1998 AIRPORT SURFACE OPERATIONS SAFETY ACTION PLAN

To Prevent Runway Incursions and Improve Operations

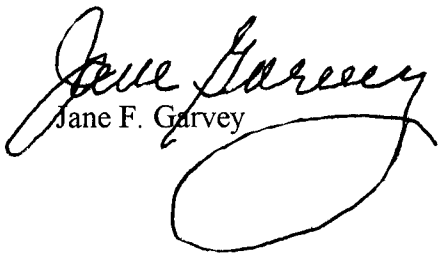
Runway Incursion Program Office (ATO-102)
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Message From the Administrator

I am pleased to offer the 1998 Airport Surface Operations Safety Action Plan. This Action Plan is the culmination of months of effort that took into account input from both the Federal Aviation Administration (FAA) and the aviation industry. The aviation community contributed significantly through forums, such as the Industry Roundtable on Runway Incursions and the Research, Engineering, and Development Advisory Committee's Runway Incursion Subcommittee. Key FAA organizations were deeply involved throughout the development process through the use of a Runway Incursion Leadership Team. This team met on a regular basis fine-tuning the action plan and will continue to provide guidance as we carry out the action plan initiatives.

The action plan will be followed by a Program Implementation Plan (PIP) that will identify the tasks associated with the actions set forth in the action plan and provide the basis for measuring our performance. The PIP will also include time lines and funding profiles.

In closing, I ask for your support in implementing these initiatives and welcome your input. I am confident that we, working together, can significantly reduce runway incursions.



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Acknowledgments

Development of this 1998 Airport Surface Operations Safety Action Plan was sponsored by the Federal Aviation Administration (FAA) Runway Incursion Program Office, ATO-102. The sponsor thanks the Runway Incursion Leadership Team for their advice and counsel during the development process. The Leadership Team is made up of the following FAA organizations: Air Traffic Service, Flight Standards Service, Office of Communication, Navigation, and Surveillance Systems, Office of Airport Safety and Standards, and the Office of System Safety.

In addition, appreciation is extended to the aviation industry participants in the Safety Roundtable on Runway Incursion Prevention, the Research, Engineering, and Development Runway Incursion Subcommittee, the Department of Transportation Inspector General's office, and Applied Techno-Management Systems, Inc. (ATMS), who produced the Action Plan.

1998 AIRPORT SURFACE OPERATIONS
SAFETY ACTION PLAN
- to Reduce Runway Incursions and Improve Operations

Table of Contents

EXECUTIVE SUMMARY

This 1998 Action Plan represents a systemwide, multifaceted strategy to reduce incidents and accidents directly attributable to runway incursions and improve airport surface operations. It identifies goals, objectives, and actions that address *management and procedural changes; improvements in airport navigation aids, signs, and surface markings; technology-based efforts; and increased incursion awareness efforts.* The Plan is in direct support of the FAA Administrator's goal to reduce runway incursions by 15 percent of the 1997 level by the year 2000.

Historical data clearly demonstrate that runway incursions most likely to cause accidents generally occur at complex, high volume airports. These airports are characterized by parallel/intersecting runways; multiple taxiway/runway intersections; complex taxi patterns; and the need for traffic to cross active runways. The analysis of historical data also shows that a disproportionately large number of runway incursions involve general aviation pilots and often result from misunderstood controller instructions, confusion, disorientation, and/or inattention.

Nearly all runway incursions are caused by human error. ***While it is fortunate that very few runway incursions result in accidents, the lapses of discipline or procedure that create these errors point to a potentially serious problem that must be addressed at all levels within FAA.***

FAA is working closely with industry to find and implement runway incursion prevention techniques that will reduce or eliminate incidents and accidents attributable to runway incursions. These initiatives will help pilots, ground vehicle operators, and controllers avoid potentially dangerous events. Runway incursion prevention methods that act on pilots directly are generally preferred over those that require controllers to conduct surveillance, interpret the information, and then relay instructions to the pilots.

The FAA and industry efforts have pursued a number of initiatives designed to reduce incidents and accidents attributable to runway incursions. There have been major efforts to achieve full implementation of a new system of international standard signage and improvements in runway marking; the development and implementation of surface radar surveillance; the development of a surface conflict detection system; and important improvements in pilot and vehicle operator training and airport charting.

Despite these efforts, the number of incursions tracked by FAA has risen in recent years. While the numbers for any year are not reliable indicators of the future, or reliable indicators of future incidents and accidents, they clearly point to a potentially serious problem that requires immediate action.

To address the problem, this Action Plan contains a highly focused central management structure and a systemwide approach to accomplish the Plan's goals and objectives. An internal leadership team has been established to ensure close coordination and cooperation between the Air Traffic Service, as the lead organization, and the other major FAA elements. A regional FAA management process has been developed to place appropriate emphasis at the regional level on the prevention of incidents and accidents attributable to runway incursions. A crucial aspect of this approach is to ensure thorough understanding and heightened awareness – by both FAA personnel and system users – of the factors contributing to runway incursions and surface incidents.

In formulating this Action Plan, the FAA has sought and received the advice and recommendations of individuals and groups of experts, as well as industry representatives and government bodies. The Action Plan incorporates specific recommendations made by these groups.

The 1998 Plan has identified **five (5) major goals** with associated objectives in support of FAA's overall goal to reduce runway incursions :

- **To improve strategic planning, data collection and analysis, human resource management, and stakeholder participation** — through enhancements in internal management, revised guidance and procedures, better data collection and analysis capability, progress on human resource issues, and partnership with stakeholders.

- **To seek improvements in pilot/controller communications, pilot and crew training, and in-cockpit techniques** — by addressing frequency congestion and voice delivery issues, ensuring pilot ground safety awareness training, addressing cockpit procedures and intra-cockpit communication issues, conducting aircraft lighting research, and improving aircraft conspicuity.

- **To provide controllers with enhanced capabilities, tools, and techniques** — by completing Airport Surface Detection Equipment (ASDE) and Airport Movements Area Safety System (AMASS) installations and pursuing cost-effective alternatives for mid-sized and smaller airports; by continuing research and development on data fusion technology, multi-lateration, and other sensors; and by addressing controller human resource needs through training and human factors initiatives.

- **To seek improvements in airport surface facilities, design, and operations** — through enhancements in airport surface navigation aids; use of objective methods to determine the adequacy of existing aids and services; improvements in aircraft positioning techniques; and thorough communication of lessons learned.

- **To improve communications with the aviation community to enhance incursion awareness** — by highlighting incursion problem areas to create awareness and seek solutions; conducting an airport surface safety awareness campaign; and improving dissemination of safety-related information.

Objectives were developed for each of the above goals and will be supported by specific actions. The Plan also identifies the responsible organizational element and expected completion time of each individual effort.

PROGRAM PURPOSE AND BACKGROUND

Purpose

The purpose of this 1998 Action Plan is to strengthen FAA's Runway Incursion prevention efforts. Specific and measurable actions have been identified that, when complete, will significantly reduce or eliminate surface incidents and accidents that are attributable to runway incursions.

The Plan also establishes the strategic framework for the Runway Incursion program. Specific goals, objectives, and initiatives have been developed, together with a process for assessing program accomplishments. These directly support the Administrator's goal to reduce runway incursions by 15 percent of the 1997 level by the year 2000.

A multifaceted, systemwide strategy for reducing runway incursions and improving the efficiency of airport surface operations is presented. Specific initiatives to be implemented encompass *management and procedural changes, improvements in surface markings and airport navigation aids, technology-based initiatives, and increased incursion awareness efforts.*

The Action Plan calls for immediate action to implement a series of low-cost initiatives that are most likely to reduce runway incursions in the near term. These include efforts that address *pilot familiarity with airports, navigation and communications improvements, pilot/controller memory and attention, controller skill development, compliance with FAA regulations by pilots and controllers, and improved dissemination of safety/security-related information.*

Background

The FAA defines a runway incursion as "any occurrence at an airport involving an aircraft, vehicle, person or object on the ground that creates a collision hazard or results in a loss of separation with an aircraft taking off, intending to take off, landing, or intending to land." Runway incursions are classified into four categories: *Pilot Deviations, Operational Errors, Operational Deviations,* and *Vehicle or Pedestrian Deviations.*

The number of incursions tracked by the FAA has risen significantly in recent years, increasing from 186 in 1993 to 318 in 1997. This has occurred despite the fact that the FAA and industry have undertaken a number of beneficial actions to reduce runway incursions. While the runway incursion numbers for any given year are not reliable indicators of the future, or reliable indicators of accidents to come, the trend over the past few years clearly indicates that a potentially serious problem exists. Four major accidents attributable to runway incursions have occurred since 1990 (the most recent in 1994), claiming 45 lives.

Historical data clearly demonstrate that runway incursions most likely to cause accidents generally occur at complex, high volume airports. These airports are characterized by parallel/intersecting runways; multiple taxiway/runway intersections; complex taxi patterns; and the need for traffic to cross active runways. The analysis of historical data also shows that a disproportionately large number of runway incursions involve general aviation pilots and often result from misunderstood controller instructions, confusion, disorientation, and/or inattention. However, past accidents have

tended to occur at busy airports, at night, or when visibility is impaired. This runway data analysis indicates that runway incursion prevention measures need to be spread as widely as possible.

