversight as appropriate to ensure compliance with regulations.(see 145, 146, 202, 345)	2.1
0.8	2.5	152	Airlines/operators and regulators should raise standards (e.g. crew pairing, approach minimums, etc.) for flightcrew members that meet minimum qualifications but have demonstrated specific weaknesses. (see 151, 335, 337)	2.0
0.7	2.8	113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning.	2.0
0.7	2.8	113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning.	2.0
0.7	2.8	203	Airlines/operators should provide crews with in-flight rest periods and adequate facilities. (see 31, 130, 315)	2.0
0.9	2.2	138	Manufacturers should ensure that design logic for warnings and equipment failures to be annunciated to the crew do not cause nuisance warnings which would contribute to crew complacency. (see 45, 243)	2.0
0.7	2.7	105	Airlines/operators should train flightcrews on how flight delays upon departure or enroute (weather, maintenance, ATC, etc.) can affect their subsequent decision making relative to the safe conduct of the flight.	1.9
0.7	2.5	218	Airlines/operators should properly surveill contractor training programs for adequacy of training.(see 110, 202)	1.8
0.7	2.2	340	Airlines/operators should implement procedures to ensure flightcrews are aware of appropriate Airworthiness Directives, Certification and flight testing standards. (see 76, 46)	1.5
1.1	1.3	154	Airlines/operators should improve/increase training to increase awareness of icing effects on airplane type including dynamic simulator training.	1.5
0.6	2.3	37	Regulators should discontinue on-time arrival tracking for airlines.	1.4
0.5	2.7	311	Airlines/operators should ensure their "reward system" does not penalize flightcrews for executing missed approaches. (see 217)	1.3
0.7	1.8	317	Regulators should ensure one level of safety exists for all commercial transport operations (whether passenger or freighter operations).	1.3
0.7	1.7	245	To recover aircraft in unusual attitude, manufacturers should develop systems to return aircraft to normal attitude with one pilot button push (pilot initiated auto-recovery systems).	1.2
0.4	2.8	12	Air Traffic service providers should emphasize in ATC training the controllers' potential in assisting the flightcrew in improving their situation awareness.	1.1
0.4	2.8	22	Airlines/operators should encourage a culture that emphasizes safe arrivals over timely arrivals. (see 63, 143)	1.1
0.4	2.8	47	Airlines/operators should ensure that their training/standardization programs direct the flightcrews to use all available resources (charts, ATC, inter/intra crew) to establish aircraft position. (see 75)	1.1
0.4	2.7	88	Airlines/operators should train and monitor flightcrew compliance with established communication phraseology guidelines. (see 240)	1.1
0.4	2.7	95	Airlines/operators should establish procedures for flightcrews to review/cross check instructions, clearances, etc. to ensure consistency with expected procedures or practices.	1.1
0.6	1.7	334	Regulators should require airports to comply with International standards for airport construction.	1.0
0.4	2.5	355	Non-precision approaches should be conducted as constant angle, stabilized approaches. (see 59)	1.0
0.3	2.8	48	Airlines/operators and regulators should strictly enforce flight/duty time limitations.	0.9
0.3	2.8	106	Air Traffic service providers should train and monitor ATC adherence to established communications procedures including hearback problems. (see 240)	0.9

0.3	2.8	141	Airlines/operators and regulators should require training/standardization programs include training regarding physiological effects on aircrew performance, (e.g. low blood sugar).	0.9
0.3	2.8	324	Air Traffic services should ensure proper/close supervision of controllers undergoing training so that all outages, construction, airport hazards, etc. are reported to flightcrews in a timely and accurate manner. (see 11)	0.9
0.3	2.7	217	Airlines/operators should ensure their "reward system" is not related to the completion of a route segment. (see 311)	0.8
0.3	2.7	353	Airlines/operators should establish and enforce a clear MEL policy to aid flightcrews in making maintenance-related decisions.	0.8
0.3	2.3	349	Airlines/operators should ensure training for instructors and check airmen include objective criteria to be used in evaluating crew CRM performance. (see 25,131)	0.7
0.4	1.7	235	Manufacturers should provide a more positive means of external strut pre-flight inspections.	0.7
0.4	1.7	259	Regulators should set engineering standards requiring propeller manufacturers to provide positive prevention designs, to eliminate all flight critical failure modes (e.g. flat pitch).	0.7
0.3	2.2	122	Air Traffic service providers should implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications.	0.7
0.3	2.2	352	Airlines/operators should equip aircraft with autopilots to reduce crew workload during critical phases of flight.	0.7
0.2	2.8	75	Airlines/operators should ensure that their training/standardization programs direct that flightcrews use all available tools to establish aircraft position. (see 45)	0.6
0.2	2.7	347	Parent airlines/operators should adopt a program to ensure the same level of safety in regional partners including, but not limited, to recruitment, training, operations and maintenance.	0.5
0.2	2.3	354	Organizations responsible for developing approach/arrival/departure procedures should not report to the organization responsible for Air Traffic service (e.g. In the FAA AVN-100 not reporting to AAT)	0.5
0.3	1.5	94	Implement real time (digital) transmission of airport and weather information to the aircraft.	0.5
0.1	3	137	Manufacturers should ensure cockpit design that does not interfere with or distract the flightcrew from executing their duties (e.g. rain in the cockpit, location of switches in cockpits)	0.3
0.1	2.8	21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flightcrews is occurring.	0.3
0.1	2.8	63	Airlines/operators should implement a culture which encourages flightcrew voluntary removal from flight status due to illness and/or emotional distress (including the use of a self-assessment tool). (see 70)	0.3
0.1	2.8	108	Air Traffic service providers should implement and/or review procedures to ensure ATC training does not create a hazard to flight operations.	0.3
0.1	2.8	320	Air Traffic service providers should institute an ATC "Crew Resource Management Program" similar to those required of flightcrews. (FAA AC 120-51b)	0.3
0.1	2.7	222	Regulators should require PMI's to have expertise in the assigned carrier's equipment.	0.3
0.1	2.3	220	Regulators should ensure that all POIs are current and qualified in one model of the company's equipment.	0.2
0.1	2.2	242	To prevent excessive fatigue, airlines/operators should consider circadian rhythm in crew scheduling to compensate for the effects of rhythm interruptions.	0.2
0.1	1	42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology.	0.1
0	3	236	Airlines/operators should develop/publish appropriate procedures for radio communications restoration.	0.0
0	2.8	240	To reduce the possibility of error, confusion and workload increase related to ATC clearances, regulators should require and operators ensure that flightcrews utilize proper phraseology and readbacks. (see 88)	0.0
0	1.7	241	To eliminate hearback errors, ATC should reexamine and implement improvements to address hearback problems. (see 240)	0.0

0	3	247	To ensure timely dissemination of navaid anomalies, airlines/operators and ATC should re-emphasize the requirement that flightcrews report and ATC disseminate any navigation anomalies.	0.0
0	2.2	257	To eliminate loop holes in crew rest requirements and to ensure adequate crew rest, regulators should clarify crew rest regulations. (see 31, 130, 203, 315, 316)	0.0
0	2.8	258	To facilitate the FAA awareness of safety related problems; there should be improved dissemination of the FAA hotline numbers.	0.0
0	2.8	296	To mitigate confusion regarding ATC clearances, operators should develop procedures to ensure flightcrews query ATC whenever uncertainty exists.	0.0
0	2.3	346	Airlines/operators should ensure better-educated regulators by providing intern programs.	0.0

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Aircraft Design

SOW: The purpose of this project is to ensure critical control systems design incorporate fault tolerant design and are subjected to critical point flight realistic condition certification testing/analysis. Changes to critical systems will be considered a major change unless the applicant can show the change is in fact a minor change and monitor the continued airworthiness (in-service failures) of these systems using a risk assessment focused methodology.

OPTIONS:
A proactive review/evaluation of critical components anytime maintenance is performed, or service difficulty report received, on critical control systems.

Develop and issue revised guidance material accomplishing the objectives of this SOW to be applied during certification of new designs and continued airworthiness evaluations.

STAKEHOLDERS: Manufacturers, FAA, and Operators

POTENTIAL IMPACT:
Additional costs associated with more extensive design reviews and testing, lowering the incidence of these control systems contributing to ALAR, reduce the amount of "isolated cases", modify service difficulty reporting practices.

CURRENT STATUS: AC 39-xx (in development), applicable to risk management of continued airworthiness problems currently in coordination.

PROJECT PLANNING LEADER: Paul Russell, Boeing

DETAILED PLAN BY: June 1, 2000

Flightcrew Training

SOW:
Ensure that Part 121 flight training departments implement syllabi that train and evaluate aircrews on stabilized approaches. Examples of topics such as crew resource management, go-around criteria, approaches with system malfunctions, rare-normal conditions, emphasis on basic airmanship, approach briefings, approach and missed approach procedures, and advanced aircraft maneuvering (e.g., unusual attitude and upset recovery).

OPTIONS:
- Operators and Part 142 Training providers voluntarily include all the above training topics, and develop evaluation of same.
- FAA: develop and publish regulatory/policy changes or guidelines to create and evaluate these training standards**.**

STAKEHOLDERS:
Operators, pilots associations, and the FAA.

POTENTIAL IMPACT:
- Reduce approach and landing accidents due to better flightcrew training and enhanced crew performance.
- Increased crew situation awareness and coordination during approaches.
- Increased FAA surveillance of training programs.
- Increased training costs to operators for program changes (i.e. Added sims , added training events and added CBT or classroom activity).

CURRENT STATUS:
There are numerous good examples of training programs at various levels of voluntary compliance.

PROJECT PLANNING LEADERS: Rick Williams ALPA/Delta

DETAILED PLAN BY: June 1, 2000

Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion

SOW: The purpose of this project is to ensure vertical situation awareness and accomplishment of checklist items; to develop guidelines and procedures for flight deck smart alerting system design through:

- The installation of equipment to provide automatic alert call outs on final approach or other altitude alerting systems.
- The installation of automated or mechanical checklist devices to provide a positive means for checklist completion.
- Research and assessment of existing technology in flight deck smart-alerting system design.

OPTIONS:

- Installation of automatic aural altitude alerting system in all new production aircraft.
- Installation of automatic or mechanical checklist devices in all new production aircraft.
- A retrofit program to capture in-service aircraft.
- Include in Standard Operating Procedures a process to reinforce checklist Challenge/Response or PF/PNF procedures.
- May require a rule if voluntary compliance does not achieve desired results.
- Encourage research to develop guidance, specifications and implementation strategies for flight deck smart-alerting system design and survey existing industry technology.

STAKEHOLDERS: Aircraft and Avionics Equipment Manufactures, FAA, NASA, Operators, ATA, APA, ALPA, RAA, and Human Factors.

POTENTIAL IMPACT: Additional resources associated with research, design, certification, and installation. Operational considerations should include training and procedures for use of new equipment.

CURRENT STATUS: Varying degree (in current fleet) of implementation of aural warning, automated checklist, and flight deck smart-alerting design. NASA Aviation Safety Program currently conducting research in related areas (Single Aircraft Accident Prevention Project).

PROJECT PLANNING LEADER: Jerry Davis, Airbus Industrie Inc.

DETAILED PLAN BY: October 1, 2000

Maintenance Procedures

SOW: A reduction in Approach and Landing accidents is attainable by re-emphasizing current Maintenance rules, policies, and procedures developed by the commercial airline operators and the FAA. The re-emphasis should specifically direct:

- That approved maintenance programs related to the servicing of components incorporate all of the OEM safety related components and procedures
- That oversight of sub contract activity is increased by both the operators and regulators, and
- That MEL policy and procedures are strictly adhered to. The re-emphasis could be acted upon almost immediately.

OPTIONS:

- If unsuccessful with the re-emphasis of current maintenance rules, policies, and procedures, additional rule making would need to be initiated.

STAKEHOLDERS: Commercial airline operators, employee associations, regulatory agencies (FAA).

POTENTIAL IMPACT: Minimal to operators, would require a positive self compliant commitment by operators, may require additional operator and regulatory oversight personnel, would reduce ALAR accidents.

CURRENT STATUS: Current maintenance rules, policies and procedures are adequate. Re-emphasizing those rules, policies and procedures along with the operators, employee groups, and regulators working in partnership, ALAR accidents can be reduced.

PROJECT PLANNING LEADER: Jerry Tegen, ACE-203

DETAILED PLAN BY: June 1st, 2000

ALAR Policies (Safety Culture)

SOW: Develop a strategy to promote a safety culture at each Part 121 air carrier specifically targeting approach and landing accident reduction (ALAR). Ensure that essential safety information generated by an airplane manufacture and by the FAA is included in company operating manuals and in training programs for pilots and other appropriate employee groups. Teams of volunteers within each air carrier would jointly develop manuals and training programs striving for the highest safety goals. The teams would further ensure that the content of those manuals would be rigorously followed in training programs and in day-to-day operations. It is recognized that rulemaking may be necessary to clarify existing requirements specifying the content and use if company operating manuals.

OPTIONS:

1. Delegation. The JSIT would identify safety functions of each operator's Director of Safety (DOS) and would recommend that the DOS maintain an effective safety culture. Those functions would specifically include ensuring timely inclusion in company manuals of essential safety information generated by an airplane manufacture or by the FAA.

2. Voluntary joint effort. Operators and the FAA would work together voluntarily to ensure that an effective safety culture is a top corporate priority, and to ensure specifically that company operating manuals are aligned with manufactures' operating manuals to reflect all essential safety information. (Rulemaking may be required to clarify existing requirements regarding operating manuals.)

3. Guidance may be issued to manufactures and FAA defining essential safety information requirements for Manufactures manuals. Rulemaking may be required compelling an effective safety culture comprising high quality operating manuals and training programs

STAKEHOLDERS: Part 121 certificate holders; their Directors of Safety; their managers, maintenance staff, and pilots; pilots associations; the FAA (principally AFS; AEGS, AFS-200, and AFS-300).

POTENTIAL IMPACT: A productive in-house collaboration tends to endure as a Safety Culture. Benefits accrue to every stakeholder, especially the public.

CURRENT STATUS: HBAT 99-07 was issued on 5/28/99, followed by HBAT 99-16 on 10/25/99. Together those bulletins established FAA policy designed to improve the quality of the manuals and training programs involving Part 121 pilots. Rulemaking is being considered in Part 121 N and O that would require essential safety information generated by an airplane manufacture, and by the FAA, to be included in those manuals and training programs. NPRM to be issued during December, 2000.

PROJECT PLANNING LEADER: Hop Potter, AFS-210

DETAILED IMPLEMENTION PLAN BY: June 1, 2000

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Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan
for
Aircraft Design

Executive Summary

The purpose of this project is to ensure flight critical system components incorporate fault tolerant design principles and are subjected to critical-point, flight-realistic-condition, certification testing/analysis. Changes to flight critical system components will be considered a major change unless the applicant can show the change is in fact a minor change and monitors the continued airworthiness (in-service failures) of these systems using a risk assessment focused methodology.

Lead organization for Overall Project Coordination (LOOPC):

AIR-1 (LOOPC)

Output 1:

- Utilize the definition developed by ARAC 25.1309 working group to identify flight critical system components as the basis for design guidance, continuing airworthiness, and maintenance.

Resources: ARAC 25.1309 working group (LOOC)

Timeline: TBD

Actions: Await the ARAC report.

Output 2:

- Issue design guidance to ensure flight critical system components are fault tolerant and are subjected to critical-point, flight-realistic-condition, certification testing/analysis.

Resources: AIR-1 (LOOC) and Manufactures

Timeline: 12 Months after issuance of ARAC report

Actions: Review AC's 23.1309-1B (Equipment, Systems, and Installations in Part 23 Aircraft), 25.1309-1A (System Design and Analysis) and 25-7 (Flight Test Guide for Certification of Transport Category Airplanes, and appropriate FAR's. Ensure these AC's/FAR's adequately address flight critical component fault tolerance, error tolerance, unintended functions, and hazard assessment to include critical point flight

envelope testing (including computer modeling and simulation) and reliability requirements. Issue new guidance on the control of design changes to flight critical components (including STC/PMA)

Output 3:

- Issue guidance to 1) ensure continuing airworthiness processes adequately analyze fleet performance to verify that the original design level of safety remains unchanged and 2) ensure that safety risk management processes are applied to identify and prioritize safety critical threats/trends and mitigating corrective action.

