Runway Incursion Airport Assessment Report

Prepared by:
Technology Assessment Team (TAT)
December 2002

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1.0 EXECUTIVE SUMMARY

The National Transportation Safety Board (NTSB) has expressed concern that the expected increase in air traffic activity within the next decade may result in corresponding increases in runway incursions. Because of this concern, the NTSB has included reducing runway incursions on its annual "Most Wanted" list of transportation safety improvements since 1990.

On June 26, 2001, the Office of the Inspector General (OIG) issued a report (Appendix A) to the House Transportation and Infrastructure's Aviation Subcommittee stating that the Federal Aviation Administration's (FAA) progress in reducing incursions is hindered by the ineffective deployment of technologies to airports with continued runway incursion problems, as well as the FAA's Runway Safety Program Director not being given sufficient authority to ensure that initiatives undertaken by employees responsible for runway safety are completed. The OIG further recommended that the FAA determine if technological solutions are needed for airports not scheduled to receive any new technology.

Based on these recommendations from the NTSB and the OIG, the FAA committed to conducting technology assessments at thirteen airports with a high number of runway incursions (ten or more during the period 1997-2000) that are not currently scheduled to receive an Airport Surface Detection Equipment - Model 3 (ASDE-3), an Airport Movement Area Safety System (AMASS) or an Airport Surface Detection Equipment – Model X (ASDE-X) to help enhance surface safety. An additional three airports were added to the list due to special circumstances related to their runway incursion risk. Airports surveyed are as follows: North Las Vegas (VGT), Fort Lauderdale Executive (FXE), Daytona Beach International (DAB), Merrill Field (MRI), Fairbanks International (FAI), McGhee-Tyson (TYS), Long Beach (LGB), Concord Buchanan (CCR), Santa Barbara Municipal (SBA), Montgomery Field (MYF), Flying Cloud (FCM), Crystal (MIC), Teterboro (TEB), Denver Centennial (APA), Deer Valley (DVT), and Sarasota-Bradenton (SRQ).

The purpose of these assessments was to evaluate an airport's runway incursion history and operations in order to determine whether potential technology solutions selected from the Surface Technology Assessment Product Team's (AND-520) Broad Agency Announcement (BAA), might contribute toward improving runway safety at these airports. Prior to the individual airport assessments, pertinent information on runway incursions and airport configuration was reviewed, along with runway safety action team (RSAT) reports. During the site visits, interviews and meetings were conducted with FAA and other airport personnel knowledgeable about airport runway incursion issues, after which an airport was physically surveyed. Within 30 days after each site visit, a draft report describing the purpose of the survey and initial results and findings was generated and forwarded to all stakeholders for further coordination. Based on a consensus of the stakeholders, a set of recommendations for reducing the potential for runway incursions was then generated for each airport.

The airport assessments were conducted by a Technology Assessment Team (TAT) that consisted of representatives from AND-520, the Office of Runway Safety (ARI), and the National Air Traffic Controllers Association (NATCA). Site surveys for these assessments were conducted between August 1, 2001 and August 1, 2002.
Once all of the airports had been visited, the TAT identified four primary runway incursion causal factors: 1) easy access to the airport movement area; 2) complex layout of the airport; 3) insufficient or improperly maintained surface markings and signs; and 4) tower height/airfield location and lack of radar surveillance. The recommendations for individual airports varied depending on their causal factors, and included both technological and non-technological solutions.

Non-technological recommendations included enforcing procedures, ensuring the physical upkeep of the runway/taxiway areas, and upgrading fencing/gating. Where complex runway and taxiway configurations appeared to contribute to potential runway incursion risk, educational/informational meetings and forums were either formulated or increased to keep the community and pilots advised of changes or improvements at the airport. Seven airports were advised to ensure that the runway/taxiway airport operations area was properly maintained (cut the grass, paint the runway and hold lines, widen the hold line width). Every airport was advised to take an aggressive approach toward securing access to the airport operations and movement areas, since this appeared to be a common problem throughout the airports.

Technological solutions could be beneficial for any and all of these airports. None of the sites have radar technology, and a few could definitely benefit from the addition of runway/taxiway surface lighting on the airport movement area. An effort should be made to explore the use of existing surface lighting technology as a way to improve runway safety. An example of this type of lighting could be elevated or in-pavement runway guard lights. These lighting solutions could provide an extra layer of protection at the high alert intersections mentioned in this report. Other emerging technologies being tested and evaluated by AND-520 (light emitting diodes (LED), addressable message boards (AMB), Ground Marker (GM), laser light hold lines, or flashing precision approach path indicator (PAPI)), upon certification, may provide the same layer of protection.

Based on the completion of these assessments, the TAT recommends continuing to monitor these airports to determine the effectiveness of these improvements in reducing runway incursions, and the need for low-cost technological solutions for airports continuing to have runway incursion problems.

2.0 BACKGROUND

The NTSB has expressed concern that the expected increase in air traffic activity within the next decade may result in corresponding increases in runway incursions. This increase could lead to a higher incidence of incursion-related accidents. Because of this concern, the NTSB has included reducing runway incursions on its annual "Most Wanted" list of transportation safety improvements since 1990.

On June 26, 2001, the OIG issued a report to the House Transportation and Infrastructure's Aviation Subcommittee stating that while the FAA has placed substantial management focus on reducing runway incursions in recent years, its progress in reducing incursions is hindered by the ineffective deployment of technologies to airports with continued runway incursion problems. The OIG also stated that the FAA's Runway Safety Program Director has not being given sufficient authority to ensure that initiatives undertaken by employees responsible for runway safety are completed. Furthermore, the OIG recommended that the FAA determine if technological solutions are needed for airports not scheduled to receive new technology.

Based upon the above recommendations from the NTSB and OIG, ARI chartered the TAT, led by AND-520, to conduct a technology needs assessment at thirteen airports with ten or more runway incursions (1997-2000) not scheduled to receive ASDE-3, AMASS or ASDE-X. ARI also asked the Runway Safety Regional Safety Managers to support the TAT activities (Appendix B).

	ID	Airport	State	Region	Site Visit
1	VGT	North Las Vegas Airport	NV	WP	08/01/01
2	FXE	Fort Lauderdale Executive	FL	SO	10/15/01
3	DAB	Daytona Beach International	FL	SO	10/16/01
4	MRI	Merrill Field	AK	AL	10/31/01
5	FAI	Fairbanks International	AK	AL	11/1/01
6	TYS	McGhee-Tyson	TN	SO	12/10/01
7	LGB*	Long Beach Airport	CA	WP	1/26/02
8	CCR	Concord Buchanan Airport	CA	WP	3/26/02
9	SBA	Santa Barbara Municipal	CA	WP	3/27/02
10	MYF	Montgomery Field	CA	WP	3/28/02
11	FCM	Flying Cloud Airport	MN	GL	6/4/02
12	MIC	Crystal Airport	MN	GL	6/5/02
13	TEB	Teterboro	NJ	EA	6/11/02
14	APA	Denver Centennial Airport	CO	NM	6/18/02
15	DVT	Deer Valley Municipal	AZ	WP	6/20/02
16	SRQ	Sarasota-Bradenton International	FL	SO	08/01/02

*See Appendix E

Three additional airports were added to the original list due to special circumstances related to runway incursion risk:

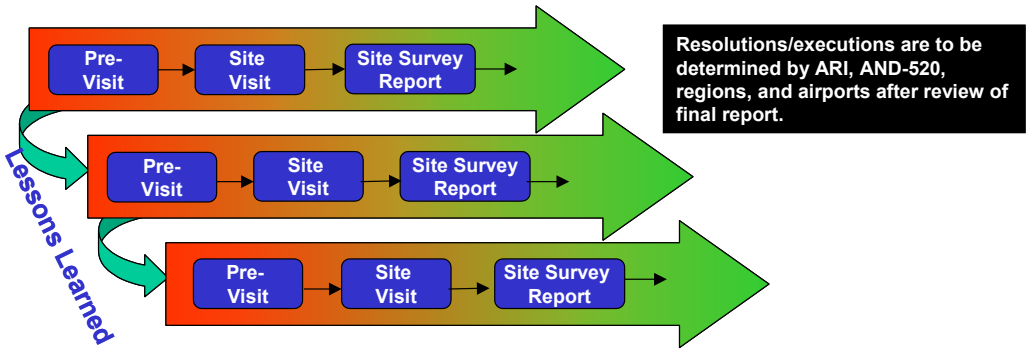
- FAI – (Reason: unique weather conditions and airport layout)
- TYS – (Reason: invitation from airport and Regional Runway Safety Program Manager)
- SRQ – (Reason: fatal accident in 2000)

The TAT included core members from ARI, NATCA, and AND-520. Additionally, each site survey/assessment included Regional Runway Safety Program Managers, local airport authority personnel, local air traffic representatives, and applicable site representatives from each location. The assessment process included analyzing site-specific configurations and related runway incursion data, conducting site surveys, and issuing analysis reports and recommendations.

The OIG report (Appendix A), the tasking memorandum from ARI (Appendix B), the RSAT reports and the Runway Safety Blueprint defining runway incursions and surface incidents (Appendix C) were reviewed by the team before initiating their site visits.

3.0 PROCESS AND APPROACH

The TAT established an assessment process based on a review of data already compiled by the ARI. Their charter included analyzing site-specific configurations and runway incursion data at each airport, conducting a site survey and technical assessment, and issuing analysis reports and recommendations to ARI and AND-520. The TAT established a parallel process that would allow the team to conduct surveys at multiple sites concurrently. As depicted, each of the arrows represents a process from planning to final report.



Technical Assessment Team Process

During the pre-visit, the TAT collected runway incursion data, airport diagrams, RSAT reports, and any other information necessary to prepare for each site visit. The TAT members then scheduled a meeting to review the data together in an attempt to gain an agreed understanding of the problems at each airport. Next, the team coordinated a meeting at the airport with the Regional Runway Safety Program Manager, local airport authorities, local air traffic representatives, and local subject matter experts (engineers, operations personnel, etc.)

The first site survey was conducted on August 1, 2001 and the team completed all surveys by August 1, 2002. During each site survey visit, the local personnel and TAT members discussed issues, challenges, lessons learned, and local solutions pertaining to the individual airport. The TAT toured the airfield and focused on high-alert areas. It then visited the control tower and focused on operational perspectives. The team presented a briefing (Appendix D) showing AND-520 solutions that had been selected from the BAA. The site survey concluded with an out-briefing that described future improvements or changes the airport had initiated on their own, a schedule/timeline for these changes, and a review of potential technology solution(s) the team felt would benefit the airport.

The team then focused on the site survey final reports. Within thirty days after the completion of the site visit, the TAT generated a draft report and requested comments

and additional input from each person who attended the site visit. After incorporating these comments, the TAT sent out a final site survey report to each airport. These final survey reports are included in this report by airport identifier order (Appendix E).

To conclude this team's charter, the TAT has written a final Runway Incursion Airport Assessment Report, to be distributed to ARI, the Safe Flight 21 and Surface Technology Assessment Integrated Product Team (AND-500), NATCA, and the OIG.

4.0 FINDINGS

It is extremely challenging to characterize the trend of runway incursions (RIs) and to identify the causal factors involved. Because of their concern for safety, the FAA began sending RSATs to airports with high incursion rates in 1998. The RSATs met with airport officials, pilots, controllers, and commercial airlines in an attempt to understand why past incursions had occurred and what was needed to prevent future recurrences. For the sixteen airports surveyed, the TAT utilized the RSAT report information extensively, and found the reports to be extremely useful in understanding the root causes of runway incursions at each site.

The airports visited by the TAT host mostly general aviation traffic. With this in mind, the team viewed each airport's operations area (AOA) and the overall airport layout to get a better understanding of what can/does happen on a daily basis. After conducting five or six of the airport site surveys, some common factors for runway incursions at these airports evolved. Once all airports were surveyed, four major causes for runway incursions surfaced to the top: 1) easy access to the runways/taxiways; 2) complexity of or unfamiliarity with airport layout; 3) insufficient markings/signs; and 4) tower height/airfield location and lack of radar surveillance. Although every airport surveyed does not fall into these categories, the majority of the airports visited were found to have one or more of these problems.

4.1 ACCESS TO AIRPORT

Access to the airport operations area was found to be a problem at FXE, MRI, FAI, MYF, FCM, and DVT. In some instances, the fencing and security gates are too short to keep intruders off of the airfield. At one particular airport, the automatic gates close too slowly, allowing unauthorized drivers or people to "piggyback" onto the airfield. This is a serious security problem, as well as a safety risk. At other airports, security gates are left open after use, allowing unauthorized vehicles, tugs, and field trucks, to gain access to the airport movement area. This has resulted in several unauthorized taxiway crossings. Finally, some airports are not equipped with any security gates near the business areas, giving people direct access to the airport without authorization.

Some of the access and perimeter roads at these airports do not have adequate security fences/signs providing any warning of secured or off-limit areas, allowing people unfamiliar with the airport to get lost and enter the airport operations area unknowingly. Most of the airports are aggressively addressing these problems as a result of the terrorism on September 11, 2001, in an effort to increase security. It is the opinion of the TAT that any upgrades/improvements will be of major benefit and will help to decrease these types of incidents.

4.2 AIRPORT LAYOUT

The airport layout was found to be a problem at MIC, FXE, FAI, SBA, VGT, CCR, LGB, DAB, APA, TEB, and SRQ. Each one of these airports has had incidents occur due to the complexity of the airport or because the airport layout can be confusing. Complexity is an issue for transient pilots unfamiliar with the airport, while confusion occurs due to the configuration of the airport. Two prime examples of configurations problems are parallel runways only 300 feet apart (MIC) and short taxiways (SBA and SRQ). Both of these examples cause confusion for pilots or vehicle operators, since it is difficult to determine where one taxiway or runway begins and ends.

Another problem area is the wide expanse and layout of pavement at LGB, SBA, and APA that cause confusion for pilots. Other airports with layout problems not clearly marked include TEB, MIC and SRQ.

Virtually every one of these airports feel that updated diagrams of the airport configuration would be beneficial, and some have already initiated the project. One airport has instituted a strong safety rule enforcement program, instigating stiff fines for repeat violations. To further reduce runway incursions, some of the airports have reinforced strong educational programs to discuss safety issues and inform pilots of changes to the airport surface (i.e. construction, re-engineering of high alert areas, etc). Regular information exchanges are conducted through workshop forums, guidance materials, pamphlets, and updated websites. The Regional Runway Safety Program Managers have been discussing runway incursion problems as a hot topic at their regular safety meetings and in newsletters.

4.3 SURFACE MARKINGS AND SIGNS

Several of the airports surveyed had runway incursions that were a direct result of insufficient markings or signs on the runways or taxiways. These airports included VGT, CCR, APA, MYF, FCM, and DVT. Immediate improvements could be made with little or no effort by mowing the grass and weeds around airport signs so that aircraft/vehicles can better see them. At many of these airports the hold lines and taxiway/runway markings are faded and need to be repainted. In addition, the signs need to be upgraded or improved upon so that the new signs are large enough to be seen at a greater distance when positioned correctly. At one airport, the signs are illegible, causing pilots to enter incorrect taxiways or active runways erroneously. The lighting at another airport was poor and in need of a power upgrade so that all runways and taxiways could be lighted and seen. It should be noted that without sufficient markings and signs, air traffic controllers have an additional burden placed upon them to provide more guidance than is operationally necessary, since pilots/vehicles on the airport movement area cannot be relied upon to follow signs and markings they cannot see, especially in the “high alert” areas. The distraction of controllers’ attention to provide the added/extra vigilance in these areas could cause runway incursions resulting from operational error.

4.4 TOWER HEIGHT/AIRFIELD LOCATION/ LACK OF RADAR SURVEILLANCE

Another key contributor to incursions at the airports surveyed was surveillance problems. Those airports with surveillance issues included TEB, TYS, FCM, and SRQ.

At TYS, the runways have been extended from 6000 feet to 9000 feet and the cargo and maintenance areas are in the midst of being expanding. Since the tower is less than 90 feet in height, the air traffic controllers can see only a limited view of the aircraft at the east end of the taxiway. In addition, there are two major obstructions: higher ground from on-going construction at the hold-short line, and ambient light around the airport in the evening and early morning hours. Sometimes the air traffic controllers lose complete visual contact with the traffic on the ground.

TEB has had a significant increase in traffic since September 11, 2001, because many executives have chosen to use business jets over corporate travel. With a shortage of allocated frequencies at the airport, there have been communication difficulties for air traffic controllers and pilots. Both of these problems have contributed to delays at TEB. Though the problems mentioned are not directly related to tower height, they do add further runway/surface problems, and can be linked to a lack of proper tools for air traffic. Furthermore, the existing towers prohibit controllers from seeing aircraft on taxiway J and K, which is an entrance to a large fixed base operator (FBO). It should be noted that TEB has submitted a cost-sharing proposal for the purchase and installation of ASDE-X. The proposal is currently under evaluation.

At SRQ, the current tower is 87 feet in height, not tall enough to see the approach end of runway 32. This is due, mostly, because of the extension of runways and taxiways recently completed at the airport and continuing into fiscal year 2003.

FCM has two parallel runways approximately 850 feet apart. The tower height and distance from these runways makes it difficult for air traffic controllers to know if an aircraft is lined up on the appropriate runway. The height and distance of the tower also makes it nearly impossible for the controller to correct this type of problem before it is too late.

Finally, none of the sixteen airports has any surface surveillance radar installed at this time and many have limited final approach coverage. Since some of the airports have an immense amount of traffic coming in or taking off during any given day, it is very difficult to see all the air and ground traffic at any one time, sometimes creating confusion and unsafe situations.

5.0 RECOMMENDATIONS

There are several precautionary measures that can be taken to reduce the probability that a runway incursion will occur. These measures include both technological and non-technological means of controlling access, enhancing surface markings, and increasing situational awareness.

The TAT saw numerous examples of non-technological solutions being pursued at each airport. The progress and status of those solutions are being monitored by the RSAT. All of the airports have been pro-active in trying to improve existing airport problem areas to reduce the likelihood of a runway incursion/surface incident.

The Regional Runway Safety Program Managers and the airports that have started regular informational interchanges with pilots, vehicle operators, and surrounding residential communities have demonstrated that pilot training and educational programs are invaluable, providing increased situational awareness. This interaction has taken place via workshop forums, pamphlets, web sites, and other communication avenues. While these items are definitely non-technological in nature (and outside the scope of the TAT), it is the recommendation of the team that these programs be continued and, if feasible, expanded at each of the airports.

The TAT team noticed that unrestricted access to the airport was the leading cause of surface incidents. Several airports surveyed had limited security fencing/gating to prevent unauthorized access to the airport movement area. Airport access and security issues have become much more important since the attacks on September 11, 2001, and it is the opinion of the team that an increased effort to improve fencing and gating will have a dual benefit: reducing runway incursions and providing increased security. Therefore, it is imperative that airport access be controlled.

The TAT also noticed a reduction in runway incursions at airports that had enhanced the airport signage and surface markings. It is apparent that an increased effort to provide quality signs and paint leads to increased situational awareness for the users.

Some of the airports surveyed have addressed education, access, and surface marking issues but continue to have runway incursions. These airports could potentially benefit from technological solutions to mitigate the runway incursion problems by providing surface radar or other surface surveillance capability, thus increasing overall situational awareness of controllers.

For the purposes of this document, other technological solutions are/can be defined as a medium by which warnings/advisories can be delivered directly to the flight crews. Emerging technologies being researched by AND-520, but not part of the BAA, include LED enhanced hold lines, flashing PAPIs, GM, laser enhanced hold lines, and the airport lighting project. These technologies have shown potential in proof-of-concept demonstrations and efforts are ongoing to determine their effectiveness in an operational environment.

An effort should be made to explore the use of existing surface lighting technology as a deterrent for runway incursions. Examples of this type of lighting include elevated runway guard lights (commonly referred to as wig-wag lights), and in-pavement runway guard lights. These lighting solutions could provide an extra layer of protection at high alert intersections.

For all sixteen airports, the TAT believes that a technological solution may be useful at all of them. Since seven of the airports surveyed have taken significant steps to address educational, access, and surface marking problems, the TAT believes that technological enhancements identified in Appendix F could be of benefit at the following airports:

VGT	North Las Vegas Airport	Las Vegas, Nevada
FXE	Fort Lauderdale Executive Airport	Fort Lauderdale, Florida
LGB	Long Beach/Daugherty Field Airport	Long Beach, California
FCM	Flying Cloud Airport	Minneapolis, Minnesota
MIC	Crystal Airport	Minneapolis, Minnesota
APA	Centennial Airport	Denver, Colorado
SBA	Santa Barbara Municipal Airport	Santa Barbara, California

A summary matrix of each airport and their potential solutions are listed below.

SUMMARY MATRIX

Airport	Control access to airport	Improve airport layout	Improve surface markings/signs	Add technology enhancement
APA		X	X	X
CCR		X	X	
DAB		X		
DVT	X		X	
FAI	X	X		
FCM	X		X	X
FXE	X	X		X
LGB		X		X
MIC		X		X
MRI	X			
MYF	X		X	
SBA		X		X
SRQ		X		X
TEB		X		X
TYS				X
VGT		X	X	X

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Appendix A:
Office of Inspector General Report

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Office of Inspector General

Despite Significant Management Focus, Further Actions Are Needed To Reduce Runway Incursions

Federal Aviation Administration

Report Number: AV-2001-066
Date Issued: June 26, 2001

Memorandum

U.S. Department of Transportation
Office of the Secretary
Of Transportation
Office of Inspector General

Subject: ACTION: Despite Significant Management Focus, Further Actions Are Needed to Reduce Runway Incursions
AV-2001-066

Date: June 26, 2001

From: Alexis M. Stefani
Assistant Inspector General for Auditing

Reply to Attn of: JA-10:x60500

To: Federal Aviation Administrator

This report summarizes our audit of FAA's Runway Incursion Technologies. We are providing this final report for your information and use. In preparing this report, we considered FAA's June 21, 2001 comments to our draft report.

FAA agreed with our recommendations to reevaluate the Airport Movement Area Safety System deployment schedule, reexamine airport needs for a full Airport Surface Detection Equipment-X system, and determine if technological solutions are needed for airports that are not receiving any technology. These actions, when implemented, should help FAA make progress in reducing runway incursions. These recommendations are considered resolved subject to the follow-up provisions of Department of Transportation Order 8000.1C.

FAA's proposed actions to expedite the use of in-cockpit moving map displays and Automatic Dependent Surveillance - Broadcast and to improve the authority and accountability of the Runway Safety Program Director are ambiguous. Also, it is not clear to us what milestones, if any, apply to implementing these recommendations. We request that you reconsider your response to both recommendations and provide further clarification by July 27, 2001, with target dates for implementation.

We appreciate the cooperation and assistance provided by your staff during the audit. If I can answer any questions or be of further assistance, please feel free to call me at (202) 366-1992, or David A. Dobbs, Deputy Assistant Inspector General for Aviation, at (202) 366-0500.

Attachment

Despite Significant Management Focus, Further Actions Are Needed to Reduce Runway Incursions

Federal Aviation Administration

Report No. AV-2001-066 ***June 26, 2001***

Background and Objectives

Runway incursions,[1] incidents on the runway that create a collision hazard, can have serious consequences**.** The worst aviation accident in history occurred in 1977 on a runway in the Canary Islands in Tenerife where 583 people were killed. Another accident occurred in October 2000 at Taipei's Chang Kai Shek International Airport when a Boeing 747 took off on a closed runway and collided with construction equipment killing 81 people onboard. While these accidents did not occur in the United States, they show the extent of the safety risk posed by runway incursions. Since 1990, there have been 7 runway accidents in the United States that claimed 63 lives and damaged 13 aircraft. One of these accidents occurred in March 2000 when two general aviation aircraft collided at Bradenton International Airport in Sarasota, Florida, killing four people onboard both aircraft.

The National Transportation Safety Board (NTSB) has expressed concern that the expected increase in air traffic activity may result in further increases in runway incursions, which may lead to additional accidents. NTSB has included reducing runway incursions on its annual "Most Wanted" list of transportation safety improvements since 1990. A November 2000 study titled "Fatal U.S. Runway Collisions Over the Next Twenty Years" performed under contract for the Federal Aviation Administration (FAA) projected that 15 fatal runway collisions at towered airports could kill 700 to 800 people and seriously injure 200 others over the next 20 years if nothing more is done.[2]

FAA has been pursuing technologies to reduce runway incursions and prevent accidents for over a decade. It funded $376 million for such projects during fiscal years (FY) 1985 to 2000 and an additional $52.6 million for FY 2001

[1] 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. FAA's definition applies only to airports with operating air traffic control towers.

[2] The study treated 2003 through 2022 as "the next twenty years."

(see Exhibit A). All funds have been obligated and expended through FY 2000.

The majority of the funds for runway incursions technology projects has been used for Airport Surface Detection Equipment, Model 3 (ASDE-3) and Airport Movement Area Safety System (AMASS) to assist air traffic controllers at 34 of the largest airports. ASDE-3, which costs approximately $7 million per unit and is designed to aid controllers in the safe movement of aircraft especially in low visibility conditions, is operational at 32 airports. ASDE-3 is expected to be operational at two more airports by October 2002. AMASS, a software enhancement to ASDE that will cost an additional $4 million per unit, is designed to alert controllers of impending collisions. AMASS has been commissioned at 2 of the 34 airports.

The audit objective was to evaluate the adequacy of the FAA's efforts to identify and deploy (commission for operational use) new technologies to reduce runway incursions. Additionally, we determined whether FAA implemented recommendations contained in our previous reports.[3] We conducted the audit between November 1999 and May 2001.

Results-in-Brief

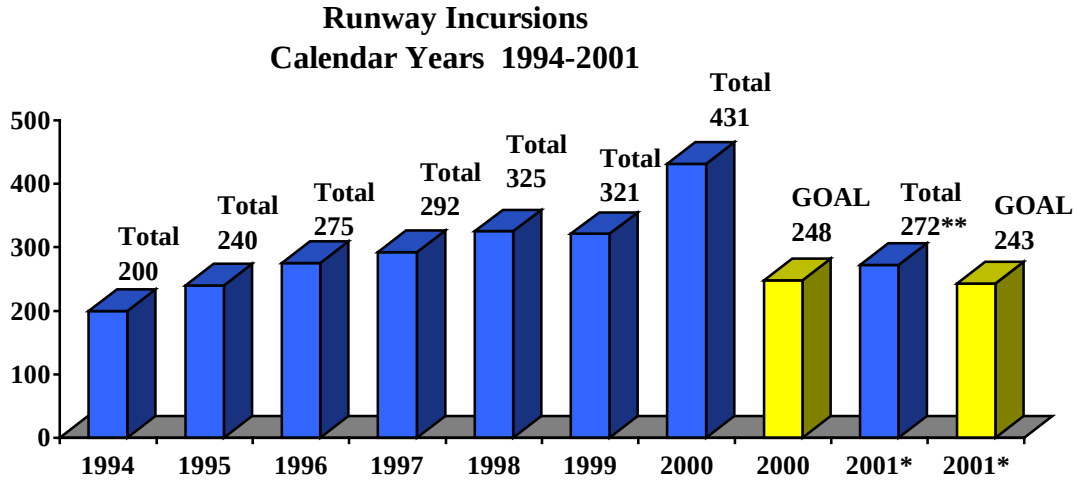
FAA has taken many steps to reduce runway incursions. FAA has had 3 plans since 1991 that included over 260 actions to reduce runway incursions. Actions included such things as improving markings, signs, and lighting, and training vehicle operators. FAA also made procedural changes such as requiring pilots to read back their clearances before entering an active runway and establishing uniform procedures for airport surface movement in low visibility conditions.