In an effort to stem the rising tide of accidents and incidents attributable to runway incursions, the FAA developed action plans in 1991 and 1995 to address this problem. A number of management and procedural changes and technology-based initiatives have been pursued.

Among them was the formation of a national program office to coordinate FAA activities to reduce runway incursions. Over the past several years, the FAA has worked to achieve full implementation of a new system of international standard signage and improvements in runway marking. Deployment of Airport Surface Detection Equipment (ASDE) radar and development of an Airport Movement Area Safety System (AMASS) are being actively pursued. Important improvements in pilot and vehicle operator training and airport charting have also been realized.

Building on these earlier initiatives, the **1998 Action Plan** emphasizes results and accountability. The Action Plan identifies a series of actions needed to reduce runway incursions and other surface incidents. For each action, a lead organization is assigned and a target completion date is established. Since these activities cross several of FAA's lines of business, a concerted, integrated effort by the agency will be required to implement this program.

The Runway Incursion Program Office within Air Traffic Operations provides direction, guidance, and oversight for the research, development, and acquisition of surface movement products and for other initiatives designed to promote surface movement safety and efficiency.

To support these initiatives, a **Runway Incursion Leadership Team** has also been formed to work in partnership with the program office. This cross-functional leadership team is comprised of representatives from Flight Standards, Airports, Research and Acquisitions, Systems Safety, and Air Traffic Service.

A **Program Implementation Plan (PIP)** is currently being written. The PIP will prioritize the efforts to be pursued, evaluate the actions most likely to produce near-term results, identify organizational responsibilities, establish firm schedules, identify funding needs, and outline the specific tasks required to accomplish the selected actions. The Program Implementation Plan will also include sound performance measures to assess program accomplishments.

During the Implementation Phase, the Program Implementation Plan initiatives will be accomplished by the responsible organizations with oversight provided by the Program Office and the Leadership Team. Necessary adjustments in timing and program emphasis will be coordinated with other FAA elements and FAA top management will be kept fully informed of progress and problems.

RUNWAY INCURSION DEFINITIONS

This section includes two groups of definitions. The first group includes terms that have been subject to some confusion and misunderstandings in the past; the second set is comprised of definitions tailored specifically to runway incursion analysis.

Runway Incursion (FAA Order 8020.11A, Ch.1 Par 5)

> Any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of separation* with an aircraft taking off, intending to take off, landing, or intending to land[1].
>
> *A loss of separation means that aircraft involved in the incident were closer than allowed by air traffic requirements.

Runway Incursions are classified into four categories:

> **Pilot Deviations** (PD) - action of a pilot that results in violation of a Federal Aviation Regulation.
>
> **Operational Errors** (OE) - an occurrence attributable to an element of the ATC system which results in:
>
> 1) less than the applicable separation minima between two or more aircraft, or between an aircraft and terrain or obstacles, as required by FAA Order 7110.65, Air Traffic Control, and supplemental instructions. Obstacles include vehicles/equipment/personnel on runways; or
> 2) an aircraft landing or departing on a runway closed to aircraft operations after receiving air traffic authorization.

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[1]**Clarifications** developed by the FAA Runway Incursion Team (Runway Incursion Team Report, 3/29/96):

Runway incursions include problems on the runway but not on taxiways or the ramps (in this case, the runway is considered that area intended for landing and take off between the runway holding position markings). The definition applies only to airports with operating control towers, since events at non-towered airports are not likely be reported. In order for an event to be a runway incursion, at least one aircraft, vehicle, pedestrian, or object must be on the ground.

Runway incursions should not include events involving aircraft, vehicles, pedestrians or objects on the runway without permission when there is no collision hazard or loss of separation; nor should they include animals on the runway. (Although these and other similar or unapproved movements occur, they are called surface incidents, not runway incursions.)

A runway incursion occurs when a pilot or controller takes an unplanned or evasive action to avoid a collision hazard. *Pilot actions* might include unplanned deceleration (ground or air), accelerated rotation during takeoff, evasive change in heading or altitude, initiated "go around" or aborted landing, aborted takeoff. *Controller action* might be a canceled landing or takeoff clearance.

Operational Deviations (OD) (FAA Order 7210.3)

Controlled occurrences where applicable separation minima, as referenced in the definition of operational error (see above) are maintained, but 1) less than the applicable separation minima existed between an aircraft and protected airspace without prior approval, or 2) an aircraft penetrated airspace that was delegated to another position of operation or another facility without prior coordination and approval.

Vehicle/Pedestrian Deviations (VPD) - vehicle or pedestrian incursions resulting from a vehicle operator, non-pilot operator of an aircraft, or pedestrian who deviates onto the movement area (including the runway) without ATC authorization.

It should be noted that not all events that fall into these categories are counted as runway incursions. While these four categories all represent surface incidents, they are considered runway incursions only when a collision hazard or loss of separation occurs.

Surface Incident

Any event where unauthorized or unapproved movement occurs within the movement area or an occurrence in the movement area associated with the operation of an aircraft that affects or could affect the safety of flight. Surface incidents result from pilot deviations, operational errors, vehicle or pedestrian deviations, or operational deviations.

Some surface incidents are not captured in the runway incursion definition, and, therefore, are separately analyzed and addressed for corrective action. There are several FAA incident recording systems that contain information on surface (as well as other) incidents. These include the National Airspace Information Monitoring System (NAIMS) and the Aviation Safety Reporting System (ASRS). Runway incident data collected by the National Aeronautics and Space Administration (NASA) can be used to supplement the FAA's data.

Runway Transgression/Unauthorized Landing[2] (NASA Definition)

A runway transgression specifically involving landing without a landing clearance or landing on the wrong runway.

[2]Unlike FAA's runway incursion definition, another aircraft does not have to be present for the incident to be counted by NASA. For example, an incident where an aircraft continues past the point where it was told to stop and enters an active runway, but does not interfere with another aircraft, will be a transgression and included under NASA's definition. Also, the NASA data will be different from FAA's, because reports of runway transgressions are submitted voluntarily by pilots, air traffic controllers, and others to NASA, and are not validated

Runway Transgression/Other[2] (NASA Definition)

> The erroneous or improper occupation of a runway or its immediate environs by an aircraft or other vehicle so as to pose a potential collision hazard to other aircraft using the runway, even if no such other aircraft were actually present.

Other Definitions, Tailored for Runway Incursion Analysis

Several other definitions, specifically tailored for use in dealing with runway incursions and incidents are as follows:

Aircraft: Any FAA certified device that is used or intended to be used for flight in the air.

Aircraft intending to land: An aircraft that has been cleared to land by ATC but has not crossed the landing threshold.

Aircraft landing: An aircraft that has crossed the landing threshold with or without ATC clearance.

Aircraft intending to take off: An aircraft that has been cleared for takeoff by ATC and has entered the runway, but has not commenced takeoff roll.

Aircraft taking off: An aircraft in the process of rolling down the runway for departure, with or without ATC takeoff clearance.

Airport: Any ATC towered airport. An ATC towered airport includes FAA and contract towers.

Collision hazard: Any condition, event, or circumstance which could induce an occurrence of a collision or surface accident or incident (e.g., a pilot takes an unplanned or evasive action to avoid an aircraft, vehicle, object, or person on the runway).

Loss of separation: An occurrence or operation which results in less than the prescribed separation between aircraft, vehicles, or an object.

Object: Any moveable or stationary physical matter (e.g., above-ground structure, obstacle, debris, barrier).

On the ground: On the runway, including surfaces inside the runway holding position markings.

Person: Any human (affiliation may be civilian, maintenance, security, emergency personnel, military, airline personnel, other, unknown).

Runway: That area intended for landing and takeoff between the runway holding position markings (FAA Runway Incursion Team Report, March 29, 1996)[3].

Runway Incursion Action Team: A team of FAA and industry experts assembled to conduct on-site evaluations at airports that have special problems or have been experiencing an unusually high incidence of incursions.

Vehicle: Any motorized or powered device, car, truck, tool, equipment, or other mechanical machine (e.g., sweeper, tug, mower, baggage truck, bus, people mover, snow plow, emergency vehicle, or an aircraft being positioned by a non-pilot).

[3] ***Runway*** *(as defined in FAA Order 7110.65, Air Traffic Control): A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees; e.g., Runway 01, Runway 25.*

ACTION PLAN OVERVIEW

The FAA has expended significant efforts and resources over the past several years to identify and analyze the factors that are contributing to the increase in runway incursions. Several studies have been completed, surveys and interviews with key participants have been conducted, and three separate FAA/Industry working groups met in 1997 to address the runway incursion problem. Reports issued by these groups addressed a series of issues and recommended specific actions and strategies.

This Action Plan addresses these recommendations, as well as those from the Department of Transportation Inspector General's Audit Report, issued in December 1997. The Action Plan also builds upon actions and initiatives currently underway in the FAA, including the initiatives described in the 1995 Runway Incursion Action Plan.

In developing the Action Plan, each of the recommendations and ongoing activities have been assessed. Appendix I lists each of these recommendations and initiatives and provides the specific Action Plan reference where the recommendation was addressed.