Resources: AIR-1 (LOOC), AFS, Manufacturers, and Operators

Timeline: 1) FAA; 12 Months, 2) Manufacturers/operators; 12 months after receiving guidance material.

Actions: Regulators will develop guidance on acceptable procedures to ensure that there is timely closure of all safety related reported events. Manufacturers will develop a process that ensures original reliability design assumptions are valid and a new safety issue has not occurred. The operators will develop a process within their approved continuing airworthiness program that includes a method for reporting of all safety related events.

Output 4:

- Issue guidance on acceptable procedures to ensure maintenance activity involving flight critical system components does not reduce or compromise the designed level of safety and is in accordance with FAA approved data.

Resources: AFS-300 (LOOC), Manufactures, and Operators

Timeline: 6 Months

Actions: AFS-300 will issue an HBAW that specifies 1) that maintenance activity involving flight critical system components does not reduce or compromise the designed level of safety, and 2) that maintenance activity is in accordance with FAA approved data. The bulletin will further provide that significant discrepancies noted during maintenance are reported in a timely manner.

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan
for
Flightcrew Training

Executive Summary

Ensure that Part 121 air carriers implement syllabi that train and evaluate aircrews on stabilized approaches, unusual attitudes, and upset recoveries. Specific topics related to stabilized approaches should include: crew resource management, go around criteria, approaches with system malfunctions, non-normal conditions, emphasis on basic airmanship, approach briefings, approach and missed approach procedures.

Lead Organization for Overall Project Coordination (LOOPC):

AFS-1

Output #1

Develop an ALAR JSIT Training Guide, using the Flight Safety Foundation CFIT and ALAR training guide and similar documents as reference material, that addresses the topics contained in Output 3 below.

Resources : ATA Training Committee (LOOC), ALPA, RAA, APA, manufactures and AFS-200.

Timeline : 180 Days

Action : The organizations identified under resources above will convene a working group and develop the necessary training guide working collaboratively.

Output #2

Issue a Handbook Bulletin strongly recommending that air carrier effectively address the specified topics under their approved flightcrew qualification programs (approved training programs).

Resources: AFS-200 (LOOC), ATA, ALPA, APA and RAA

Timeline: 60 days after development of the Training Guide.

Actions: Handbook Bulletin drafted by AFS-200 listing specified training and procedures, flightcrew qualification programs revised by air carriers, if required, approval of revised qualification programs granted by the assigned POI.

Output #3

Utilizing the ALAR JSIT Training Guide, conduct a review of all Part 121 air carriers by their assigned Principal Operations Inspector (POI's) and Directors of Safety (or designees) to determine which air carriers effectively address the following topics under their flightcrew qualification programs (approved training programs):

- Stabilized Approaches
- Go Around Gates and Missed Approach Criteria
- Approach Procedures and Briefings
- Non Normal Aircraft Conditions
- CRM Courses and Training
- Basic Airmanship Skills
    - Specific turbojet, high speed, versus propeller, low speed aircraft characteristics for transitioning pilots if appropriate
    - Basic instrument and visual airmanship.
- Transfer of Aircraft Control
- Upset recoveries, unusual attitudes, mountain flying, heavy aircraft operations.

Resources: AFS-1, (LOOC), AFS-200, POI's, ATA, APA, ALPA, Directors of Safety and RAA.

Timeline: 60 days after issuance of Handbook Bulletin

Actions: Through Regional Flight Standards Division Managers, AFS-1/AFS-200 will request POI's, working together with the Directors of Safety, to conduct a review of their assigned Part 121 air carriers and identify those carriers that do not provide the specified training and procedures within their approved Part 121 flightcrew qualification programs.

Output #4

Industry and Employee Groups will coordinate with the Director of Safety to ensure their air carriers establish effective flightcrew qualification programs (approved training programs) as specified in Output 1 and in turn report to their respective CAST member representative on implementation progress.

Resources: ATA (LOOC), RAA, NACA, ALPA, APA and Air Carriers.

Timeline: 300 days after initial review.

Action: Industry Groups and Employee Groups will communicate to their member operators the importance of addressing these specified topics in their respective flightcrew qualification programs. Operators will report to CAST representatives to ensure through their respective Directors of Safety that these topics have been addressed in their approved qualification programs.

Output #5

Through Regional Flight Standards Division Managers, AFS-1/AFS-200 will request POI's to conduct a re-review of all Part 121 Air Carriers utilizing the CFIT/ALAR JSIT Training Guide to determine that all carriers effectively address, the specified topics in their flightcrew training programs (approved training programs).

Resources: AFS-1 LOOC), AFS-200, POI's, Air Carriers.

Timeline: 300 days after initial review.

Action: All Part 121 Air Carrier will evaluate their flightcrew qualification programs, those that do not contain the specified topics will submit revised qualification programs, if appropriate. POIs will approve the revisions incorporating training and evaluation in the specified topics.

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan for Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion

Executive Summary

The purpose of this project is to ensure altitude awareness and accomplishment of checklist items. This will be accomplished through the development of guidelines and procedures for flight deck smart alerting system design and supporting operational procedures and training based upon:

- The installation of equipment to provide automatic aural altitude alert calls outs on final approach or other such altitude alerting systems.
- The installation of automated or mechanical checklist devices to provide a positive means for checklist completion.
- Research and assessment of existing technology in flight deck smart-alerting system design.

Lead Organization for Overall Project Coordination (LOOPC):

AIR-1

New Type Design Aircraft
Applies to Type Certificates (TC's) (new and amended) and Supplemental Type Certificates (STC's) as required by existing FAA regulations

OUTPUT #1. Implement interactive electronic checklist and smart alerting systems that address issues: such as:

- Reduced nuisance alerts
- Reduced redundant alerts
- Flight-phase sensitive alerts (e.g., some alerts attenuated on takeoff roll, others on short final approach)
- Built-in logic prompting the flightcrew to appropriate actions

Resources: AIR-1 (LOOC), AFS, Manufacturers, Airlines/Operators (training)

Timeline: 1) FAA: 24 months, 2) Manufacturers: with each new type design aircraft following issuance of advisory material, 3) Operators: with delivery of new type design aircraft.

Actions: 1) FAA and Industry: Develop advisory material defining the characteristics of interactive checklist and smart alerting systems for all new type designs. Develop compatible operational guidance. 2)

Manufacturers: Design and Install on new Type Design aircraft. 3) Operators: Develop training syllabi and procedures for use.

OUTPUT #2. Manufactures evaluate/consider during checklist design, the principles contained in the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck Procedures* and the *NASA Human Factors of Flight-Deck Checklist: The Normal Checklist*.

Resources: AIA (LOOC), FAA, Airlines/Operators, ALPA, APA, ATA, RAA, NACA

Timeline: During development of new type design after issuance of advisory material.

Actions: Analyze the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck Procedures*, NASA *Human Factors of Flight-Deck Checklist: The Normal Checklist*, and evaluate/consider during design of checklist.

OUTPUT #3. Manufacturers should provide automatic aural altitude call outs on final approach for all new type design aircraft (including arrival at MDA/DH).

Resources: AIR-1 (LOOC), AFS, Manufacturers, Airlines/Operators (training)

Timeline: 1) FAA and Industry: 24 months, 2) Manufacturers: with each new type design aircraft following issuance of advisory material, 3) Operators: with delivery of new type design aircraft.

Actions: 1) FAA: Develop advisory material defining the standards for automatic aural altitude call outs on final approach (including arrival at MDA/DH) for all new type design designs. 2) Manufacturers: Design and Install on new type design aircraft. 3) Operators: Develop training syllabi.

Outputs: Existing Aircraft Type Designs

OUTPUT #4. Reassess checklists used in the existing fleet by considering the principles contained in the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck Procedures* and the *NASA Human Factors of Flight-Deck Checklist: The Normal Checklist*, and revising as necessary.

Resources: AFS-1 (LOOC), Airlines/Operators, ALPA, APA, ATA, RAA, NACA, Manufacturers

Timeline: 1) FAA; 12 months, 2) Manufacturers and airlines/operators; 12 months after issuance of advisory material and policy guidance.

Actions: Manufactures and airlines analyze the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck*

Procedures, NASA *Human Factors of Flight-Deck Checklist: The Normal Checklist*, review checklists and revise as necessary.

OUTPUT #5. Until TAWS is fully implemented, altitude reminder systems (such as altimeter bugs for MDA/DH) should be installed to improve altitude awareness on final approach.

Resources: AFS-1 (LOOC), Airlines/Operators, ALPA, APA, ATA, RAA, NACA

Timeline: 1) FAA; 12 months 2) Airlines/operators; 12 months after issuance of advisory material and policy guidance for altitude alerting or reminder systems.

Actions: Develop draft advisory material for FAR Part 121 operators and policy guidance for inspectors. Airlines/Operators install equipment and train for its use.

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan
for
Maintenance Procedures

Executive Summary

The purpose of this project is a reduction in Approach and Landing accidents by re-emphasizing current Maintenance rules, policies, and procedures developed by the commercial airline operators and the FAA. The re-emphasis should specifically direct:

- That approved maintenance programs related to the servicing of components incorporate all of the OEM safety related components and procedures
- That oversight of sub-contract activity is increased by both the operators and regulators, and
- That MEL policy and procedures are strictly adhered to. The re-emphasis could be acted upon almost immediately.

Lead Organization for Overall Project Coordination (LOOPC):

AVR-1

Output 1:

- AFS-300 will issue guidance, to their field inspectors, outlining FAA national policy to ensure that aircraft nose landing gear struts are serviced in accordance with the original manufacturers recommended methods for cold weather operations.

Resources: AFS-300 (LOOC) and PMI's

Timeline: Completed

Actions: Flight Standards Information Bulletin FSAW 97-10 dated March 3, 1997 was issued specifically as a result of this particular approach and landing accident. The bulletin describes FAA national policy regarding adequate procedures to ensure that aircraft nose landing gear struts are serviced in accordance with the manufactures recommended methods for cold weather operations. The bulletin closed NTSB Safety Recommendation A-96-166 and remains as current FAA national policy.

Output 2:

- AFS-300 will issue guidance, to their field inspectors, outlining FAA national policy for the evaluation and surveillance of sub-contractor maintenance providers.

Resources: AFS-300 (LOOC) and PMI's

Timeline: Completed

Actions: Flight Standards Handbook Bulletins HBAW-96-05C and HBAW-98-01 dated December15, 1997 and February 3, 1998 respectively, were issued specifically addressing FAA surveillance oversight activity of air carriers sub contractor activities and evaluation of contractual relationships between air carriers and maintenance providers. HBAW-96-05C closed NTSB Safety Recommendation A-97-74. Both bulletins remain as current FAA national policy.

Output 3:

- AFS-300 will issue guidance, to their field inspectors, revising FAA national policy regarding the use of Minimum Equipment List (MEL) conditions and limitations by air carriers.

Resources: AFS-300 (LOOC) and PMI's

Timeline: Completed

Actions: Flight Standards Joint Handbook Bulletin HBAT-98-18 and HBAW-98-09 dated April 28, 1998 were issued to provide guidance to aviation safety inspectors regarding the requirement for air carriers to include instructions concerning the MEL conditions and limitations. The bulletin closed NTSB Safety Recommendation A-97-57 and remains as current FAA national Policy.

Output 4:

- Directors of Safety will determine 1) that the maintenance deficiencies described in the attached bulletins and policy letters have been remedied and 2) that Quality Control Procedures have been implemented to ensure that those deficiencies are continually addressed.

Resources: ATA (LOOC), RAA, NACA, Directors of Safety

Timeline: 180 days

Actions: Directors of Safety will ensure an internal audit is conducted to determine that rules relating to the maintenance deficiencies described in the specified bulletins are being met through adequate maintenance procedures. Further, the DOS will establish system safety procedures to ensure continuing conformance with the bulletins. The DOS will report the outcome of the audit to his/her respective CAST member.

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan
for
Policies for ALAR (Safety Culture)

Executive Summary

The purpose of this project is to develop a strategy to promote a safety culture at each Part 121 air carrier specifically targeting approach and landing accident reduction (ALAR). Ensure that essential safety information generated by an airplane manufacturer and by the FAA is included in company operating manuals and in training programs for pilots and other appropriate employee groups. Teams within each air carrier would jointly develop manuals and training programs striving for the highest safety goals. The teams would further ensure that the content of those manuals would be rigorously followed in training programs and in day-to-day operations. It is recognized that rulemaking may be necessary to clarify existing requirements specifying the content and use of company operating manuals.

Lead Organization for Overall Project Coordination (LOOPC):

ATA (LOOPC), RAA, NACA

Background: Many milestones mark the development to date of an aviation safety environment promoting safety culture from within, among them:

1. Public Law calling for certificate holders to maintain the highest level of safety in the public interest (existing since 1958)
2. Comprehensive regulations and FAA policy specifying flight instructor and check airman functions and conduct, including standardization meetings (existing since the 1970s and earlier)
3. Public Law permitting the Secretary of the Department of Transportation to delegate to non-government persons (designated examiners) the awarding of airmen's certificates (existing since 1958)
4. Comprehensive FAA policy specifying the functions and conduct of aircrew program designees, or APDs (existing since 1983)
5. Advanced Qualification Program (AQP) permitting modern training of flightcrew based on crew concept, CRM, and data analysis for continual program improvement (existing since 1990)
6. Flightcrew training in crew resource management, or CRM (voluntarily training conducted since the late 1970s, mandatory training conducted since 1998)
7. Comprehensive FAA guidance recommending Air Carrier Internal Evaluation Programs, including a model program guide (existing since 1992)
8. Comprehensive FAA guidance recommending a Voluntary Disclosure Reporting Program (existing since 1992)

9. FAA regulation requiring a Director of Safety at each Part 121 certificate holder, responsible for keeping the highest management officials fully informed of the safety status of the entire air carrier operation (existing since 1995)
10. Comprehensive FAA guidance specifying recommended functions and conduct of the Director of Safety (existing since 1999)
11. Comprehensive FAA guidance specifying recommended quality control measures to be taken by an air carrier providing simulator flight training by way of outsourcing to a contractor (existing since 1996)
12. A special FAA certification program division, a national program office, and comprehensive FAA guidance to implement the Certification, Standardization, and Evaluation Team (CSET). CSET would assist local FAA offices in certification of air carrier start-ups. The expertise of CSET would include promoting best practices to each air carrier start-up and to its local FAA overseers (existing since 1997).
13. A national program office and comprehensive FAA guidance to implement the Air Transportation Oversight System (ATOS). ATOS would address an air carrier's entire safety system in terms of identifiable safety attributes. Emphasis in ATOS is on prevention of accidents, enlisting each air carrier under ATOS to effect preventive measures, as well as corrective measures. (existing since 1998).

Output #1

CEOs and other key officers made more visible and more effective in promoting Safety Culture.

Resources: ASY-1 (LOOC), CAST co-chairs, airplane manufacturers, operators, AOA-1, airline CEOs and DOS, industry associations (ATA, RAA, NACA, CAA, AIA**, etc.).**

Timeline:	CAST endorsement (G approval):	Expected, September 2000
	Initial distribution of the Guidance materials:	60 days from CAST endorsement
	Commitment Statement Due	90 days from CAST endorsement
	First report back to CAST:	120 days from CAST endorsement

Actions:

- Safety culture guidance material such as, *Operator's Aviation Safety Handbook*, SAE-G18 Committee document, FAA Audit Tool, or other similar guidance, endorsed by CAST.
- Guidance material, accompanied by a cover letter signed by the FAA Administrator and CAST co-chairs and a commitment statement, distributed by ASY to CEO of every Part 121 certificate holder.
- CEO's forward signed copy of commitment statement to industry association or CAST representative.
- Senior management, through the Director of Safety, report to CAST progress made on the above items and any new initiatives to improve their carriers safety culture.

Output #2

Directors of Safety are made more visible and more effective in promoting safety culture.

Resources: ATA (LOOC), CAST, RAA, NACA, CAA, Directors of Safety.