In the past 2 years, the FAA Administrator has made reducing runway incursions a top agency priority and appointed a new Director of Runway Safety as the single point of contact for all runway safety activities. In 2000, FAA conducted nine regional runway incursion workshops, a Human Factors symposium, and a Runway Safety National Summit, and published a National Blueprint to reduce runway incursions. FAA appointed nine new full-time Regional Runway Safety Managers to strengthen its focus on reducing runway incursions at the regional and local levels. FAA also revised its standards to

[3]Report on Audit of the Runway Incursion Program (Report Number AV-1998-075, February 9, 1998) and Report on Follow-up Review of FAA's Runway Safety Program (Report Number AV-1999-114, July 21, 1999).

increase the size of various holding position runway markings to make them more noticeable.

Despite FAA's significant management focus on reducing runway incursions, it is apparent that what FAA is doing is not sufficient. The number of runway incursions, as shown on the following chart, continues to go in the wrong direction. Runway incursions, which increased 60 percent from 200 in 1994 to 321 in 1999, reached a new high of 431 in 2000. *This number was 74 percent higher than FAA's goal of having no more than 248 runway incursions by the end of 2000.*



*** Beginning with October 2000, FAA changed its goal from a calendar year to a fiscal year basis**
****As of May 31, 2001 (Total includes 106 runway incursions from October-December 2000)**

Runway incursions continue to be a serious aviation safety risk. Based on preliminary FAA data on runway incursions from 1997 to 2000, close calls on the runway have remained a serious problem. During the 4-year period, there were 256 close calls, between 59 and 66 a year. Sixty-three percent or 161 of the close calls involved at least one commercial aircraft. Close calls are those runway incursions that barely avoid a collision or that posed a significant potential for a collision.

In our opinion, FAA has taken many steps toward reducing runway incursions, but two significant factors have constrained FAA's progress. Actions FAA needs to take to reverse the upward trend in runway incursions are indicated in the following paragraphs.

- First, FAA has not provided technologies to airports with continued runway incursion problems.

- FAA has been developing, evaluating, and testing AMASS since 1991. FAA commissioned the first two AMASS at the San Francisco and Detroit airports in June 2001. Based on longstanding problems with false alerts during evaluation and testing, however, there is uncertainty as to how well the system will work at the remaining sites and whether the schedule to commission 31 additional sites by November 2002 will be met. Accordingly, FAA needs to revisit the AMASS schedule and develop a realistic schedule to commission the remaining sites. The current schedule is unlikely to be met unless Airway Facilities resources are adequate to commission the remaining sites and time is allowed to ensure controller acceptance of AMASS.

- FAA has not provided small to medium airports with low-cost technologies to reduce runway incursions. FAA awarded a contract in October 2000 to provide ASDE-X technology to 25 small to medium airports. However, FAA used a "top down" approach, rather than evaluating the specific technological needs of airports with continued runway incursion problems and determining if low-cost solutions are available.

  ASDE-X is not a "one size fits all" system and can be tailored to the needs of each airport. In May 2001, FAA decided to reevaluate the need for a full ASDE-X system at each of the 25 airports. We agree with FAA's decision, and FAA should revise its ASDE-X cost and schedule baseline after the reevaluation.

- FAA's major technology efforts have been focused on helping air traffic controllers prevent accidents, but these tools will not help pilots avoid runway incursions before they happen. Runway incursions caused by pilot errors, which represented 60 percent of the runway incursions in 2000, continue to be the leading cause of runway incursions.

  Technologies to help pilots know where they are on the runway and where others are on the runway, such as in-cockpit moving map displays and Automatic Dependent Surveillance Broadcast (ADS-B), must be expedited to avoid close calls that continue to happen and pose a serious safety risk to airline crews and passengers. ADS-B differs significantly from other technologies because it creates a redundancy, a *"second set of eyes"*, by including the pilot in the loop to help detect and alleviate hazardous surface situations. FAA must expedite the use of these technologies. FAA should determine if its process to certify new equipment could be accelerated to expedite these technologies. FAA

should also issue an Advanced Notice of Proposed Rulemaking to obtain comments from the airline industry and general aviation community on implementing in-cockpit moving map displays and ADS-B.

- Second, to successfully reverse the upward trend in runway incursions, strong program oversight is needed to ensure follow-through on planned initiatives to reduce runway incursions.

  - We found improvement in program oversight is needed because initiatives are not completed on time, completed initiatives are not evaluated to determine if they are working, and regional efforts are not periodically assessed to ensure that progress is being made to reduce runway incursions at airports.

  - We found that an important factor constraining strong program oversight is that, even though the Runway Safety Program Director is the single point of contact for all runway safety activities, the Director has little authority to ensure initiatives undertaken by various FAA lines of business (Air Traffic, Flight Standards, Airports, and Research and Acquisition) are completed. FAA needs to provide the Director with the authority needed to ensure that employees from other lines of business are fully supporting the Runway Safety Program mission.

    We acknowledge that many offices in FAA have a role in ensuring runway safety, and it is not practical to have the Runway Safety Program Director be in charge of all employees involved in some way with reducing runway incursions. For example, the Safe Flight 21 program office, under the Office of Communications, Navigation and Surveillance, demonstrates technologies to improve the efficiency and capacity of the National Airspace System. This includes technologies such as ADS-B to reduce runway incursions. These employees do not report to the Runway Safety Program Director. However, the Director should have a mechanism to provide input on individual performance appraisals and bonuses if the employee's performance can impact FAA's progress in reducing runway incursions. Such mechanisms are needed to hold people involved with runway safety accountable for completing initiatives within established milestones.

Principal Finding and Recommendations

FAA Made Reducing Runway Incursions a Top Priority. Since the fall of 1999, the FAA Administrator has made reducing runway incursions a top agency priority. The administrator appointed a new Director of Runway Safety as the single point of contact for all runway safety activities. In the spring of 2000, FAA conducted nine regional runway incursion workshops, followed by a Human Factors symposium and a Runway Safety National Summit. These events brought together all the stakeholders in runway safety to develop additional ways to reduce runway incursions.

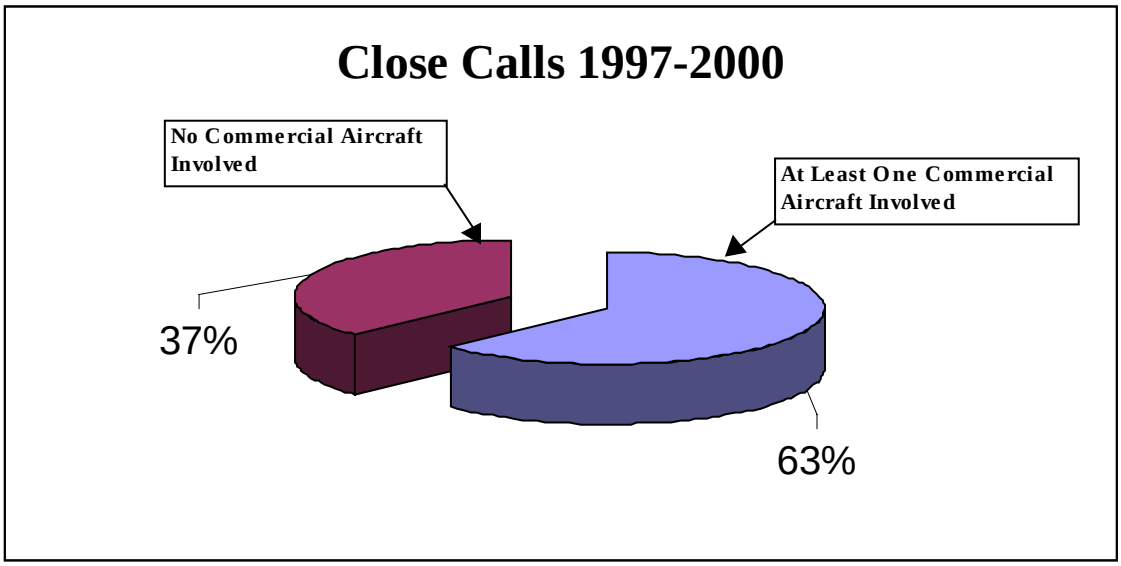
In August 2000, FAA identified 10 initiatives most likely to reduce runway incursions in the near term. These initiatives included reviewing pilot/controller communications phraseology, providing runway incursion training for pilots and controllers, implementing a technology assessment program, and improving airport surface operations and markings. In October 2000, FAA included these 10 initiatives together with certain initiatives selected from its 1998 Action Plan and published a National Blueprint to reduce runway incursions. In FY 2001, Congress appropriated $52.6 million for runway incursion initiatives, almost $19 million more than in FY 2000. FAA has requested a total of $73.6 million in the FY 2002 budget in support of Runway Safety Programs.

FAA also took action to improve regional and local efforts to reduce runway incursions and to improve data to better identify causes of runway incursions. In October 2000, FAA appointed nine new full-time Regional Runway Safety Program Managers. These managers plan to direct evaluations on runway safety at 167 airports this year, over 140 more than last year. To improve runway incursion data, FAA is developing a new process to identify and investigate those incursions where there was a high risk of collision. This process should help FAA identify the related causes and contributing factors of runway incursions and develop an effective prevention strategy. FAA has identified whether commercial or general aviation aircraft are involved for <u>all</u> runway incursions. In the past, this information was only available for runway incursions involving pilot error. FAA plans to implement its new runway incursion data system by the end of June 2001.

Runway Incursions Continue to Rise. Despite FAA's significant management focus on reducing runway incursions, the numbers are going in the wrong direction. Runway incursions, which increased 60 percent from 200 in 1994 to 321 in 1999, reached a new high of 431 in 2000. *This number was 34 percent higher than the 321 occurrences in 1999 and 74 percent higher than FAA's goal of having no more than 248 runway incursions by the end of 2000.*

The rate[4] of runway incursions per 100,000 operations (takeoffs and landings) has also increased, not just the absolute number.

The number of close calls (runway incursions where a high risk of collision exists) over the 4-year period from 1997 to 2000 have remained constant, with between 59 and 66 close calls occurring a year. There was at least one commercial aircraft involved in 161 (63 percent) of the 256 close calls that occurred during that 4-year period. When commercial aircraft are involved, the potential loss of life due to a runway accident is much greater.



Close calls involving commercial aircraft are continuing in 2001 as shown in the following examples.

- In January 2001 an American Airlines MD-80 was cleared to taxi and hold short of an active runway just after landing at Seattle-Tacoma International Airport. The pilot instead crossed the runway as a Trans World Airlines MD-80 was taking off. The two aircraft missed colliding by about 60 feet.

- In March 2001 a Delta Airlines 767 was cleared to land at Fort Lauderdale International Airport while a US Airways 737 had been told to taxi onto the runway to await takeoff. The two jets were within about 100 feet from a collision.

- In May 2001 at Dallas-Ft. Worth International Airport, a cargo plane mistakenly taxied onto an active runway directly in the path of an American

[4] The rate has increased from .32 in 1994 to .64 in 2000.

Airlines jet, rolling down the runway. The American Airlines jet flew over the cargo plane and missed it by less than 100 feet.

In the Department of Transportation FY 2002 Performance Plan, FAA's goal is to reduce runway incursions to no more than 243 by the end of FY 2001. (In prior years, runway incursion goals were based on calendar years, but DOT changed its reporting of runway incursions to a fiscal year basis to facilitate timely performance reporting.) As of May 31, 2001, the number of runway incursions for FY 2001 was already 272,[5] surpassing FAA's goal of 243 for FY 2001, with 4 months remaining in the fiscal year. FAA's FY 2002 goal is to reduce runway incursions to no more than 236.

Airports With Continued Runway Incursions Need Technological Solutions. Airports with continued runway incursion problems have been relying on non-technological solutions such as improving airport markings and lighting, and providing additional training to pilots and vehicle operators to reduce runway incursions. For example, Los Angeles International Airport, which had a runway accident in 1991 that killed 34 people and has led the Nation with 33 runway incursions over the past 4 years, has not been provided technology to mitigate the risk of another runway accident. Now FAA plans to commission AMASS by the end of August 2001 at Los Angeles International Airport, 10 years after the start of the development of AMASS and 10 years after the fatal accident on the runway. Further, ASDE-X technology designed to help air traffic controllers prevent runway accidents at 25 small to medium airports is not expected to be commissioned at the first 3 sites until FY 2003-2004, with the remaining 22 sites to be commissioned between FY 2005 and FY 2007.

Four of the top 10 airports with the most runway incursions from 1997 to 2000 (North Las Vegas, Long Beach, Fort Lauderdale Executive, and San Diego/Montgomery Field) are not scheduled to receive any technology to reduce runway incursions. Runway incursions at these 4 airports have increased 126 percent from a total of 19 in 1999 to 43 in 2000, primarily due to increases in pilot deviations. While we recognize that these airports, except for Long Beach, do not have commercial air service, FAA needs to determine whether low-cost technological solutions are available to reduce runway incursions and prevent accidents. In addition to these 4 airports, we identified 9 other airports that had a total of 10 or more runway incursions from 1997 to 2000 that are not scheduled to receive any technology. These 13 airports

[5] This number includes 106 runway incursions from October to December 2000.

represent 35 percent of the 37 airports that had 10 or more incursions over the past 4 years *(see Exhibit E)*.

FAA Has Started to Commission AMASS After Major Delays, But Challenges Still Remain. Over the last decade FAA has focused on AMASS to alert air traffic controllers at the 34 largest airports of impending runway incursions and accidents. AMASS is a "one size fits all" software enhancement to the ASDE-3 radar. Since 1991, FAA has been developing and evaluating AMASS, which was initially designed to address the NTSB's recommendation in 1991 to commission technologies to prevent runway incursions. In October 1999, FAA told NTSB that the focus of AMASS changed from preventing runway incursions to preventing collisions because FAA had not developed an acceptable predictive warning system.

AMASS has experienced cost increases and schedule delays due to software development problems, human factors issues, and operational problems. The following chart shows that AMASS is 6 years behind schedule and $86 million over cost projections made in 1993.

Plan	Baseline Cost	Last Installation Date
1993	$59.8 M	1996
1997	$74.1 M	2000
As of May 2001	$146.0 M	2002

AMASS has had continued problems with nuisance and false alerts.[6] In November 2000, FAA's Air Traffic Services Test Team issued its report on the independent operational test and evaluation of AMASS at San Francisco International Airport and Detroit Metropolitan Wayne County Airport and concluded that *AMASS is not operationally acceptable.* The system was reevaluated at both airports after software modifications were made and found to be operationally acceptable in May 2001.

FAA has been evaluating and testing AMASS for nearly 2 years at San Francisco and Detroit airports. AMASS was commissioned at San Francisco and Detroit airports in June 2001. FAA plans to commission AMASS at 31[7]

[6] A nuisance alert results when two or more actual targets are incorrectly shown in conflict. A false alert occurs when one actual target and one false target are shown in conflict.

[7] Ronald Reagan Washington National Airport is not expected to receive AMASS until after November 2002 because a remote tower has to be built for the ASDE-3 radar.

additional sites by November 2002, an average of about 2 sites per month. Before AMASS is commissioned at each site, the system must be adapted to the airport's configuration and operations, and fully tested to ensure that the system functions properly.

Based on longstanding problems with nuisance and false alerts at San Francisco and Detroit airports during evaluation and testing, the aggressive schedule poses a significant risk. *In our opinion, there is uncertainty as to how well the system will work at the remaining sites and whether this schedule will be met.* If controllers do not use AMASS due to excessive nuisance and false alerts, the system may be turned off just like the ASDE-3 radar at Ronald Reagan Washington National Airport, which was removed in the summer of 2000 because controllers were reluctant to use it due to excessive false targets.

FAA's Air Traffic Services Test Team from FAA's Office of Independent Test and Evaluation also has concerns about whether the AMASS schedule will be met. In its May 2001 Independent Operational Test and Evaluation Follow-up Report, the team concluded that Airway Facilities resources may not be sufficient to address requirements of the commissioned AMASS systems (San Francisco and Detroit), while working on commissioning AMASS at other airports. Accordingly, FAA needs to revisit the AMASS schedule and develop a realistic schedule for the remaining 32 AMASS sites.

FAA Needs to Provide Small to Medium Airports with Low-Cost Technologies to Reduce Runway Incursions. FAA has not provided small to medium airports (those not scheduled to receive AMASS), with low-cost technologies to prevent runway incursions as directed by Congress in October 1995. We found that FAA needs to determine technological needs of small to medium airports. Also, FAA needs to follow-through to ensure that runway incursion technologies that may benefit small to medium airports are evaluated in a timely manner.

<u>The Technological Needs of Small to Medium Airports Must Be Determined.</u> Between 1995 and 1999, in response to congressional direction, FAA evaluated three radars at Milwaukee, Salt Lake City, and Norfolk airports. The approximate costs of the radar systems produced by three different vendors were $489,000, $990,000, and $3.2 million, respectively. In August 1999, FAA issued its evaluation report, which indicated that the low-cost radars did not meet reliability and maintainability requirements to work at airports.

Instead of a radar-only system, FAA awarded a contract in October 2000 for ASDE-X at 25 small to medium airports and 4 support systems. ASDE-X,

which is designed to more precisely identify aircraft and vehicles on the ground than just radar alone, has a contract cost of approximately $2 million per unit. FAA's August 2000 Estimated Acquisition Program Baseline document for ASDE-X projects the life-cycle Facilities and Equipment costs from FY 2000 to FY 2026 to be $332.6 million for the 29 systems, which comes to about $11 million per unit (not low-cost as intended by Congress). This amount includes the cost of research and development, installation, initial spare parts, and contract administration, but does not include operations and maintenance costs. ASDE-X is not expected to be commissioned at the first 3 sites until FY 2003-2004, with the remaining 22 sites to be commissioned between FY 2005 and FY 2007.

FAA selected this technology using a "top down" approach, rather than evaluating the technological needs of specific airports with continued runway incursion problems. ASDE-X, which consists of a radar, processor, non-radar sensors,[8] and a display, can be tailored to each airport's needs. ASDE-X was not designed to be a "one size fits all" technology. For example, one airport may need a radar-only system while another airport may need the full system with multilateration capability. While ASDE-X is not a "one size fits all" system, FAA's cost estimate reflects a full system for each of the 25 airports. On May 1, 2001, FAA decided to reevaluate the need for a full ASDE-X system at each of the 25 airports due to the high cost of the system. We agree with FAA's decision.

Evaluations of Technologies Must Be Completed Timely. FAA needs to follow-through to ensure that runway incursion technologies that may benefit small to medium airports are evaluated in a timely manner. For example, FAA did not give a high priority to completing its evaluation of loop technology at Long Beach airport, which monitors the movement of aircraft and vehicles by using in-ground sensors similar to those used on roads to activate stop lights. In October 1993, FAA told NTSB that it was evaluating loop technology as one of several different technologies for monitoring airport surface movement at lower activity airports. Loop technology was installed and tested at Long Beach airport in 1993. Congress appropriated $2 million in FY 1996 and another $1.9 million in FY 1998 to develop the prototype loop system at Long Beach airport. After 8 years, FAA has finally completed testing of loop technology at Long Beach airport and plans to issue a final report in the summer of 2001.

[8] The purpose of these sensors is to more accurately identify aircraft and vehicles on the airport surface than radar alone.

In September 2000, FAA issued a Broad Agency Announcement (BAA) to solicit ideas from industry to explore new and emerging lower cost technologies to improve surface safety in the near term. In February 2001, FAA awarded contracts to five vendors to demonstrate technologies such as addressable signs and infrared and magnetic sensors that detect aircraft and vehicle movement on the ground. In May 2001, FAA issued a contract to another vendor to demonstrate runway safety lights to help pilots determine if it is safe to cross a runway. Field demonstrations are to be completed within a year of award. This BAA is a step in the right direction, but FAA must follow-through and complete its evaluations of these technologies.

Technologies to Assist Pilots in Preventing Runway Incursions Need to Be Expedited. Runway incursions caused by pilot error (pilot deviations), which represented 60 percent of the runway incursions in 2000, continue to be the leading cause of runway incursions. However, AMASS and ASDE-X are tools to help controllers prevent runway accidents, and they will be at a total of 59 airports. Technologies such as in-cockpit moving map displays and ADS-B satellite navigation technology have the most potential for reducing runway incursions because they help pilots prevent runway incursions. However, these technologies are several years away from becoming fully operational unless efforts are made by FAA, the airline industry, and the general aviation community to expedite their use.

The National Aeronautics and Space Administration (NASA), FAA, and the Cargo Airline Association (CAA) are assessing electronic moving map display technology to increase pilot situational awareness and help reduce pilot errors on runways and taxiways. This technology provides the pilot with a map of the airport on a cockpit display depicting the aircraft's exact location. A system will be available for the general aviation community by summer 2001 and a commercial variation will be available by winter 2001. The system is estimated to cost between $15,000 and $90,000, depending on whether the display is fully integrated with an aircraft's avionics. The moving map display is a promising first step in helping pilots know precisely where they are on the airport surface at all times. While FAA has decided not to mandate this equipment to the airline industry, FAA should aggressively promote this technology as a vital first step in increasing flight crews' surface situational awareness.

The second step, which FAA is demonstrating in conjunction with CAA under FAA's Safe Flight 21 program, is to provide pilots, through the use of ADS-B satellite technology, a moving map display that shows where other aircraft are on the runways and taxiways. ADS-B differs significantly from other technologies because it creates a redundancy (*"a second set of eyes")* by

including the pilot in the loop to help detect and alleviate hazardous surface situations. One drawback of this technology is that it requires all aircraft, including general aviation aircraft, to be equipped with this technology. Equipage of ADS-B technology may cost approximately $15,000 to $17,000 for each general aviation aircraft. A system for commercial cargo and air carrier aircraft is estimated to cost approximately $100,000. FAA officials do not think ADS-B technology will be ready for commissioning and full operational use for another 2 to 5 years depending on how long it takes to certify ADS-B for safe operation.

The use of these technologies must be expedited. FAA should determine if its process to certify new equipment could be accelerated to expedite these technologies. FAA should also issue an Advanced Notice of Proposed Rulemaking to obtain comments from the airline industry and general aviation community on implementing in-cockpit moving map displays and ADS-B.

Oversight Authority and Accountability Over the Runway Safety Program Need to Be Strengthened. Another significant factor constraining FAA's efforts to reverse the upward trend in runway incursions is the lack of accountability for completion of actions to reduce runway incursions. While FAA's Runway Safety Program Director is the single point of contact for all runway safety activities, the Director has little authority to ensure initiatives undertaken by various FAA lines of business are completed. FAA needs to provide the Director, who is under Air Traffic, authority to ensure that employees from other lines of business complete tasks to reduce runway incursions on time. FAA needs to develop a mechanism to hold people involved with runway safety accountable, such as directing the Runway Safety Director to provide input on individuals' performance appraisals and bonuses. Additionally, FAA should also consider realigning the Runway Safety Program under FAA's Deputy Administrator office to elevate the program importance above all lines of business.

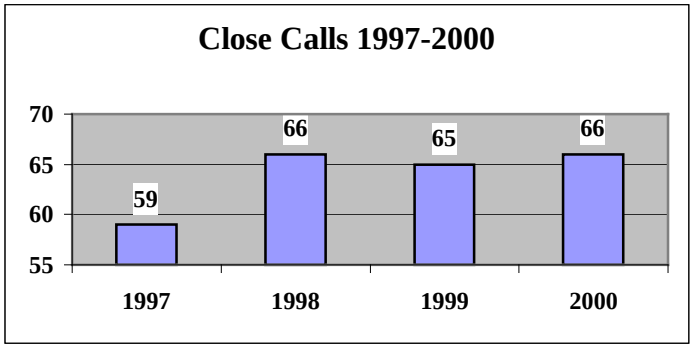
FAA Needs to Measure the Effectiveness of Its Initiatives. While FAA has had three action plans to reduce runway incursions since 1991, it has not determined whether its specific actions are working, or if other actions are needed. Runway Safety Program officials stated that FAA needs to improve its runway incursion data in order to determine why runway incursions occurred before it can evaluate whether initiatives to correct the identified causes are working.

FAA is making progress in improving its runway incursion data. To its credit, FAA has evaluated 1,369 runway incursions that occurred between 1997 and

2000, and grouped them into four risk categories. The four risk categories described in part are:

- A: barely avoid a collision,
- B: significant potential for a collision exists,
- C: ample time and distance exists to avoid a potential collision, and
- D: little or no risk of a collision exists.

During the 4-year period ending in December 2000, there were 256 close calls (those runway incursions in categories A and B) or between 59 to 66 a year. About 63 percent or 161 of close calls involved at least one commercial aircraft.



FAA is planning to use these data to obtain a historical perspective and determine the causal factors contributing to runway incursions and prevention strategies. FAA plans to implement its new runway incursion data system by the end of June 2001. Once the data are improved, FAA needs to measure the effectiveness of its initiatives to ensure that its resources are focused in the right direction.

FAA Needs to Hold Regions Accountable for Making Progress in Reducing Runway Incursions. Before new Regional Runway Safety Program Managers were hired in October 2000, regional focus on local incursion prevention activities was inadequate.

- None of the five regional offices visited during the audit could provide any analyses of runway incursion trends at airports in the region to identify solutions for airport-specific problems.

- Surface Incident Prevention Plans, comprehensive plans that address the prevention of runway incursions and surface incidents[9] at specific airports, were not prepared for 5 of 11 airports visited.

- Two of five regions (Southern and Eastern Regions) visited did not adequately track the status of Runway Incursion Action Team evaluation recommendations or establish target dates to ensure timely completion.

FAA recently strengthened regional efforts to reduce runway incursions but needs to go farther. The nine new Regional Runway Safety Program Managers will report directly to the Regional Administrator and indirectly to the Director of the Runway Safety Program at headquarters. The new managers will work on runway incursion issues full time, unlike their predecessors who only performed the function as a collateral duty. These managers plan to direct evaluations on runway safety at 167 airports this year, over 140 more than last year. These efforts are steps in the right direction. However, FAA must develop a mechanism to periodically assess whether the Regional Runway Safety Program Managers are making progress in correcting airport-specific problems and reducing runway incursions. Without strong oversight and accountability, FAA's Runway Safety Program Office has no assurance that regional efforts are adequately focused on correcting airport-specific problems.

Recommendations

Our recommendations focus on what FAA needs to do to reverse the upward trend in runway incursions.

- To ensure technologies are provided to airports with continued runway incursion problems, FAA should:

  - Expedite the use of in-cockpit moving map displays and ADS-B for use by pilots in reducing runway incursions. FAA should determine if its process to certify new equipment for safe operation could be accelerated to expedite these technologies. FAA should also issue an Advanced Notice of Proposed Rulemaking to obtain comments from the airline industry and general aviation community on implementing in-cockpit moving map displays and ADS-B.