These recommendations and activities were grouped into five categories: *program management, pilot-focused improvements, controller-focused improvements, airport operations improvements, and overall incursion awareness efforts.* From these five categories, goal statements were formulated as follows:

Goal I *Strengthen the Runway Incursion Program through improvements in strategic planning, data collection and analysis, human resources management, and stakeholder participation.*

Goal II *Reduce the potential for pilot error through improved pilot/controller communications, an education and training program for pilots and crewmembers, and pursuit of enhanced in-cockpit procedures and technologies.*

Goal III *Provide controllers with enhanced capabilities, tools, and techniques needed to improve surface safety and operational efficiency.*

Goal IV *Seek improvements in airport surface facilities, design, and operations.*

Goal V *Improve communications with the aviation community to enhance runway incursion awareness.*

A set of objectives was developed for each goal and a series of specific actions was formulated. The matrix contained in Appendix I traces the specific recommendations from the source reports to the specific goal, objective, or action described in the next section.

FAA recognizes that effective program management and leadership are needed to implement the Airport Surface Operations Safety Action Plan. A results-oriented **Program Implementation Plan** will address the management, cost, technical, and schedule elements needed to implement this multifaceted, systemwide approach to reduce incidents and accidents attributable to runway incursions.

The **Program Implementation Plan** (PIP) with time lines and funding profiles is under preparation and will follow this Action Plan. The PIP will identify the specific tasks, resource requirements, organizational responsibilities, and detailed schedules needed to implement the Action Plan successfully.

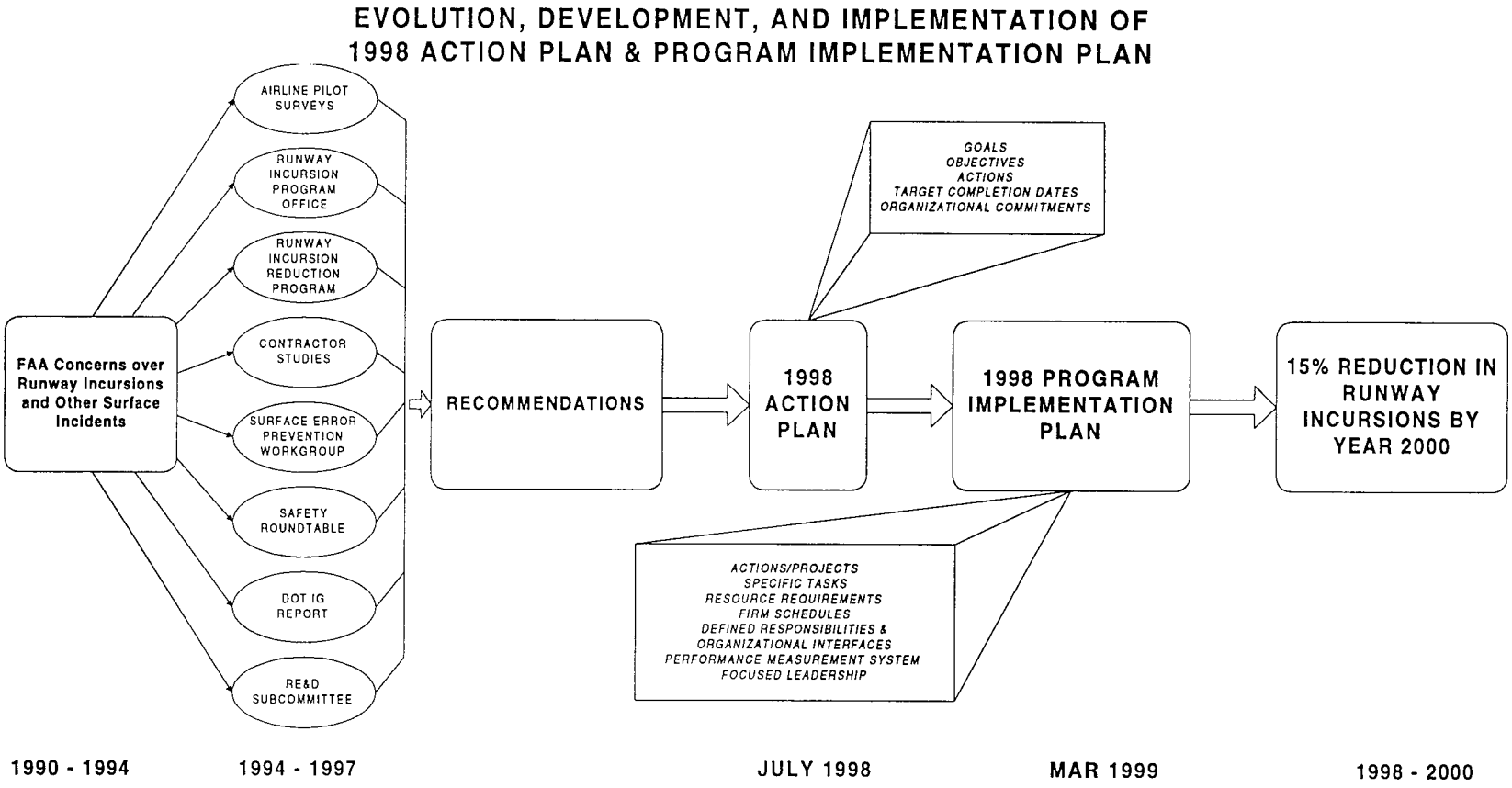
As noted above, this Plan is based on what has been learned to date about the complexity surrounding runway incursions and related surface incidents. It also takes into consideration the substantial planning that has been accomplished to date and continues to be undertaken to further the future environment of aviation. The Plan builds upon the work and recommendations of many individuals and advisory groups consisting of experts and aviation practitioners, both within and outside FAA. Their counsel and help are sincerely appreciated.

Integral to this **Program Implementation Plan** will be a structured performance measurement system that will track the achievement of the goals and objectives described in the next section. For each approved action, funding and personnel requirements will be identified, schedules formulated, firm performance targets established, success criteria agreed upon, and organizational responsibilities and interfaces defined. Periodic reporting will be implemented to assess progress against targets.

Each action will have **specific** tasks from which success can be **measured**. The initiatives must be technically feasible and have a realistic chance of being **achieved**. They must also be within the scope of FAA's mission and be **compatible** with the agency's strategic objectives. Each initiative will have a completion date specified and will contain milestones to be tracked over **time**. Finally, **ownership** of the initiative will be assigned to a specific individual or organization, who will be accountable for successfully completing the initiative.

Figure 1 depicts the evolution of the 1998 Action Plan and its relationship to the Program Implementation Plan.

Figure 1 - Evolution of 1998 Action Plan



GOALS, OBJECTIVES, ACTIONS

Listed in this section are specific objectives for each of the five goals. In most, but not all, cases, actions are also described. The actions, along with specific management, technical, cost, and schedule information will be included in the Program Implementation Plan. Listed after each action is the responsible organization(s) along with a target completion date. Where more than one organization is listed, the first one has primary responsibility.

GOAL I ***Strengthen the FAA Runway Incursion Program through improvements in strategic planning, data collection and analysis, human resources management, and stakeholder participation.***

Objective 1A Improve Internal Management. Implement measures to address systemwide problems and expedite solutions.
(DOT IG Recommendation)

Actions

(a) Increase emphasis on results and accountability within FAA headquarters and field organizations by improving communications and implementing effective performance measurement reporting systems.
(DOT IG Recommendation, Surface Error Prevention Workgroup Strategy #7)

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(b) Establish a regional framework and identify requisite responsibilities for each operational element to place special emphasis on prevention of accidents and incidents attributable to runway incursions.
(DOT IG Recommendation, Surface Error Prevention Workgroup Strategy #1)

Responsible Organization(s)	Target Completion Date
ATO-102, Regions AAT	8/98-11/98

(c) Each FAA control tower management will work with airport operators and aircraft operators in the development of surface incident prevention plans.
(DOT IG Recommendation, Surface Error Prevention Workgroup Strategy #1)

Responsible Organization(s)	Target Completion Date
Regions AAT	12/98

Objective 1B **Issue Revised Guidance and Procedures.** Implement improved guidance and procedures to enhance airport surface operations.

Actions

(a) Implement new procedures to enhance the safety of Land and Hold-Short Operations (LAHSO).
(RI Program Initiative #7)

These procedures are currently being implemented via FAA Order 7110.114 (July 1997) with a planned completion date of July 2000.

Responsible Organization(s)	Target Completion Date
Regions AAT	7/00

(b) Develop and implement procedures for assuring positive clearance onto runways. (Possible amendment to FAR-91-129(i))
(Safety Roundtable Recommendation, RE&D Subcommittee Recommendation #1, 1996 MITRE Report Recommendation)

Responsible Organization(s)	Target Completion Date
AAT Procedures Division	5/00

(c) Develop and implement standardized taxi routes where appropriate.
(RI Program Initiative #13)

A FAA draft order has been developed and coordinated with users. It is now in final coordination.