Timeline:	CAST endorses HBAT 99-19, "14 CFR Part 121 and 135 Air Carrier Safety Departments, Programs, and the Director of Safety"	Expected, November 2000
	Industry organizations distribute HBAT to DOS	60 days from CAST "G"
	First report back to CAST	120 days from CAST "G"

Actions:

- HBAT 99-19 endorsed by CAST as good guidance material.
- Industry organizations (ATA, RAA, NACA, CAA, etc.) contact the DOS of its member airlines and convey a copy of HBAT 99-19.
- DOS's, working through senior management, will implement guidance contained in HBAT 99-19.
- DOS's report back to the respective industry association periodically, or to CAST representative until all elements of an effective safety program are implemented.
- JIMT tracks implementation and DOS effectiveness in promoting safety culture.

Output #3

Director of Safety ensures the establishment of a process to identify, review, analyze and include appropriate safety information in training programs and in manuals used by flightcrews and maintenance staff.

Resources: ATA (LOOC), CAST, RAA, NACA, CAA, ALPA, APA, Directors of Safety.

Timeline:	CAST endorses HBAT 99-07, "Flight Standards Policy Company Operating Manuals and Company Training Program Revisions for Compliance with Current Airplane Or Rotorcraft Flight Manual Revisions"	Expected, November 2000
	Industry organizations distribute HBAT to DOS	60 days from CAST "G"
	First report back to CAST	120 days from CAST "G"

Actions:

- HBAT 99-07 endorsed by CAST as good guidance material.
- Industry organizations (ATA, RAA, NACA, CAA, etc.) contact the DOS of its member airlines and convey a copy of HBAT 99-07.
- DOS's, working through senior management, will apply principles contained in HBAT 99-07 to training programs and manuals used by flightcrews and maintenance staff.
- DOS's report back to the respective industry association periodically, or to CAST representative until all elements of an effective safety program are implemented.
- JIMT tracks implementation and DOS effectiveness in promoting safety culture.

Output #4

FAA fully implements the AFM database for inspectors' use.

Resources: AFS-600 (LOOC), AIA, manufacturers, and FAA Flight Standards and Aircraft Certification services, specifically including ANM-100 and AEGs.

Timeline:	CAST endorses HBAT 99-16, "Announcement of New Database System on the FAA Intranet: Airplane Flight Manual Revisions and Aircraft Manufacturers Operations Bulletins"	Expected, November 2000
	Industry organizations distribute HBAT 99-16 to manufacturers and to DOS	60 days from CAST "G"
	AFS-600 populates database w/ records	180 days from CAST "G"
	First report back to CAST	180 days from CAST "G"
	Subsequent reports to CAST	Each 90 days, until database 100% implemented

Actions:

- HBAT 99-16 endorsed by CAST as good guidance material.
- AIA contacts its members and conveys a copy of HBAT 99-16.
- Manufacturers supply AFS-600 with all future AFM-revisions for each model affected.
- Manufacturers supply AFS-600 with all future Operator's Bulletins, or the equivalent, for each model affected.
- FAA (AFS-600, ANM-100, AEG) populates the database with existing records in the most effective way possible for use by FAA inspectors, and all new records.

NO.	PROBLEM STATEMENT

Aircraft Design

Interventions 304, 332, 248, 249, 252, 254, 251

14 AIRCRAFT EQUIPMENT - EQUIPMENT FAILURE
39 AIRCRAFT EQUIPMENT - DESIGN NOT ERROR TOLERANT
57 AIRCRAFT EQUIPMENT – DESIGN SHORTCOMINGS

Flightcrew Training

Interventions 116, 111, 300, 328, 331, 350, 163, 165, 153, 131, 322, 96, 325, 17, 113, 105, 47, 75

2 FLIGHTCREW - FAILURE TO FOLLOW PROCEDURES (COMMUNICATIONS)
5 ATC / FLIGHTCREW INADEQUATE COMMUNICATIONS
10 FLIGHTCREW - FAILURE TO FOLLOW PROCEDURES (SOP)
11 FLIGHTCREW – INADEQUATE SITUATION AWARENESS (VERTICAL)
14 AIRCRAFT EQUIPMENT - EQUIPMENT FAILURE
16 FLIGHTCREW - CRM FAILURE
17 AIRLINE OPERATIONS - LACK OF STANDARDIZED PROCEDURES
19 FLIGHTCREW - LACK OF BASIC PILOTING SKILLS OR KNOWLEDGE
20 AIRLINE OPERATIONS - LACK OF TRAINING (FLIGHTCREW)
21 FLIGHTCREW - "PRESS-ON-ITUS"
22 FLIGHTCREW - PNF DUTIES NOT PERFORMED
23 FLIGHTCREW - DISREGARD FLIGHTDECK WARNING
29 AIRLINE OPERATIONS - NO-FAULT GO-AROUND POLICY
34 FLIGHTCREW - FAILURE TO EXERCISE COMMAND (CAPTAIN) RESPONSIBILITY
38 FLIGHTCREW INAPPROPRIATE TASK PRIORITIZATION UNDER TIME CONSTRAINTS
39 AIRCRAFT EQUIPMENT - DESIGN NOT ERROR TOLERANT
41 FLIGHTCREW - FAILURE TO USE AVAILABLE APPROACH AIDS
42 FLIGHTCREW - FAILURE TO ADDRESS COMBINED HAZARDS ASSOCIATED WITH THE SITUATION
43 FLIGHTCREW - HOME AERODROME COMPLACENCY
44 FLIGHTCREW -FAILURE TO RECOGNIZE AND CORRECT UNSTABLE APPROACH
45 FLIGHTCREW- FAILURE TO UNDERSTAND THE IMPLICATIONS OF INOPERATIVE OR DEGRADED SYSTEMS
47 FLIGHTCREW - FAILURE TO MAINTAIN AIRCRAFT SYSTEMS STATUS AWARENESS
48 AIRLINE OPERATIONS - LACK OF STABILIZED APPROACH CRITERIA, MANDATORY GO-AROUND POLICY
50 AIRLINE OPERATIONS - INEFFECTIVE CORRECTION OF PROCEDURAL NON-COMPLIANCE
51 AIRLINE OPERATIONS – SYSTEMIC COMPLACENCY AND NON-STANDARD CONDUCT
53 AIRLINE OPERATIONS – INEFFECTIVE/ INAPPROPRIATE DISCIPLINARY POLICIES
102 FLIGHTCREW – INADEQUATE PLANNING/BRIEFING
204 FLIGHTCREW – NOT ADEQUATELY PREPARED FOR THE TASK
305 AIRLINE OPERATIONS - LACK OF PROACTIVE SAFETY CULTURE/PROGRAM

Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion

Interventions 305, 211, 14, 306

10 FLIGHTCREW - FAILURE TO FOLLOW PROCEDURES (SOP)
11 FLIGHTCREW – INADEQUATE SITUATION AWARENESS (VERTICAL)
17 AIRLINE OPERATIONS - LACK OF STANDARDIZED PROCEDURES
22 FLIGHTCREW - PNF DUTIES NOT PERFORMED
38 FLIGHTCREW INAPPROPRIATE TASK PRIORITIZATION UNDER TIME CONSTRAINTS
101 AIRLINE OPERATIONS – FAILURE TO MAINTAIN AIRCRAFT SYSTEMS

Maintenance Procedures

Interventions 232, 145, 213, 146, 233, 353

23 FLIGHTCREW - DISREGARD FLIGHTDECK WARNING
45 FLIGHTCREW- FAILURE TO UNDERSTAND THE IMPLICATIONS OF INOPERATIVE OR DEGRADED SYSTEMS
101 AIRLINE OPERATIONS – FAILURE TO MAINTAIN AIRCRAFT SYSTEMS
305 AIRLINE OPERATIONS - LACK OF PROACTIVE SAFETY CULTURE/PROGRAM

ALAR Policies (Safety Culture)

Interventions 143, 225, 132, 255, 214, 340, 22

14 AIRCRAFT EQUIPMENT - EQUIPMENT FAILURE
15 AIRLINE OPERATIONS - CORPORATE "ON-TIME" CULTURE
20 AIRLINE OPERATIONS - LACK OF TRAINING (FLIGHTCREW)
21 FLIGHTCREW - "PRESS-ON-ITUS"
32 AIRLINE OPERATIONS - INADEQUATE INFORMATION DISSEMINATION
45 FLIGHTCREW- FAILURE TO UNDERSTAND THE IMPLICATIONS OF INOPERATIVE OR DEGRADED SYSTEMS
50 AIRLINE OPERATIONS - INEFFECTIVE CORRECTION OF PROCEDURAL NON-COMPLIANCE
51 AIRLINE OPERATIONS – SYSTEMIC COMPLACENCY AND NON-STANDARD CONDUCT
53 AIRLINE OPERATIONS – INEFFECTIVE/ INAPPROPRIATE DISCIPLINARY POLICIES
57 AIRCRAFT EQUIPMENT – DESIGN SHORTCOMINGS
100 REGULATORS – INSUFFICIENT AIR CARRIER OVERSIGHT .
101 AIRLINE OPERATIONS – FAILURE TO MAINTAIN AIRCRAFT SYSTEMS
105 AIRLINE OPERATIONS – PAIRING INEXPERIENCED PILOTS
305 AIRLINE OPERATIONS - LACK OF PROACTIVE SAFETY CULTURE/PROGRAM
308 AIRLINE OPERATIONS - SEVERE CORPORATE PRESSURE TO ACCOMPLISH MISSION
309 AIRLINE OPERATIONS - INADEQUATE "SPECIAL QUALIFICATION AIRPORT" TRAINING

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan
for
Aircraft Design

Statement of Work:

The purpose of this project is to ensure flight critical system components incorporate fault tolerant design principles and are subjected to critical-point, flight-realistic-condition, certification testing/analysis. Changes to flight critical system components will be considered a major change unless the applicant can show the change is in fact a minor change and monitors the continued airworthiness (in-service failures) of these systems using a risk assessment focused methodology.

Lead organization for Overall Project Coordination (LOOPC):

AIR-1 (LOOPC)

Outcome:

Develop and issue revised guidance material accomplishing the objectives of this project to be applied during certification of new designs and continued airworthiness evaluations.

Output 1:

- Utilize the definition developed by ARAC 25.1309 working group to identify flight critical system components as the basis for design guidance, continuing airworthiness, and maintenance.

Resources: ARAC 25.1309 working group (LOOC)

Timeline: TBD

Actions: Await the ARAC report.

Output 2:

- Issue design guidance to ensure flight critical system components are fault tolerant and are subjected to critical-point, flight-realistic-condition, certification testing/analysis.

Resources: AIR-1 (LOOC) and Manufactures

Timeline: 12 Months after issuance of ARAC report

Actions: Review AC's 23.1309-1B (Equipment, Systems, and Installations in Part 23 Aircraft), 25.1309-1A (System Design and Analysis) and 25-7 (Flight Test Guide for Certification of Transport Category Airplanes, and appropriate FAR's. Ensure these AC's/FAR's adequately address flight critical component fault tolerance, error tolerance, unintended functions, and hazard assessment to include critical point flight envelope testing (including computer modeling and simulation) and reliability requirements. Issue new guidance on the control of design changes to flight critical components (including STC/PMA)

Output 3:

- Issue guidance to 1) ensure continuing airworthiness processes adequately analyze fleet performance to verify that the original design level of safety remains unchanged and 2) ensure that safety risk management processes are applied to identify and prioritize safety critical threats/trends and mitigating corrective action.

Resources: AIR-1 (LOOC), AFS, Manufacturers, and Operators

Timeline: 1) FAA; 12 Months, 2) Manufacturers/operators; 12 months after receiving guidance material.

Actions: Regulators will develop guidance on acceptable procedures to ensure that there is timely closure of all safety related reported events. Manufacturers will develop a process that ensures original reliability design assumptions are valid and a new safety issue has not occurred. The operators will develop a process within their approved continuing airworthiness program that includes a method for reporting of all safety related events.

Output 4:

- Issue guidance on acceptable procedures to ensure maintenance activity involving flight critical system components does not reduce or compromise the designed level of safety and is in accordance with FAA approved data.

Resources: AFS-300 (LOOC), Manufactures, and Operators

Timeline: 6 Months

Actions: AFS-300 will issue an HBAW that specifies 1) that maintenance activity involving flight critical system components does not reduce or compromise the designed level of safety, and 2) that maintenance activity is in accordance with FAA approved data. The bulletin will further provide that significant discrepancies noted during maintenance are reported in a timely manner.

Relationship to Current Aviation Community Initiatives:

- Aviation Rule Making Advisory Committee (ARAC) on Advisory Circular (AC) 25.671 (both the AC and the rule, Part 25)
- ARAC on AC 25.1309-1A (System Design and Analysis)
- ARAC on AC 25.1329-1A (Automatic Pilot Systems Approval)
- ARAC on AC 39-xxx (Safety Risk Management for Part 25 Aircraft and engines)
- The Special Aging Systems Task Force

Performance Goals & Indicators for Outcomes/outputs:

- Goal: A substantial reduction or elimination of design related Approach and Landing accidents.
    - Indicator: Approach and Landing accidents for all U.S. Air Carriers are substantially reduced or eliminated.

- Goal: Review of AC's/FAR's completed and revised as necessary.
    - Indicator: Revisions drafted and published.

- Goal: Development of AC 39-XXX.
    - Indicator: AC drafted and published.

Programmatic Approach:

Organizational Strategy

The ALAR JSIT identified Paul Russell, Aviation System Safety, Boeing Airplane Company as the JSIT project lead for Aircraft Design. The project lead will work with FAA, Manufactures, and Operators until the Outputs of this project have been initiated. Thereafter, the project lead will monitor implementation activities outlined in the Implementation Plan and will provide progress reports, when requested, to the ALAR JSIT. Implementation is viewed as a shared responsibility and tasks will be divided between the FAA and organizations in industry. The Lead Organization for Overall project Coordination (LOOPC) is AVR-1. The Lead Organizations for Output Coordination (LOOC) are identified in each Output of this Implementation Plan. The roles and responsibilities of the LOOPC and LOOC are described in the CAST approved JSIT Process Document.

Implementation Activities

In collaboration with industry, the FAA will review pertinent AC's and FAR's to ensure flight critical system components are fault tolerant and are subjected to critical-point, flight-realistic-conditions, certification testing/analysis. Guidance will be issued to ensure continuing airworthiness processes adequately analyze fleet performance to verify that the original designed level of safety remains unchanged and utilize safety risk management processes to identify and prioritize safety threats/trends. Guidance will also be issued to ensure maintenance activity involving flight critical system components does not reduce or compromise the designed level of safety. Finally, methodology that identifies flight critical system components that form the basis for

design guidance, continuing airworthiness and maintenance will be developed by a working group comprised of FAA and industry organizations.

Key Products and Milestones:

- Review of Guidance Material 12 Months
  - FAR's
  - AC 23.1309-1B
  - AC 25.1309.1A
  - AC 25-7

- Issue Continuing Airworthiness Guidance 12 Months
  - Manufacturers
  - Operators
  - Regulators

- Issue Maintenance Activity Guidance 6 Months

- Develop Methodology Identifying Flight critical System Components 12 Month
  - Working Group

Plan and Execution Requirements:

If this project is approved, FAA, operators, and manufactures must commit adequate resources to support Aircraft Design implementation. Tasks must be shared by all parties to ensure equal resource allocation by all involved organizations. With activities that are currently underway, this project could be completed in a relatively short period of time.

Risk Description:

- Delay of guidance material
- Mixing various levels of users with competing interest.
- Economic burden for low end users
- Challenging validity of guidance material
- Without agreement rule making maybe required

Risk Mitigation Plan:

With the ARAC activity currently in progress concerning key guidance material contained in this project, timing is perfect for the completion and implementation of this project. Cooperation between FAA and industry organizations would avert the exhaustive rule making process and obtain the desirable result of a substantial reduction or elimination of design related Approach and Landing accidents.

Impact on Non - Part 121 or International Applications:

This project would impact commercial and corporate operators utilizing smaller aircraft certificated under Parts 23 and 25 of the FAA Regulations. The project would also impact foreign manufacturers and operators because of our Bi-Lateral agreements. However, JAA and ICAO are both represented on the CAST and the ALAR JSIT and have agendas for the reduction of ALAR accidents. Information is routinely exchanged between those organizations and the CAST and ALAR JSIT.