[9] An event where authorized or unauthorized/unapproved movement occurs on the airport surface that affects or could affect the safety of flight.

- Develop a realistic schedule to commission the remaining 32 AMASS sites. The current schedule is unlikely to be met unless Airway Facilities resources are adequate to commission the remaining sites and time is allowed to ensure controller acceptance of AMASS.

- Determine whether some airport needs for ASDE-X can be met by radar alone. After airport needs are identified, FAA should revise its ASDE-X cost and schedule baseline.

- Complete its evaluations of the six emerging technologies it has identified to assist controllers and pilots in reducing runway incursions and advance the ones most likely to reduce runway incursions quickly to high-risk airports.

- Conduct reviews at the 13 airports that had 10 or more runway incursions over the past 4 years to determine whether technological solutions are needed.

➢ To improve oversight authority and accountability over the Runway Safety Program, FAA should:

- Provide the Runway Safety Program Director with authority to ensure that employees from other lines of business complete tasks to reduce runway incursions on time. An accountability mechanism, such as directing the Runway Safety Program Director to provide input on individuals' performance appraisals and bonuses, should be developed to hold people involved with runway safety accountable for completing initiatives within established milestones. Consideration should be given to realigning the Runway Safety Program under FAA's Deputy Administrator office to elevate the program importance above all lines of business.

➢ To further facilitate accountability over the Runway Safety Program, FAA should:

- Measure whether initiatives are effective in addressing the causes of runway incursions, and periodically assess regional efforts to ensure that progress is being made to reduce runway incursions at specific airports.

Agency Comments and Office of Inspector General Response

With the exception of FAA's proposed actions to expedite the use of in-cockpit moving map displays and ADS-B and to improve the authority and accountability over the Runway Safety Program, we considered its actions taken and planned to be responsive to our recommendations.

FAA's proposed actions to expedite the use of in-cockpit moving map displays and Automatic Dependent Surveillance - Broadcast and to improve the authority and accountability of the Runway Safety Program Director are ambiguous. Also, it is not clear to us what milestones, if any, apply to implementing these recommendations. FAA needs to reconsider its position on both recommendations and provide target dates for implementation.

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Introduction

Background

Runway incursions,[1] incidents on the runway that create a collision hazard, can have serious consequences**.** The worst aviation accident in history occurred in 1977 on a runway in the Canary Islands in Tenerife where 583 people were killed. Another accident occurred in October 2000 at Taipei's Chang Kai Shek International Airport when a Boeing 747 took off on a closed runway and collided with construction equipment killing 81 people onboard. While these accidents did not occur in the United States, they show the extent of the safety risk posed by runway incursions. In the United States there have been 7 runway accidents since 1990 that claimed 63 lives and damaged 13 aircraft. One of these accidents occurred in March 2000 when two general aviation aircraft collided at Bradenton International Airport in Sarasota, Florida, killing four people onboard both aircraft.

The National Transportation Safety Board (NTSB) has expressed concern that the expected increase in air traffic activity may result in further increases in runway incursions, which may lead to additional accidents. NTSB has included reducing runway incursions on its annual "Most Wanted" list of transportation safety improvements since 1990. A November 2000 study titled "Fatal U.S. Runway Collisions Over the Next Twenty Years" performed under contract for the Federal Aviation Administration (FAA) projected that 15 fatal runway collisions at towered airports could kill 700 to 800 people and seriously injure 200 others over the next 20 years if nothing more is done.[2]

FAA has been pursuing technologies to reduce runway incursions and prevent accidents for over a decade. It funded approximately $376 million for such projects during fiscal years (FY) 1985 to 2000. An additional $18.6 million was appropriated for FY 1999, $33.7 million for FY 2000, and $52.6 million for FY 2001.

The majority of the funds for runway incursions technology projects have been used for Airport Surface Detection Equipment, Model 3 (ASDE-3) and Airport

[1] 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. FAA's definition applies only to airports with operating air traffic control towers.

[2] The study treated 2003 through 2022 as "the next twenty years."

Movement Area Safety System (AMASS) to assist air traffic controllers at 34 of the largest airports. ASDE-3, which costs approximately $7 million per unit and is designed to aid controllers in the safe movement of aircraft especially in low visibility conditions, is operational at 32 airports. ASDE-3 is expected to be operational at two more airports by October 2002. AMASS, a software enhancement to ASDE that will cost an additional $4 million per unit, is designed to alert controllers of impending collisions. AMASS has been commissioned at 2 of the 34 airports.

Objectives, Scope, and Methodology

The audit objective was to evaluate the adequacy of the FAA's efforts to identify and deploy (commission for operational use) new technologies to reduce runway incursions. Additionally, we determined whether FAA implemented recommendations contained in our previous reports.[3] We conducted the audit between November 1999 and May 2001.

We conducted the audit at FAA Headquarters in Washington, DC, 5 regions, and 13 airport facilities. The review was conducted in accordance with the Government Auditing Standards prescribed by the Comptroller General of the United States.

Findings and Recommendations

FAA Made Reducing Runway Incursions a Top Priority

Since the fall of 1999, the FAA Administrator has made reducing runway incursions a top agency priority. The Administrator appointed a new Director of Runway Safety as the single point of contact for all runway safety activities. In the spring of 2000, FAA conducted nine regional runway incursion workshops, followed by a Human Factors symposium and a Runway Safety National Summit. These events brought together all the stakeholders in runway safety to develop additional ways to reduce runway incursions.

In August 2000, FAA identified 10 initiatives most likely to reduce runway incursions in the near term. These initiatives included reviewing pilot/controller communications phraseology, providing runway incursion

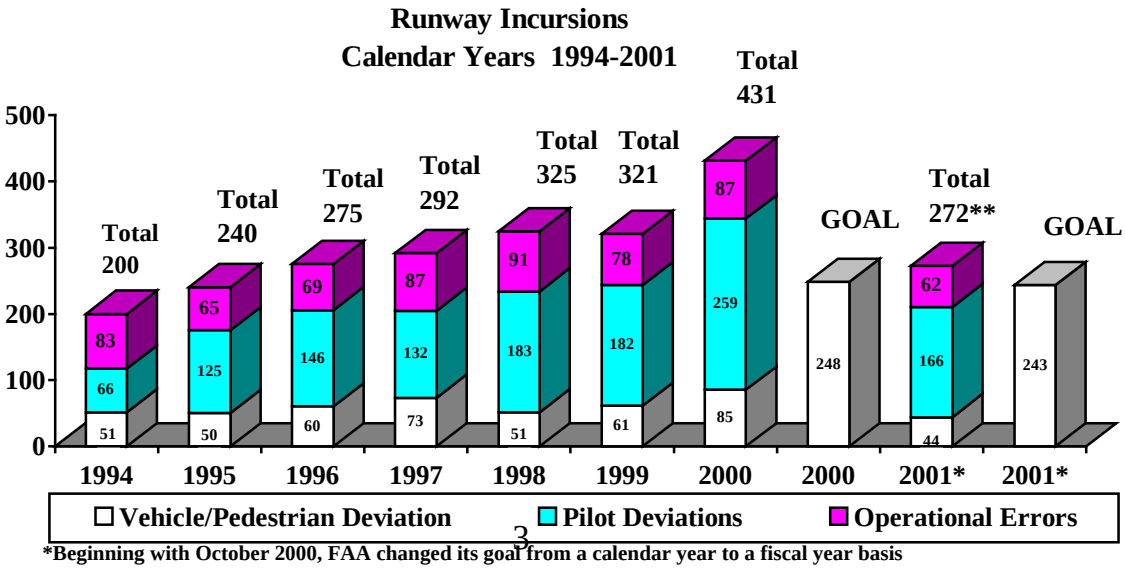
[3] Report on Audit of the Runway Incursion Program (Report Number AV-1998-075, February 9, 1998) and Report on Follow-up Review of FAA's Runway Safety Program (Report Number AV-1999-114, July 21, 1999).

training for pilots and controllers, implementing a technology assessment program, and improving airport surface operations and markings. In October 2000, FAA included these 10 initiatives together with certain initiatives selected from its 1998 Action Plan and published a National Blueprint to reduce runway incursions. FAA also revised its standards to increase the size of various holding position markings to make them more noticeable. In FY 2001, Congress appropriated $52.6 million for runway incursion initiatives, almost $19 million more than in FY 2000. FAA has requested a total of $73.6 million in the FY 2002 budget in support of Runway Safety Programs.

FAA took action to improve regional and local efforts to reduce runway incursions and to improve data to better identify causes of runway incursions. In October 2000, FAA appointed nine new full-time Regional Runway Safety Program Managers. These managers plan to direct evaluations on runway safety at 167 airports this year, over 140 more than last year. To improve runway incursion data, FAA is developing a new process to identify and investigate those incursions where there was a high risk of collision. This process should help FAA identify the related causes and contributing factors of runway incursions and develop an effective prevention strategy. FAA has identified whether commercial or general aviation aircraft are involved for all runway incursions. In the past, this information was only available for runway incursions involving pilot error. FAA plans to implement its new runway incursion data system by the end of June 2001.

Runway Incursions Continue to Rise

Despite significant management focus this past year, runway incursions continue to rise and still pose a serious safety risk. The following chart shows the number of runway incursions by three types: pilot deviations, operational errors, and vehicle or pedestrian deviations.



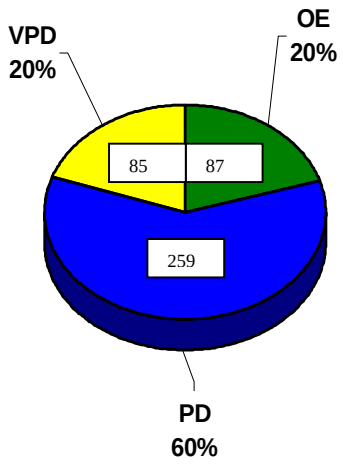
Beginning with October 2000, FAA changed its goal from a calendar year to a fiscal year basis

**** As of May 31, 2001 (Total includes 106 runway incursions from October-December 2000)**

Pilot deviations are errors that violate Federal Aviation Regulations. For example, a pilot deviation occurs when a pilot fails to follow air traffic controller instructions to stop short of an active runway, causing another aircraft to abort its departure or arrival. Operational errors are occurrences attributable to air traffic control that result in less than the required separation between aircraft. Vehicle or pedestrian deviations involve the presence of vehicles, non-pilot operated aircraft, or pedestrians on runways or taxiways without authorization from a controller.

The primary cause for the increase in runway incursions during 2000 continues to be attributed to pilot deviations, which accounted for 60 percent of the 431 runway incursions, as shown on the following chart.

Causes of Runway Incursions in 2000



OE-Operational Error
VPD-Vehicle/Pedestrian Deviation
PD-Pilot Deviation

In the Department of Transportation FY 2002 Performance Plan, FAA's goal is to reduce runway incursions to no more than 243 by the end of FY 2001. (In prior years, runway incursion goals were based on calendar years, but DOT changed its reporting of runway incursions to a fiscal year basis to facilitate timely performance reporting.) As of May 31, 2001, the number of runway incursions for FY 2001 is already 272, surpassing FAA's goal for FY 2001 with 4 months remaining in the fiscal year. FAA's FY 2002 goal is to reduce runway incursions further, to no more than 236.

While there is no one solution to reducing runway incursions, it has become apparent, based on the increasing numbers of runway incursions, that technological solutions must be expedited to assist pilots and controllers in preventing runway incursions and accidents. Further, the Runway Safety Program Office must have the authority to hold Headquarters and Regions accountable for making progress in completing runway incursion initiatives and in reducing the number of runway incursions. FAA has had 3 plans since 1991 that included over 260 actions to reduce runway incursions. Actions included such things as training vehicle operators and improving markings, signs, and lighting. FAA also made procedural changes such as requiring pilots to read back their clearances before entering an active runway and establishing uniform procedures for airport surface movement in low visibility conditions. Despite these actions, including FAA's significant management focus on reducing runway incursions since the fall of 1999, close calls on the runway continue to happen.

In our opinion, FAA has taken many steps to reduce runway incursions, but it is apparent that what FAA is doing is not enough to lower the risk of a runway accident. Actions FAA needs to take to reverse the upward trend in runway incursions are indicated below.

Two significant factors have constrained FAA's progress in reducing runway incursions.

- FAA has not provided technologies to airports with continued runway incursion problems.

  - FAA has been developing, evaluating, and testing AMASS since 1991. FAA commissioned AMASS at San Francisco and Detroit airports in June 2001. Based on longstanding problems with false alerts at San Francisco and Detroit airports during evaluation and testing that have only recently been corrected, there is uncertainty as to whether the system will work at the remaining sites and whether the schedule to commission 31[4] additional sites by November 2002 will be met.

  - FAA has not provided low-cost technologies to reduce runway incursions to small to medium airports. FAA needs to follow-through to ensure that runway incursion technologies are evaluated timely. Also,

[4] Ronald Reagan Washington National Airport is not expected to receive AMASS until after November 2002 because a remote tower has to be built for the ASDE-3 radar.

FAA needs to evaluate the technological needs of specific airports with continued runway incursion problems and determine if low-cost solutions are available, rather than using a top down "one size fits all" approach.

FAA's major technology efforts have been focused on assisting air traffic controllers in preventing accidents, but these tools will not help pilots avoid runway incursions. Runway incursions caused by pilot errors, which represented 60 percent of the runway incursions in 2000, continue to be the leading cause of runway incursions. Technologies to assist pilots in knowing where they are on the runway and where others are on the runway to provide *"a second set of eyes"* must be expedited by FAA, the airline industry, and the general aviation community to avoid close calls that continue to happen and pose a serious safety risk to airline crews and passengers.

FAA should determine if its process to certify new equipment could be accelerated to expedite these technologies. FAA should also issue an Advanced Notice of Proposed Rulemaking to obtain comments from the airline industry and general aviation community on implementing in-cockpit moving map displays and Automatic Dependent Surveillance Broadcast (ADS-B).

- Another important factor constraining FAA's efforts to reduce runway incursions is the lack of strong national oversight and accountability for both Headquarters and regional actions to reduce runway incursions. Without strong oversight of FAA's Runway Safety Program activities, FAA has little assurance that its actions are completed on time and are effective in reducing runway incursions.

Airports With Continued Runway Incursion Problems Need Technological Solutions

The following chart shows the 10 airports with the most runway incursions over the last 4 years, and indicates whether they are scheduled to receive AMASS or ASDE-X. The chart also indicates whether the airport has commercial airline service and shows the number of airport operations in 2000. *See Exhibit E for the complete listing of airports with a total of 10 or more runway incursions from 1997 to 2000.*

10 Airports With the Most Runway Incursions During 1997-2000

Rank	Airport	Total Number of Runway Incursions	Commercial Service	Number of Airport Operations in 2000	Planned Date to Commission AMASS	Scheduled to Receive ASDE-X Between FY2003-FY2007
1	Los Angeles	33	X	783,684	8/01	
2	St. Louis	30	X	484,224	7/01	
3	Orange County	27	X	387,864		X
4	North Las Vegas	26		225,505		
5	Long Beach	25	X	379,399		
6	Dallas-Forth Worth	23	X	865,777	9/02	
7	San Francisco	21	X	430,554	6/01 (Commissioned)	
8	San Diego/Montgomery Field	20		232,141		
9	Fort Lauderdale Executive	20		259,876		
10	Phoenix	20	X	638,757		X

As shown above, FAA commissioned AMASS at San Francisco airport, and three other airports with the most runway incursions are scheduled to have AMASS commissioned this year. Two airports (Orange County and Phoenix) shown in the above chart, are programmed to receive ASDE-X some time after FY 2003, but a schedule showing when each of the 25 sites will receive ASDE-X has not yet been developed.

However, Long Beach airport and three general aviation airports (North Las Vegas, Fort Lauderdale Executive, and San Diego/Montgomery Field) are not scheduled to receive any technology to reduce runway incursions. Runway incursions at these 4 airports have increased 126 percent from a total of 19 in 1999 to 43 in 2000, primarily due to increases in pilot deviations.

In addition to these 4 airports, we identified 9 other airports that had a total of 10 or more runway incursions from 1997 to 2000 that are not scheduled to receive any technology. These 13 airports represent 35 percent of the 37 airports that had 10 or more incursions over the past 4 years *(see Exhibit E)*. Accordingly, FAA should conduct reviews at these airports to determine whether low-cost technological solutions are needed.

FAA Has Started to Commission AMASS After Major Delays, But Challenges Still Remain

Over the last decade FAA has focused on AMASS, a "one size fits all" software enhancement to the ASDE-3 radar designed to alert air traffic controllers at the 34 largest airports of impending runway conflicts. Since 1991, FAA has been developing and evaluating AMASS in response to an NTSB recommendation that FAA expedite efforts to develop and implement a system to alert controllers of impending runway incursions. The recommendation was made after a runway incursion caused an accident on the runway at Atlanta Hartsfield International Airport in January 1990. NTSB then listed runway incursions on its "Most Wanted" list of transportation safety improvements in 1990, and it has been on the list since that time.

In August 1991, FAA advised NTSB that AMASS would address the intent of the Board's safety recommendation. AMASS was intended to continually monitor airport surface traffic and automatically alert air traffic controllers to potential conflicts. FAA plans to commission AMASS at the 34 largest airports nationwide that have the ASDE-3 radar. The contract for the first three AMASS units was awarded in June 1996.

AMASS will not meet the intent of NTSB's initial recommendation in 1991, which was to commission technologies to <u>prevent runway incursions</u>. In October 1999, FAA told NTSB that the focus of AMASS changed from preventing runway incursions to <u>preventing collisions</u> because FAA was unable to develop an acceptable predictive warning system. Now NTSB is concerned that AMASS may not even alert air traffic controllers in time to avoid an accident.

AMASS has experienced cost increases and schedule delays due to software development problems, human factors issues, and operational problems. The following chart shows that AMASS is 6 years behind schedule and $86 million over cost projections made in 1993.

Plan	Baseline Cost	Last Installation Date
1993	$59.8 M	1996
1997	$74.1 M	2000
As of May 2001	$146.0 M	2002

AMASS has had continuous problems with nuisance and false alerts.[5] In November 2000, FAA's Air Traffic Service test team issued its report on the independent operational test and evaluation of AMASS at San Francisco International Airport and Detroit Metropolitan Wayne County Airport and concluded that *AMASS is not operationally acceptable.* The system was reevaluated at both airports after software modifications were made and found to be operationally acceptable in May 2001.

FAA has been evaluating and testing AMASS for nearly 2 years at San Francisco and Detroit airports. AMASS was commissioned at San Francisco and Detroit airports in June 2001. FAA plans to commission AMASS at 31[6] additional sites by November 2002, an average of about 2 sites per month. Before AMASS is commissioned at each site, the system must be adapted to the airport's configuration and operations and must be fully tested to ensure that the system functions properly.

Based on the longstanding problems with nuisance and false alerts at San Francisco and Detroit airports, the aggressive schedule poses a significant risk. *In our opinion, there is uncertainty as to how well the system will work at the remaining sites and whether this schedule will be met.* If controllers do not use AMASS due to excessive nuisance and false alerts, the system may be turned off just like the ASDE-3 radar at Ronald Reagan Washington National Airport, which was removed in the summer of 2000 because controllers were reluctant to use it due to excessive false targets.

FAA's Air Traffic Services Test Team from FAA's Office of Independent Test and Evaluation also has concerns about whether the AMASS schedule will be met. In its May 2001 Independent Operational Test and Evaluation Follow-up Report, the team concluded Airway Facilities resources may not be sufficient to address requirements of the commissioned AMASS systems (San Francisco and Detroit), while working on commissioning AMASS at other airports. Accordingly, FAA needs to revisit the AMASS schedule and develop a realistic schedule for the remaining 32 AMASS sites. The current schedule is unlikely to be met unless Airway Facilities resources are adequate to commission the remaining sites and time is allowed to ensure controller acceptance of AMASS.

[5] A nuisance alert results when two or more actual targets are incorrectly shown in conflict. A false alert occurs when one actual target and one false target are shown in conflict.

[6] Ronald Reagan Washington National Airport is not expected to receive AMASS until after November 2002 because a remote tower has to be built for the ASDE-3 radar.

FAA Has Not Provided Technologies to Assist Smaller Airports in Reducing Runway Incursions

FAA has not provided small to medium airports (those not scheduled to receive AMASS) with low-cost technologies to prevent runway incursions as directed by Congress in October 1995. We found that FAA needs to determine technological needs of small to medium airports. Also, FAA needs to follow-through to ensure that runway incursion technologies under its Research, Engineering, and Development (R, E &D) Program that may benefit small to medium airports are evaluated timely.

FAA Should Determine Technological Needs of Small to Medium Airports. Between 1995 and 1999, FAA evaluated three radars at Milwaukee, Salt Lake City, and Norfolk airports in response to congressional direction to provide small to medium airports not scheduled to receive AMASS with low-cost technologies to prevent runway incursions. The approximate cost of the radar systems was $489,000, $990,000, and $3.2 million, respectively. In August 1999, FAA issued its evaluation report which indicated that the low-cost radars did not meet reliability and maintainability requirements to work at airports.

Instead of a radar-only system, FAA awarded a contract in October 2000 for ASDE-X at 25 small to medium airports and 4 support systems. ASDE-X consists of a radar, processor, non-radar sensors,[7] and a display. It is designed to more precisely identify aircraft and vehicles on the ground than radar alone. ASDE-X can be tailored to each airport's needs. For example, one airport may need a radar-only system while another airport may need the full system with multilateration capability.

However, ASDE-X is not low cost and will take several years to commission. The contract cost of the ASDE-X hardware is approximately $2 million per site. FAA's August 2000 Estimated Acquisition Program Baseline document for ASDE-X projects the life-cycle Facilities and Equipment costs from FY 2000 to FY 2026 to be $332.6 million for the 29 systems. That comes to about $11 million per unit, when adding in the cost of research and development, installation, initial spare parts, and contract administration. These costs do not include operations and maintenance costs. Further, ASDE-X is not expected to be commissioned at the first 3 sites until FY 2003-

[7] The purpose of these sensors is to more accurately identify aircraft and vehicles on the airport surface than radar alone.

2004, with the remaining 22 sites to be commissioned between FY 2005 and FY 2007.
In the October 2000 House of Representatives Conference Report on the Department of Transportation appropriations for FY 2001, Congress questioned the high cost of ASDE-X especially given that it will be placed at small to medium airports. Congress also raised concerns because FAA did not agree to congressional direction to commission the first 10 ASDE-X systems by September 2002. Instead, FAA's proposed schedule for the first 10 systems is 3 years later.

We agree with congressional concerns over the affordability of ASDE-X, given that the airports are small to medium airports and may not need a full ASDE-X system. While ASDE-X is not a "one size fits all" system, FAA's cost estimate reflects a full system for each of the 25 airports.

On May 1, 2001, FAA decided to reevaluate the need for a full ASDE-X system at each of the 25 airports due to the high cost of the system. We agree with FAA's decision because $11 million per unit is no longer low-cost given that ASDE-X is intended for small to medium airports. FAA selected this technology using a "top down" approach, rather than evaluating the technological needs of specific airports with continued runway incursion problems.

FAA Needs to Ensure that Evaluations of R, E & D Projects Are Completed. We found that FAA did not always follow through to complete evaluations of runway incursion technologies in a timely manner.

For example, FAA did not give a high priority to completing its evaluation of loop technology at Long Beach airport, which monitors the movement of aircraft and vehicles by using in-ground sensors similar to those used on roads to activate stop lights. In October 1993 FAA told NTSB that it was evaluating loop technology as one of several different technologies for monitoring airport surface movement at lower activity airports. Loop technology was installed and tested at Long Beach airport in 1993. Congress appropriated $2 million in FY 1996 and another $1.9 million in FY 1998 to develop the prototype loop system at Long Beach airport. After 8 years, FAA has finally completed testing of loop technology at Long Beach airport and plans to issue a final report in the summer of 2001.

In September 2000, FAA issued a Broad Agency Announcement (BAA) to solicit ideas from industry to explore new and emerging lower cost technologies to improve surface safety in the near term. In February 2001,

FAA awarded contracts to five vendors to demonstrate technologies such as addressable signs and infrared and magnetic sensors that detect aircraft and vehicle movement on the ground. In May 2001, FAA issued a contract to another vendor to demonstrate runway safety lights to help pilots determine if it is safe to cross a runway. Field demonstrations are to be completed within a year of award. This BAA is a step in the right direction, but FAA must follow-through and complete its evaluations of these technologies.

Technologies to Help Pilots Prevent Runway Incursions Need to Be Expedited

Runway incursions caused by pilot error (pilot deviations), which represented 60 percent of the runway incursions in 2000, continue to be the leading cause of runway incursions. AMASS and ASDE-X are tools to help controllers prevent runway accidents, and they are limited to a total of 59 airports. Technologies such as in-cockpit moving map displays and ADS-B satellite navigation technology have the most potential for reducing runway incursions because they help pilots prevent runway incursions. However, these technologies are several years away from becoming fully operational unless efforts are made by FAA, the airline industry, and the general aviation community to expedite their use.

National Aeronautics and Space Administration (NASA), FAA, and the Cargo Airline Association (CAA) are assessing electronic moving map display technology to increase pilot situational awareness and help reduce pilot errors on runways and taxiways. This technology provides the pilot with a map of the airport on a cockpit display depicting the aircraft's exact location. A system will be available for the general aviation community by summer 2001 and a commercial variation will be available by winter 2001. The system is estimated to cost between $15,000 and $90,000, depending on whether the display is fully integrated with an aircraft's avionics. The moving map display is a promising first step in helping pilots know precisely where they are on the airport surface at all times. While FAA has decided not to mandate this equipment to the airline industry, FAA should aggressively promote this technology in the aviation industry as a vital first step in increasing flight crews' surface situational awareness.

The second step, which FAA is demonstrating in conjunction with CAA under FAA's Safe Flight 21 program, is to provide pilots, through the use of ADS-B satellite technology, a moving map display that shows where other aircraft are on the runways and taxiways. ADS-B differs significantly from other technologies because it creates a redundancy *("a second set of eyes")* by

including the pilot in the loop to help detect and alleviate hazardous surface situations. One drawback of this technology is that it requires all aircraft, including general aviation aircraft, to be equipped with this technology. Equipage of ADS-B technology may cost approximately $15,000 to $17,000 for each general aviation aircraft. A system for commercial cargo and air carrier aircraft is estimated to cost approximately $100,000. FAA officials do not think ADS-B technology will be ready for commissioning and full operational use for another 2 to 5 years depending on how long it takes to certify ADS-B.

FAA must expedite the use of these technologies. FAA should determine if its process to certify new equipment could be accelerated to expedite these technologies. FAA should also issue an Advanced Notice of Proposed Rulemaking to obtain comments from the airline industry and general aviation community on implementing in-cockpit moving map displays and ADS-B.