Responsible Organization(s)	Target Completion Date
AAT Procedures Division	12/98

(d) Work with aircraft operators in the development of improved cockpit procedures for surface movement.
(RE&D Subcommittee Recommendation #7)

Responsible Organization(s)	Target Completion Date
AFS	1/00

(e) Develop and implement an improved position relief checklist for air traffic facilities.
(Surface Error Prevention Workgroup Strategy #5)

Responsible Organization(s)	Target Completion Date
AAT Procedures Division	12/98

(f) Develop a remedial training program for FAA employees involved in surface incidents. This program will involve employees such as technicians and vehicle operators who are directly involved in these incidents.

Responsible Organization(s)	Target Completion Date
ARP	12/98

Objective 1C Improve Data Collection and Analysis Capability. Improve data collection and analysis capability to better assess surface incidents.
(DOT IG Recommendation, Surface Error Workgroup Strategy #14)

Actions

(a) Implement controls to ensure the accuracy and completeness of surface incident data.
(DOT IG Recommendation, Surface Error Workgroup Strategy #14)

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(b) Develop more effective means to use incursion/incident/transgression data and related human factors data, taking full advantage of sources such as NASA (including the Aviation Safety Reporting System (ASRS)), National Transportation Safety Board (NTSB), and the National Airspace Information Monitoring System (NAIMS).
(DOT IG Recommendation, Human Factors Report Recommendation)

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(c) Improve the utility of Operational Error (OE), Operational Deviation (OD), Pilot Deviation (PD), and Vehicle/Pedestrian Deviation (VPD) reports.

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(d) Develop an improved reporting form for vehicle/pedestrian deviations (VPDs).
(DOT IG Recommendation, RI Program Initiative #12)

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(e) Develop special programs and publications to improve the dissemination of surface safety-related "Lessons Learned."
(DOT IG Recommendation, Safety Roundtable Recommendation, Surface Error Prevention Workgroup Strategy #15)

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(f) Examine the effectiveness of using pilot and controller immunity as a means of gathering and analyzing "root cause" information pertaining to surface incidents.
(RE&D Subcommittee Recommendation #11)

Responsible Organization(s)	Target Completion Date
AFS/ATO/ASY	12/98

Objective 1D Address Human Resources Issues. Identify and evaluate human resource/human factors issues related to surface incident prevention.

Actions

(a) Work with Regional management to assure effective response by FAA Headquarters to surface incident prevention issues raised by field facilities.
(Surface Error Prevention Workgroup Strategy #2)

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(b) Develop specific remedial training for pilots/crews involved in surface incidents.
(RE&D Subcommittee Recommendation #11)

Responsible Organization(s)	Target Completion Date
AFS	12/98

(c) Develop specific remedial training for controllers involved in surface incidents.
(RE&D Subcommittee Recommendation #11)

Responsible Organization(s)	Target Completion Date
AAT	12/98

(d) Encourage airport operators to develop remedial training programs for employees involved in surface incidents.

Responsible Organization(s)	Target Completion Date
ARP	12/98

Objective 1E Work with Stakeholders. Use inputs from stakeholders in identifying and resolving safety and security issues and increasing the efficiency of airport surface operations.

Actions

(a) Strengthen partnerships with stakeholders such as commercial and general aviation pilots, airport operators, controllers, NTSB, NASA, air carriers, associations, military, and aircraft and equipment manufacturers in implementing the efforts to reduce surface incidents.
(Safety Roundtable Recommendations)

Responsible Organization(s)	Target Completion Date
ATO-102	Ongoing

(b) Continue the use of advisory bodies to ensure the broadest possible range of advice and inputs.
(RE&D Subcommittee Recommendation #13)

The FAA RE&D Advisory Committee has approved the continuation of the Runway Incursion Subcommittee as its principal advisory body for this issue.

Responsible Organization(s)	Target Completion Date
ATO-102	Ongoing

GOAL II *Reduce the potential for pilot error through improved pilot/controller communications; an education and training program for pilots and crewmembers; and enhanced in-cockpit procedures and technologies.*

Objective 2A **Address Frequency Congestion and Voice Delivery Issues.** Enhance pilot/controller communications by addressing radio frequency and voice delivery issues.
(DOT IG Report, Safety Roundtable Recommendation, Human Factors Report Recommendation, 1994 MITRE Report, 1996 MITRE Report, Surface Error Prevention Workgroup)

Action

Reduce radio frequency congestion through implementation of standard taxi routes (where appropriate) and support early certification and use of digital communications. Address issues pertaining to the switching of frequencies.

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

Objective 2B **Conduct Pilot Ground Safety Awareness Training.** Pursue pilot and crewmember training programs that promote greater awareness of ground safety issues.
(Human Factors Report, Surface Error Prevention Workgroup, 1994 MITRE Report, 1996 MITRE Report, RE&D Subcommittee Recommendation #6)

Actions

(a) Provide airport-specific training to pilots and crewmembers in signage, surface marking identification, standard taxi routes, and runway lighting especially for large airports with complex runway and taxiway layouts.

Responsible Organization(s)	Target Completion Date
AFS	1/00

(b) Pursue improved training for surface operations and provide a mechanism that will allow pilots to provide confidential feedback on the quality of training, its perceived effectiveness in alleviating problems, and recommendations for continued improvements.

Responsible Organization(s)	Target Completion Date
AFS	1/00

Objective 2C **Address Cockpit Procedures and Intra-Cockpit Communication Issues.** Work with pilots and crewmembers to improve cockpit procedures and intra-cockpit communications to address issues associated with pilot airport familiarity and pilots' ability to properly respond to ATC instructions.
(R&D Subcommittee Recommendation #7, Human Factors Report, 1994 MITRE Report, 1996 MITRE Report)

Previous studies and surveys have concluded that techniques such as the use of memory aids, writing down complex instructions, read-backs, and the use of mechanical aids can reduce the probability of pilot error during ground operations.

Responsible Organization(s)	Target Completion Date
AFS	1/00

Objective 2D **Conduct R&D of In-Cockpit and Surface Technologies.** Continue research on in-cockpit and surface technologies to improve the safety and efficiency of surface operations, particularly during low visibility conditions.
(RE&D Subcommittee Recommendation 10 & 9)

Responsible Organization(s)	Target Completion Date
AAR-410/AND-400/NASA	12/01

Action

Draw upon results from the NASA/FAA Low Visibility Landing and Surface Operations Program with emphasis on achieving improved airport surface orientation from electronic moving map displays, optimized heads-up displays, and use of differential GPS.

Responsible Organization(s)	Target Completion Date
AND-400/NASA	01/03

Objective 2E **Improve Aircraft Conspicuity.** Task the FAA William J. Hughes Technical Center (WJHTC) and work with aircraft operators and aircraft manufacturers to investigate technologies and procedures to improve aircraft conspicuity.

Action

Task the WJHTC and work with aircraft operators and aircraft manufacturers to investigate technologies and procedures to improve aircraft lighting and other schemes to improve aircraft conspicuity.
(RE&D Subcommittee Recommendation #4 & 5, 1994 MITRE Recommendation)

Responsible Organization(s)	Target Completion Date
AFS/ATO-102/ACT	12/98

GOAL III *Provide controllers with enhanced capabilities, tools, and techniques needed to improve surface safety and operational efficiency.*

Objective 3A **Address controller human resource needs through improved training, controller surveys, and human factors initiatives.**

Actions

(a) Develop and implement standard phraseology for local control and ground control coordination of runway crossings to eliminate misunderstandings, provide more specific instructions, and reduce the length of the exchange.
(Surface Error Prevention Workgroup Strategy #10, 1996 MITRE Report)

Responsible Organization(s)	Target Completion Date
ATO-102	06/99

(b) Implement training for controllers to improve clarity of transmission content, voice delivery, speech rates, and word enunciation.
(1996 MITRE Report)

Responsible Organization(s)	Target Completion Date
ATO-102	06/99

(c) Implement Scan Technique Training.
(Surface Error Prevention Workgroup Strategy #9)

Responsible Organization(s)	Target Completion Date
ATO-102	06/99

(d) Undertake a Controller Survey to help identify surface incident causal factors.
(RI Program Initiative #1)

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(e) Develop and implement training simulators with different levels of capability that apply to various types of facilities to permit effective on-site training for airport surface operations, with emphasis on surface incident prevention.

Responsible Organization(s)	Target Completion Date
ATO-102	9/01

(f) Develop a capability for graphical re-creation of runway incidents to enhance training and awareness of specific surface incident problems.

Responsible Organization(s)	Target Completion Date
ATO-102	9/01

Objective 3B Complete ASDE and AMASS Installation and Pursue Cost-Effective Alternatives. Complete installation of **ASDE-3**, continue testing and deployment of AMASS, and pursue alternatives to provide detection and conflict alert capability to mid-sized and smaller airports.

Actions

(a) Complete the installation of Airport Surface Detection Equipment-3 (ASDE-3). *(RI Program Initiative #3)*

Responsible Organization(s)	Target Completion Date
AAF/AND-400	1/99

(b) Continue testing and deployment of the Airport Movement Area Safety System (AMASS)
(RI Program Initiative #2)

Responsible Organization(s)	Target Completion Date
AAF/AND-400	8/00

(c) Pursue ASDE systems which may be suitable for mid-sized and smaller airports. *(RI Program Initiative #4, RE&D Subcommittee Recommendation #10, Safety Roundtable Recommendation)*

Responsible Organization(s)	Target Completion Date
AND-400	Ongoing

Objective 3C **Continue R&D on Data Fusion Technology, Multi-lateration, and Other Technologies.** Continue research and development of data fusion technology for processing information from airport surveillance radars, multi-lateration surveillance sensors, and acoustic sensor systems to provide greater situational awareness, "seamless" coverage, and improved conflict alerting. Sight lines from the tower and physical obstructions often prevent controllers from seeing all pertinent parts of the airport movement area. This research is to include efforts to make all of the movement area visible to controllers.
(RE&D Subcommittee Recommendation #10)

See Appendix II for a brief description of several promising technologies.