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan for Flightcrew Training

Statement of Work:

Ensure that Part 121 air carriers implement syllabi that train and evaluate aircrews on stabilized approaches, unusual attitudes, and upset recoveries. Specific topics related to stabilized approaches should include: crew resource management, go around criteria, approaches with system malfunctions, non-normal conditions, emphasis on basic airmanship, approach briefings, approach and missed approach procedures.

Lead Organization for Overall Project Coordination (LOOPC):

AFS-1

Outcome:

Substantially reduce or eliminate Approach and Landing (A&L) accident rate by the incorporation of A&L training into flightcrew qualification programs (approved training programs) of all Part 121 air carriers. This training will increase the pilots' ability to recognize and cope with airborne situations that would otherwise overtax their knowledge and skills.

Output #1

Develop an ALAR JSIT Training Guide, using the Flight Safety Foundation CFIT and ALAR training guide and similar documents as reference material, that addresses the topics contained in Output 3 below.

Resources : ATA Training Committee (LOOC), ALPA, RAA|, APA and AFS-200.

Timeline : 180 Days

Action : The organizations identified under resources above will convene a working group and develop the necessary training guide working collaboratively.

Output #2

Issue a Handbook Bulletin strongly recommending that air carrier effectively address the specified topics under their approved flightcrew qualification programs (approved training programs).

Resources: AFS-200 (LOOC), ATA, ALPA, APA and RAA

Timeline: 60 days after development of the Training Guide.

Actions: Handbook Bulletin drafted by AFS-200 listing specified training and procedures, flightcrew qualification programs revised by air carriers, if required, approval of revised qualification programs granted by the assigned POI.

Output #3

Utilizing the ALAR JSIT Training Guide, conduct a review of all Part 121 air carriers by their assigned Principal Operations Inspector (POI's) and Directors of Safety (or designees) to determine which air carriers effectively address the following topics under their flightcrew qualification programs (approved training programs):

- Stabilized Approaches
- Go Around Gates and Missed Approach Criteria
- Approach Procedures and Briefings
- Non Normal Aircraft Conditions
- CRM Courses and Training
- Basic Airmanship Skills
    - Specific turbojet, high speed, versus propeller, low speed aircraft characteristics for transitioning pilots if appropriate
    - Basic instrument and visual airmanship.
- Transfer of Aircraft Control
- Upset recoveries, unusual attitudes, mountain flying, heavy aircraft operations.

Resources: AFS-1, (LOOC), AFS-200, POI's, ATA, APA, ALPA, Directors of Safety and RAA.

Timeline: 60 days after issuance of Handbook Bulletin

Actions: Through Regional Flight Standards Division Managers, AFS-1/AFS-200 will request POI's, working together with the Directors of Safety, to conduct a review of their assigned Part 121 air carriers and identify those carriers that do not provide the specified training and procedures within their approved Part 121 flightcrew qualification programs.

Output #4

Industry and Employee Groups will coordinate with the Director of Safety to ensure their air carriers establish effective flightcrew qualification programs (approved training programs) as specified in Output 1 and in turn report to their respective CAST member representative on implementation progress.

Resources: ATA (LOOC),, RAA, NACA, , ALPA, APA and Air Carriers.

Timeline: 300 days after initial review.

Action: Industry Groups and Employee Groups will communicate to their member operators the importance of addressing these specified topics in their respective flightcrew qualification programs. Operators will report to CAST representatives to ensure through their respective Directors of Safety that these topics have been addressed in their approved qualification programs.

Output #5

Through Regional Flight Standards Division Managers, AFS-1/AFS-200 will request POI's to conduct a re-review of all Part 121 Air Carriers utilizing the CFIT/ALAR JSIT Training Guide to determine that all carriers effectively address, the specified topics in their flightcrew training programs (approved training programs).

Resources: AFS-1 LOOC), AFS-200, POI's, Air Carriers.

Timeline: 300 days after initial review.

Action: All Part 121 Air Carriers will evaluate their flightcrew qualification programs/ those that do not contain the specified topics will submit revised qualification programs, if appropriate. POIs will approve the revisions incorporating training and evaluation in the specified topics.

Relationship to Current Aviation Community Initiatives:

- Previous Flight Safety Foundation Report on ALAR accidents issued in 1998.
- Flight Safety Foundation ALAR Training Aid (template aid 4th Qtr 2000).
- Previous CFIT and ALAR reports published by the JSAT in 1999.
- Part 121 rulemaking in progress regarding Stabilized Approaches, Basic Airmanship, Upset and Unusual Attitudes Recovery.
- Most Part 121 air carriers are conducting voluntary Selected Event Training; some including added training events, simulator periods, and training days to their flightcrew qualification programs in response to recent accidents and pilot input.

Performance Goals and Indicators for Outcomes/Outputs:

- Goal: Substantial reduction of ALAR accidents involving Part 121 air carriers
- Indicator: 80% accident reduction of ALAR accidents by 2007

- Goal: All 121 Air Carriers have training and evaluation in their flightcrew qualification programs (approved training programs) in the specified topics .
- Indicator: 100% compliance by all Part 121 Air Carriers

Programmatic Approach:

Organizational Strategy

ALAR JSIT has identified Captain Rick Williams, Delta Airlines, as the project lead for ALAR Flightcrew Training. The project lead will work with AFS-200, ATA, and RAA to draft a Handbook Bulletin. Thereafter, the project lead will coordinate activities outlined in the implementation plan, and will provide progress reports, when requested, to the ALAR JSIT. Implementation is a shared responsibility between the FAA and the air carriers. . The Lead Organization for Overall project Coordination (LOOPC) is AVR-1. The Lead Organizations for Output Coordination (LOOC) are identified in each Output of this Implementation Plan. The roles and responsibilities of the LOOPC and LOOC are described in the CAST approved JSIT Process Document.

Implementation Activities

Upon request by AFS-1/AFS-200, a review of their assigned Part 121 air carriers will identify to the Principal Operations Inspector those air carriers that do not presently provide the specified training to their flightcrews. A Handbook Bulletin will be prepared by AFS-200, in collaboration with industry partners specifying guidance to the POI's and minimum training expectations. A re-review will determine that all Part 121 air carriers provide training in the specified topics.

Key Products and Milestones:

- Develop Training Guide — 180 Days
- Handbook Bulletin drafted by (AFS-200) — 60 days after development of Training Guide
- Review conducted by POI's — 60 Days after issuance of HBAT
- Revised programs, if needed, submitted and approved — 300 days after review
- Re-review conducted by POI's — 300 days after review

Plan and Execution Requirements:

The Training Guide and Handbook Bulletin should be user friendly, and clearly written with specific examples, to facilitate the current thoughts on recommended practices for flightcrew qualification program updates with respect to these listed outcomes.

Risk Description:

- Training Guide and/or Handbook Bulletin challenged by POI's
- Handbook Bulletin challenged by carriers
- Possible added training cost for carriers
- May require rule making

Risk Mitigation Plan:

Many of the air carriers presently provide training in the specified topics. Cooperation between FAA and industry organizations would avert the exhaustive rule making process and obtain the desirable result of a substantial reduction or elimination of Flightcrew related Approach and Landing accidents.

Impact on Non Part 121 or International Applications:

This project could impact commercial and corporate operators utilizing smaller aircraft in that flight training naturally appears to gravitate to the highest standard. The project would also have international applications. However, the JAA and ICAO are both represented on the CAST and the ALAR JSIT and have agendas for the reduction of ALAR accidents. Information is routinely exchanged between those organizations and CAST and ALAR JSIT.

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan for Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion

Statement of Work:

The purpose of this project is to ensure altitude awareness and accomplishment of checklist items. This will be accomplished through the development of guidelines and procedures for flight deck smart alerting system design and supporting operational procedures and training based upon:

- The installations of equipment to provide automatic aural altitude alert call outs on final approach or other such altitude alerting systems.
- The installation of automated or mechanical checklist devices to provide a positive means for checklist completion.
- Research and assessment of existing technology in flight deck smart-alerting system design.

Lead Organization for Overall Project Coordination (LOOPC):

AIR-1

Outcome:

A reduction in Approach and Landing accidents by enhanced vertical situation awareness and accomplishment of critical actions by developing requirements, guidelines, and procedures for flight deck smart alerting system design, automated or mechanical checklist devises, and automatic altitude call outs (including arrival at MDA/DH) and checklist design.

New Type Design Aircraft

Applies to Type Certificates (TC's) (new and amended) and Supplemental Type Certificates (STC's) as required by existing FAA Regulations

OUTPUT #1. Implement interactive electronic checklist and smart alerting systems that address issues: such as:

- Reduced nuisance alerts
- Reduced redundant alerts
- Flight-phase sensitive alerts (e.g., some alerts attenuated on takeoff roll, others on short final approach)
- Built-in logic prompting the flightcrew to appropriate actions

Resources: AIR-1 (LOOC), AFS, Manufacturers, Airlines/Operators (training)

Timeline: 1) FAA: 24 months, 2) Manufacturers: with each new type design aircraft following issuance of advisory material, 3) Operators: with delivery of new type design aircraft.

Actions: 1) FAA and Industry: Develop advisory material defining the characteristics of interactive checklist and smart alerting systems for all new type designs. Develop compatible operational guidance. 2) Manufacturers: Design and Install on new Type Design aircraft. 3) Operators: Develop training syllabi and procedures for use.

OUTPUT #2. Manufactures evaluate/consider during checklist design, the principles contained in the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck Procedures* and the *NASA Human Factors of Flight-Deck Checklist: The Normal Checklist*.

Resources: AIA (LOOC), FAA, Airlines/Operators, ALPA, APA, ATA, RAA, NACA

Timeline: During development of new type design after issuance of advisory material.

Actions: Analyze the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck Procedures*, NASA *Human Factors of Flight-Deck Checklist: The Normal Checklist*, and evaluate/consider during design of checklist.

OUTPUT #3. Manufacturers should provide automatic aural altitude call outs on final approach for all new type design aircraft (including arrival at MDA/DH).

Resources: AIR-1 (LOOC), AFS, Manufacturers, Airlines/Operators (training)

Timeline: 1) FAA and Industry: 24 months, 2) Manufacturers: with each new type design aircraft following issuance of advisory material, 3) Operators: with delivery of new type design aircraft.

Actions: 1) FAA: Develop advisory material defining the standards for automatic aural altitude call outs on final approach (including arrival at MDA/DH) for all new type design designs. 2) Manufacturers: Design and Install on new type design aircraft. 3) Operators: Develop training syllabi.

Outputs: Existing Aircraft Type Designs

OUTPUT #4. Reassess checklists used in the existing fleet by considering the principles contained in the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck Procedures* and the *NASA Human Factors of Flight-Deck Checklist: The Normal Checklist*, and revising as necessary.

Resources: AFS-1 (LOOC), Airlines/Operators, ALPA, APA, ATA, RAA, NACA, Manufacturers

Timeline: 1) FAA; 12 months, 2) Manufacturers and airlines/operators; 12 months after issuance of advisory material and policy guidance.

Actions: Manufactures and airlines analyze the FAA *Human Performance Considerations in the Use and Design of Aircraft Checklists*, the *NASA Contract Report on Design of Flight-Deck Procedures*, NASA *Human Factors of Flight-Deck Checklist: The Normal Checklist*, review checklists and revise as necessary.

OUTPUT #5. Until TAWS is fully implemented, altitude reminder systems (such as altimeter bugs for MDA/DH) should be installed to improve altitude awareness on final approach.

Resources: AFS-1 (LOOC), Airlines/Operators, ALPA, APA, ATA, RAA, NACA

Timeline: 1) FAA; 12 months 2) Airlines/operators; 12 months after issuance of advisory material and policy guidance for altitude alerting or reminder systems.

Actions: Develop draft advisory material for FAR Part 121 operators and policy guidance for inspectors. Airlines/Operators install equipment and train for its use.

Relationship to Current Aviation Community Initiatives:

- TAWS Rule
- FAA and NASA Checklist Studies previously distributed by FSF, Boeing and Airbus
- Features already incorporated in many current aircraft
- NASA Single Aircraft Accident Prevention Project (manufacturers/human factors survey of existing technologies)

Performance Goals & Indicators for Outcomes/outputs:

- **Goal:** Substantial reduction or elimination of ALAR accidents involving Part 121 carriers worldwide.

- **Indicators:**
    - A reduction in procedural non-compliance.
    - Part 121 ALAR accident rate is reduced.
    - All checklists incorporate the principles within the FAA and NASA checklist studies and other appropriate documents.
    - All aircraft incorporate radio altimeters and audio callouts.
    - All new aircraft incorporate smart alerting systems.

Programmatic Approach:

Organizational Strategy

The CFIT/ALAR JSIT identified Jerry Davis of Airbus Industries (904-322-8186) as the CFIT/ALAR JSIT Project Lead for Flight Deck Equipment Upgrade/Installation. The project lead will assist with implementation activities outlined in the Implementation Plan and will provide progress reports, when requested to do so, to the CFIT/ALAR JSIT. Implementation is viewed as a shared responsibility and tasks will be divided between the FAA and organizations in industry. The Lead Organization for Overall project Coordination (LOOPC) is AVR-1. The Lead Organizations for Output Coordination (LOOC) are identified in each Output of this Implementation Plan. The roles and responsibilities of the LOOPC and LOOC are described in the CAST approved JSIT Process Document.

Implementation activities

In collaboration with industry (AIA, operators, manufactures, and employee groups) the FAA will publish an amendment to Part 25 of the FAA Regulations and issue advisory material and policy guidance to implement interactive electronic checklist and smart alerting systems for all new type design aircraft operated under FAR Part 121. The results of numerous FAA, NASA, and other studies dealing with checklist development will be incorporated in the checklist design. Checklists in use by the existing fleets will be re-assessed and enhanced using numerous studies concerning checklist design. The FAA, in collaboration with industry, will issue advisory material and policy guidance for revision, if necessary, of presently used checklist. The implementation of altitude alerting systems for the existing fleets will also be contained in the guidance material.

Key Products and Milestones:

FAA: Draft Amendment to CFR 14 Part 25 and develop accompanying advisory material requiring installation of interactive checklist and smart alerting systems in all new designs. Develop draft Advisory Circular and policy guidance for inspectors.

- Manufacturers: Design and Install on new TC aircraft.
- Airlines/Operators install equipment and train for its use..

FAA: Analyze existing checklist studies and develop draft Advisory Circular and policy guidance for new and existing aircraft.

- Manufacturers and airlines/operators review checklist and revise as necessary.

FAA: Draft advisory material and policy guidance implementing altitude-alerting systems for existing aircraft.

- Manufactures and operators commit to implementation of altitude alerting systems on all existing aircraft.

Plan and Execution Requirements:

The FAA and industry must work in collaboration on the development of the amendment to Part 25 of the FAA Regulations implementing interactive electronic checklist and smart alerting systems for new type design aircraft. The guidance material should be user friendly, and clearly written with specific examples, to facilitate the current thoughts on implementation and recommended checklist design for new and existing aircraft. The FAA, NASA, and other studies should be used as a model for checklist development for both new and existing aircraft. Until the TAWS rule mandates altitude alerting systems, the FAA and industry must work together in developing guidance material that implements altitude alerting methods for the existing aircraft.

Risk Description:

- Normal rulemaking process and timeframe.
- Potential failures to implement advisory material.
- Economic burden for low end users.
- Challenging validity of FAA, NASA, and other checklist reports.

Risk Mitigation Plan:

- Pending successful change to Part 25, FAA and Industry will continue with voluntary equipage for all new aircraft.
- Failure to implement advisory material for existing aircraft may require additional rulemaking.
- Seek consensus on the use of existing checklist studies by citing use in Industry.
- Low cost alternatives of altitude alerting systems would be installed voluntarily by operators of existing aircraft until mandated by TAWS.

Impact on Non - Part 121 or International Applications:

Equipment changes already incorporated in existing type design in many new aircraft. Alternative altitude alerting methods, such as altimeter bugs, are used on many existing aircraft. Additional methods of altitude alerting methods of low cost for existing aircraft would be widely accepted by industry.

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan
for
Maintenance Procedures

Statement of Work:

The purpose of this project is a reduction in Approach and Landing accidents by re-emphasizing current Maintenance rules, policies, and procedures developed by the commercial airline operators and the FAA. The re-emphasis should specifically direct:

- That approved maintenance programs related to the servicing of components incorporate all of the OEM safety related components and procedures
- That oversight of sub-contract activity is increased by both the operators and regulators, and
- That MEL policy and procedures are strictly adhered to. The re-emphasis could be acted upon almost immediately.