Oversight Authority and Accountability Over the Runway Safety Program Need to Be Strengthened

Another important factor constraining FAA's efforts to reverse the upward trend in runway incursions is the lack of accountability for completion of actions to reduce runway incursions. While FAA's Runway Safety Program Director is the single point of contact for all runway safety activities, the Director has little authority to ensure initiatives undertaken by various FAA lines of business are completed. FAA needs to provide the Director, who is under Air Traffic, with authority to ensure that employees from other lines of business complete tasks to reduce runway incursions on time. An accountability mechanism, such as directing the Runway Safety Program Director to provide input on individuals' performance appraisals and bonuses, should be developed to hold people involved with runway safety accountable for completing initiatives within established milestones. Consideration should be given to realigning the Runway Safety Program under FAA's Deputy Administrator office to elevate the program importance above all lines of business.

FAA Needs to Complete Actions to Reduce Runway Incursions On Time. FAA had not implemented 50 percent of the initiatives in its 1998 Airport Surface Operations Safety Action Plan with scheduled milestone dates through April 2000. For example, a project tasking the FAA Technical Center to work with aircraft operators and manufacturers to investigate technologies and procedures to improve aircraft lighting had not been completed.

In August 2000, FAA identified 10 initiatives most likely to reduce runway incursions in the near term. FAA included these 10 initiatives in its October 2000 National Blueprint to reduce runway incursions together with certain initiatives selected from its 1998 Action Plan. We evaluated the 10 initiatives and found that 4 were 6 to 12 months behind schedule. For example, an action to enhance operational tower controller training scheduled to be completed by December 31, 2000, is not expected to be completed until the beginning of October 2001 at the earliest. Officials from the Runway Safety Program Office attributed delays in meeting schedule to funds not being allocated in a timely manner and delays in forming workgroups assisting with completing initiatives.

FAA Needs to Measure the Effectiveness of Its Initiatives. While FAA has had three action plans to reduce runway incursions since 1991, it still is not determining whether its specific actions are working, or if other actions are needed. Runway Safety Program officials stated that FAA needs to improve its runway incursion data in order to determine why runway incursions occurred before it can evaluate whether initiatives to correct the identified causes are working.

In May 2000, FAA and industry officials on the Runway Incursion Joint Safety Analysis Team reported that FAA's current reports of operational errors, pilot deviations, and vehicle/pedestrian deviations are inadequate to readily determine why a particular incident occurred. The team recommended standardization and improvements to FAA's data collection and analysis efforts. In October 2000, FAA began developing a process to improve its runway incursion data collection, analysis and reporting.

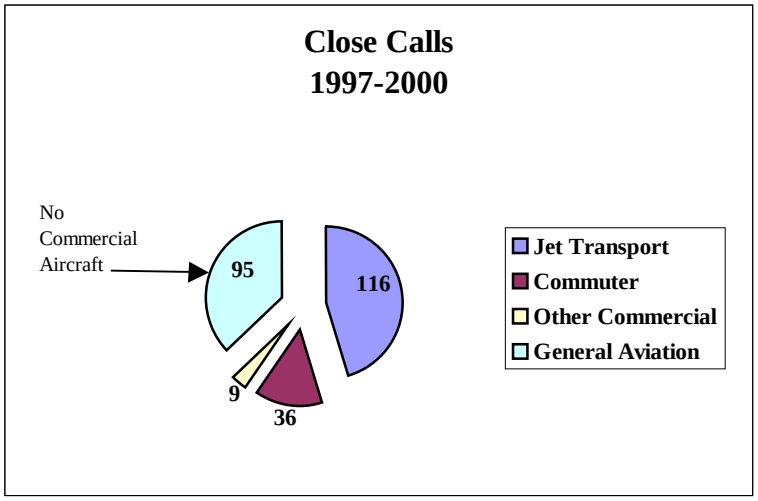
FAA is making progress in improving its runway incursion data. To its credit, FAA has evaluated over 1,369 runway incursions that occurred between 1997 and 2000, and grouped them into 4 risk categories. The four risk categories described in part are:

- A: barely avoid a collision,
- B: significant potential for a collision existed,
- C: ample time and distance exists to avoid a potential collision, and
- D: little or no risk of a collision exists.

FAA is planning to use these data to obtain a historical perspective and determine the causal factors contributing to runway incursions.

The data show that close calls (those runway incursions in levels A and B), totaling 256 over the 4-year period, have remained constant at between 59 to 66

close calls a year. The data also show that about 63 percent or 161 of close calls involve at least one commercial aircraft. The following chart shows the close calls between various types of aircraft.



FAA plans to implement its new runway incursion data system by the end of June 2001. Through its new process, FAA will identify and investigate those incursions where there was an increased risk of collision in order to identify the related causes and contributing factors and develop an effective prevention strategy. The system will also provide details such as aircraft type, airport location, and weather conditions. Once the data are improved, FAA needs to develop a method to evaluate its initiatives to ensure that its resources are focused in the right direction.

FAA Needs to Assess Regions' Progress in Reducing Runway Incursions. Before the new Regional Runway Safety Program Managers were hired in October 2000, we found that FAA's regional focus on local incursion prevention activities was inadequate.

- None of the five regional offices visited during the audit could provide any analyses of runway incursion trends at airports in the region to identify solutions for airport-specific problems.

- Surface Incident Prevention Plans, comprehensive plans that address the prevention of runway incursions and surface incidents[8] at specific airports, were not prepared for 5 of 11 airports visited.

[8] An event where authorized or unauthorized/unapproved movement occurs on the airport surface that affects or could affect the safety of flight.

- Two of five regions (Southern and Eastern Regions) visited did not adequately track the status of Runway Incursion Action Team evaluation recommendations or establish target dates to ensure timely completion.

We found that FAA recently strengthened regional efforts to reduce runway incursions, but needs to go farther. In October 2000, FAA hired nine new Regional Runway Safety Program Managers that will report directly to the Regional Administrator and indirectly to the Director of the Runway Safety Program at headquarters. The new managers will work runway incursion issues full-time unlike their predecessors who only performed the function as a collateral duty. These managers plan to direct evaluations on runway safety at 167 airports this year, over 140 more than last year. These efforts are steps in the right direction, as strong regional efforts are needed to identify and correct airport-specific problems. However, FAA must develop a mechanism to periodically assess whether the Regional Runway Safety Program Managers are making progress in correcting airport-specific problems and reducing runway incursions.

Recommendations

Our recommendations focus on what FAA needs to do to reverse the upward trend in runway incursions.

To ensure technologies are provided to airports with continued runway incursion problems, FAA should:

1. Expedite the use of in-cockpit moving map displays and ADS-B for use by pilots in reducing runway incursions. FAA should determine if its process to certify new equipment for safe operation could be accelerated to expedite these technologies. FAA should also issue an Advanced Notice of Proposed Rulemaking to obtain comments from the airline industry and general aviation community on implementing in-cockpit moving map displays and ADS-B.

2. Develop a realistic schedule to commission the remaining 32 AMASS sites. The current schedule is unlikely to be met unless time is allowed to ensure that Airway Facilities resources are adequate to commission the remaining sites and to ensure controller acceptance of AMASS.

3. Determine whether some airport needs for ASDE-X can be met by radar alone. After airport needs are identified, FAA should revise its ASDE-X cost and schedule baseline.

4. Complete its evaluations of the six emerging technologies it has identified to assist controllers and pilots in reducing runway incursions and advance to high risk airports the ones most likely to reduce runway incursions quickly.

5. Conduct reviews at the 13 airports that had 10 or more runway incursions over the past 4 years to determine whether technological solutions are needed.

To improve oversight authority and accountability over the Runway Safety Program, FAA should:

6. Provide the Runway Safety Program Director with authority to ensure that employees from other lines of business complete tasks to reduce runway incursions on time. An accountability mechanism, such as providing the Runway Safety Program Director with input on individuals' performance appraisals and bonuses, should be developed to hold people involved with runway safety accountable for completing initiatives within established milestones. Consideration should be given to realigning the Runway Safety Program under FAA's Deputy Administrator office to elevate the program importance above all lines of business.

To further facilitate accountability over the Runway Safety Program, FAA should:

7. Measure whether initiatives are effective in addressing the causes of runway incursions, and periodically assess regional efforts to ensure that progress is being made to reduce runway incursions at specific airports.

Agency Comments and Office of Inspector General Response

FAA promised to (1) reevaluate the schedule to commission the remaining AMASS sites by September 30, 2001; (2) reexamine airport needs for ASDE-X components by October 31, 2001; (3) complete an evaluation of the 6 emerging technologies to assist pilots and controllers in reducing runway incursions by September 30, 2002; and (4) complete technology reviews during calendar year 2002 at the 13 airports with high numbers of runway incursions. We considered these actions responsive to our recommendations.

FAA's proposed actions to expedite the use of in-cockpit moving map displays and ADS-B and to improve the authority and accountability of the Runway Safety Program Director are ambiguous. Also, it is not clear to us what milestones, if any, apply to implementing these recommendations. FAA needs to reconsider its position on both recommendations.

EXHIBIT A
(1 of 2)

Status and Funding of Runway Incursion Initiatives
(in millions)

Program	Status	Prior Years	FY 1999	FY 2000	FY 2001	Program Total
Airport Surface Detection Equipment-Model 3 (ASDE-3) provides radar surveillance of aircraft and airport service vehicles at high activity airports to aid in the orderly movement of aircraft and ground vehicles on the airport surface, especially during low or no visibility conditions.	Of the 40 systems, 36 of 38 systems are commissioned, plus 2 support systems. First system commissioned in 1993, last system is planned for October 2002.	$241	$5.6	$2.4	$4.0	$253
Low Cost Airport Surface Detection Equipment will aid in the orderly movement of aircraft and ground vehicles on the airport surface during low or no visibility conditions at low density airports not qualified to receive ASDE-3.	Three radars were evaluated between 1995 and 1999. No additional funding has been identified for this program because the radars did not meet reliability and maintainability requirements.	$5.0				$5.0
Airport Surface Detection Equipment- Model X (ASDE-X) will provide high resolution, short-range, clutter free surveillance information about aircraft and vehicles, both moving and fixed, located on or near the surface of the airport movement area under all weather and visibility conditions.	FAA signed a contract for 25 plus 4 support ASDE-X systems in October 2000. First site planned for FY2003 and the last site for FY2007.			$7.6	$8.4	$16.0
Airport Movement Area Safety System (AMASS) is an enhancement to the Airport Surface Detection Equipment-Model 3 radar to provide air traffic controllers with automated alerts and warnings of potential runway accidents.	Of the 40 systems, 39 have been delivered, 2 are support systems. An In-Service decision meeting was held in May 2001. AMASS was commissioned at San Francisco and Detroit June 2001. FAA plans to commission 31 additional sites by November 2002.	$64.4	$9.8	$18.2	$20.6	$113.0
Surface Inductive Loop Technology provides a prototype system that will classify, track, and record aircraft and ground vehicle movement on taxiways and runways.	Long Beach airport has completed testing and the final report is due summer of 2001.	$3.9		$0.25		$4.15

EXHIBIT A
(2of 2)

Status and Funding of Runway Incursion Initiatives (in millions)

Program	Status	Prior Years	FY 1999	FY 2000	FY 2001	Program Total
Runway Incursion Reduction Program is designed to provide air traffic controllers, surface vehicle operators, and pilots with situational awareness, incursion monitoring and alerting information.	Program started in 1997. FAA continues to assess and validate several technologies performance and demonstrate the surface surveillance infrastructure capabilities at DFW airport.	$5.9	$3.2	$1.9	$11.5	$22.5
Airport Target Identification System (ATIDS) will provide controllers with aircraft/vehicle identification and position on the airport movement area and in selected ramp and gate areas to augment existing Airport Surface Detection Equipment/Airport Movement Area Safety Systems. NASA's Low-Visibility and Surface Operations demonstration project is part of this system.	Program started in 1992. Since that time program was rolled into Runway Incursion Reduction Program. Work has begun on the installation of ATIDS on the west side of the Dallas/ Fort Worth airport.	$4.0				$4.0
Runway Safety Program provides a single focus to integrate and coordinate activities to reduce surface incidents, runway incursions and accidents within FAA and external organizations.	Runway Safety Program Office developed 10 near-term initiatives to address runway incursion problems. Additionally, a Runway Safety National Blueprint was developed in October 2000.			$3.3	$8.1	$11.4
Total		$324.2	$18.6	$33.65	$52.6	$429.05

EXHIBIT B

Audit Methodology

We evaluated FAA's process for identifying and commissioning technologies to reduce runway incursions. We also interviewed aviation industry officials to obtain their views on technologies and other methods to assist with the reduction of runway incursions. We analyzed runway incursions from 1997 to 2000 and determined the top airports with a total of 10 or more. We compared these airports to airports designated for AMASS or ASDE-X and identified those airports not designated to receive any technology. Additionally, we reviewed FAA's data collection and evaluation process to determine runway incursion causal factors. Finally, we discussed technology-based initiatives for the prevention of runway incursions with various vendors. See Exhibit F for a listing of FAA, contractors, and industry associations contacted.

To determine whether FAA completed our prior recommendations, we interviewed FAA's Runway Safety Program officials to determine what actions were undertaken to address the recommendations. To evaluate the adequacy of completion of actions in the 1998 Action Plan and other initiatives, we analyzed support documentation provided by FAA to verify implementation of initiatives. In addition, we determined the status of 10 initiatives established in August 2000 most likely to reduce runway incursions in the near-term.

We conducted the audit at FAA Headquarters in Washington, DC, 5 regions, and 13 airport facilities. The review was conducted in accordance with the Government Auditing Standards prescribed by the Comptroller General of the United States.

EXHIBIT C

Status of Prior Recommendations as of March 2001

REPORT	RECOMMENDATIONS TO BE IMPLEMENTED	FAA'S CURRENT STATUS
Report on Audit of the Runway Incursion Program (Report Number AV-1998-075, February 9, 1998)	1. Implement specific responsibilities to oversee and coordinate initiatives and projects in the plan at the Headquarters and regional levels.	1. FAA is revising its Runway Safety Program order from an Air Traffic to an FAA-wide order to institute better National and Regional controls. Planned completion has yet to be determined.
	2. Institute controls to ensure accurate runway incursion data, and collect and analyze data on the type of aircraft operations involved in operational errors and vehicle/pedestrian deviations on the runways. Use NASA's runway transgression data to aid in identifying potential problem airports.	2. FAA is currently revising its process for collecting, analyzing, and reporting runway incursion data. Expected completion date is June 2001.
	3. Establish regional focal points to analyze data to ensure that resources are focused on causes of runway incursions. Require regional focal points to implement local action plans directed at airport-specific incursion problems.	3. FAA hired nine new regional runway safety program managers to focus on implementing regional initiatives. However, FAA has yet to develop a system to assess regional efforts.
	4. Require regional offices to periodically analyze runway incursion data for their airports.	4. See status of # 1.
Report on Follow-up Review of FAA's Runway Safety Program (Report Number AV-1999-114, July 21, 1999)	1. Establish central oversight authority to ensure follow-through on initiatives in the Action Plan to reduce runway incursions.	1. FAA included all outstanding initiatives in the 1998 Action Plan into its National Blue Print in October 2000. However, FAA has yet to develop a system to monitor implementation.
	2. Develop operating procedures for regional focal points, surface incident prevention plans, and controls for ensuring the accuracy of runway incursion data, by finalizing its Runway Safety Program standard operating procedures.	2. FAA is revising its Runway Safety Program order from an Air Traffic to an FAA-wide order to institute better National and Regional controls. Planned completion has yet to be determined.

EXHIBIT D

Status of 10 Near-Term Initiatives as of April 2001

Actions Related to FAA Runway Safety Program Management and Procedural Changes	**Target Date**	**Revised Date**	**Status/ Remarks**
1. Review pilot/controller communications phraseology. Reduce surface incidents by improving, via condensing, modifying, or eliminating, surface related pilot/controller phraseology and associated procedures.	12/31/00	12/31/01	12 months behind schedule
Actions Related to Pilot Education, Training, and Incursion Awareness	**Target Date**	**Revised Date**	**Status/ Remarks**
1. Foreign air carrier pilot training, education, and awareness. Develop and promote a runway incursion educational awareness program for Part 129 foreign air carriers in order to promote an enhanced awareness of runway safety and incursion prevention throughout the foreign air carrier community.	4/01/01	9/30/01	6 months behind schedule
2. Education, training, and awareness for pilots, controllers, and vehicle operators.	6/30/01		On schedule
3. Improved pilot evaluation and testing. Require all pilot check (certification) flights to evaluate ground operations performance and test for knowledge of airport signs, lighting, and markings.	4/01/01		On schedule
Actions to Aid Controllers Including Technology-Based Initiatives	**Target Date**	**Revised Date**	**Status/ Remarks**
1. Enhanced operational tower controller training. Reduce runway incursions and related surface incidents associated with operational errors by developing enhanced training tools and techniques to enhance focus during controller training on "anticipated separation" and "prioritization of control actions".	12/31/00	10/01/01 to 12/31/01	10 to 12 months behind schedule
2. Memory enhancement techniques training for tower controllers. In an effort to reduce runway incursions, formal memory training on ways to enhance working memory is needed.	1/01/01	7/01/01 to 9/30/01	7 to 9 months behind schedule
3. Air Traffic Teamwork Enhancement (ATTE) training for tower controllers. At least one prior study concluded that there is a strong correlation between teamwork, or more precisely a lack of teamwork, and the occurrence of operational errors.	3/01/01	5/31/01	Complete
4. Technology assessment. Implement a more effective method of identifying and assessing new and emerging surface technologies. FAA completed initial action. FAA will be assessing technologies over the next 12 months.	2/28/01		Complete/Ongoing
Actions to Improve Airport Surface Facilities, Design, and Operations	**Target Date**	**Revised Date**	**Status/ Remarks**
1. Advisory circular for airport surface operations. To reduce runway incursion accidents/incidents by finalizing and publishing an advisory circular that emphasizes "Best Practices" for airport surface operations.	12/31/00	5/31/01	FAA plans to issue this circular in June 2001.
2. Airport markings. To reduce runway incursion accidents/incidents and enhance the safe and efficient movement of aircraft by increasing the visibility of runway hold line markings, improving flight crew/vehicular operator recognition.	1/01/01		Complete

EXHIBIT E

Airports With a Total of 10 or More Runway Incursions From 1997 to 2000

Overall Rank	LOCATION	LOC ID	1997	1998	1999	2000	TOTAL	AMASS*	ASDE-X**
1	Los Angeles	LAX	3	12	10	8	33	Aug-01	
2	St Louis	STL	8	9	7	6	30	Jul-01	
3	Orange County	SNA	8	3	9	7	27		X
4	North Las Vegas	VGT	2	4	3	17	26		
5	Long Beach	LGB	7	4	6	8	25		
6	Dallas-Ft Worth	DFW	8	5	7	3	23	Sep-02	
7	San Francisco	SFO	6	4	7	4	21	Jun-01	
8	San Diego/Mont	MYF	1	5	5	9	20		
9	Ft Lauderdale Exec	FXE	3	3	5	9	20		
10	Phoenix	PHX	4	7	3	6	20		X
11	Newark	EWR	2	8	3	5	18	Nov-01	
12	Merrill Field	MRI	7	2	0	8	17		
13	Chicago O'Hare	ORD	3	4	6	4	17	Sep-01	
14	Boston	BOS	1	4	3	8	16	Oct-01	
15	Cleveland	CLE	6	6	3	1	16	Oct-01	
16	Midway	MDW	2	5	5	4	16		X
17	San Jose	SJC	4	5	2	5	16		X
18	Deer Valley	DVT	6	5	2	2	15		
19	Daytona Beach	DAB	2	3	6	3	14		
20	Minneapolis	MSP	6	2	3	3	14	Jan-02	
21	San Antonio	SAT	4	4	4	2	14		X
22	Teterboro	TEB	4	2	3	5	14		
23	Atlanta	ATL	2	2	6	3	13	Jul-01	
24	Las Vegas	LAS	2	5	4	2	13	Jul-02	
25	Concord	CCR	0	1	3	7	11		
26	Detroit Metro	DTW	2	6	1	2	11	Jun-01	
27	J F Kennedy	JFK	4	2	5	0	11	Feb-02	
28	LaGuardia	LGA	3	3	2	3	11	Oct-02	
29	Milwaukee	MKE	1	4	3	3	11		X
30	Providence	PVD	0	2	5	4	11		X
31	Santa Barbara	SBA	2	1	2	6	11		
32	Centennial	APA	1	3	4	2	10		
33	Burbank	BUR	4	3	1	2	10		X
34	Flying Cloud	FCM	2	2	4	2	10		
35	Crystal	MIC	1	3	4	2	10		
36	Philadelphia	PHL	1	5	1	3	10	Jul-02	
37	Salt Lake City	SLC	2	1	3	4	10	Sep-01	

* AMASS commissioning dates.

**The exact dates for commissioning ASDE-X have not been determined

Note: The highlighted airports are not currently scheduled to receive any technology.

EXHIBIT F
(1 of 2)

Organizations Visited or Contacted

Federal Aviation Administration

FAA Headquarters, Washington, DC
Western-Pacific Region Headquarters, Los Angeles, CA
Great Lakes Region Headquarters, Chicago, IL
New England Region Headquarters, Boston, MA
Southern Region Headquarters, Atlanta, GA
Eastern Region Headquarters, New York, NY
Technical Center, Atlantic City, NJ
Volpe Center, Boston, MA

Airports

Los Angeles International Airport
John Wayne Airport Orange County
Long Beach Municipal Airport
Montgomery Field Airport
San Francisco International Airport
Chicago O'Hare International Airport
Chicago Midway Airport
Detroit Metropolitan Wayne County
Hartsfield Atlanta International Airport
Daytona Beach Regional Airport
John F. Kennedy International Airport
Logan International Airport
T. F. Green State Airport

Contractors and Industry Associations

Thomson CSF-Detexis, Washington, DC
ARINC, Annapolis, MD
ADB, Inc., A Seimens Company
Raytheon, Inc.
Sensis Corporation
Northrop Grumman
United Parcel Service
Cargo Airline Association

EXHIBIT F
(2 of 2)

National Air Traffic Controllers Association
American Association of Airport Executives
Air Transport Association
Aircraft Owners and Pilots Association
Professional Airways Systems Specialists
Air Line Pilots Association

EXHIBIT G

Major Contributors to This Report

The following Office of Inspector General staff contributed to this report.

Richard Kaplan	Program Director
Kevin Dorsey	Project Manager
Robert Drake	Engineer
John Crowson	Senior Auditor
Tanya Rucker	Analyst
Hezekiah Hayes	Analyst

U.S. Department
of Transportation
Federal Aviation Administration

Memorandum

Subject: **INFORMATION:** Further Actions Are Needed to Reduce Runway Incursions

Date: JUN 21, 2001

From: Assistant Administrator for Financial Services/CFO

Reply to Attn. of:

To: Assistant Inspector General for Auditing

As requested in your memorandum dated June 14, attached are the Federal Aviation Administration's (FAA) comments, to the subject report, which include specific actions taken or planned for each recommendation and estimated completion dates.

If you have questions or need further information, please contact Anthony Williams, Budget Policy Division, ABU-100. He can be reached at (202) 267-9000.

Chris Bertram

Attachment

Federal Aviation Administration (FAA) Response to the Office of Inspector General Report Further Actions Are Needed to Reduce Runway Incursions

1. **OIG Recommendation**: Expedite the use of in-cockpit moving map displays and ADS-B for use by pilots in reducing runway incursions. FAA should determine if its process to certify new equipment for safe operation could be accelerated to expedite these technologies. FAA should also issue an Advanced Notice of Proposed Rulemaking to obtain comments from the airline industry and general aviation community on implementing in-cockpit moving map displays and ADS-B.

FAA Response: Partially concur.

a. The FAA is taking many steps to accelerate the development and operational availability of in-cockpit moving map displays. The FAA is working with United Parcel Service Aviation Technologies (UPSAT) to approve a Supplementary Type Certificate (STC) for a cockpit moving map display called Cockpit Display of Traffic Information (CDTI) display. The project is on schedule and will be completed in January 2002. The FAA is also establishing an agreement with UPSAT to delineate its long-term goals for these technologies and lay out the complete schedule for certification and operational approvals of ADS-B and CDTI projects. By establishing the end-state goals and completing the safety assessment for the end-state project, the FAA and UPSAT can ensure that operational approval of the system is completed in the quickest and most efficient manner. The criteria to certify the UPS system can be applied to other similar systems developed by other applicants.

b. FAA has two existing methods to obtain airline industry and general aviation comments on moving map displays and ADS-B. Safer Skies is one forum where industry and FAA are working to prioritize the safety interventions that will reduce the accident rate five-fold by 2007. Determining the role of new technology, including moving maps and ADS-B, in accomplishing that goal is a key focus for the Safer Skies work groups. The Safe Flight 21 program also serves as a government-industry forum, which allows FAA to coordinate ADS-B operational demonstaration/validations with commercial and general aviation interests. Through these industry groups, we will determine when to proceed with an ANPRM.

2. **OIG Recommendation**: Develop a realistic schedule to commission the remaining 32 AMASS sites. The current schedule is unlikely to be met unless Airway Facilities resources are adequate to commission the remaining sites and time is allowed to ensure controller acceptance of AMASS.

FAA Response: Partially concur. The FAA will reevaluate the schedule to commission the remaining AMASS sites by September 30.

3. **OIG Recommendation**: Determine whether some airport needs for ASDE-X can be met by radar alone. After airport needs are identified, FAA should revise its ASDE-X cost and schedule baseline.

FAA Response: Partially concur. The FAA is reexamining airport needs for ASDE-X components required to meet the particular needs of individual airports. We will report by October 31.

4. **OIG Recommendation**: Complete its evaluations of the six emerging technologies it has identified to assist controllers and pilots in reducing runway incursions and advance the ones most likely to reduce runway incursions quickly to high-risk airports.

FAA Response: Concur. The FAA will complete evaluation of the six emerging technologies and issue a report of findings and recommendations by September 30, 2002.

5. **OIG Recommendation**: Conduct reviews at the 13 airports that had 10 or more runway incursions over the past 4 years to determine whether technological solutions are needed.

FAA Response: Concur. We will complete technology reviews during calendar year 2002 at the 13 airports that had 10 or more runway incursions during the four-year study (1997-2000) and are not receiving AMASS or ASDE-X.

6. **OIG Recommendation**: Provide the Runway Safety Program Director with authority to ensure that employees from other lines of business complete tasks to reduce runway incursions on time. An accountability mechanism, such as directing the Runway Safety Program Director to provide input on individuals' performance appraisals and bonuses, should be developed to hold people involved with runway safety accountable for completing initiatives within established milestones. Consideration should be given to realigning the Runway Safety Program under FAA's Deputy Administrator office to elevate the program importance above all lines of business.

FAA Response: Partially concur. We will ensure that this recommendation is evaluated as a part of the ongoing administrative review surrounding the development of the Performance-Based Organization.

7. **OIG Recommendation**: Measure whether initiatives are effective in addressing the causes of runway incursions, and periodically assess regional efforts to ensure that progress is being made to reduce runway incursions at specific airports.