Responsible Organization(s)	**Target Completion Date**
AND-400/AAR-410	Ongoing

GOAL IV *Seek Improvements in Airport Surface Facilities, Design, and Operations.*

Objective 4A **Develop Objective Methods for Determining Adequacy of Existing Aids and Services.** Develop objective methods for determining the adequacy of existing aids and services (e.g. surface markings and low visibility operations services).

Actions

(a) Continue research on surface technologies to improve the safety and efficiency of surface operations, particularly during low visibility conditions.
(RE&D Subcommittee Recommendation 10 & 9)

Responsible Organization(s)	Target Completion Date
AND-400/AAR-410	Ongoing

(b) Task the FAA Technical Center to investigate methods/techniques to ensure that aircraft have fully cleared the runway.
(RE&D Subcommittee Recommendation #12)

Responsible Organization(s)	Target Completion Date
AAS/ATO-102/ACT/AAR-410	06/99

(c) Task the FAA Technical Center to develop an easy-to-use objective method for airport operators to determine when airport surface markings need repainting due to rubber obscuration, normal wear, fading, lack of contrast with the pavement, or other reasons.
(RE&D Subcommittee Recommendation #9)

Responsible Organization(s)	Target Completion Date
ARP/ATO-102/ACT/AAR410	06/99

Objective 4B **Pursue Implementation of Needed Improvements in Airport Surface Navigation Aids.** Pursue airport specific improvements in airport surface navigation aids — signs, markings, lighting, and airport charts.
(Safety Roundtable Recommendation, R&E Subcommittee Recommendation #2 & 3, 1994 MITRE Report, 1996 MITRE Report)

Actions

(a) Task FAA control tower management to work with the Regional Airports Divisions, airport operators, and aircraft operators to develop surface incident prevention plans, and identify needed surface aids.

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(b) Take action to ensure implementation of Surface Movement Guidance and Control Systems (SMGCS).

Responsible Organization(s)	Target Completion Date
AFS-400	12/99

Objective 4C **Identify Problems and Communicate "Lessons Learned."** Work with airport operators and airport users to identify problems and communicate "lessons learned."

Actions

(a) Take steps to systematically identify and analyze surface incident problem areas to enhance awareness and develop workable solutions.
(DOT IG Report)

Responsible Organization(s)	Target Completion Date
ATO-102/Regions AAT	12/98

(b) Expand the use of Runway Incursion Action Teams, where appropriate.
(RI Program Initiative #11, RE&D Subcommittee Recommendation #8)

Runway Incursion Action Teams are used to conduct on-site evaluations at airports that have special problems or experience an unusually high incidence of incursions. The Teams are comprised of FAA and industry subject matter experts.

Responsible Organization(s)	Target Completion Date
ATO-102	12/98

(c) Develop special programs and publications to improve the dissemination of surface safety-related "Lessons Learned."
(DOT IG Recommendation, Safety Roundtable Recommendation, Surface Error Prevention Workgroup Strategy #15)

Responsible Organization(s)	Target Completion Date
ATO-102/AFS	Ongoing

GOAL V *Improve communications with the aviation community to enhance surface incident awareness and solicit inputs to address problem areas and identify solutions.*

Objective 5A **Identify/Analyze Incursion Problem Areas to Improve Awareness and Seek Solutions.** Take steps to systematically identify and analyze surface incident problem areas to create awareness and develop workable solutions.

Actions

(a) Broaden the human factors analysis on pilot deviation to encompass operational errors (OE), Operational Deviations (OD), and Vehicle/Pedestrian Deviations (VPD) and heighten awareness of the issues.
(Human Factors Report Recommendation)

Responsible Organization(s)	Target Completion Date
ASY	6/99

(b) Evaluate the effectiveness of ATCT Surface Incident Prevention Plans during full facility evaluations.
(Surface Error Prevention Workgroup Strategy #7)

Responsible Organization(s)	Target Completion Date
AAT	Ongoing

Objective 5B **Conduct an Airport Surface Safety Campaign.** Conduct campaigns to heighten awareness and provide training to mitigate causal factors that lead to surface incidents.

Actions

(a) Promote pilot and airport operator involvement in surface incident awareness issues.
(Surface Error Prevention Workgroup Strategy #11, 12, 13)

Responsible Organization(s)	Target Completion Date
AFS/ATO-102	Ongoing

(b) Prepare educational, training, and advisory material to mitigate causal factors that contribute to surface incidents, including the use of visual aids.
(Human Factor Report Recommendation, 1996 MITRE Report Recommendation, Surface Error Prevention Workgroup Strategy #15)

Responsible Organization(s)	Target Completion Date
ASY/AFS	Ongoing

(c) Increase the availability of airport diagrams and promote their use by VFR pilots.

Responsible Organization(s)	Target Completion Date
AAT	Ongoing

STATUS OF ACTION ITEMS IN THE 1995 RUNWAY INCURSION ACTION PLAN

	ACTION ITEM	STATUS	REMARKS
1	Advisory Circular on Surface Movement	Ongoing	
2	Improved Cockpit Procedures for Surface Movement	Ongoing	RE&D Subcommittee Recommendation under consideration for near-term implementation
3	Runway Incursion Action Teams (RIAT)	Complete	Seven Action Teams were convened in 1997. Effort will continue in 1998 as needed.
4	Improved Aircraft Conspicuity	Ongoing	RE&D Subcommittee Recommendation under consideration
5	Land & Hold-Short Procedures (LAHSO)	Complete	FAA Order Implemented July 1997
6	Standardized Pilot Phraseology	Open	
7	Voice Recognition Guidance	Ongoing	Part of NASA Low Visibility Landing and Surface Operations (LVLASO) program; testing planned in 2000
8	Improved Airport Charting	Ongoing	RE&D Subcommittee Recommendation under consideration for near-term implementation
9	Reflective Paint Standards Research	Ongoing	RE&D Subcommittee Recommendation under consideration for near-term implementation
10	Update of Lighting Standards (stop bar control systems, taxi holding position lighting)	Ongoing	Draft Advisory Circulars have been completed; undergoing final coordination within the General Counsel's Office
11	Automated Airfield Lighting Control	Ongoing	William J. Hughes Technical Center is continuing research efforts.
12	Cockpit Moving Map Standards	Ongoing	Part of NASA LVLASO Project at Dallas/Fort Worth
13	Runway Status Lights (RWSL)	Ongoing	Proof of concept testing at Boston completed; follow-on efforts under consideration

	ACTION ITEM	STATUS	REMARKS
14	Airport Surface Detection Equipment (ASDE-3)	Ongoing	Final system scheduled for installation 6/99
15	Airport Movement Area Safety System (AMASS)	Ongoing	Final system scheduled for installation 8/2000
16	Lower Cost Alternative Technology for Surface incident prevention	Ongoing	Lower cost ASDE systems have been evaluated at Milwaukee and Salt Lake City; a third system is currently being evaluated at Norfolk.
17	Data Link for GPS/ADS on the Airport Surface	Ongoing	Will be tested in 1998 at Dallas/Fort Worth as part of the NASA Low Visibility Landing and Surface Operations (LVLASO) program.
18	Airport Surface Traffic Automation	Incorporated into other programs	Initiative has been separated into Surface Movement Advisor (not a runway incursion tool) and ATIDS, an ongoing initiative.
19	Operational Concept & Requirements for 21st Century Airports	Complete	Final report issued in April 1997 for the year 2005
20	Define Surface System Architecture	Complete	Draft completed as part of broader National Airspace System Architecture 3.0 and 2005 Operations Concept. No longer being tracked as a separate runway incursion initiative.
21	Surface Movement Considerations for New Large Aircraft	Ongoing	Project is in early stages of development with procedures to be in place by 2005
22	International Harmonization on Surface Movement Automation	Ongoing	U.S. is a member of the ICAO Panel involved in this effort.

THE RUNWAY INCURSION PROGRAM — ORGANIZATION AND MANAGEMENT

Program responsibility for runway incursions resides in the Runway Incursion Program Office, which is within the Office of the Associate Administrator for Air Traffic Services, ATS-1. This office was created in 1996 to coordinate FAA activities to reduce runway incursions. The **Runway Incursion Program Office, ATO-102** is part of the Air Traffic Operations organization. Personnel within this office provide skills in the technology related to runway problems, computer and database management, air traffic operations, flight standards issues, and airport surface navigation aids. The program office has recently been strengthened and augmented with expertise from the FAA Airports and Flight Standards organizations.

This Action Plan recognizes that an integrated, systemwide approach by FAA must be implemented to reduce runway incursions and improve the safety and efficiency of surface operations. The Plan establishes clear delineation of responsibilities and provides a mechanism to ensure coordination between elements of FAA and the aviation community.