Lead Organization for Overall Project Coordination (LOOPC):

AVR-1

Outcome:

Substantially reduce or eliminate the Approach and Landing (ALAR) accident rate by strict adherence to established maintenance rules, policies, and procedures relating to the proper servicing of aircraft components, oversight of maintenance contract activities, and compliance with the approved Minimum Equipment List (MEL).

Output 1:

- AFS-300 will issue guidance, to their field inspectors, outlining FAA national policy to ensure that aircraft nose landing gear struts are serviced in accordance with the original manufacturers recommended methods for cold weather operations.

Resources: AFS-300 (LOOC) and PMI's

Timeline: Completed

Actions: Flight Standards Information Bulletin FSAW 97-10 dated March 3, 1997 was issued specifically as a result of this particular approach and landing accident. The bulletin describes FAA national policy regarding adequate procedures to ensure that aircraft nose landing gear struts are serviced in accordance with the

manufactures recommended methods for cold weather operations. The bulletin closed NTSB Safety Recommendation A-96-166 and remains as current FAA national policy.

Output 2:

- AFS-300 will issue guidance, to their field inspectors, outlining FAA national policy for the evaluation and surveillance of sub-contractor maintenance providers.

Resources: AFS-300 (LOOC) and PMI's

Timeline: Completed

Actions: Flight Standards Handbook Bulletins HBAW-96-05C and HBAW-98-01 dated December15, 1997 and February 3, 1998 respectively, were issued specifically addressing FAA surveillance oversight activity of air carriers sub contractor activities and evaluation of contractual relationships between air carriers and maintenance providers. HBAW-96-05C closed NTSB Safety Recommendation A-97-74. Both bulletins remain as current FAA national policy.

Output 3:

- AFS-300 will issue guidance, to their field inspectors, revising FAA national policy regarding the use of Minimum Equipment List (MEL) conditions and limitations by air carriers.

Resources: AFS-300 (LOOC) and PMI's

Timeline: Completed

Actions: *Flight Standards Joint Handbook Bulletin HBAT-98-18* and *HBAW-98-09* dated April 28, 1998 were issued to provide guidance to aviation safety inspectors regarding the requirement for air carriers to include instructions concerning the MEL conditions and limitations. The bulletin closed NTSB Safety Recommendation A-97-57 and remains as current FAA national Policy.

Output 4:

- Directors of Safety will determine 1) that the maintenance deficiencies described in the attached bulletins and policy letters have been remedied and 2) that Quality Control Procedures have been implemented to ensure that those deficiencies are continually addressed.

Resources: ATA (LOOC), RAA, NACA, Directors of Safety

Timeline: 180 days

Actions: Directors of Safety will ensure an internal audit is conducted to determine that rules relating to the maintenance deficiencies described in the specified bulletins are being met through adequate maintenance

procedures. Further, the DOS will establish system safety procedures to ensure continuing conformance with the bulletins. The DOS will report the outcome of the audit to his/her respective CAST member.

Relationship to Current Aviation Community Initiatives:

- Flight Standards Information Bulletin Airworthiness (FSAW) 97-10 dated 03/397
- Handbook Bulletin Airworthiness (HBAW) 96-05C dated 12/15/97
- Handbook Bulletin Airworthiness (HBAW) 98-01 dated 02/03/98
- Handbook Bulletin Air Transportation (HBAT) 98-18 dated 04/28/98
- Handbook Bulletin Airworthiness (HBAW) 98-09 dated 04/28/98
- Minimum Equipment List (MEL) Policy Letter 87-2 dated 09/23/98
- Minimum Equipment List (MEL) Policy Letter 87-3 dated 11/20/98
- NTSB Safety Recommendation A-96-166
- NTSB Safety Recommendation A-97-74
- NTSB Safety Recommendation A-97-57

Performance Goals & Indicators for Outcomes/outputs:

- Goal: Approach and Landing accident reduction in these specific maintenance areas.
    - Indicator: A reduction in Approach and Landing accidents in these maintenance areas.
- Goal: All air carriers have FSAW's, HBAW's, HBAT's, and MEL Policy Letters
    - Indicator: Audit confirms air carriers have guidance material.
- Goal: All air carriers in conformance with guidance material.
    - Indicator: Audit confirms air carriers in conformance with guidance material
- Goal: All air carries have safety system procedures in place to maintain continued conformance with guidance material.
    - Indicator: Audit confirms air carriers have safety systems in-place for continued regulatory compliance.

Programmatic Approach:

Organizational Strategy

The CFIT/ ALAR JSIT identified Jerry Tegen, ACE-203 (816-329-3204) as the JSIT project lead for Maintenance Procedures. The project lead will assist with the implementation of the activities outlined in this Implementation Plan and will, when requested, provide progress reports to the CFIT/ALAR JSIT. Implementation of this project is viewed as a shared responsibility and tasks will be divided between the FAA and organizations/persons in industry. The Lead Organization for Overall project Coordination (LOOPC) is AVR-1. The Lead Organizations for Output Coordination (LOOC) are identified in each Output of this Implementation Plan. The roles and responsibilities of the LOOPC and LOOC are described in the CAST approved JSIT Process Document.

Implementation Activities

The FAA, in addressing several NTSB Safety Recommendations and the interventions later identified by the CFIT/ALAR JSAT concerning this particular accident, issued guidance in the form of Handbook Bulletins for FAA field inspectors and air carriers. CAST, believing the guidance that was issued to be adequate, had concerns as to conformance with the guidance by all air carriers. Thus, the internal audit directed by the air carriers Directors of Safety (DOS) called for in this Implementation Plan and a final report submitted to CAST outlining the results of the of each air carriers internal audit.

Key Products and Milestones:

- Identification of each Part 121 air carrier and their required DOS
- Specific FSAW's, HBAW's, and HBAT's, and MEL Policy Letters in the possession of each air carrier.
- Internal audit directed by each air carriers DOS to confirm conformance with bulletins and MEL Policy Letters
- Internal audit to confirm safety system procedures are in place by each air carrier to show continued conformance with bulletins and MEL Policy Letters.
- Report to CAST outlining the results of each air carrier's internal audit.

Plan and Execution Requirements:

FAA Regulations, policies, and procedures developed by the commercial airline operators and the FAA are believed to be adequate and in place. The internal audit called for in this Implementation Plan will merely confirm that the well thought through regulations, policy and procedures are in fact being adhered to by all air carriers. The involvement of the air carriers DOS is considered a needed self-check of the industry and not an inspection conducted by the FAA.

Risk Description:

- Additional workload imposed on the air carriers to perform the audit.
- Additional workload imposed on the DOS to perform the audit.
- Fear of action taken by FAA if audit proves non-conformance with bulletins and MEL Policy Letters.
- Carriers not aligned with CAST might not perform the audit.
- Method of reporting audit results to CAST

Risk Mitigation Plan:

- As a matter of good practice, air carriers routinely perform internal audits to assure self-compliance with FAA Regulations, this audit would benefit individual programs.
- This plan does not require the DOS to complete the audit personally, the air carrier will use what ever method they have established for conducting internal audits. The DOS will merely report the results to CAST through their CAST representative.
- The FAA is not conducting the audit, the air carrier is and reporting the results directly to CAST not to the FAA. Since the bulletins are linked directly to a FAA regulation, compliance is assured.

- AFS-1 and ATA to develop a communication link with non-aligned carriers.
- CAST is a very diverse group of individuals representing a majority of the commercial air carrier industry. The DOS can report to CAST through its member organization represented on CAST or not being a member of an organization through the DOS on the CAST.

Impact on Non - Part 121 or International Applications:

FAR Part 125 and 135 operators are impacted as the HBAT's, HBAW's, FSAW's, and MEL Policy Letters are directly related to FAR's.

Impacts and risks identified by the CFIT/ALAR JSIT are conveyed to other organizations as appropriate, such as the general aviation teams convened under the JSC. Those teams generally return in kind.

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

Approach and Landing Accident Reduction
Joint Safety Implementation Team

Implementation Plan
for
Policies for ALAR (Safety Culture)

Statement of Work:

The purpose of this project is to develop a strategy to promote a safety culture at each Part 121 air carrier specifically targeting approach and landing accident reduction (ALAR). The goal is to ensure that essential safety information generated by an airplane manufacturer and by the FAA is included in company operating manuals and in training programs for pilots and other appropriate employee groups. Teams within each air carrier would jointly develop manuals and training programs striving for the highest safety goals. The teams would further ensure that the content of those manuals would be rigorously followed in training programs and in day-to-day operations. It is recognized that rulemaking may be necessary to clarify existing requirements specifying the content and use of company operating manuals.

Lead Organization for Overall Project Coordination (LOOPC):

ATA (LOOPC), RAA, NACA

Outcome:

Each U.S. air carrier operating under 14 CFR part 121, manufacturers and repair stations as appropriate, will demonstrate better performance in respect to approach and landing accidents through voluntary collaboration in existing and proposed programs promoting safety from within.

Background: Many milestones mark the development to date of an aviation safety environment promoting safety culture from within, among them:

14. Public Law calling for certificate holders to maintain the highest level of safety in the public interest (existing since 1958)
15. Comprehensive regulations and FAA policy specifying flight instructor and check airman functions and conduct, including standardization meetings (existing since the 1970s and earlier)
16. Public Law permitting the Secretary of the Department of Transportation to delegate to non-government persons (designated examiners) the awarding of airmen's certificates (existing since 1958)
17. Comprehensive FAA policy specifying the functions and conduct of aircrew program designees, or APDs (existing since 1983)
18. Advanced Qualification Program (AQP) permitting modern training of flightcrew based on crew concept, CRM, and data analysis for continual program improvement (existing since 1990)
19. Flightcrew training in crew resource management, or CRM (voluntarily training conducted since the late 1970s, mandatory training conducted since 1998)

20. Comprehensive FAA guidance recommending Air Carrier Internal Evaluation Programs, including a model program guide (existing since 1992)
21. Comprehensive FAA guidance recommending a Voluntary Disclosure Reporting Program (existing since 1992)
22. FAA regulation requiring a Director of Safety at each Part 121 certificate holder, responsible for keeping the highest management officials fully informed of the safety status of the entire air carrier operation (existing since 1995)
23. Comprehensive FAA guidance specifying recommended functions and conduct of the Director of Safety (existing since 1999)
24. Comprehensive FAA guidance specifying recommended quality control measures to be taken by an air carrier providing simulator flight training by way of outsourcing to a contractor (existing since 1996)
25. A special FAA certification program division, a national program office, and comprehensive FAA guidance to implement the Certification, Standardization, and Evaluation Team (CSET). CSET would assist local FAA offices in certification of air carrier start-ups. The expertise of CSET would include promoting best practices to each air carrier start-up and to its local FAA overseers (existing since 1997).
26. A national program office and comprehensive FAA guidance to implement the Air Transportation Oversight System (ATOS). ATOS would address an air carrier's entire safety system in terms of identifiable safety attributes. Emphasis in ATOS is on prevention of accidents, enlisting each air carrier under ATOS to effect preventive measures, as well as corrective measures. (existing since 1998).

Output #1

CEOs and other key officers made more visible and more effective in promoting Safety Culture.

Resources: ASY-1 (LOOC), CAST co-chairs, airplane manufacturers, operators, AOA-1, airline CEOs and DOS, industry associations (ATA, RAA, NACA, CAA, AIA, etc.).

Timeline:	CAST endorsement (G approval):	Expected, September 2000
	Initial distribution of the Guidance materials:	60 days from CAST endorsement
	Commitment Statement Due	90 days from CAST endorsement
	First report back to CAST:	120 days from CAST endorsement

Actions:

- Safety culture guidance material such as, *Operator's Aviation Safety Handbook*, SAE-G18 Committee document, FAA Audit Tool, or other similar guidance, endorsed by CAST.
- Guidance material, accompanied by a cover letter signed by the FAA Administrator and CAST co-chairs and a commitment statement, distributed by ASY to CEO of every Part 121 certificate holder.
- CEO's forward signed copy of commitment statement to industry association or CAST representative.
- Senior management, through the Director of Safety, report to CAST progress made on the above items and any new initiatives to improve their carriers safety culture.

Output #2

Directors of Safety are made more visible and more effective in promoting safety culture.

Resources: ATA (LOOC), CAST, RAA, NACA, CAA, Directors of Safety.

Timeline:	CAST endorses HBAT 99-19, "14 CFR Part 121 and 135 Air Carrier Safety Departments, Programs, and the Director of Safety"	Expected, September 2000
	Industry organizations distribute HBAT to DOS	60 days from CAST "G"
	First report back to CAST	120 days from CAST "G"

Actions:

- HBAT 99-19 endorsed by CAST as good guidance material.
- Industry organizations (ATA, RAA, NACA, CAA, etc.) contact the DOS of its member airlines and convey a copy of HBAT 99-19.
- DOS's, working through senior management, will implement guidance contained in HBAT 99-19.
- DOS's report back to the respective industry association periodically, or to CAST representative until all elements of an effective safety program are implemented.
- JIMT tracks implementation and DOS effectiveness in promoting safety culture.

Output #3

Director of Safety ensures the establishment of a process to identify, review, analyze and include appropriate safety information in training programs and in manuals used by flightcrews and maintenance staff.

Resources: ATA (LOOC), CAST, RAA, NACA, CAA, ALPA, APA, Directors of Safety.

Timeline:	CAST endorses HBAT 99-07, "Flight Standards Policy Company Operating Manuals and Company Training Program Revisions for Compliance With Current Airplane Or Rotorcraft Flight Manual Revisions"	Expected, September 2000
	Industry organizations distribute HBAT to DOS	60 days from CAST "G"
	First report back to CAST	120 days from CAST "G"

Actions:

- HBAT 99-07 endorsed by CAST as good guidance material.
- Industry organizations (ATA, RAA, NACA, CAA, etc.) contact the DOS of its member airlines and convey a copy of HBAT 99-07.

- DOS's, working through senior management, will apply principles contained in HBAT 99-07 to training programs and manuals used by flightcrews and maintenance staff.
- DOS's report back to the respective industry association periodically, or to CAST representative until all elements of an effective safety program are implemented.
- JIMT tracks implementation and DOS effectiveness in promoting safety culture.

Output #4

FAA fully implements the AFM database for inspectors' use.

Resources: AFS-600 (LOOC), AIA, manufacturers, and FAA Flight Standards and Aircraft Certification services, specifically including ANM-100 and AEGs.

Timeline:	CAST endorses HBAT 99-16, "Announcement of New Database System on the FAA Intranet: Airplane Flight Manual Revisions and Aircraft Manufacturers Operations Bulletins"	Expected, September 2000
	Industry organizations distribute HBAT 99-16 to manufacturers and to DOS	60 days from CAST "G"
	AFS-600 populates database w/ records	180 days from CAST "G"
	First report back to CAST	180 days from CAST "G" Subsequent
	reports to CAST	Each 90 days, until database 100% implemented

Actions:
- HBAT 99-16 endorsed by CAST as good guidance material.
- AIA contacts its members and conveys a copy of HBAT 99-16.
- Manufacturers supply AFS-600 with all future AFM-revisions for each model affected.
- Manufacturers supply AFS-600 with all future Operator's Bulletins, or the equivalent, for each model affected.
- FAA (AFS-600, ANM-100, AEG) populates the database with existing records in the most effective way possible for use by FAA inspectors, and all new records.

Relationship to Current Aviation Community Initiatives:

- **Operator's Aviation Safety Handbook (or similar guidance).** This Handbook was ratified by an international group of representatives at a recent aviation safety conference in Paris (June, 2000) sponsored by Airbus, Air France, and by the Global Aviation Information Network (GAIN), of which the FAA is founding member. This Handbook speaks primarily to air carrier chief executive operators (CEOs) and to their principal safety officers, required in US regulations (14 CFR part 121) as directors of safety, or DOS. The Handbook is founded on the premise that safety culture is most effectively

established and maintained when it comes from within the corporation, and is promoted from the top down. It is expected that the timeliness and wide implementation of the Handbook, or similar guidance, will cause the CEO, the DOS, and other key officers to be more effective performers in promoting safety culture and ALAR.