FAA Response: Concur. Several actions are already ongoing, including:

a. publication of our recent report on severity trends from 1997 to 2000 by Booz-Allen-Hamilton;

b. completion of a MITRE report on causal factors is underway and is scheduled for completion in September, 2001;
c. Quarterly Program Reviews that we conduct with our Regional Runway Safety Program Managers;
d. standardization of Runway Incursion Action Team visits conducted by the nine FAA Regional Runway Safety teams;
e. development of Web-based and other data systems to improve program management.
f. Additionally, efforts are planned for FY02 to develop improved runway safety metrics.

Appendix B:
Letter to Regional Runway Safety Program Managers from ARI-1

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

Memorandum

Subject: ACTION: Runway Incursion Airport Technical Assessments

Date: JAN 1 6 2002

From: Director, Office of Runway Safety, ARI-1

Reply to Attn. of:

THRU: Regional Administrators

To:

Regional Runway Safety
Program Managers

As most of you know, the Office of Inspector General (OIG) recommended in its June 2001 report, that the Federal Aviation Administration (FAA) conduct a technical assessment at thirteen airports with ten or more runway incursions (1997-2000) that were not scheduled to receive ASDE-3/AMASS. Three additional airports were added to the list due to issues raised after the OIG issued its report. A list of these airports is attached.

The purpose of the assessments is to evaluate the airport's runway incursion history and operations to determine if there are potential technology solutions that are currently under evaluation that may assist in improving runway safety at these airports. The assessment includes a review of runway incursion data, airport diagrams, runway safety action team (RSAT) reports, and any other pertinent information. A report is generated at the completion of each visit.

I have chartered a team that is being led by the Surface Technology Assessment Product Team (AND-520), to conduct these assessments. The Team also includes members from the Office of Runway Safety and the National Air Traffic Controllers Association. You are a very important member of this team as well, and I recommend that you attend the assessments that will be conducted in your respective regions. I have requested that the Technical Assessment Team coordinate all visits with the appropriate Regional Runway Safety Program Manager.

To date, seven of the sixteen airports have been visited and reports have either been prepared or are currently being prepared. Assessments remain to be conducted in the following regions:

Southern (1), Western-Pacific (5), Great Lakes (2), Eastern (1), Northwest Mountain (1)

You will be contacted by the AND-520 Assessment Team Lead on planned dates for all future visits. All assessments will be completed by December 2002.

I ask for your continued support and cooperation in these very important technology assessments. If there are any questions, please contact Arthur Sullivan.

for John Fallmat

William Davis

Attachment

Appendix C:
Runway Incursion Definitions

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DEFINITIONS

- A surface incident (SI) is defined as "an event during which 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."

- A runway incursion (RI) is defined 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 takeoff, landing, or intending to land."

- An occurrence is further defined as:

    - A pilot deviation (PD) - any action of a pilot that results in violation of a Federal Aviation Regulation.
    - An operational error (OE) is an occurrence attributable to an element of the ATC system which results in:
        - less than the applicable separation minimum between two or more aircraft and obstacles. Obstacles include vehicles, equipment, and personnel on runways;
        - an aircraft landing or departing on a runway closed to aircraft after receiving air traffic authorization.
    - A vehicle or pedestrian deviation (VPD) results from a vehicle operator, non pilot operator of an aircraft, or pedestrian who deviates onto the movement area, including the runway, without ATC authorization.

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Appendix D:
TAT Presentation to Airports

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RUNWAY INCURSION AIRPORT ASSESSMENT

Runway Incursion Airport Assessment Team

Sarasota – Bradenton International, FL

August 1, 2002

Who and Why We Are Here

- Runway Incursion Assessment Team
  - AND-520
  - ARI
  - NATCA
  - RSP
  - Local Airport Authority
  - Local Air Traffic Representative
  - Others
- Chartered by Director of Runway Safety Office, ARI-1, to conduct surveys at top non-ASDE runway incursion airports :
  - Responsive to IG recommendations
  - Identify technology interventions as appropriate
  - Focus on solutions that provide direct warning to aircrews
  - Fast track development and in-situ hardening of solutions
- Potential technology solutions from AND-520 R&D

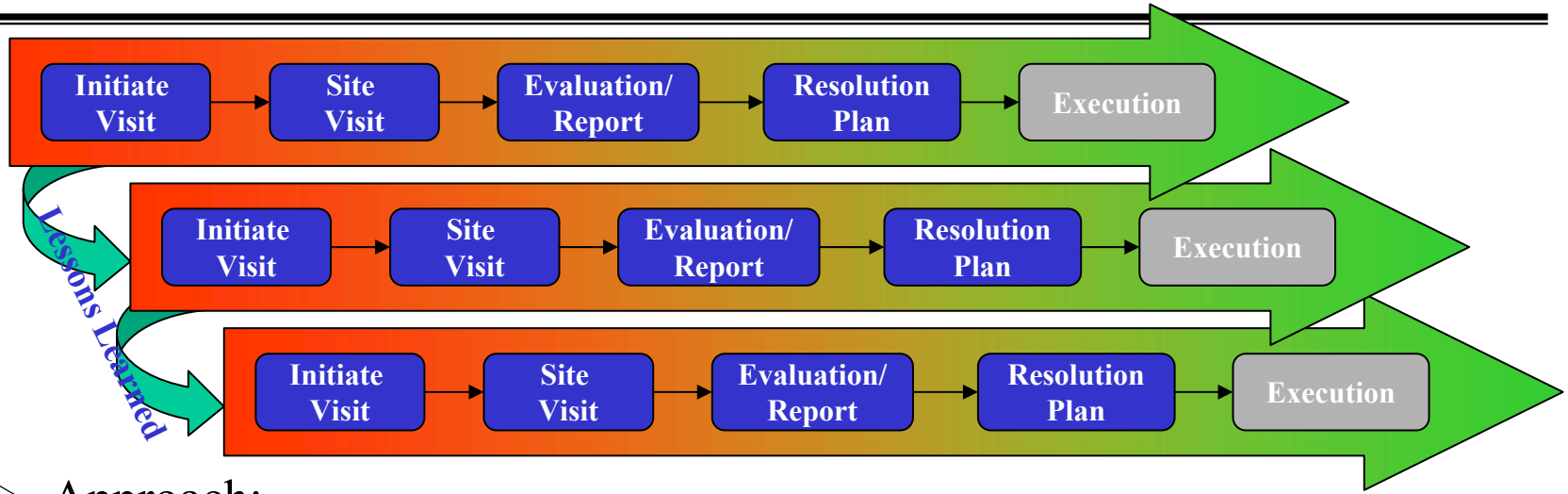
Purpose of Meeting

- Conduct two-way interchange to gain better understanding of local runway incursion causal factors
- Gain insight to local runway incursion reduction initiatives
- Discuss potential for technology solutions(s) to mitigate causal factors
- Describe current and near future AND surface technology projects

Drivers

- NTSB safety recommendation (July 2000)
  - A-00-66: "Require, **at all airports with scheduled passenger service, a ground movement safety system** that will prevent runway incursions; the system should provide a **direct warning capability to flight crews**. In addition, **demonstrate** through computer simulations or other means that the system, in fact, prevent incursions."
- FAA Ten Initiatives for Reducing Runway Incursions (August 2000): Number 10 Technology Assessment
  - "Purpose: Implement a more effective method of **identifying and assessing new an emerging surface technologies**. A broad Agency Announcement (BAA) requesting information on potential technologies that will improve runway safety."
- FAA response to IG Report (May 2001)
  - **Conduct review at airports with 10 or more runway incursions** over the last four years to determine need for technology solutions
- NTSB letter to Congress (August 2001)
  - "Need for immediate action"

Process and Approach



- Approach:
  - Identify target airports (16 total in 2002)
  - Analyze site specific configurations and RI data
  - Conduct site surveys and issue analysis reports with recommendations
- ARI identified sites (RIs from 1997-2000)

Airport	RI	Airport	RI	Airport	RI
North Las Vegas *	26	Deer Valley	15	Centennial	10
Long Beach *	25	Daytona Beach *	14	Flying Cloud *	10
San Diego/Mont *	20	Teterboro	14	Sarasota	7
Ft. Lauderdale Exec *	20	Concord *	11	Fairbanks *	2
Merrill Field *	17	Santa Barbara *	11	Knoxville Tyson *	8
Crystal Airport *	10				

* Airports surveyed

Runway Incursion Airport Assessment Team

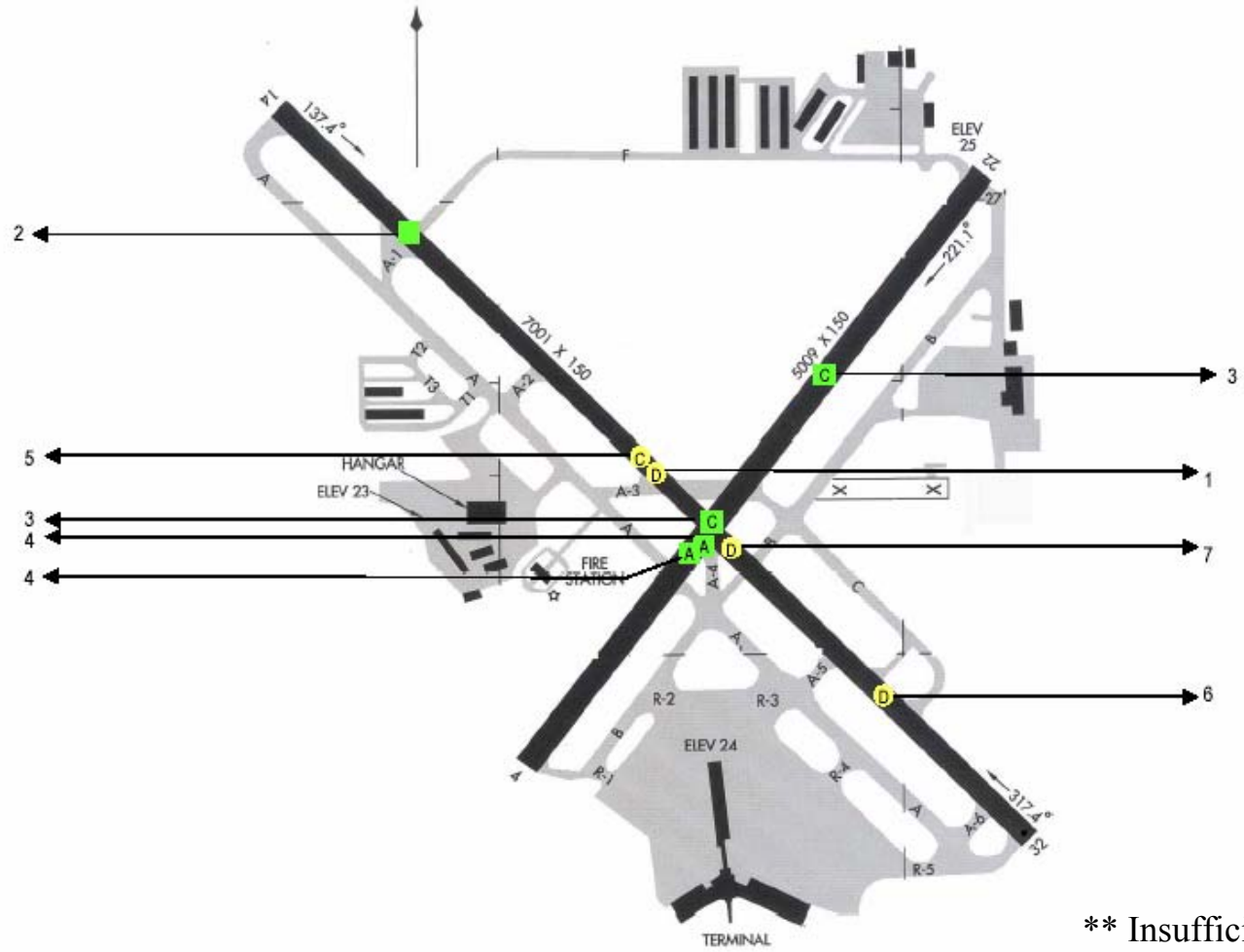
Process and Approach (cont'd)

- Perform assessment
- Make recommendation to management
- Draft report
- As appropriated:
  - Draft Implementation Plan
  - Follow up meeting
  - Initiate resolution

AND-520 - Current Program Thrusts

- Surface movement sensors
  - Inductive loop and magnetic checkpoint
  - Microwave motion sensors
  - Multilateration
- Visual guidance tools
  - Runway Status Lights (RWSL)
  - Hold-bar enhancement
    - » Laser and embedded light emitting diode (LED) strips
  - Flashing precision approach path indicator (PAPI)
- Other pilot aids for surface navigation
  - Ground Marker Beacon

Runway Incursions at SRQ



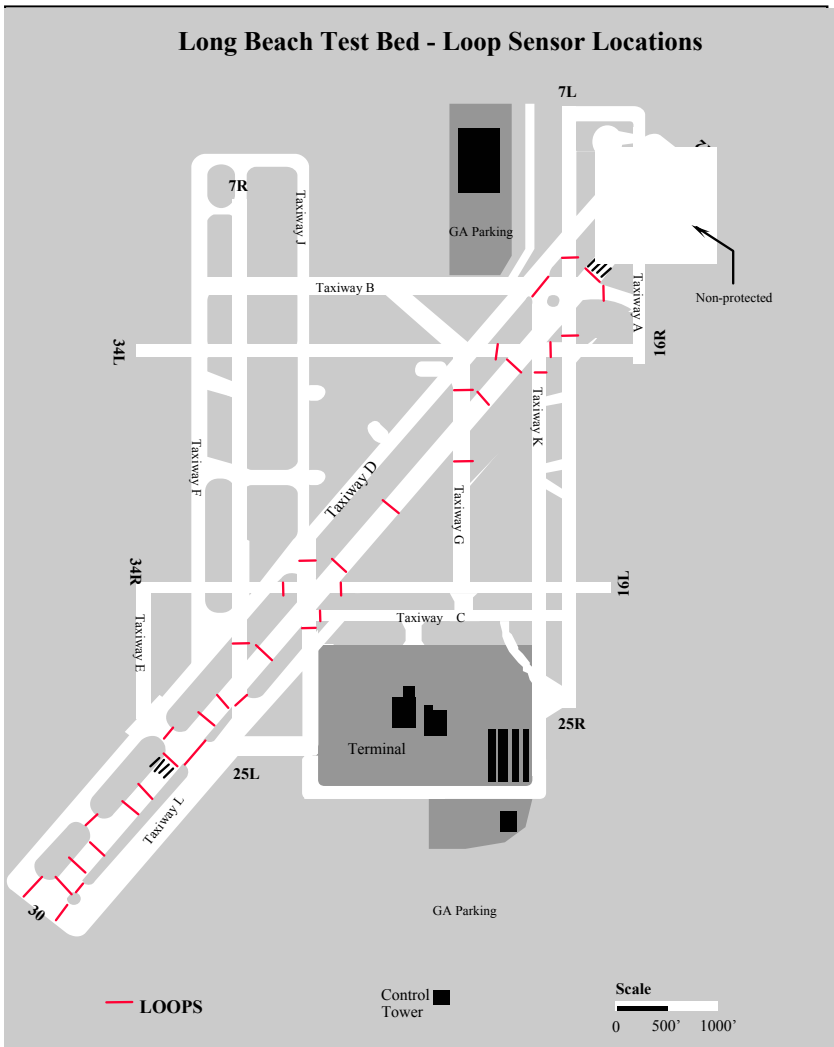
Key Locator	REPORT	RI Type	RI Category
1	PSOTSRQ97001	PD	D
2	SRQ-T-00-E-001	OE	Accident
3	SRQ-T-97-E-001**	OE	C
4	SRQ-T-97-E-002	OE	A
5	PSOTSRQ00001	PD	C
6	PSOTSRQ00003	PD	D
7	PSOTSRQ00A02	PD	D

** Insufficient data to determine exact location. Location estimated based upon available data.

Core Team Members

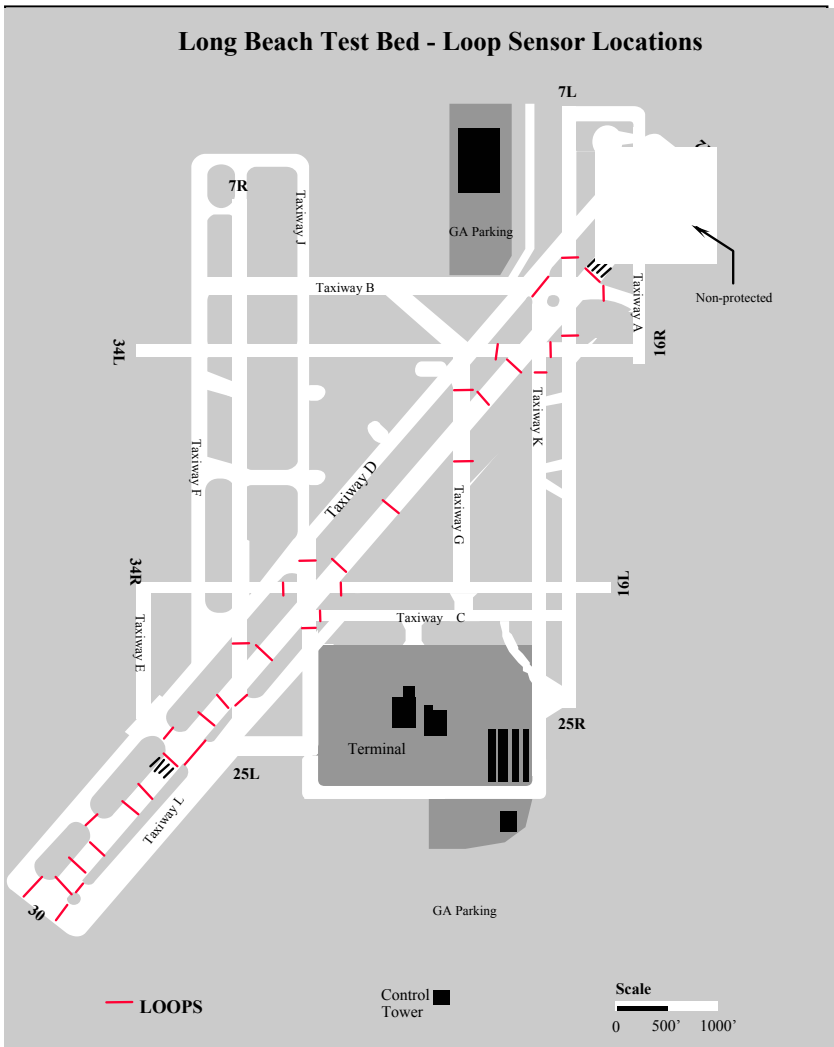
- AND-520:
  - Thien Ngo, 202-493-5012, Thien.Ngo@faa.gov
- ARI:
  - Fong Lee, 202-385-4768, Fong.Lee@faa.gov
- NATCA:
  - Dennis McGee, 214-641-3000, Dennis.McGee@faa.gov
  - Mike Ryan, 202-493-5089, Mike.Ryan@faa.gov
- RSP:
  - Anna Cohen, 404-305-5558, Anna.Cohen@faa.gov
- Local Airport Manager
- Local Air Traffic Representative

Inductive Loop Technology (LOT)



- Purpose
  - Evaluate effectiveness of non-radar based sensors for surface applications
- Approach
  - Technical assessment of LOT detection and tracking performance
  - Several applications examined
    - » Runway encapsulation
    - » Runway/taxiway intersection
    - » Blind spot monitoring
  - Determine and recommend cost-beneficial applications

Inductive Loop Technology (LOT) (cont'd)



- Status
  - Technical and Controller assessments concluded
    - » Reports on September and November 2001
  - Conclusions:
    - » Viable blind spot and intersection monitoring aid
    - » Runway encapsulation application not viable in its present form
    - » Considerable system engineering and Computer Human Interface (CHI) rework required

BAA Activities

- Purpose
  - Respond to Runway Safety Summit Initiative # 10: **"Implement a more effective method of identifying and assessing new and emerging surface technologies"**
- Approach
  - Issue Surface Technology Broad Agency Announcement (BAA): Explore new and emerging, lower cost technology solutions
  - Demonstrate technical feasibility of proposed technology
  - Proceed to technology/solution development phase based on operational transition potential

BAA Activities (cont'd)

- Status
  - Six demonstration contracts awarded (summary on next slide)
    - » Five demonstrations completed to date
      - – Reports being generated
    - » **Two of five technologies offer viable solutions**
  - Follow-on BAA for vehicle tracking system demonstration in process
    - » Resolving AGC solicitation review comments
  - Flashing PAPI demonstration contract awarded
  - Embedded LED visual guidance products in process
    - » Delayed to incorporate change requested by ARI

BAA Activities (cont'd)

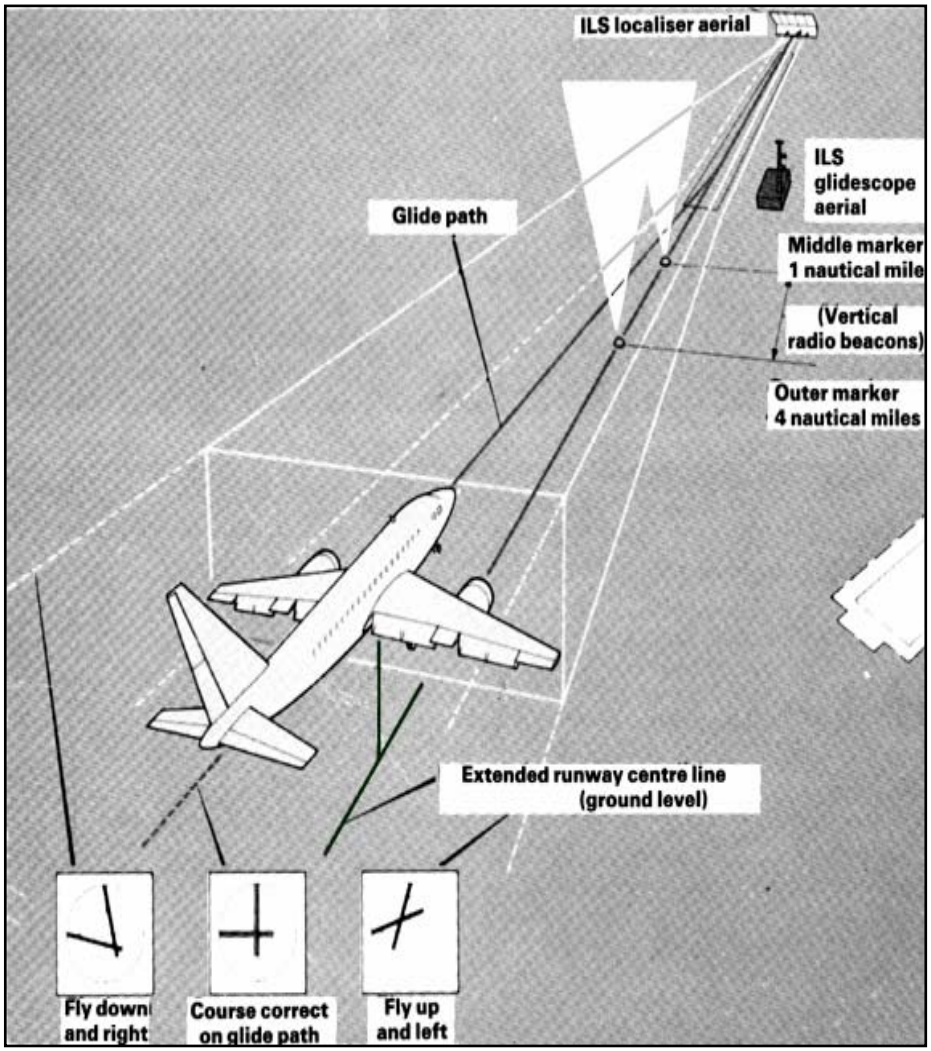
Summary of BAA Contracts

Technology/Product	Contractor	Site	Status
Multilateration/IR Sensor Fusion	Sensis and Tri-Space	Memphis, TN	**Demonstration conducted in August and October 2001. Final report: January 31, 2002.**
Magnetic Sensors	Honeywell	Minneapolis, MN	**Demonstration conducted in October 2001. Final report: January 31, 2002.**
GPS/RF Data Link Vehicle Tracking	Veridian Engineering	Warminster, PA	**Demonstration conducted in December 2001. Final report: January 31, 2002.**
Ground Marker	Airspec	WJHTC	**Demonstration conducted in November 2001. Final report: January 31, 2002.**
Addressable Signs/SmartBoard	Technology Planning Inc.	College Park Maryland Airport	**Demonstration conducted in October 2001. Final report: January 31, 2002.**
Radar guns and Runway Status Lights	Architecture Technology Corporation	Long Beach, CA	**Demonstration scheduled for May 2002**

RIRP BAA- Airspec Ground Marker

- Technology/product
  - Ground Marker digital radios
- Purpose
  - Demonstrate technical feasibility and operational suitability of using ground marker channel for disseminating automated airport location advisories to aircrew
- Demonstration requirements
  - Optimize radio transmitter deployment to minimize interference
    - » ILS components and other ground marker voice transmitters
  - Assess human factor issues

RIRP BAA - Airspec Ground Marker (cont'd)



- Ground Marker Overview
  - Instrument Landing System (ILS) basics
    - » Successive markers of distance to runway for aircraft on final approach
    - » Ground infrastructure consists of 75 Mhz radio beacon transmitter
    - » On-board equipment consists of 75 Mhz radio receiver

RIRP BAA - Airspec Ground Marker (cont'd)

- Ground Marker Overview (cont'd)
  - Cellular array of low power 75 Mhz vertical radio beacon transmitters
  - Extends ILS marker concept to provide surface navigation aid for aircrews
  - Ground marker in the form of digital voice message received on 75 Mhz marker receiver
    - » e.g. **"TAXIWAY C APPROACHING 27L"**
  - Low technology risk
    - » No new avionics required
    - » Functional upgrade path

RIRP BAA- Technology Planning, Inc. Addressable Signs

- Product/Technology
  - Low cost electronic message boards installed at airport surface movement areas
  - Sensor driven (i.e. loops)
  - Each board is wirelessly addressable
  - Message can be changed
  - Not a replacement of existing signage
- Objective
  - To raise pilot/user situation awareness (information only – NO controller messages)

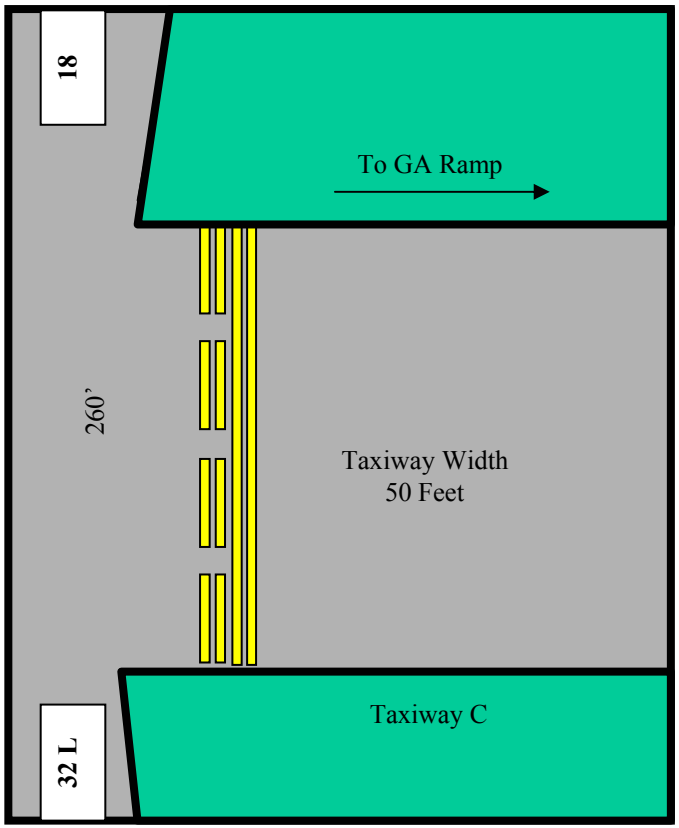
RIRP BAA- Technology Planning, Inc.
Addressable Signs (cont'd)