While technology and procedures are necessary ingredients in runway incursion mitigation, it is essential that the runway incursion program management process be strengthened at both the regional and national levels. A number of management actions have been taken to strengthen the runway incursion program.

First, an internal FAA Leadership Team has been developed to ensure close coordination and cooperation between the Air Traffic Service (as the lead organization) and the Flight Standards Service, the Airports Organization, the Research and Acquisitions Organization, and the Office of Systems Safety. Each of these organizations plays an important role in reducing runway incursions. A block diagram depicting this relationship is shown on the next page.

Second, a FAA regional management structure has been developed to help place appropriate emphasis at the regional level on the prevention of incidents and accidents attributable to runway incursions. FAA management has directed each FAA region to identify a focal point in the regional Air Traffic Division Operations Branch, Airports, and Flight Standards. These individuals will accomplish the responsibilities related to surface incidents.

Third, the FAA has conducted a series of valuable outreach activities to solicit recommendations from the aviation community and has established a Subcommittee on Runway Incursions under its Research, Engineering and Development Committee. This ensures that close interaction between the FAA and the aviation community will continue. FAA will draw upon the expertise from this Subcommittee and other forums to solicit industry input and to help monitor FAA's progress on project implementation.

In addition to the above actions, FAA will continue to use Runway Incursion Action Teams, comprised of FAA and industry subject matter experts, to conduct on-site evaluations at airports that have special problems or experience unusually high incidences of incursions.