- **Director of Safety (DOS)**. A DOS is required by 14 CFR Part 119, and now has explicit functions defined in guidance issued by the FAA. Those functions comprise all of the elements of safety culture described in Background, items 1 – 13, above. It is expected that the FAA guidance re the DOS and CAST's focus on ALAR will cause the Director of Safety to be a more effective performer in promoting safety culture and ALAR.

- **HBAT 99-07**. This bulletin provides comprehensive FAA guidance specifying an air carrier's responsibilities (1) to keep manuals current, (2) to ensure timely delivery of essential safety information, consisting of airplane flight manual (AFM) revisions and operations bulletins issued by the manufacturer, and (3) to ensure timely action in response to those revisions and bulletins. Effects are more effective manuals used by flightcrew [and maintenance], more effective surveillance in respect to manuals by the FAA, and desirable impact on ALAR.

- **HBAT 99-16**. Complementing HBAT 99-07, HBAT 99-16 announces the implementation of a centralized database system for use by the FAA. FAA inspectors may refer to the records in that database to track each air carrier's timeliness and effectiveness in response to essential safety information generated by the manufacturer or by the FAA.

- **ASAP**. Comprehensive FAA guidance has recently been issued recommending each air carrier's voluntary participation in an Aviation Safety Action Program (ASAP) and specifying the terms of its operation. Under ASAP a participating air carrier would encourage its employees to come forth with observations bearing on safety. Under all but certain specific conditions. those observations would not incur FAA penalties, but would encourage a collaboration of managers, employees, and the FAA to address and correct safety hazards before an accident might occur. (existing since April, 2000)

- **FOQA: Public Law, FAA regulations, and comprehensive FAA guidance to enable implementation of Flight Operational Quality Assurance programs (FOQA).** Under FOQA participation by an air carrier would be voluntary. Copious data from flight data recorders would be de-identified and used for analysis and identification of accident precursors. An air carrier would take corrective actions before an accident might occur, based on its analyses. At some later time, de-identified FOQA data and analysis might be shared among air carriers in order to share the safety benefits of FOQA among all air carriers. (expected in 2000)

- **Revised Air Carrier Training Rules**. A re-write of 14 CFR Part 121, subparts N (Training Program) and O (Crewmember Qualifications), is under way. The rulemaking will promote safety culture, including better discipline re manuals and training programs, and will reduce the number of ALAR accidents. The

NPRM is expected in December, 2000. A lengthy public comment period is expected because of the scope and complexity of the rulemaking package. The NPRM will propose the following:

- to confer greater responsibility on examiners and check airmen employed by the air carrier (see Background, items 2 and 4, above)
- to require (rather than recommend) that air carriers have a quality control system for major outsourced flightcrew training (see Background, item 10, above)
- to clarify regulations regarding the manuals used by the flightcrew [and maintenance] to ensure that necessary manuals are complete, accurate, available and appropriately used.

- **TICC**. Air Transport Association (ATA) committee work will result in improved distribution of material contained in the flightcrew operating manuals (FCOM) generated by aircraft manufacturers such as Boeing. The Technical Information Communication Committee (TICC) of ATA has developed an electronic system by which changes to the FCOM will be distributed by, say, Boeing Company to the majority of Boeing aircraft operators virtually at the click of a mouse button. Essential information will be translated, routed, and delivered far more quickly and reliably than today.

Performance Goals & Indicators for Outcomes/Outputs:

Goal: **A major improvement in ALAR**
Indicator: **Part 121 air carrier ALAR rate decreases**

Output #1

Goal: CEOs become high-visibility advocates of safety culture
Indicator: Every Part 121 CEO receives a copy of "Operator's Aviation Safety Handbook", SAE-G18 Committee document, FAA Audit Tool

Indicator: Every Part 121 CEO reports all elements of an effective safety program are implemented in accordance with the guidance in that Handbook, or equivalent guidance endorsed by CAST

Output #2

Goal: Directors of Safety become high-performing advocates of safety culture
Indicator: Every DOS receives a copy of HBAT of 99-19.
Indicator: Every DOS reports all elements of an effective safety program are implemented in accordance with the guidance in that bulletin.

Output #3

Goal: Director of Safety ensures inclusion of essential safety information in training programs and in manuals used by flightcrews and maintenance staff.

Indicator: DOS reports AFM revisions and bulletins generated by the airplane manufacturer are promptly received and promptly implemented in manuals and training programs used by flightcrews and maintenance staff.

Output #4

Goal: FAA fully implements the AFM database for inspectors' use in surveillance.

Indicator: The database described in HBAT 99-16 has ample staff to populate the database with records pertaining to all aircraft used in all operating Parts of the CFR, and to support daily changes in records contained in the database.

Indicator: FAA inspectors report satisfaction with completeness, currency, and ease of use of the database.

Indicator: Surveillance determines that the operators are addressing changes in a timely manner when generated by the manufacturers.

Programmatic Approach:

Organizational strategy

The FAA Act of 1958 established the inherent obligation of any air carrier certificate holder to maintain the highest level of safety in the public interest. In addition to its regulatory and enforcement functions, the FAA has developed many voluntary programs for the promotion of safety culture from within an air carrier corporation. Those programs range from Aircrew Program Designees (APDs) and check airmen to ASAP and FOQA. It is incumbent on the air carriers and their employee groups to embrace these voluntary programs gladly and to implement them as effectively as possible. The CEO and the Director of Safety are the principal advocates of safety culture within the corporation, without whose tireless efforts an effective safety program fails. Collaboration between managers and non-manager employees is absolutely essential.

Concurrently, the FAA should promote collaboration with operators for safety. The FAA will meet its own statutory obligation to promulgate regulations and standards in the public safety interest by proceeding with the rule changes in 14 CFR part 121 (N and O). Those rule changes will modernize training requirements. They will unburden air carriers in some respects, but will require more discipline in respect to certain processes involving safety culture, such as quality control of outsourced flightcrew training and manuals used by flightcrews [and maintenance]. The Lead Organization for Overall project Coordination (LOOPC) is AVR-1. The Lead Organizations for Output Coordination (LOOC) are identified in each Output of this Implementation Plan. The roles and responsibilities of the LOOPC and LOOC are described in the CAST approved JSIT Process Document.

Implementation activities

In collaboration with industry (operators, aircraft manufacturers, industry associations, and employee groups) the FAA will promote voluntary programs advancing safety culture. Industry and employee groups will join in their shared safety mission by implementing those voluntary programs. The FAA will press the rulemaking effort in 14 CFR part 121 (N and O) to ensure that its expected safety benefits in ALAR are not unduly delayed.

Key Products and Milestones:

- Public Law, FAA regulations and guidance for FOQA – NPRM Signed July 5, 2000

Plan and Execution Requirements:

Industry stakeholders should commit at the highest levels to embracing and staffing the voluntary programs available to them that will promote safety culture from within. In particular, CEOs should make their own high-level commitment to safety culture and should increase the scope and visibility of the office of the Director of Safety. CEOs, DOS, and other key players in the corporation should join together to implement the safety and quality control processes detailed under ATOS and ASAP, and promised under FOQA. Associations such as ATA, NACA, ALPA, APA, and others should not wait for the FAA to act, but should eagerly step up to the safety benefits of collaboration to prevent ALA. If additional FAA guidance materials become necessary for FAA inspectors or industry users, FAA managers must readily provide adequate manpower and funding to meet those needs.

Risk Description:

The FAA Act of 1958 established that the primary responsibility to protect the public safety interest rests with the holder of an air carrier operating certificate. The FAA was established to oversee air carriers' safety performance, not to manage or operate an air carrier on behalf of its owners. Inadequate motivation on the part of industry stakeholders shifts the challenge to the FAA of protecting the public safety interest. This challenge is more effectively met by voluntary performance on the part of industry than by coercion on the part of the FAA. Absent an adequate voluntary commitment to safety culture, the public safety is compromised and an air carrier's own future is put at risk

Some of the most promising safety systems in years are now available to air carriers voluntarily embracing them – such as ATOS, ASAP, and prospectively, FOQA. Absent an adequate voluntary commitment to those specific safety systems, an air carrier faces an unnecessary risk of ALA and accidents from other causes.

The most complex rulemaking effort currently under way at the FAA is the sweeping re-write of 14 CFR part 121, subparts N and O. In many ways it is also the most ambitious rulemaking effort because it proposes to modernize air carrier training and qualification rules in so many ways. In addition to promoting safety culture in the broad sense, the rulemaking would spread the safety benefits of AQP without requiring participation in AQP to the full extent required under AQP rules. Those safety benefits would affect air carriers not willing or able to enroll in the AQP process. Typically such air carriers are small ones or start-ups, the very ones sometimes most in need of those safety benefits. If special interests push too hard against certain requirements proposed in the rulemaking package, the resulting delay would cause considerable damage to the safety impact of the package.

Risk Mitigation Plan:

Industry and the FAA will commit adequate resources to promote safety culture under the various voluntary programs now available. FAA will provide adequate staff and funding to support FAA safety programs and related rulemaking projects.

The FAA will work with industry groups within the provisions of the Administrative Procedures Act to ensure that the desired safety benefits of the proposed rule changes are conveyed to the public without undue economic burden on air carriers.

Impact on Non-FAR Part 121 or International Applications:

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

Impacts and risks identified by the ALAR JSIT are conveyed to other organizations as appropriate, such as the general aviation teams convened under the JSC. Those teams generally return in kind.

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Intervention No.	INTERVENTIONS	Overall Effectiveness x Feasibility
	Aircraft Design	
	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.	
209	To improve survivability manufacturers should improve design, installation and inspection schedules of emergency equipment to increase reliability (e.g. escape slides). (see 45, 138, 201, 202)	###
	No actions by this JSIT.	
260	To prevent uncommanded in-flight flat pitch, research should be conducted into prop brake designs.	###
	No actions by this JSIT.	
261	To improve passenger and flightcrew survivability, research should be conducted to explore new methods to increase crash survivability.	###
	Research is being conducted by the FAA in the Crashworthiness program and at NASA in the Accident Mitigation project. The agencies are prepared to sign a Memorandum of Agreement to ensure coordination/integration of efforts.	
262	To improve passenger and flightcrew survivability, regulators should require and operators should implement existing knowledge of crash survivability.	###
	No actions by this JSIT. Operators upgrade equipment as newer technology becomes available.	
304	Manufacturers should improve the design for an error tolerant ground spoiler deployment system.	8.3
	Covered by Output #2 of the Detailed Implementation Plan.	
332	Manufacturers should design ground sensing systems that are tolerant to adverse conditions without degrading inflight safety features (e.g. which prevent deployment of ground spoilers and reverse in-flight). (see 16)	6.8
	Covered by Output #2 of the Detailed Implementation Plan.	
248	To ensure adequate testing of equipment, manufacturers' testing should be conducted under worst case scenarios taking into account new technologies and testing under simulated flight realistic conditions.	6.0
	Covered by Output #2 of the Detailed Implementation Plan.	
249	To ensure the accuracy and safety of computer modeling used for design and failure analysis, the modeling must be adequately re-validated on a continuing basis to account for new technology.	6.0
	Covered by Output #3 of the Detailed Implementation Plan.	

252	To prevent loss of control in flight, all changes to flight critical components, such as primary propeller pitch controller components, should be considered major changes.	5.9
	Covered by Output #1, #2, and #4 of the Detailed Implementation Plan.	
254	To avoid the isolated incident syndrome and to ensure on-going assessment of flight critical control system reliability, a focused safety or risk assessment of all in-service failures or problems should be conducted to determine the need for immediate resolution.	5.3
	Covered by Output #3 of the Detailed Implementation Plan.	
250	To ensure test components are representative of the final product, manufacturers should test the final component and regulators should require this type testing.	4.7
	To be addressed by ongoing program to rework FAR 25.1309.	
256	To prevent loss of aircraft control in-flight, all propeller pitch control systems must be designed to positively feather in the event of pitch control loss. Propeller pitch control system malfunctions must be positively annunciated to the flightcrew.	4.5
	No action by this JSIT. AD's exist on selected aircraft models.	
158	Develop technology to provide real time assistance to flightcrews with onboard system failures and diagnostics (e.g. data link transmittal to ground support) (see 103)	4.4
	Some new aircraft designs already incorporate these technologies. Also, NASA Aviation Safety Program activity within Single Aircraft Accident Prevention Project.	
251	To preserve the original intended level of airworthiness, there should be a better definition and classification of subsequent in-service major and minor critical component changes. The definition of critical component should be more specific.	3.7
	Covered by Output #1and #3 of the Detailed Implementation Plan.	
253	To prevent loss of control, there should be redundancy and failure tolerance features for all flight critical components, such as dual path design, fail operational redundant systems, with fault annunciation.	3.3
	Some new aircraft designs already incorporate these technologies. Also, NASA Aviation Safety Program activity within Single Aircraft Accident Prevention Project.	
159	Manufacturers should incorporate an "input rudder" indicator or automatic yaw compensation to ensure that adequate yaw control is provided.	2.8
	No action by this JSIT.	
49	Regulators should establish criteria for, and manufacturers should evaluate and improve, the reliability and failure tolerance of flight systems. (see 332)	2.8
	NASA Aviation Safety Program activity within Single Aircraft Accident Prevention Project.	
203	Airlines/operators should provide crews with inflight rest periods and adequate facilities. (see 31, 130, 315)	2.0
	No action by this JSIT.	
138	Manufacturers should ensure that design logic for warnings and equipment failures to be annunciated to the crew do not cause nuisance warnings, which would contribute to crew complacency. (see 45, 243)	2.0
	Started ARAC process to update FAR 25.1322 and associated Advisory Circular.	
245	To recover aircraft in unusual attitude, manufacturers should develop systems to return aircraft to normal attitude with one pilot button push (pilot initiated auto-recovery systems).	1.2
	Not permitted under current certification rules. Rejected by the Flight Guidance System Harmonization Group.	

235	Manufacturers should provide a more positive means of external strut pre-flight inspections.	0.7
	No action by this JSIT.	
259	Regulators should set engineering standards requiring propeller manufacturers to provide positive prevention designs, to eliminate all flight critical failure modes (e.g. flat pitch).	0.7
	No action by this JSIT.	
137	Manufacturers should ensure cockpit design that does not interfere with or distract the flightcrew from executing their duties (e.g. rain in the cockpit, location of switches in cockpits)	0.3
	Human Factors Harmonization Group is evaluating cockpit designs.	
	Air Traffic Control	
	An ATC CFIT Training project was implemented by the CFIT JSIT. Some of the interventions, while having low effectiveness and low ExF values, were included in the project because of their similarities and ease of incorporation in the project.	
126	Air Traffic service providers should prioritize the use of precision approaches (glideslope guidance) when available and appropriate.	7.9
	ATB was issued 12/99.	
327	Air Traffic service runway selection policies should be based on the most current wind available.	7.0
	Policy is included in Air Traffic Controllers Handbook 7110.65.	
157	Airlines/operators, regulators, Air Traffic service providers should establish policies or programs to address rushed approaches, including elimination of rushed approaches, recognition and rejection of rushed approaches and training for those encountered	4.8
	No action by this JSIT. Guidance is given to pilots for stabilized approach.	
13	Air Traffic service providers should enhance ATC training to emphasize the dangers of rushed approaches and performance characteristics of modern jet transports. (see 115, 157)	4.0
	ATB was issued 12/99.	
124	Air Traffic service providers should implement a Quality Assurance program to ensure adherence to established procedures.	2.3
	ATB was issued 12/99.	
12	Air Traffic service providers should emphasize in ATC training the controllers' potential in assisting the flightcrew in improving their situation awareness.	1.1
	ATB was issued 12/99.	
106	Air Traffic service providers should train and monitor ATC adherence to established communications procedures including hearback problems. (see 240)	0.9
	ATB was issued 12/99.	
324	Air Traffic services should ensure proper/close supervision of controllers undergoing training so that all outages, construction, airport hazards, etc. are reported to flightcrews in a timely and accurate manner. (see 11)	0.9
	ATB was issued 12/99.	