RIRP - Special Projects

- Microwave motion sensors
  - Purpose
    - » Evaluate technical and performance characteristic of commercial off the shelf (COTS) sensor developed by MSI, Inc.
    - » Assess suitability for surface applications
  - Approach
    - » Conduct tests (laboratory and field) to verify performance, per manufacturer's specification
    - » Determine field installation requirements
    - » Conduct field test to determine operational suitability
  - Status
    - » Initial technical assessment conducted at Omaha Eppley Field: August 27-31, 2001
      - – Motion sensors potentially viable for isolated surveillance applications
    - » Follow-on operational evaluation in conjunction with embedded LED products planned during May-June 2002

Special Projects (cont'd)

- LED to enhance hold line application to be tested at Omaha



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Appendix E:
Airport Site Surveys

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FAA/Denver Centennial Airport (APA) Runway Incursion Airport Assessment Meeting
June 18, 2002

Purpose

Federal Aviation Administration (FAA) Technology Assessment Team visited Denver Centennial airport (APA) on June 18, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. APA air traffic management and airport management personnel attended the meeting. The discussion included:

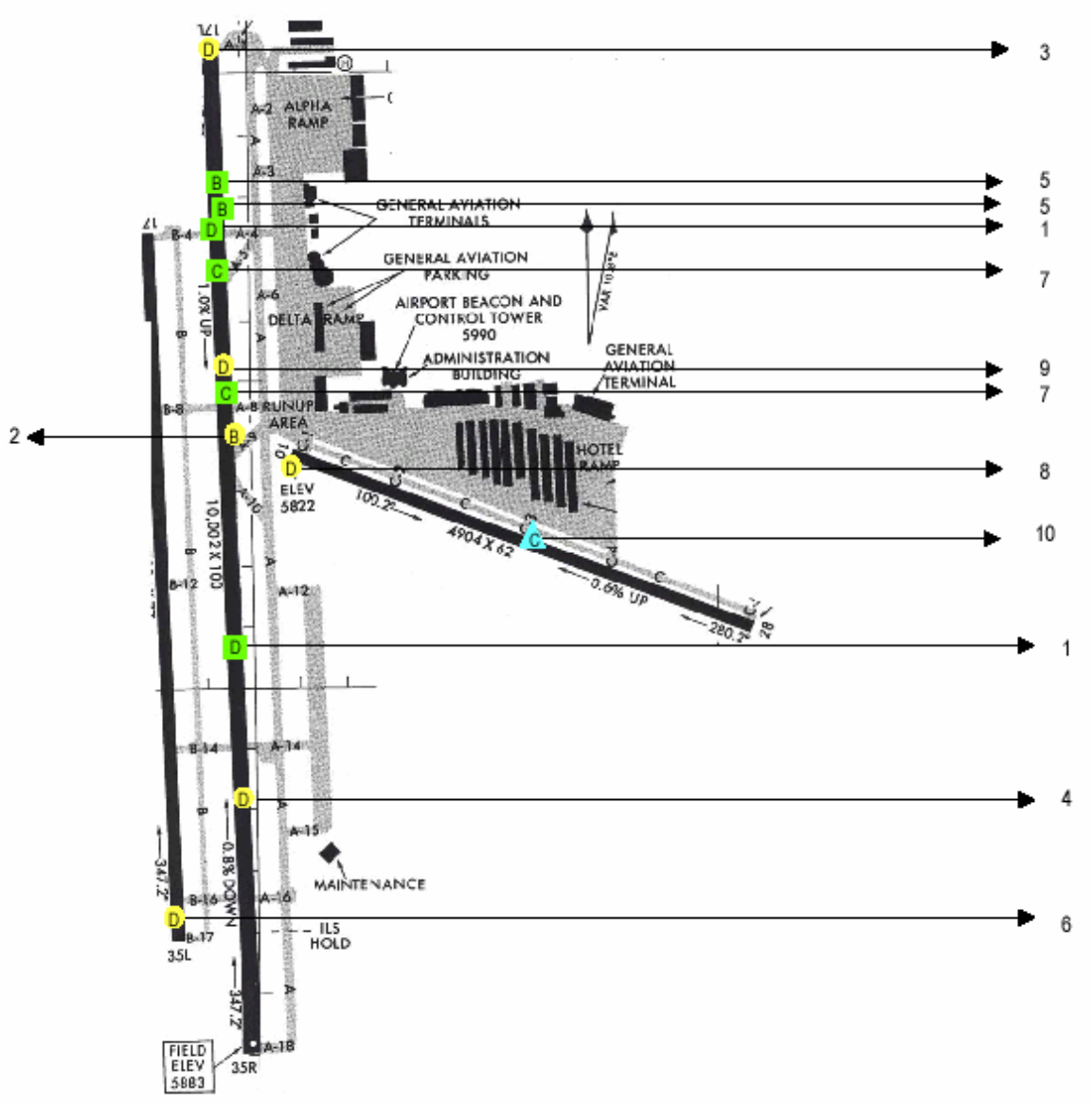
- A two-way interchange to gain a better understanding of local runway incursion causal factors;
- Insight into local runway incursion reduction initiatives;
- Descriptions of current and near future surface technology projects being developed thorough the FAA Surface Technology Assessment Product Team (AND-520);
- Potential technology solutions to mitigate causal factors.

After reviewing the meeting objectives and receiving a comprehensive presentation on runway incursions and prevention efforts by the facility, the Technology Assessment Team provided a brief overview of FAA's current and on-going technology development efforts. (See attached road show briefing). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility and the airport.

Background

Statistical data on runway incursions at APA between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	APA-T-97-E-001	OE	D
2	PNMTAPA98001	PD	B
3	PNMTAPA98002	PD	D
4	PNMTAPA98004	PD	D
5	APA-T-99-E-001	OE	B
6	PNMTAPA99003	PD	D
7	APA-T-99-E-002	OE	C
8	PNMTAPA99004	PD	D
9	PNMTAPA00002	PD	D
10	VNMTAPA00006	VPD	C



Key

= Pilot Deviation
= Operational Error
= Vehicle/Pedestrian Deviation

Fact Finding/Assessment

The Technology Assessment Team received an extensive tour of the airport and the tower.

APA is mostly a general aviation (GA) airport with about 400,000 to 450,000 operations per year. The airport regularly experiences 1600 + operations per day.

The tightening of security since September 11, 2001 has proven to be helpful in reducing pedestrian deviations at APA.

APA identified a "hotspot" at the intersection between taxiway C1 and runway 10 due to vehicle operators and pedestrians crossing. There is a business, Signature Aviation, to the south of the run up area and GA parking to the north of runway 10. Between Signature Aviation and the hangars/runup area, there was a perimeter road not being used until a year ago. As a result, inexperienced pilots use runway 10 as a shortcut. If a vehicle needs to go from one side to another, it needs to gain clearance to cross. Inexperienced users have used runway 10 as a shortcut.

Double-sized painted hold lines were painted last summer at multiple intersections.

The intersection of taxiway B-8 and runway 17L/35R is a heavy traffic runway crossing when 17R is being used.

Non-technology Recommendations

The airport has put up "STOP" signs at both sides of runway 10 at C-1 and D-1. There are warning signs at taxiway entrances A-1, 2, 3, 4, 6, 8, 10, 12, 14 and 15. To minimize runway crossings by vehicles, the airport has constructed a perimeter road to go around runway 10/28.

Technology Recommendations

The airport has been pursuing a number of solutions from signage to construction. These solutions should be given a chance to work. A technology solution of addressable message boards was discussed with the airport for intersection A-8 and A-9.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Attendance:

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
Dennis McGee	NATCA/RSP	214-641-3000	dennis.mcgee@faa.gov
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Kelly Dymond	ACPAA	303-790-0598	kdymond@centennialairport.com
Scott Brownlee	ACPAA	303-790-0598	sbrownlee@centennialairport.com
Don O'Brien	DEN ADO	303-342-1257	donald.o'brien@faa.gov
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FAA/Concord Buchanan Field (CCR) Runway Incursion Airport Assessment Meeting
March 26, 2002

Purpose

Federal Aviation Administration (FAA) Technology Assessment Team visited Concord Buchanan Field (CCR) on March 26, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. CCR air traffic management and airport management personnel attended the meeting. The discussion included:

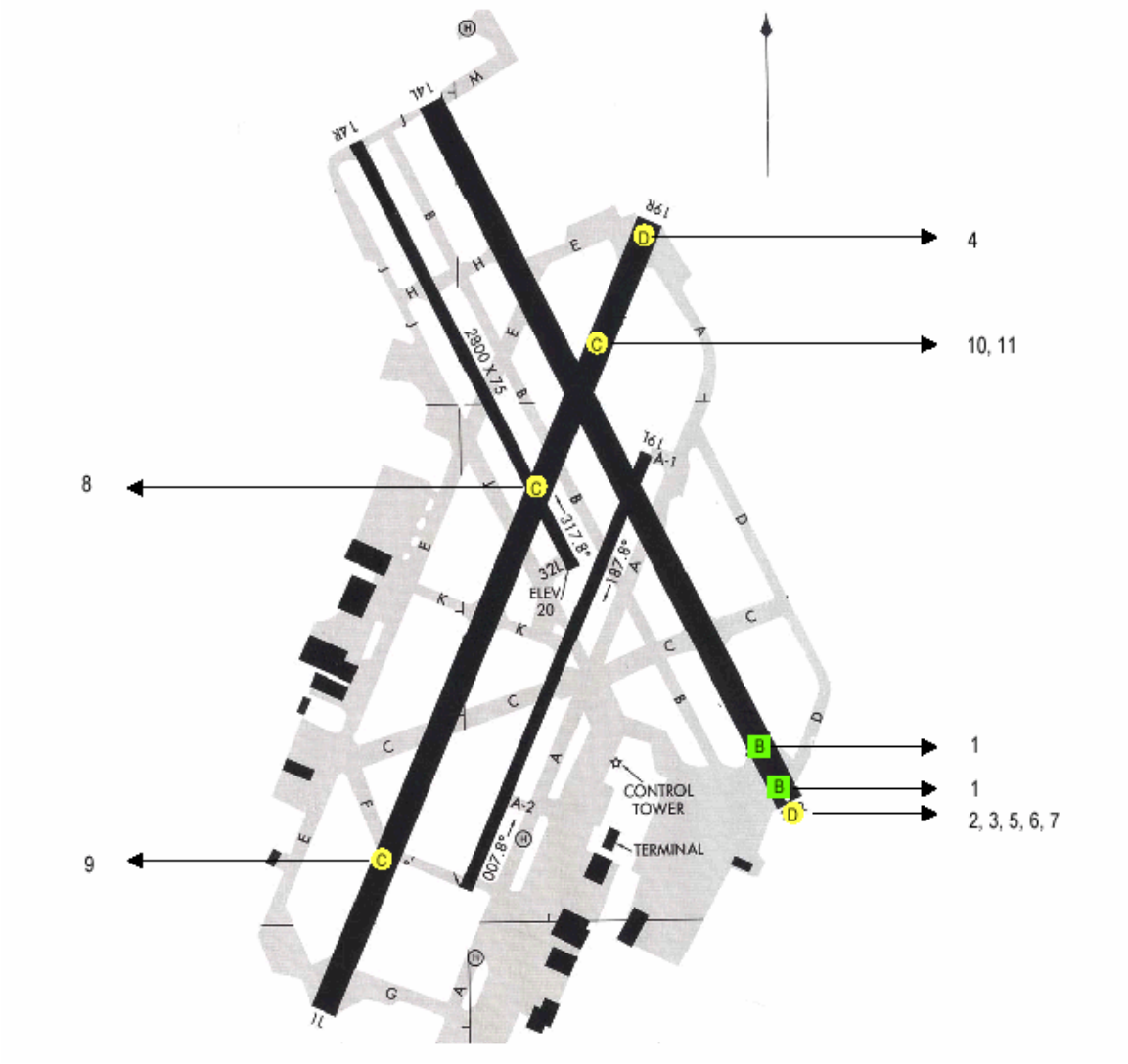
- A two-way interchange to gain a better understanding of local runway incursion causal factors;
- Insight into local runway incursion reduction initiatives;
- Descriptions of current and near future surface technology projects being developed thorough the FAA Surface Technology Assessment Product Team (AND-520);
- Potential technology solutions to mitigate causal factors.

After reviewing the meeting objectives and receiving a comprehensive presentation on runway incursions and prevention efforts by the facility, the Technology Assessment Team provided a brief overview of FAA's current and on-going technology development efforts. (See attached road show briefing). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility and the airport -- an effort that appears to be making a difference as indicated by the downward trend in runway incursions during 2001 (CCR has had only one runway incursion for the year 2001).

Background

Runway incursion data at CCR between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	CCR- T- 98- E- 001	OE	B
2	2 PWPTCCR00002	PD	D
3	PWPTCCR00004	PD	D
4	PWPTCCR00005	PD	D
5	PWPTCCR00007	PD	D
6	PWPTCCR00008	PD	D
7	PWPTCCR00009	PD	D
8	PWPTCCR00010	PD	C
9	PWPTCCR99004	PD	C
10	PWPTCCR99003A	PD	C
11	PWPTCCR99005	PD	C


4
10, 11
8
1
1
2, 3, 5, 6, 7
9
CONTROL TOWER
TERMINAL
2800 X 75
ELEV 20
Key
= Pilot Deviation
= Operational Error
= Vehicle/Pedestrian Deviation

Fact Finding/Assessment

The key problem at CCR is a lack of information given to pilots due to inadequate signage and airport markings. The following areas were identified:

- Problem spot one – when an aircraft is on taxiways H, E or runway 19R and wants to cross taxiway B in order to get to14R, taxiway B is difficult to be seen. Pilots are often confused.
- Problem spot two – the complicated geometry of the intersection of taxiways A, C, J and runway19L can easily confuse pilots.
- Problem spot three – at the holding to departure end of runway 32R, there is a large open area of concrete pavement that makes it difficult for pilots to see the signs and markings.

Within the past nine months, the airport has repainted some of the markings and installed temporary signs to correct existing problems. They also have developed a Signage Plan to permanently replace the temporary and existing signs. The electrical upgrades supporting the signage should be completed by January 2003 and the installation of new signs/replacement of temporary should be completed by the end of 2003. The airport has also started an operator driving program to train users on runway safety at taxiway G and runway 1L.

Non-technology Recommendations

The Regional Runway Safety Program Manager will keep monitoring the sign and marking implementation activities and inform the headquarters Runway Safety Program Office of the progress and whether local solutions are effective and adequate when reporting at the quarterly Program Reviews and/or through periodic Regional Safety Action Team (RSAT) database updates.

Technology Recommendations

CCR appears to be a candidate for technology solutions to mitigate surface incidents and runway incursions. However, CCR is already executing plans to install signage and put down markings. This is a significant improvement that should be given an opportunity to work. No technology solutions are recommended for CCR at this time.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Concord Buchanan Field (CCR) Runway Incursion Airport Assessment Meeting
March 26, 2002

Attendance:

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
Dave Kurner	FAA RSP/Western Pacific	310-725-6681	dave.kurner@faa.gov
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Mike Ryan	NATCA/AND	202-493-5089	mike.ryan@faa.gov
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FAA/ Daytona Beach International (DAB) Runway Incursion Airport Assessment Meeting
October 16, 2001

Purpose

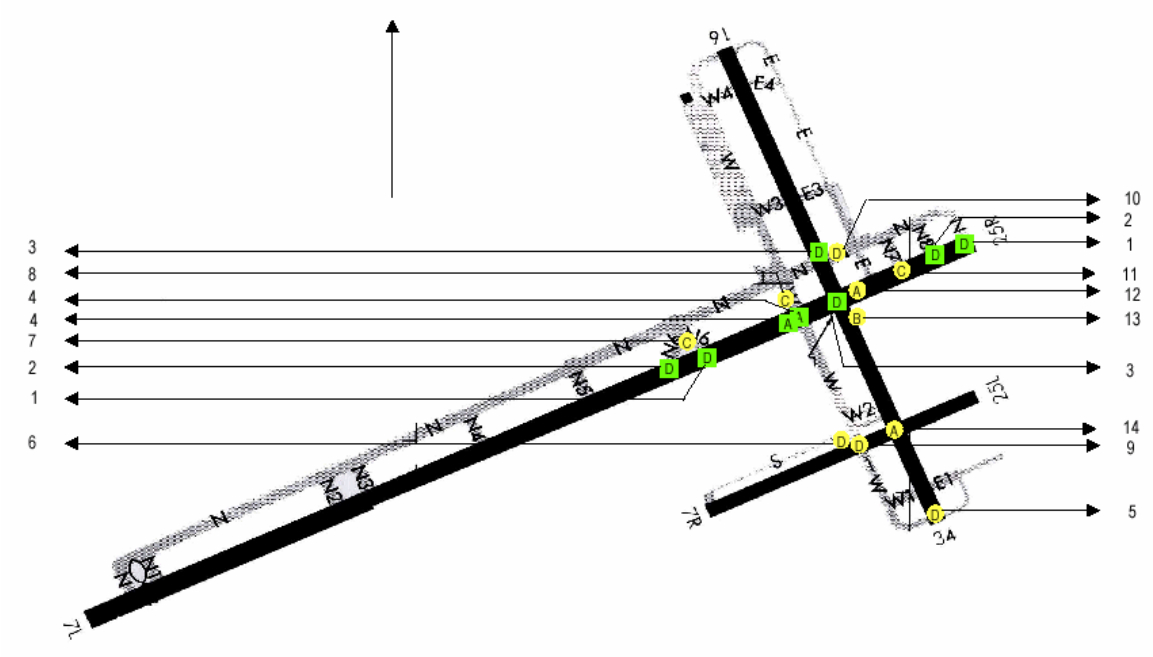
Federal Aviation Administration (FAA) Technology Assessment Team visited Daytona Beach International (DAB) on October 16, 2001 to discuss runway incursion trends and mitigation alternatives specific to this facility. DAB air traffic management and airport management personnel attended the meeting. The discussion included:

- A two-way interchange to gain a better understanding of local runway incursion causal factors;
- Insight into local runway incursion reduction initiatives;
- Descriptions of current and near future surface technology projects being developed thorough the FAA Surface Technology Assessment Product Team (AND-520);
- Potential technology solutions to mitigate causal factors.

Background

Runway incursion data at DAB between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	DAB-T-97-E-001	OE	D
2	DAB-T-97-E-003	OE	D
3	DAB-T-99-E-001	OE	D
4	DAB-T-99-E-002	OE	A
5	PSOTDAB00005	PD	D
6	PSOTDAB00007	PD	D
7	PSOTDAB00008	PD	C
8	PSOTDAB00001	PD	C
9	PSOTDAB00002	PD	D
10	PSOTDAB00007	PD	D
11	PSOTDAB00001	PD	C
12	PSOTDAB00003	PD	A
13	PSOTDAB00004	PD	B
14	PSOTDAB00008	PD	A



Fact Finding/Assessment

After reviewing the meeting objectives and receiving a comprehensive presentation on runway incursions and prevention efforts by the facility, the Technology Assessment Team provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility and the airport -- an effort that appears to be making a difference as indicated by the downward trend in runway incursions during 2001 (DAB had two runway incursions and one surface incident in the year 2001).

DAB is an ATC-10 (370,000 operations annually) level facility. Approximately 90% of their traffic is single engine aircraft being operated by the flight schools located on the field. One of the concerns that DAB has is the fact that Embry-Riddle, a pilot training school, has problems retaining flight instructors (turn over rate is every 12-18 months). This lack of continuity could be a factor in contributing to runway incursions, and increasing the pilot awareness on the airfield might be necessary.

DAB has taken the following proactive measures to eliminate runway incursions and surface incidents:

- Two new taxiways (P and T) are currently under construction. These are additional parallels to runways 7R and 7L. This will eliminate the need for many of the active runway crossings that currently take place.
- Runway guard lights are being installed at every runway and taxiway intersection by summer of 2002). They have already begun installation at some of the busiest intersections on the field (i.e., RWY 7L /TWY W & RWY16/TWY N).
- An informal user forum is now held every Friday morning, allowing the flight schools (both instructors and students), Fixed Base Operators (FBO), air carriers, and others to interact with controllers and other airport personnel.
- DAB has repainted all runway/taxiways with wide hold position lines.

Non-Technology Recommendations

A recommendation was made by both DAB management and NATCA to put a hold short line on runway 7L west of taxiway W. This marking would allow traffic to cross runway 7L on taxiway W when land and hold short operations (LHASO) are in use on 7L. Currently, controllers have to give LAHSO instructions to hold short of runway 16, rendering taxiway W unusable, even though most traffic using 7L are cleared at N2 or N3, well short of taxiway W.

The Technology Assessment Team recommended that DAB collect data relating to local solutions (i.e. measure effectiveness, create metrics, determine guidelines to assess how/when determination can be made if local solutions work and how well).

Technology Recommendations

Runway guard lights (wig-wag) have been installed at the three locations where the majority of surface incidents originated. This modification alone has dramatically improved pilot compliance to hold short instructions. The airport intends to add six to eight more wig-wag units at the remaining runway crossing locations to provide a maximum safeguard. Due to the positive impact of the current, yet on-going, installation of runway guard lights, along with the anticipated enhancements to safety when all installation and construction projects are complete, both the airport and the Technology Assessment Team believe that the improvements made at DAB are significant and should be given an opportunity to work. No new technologies are recommended at this time.

DAB has indicated that they are willing to be a test bed site for technology solutions applicable to their needs in the future.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

List of Attendees

Name	Organization	Phone	Email
Anna Cohen	FAA / RSP Southern Region	404-305-5558	Anna.Cohen@faa.gov
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Burt L. Willis	DAB ATC Tower	386-226-3900	Burt.Willis@faa.gov

FAA/Deer Valley Municipal Airport (DVT) Runway Incursion Airport Assessment Meeting
June 20, 2002

Purpose

Federal Aviation Administration (FAA) Technology Assessment Team visited Deer Valley Municipal (DVT) on June 20, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. DVT air traffic management and airport management personnel attended the meeting. The discussion included:

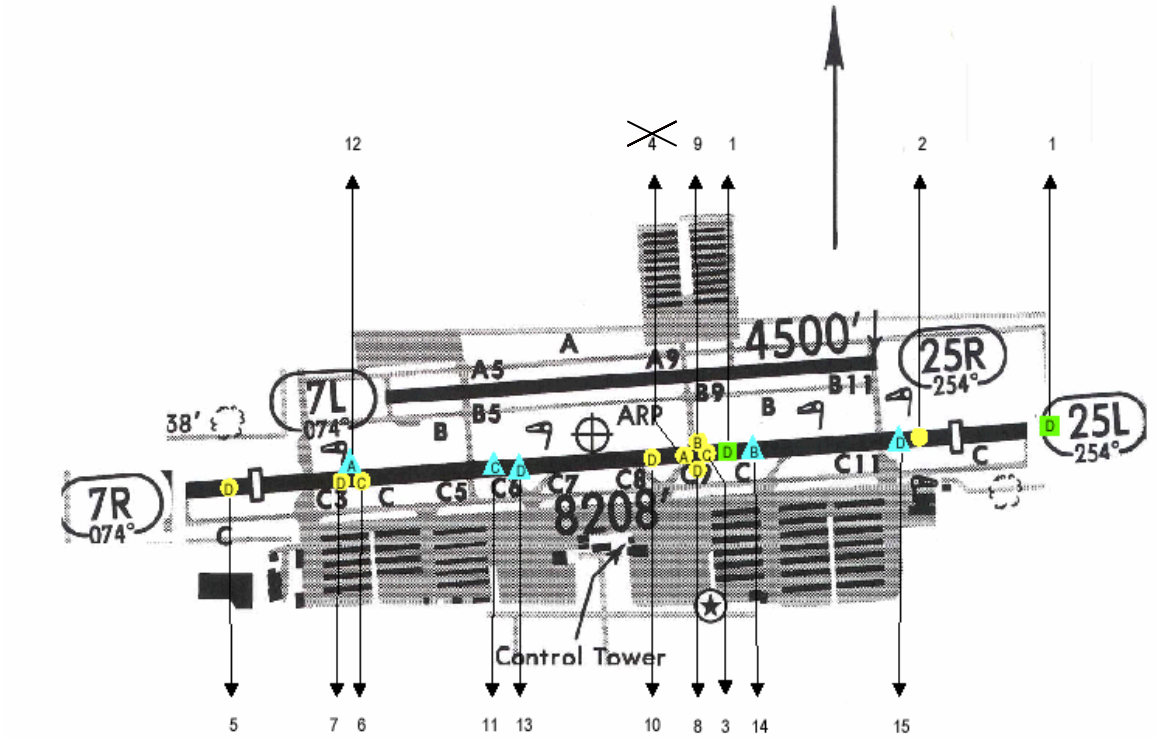
- A two-way interchange to gain a better understanding of local runway incursion causal factors;
- Insight into local runway incursion reduction initiatives;
- Descriptions of current and near future surface technology projects being developed thorough the FAA Surface Technology Assessment Product Team (AND-520);
- Potential technology solutions to mitigate causal factors.

After reviewing the meeting objectives and receiving a comprehensive presentation on runway incursions and prevention efforts by the facility, the Technology Assessment Team provided a brief overview of FAA's current and on-going technology development efforts. (See attached road show briefing). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility.

Background

Runway incursion data at DVT between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	DVT-T-98-E-001	OE	D
2	PNMTDVT98002	PD	ID
3	PWPTDVT00001	PD	C
4	PWPTDVT97001	PD	A
5	PWPTDVT97007	PD	D
6	PWPTDVT98001	PD	C
7	PWPTDVT98002	PD	D
8	PWPTDVT98004	PD	D
9	PWPTDVT99010	PD	B
10	PWPTDVT99012	PD	D
11	V00DVTATCT001 VWPTDVT00001	VPD	C
12	V97DVTATCT118	VPD	A
13	V97DVTATCT120	VPD	D
14	V97DVTATCT123	VPD	B
15	V97DVTATCT128	VPD	D



Key

= Pilot Deviation
= Operational Error
= Vehicle/Pedestrian Deviation

Facts Finding/Assessment

The Technology Assessment Team received an extensive tour of the airport and the tower.

DVT is the 19th busiest airport in the country and is one of the cleanest airports that the team has seen! The airport traffic control tower is open from 6AM to 9PM with about 1000 operations daily; 57% of the traffic is student pilots.