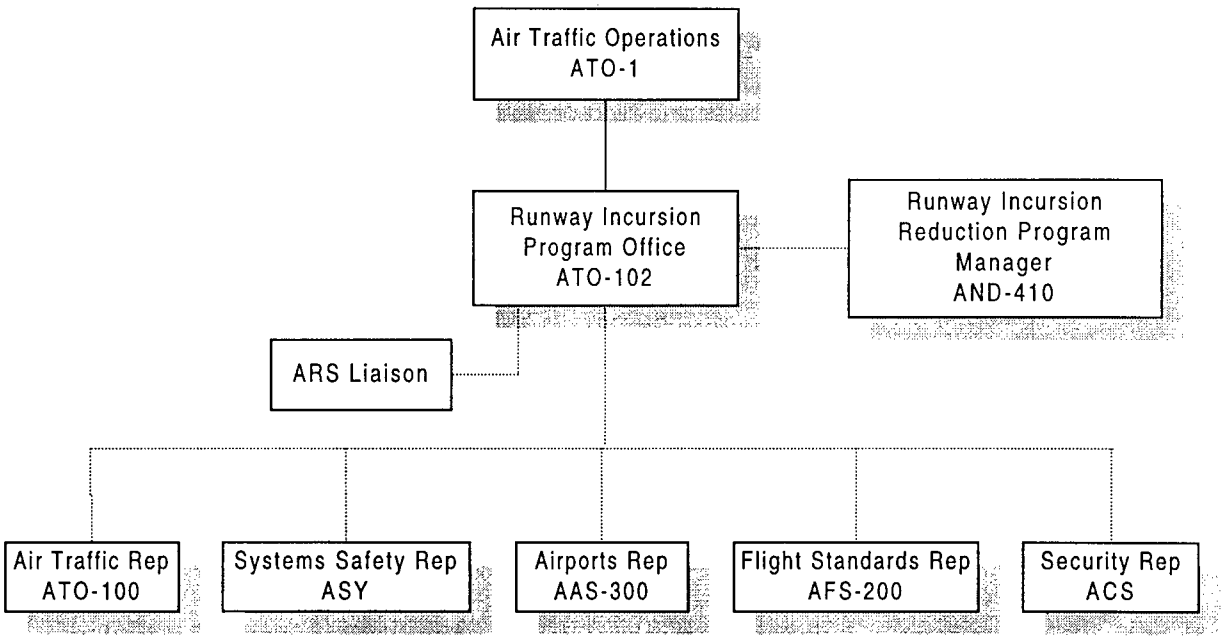


Figure 2 - Runway Incursion Program Organizational Chart

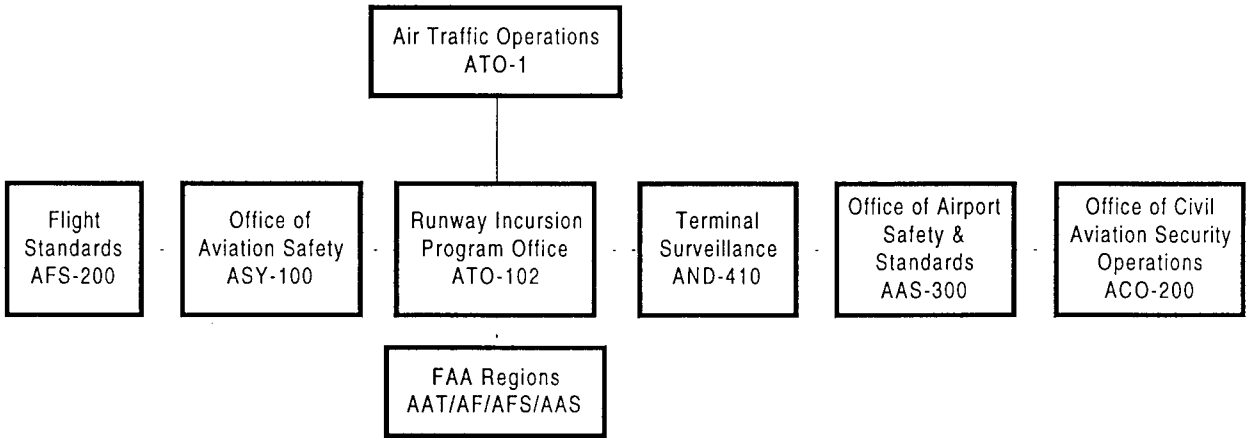


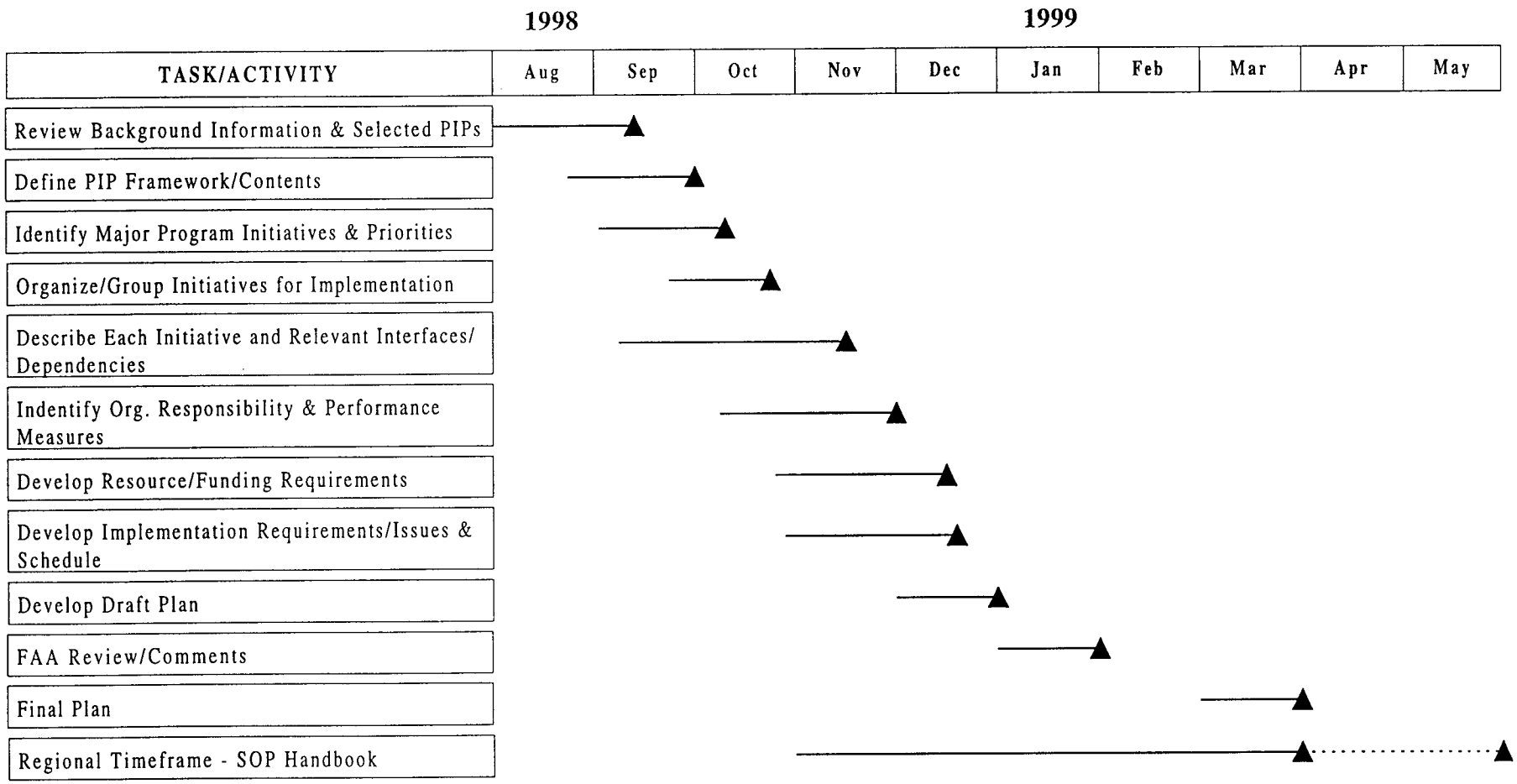
Figure 3 - Leadership Team

ACRONYMS

AAAE	American Association of Airport Executives
AAS	FAA Office of Airport Safety and Standards
AAT	FAA Air Traffic Service
ACI	Airport Council International
ACI-NA	Airport Council International - North America
ACO	FAA Office of Civil Aviation Security Operations
ACP	FAA Office of Civil Aviation Security Policy & Planning
ACS	FAA Associate Administrator for Civil Aviation Security
ACT	FAA William J. Hughes Technical Center
ADS	Automatic Dependent Surveillance
ADS-B	Automated Dependent Surveillance - Broadcast
AAF	FAA Airway Facilities Service
AFS	FAA Flight Standards Service
AIDS	Accident and Incident Data System
ALPA	Air Line Pilots Association
AMASS	Airport Movement Area Safety System
AND	FAA Communications, Navigation, and Surveillance Systems
AOPA	Aircraft Owners and Pilots Association
ARA	FAA Associates Administrator for Research and Acquisitions
ARP	FAA Associate Administrator for Airports
ASDE	Airport Surface Detection Equipment
ASP	Aviation Safety Program
ASR	Airport Surveillance Radar
ASRS	Aviation Safety Reporting System
ASY	FAA Office of System Safety
ATA	Air Transport Association of America
ATC	Air Traffic Control
ATIDS	Airport Target Identification System
ATO	FAA Air Traffic Operations
ATO-102	FAA Runway Incursion Program Office
ATS-1	FAA Associate Administrator for Air Traffic Services

DOT	Department of Transportation
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FMCW	Frequency Modulated Continuous Wave
GAMA	General Aviation Manufacturers Association
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
LAHSO	Land and Hold-Short Operations
LVLASO	Low Visibility Landing and Surface Operations
NAIMS	National Airspace Information Monitoring System
NAS	National Airspace System
NASA	National Aeronautics & Space Administration
NATCA	National Air Traffic Controllers Association
NBAA	National Business Aircraft Association
NCARC	National Civil Aviation Review Commission
NTSB	National Transportation Safety Board
OD	Operational Deviation
OE	Operational Error
OIG	DOT Office of Inspector General
PD	Pilot Deviation
R, E & D	FAA Research, Engineering & Development
RAA	Regional Airline Association
RI	Runway Incursion
RIAP	Runway Incursion Action Plan
RIAT	Runway Incursion Action Team
SAMA	Small Aircraft Manufacturers Association
SMGCS	Surface Movement Guidance & Control System
SSR	Secondary Surveillance Radar
STARS	Standard Terminal Automation Replacement System
VMC	Visual Meteorological Conditions
VPD	Vehicle/Pedestrian Deviation

PROGRAM IMPLEMENTATION PLAN (PIP) TIMETABLE



APPENDIX I
CORRELATION OF RUNWAY INCURSION RECOMMENDATIONS TO GOAL CATEGORY AND ACTION PLAN REFERENCE

RECOMMENDATIONS/FINDINGS	ACTION PLAN GOAL CATEGORY	ACTION PLAN REFERENCE
RE&D SUBCOMMITTEE RECOMMENDATIONS		
1. Expeditiously amend FAR 91.129(l) to require a specific ATC clearance to cross any runway	Program Management	1Bb
2. Provide directions to airport operators regarding expanding the size, number, and conspicuity of runway holding positions markings	Airport Surface Improvements	4B
3. Encourage use of runway entrance lighting	Airport Surface Improvements	4B
4. Develop a standard procedure for use of aircraft lights during surface operations	Pilot Improvements	2Ea
5. Research ways to improve aircraft conspicuity particularly to make aircraft more visible from the rear	Pilot Improvements	2Ea
6. With industry, develop specific training for all general aviation pilots to address techniques for surface error prevention	Pilot Improvements	2Ba
7. Provide direction to the airline industry to develop standardized cockpit procedures for surface movement to minimize runway incursions	Program Management, Pilot Improvements	1Bd, 2C
8. Expand the use of Runway Incursion Action Teams (RIAT)	Airport Surface Improvements	4Cb
9. Develop an objective method for determining when airport surface markings need repainting	Program Management, Pilot Improvements, Airport Surface Improvements	2D, 4Ac
10. Continue research on low cost ASDE, other ground surveillance, and in-cockpit technologies geared to short-term implementation	Pilot Improvements, Controller Improvements, Airport Surface Improvements	2D, 3Bc, 3C, 4Aa

RECOMMENDATIONS/FINDINGS	ACTION PLAN GOAL CATEGORY	ACTION PLAN REFERENCE
11. Provide immunity/remedial training for gathering safety data	Program Management	1Cf, 1Db, 1Dc
12. Study runway exiting to determine ways pilots can ensure the aircraft tail is clear of the runway	Airport Surface Improvements	4Ab
13. Extend the charter of the Runway Incursion Subcommittee	Program Management	1Eb
1997 DOT INSPECTOR GENERAL AUDIT REPORT		
1. Establish a strong Runway Incursion Program	Program Management	1A
2. Designate specific responsibilities	Program Management	1Aa
3. Disseminate lessons learned	Program Management, Incursion Awareness, Airport Surface Improvements	1Ce, 4Cc, 5B
4. Emphasize projects to reduce pilot deviations (PD)	Pilot Improvements	2A, 2B, 2C, 2D
5. Improve data collection and analysis	Program Management	1C
SAFETY ROUNDTABLE LIST OF PRIORITY PROBLEM AREAS		
1. Improve pilot/controller communications	Pilot Improvements	2A
2. Acquire ASDE-X	Controller Improvements	3Bc
3. Involve regional management	Program Management	1A
4. Address positive clearance onto runway	Program Management	1Bb
5. Improve signage marking difficulties	Airport Surface Improvements	4B
6. Improve runway holding position markings	Airport Surface Improvements	4B

RECOMMENDATIONS/FINDINGS	ACTION PLAN GOAL CATEGORY	ACTION PLAN REFERENCE
SAFETY ROUNDTABLE LIST OF PRIORITY PROBLEM AREAS (cont'd)		
7. Use Runway Incursion Action Teams	Airport Surface Improvements	4Cb
8. Include NCARC input	Program Management	1Ea
9. Use AOPA as focal point for general aviation type ASAP program	Program Management	1Ea
10. Use special programs to investigate runway incursions	Program Management	1Ce
11. Understand challenges faced by pilots during surface operations	Pilot Improvements	2A, 2B, 2C, 2D
SURFACE ERROR PREVENTION NATIONAL WORKGROUP ISSUES AND STRATEGIES		
1. Update operational error prevention plan	Program Management	1Ac
2. Ensure effective supervision	Program Management	1Aa, 1Ac
3. Discuss expectations with employees	Program Management	1Ac
4. Mandate the use of memory aids	Pilot Improvements	2C
5. Change position relief checklist	Program Management	1Be
6. Develop special air traffic bulletin	Incursion Awareness	5A, 5B
7. Evaluate effectiveness of strategies	Incursion Awareness	5A
8. Update awareness and memory training tape	Incursion Awareness	5Ba, 5Bb
9. Implement scan technique training	Controller Improvements	3Ac
10. Revise standard phraseology	Controller Improvements	3Aa
11. Heighten employee awareness	Incursion Awareness	5A, 5B
12. Promote Pilot involvement	Pilot Improvements Incursion Awareness	2Ba, 2Bb, 5Ba

RECOMMENDATIONS/FINDINGS	ACTION PLAN GOAL CATEGORY	ACTION PLAN REFERENCE
SURFACE ERROR PREVENTION NATIONAL WORKGROUP ISSUES AND STRATEGIES (cont'd)		
13. Heighten airport operator awareness	Program Management Incursion Awareness	1Ad, 5Ba
14. Produce surface error data	Incursion Awareness	1C
15. Assess need for local assistant/cab coordinator	Program Management	1Da
16. Eliminate ambiguity on flight progress strips	Controller Improvements	3A
RUNWAY INCURSION PROGRAM OFFICE INITIATIVES		
1. Controller survey	Controller Improvements	3Ad
2. AMASS	Controller Improvements	3Bb
3. ASDE-3	Controller Improvements	3Ba
4. ASDE-X	Controller Improvements	3Bc
5. NASA/FAA Low Visibility Landing and Surface Operations Program	Pilot Improvements	2Da
6. 1998 RIAP	All	All
7. Land and Hold-Short Operations	Program Management	1Ba
8. Safety Roundtable meeting	n/a	Overview
9. Executive Level Government/Industry Steering Committee	Program Management	1Eb
10. HF Study on role of civil aviation in RIs	Incursion Awareness	5A
11. Runway Incursion Action Team meetings	Airport Surface Improvements	4Cb
12. New reporting form for VPDs	Program Management	1Cd