108	Air Traffic service providers should implement and/or review procedures to ensure ATC training does not create a hazard to flight operations.	0.3
	ATB was issued 12/99.	
320	Air Traffic service providers should institute an ATC "Crew Resource Management Program" similar to those required of flightcrews. (FAA AC 120-51b)	0.3
	ATC CRM already instituted and included in recurrent training (1995).	
241	To eliminate hearback errors, ATC should reexamine and implement improvements to address hearback problems. (see 240)	0.0
	No action by this JSIT.	
	Charting	
	ExF values for the intervention in this project was in the bottom one-half of the total list. The intervention was characterized by a low effectiveness rating.	
6	Regulators should establish standardized approach plate depiction/information requirements for approach plate publishers.	2.8
	SAE-G10 ARP document that gives standard symbology.	
	CRM - Training	
	ExF values for the interventions in this project were below the cutoff value selected by the ALAR JSIT. However, some of the interventions were implemented by the CRM Training CFIT JSIT Project.	
237	Airlines/operators should provide guidance to crew concerning evaluation of all options prior to decision making as part of CRM training. (see 25, 26, 131, 132, 133, 308)	###
23	Airlines/operators should ensure that regularly scheduled recurrent training (e.g. LOFT) emphasizes crew cooperation and working together to maximize safe operations. (see 308, 314)	4.0
	Included in AC 120-51 developed through actions of CFIT JSIT.	
308	Airlines/operators should ensure their formal CRM training emphasizes the following management skills: decision making, workload management, crew coordination, planning, communication, situational awareness, advocacy. (IAW AC120-51b). (See 133)	3.7
	Included in AC 120-51.	
227	Airlines/operators should ensure that their training/standardization program emphasizes the benefits of inter-crew/company communications. (see 131)	3.3
	Included in AC 120-51.	
25	Airlines/operators should establish a CRM training program and regulators should require and insure that the initial training is provided prior to line flying and require recurrent CRM training. (see 131, 132, 349)	3.1
	Covered by change to FAR 120.404, effective 1996.	
228	Regulators should require airlines/operators to modify their training to maximize benefits of inter-crew/company communications.	3.1
	Generally covered by AC 120-51, although not required.	

349	Airlines/operators should ensure training for instructors and check airmen include objective criteria to be used in evaluating crew CRM performance. (see 25,131)	0.7
	Addressed in AQP event/set methodology.	
	# Datalink Enhancement	
	ExF values for all interventions in this project were in the bottom quarter of the total list. All interventions were characterized by low effectiveness ratings. 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.	
28	Implement a system to automatically transmit ATC instructions/information between the ground controller and the aircraft.	###
	Part of the FAA CPDLC program that was initiated in Miami.	
122	Air Traffic service providers should implement transmission of ATC instructions/information (between the ground and aircraft) via a computer link as opposed to voice communications.	0.7
	Part of the FAA CPDLC program that was initiated in Miami.	
94	Implement real time (digital) transmission of airport and weather information to the aircraft.	0.5
	Included in the FAA Aviation Weather Research Program, FAA Flight Information Services program and NASA Aviation Safety Program.	
	# Flightcrew Training	
	Combination of high effectiveness and high feasibility (and the resultant high values of ExF) for seven of these interventions resulted in a recommendation that this project be implemented.	
116	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of high rate of descent and unstable approaches. (see 142)	7.9
	Covered by Output #1 and #3 of the Detailed Implementation Plan.	
111	Airlines/operators should ensure that their training/standardization programs emphasize basic airmanship skills and knowledge during initial and recurrent training.	5.6
	Covered by Output #1 and #3 of the Detailed Implementation Plan.	
300	Airlines/operators should adopt, implement and train a risk assessment tool to enhance flightcrew awareness of hazards associated with all approaches and airports (see risk analysis tactical checklist).	5.6
	Covered by Output #1 and #3 of the Detailed Implementation Plan.	
328	Airlines/operators should ensure that flightcrews are trained to think in terms of "I will go-around unless" rather than "I will land unless". Regulatory policy should support this approach. (see 142, 311)	5.6
	Covered by Output #1 and #3 of the Detailed Implementation Plan.	
331	Airlines/operators and manufacturers should train crews to understand the capabilities and limitations of systems, conditions which would cause systems to not function as the crew anticipates, and how to detect those conditions (e.g. lack of brakes, spoil	5.6
	Covered by Output #1 and #3 of the Detailed Implementation Plan.	
350	Airlines/operators should ensure that adequate approach briefings are conducted that include descriptions of normal approach, non-normal conditions and the results of risk assessment analysis. (see 300)	5.6
	Covered by Output #1 and Advisory Circular AC 120-71.	

163	Airlines/operators should ensure that their training/standardization programs address common misperceptions that could lead to unsafe practices (i.e. ATC always wants high energy approaches).	5.3
	Covered by Output #1 of the Detailed Implementation Plan.	
100	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adhering to MDA/DH.	4.8
	Addressed by the CFIT Education and Training Aid (on the WWW)and Handbook Bulletin 99-08.	
165	Airlines/operators should provide training scenarios that match realistic situations (i.e. stall recoveries during approach, in landing configuration at flight idle with the autopilot on (in simulator)).	4.6
	Addressed by Output #1 of the Detailed Implementation Plan and FSAT95-10, Selected Event Training.	
153	Ensure that flightcrews are adequately trained in a level D simulator for dynamic characteristics before assignment to the line. (see 312)	4.2
	Covered by Output #1 and #3 of the Detailed Implementation Plan and the allowance for other training that is as effective.	
7	Airlines/operators should ensure that their training/standardization programs emphasize review of approach and missed approach procedures. (see 329)	4.0
	Covered by CFIT SOP Detailed Implementation Plan (template).	
64	Airlines/operators should ensure that their training/standardization programs direct the flightcrews to regularly cross check all instrumentation.	4.0
	Addressed by the CFIT Education and Training Aid (on the WWW)and Handbook Bulletin 99-08.	
131	Airlines/operators should ensure that their training/standardization program emphasizes the importance of the team concept, cross cultural issues, evaluation of options and the obligation of the FO to effectively communicate any concerns (CRM) (see 237)	4.0
	Covered by Output #1 of the Detailed Implementation Plan.	
20	Airlines/operators should ensure that command oversight training for captains is provided during the upgrade process and in recurrent training and first officer responsibility for monitoring are reviewed during recurrent training.	3.9
	Covered by CRM training and Advisory Circular 120-51.	
147	Airlines/operators should require training/standardization programs which teach situation awareness. (the knowledge and understanding of the relevant elements of the pilot surroundings, including aircraft systems, and the pilots intentions)	3.7
	Covered by CRM training and Advisory Circular 120-51, and SOP AC 120-71.	
322	Airlines/operators should develop and implement a ground school and simulator training program similar to the Advanced Aircraft Maneuvering Program.	3.7
	Addressed by Output #1 of the Detailed Implementation Plan and FSAT95-10, Selected Event Training. Also to be addressed by NPRM package in Summer 2001.	
316	Regulators should require airline/operators to train flightcrews to recognize and counteract acute and chronic fatigue. (see 31, 130, 203, 257,315)	3.5
	FAA requires to train in CRM and this is one of the elements.	
314	Airlines/operators should develop simulator training scenarios that require flightcrews to learn multi-tasking abilities and appropriate prioritization abilities in concert with CRM skills (see Red Flag LOFT scenarios).	3.3
	Covered in AC 120-51 and AQP rule.	

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.	3.1
	Covered by Output #1 and Advisory Circulars AC 120-71 and AC 120-51.	
136	Airlines/operators should ensure that their training/standardization programs emphasize the importance of the sterile cockpit environment	2.8
	Covered by AC 120-71, Sterile Cockpit Rule.	
162	Airline/operators should include in their training programs the awareness of potential safety risks due to the complacency when operating at a very familiar airport (e.g. home base).	2.7
	Covered by Advisory Circulars AC 120-71 and AC 120-51.	
325	Airline/operators should emphasize during initial and recurrent training the importance of maintaining systems status awareness during non-normal events and hazardous approaches (goal to avoid tunnel vision/narrowed attention)	2.7
	Covered by Output #1 of the Detailed Implementation Plan.	
133	Airlines/operators training of Captains and Chief Pilots should include Management practices that promote team building and effective human relations (leadership training beyond current CRM programs). (see 308)	2.6
	Covered by Advisory Circular AC 120-51.	
17	Airlines/operators should ensure that their training/standardization programs emphasize the importance of all flight-related briefings. (see 342)	2.6
	Covered by Output #1, Advisory Circulars AC 120-71 and AC 120-51, and the CFIT Training Aid.	
144	Airlines/operators and regulators should ensure that their training/standardization programs clarify the differences between vertical and slant range visibility	2.4
	Addressed by Advisory Circulars AC 120-28 and AC 120-29.	
312	Airline/operators should ensure flightcrews are trained in operations involving low light and poor visibility, on wet or otherwise contaminated runways, and with the presence of optical or physiological illusions before they are assigned line duties. (re	2.4
	Covered by existing Regulations. SMGS training required.	
15	Airlines/operators should ensure that their training/standardization programs instruct when to disengage automated systems and fly manually. (see 246)	2.3
	Covered by Advisory Circular AC 120-71.	
113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning.	2.0
	Covered by Output #1 and Advisory Circulars AC 120-71 and AC 120-51.	
105	Airlines/operators should train flightcrews on how flight delays upon departure or enroute (weather, maintenance, ATC, etc.) can affect their subsequent decision making relative to the safe conduct of the flight.	1.9
	Covered by Output #1, Advisory Circulars AC 120-71 and AC 120-51, and the CFIT Training Aid.	
154	Airlines/operators should improve/increase training to increase awareness of icing effects on airplane type including dynamic simulator training.	1.5
	No action by this JSIT. Being addressed by In-flight Icing Working Group. Ground training required.	

47	Airlines/operators should ensure that their training/standardization programs direct the flightcrews to use all available resources (charts, ATC, inter/intra crew) to establish aircraft position. (see 75)	1.1
	Covered by Output #1, Advisory Circulars AC 120-71 and AC 120-51, and the CFIT Training Aid.	
88	Airlines/operators should train and monitor flightcrew compliance with established communication phraseology guidelines. (see 240)	1.1
	No action by this JSIT.	
141	Airlines/operators and regulators should require training/standardization programs include training regarding physiological effects on aircrew performance, (e.g. low blood sugar).	0.9
	No action by this JSIT.	
75	Airlines/operators should ensure that their training/standardization programs direct that flightcrews use all available tools to establish aircraft position. (see 45)	0.6
	Covered by Output #1, Advisory Circulars AC 120-71 and AC 120-51, and the CFIT Training Aid.	
	Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion	
	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.	
305	Regulators should require airlines/operators to outfit aircraft with electronic checklists. If unable to install electronic checklists, use mechanical checklists or, at a minimum, develop a process to reinforce challenge and response checklists.	7.0
	Covered by Output #1, #2, and #4 of the Detailed Implementation Plan.	
211	Airlines/operators should retrofit equipment to provide automatic altitude callouts on final approach. If unable, other altitude alerting or reminder systems (such as altimeter bugs) should be installed.	5.1
	Covered by Output #5 of the Detailed Implementation Plan in conjunction with the required installation of TAWS.	
14	Install aural warning devices on aircraft to alert flightcrew of arrival at MDA/DH.	4.7
	Covered by Output #3 and #5 of the Detailed Implementation Plan.	
306	Regulators should require manufacturers to equip all new aircraft with electronic checklists.	4.3
	Covered by Output #1 of the Detailed Implementation Plan.	
343	Airlines/operators should install radio altimeters in all aircraft and develop procedures for their use on approach as recommended by FSF ALAR.	3.7
	No action by this JSIT. Covered by TAWS Rule.	
352	Airlines/operators should equip aircraft with autopilots to reduce crew workload during critical phases of flight.	0.7
	No action by this JSIT.	

	FOQA	
	FOQA Project implemented by CFIT JSIT.	
54	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs. (not rated)	###
	FOQA NPRM was issued June 30, 2000. Comment period ended October 3, 2000.	
55	Airlines/operators should implement a Flight Operations Quality Assurance (FOQA) program to identify flightcrew failure to respond to GPWS warnings. (not rated)	###
	No formal action. Data could be recorded as one parameter of FOQA.	
56	Airlines/operators should implement Flight Operations Quality Assurance (FOQA) programs to identify systemic procedural deviations and unsafe trends. (see 54, 55)	###
	NASA to undertake studies to develop analysis tools and methods to apply to FOQA information.	
57	Airlines/operators, regulators, and manufacturers should implement a program designed for sharing of safety related information within the aviation community. (not rated)	###
	ATA to draft guidance material regarding voluntary sharing of trend information within 24 months of passage of protective legislation.	
128	Airlines/operators and regulators should implement a no blame safety reporting and data sharing system with appropriate protections from litigation and prosecution concerns.	###
	FOQA Rule.	
348	Airlines/operators should utilize a self-audit process (such as FSF ICARUS recommendation), operational risk management programs and accident cost analysis to proactively identify and mitigate safety concerns. (see 318)	###
	Auditing of code-sharing partners contributes to implementation. DOS can and should promote AC120.59 through the Safety Culture Detailed Implementation Plan.	
129	Regulators should establish criteria to ensure operators overall quality assurance and compliance procedures are effective rather than reliance on spot checks of individual components	3.4
	Some efforts are underway such as ATOS, ACAP, and CSEP.	
202	Airlines/operators should develop a quality assurance program to ensure compliance with regulations.(see 145, 146, 201)	2.4
	No action by this JSIT.	
	Ground Equipment	
	ExF values for the intervention in this project was in the bottom one-half of the total list. The intervention was characterized by a low feasibility rating.	
150	Regulators or other governing authorities should establish policies that ensure that surrounding lights are distinguishable from airport lighting in order to avoid confusion (safety process, policy).	2.8
	No action by this JSIT.	

	Health & Usage Monitoring Systems (HUMS)	
	All of the interventions in this project have been submitted to CAST as Research and Development recommendations.	
45	Manufacturers should ensure that all impending equipment failures or inappropriate settings that may affect the safe operation of the flight are properly annunciated to the flightcrew by use of dual source sensing. (see 103, 138)	8.2
	Research recommendation.	
158	Develop technology to provide real time assistance to flightcrews with onboard system failures and diagnostics (e.g. data link transmittal to ground support) (see 103)	5.1
	Research recommendation.	
243	To prevent alerting overload, flight deck designs should consider smart alerting systems such as those with prioritization schemes or cancelable nuisance alerts.	5.1
	Research recommendation.	
103	Manufacturers should develop and implement system failure annunciation capabilities to alert flightcrews of pending failures (e.g. HUMS). (see 45, 138)	3.3
	Research recommendation.	
	Maintenance Procedures	
	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.	
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 of future accidents, it would not have prevented the subject accidents.)	###
	No action by this JSIT.	
232	Airlines/operators should ensure all nose gear struts are serviced for cold weather operation are in accordance with OEM recommendations.	5.1
	Covered by Output #1and #4 of the Detailed Implementation Plan.	
145	Airlines/operators and regulators should establish appropriate operational restrictions when equipment is inoperative (MEL)	5.1
	Covered by Output #3 and #4 of the Detailed Implementation Plan.	
213	Airlines/operators and regulators should provide additional inspectors/inspection of sub-contract activity. (see 201, 202)	3.5
	Covered by Output #2 and #4 of the Detailed Implementation Plan.	
146	Regulators should establish/enforce reasonable limitations on dispatch with safety related equipment inop. (MEL)	2.6
	Covered by Output #3 and #4 of the Detailed Implementation Plan.	
233	Regulators should require operators incorporate OEM strut servicing recommendations in mandatory maintenance procedure and surveill compliance.	2.3
	Covered by Output #1and #4 of the Detailed Implementation Plan.	
353	Airlines/operators should establish and enforce a clear MEL policy to aid flightcrews in making maintenance related decisions.	0.8

	Covered by Output #3 and #4 of the Detailed Implementation Plan.	
	MSAW	
	MSAW Project implemented by the CFIT JSIT.	
72	Air Traffic service providers should install MSAW-like capabilities world-wide with emphasis on high-risk airports.	3.8
	ICAO. Where there are FAA installations, flight checks have been completed.	