There are six vehicle gates on the airport and it has problems with "piggybacking" (a second pedestrian or vehicle entering the airport fenced area through controlled gates by following an authorized vehicle or pedestrian while the gate is closing), due to the slow closing rate of these gates. The airport is in the process of upgrading four gates to eliminate the "piggybacking" problems.

There are access roads around the airport that could provide inexperienced vehicle operators the opportunity to cut across the end of runway 25L to get to the north side of the airport. The combination of wide non-movement areas and access roads can give operators the impression that they can drive through the airport for convenience.

DVT is proactive in preventing runway incursions. It readily revokes access to the airport to tenants who violate rules allowing unauthorized users to gain access to the airport ramp and movement areas via "piggybacking". The airport is in the process of installing "Do Not Enter" signs at the movement area boundaries on taxiways C5 and C9 to further discourage illegal vehicles.

The intersections of B9/25L and B5/25L are two of the highest traffic areas on the airport. About 65% of runway crossings will go through B9/25L and 30% through B5/25L. These two intersections were high alert intersections for pilot deviation and vehicle/pedestrian deviation runway incursions. Since 2000, the airport has strengthened its educational program with the biweekly and quarterly briefings to pilots, pilot instructors, student pilots, and tenants. As a result, a significant reduction in runway incursions has occurred at those intersections.

Non-technology Recommendations

The downtrend of runway incursions at DVT in recent years is encouraging. Many of the ideas the Technology Assessment Team would recommend are already in the process of being addressed by the airport.

Technology Recommendations

No technology recommendations can be made at this time. It should be noted that DVT's busiest intersection could benefit from addressable message boards and/or enhanced hold-line light emitting diodes.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Attendance:

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
Fong Lee	ARI-200	202-385-4768	fong.lee@faa.gov
Mike Ryan	NATCA/AND	202-493-5089	mike.ryan@faa.gov
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FAA/Fairbanks International (FAI) Runway Incursion Airport Assessment Meeting
November 1, 2001

Purpose

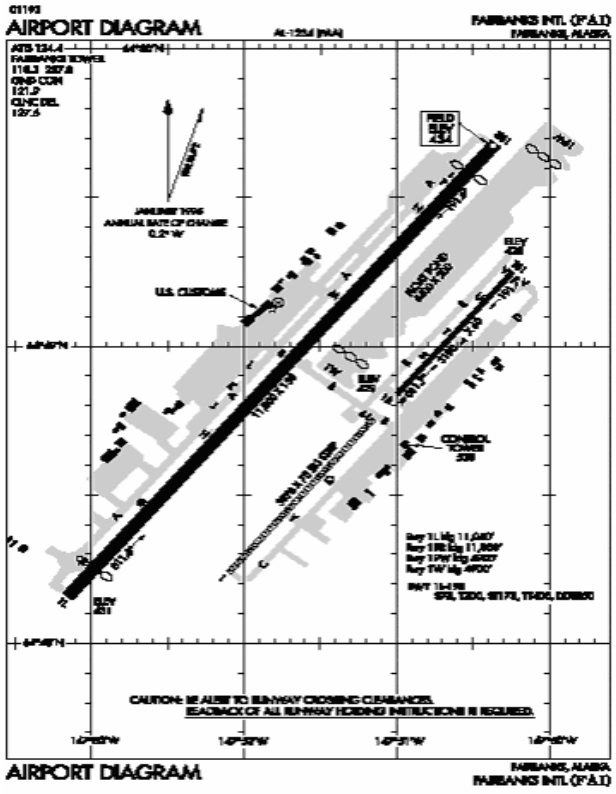
Federal Aviation Administration (FAA) Technology Assessment Team visited Fairbanks International (FAI) on November 1, 2001 to discuss runway incursion trends and mitigation alternatives specific to this facility. FAI air traffic management and airport management personnel attended the meeting. Even though FAI is not on the original list of airports to be visited by the Technology Assessment Team, we were asked by the Runway Safety Program to conduct an assessment of this airport due to the unique weather at FAI. The purpose of the meeting was to:

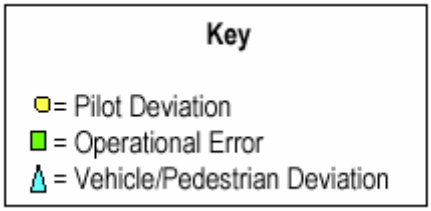
- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight to local runway incursion reduction initiatives;
- Describe current and near-future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520);
- Discuss the potential for technology solution(s) to mitigate causal factors.

Background

Runway incursion data at FAI between 1997-2000:

Report	RI Type	RI Category
PALTFAI99005 (1999)	PD	C
PALTFAI00001 (2000)	PD	C
PALTFAI00004 (2000)	PD	D





Assessment/Facts Finding

The Technology Assessment Team reviewed the meeting objectives and provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). The regional Runway Safety Program Manager reviewed the current runway incidents at FAI and its prevention program. An open discussion followed that provided insight into runway incursion prevention efforts by the facility.

FAI has a mixture of aviation that cannot be duplicated anywhere else. During the summer tourist season, FAI has a high number of pilots that are either not well trained or are unfamiliar with the airport. During the winter, the unique ice/fog forms vertically, inhibiting visibility in horizontal vision positions.

The road surrounding the float pond (1W/19W) allowed for easy access to taxiway "B". Recently, a large warning sign and flashing red lights were installed as a solution to keep unauthorized people from entering this area. The road that leads to hangars on the east side of the field is marked by a highway sign stating that there is no outlet and that it is for airport use only. There is no fencing on the east side of the airport.

FAI has been working on a number of local solutions to mitigate runway incursions and surface incidents:

- Construction is underway to lengthen runway 1R. This will help reduce the amount of traffic on taxiway "B". Local air traffic controllers have a different opinion on this-- they believe this will increase the traffic crossing that, in turn, will increase the potential for runway incursions.
- A warning sign and flashing red lights were installed near the corner of the float pond.

Non-technology Recommendations

- Due to weather, snow, and ice, removal equipment is frequently on the taxiways and runway. The equipment manager has asked for a dedicated frequency for the snow/ice removal equipment crew. This could potentially reduce the amount of messages that the equipment crew has to deal with, leading to better communication and less confusion.
- Road signs around the airport are not adequate and people who get lost are likely to end up at the airport.
- The airport has a lack of secure fencing along most of the airport perimeter.

Technology Recommendations

The Technology Assessment Team believes that the runway incursions and surface incidents at FAI could largely be solved by non-technological means (i.e. security fencing, better signs around the airport). Audible and/or visual alert technologies (Ground Marker or Light Emitting Diodes) may be effective at Taxiway B.

FAI airport manager, Mr. Doyle Ruff, indicated that he was pleased his airport made the list of airports to be surveyed and might qualify for technology solutions.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

List of Attendees

Name	Organization	Phone	Email
Julio Garcia-Laffitte	FAA HQ / ARI	202-267-7426	Julio.Garcia-Laffitte@faa.gov
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FAA/Flying Cloud Airport (FCM) Runway Incursion Airport Assessment Meeting
June 4, 2002

Purpose

Federal Aviation Administration (FAA) Technology Assessment Team visited Flying Cloud Airport (FCM) on June 4, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. FCM air traffic management and the airport management personnel attended the meeting. The purpose of the meeting was to:

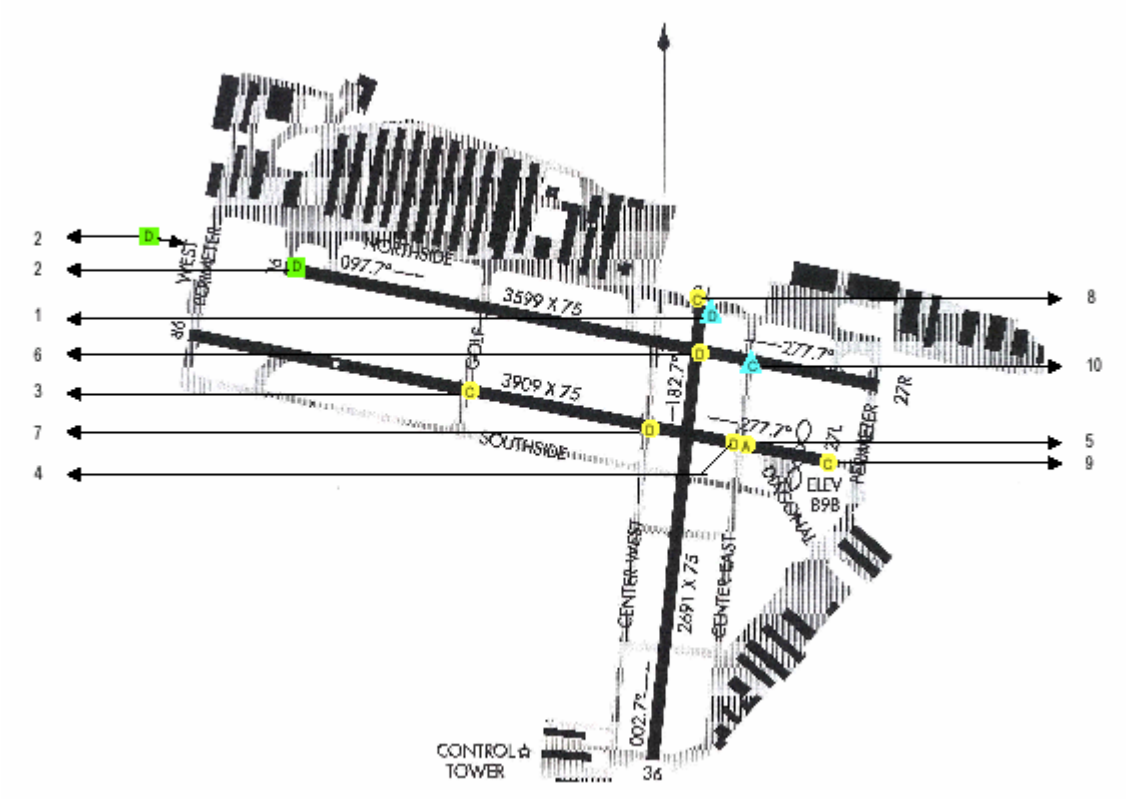
- Conduct a two-way interchange to gain better understanding of local runway incursion causal factors;
- Gain insight to local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520);
- Discuss the potential for technology solution(s) to mitigate causal factors.

Background

Runway incursion data at FCM between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	V99FCMATAC145	VPD	D
2	FCM-T-99-E-001	OE	D
3	PGLTFCM00001	PD	C
4	PGLTFCM00003	PD	D
5	PGLTFCM97001	PD	A
6	PGLTFCM98002	PD	D
7	PGLTFCM98006**	PD	D
8	PGLTFCM99001	PD	C
9	PGLTFCM99003	PD	C
10	V97FCMATCT133	VPD	C

** Insufficient data to determine exact location. Location was estimated based upon available data.



Key

= Pilot Deviation
= Operational Error
= Vehicle/Pedestrian Deviation

Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and received a comprehensive presentation on runway incursions and prevention efforts by the facility. The team then provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility. The Technology Assessment Team also received an extensive tour of the airport and the tower.

FCM is a very active general aviation airport, and is also a non-139 standard airport. There are no specific problem areas on the airport. Pilots acknowledge runway clearances or hold short instructions correctly, then cross the runway or switch to another runway appropriately. There were a few instances noted where an aircraft had landed on the south taxiway (next to 9R) or the wrong runway. The close proximity of the two parallel runways (approximately 850 feet) was one of the factors contributing to landing on the wrong runway. Due to the distance and height of the tower, it is difficult for a controller to know if an aircraft is on runway 9R or taxiway/runway parallel to it). The distance and size of the tower also reduces the controller ability to correct the problem before it happens. The runway markings were repainted in the year 2000 and this seems to have helped mitigate these incidents. (Landing on the wrong runway has not occurred since the runway was repainted).

Some airport markings are fading, but they are due to be repainted by September 2002. The airport is also planning to repaint the hold-lines so they are doublewide.

Runway signs at the approach end of the runways show only one runway number and this can confuse pilots. The airport is actively pursuing a solution to correct this problem.

There are no security gates in the airport business areas to prevent customer vehicles and/or pedestrians from gaining access to the airport without proper authorization.

FCM has a strong and pro-active prevention program. An FCM driver was fired on spot for blatantly causing a runway incursion by racing across runway 18. New signs were put up to keep unauthorized people out of the active movement area. Awareness and liaison programs such as a pilot-controller forum, and air traffic quarterly newsletters are aimed at education/information exchanges. The fixed base operator also tries to keep up with part 139 signage standards.

Non-technology Recommendations

FCM is working on the following issues:

- Unrestricted access to vehicles
- Faded runway markings
- Non-standard taxiway nomenclature
- Lack of standard signage
- Site problems from the tower cab
- Pilot error

Technology Recommendations

There are no definite hotspots identified at the airport and the pilot errors are high. The Technology Assessment Team believes that situation awareness technology such as ground marker, light emitting diode (LED) enhance hold lines and/or addressable message boards would be beneficial at high traffic intersections.

Note: There is a small percentage of aircraft not equipped with marker beacons at this airport. This must be taken into account if ground marker technology is being considered.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Flying Cloud (FCM) Runway Incursion Airport Assessment Meeting June 4, 2002

Attendance:

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
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FAA/Fort Lauderdale Executive (FXE) Runway Incursion Assessment Meeting
October 15, 2001

Purpose

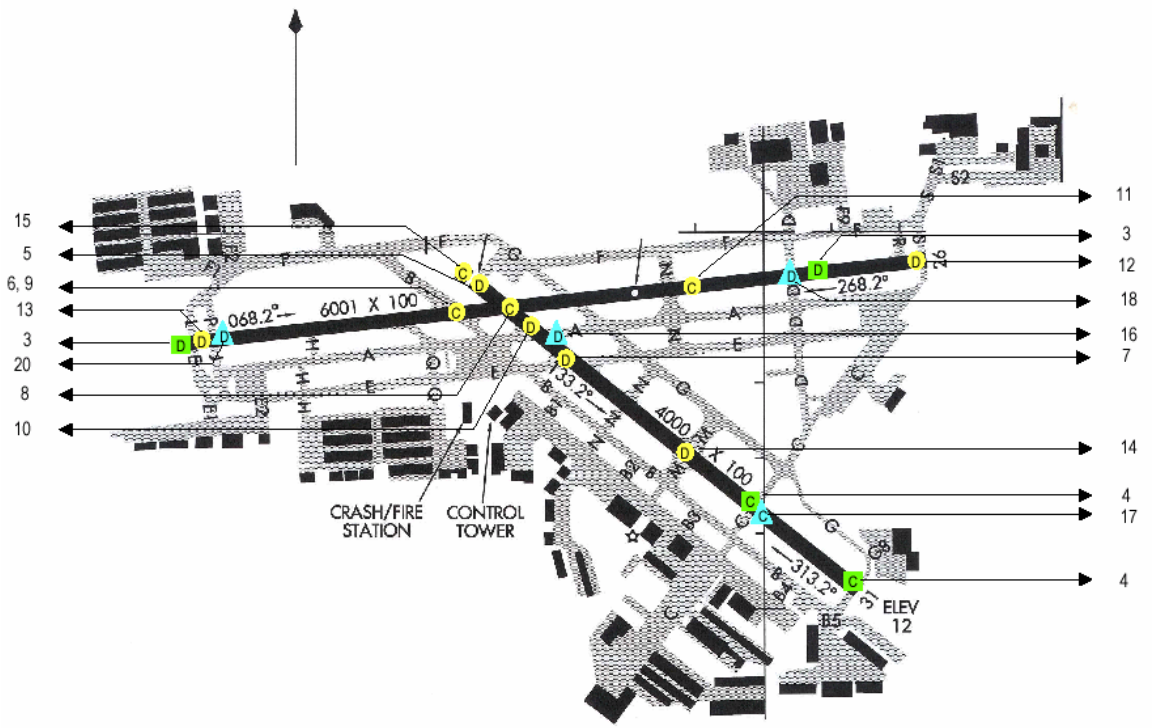
Federal Aviation Administration (FAA) Technology Assessment Team visited Fairbanks International (FXE) on October 15, 2001 to discuss runway incursion trends and mitigation alternatives specific to this facility. FXE air traffic management and airport management personnel attended the meeting. The discussion included:

- A two-way interchange to gain a better understanding of local runway incursion causal factors;
- Insight into local runway incursion reduction initiatives;
- Descriptions of current and near future surface technology projects being developed thorough the FAA Surface Technology Assessment Product Team (AND-520);
- Potential technology solutions to mitigate causal factors.

Background

Runway incursions at FXE between 1997-2000 according to FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	V99FXEATCT048*	VPD	D
2	V99FXEATCT050*	VPD	D
3	FXET00E001	OE	D
4	FXET00E002	OE	C
5	PSOTFXE00004	PD	D
6	PSOTFXE00007	PD	C
7	PSOTFXE00009	PD	D
8	PSOTFXE00010	PD	C
9	PSOTFXE00011	PD	C
10	PSOTFXE97003	PD	D
11	PSOTFXE98001	PD	C
12	PSOTFXE98002	PD	D
13	PSOTFXE99001	PD	D
14	PSOTFXE99004	PD	D
15	PSOTFXE99008	PD	C
16	V97FXEATCT034	PD	D
17	V97FXEATCT035	VPD	C
18	V97FXEATCT042	VPD	D
19	VSOTFXE00004*	VPD	D
20	VSTOFXE00012	VPD	D
	*Insufficient Location Data		


15
5
6, 9
13
3
20
8
10
068.2°
6001 X 100
133.2°
4000 X 100
268.2°
313.2°
CRASH/FIRE STATION
CONTROL TOWER
ELEV 12
11
3
12
18
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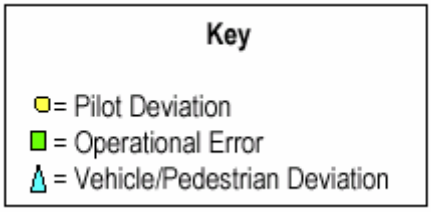
Key
= Pilot Deviation
= Operational Error
= Vehicle/Pedestrian Deviation

Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and provided a brief overview of FAA's current on-going technology development efforts (Appendix A). An open discussion followed providing insight into the runway incursion prevention effort by the facility.

The biggest problem that FXE has is with tugs, field trucks, and unauthorized vehicles (easy access to the field). This has been a major contributor to the high number of runway incursions and surface incidents. The past year there were no operational errors.

FXE has taken the following pro-active measures to mitigate runway incursions and surface incidents:

- A Security Access Study is being done, detailing ways of limiting access to the field. This study is scheduled for completion by the end of October 2001.
- A complete rehabilitation of the airfield electrical system, including new lighting, is scheduled for completion by January 2002.
- Initiated a ramp driving and vehicle permit program (user must now have permit to enter areas).
- Coordinated with all Fixed Based Operators (FBOs) to distribute flyers and posters indicating airport movement areas, field marking, taxiway/runway information (in color with street names and building numbers clearly identified).
- FXE has worked with local authorities and the city prosecutor to ensure prosecution for trespassing to those persons and vehicles that enter the airport operations area without property authority. Enforcement is done through arrests, penalties and fines.
- Applied fresh paint to runways and taxiways.
- Installed large warning signs at key locations.
- Instituted vehicle operator training for signage and communication coordination.

The Technology Assessment Team has asked for a copy of the FXE Security Access Study for further assessment. We have been advised that this study will be complete in December 2001.

Non-technology Recommendations

The existing four-foot security fence may not be enough to prevent offenders from entering the airport. Mr. Bill Crouch (FXE Airport Manager) suggested improving the security fencing and access gates. Mr. Julio Garcia (ARI representative) suggested that FXE use the forthcoming Security Access Study as back-up material to the FAA so that funding might be provided for upgrading security fence and gates.

A mandatory Flight Service District Office (FSDO) retraining program or a more pro-active FSDO follow-up on deviation reports was suggested.

Controllers suggested that fuel trucks move around the airfield via off-site locations (i.e. surface streets, perimeter roads). The controllers also suggested limiting the need for aircraft to be towed from around the airport when there was no real need for towing (i.e. flight crews leaving aircraft prior to clearing customs).

Technology Recommendations

FXE may benefit from technology solutions used to mitigate surface incidents and runway incursions. However, the improvements made by the airport thus far, together with the proposed improvements by FXE, are significant and should be given an opportunity to show benefit.

The Technology Assessment Team believes that the runway incursions and surface incidents at FXE could largely be solved by non-technological means (i.e. upgrade security fence, retraining program). No technology solutions are recommended to FXE at this time, until we can review the Security Access Study.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

List of Attendees:

Name	Organization	Phone	Email
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FAA/Long Beach Airport (LGB)
Runway Incursion Airport Assessment Meeting
February 26, 2002

Purpose

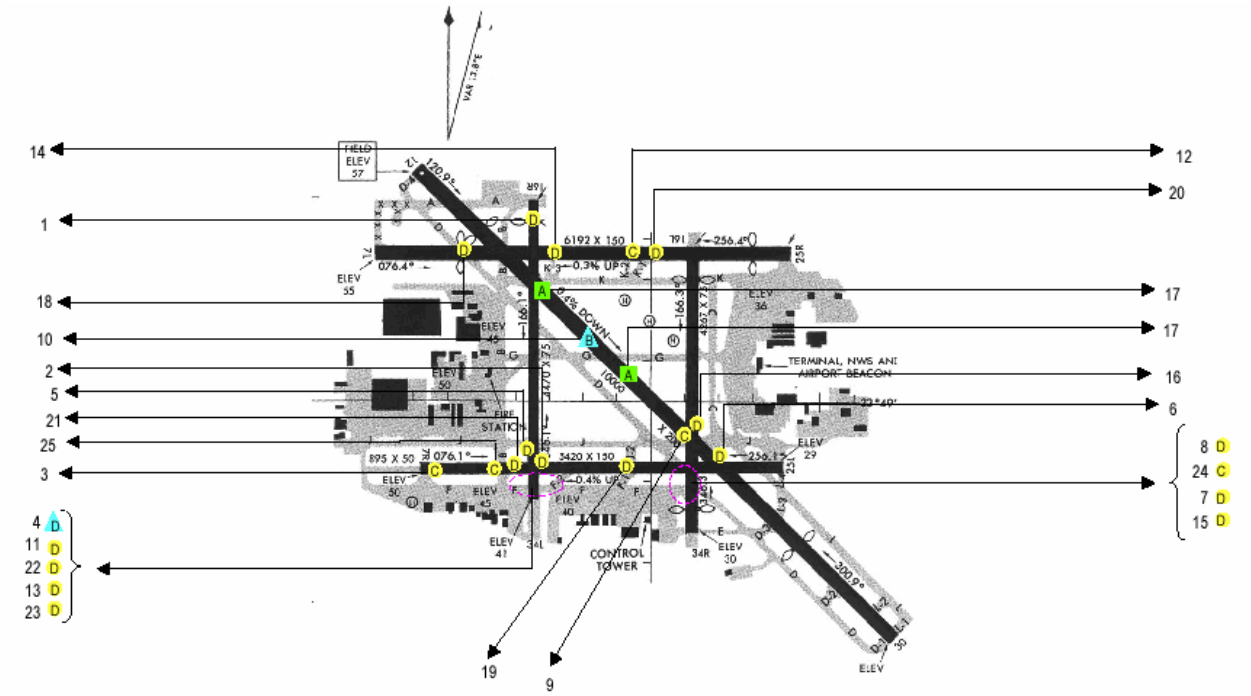
The Federal Aviation Administration (FAA) Technology Assessment Team did not conduct a formal site visit at Long Beach (LGB) to discuss runway incursion trends and mitigation alternatives specific to this facility. However, all members of the FAA Technology Assessment Team (TAT) have visited, discussed and are familiar with the problems at this airport.

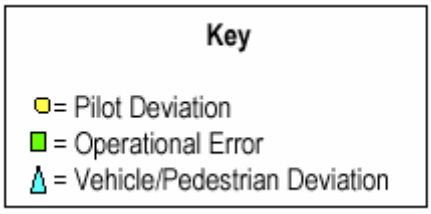
Even though the entire team did not collectively conduct a formal assessment meeting at LGB, a report can be written from the information and first hand knowledge of the TAT members, substantiated and verified by facility personnel and data derived from previous visits.

Background

Runway incursion data at LGB between 1997-2000:

Key Locator	REPORT	RI Type	RI Category
1	PWPTLGB97002	PD	D
2	PWPTLGB97003	PD	D
3	PWPTLGB97004	PD	C
4	V97LGBATCT666	VPD	D
5	PWPTLGB97015	PD	D
6	PWPTLGB97017	PD	D
7	PWPTLGB97019	PD	D
8	PWPTLGB98002	PD	D
9	PWPTLGB98003	PD	C
10	V98LGBATCT672	VPD	B
11	PWPTLGB98009	PD	D
12	PWPTLGB99002	PD	C
13	PWPTLGB99004	PD	D
14	PWPTLGB99007	PD	D
15	PWPTLGB99009	PD	D
16	PWPTLGB99015	PD	D
17	LGB-T-99-E-001	OE	A
18	PWPTLGB00002	PD	D
19	PWPTLGB00007	PD	D
20	PWPTLGB00009	PD	D
21	PWPTLGB00010	PD	D
22	PWPTLGB00013	PD	D
23	PWPTLGB00014	PD	D
24	PWPTLGB00019	PD	C
25	PWPTLGB00021	PD	C





Assessment/Fact Finding

AND-520 has been working with the LGB Airport Authority over the past five years in the design, development and demonstration of an inductive loop technology prototype system. Installed on Runway 12/30, it has been expanded to evaluate other technologies, including intersection (Runway/Taxiway) safety lights, "radar gun" for monitoring inbound/outbound aircraft surface safety, and flashing PAPI applications.

Using this multiple loop prototype installed at selected locations on the LGB airport surface, the potential exists for them to serve as a "trip-wire" for other technology solutions, such as addressable message boards that are designed to raise pilot and ground vehicle operator awareness of potential surface conflicts (i.e. "high alert intersections" such as near the flight school at 7R/24L and taxiway F). AND-520 and LGB airport

authority will continue to assess the potential solution(s) for one or more high alert intersections in the coming months.

LGB has two sets of parallel runways, one set perpendicular to the other and a long main runway that bisects the other four. During the last 12 months (2/1/2001-1/31/2002), LGB conducted 358,508 operations with five runway incursions (RIs) at the rate of 1.39 RIs per 100,000 operations. Most RIs at LGB happen when pilots are taxiing outbound for departure. If a pilot causes an incursion, he/she receives a warning letter and needs to see the LGB Safety Program Manager (Kathleen O'Brien) to discuss what happened. The event is documented and a solution must be proposed. This process is aimed at discouraging repeat offenders.

Depending on wind condition, the airport operation can change from West traffic (normal operation) to South traffic. LGB has up to five operation configurations. These operation configurations and the complex layout of the airport may cause increases in surface incidents (SIs) and RIs, since pilots need to operate with a configuration not familiar to them on a regular basis.

Currently, LGB is remodeling around the intersections of 7R/34R (this is one of the "high-alert intersections" at LGB) to reduce confusion and the complexity of this location. They have construction funding to upgrade their surface and infrastructure (i.e. power, lights). The airport also made changes to phraseology to reduce verbal confusion between controllers and users.