RECOMMENDATIONS/FINDINGS	ACTION PLAN GOAL CATEGORY	ACTION PLAN REFERENCE
RUNWAY INCURSION PROGRAM OFFICE INITIATIVES (cont'd)		
13. Standardized Taxi Routes	Program Management	1Bc
14. Surface Error Prevention National Workgroup	n/a	Overview
15. Runway Incursion Program Office - increased staffing	Program Management	1A
RE&D SUBCOMMITTEE TECHNOLOGY INITIATIVES (AND-410)		
1. ASDE-X	Controller Improvements	3Bc
2. STDMA VHF Datalink		
3. Multi-wave sensors		
4. Infrared sensors		
5. NASA Terminal Area Productivity	Controller Improvements	Appendix II
6. Data Fusion Development Platform	Controller Improvements	Appendix II
7. ADS-B/Multi-lateration System	Controller Improvements	Appendix II
8. Sensis Vehicle ADS-B System	Controller Improvements	Appendix II
9. Vehicle ADS-B System	Controller Improvements	Appendix II
10. Acoustic Sensor System	Controller Improvements	Appendix II
HUMAN FACTORS ANALYSIS OF PILOT DEVIATIONS		
1. Eliminate potential for pilot to use the wrong parallel runway	Pilot Improvements	2C
2. Extend the HF analysis to encompass OE, VPD, ASRS, and NTSB data	Incursion Awareness	5Ab
3. Conduct a Limited Structured Callback Project	Program Management	1Aa
4. Prepare educational, training, and advisory material	Pilot Improvements/ Incursion Awareness	2Ba, 5Bb

RECOMMENDATIONS/FINDINGS	ACTION PLAN GOAL CATEGORY	ACTION PLAN REFERENCE
1994 AIRLINE PILOTS SURVEY FINDINGS		
1. Airport surface navigation aids are not adequate	Airport Surface Improvements	4A, 4B
2. ATC – pilot communications need to be enhanced	Pilot Improvements	2A
3. Cockpit procedures and intra-cockpit communications need to be updated	Pilot Improvements	2C
1996 AIRLINE PILOTS SURVEY FINDINGS		
1. Ensure use of signs, markings, and lighting showing where to hold short of a runway	Airport Surface Improvements	4B
2. Provide suitable signs to show when an aircraft is completely clear of an active runway	Airport Surface Improvements	4Ab
3. Provide better instructions for transfer of communications from approach control to the tower	Pilot Improvements	2Aa
4. Review landing clearance procedures re: issue and receipt of clearance to land		
5. Provide better instructions to landing aircraft on where to clear the runway		
6. Ensure complete and accurate communications between ATC and pilots and reduce frequency congestion	Pilot Improvements	2Aa
7. Implement memory aids, including writing down complex instructions, read-backs, mechanical memory aids	Pilot Improvements	2C
8. Implement actions to ensure runway is clear before taxiing across it		
9. Provide means to ensure aircraft is completely clear of the runway after landing or crossing it	Program Management	1Bb
10. Revise current cockpit procedures and communications and implement appropriate training	Pilot Improvements	2C
11. Standardize the use of exterior aircraft lights to increase aircraft conspicuity	Pilot Improvements	2E
12. Improve ATC procedures re taxiing aircraft into position and hold	Program Management	1B
13. Clarify the intent of FAR 91.129(l) on taxiing across runways intersecting the taxi route	Program Management	1Bb

RECOMMENDATIONS/FINDINGS	ACTION PLAN GOAL CATEGORY	ACTION PLAN REFERENCE
1996 AIRLINE PILOTS SURVEY FINDINGS		
14. Respond to pilot concerns about Land and Hold-Short Operations		
15. Counter pilot fatigue and poor eating habits during duty times		
16. Improve dissemination of safety-related informative/advisory material on airport operations to pilots	Program Management, Airport Surface Improvements	1Ce, 4Cc

APPENDIX II

TECHNOLOGY ACTIVITIES UNDER RESEARCH & DEVELOPMENT

Airport Movement Area Safety System (AMASS) (Runway Incursion Program Initiative #2)

AMASS augments the ASDE-3 with an automated conflict alert system for air traffic controllers in the tower. The system tracks all aircraft and vehicles on taxiways and runways, and provides controllers with automatic visual and audible warnings of potential conflicts. The system has been designed to accept and utilize returns from the ASDE-3 radars and ASR's. As of May 1998, AMASS systems have been installed and are operational at San Francisco, Detroit, and St. Louis airports, with the last of 40 systems scheduled for installation in August 2000.

Airport Surface Detection Equipment (ASDE)

ASDE-3 (Runway Incursion Program Initiative #3)

ASDE-3 is an advanced digital radar that penetrates rain, snow, and fog to superimpose radar images of aircraft and vehicles on a computer-generated map of airport runways, taxiways, and service areas. The system produces a continuous, real-time display of all aircraft and vehicles for air traffic controllers in the airport tower and provides primary sensor input to AMASS. As of May 1998, a total of 35 ASDE-3's have been deployed at major airports, and by August 2000, FAA will have installed all 40 ASDE-3/AMASS systems at 34 airports nationwide.

ASDE-X (Runway Incursion Program Initiative #4)

ASDE-X is a low-cost surveillance system being developed for use at mid-sized and smaller airports where adverse weather conditions pose a threat to safe and efficient operations. An evaluation program is currently underway to determine the suitability of various existing, commercially-available equipment to airport operational requirements. These include an X-band marine radar with tracking and conflict alert functions added, being evaluated at Milwaukee, Wisconsin; a Ku-band FM continuous-wave radar tested at Salt Lake City, Utah; and an X-band phased-array radar being tested at Norfolk, Virginia.

Though they are currently the best primary sensors for providing situational awareness, radar systems have inherent limitations. Even with optimal siting which is crucial to good coverage, many airports have structures which create visual and radar "blind spots" that can pose a threat to safe operations. To eliminate these hazards, a number of promising technologies are being investigated and evaluated as secondary sensors and aids for air traffic controllers. In addition to the specific projects listed below, infrared and photo-optical sensing techniques are being examined for possible application to surface surveillance/detection problems.

Airport Target Identification System (ATIDS) (Runway Incursion Mission Need Statement; RE&D Subcommittee Appendix D Initiative)

Under a cooperative FAA-NASA development program, integration of a multi-lateration ADS-B system with ASDE-3/AMASS was tested at Hartsfield Atlanta International Airport in August 1997. ATIDS technology utilizes information from existing equipment, such as Mode-S and SSR transponders, and employs triangulation techniques to determine accurately the position of aircraft and vehicles on the airport surface. Fusion algorithms are then applied in AMASS and these position data become part of the complete airport movement area situation display.

Data Fusion/Conflict Alert System (RE&D Subcommittee Appendix D Initiative; Runway Incursion Mission Need Statement Briefing)

The objective of this project is the development of data fusion techniques and their incorporation into a centrally located processor that integrates data from all available surveillance sensors into a "seamless" surface surveillance presentation. The system is designed to accept inputs from a variety of primary sensors, such as ASDE's and ASR's, and secondary sensors (ADS-B, ATIDS) to provide high-integrity target track data to improve the warning algorithms that determine the controller alerts. The compiled information is then "fused" to create a complete situational presentation with overlapping coverage of the airport surface.

Vehicle Automated Dependent Surveillance - Broadcast (ADS-B) System (RE&D Subcommittee Appendix D Initiative)

The ADS-B system provides Differential GPS position reports from transceiver-equipped ground vehicles to the ATC tower for inclusion in the data fusion platform, as well as supplying AMASS target reports to an in-vehicle display for the driver. This cellular, bi-directional datalink system was demonstrated on a limited basis at Hartsfield Atlanta International Airport in 1996, and a next-generation ADS-B system will be evaluated at Dallas-Ft. Worth International Airport in mid-1998.

Inductive Loop Technology Program (RE&D Subcommittee Recommendation #9; Runway Incursion Mission Need Statement)

Inductive loops are electrical conductors that, when installed in runways and taxiways, can sense aircraft and vehicles passing over them. Loop arrays, positioned at critical points on the airport movement area, can provide information for a processing unit to display speed, size, and direction of the aircraft/vehicle for the controller. A system of loops, data transmission units, data processor and display has been installed at Long Beach, California Airport, and a comprehensive evaluation is currently underway.

Acoustic Sensor System (RE&D Subcommittee Appendix D Initiative)

An initial evaluation of the application of acoustic sensing technology to aircraft and vehicle detection was conducted at Phoenix Sky Harbor International Airport. While the specific environmental and siting conditions there proved to be significant deterrents to success, applications may exist for simpler systems at small airports.

Advanced Taxiway Guidance System (ATGS) (RE&D Subcommittee Recommendation #10)

The principal feature of this prototype is automatically-controllable taxiway lighting which is used to provide surface visual guidance to pilots operating within the system. In addition to receiving taxiing instructions from air traffic control, the automatic lighting feature provides pilots with a visual confirmation of the assigned route by illuminating only that particular path. The prototype uses non-radar based radio frequency identification (RFID) to identify aircraft and vehicles, and microwave detectors to locate them. The automatic taxiway lighting feature could also be integrated to work with inputs from ASDE/AMASS.