	Others	
204	Research should be conducted to better understand the underlying reasons/causes for procedural noncompliance.	###
	Research recommendation.	
208	Research should be conducted to understand the phenomenon of flightcrew overload. (e.g. why do flightcrews ignore GPWS warnings)	###
	Research recommendation.	
244	To prevent plan continuation errors (e.g. press-on-itis), research should be conducted to develop directive information systems for go-around situations.	###
	Research recommendation.	
318	Flight Safety Foundation should develop a cost analysis tool to educate CEO's about the high economic and psychological costs of accidents and serious incidents. (not rated)	###
	Research recommendation.	
337	Airlines/operators should establish a process (which includes an interdisciplinary team) to document and investigate high risk behavior and poor judgement as evidenced by on-the-job performance. (see 151, 152, 335)	###
	Research recommendation.	
356	Research should be done to develop an effective tactical decision making model for flightcrews in time critical situations.	###
	Research recommendation.	
	Precision Approach Implementation	
	PAI Project implemented by the CFIT JSIT.	
77	Eliminate non-precision approaches where possible. (see 59)	9.1
	Instead of eliminating NPA, the CFIT JSIT PAI project will implement precision-like approaches for all runways.	
59	Implement precision approach capability (glideslope guidance) for all runways without established precision approach procedures (e.g. ILS, DGPS, etc.). (see 77)	8.4
	Part of Precision-Like Approach Implementation, "21st Century Instrument Approaches," implemented by the CFIT JSIT.	

115	Airlines/operators should ensure that their training/standardization programs emphasize the dangers of rushed approaches. (see 13, 157)	4.5
	This intervention is part of the CFIT JSIT Project that was implemented for Standard Operating Procedures.	
355	Non-precision approaches should be conducted as constant angle, stabilized approaches. (see 59)	1.0
	Part of Precision-Like Approach Implementation, "21st Century Instrument Approaches," implemented by the CFIT JSIT. Operators are already developing CARD (Constant Angle/Rate/Descent) approaches.	

	# Precision Approach Usage	
	This intervention was implemented by the CFIT JSIT as part of the SOP Detailed Implementation Plan.	
125	Airlines/operators should encourage flightcrews to use precision approaches (glideslope guidance) when available and appropriate.	6.0
	Addressed by SOP AC 120-71. Already adopted by most operators.	
	# Pilot/ATC Communication Enhancement	
	The highest ranked intervention is included in another FAA program. Some of the other 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.	
93	Air Traffic service should provide real time (most current) radio communication of critical airport and weather information.	6.0
	AWOPS program - ATB (reminder to communicate prior to approach clearance)	
21	Establish/enhance quality assurance checks/training to ensure that timely and accurate communication between controllers and flightcrews is occurring.	0.3
	ATB was issued 12/99.	
42	Airlines/operators and air traffic service providers should implement a monitoring program to ensure the consistent use of the ICAO phraseology.	0.1
	Harmonization activities underway.	
240	To reduce the possibility of error, confusion and workload increase related to ATC clearances, regulators should require and operators ensure that flightcrews utilize proper phraseology and readbacks. (see 88)	0.0
	ATB was issued 12/99.	
296	To mitigate confusion regarding ATC clearances, operators should develop procedures to ensure flightcrews query ATC whenever uncertainty exists.	0.0
	Covered by FAR 7110.65.	

	ALAR Policies (Safety Culture)	
303	Regulators should implement the NTSB recommendations to increase DFDR parameters. (not rated)	###
	Covered by Final Rule for increased parameters. Rulemaking addresses highest priority parameters.	
143	Airlines/operators should and regulatory agencies must encourage a culture that enhances safety in their daily operations (safety culture) (see 22, 63, 348)	6.7
	Covered by Output #1, #2, and #3 of the Detailed Implementation Plan.	
225	Airlines/operators and regulators should ensure necessary manuals (operational & maintenance) are complete, accurate, available and appropriately used.	6.0
	Covered by Output #3 of the Detailed Implementation Plan.	
238	To preclude conducting flight training during operational flights, when a need for training is identified, operators should conduct training in accordance with their approved training program.	6.0
	Precluded by FAR 121.432. HBAT being prepared to clarify.	
132	Airlines/operators and regulators should ensure that disciplinary and prosecution policies don't adversely affect or countermand safety gains of good CRM practices. (see 308)	4.5
	Covered by Output #1 of the Detailed Implementation Plan.	
151	Regulators should establish policies that require additional monitoring of flightcrew members that have repeatedly failed check rides. (see 152, 335, 337)	4.5
	Covered by existing rules and policy and will be further addressed in updated Part 121 N&O.	
255	To prevent catastrophic failures, the manufacturers should issue immediate telegraphic information to all operators, and regulators should require an immediate mandatory action (AD), following the initial failure report of any critical component malfunct.	4.2
	Output #1, Aircraft Design incorporates this and flight critical components. HBAT 99-07	
130	Regulators should account for realistic rest scenarios when developing and implementing crew rest requirements during travel segments (see 31, 203, 257, 315, 316)	3.9
	Stricter interpretation of existing rule. Revision of existing rule, 121.xxx.	
89	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for non-precision approaches are adequate.	3.7
	Non-Precision Approaches are being eliminated through PAI Detailed Implementation Plan.	
112	Airlines/operators and regulators should ensure that the frequency and effectiveness of proficiency checks for simulated instrument failures (partial panel) are adequate.	3.5
	Addressed by the CFIT Education and Training Aid (on the WWW)and Handbook Bulletin 99-08.	
223	Regulators should ensure POIs are properly qualified and trained to approve appropriate company operational procedures.	3.5
	OTNA-Operational Tng. Needs & Assistance. 4040.9d rewrite. Funding and Staffing an additional issue. Nat'l Inspector Resource Program.	
345	Ensure regulators have adequate funding, training and processes to accomplish their oversight responsibilities. (see 201)	3.3
	No action by this JSIT.	

214	Regulators should enforce timely incorporation of appropriate manufacturers recommendations. (see 98, 201)	2.6
	FAR 121, Subparts N&O addresses this. Also covered by Safety Culture Output #3.	
219	Regulators should ensure company training program is in accordance with approved training program.(see 110, 201)	2.6
	Already required by existing rules.	
231	Regulators should require and airlines/operators should promptly close out all regulatory safety audit findings.	2.6
	ACAP-Air Carrier Audit Program, AFS-40, ATOS-Air Transportation Oversight System, enhance this. Existing regulations and policy promote this.	
321	Regulators and Military agencies should ensure procedures are in place to share information pertaining to operations at joint use airports. (Special Use Airports)	2.4
	No action by this JSIT.	
315	Regulators should update flight time/duty time regulations to counteract present commercial aviation environmental stressors. (e.g. crew rest requirements) (see 31, 130, 203, 257, 316)	2.2
	Stricter interpretation of existing rule. Revision of existing rule, 121.xxx.	
310	Regulators should not allow noise abatement procedures that reduce the level of safety that existed prior to their implementation.	2.2
	No action by this JSIT.	
339	Regulators should require captains and first officers each have identical approach charts for reference.	2.2
	No action by this JSIT. Electronic Flight Book under development.	
201	Regulators should develop adequate oversight as appropriate to ensure compliance with regulations.(see 145, 146, 202, 345)	2.1
	No action by this JSIT. QA program an additional benefit.	
152	Airlines/operators and regulators should raise standards (e.g. crew pairing, approach minimums, etc.) for flightcrew members that meet minimum qualifications but have demonstrated specific weaknesses. (see 151, 335, 337)	2.0
	No action by this JSIT.	
218	Airlines/operators should properly surveill contractor training programs for adequacy of training.(see 110, 202)	1.8
	HBAT 99-01. Tng. Center. Program. Mgr. (TCPM) in Part 142 operations aids in this.	
340	Airlines/operators should implement procedures to ensure flightcrews are aware of appropriate Airworthiness Directives, Certification and flight testing standards. (see 76, 46)	1.5
	Covered by Safety Culture, Output #3, AC-120-71, Existing Regulations.	
37	Regulators should discontinue on-time arrival tracking for airlines.	1.4
	No Action.	
311	Airlines/operators should ensure their "reward system" does not penalize flightcrews for executing missed approaches. (see 217)	1.3
	Covered by AC-120-71.	
317	Regulators should ensure one level of safety exists for all commercial transport operations (whether passenger or freighter operations).	1.3
	No actions by this JSIT. ARFF NPRM issued. TCAS in rulemaking process.	

22	Airlines/operators should encourage a culture that emphasizes safe arrivals over timely arrivals. (see 63, 143)	1.1
	Addressed by Output #2 of Safety Culture Detailed Implementation Plan and AC-120-71.	
334	Regulators should require airports to comply with International standards for airport construction.	1.0
	No action by this JSIT	
48	Airlines/operators and regulators should strictly enforce flight/duty time limitations.	0.9
	Stricter interpretation of existing rule. Revision of existing rule, 121.xxx.	
217	Airlines/operators should ensure their "reward system" is not related to the completion of a route segment. (see 311)	0.8
	Covered by AC-120-71.	
347	Parent airlines/operators should adopt a program to ensure the same level of safety in regional partners including, but not limited, to recruitment, training, operations and maintenance.	0.5
	No action by this JSIT.	
354	Organizations responsible for developing approach/arrival/departure procedures should not report to the organization responsible for Air Traffic service (e.g. In the FAA AVN-100 not reporting to AAT)	0.5
	No action by this JSIT.	
63	Airlines/operators should implement a culture which encourages flightcrew voluntary removal from flight status due to illness and/or emotional distress (including the use of a self assessment tool). (see 70)	0.3
	Covered by CRM Advisory Circular AC-120-51.	
222	Regulators should require PMI's to have expertise in the assigned carrier's equipment.	0.3
	OTNA-Operational Tng. Needs & Assistance. 4040.9d rewrite. Funding and Staffing an additional issue. Nat'l Inspector Resource Program.	
220	Regulators should ensure that all POIs are current and qualified in one model of the companies equipment.	0.2
	OTNA-Operational Tng. Needs & Assistance. 4040.9d rewrite. Funding and Staffing an additional issue. Nat'l Inspector Resource Program.	
242	To prevent excessive fatigue, airlines/operators should consider circadian rhythm in crew scheduling to compensate for the effects of rhythm interruptions.	0.2
	No action by this JSIT. Airline, NASA research activities underway.	
247	To ensure timely dissemination of navaid anomalies, airlines/operators and ATC should re-emphasize the requirement that flightcrews report and ATC disseminate any navigation anomalies.	0.0
	No action by this JSIT	
257	To eliminate loop holes in crew rest requirements and to ensure adequate crew rest, regulators should clarify crew rest regulations. (see 31, 130, 203, 315, 316)	0.0
	Stricter interpretation of existing rule. Revision of existing rule, 121.xxx.	
258	To facilitate the FAA awareness of safety related problems; there should be improved dissemination of the FAA hotline numbers.	0.0
	No action by this JSIT. FAA Website contains this information.	
346	Airlines/operators should ensure better educated regulators by providing intern programs.	0.0
	No action by this JSIT.	

	Standard Operating Procedures for ALAR	
297	To prevent CFIT, operators should develop procedures to ensure that flightcrews do not descend when confusion exists concerning aircraft position.	###
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
134	Airlines/operators and regulators should ensure check list designs prioritize critical items as recommended by NASA study, and that items are arranged in a manner to enhance checklist implementation	14.2
	Covered by Output #2 and #4 of the Detailed Implementation Plan for Flight Deck Equipment Upgrade/Installation to Improve Altitude Awareness and Checklist Completion.	
142	Airlines/operators should establish policies, parameters, and training to recognize unstabilized approaches and other factors and implement a go-around gate system. (see FSF - "defined gates" p. 193) (see 116, 123)	10.0
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
24	Airlines/operators should implement procedures to ensure appropriate crew pairing. (reference FSF corporate crew scheduling and fatigue evaluation.)	8.8
	FAA FAR 121.434 and 438	
224	Airlines/operators should ensure that all airline operations include compliance with all/seasonal guidance from the OEM.	8.4
	Covered by Output #3 of the Detailed Implementation Plan for Policies for ALAR (Safety Culture).	
329	Airlines/operators should incorporate in initial and recurrent training ways to recognize multiple cues that will require go-around. Including CFIT training aid 2.1.9, FSF definition of stabilized approach, risk assessment tool, and windshear training aid	7.5
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
80	Airlines/operators should ensure, and regulators should check, that operators who create their own AOM's include all procedures prescribed by original equipment manufacturers Airplane Flight Manual (AFM).	6.5
	Covered by Output #4 of the Safety Culture Detailed Implementation Plan.	
156	Require that autothrottles be used with all autopilot coupled approaches.	6.1
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
110	Airlines/operators and regulators 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. (see 99)	6.0
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
123	Airlines/operators should implement a true no-fault go around policy (learning vs. blame).	5.6
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
135	Airlines/operators and regulators should ensure checklist design and implementation of procedures to promote effective crew coordination and distribution of PF and PNF tasks. (see 82)	5.6
	Covered by CFIT SOP Detailed Implementation Plan and AC 120-71.	

319	Regulators should require a Special Qualification Airport Briefing guide be incorporated with approach charts. (Subject matter must include aircraft specific local operational procedures)	5.1
	Covered by rewrite of FAR 121.145 and will be further addressed in updated Part 121 N&O. Also addressed in AC 120-71.	
207	Airlines/operators should develop procedures to specify how transfer of control is formally accomplished.	5.1
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
342	Airlines/operators should establish an SOP to ensure that flightcrews should not begin the approach until adequate briefing is completed for the expected runway. (see 17)	5.1
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
30	Airlines/operators should adopt the "delegated" approach to standard operating procedures. (e.g. monitored approach procedures)	4.8
	Covered by FAA Order 8410 which recommends monitored approach.	
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.	4.8
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
246	To reduce pilot overload, airlines/operators policies should stress using the appropriate level of automation.	4.8
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
309	Airlines/operators should require flightcrews to fly precision instrument approach procedures during periods of reduced visibility and night operations. (see 59, 355)	4.3
	No action by this JSIT. Covered by Standard All-Weather Handling Procedures.	
99	Airlines/operators should ensure that clear, concise, accurate, appropriate standard operating procedures are published and enforced. (see 110)	3.7
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
79	Airlines/operators should implement a reliable process to communicate information to the flightcrew that may affect flight or aircraft operations.	3.4
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
82	Airlines/operators should clearly define, train and check the specific PF/PNF duties. (see 135)	3.1
	Covered by CFIT SOP Detailed Implementation Plan and AC 120-71.	
19	Airlines/operators should implement a procedure to climb to a minimum safe altitude when position uncertainty exists by at least one crew member. Flightcrew must advise ATC of intentions.	2.9
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
161	Airlines/operators should implement procedures that call for an immediate recovery maneuver following a flight control warning (e.g. stall warning) (see 61)	2.1
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
113	Airlines/operators should ensure that their training/standardization programs emphasize the importance of adequate preflight planning.	2.0
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	

95	Airlines/operators should establish procedures for flightcrews to review/cross check instructions, clearances, etc. to ensure consistency with expected procedures or practices.	1.1
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
236	Airlines/operators should develop/publish appropriate procedures for radio communications restoration.	0.0
	Covered by CFIT SOP Detailed Implementation Plan (template) and AC 120-71.	
	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, and a research DIP has been presented to and approved by CAST.	
85	The aviation industry should develop and implement synthetic vision capability (e.g. Precision Approach Terrain Information (PATI)).	11.7
	Being addressed by NASA Aviation Safety Program in the Synthetic Vision Project and companies in private industry. Recommended by the CFIT JSIT for continued research.	
295	To enhance flightcrew performance in low visibility operations, the aviation industry should continue to develop and implement HUD capability. (see 149)	5.9
	Being addressed by NASA Aviation Safety Program in the Synthetic Vision Project and companies in private industry. Recommended by the CFIT JSIT for continued research.	
149	Manufacturers should install a HUD as standard equipment. (see 85)	5.4
	Terrain Awareness and Warning System (TAWS)	
	TAWS Project implemented by CFIT JSIT.	
35	Manufacturers should install TAWS (EGPWS) in all new aircraft, airlines/operators should retrofit TAWS into the existing fleet and international regulators should require the installation of TAWS.	10.8
	Final rule was published March 27, 2000. 5 years after signing of the final rule all US carriers must meet TAWS requirements.	
60	Avionics manufacturers should improve GPWS capability to reduce GPWS nuisance warnings. (See 243)	3.5
	TAWS TSO published. Should reduce or eliminate the false warning problem experienced in the past with older GPWS equipment. As TAWS rule is introduced, the GPWS Mark I-IV will be removed from service.	