Jet Blue Airlines recently purchased 48 commercial slots and plans to start its operation in May 2002. This will result in an increased number of flights at this site.

Non-Technology Recommendations

There are no recommendations made at this time.

Technology Recommendations

There are no recommendations made at this time. Potential may exist for new technology at this airport.

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FAA/Crystal Airport (MIC) Runway Incursion
Airport Assessment Meeting
June 5, 2002

Purpose

Federal Aviation Administration (FAA) Technology Assessment Team visited Crystal Airport (MIC) on June 5, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. MIC air traffic management and airport management personnel attended the meeting. The purpose of the meeting was to:

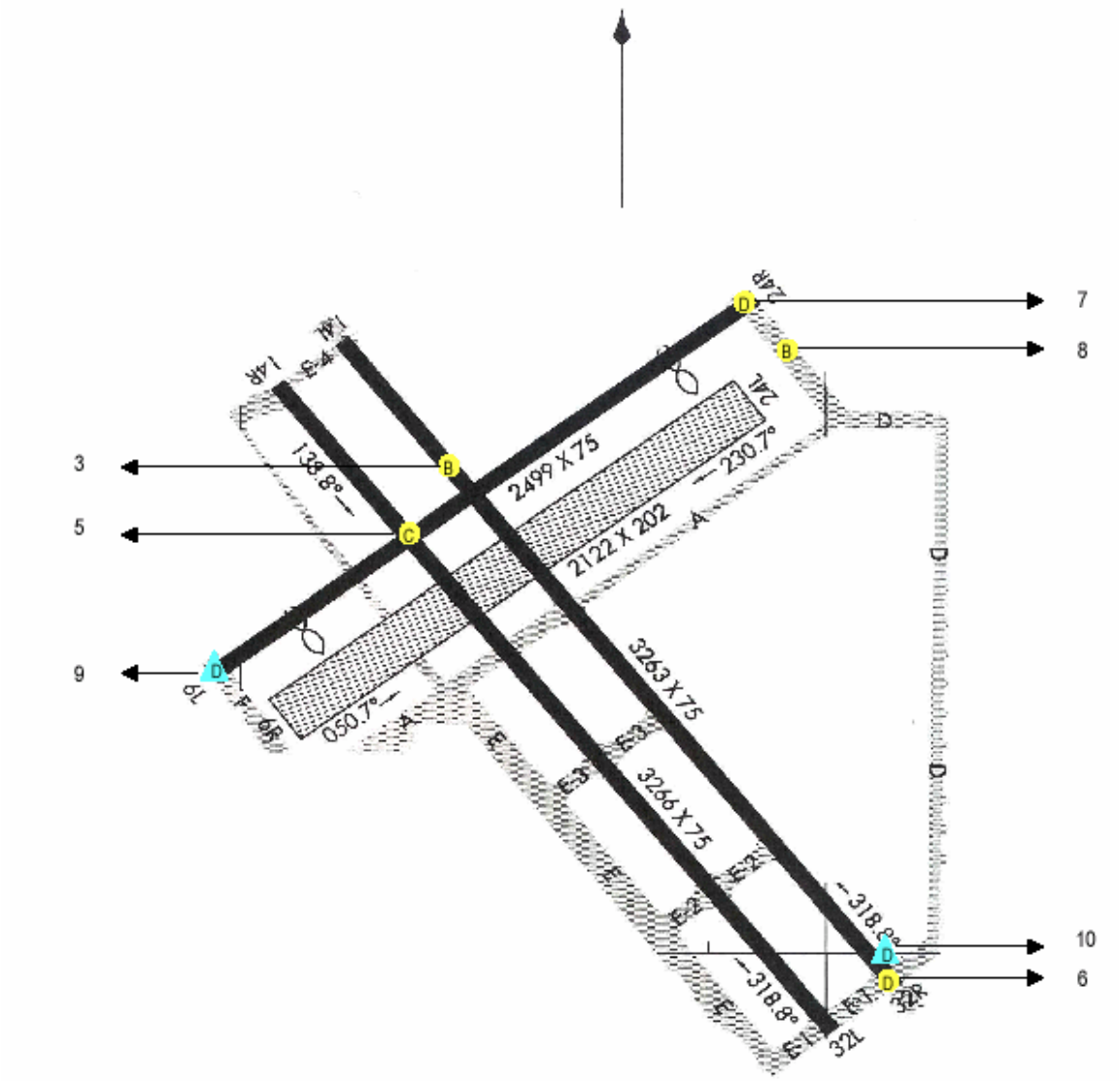
- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight to local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520);
- Discuss potential for technology solution(s) to mitigate causal factors.

Background

Runway incursion data at MIC between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	V99MICATCT043*	VPD	D
2	PGLMIC99002*	PD	C
3	PGLTMIC00001	PD	B
4	PGLTMIC00003*	PD	D
5	PGLTMIC98003	PD	C
6	PGLTMIC98004	PD	D
7	PGLTMIC99004	PD	D
8	PGLTMIC99005	PD	B
9	V97MICATCT033	VPD	D
10	V98MICATCT042	VPD	D

* Insufficient Location Data



Key

= Pilot Deviation
= Operational Error
= Vehicle/Pedestrian Deviation

Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and received a comprehensive presentation on runway incursions and prevention efforts by the facility. The team provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). An open discussion followed and revealed a

sustained and comprehensive runway incursion prevention effort by the facility. The Technology Assessment Team also received an extensive tour of the airport and the tower.

There is a big, open area near the intersection of taxiways A and E. When pilots are instructed to taxi onto taxiway A and turn right on taxiway E, they can get confused by the open area and go forward, crossing runway 14R/32L.

The runway separation between runways 14R/32L and 14L/32R is only about 300 feet, so the hold-line markings on taxiways A, E-3 and E-2 between these two runways are almost back-to-back. The pilots may get confused regarding hold-lines due to their close proximity.

At the north side of the airport, there is a straight path between the security gate and taxiway C. If a vehicle gets lost or gets disoriented around the hangar area, it can get on taxiway C and end up crossing runway 14L/32R.

The grass runway (6L/24R) is only used during the summer time. There are no markings for the runway ends. Pilots may overlook and cross this runway when they are taxiing on 14R/32L or 14L/32R.

During the time period from 2001 until the present, the airport has had six pedestrian and vehicle deviations. Some of these cases could have been avoided with educational programs. A prime example is the pilot deviation that occurred on April 27, 2001. (The pilot walked from Wiley North hangar across taxiway C, the 14L/32R overrun (paved) approach end of runway 14R, to Shamrock fixed base operator). Another example occurred on September 20, 2001, when an airport tenant walked from his hangar on the east side, across the approach ends of 32L and 32R, down taxiway E to Northland Aviation fixed base operator).

Other key factors contributing to runway incursions at MIC are unfamiliarity and airport access control.

Non-technology Recommendations

Currently MIC is trying to mitigate the following problems/issues:

- Unlimited airport access
- Limited funds

According to the airport, improved signage appeared to reduce the incursions at MIC. Some of the pedestrian and vehicle deviations could also be avoided with strong educational programs.

Technology Recommendations

The Technology Assessment Team believes that situation awareness technology such as ground marker, LED enhance hold lines and/or addressable message boards would be beneficial at high traffic intersections. There is a small percentage of aircraft at this airport that is not IFR equipped. This must be taken into account if ground marker technology is considered.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Attendance:

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
Dennis McGee	NATCA/RSP	214-641-3000	dennis.mcgee@faa.gov
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Thien Ngo	AND-520	202-493-5012	thien.ngo@faa.gov
Phil Peterson	AGI-1R	847-299-7853	philip.l.Peterson@faa.gov
Tricia Halpin	AGL 621-4	847-294-7160	tricia.halpin@faa.gov
Bob Huber	MSP-ADO	612-713-4357	robert.humber@faa.gov
Dawn Holst	MSP AT	612-713-4005	Dawn.Holst@faa.gov
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Harris Baker	Mn/DOT	651-296-8003	harris.baker@dot.state.mn.us
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Cindy Greene	MSP ATCT	612-713-4010	Cindy.J.Greene@faa.gov
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FAA/Merrill Field International (MRI)
Runway Incursion Airport Assessment Meeting
October 31, 2001

Purpose

The Federal Aviation Administration (FAA) Technology Assessment Team visited Merrill Field International (MRI) on October 31, 2001 to discuss runway incursion trends and mitigation alternatives specific to this facility. MRI air traffic management and airport management personnel attended the meeting. The purpose of the meeting was to:

- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight into local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520); and
- Discuss potential for technology solution(s) to mitigate causal factors.

Background

Runway incursions at MRI between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	MRIT00E001	OE	C
2	V00MRIATCT012 VALTMR100012**	VPD	D
3	V97MRIATCT887	VPD	D
4	V97MRIATCT889	VPD	D
5	V97MRIATCT891	VPD	C
6	V97MRIATCT896	VPD	D
7	V97MRIATCT898	VPD	D
8	V97MRIATCT905	VPD	D
9	V97MRIATCT909	VPD	D
10	V98MRIATCT930	VPD	C
11	V98MRIATCT933	VPD	D
12	VALTMRI00005	VPD	C
13	VALTMRI00007	VPD	D
14	VALTMRI00010	VPD	D
15	V00MRIATCT013 VALTMR100013	VPD	D
16	V00MRIATCTT016 VALTMR100016	VPD	D
17	VALTMRI00024	VPD	D
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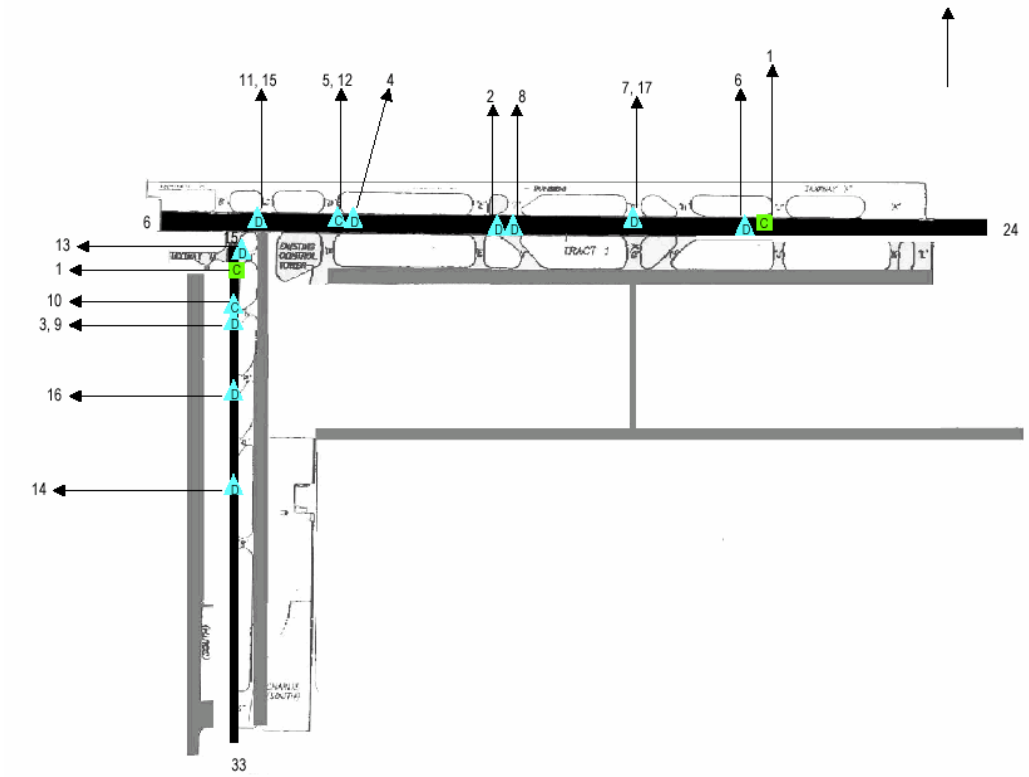

Key

= Pilot Deviation

= Operational Error

= Vehicle/Pedestrian Deviation

Assessment/Fact Finding

The regional Runway Safety Program manager reviewed the current runway incidents at MRI and its prevention program. The Technology Assessment Team reviewed the meeting objectives and provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). An open discussion followed providing insight to runway incursion prevention efforts by the facility.

MRI is an old airport located in downtown Anchorage with numerous business and residential establishments along the airport. This led to the high number of pedestrian and vehicle deviations at the airport (over 90% of the runway incursions in the last four years were a direct result of pedestrian and vehicle deviations). It is believed that there are two root causes for these types of deviations at MRI:

1) easy access to airport movement area, and
2) lack of education concerning runway safety.

People getting lost caused most of the pedestrian deviations. MRI would explain what they had done wrong and give them a warning citation. MRI can then fine a repeat offender up to $300.00. MRI indicates they have not had repeat offenders.

Taxiway "G" is being realigned to avoid the appearance of a direct line between Merrill Field Drive and Fifth Avenue. MRI believes that this realignment, in conjunction with barrier gates, will lead to a significant reduction in the number of vehicle deviations.

MRI is pursuing a number of local solutions to address runway incursions and airport incidents:

- Educational meeting forums to local residents via community outreach;
- A video advertisement for television;
- Bilingual literature handouts are being produced; and
- A multiphase security plan is being implemented and is scheduled to be complete by spring 2002:
  - Phase I – Construct incursion prevention fencing.
  - Phase II – Design phases for a replacement gate operator and an upgraded public address system.
  - Phase III – Installation phase for a replacement gate operator and upgraded public address system.
  - Phase IV – Installation of new taxiway "G" and "Q" signage and installation of taxiway "G" and "Q" barrier gates.
  - Phase V – All perimeter fencing is being raised to a minimum of seven feet.

Non-technology Recommendations

- The Technology Assessment Team recommended that the MRI security fence be upgraded. MRI was reluctant to pursue this idea due to potential negative impact this may have on the city image (i.e. community leaders may not want a tall or barbed wire type of fence in the middle of downtown).
- The team recommended MRI and the regional runway safety office to provide/recommend alternative approach/solutions to address:

    - Security fence – currently MRI has a limited five-foot high security fence surrounding its airport. This does not adequately prevent people from going over it and causing a surface incident or runway incident.
    - Intersection at taxiway Q and Merrill Field Drive – A realignment effort needs to be done for taxiway Q and Merrill Field Drive (similar to the proposed realignment at taxiway G and Merrill Field Drive/ Fifth Avenue).
    - Education for pilots from surrounding communities flying into a controlled facility who are often unaware of rules and regulations.

Technology Recommendations

The Technology Assessment Team believes that the runway incursions and surface incidents at MRI could largely be solved by non-technological means (i.e. upgrade security fence, educational program). Technology solutions would not be effective at this time.

ARI will be tracking the effectiveness of the local solutions and recommendations from the Technology Assessment Team.

List of Attendees

Name	Organization	Phone	Email
Julio Garcia-Laffitte	FAA HQ / ARI	202-267-7426	Julio.Garcia-Laffitte@faa.gov
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FAA/Montgomery Field (MYF) Runway Incursion
Airport Assessment Meeting
March 28, 2002

Purpose

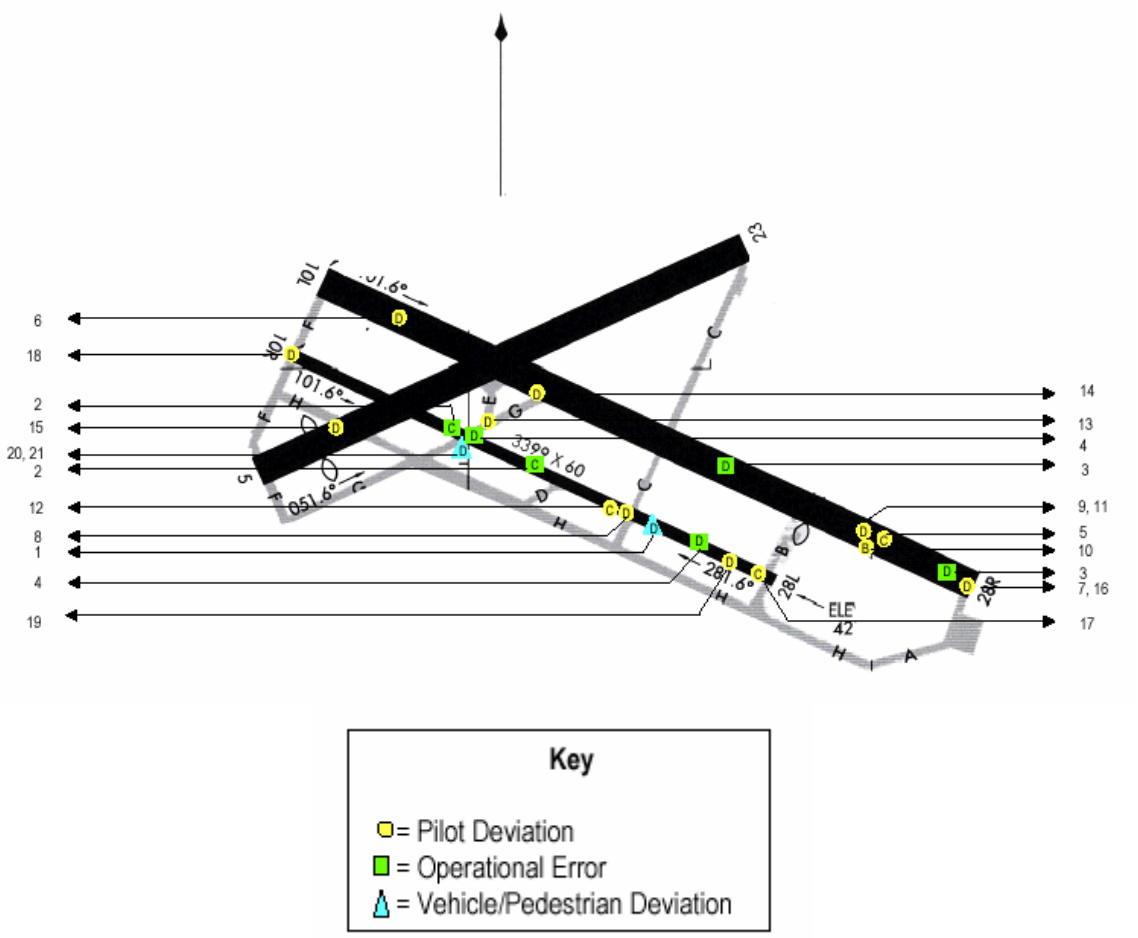
The Federal Aviation Administration (FAA) Technology Assessment Team visited Montgomery Field (MYF) on March 28, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. MYF air traffic management personnel and the airport management attended the meeting. The purpose of the meeting was to:

- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight into local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520); and
- Discuss potential for technology solution(s) to mitigate causal factors.

Background

Runway incursions at MYF between 1997-2000 according to FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	V99MYFATCT165	VPD	D
2	MYF- T- 98- E- 001**	OE	C
3	MYF- T- 99- D- 001	OE	D
4	MYFT00E001	OE	D
5	PWPTMYF00001	PD	C
6	PWPTMYF00003	PD	D
7	PWPTMYF00007	PD	D
8	PWPTMYF00008	PD	D
9	PWPTMYF00009	PD	D
10	PWPTMYF00010	PD	B
11	PWPTMYF00012	PD	D
12	PWPTMYF97001	PD	C
13	PWPTMYF98001	PD	D
14	PWPTMYF98002	PD	D
15	PWPTMYF98003	PD	D
16	PWPTMYF98004	PD	D
17	PWPTMYF99006 PD/ OE	PD	C
18	PWPTMYF99007	PD	D
19	PWPTMYF99011	PD	D
20	V97MYFATCT159	VPD	D
21	VWPTMYF00006	VPD	D
	**Insufficient data to determine exact location. Location estimated based upon location.		



Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and provided a brief overview of FAA's current and on-going technology development efforts. (See attached briefing). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility.

MYF has three runways, yet only runway 28R is lighted. The airport is quite easily accessible from the outside, since the fences are low and there is no security gate in the entrance area. With jogging and bike paths surrounding a section of the airport, the joggers and bikers can gain easy access to airport runways and taxiways (especially on the east side) that could lead to vehicle/pedestrian deviation at the airport. The funds (approximately $400,000.00) for improving fence and security gates have been identified and this improvement project will start in June 2002.

Another problem is on taxiway D, which is a one-way taxiway designed specifically for aircraft to exit from 28L. While leaving the cargo ramp and/or the transient ramp and

taxiway H, pilots get confused and treat runway 10-28 as taxiway H. Pilots find themselves on the active runway if they overlook the signs and markings.

The airport has put up "Do Not Enter" and "Wrong Way" signs at taxiway D to mitigate the problem at that location. Meanwhile air traffic controllers have made some changes to the way control instructions are given. It is a mandatory requirement to read back messages in order to increase pilot's awareness on using taxiway H.

During the site survey, the Technology Assessment Team noticed there was excessive deterioration of hold line paint that could easily be missed by pilots. Grass and weeds have grown and partially covered many signs around the airport.

The airport has conducted monthly Airport Advisory meetings to inform the community of changes and bring awareness to the pilot community. According to the MYF Airport Authority, transient pilots caused 95% of the runway incursions. Local pilots are well educated and familiar with the airport.

Non-technology Recommendations

We recommend mowing the grass and weeds around all the signs and repainting all faded hold lines and other markings.

Technology Recommendations

The runway incursions and surface incidents at MYF could largely be solved by non-technological means (i.e. upgrade security fence, new paint, signage visibility). However, if all non-technological recommendations are done and MYF still maintains a high number of runway incursions, MYF should be evaluated for potential technology solutions such as addressable signs and elevated guard lights to further mitigate surface incidents and runway incursions.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Montgomery Field (MYF) Runway Incursion Assessment Meeting
March 28, 2002

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
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Fong Lee	ARI-200	202-385-4768	fong.lee@faa.gov
Dennis McGee	NATCA/RSP	214-641-3000	dennis.mcgee@faa.gov
Thien Ngo	AND-520	202-493-5012	thien.ngo@faa.gov
Mike Ryan	NATCA/AND	202-493-5089	mike.ryan@faa.gov
Tom Erwin	FAA/MYF	858-277-5601	
Mike Tussey	City of San Diego	858-523-1538	mtussey@sandiego.gov
Elliott Brann	FAA/NATCA RSP W.P.	310-342-4900	elliottbrann@msn.com

FAA/Santa Barbara Municipal (SBA)
Runway Incursion Airport Assessment Meeting
March 27, 2002

Purpose

The Federal Aviation Administration (FAA) Technology Assessment Team visited Santa Barbara Municipal (SBA) on March 27, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. SBA air traffic management and the airport manager personnel attended the meeting. The purpose of the meeting was to:

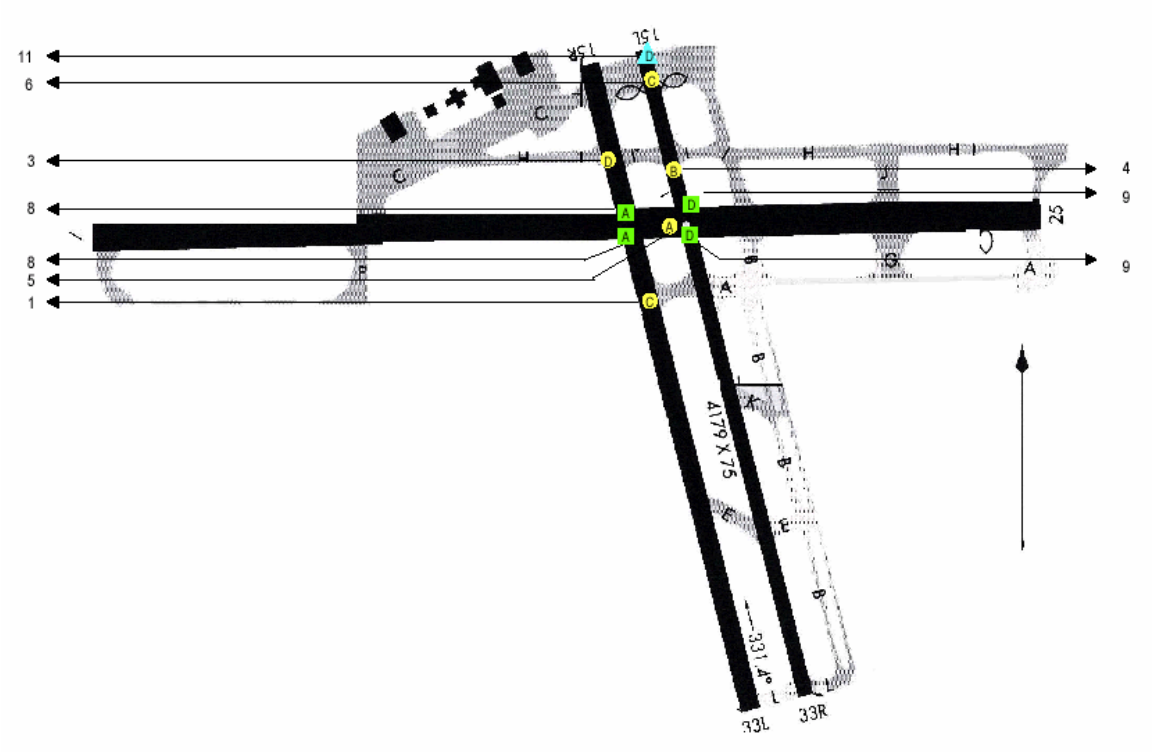
- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight into local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520); and
- Discuss potential for technology solution(s) to mitigate causal factors.

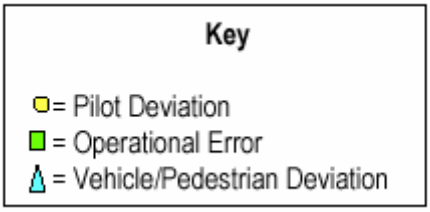
Background

Runway incursions at SBA between 1997-2000 according to FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	PWPTSBA00002	PD	C
2	PWPTSBA00008*	PD	D
3	PWPTSBA00011	PD	D
4	PWPTSBA97002	PD	B
5	PWPTSBA97003	PD	A
6	PWPTSBA99005	PD	C
7	SBAT00E001*	OE	D
8	SBA- T- 98- E- 001	OE	A
9	SBA- T- 99- E- 002	OE	D
10	V00SBAATCT002 VWPTSBA00002*	VPD	C
11	VWPTSBA00004	VPD	D

* Insufficient Location Data





Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility-- an effort that appears to be making a difference as indicated by the downward trend in incursions during 2001 (SBA had 1 runway incursion during 2001).

There are five key problem areas on the airport:

- High alert area 1 – There are general aviation hangars and a parking area along taxiway B and between taxiways K and E. Pilots occasionally fail to turn on

taxiway B via K and E and continue on 15L due to the short distance of these taxiways.

- High alert area 2 – At the approach end of 15L, there is a large open area (approximately 300 feet wide). Despite the exceptional paint, pilots cross the hold line without clearance.
- High alert area 3 – There is a slight fork where taxiways A and B intersect (A to the left and B to the right). When an aircraft is coming from the south of taxiway B and approaching the intersection of taxiways B and A, pilots get confused at the intersection and inadvertently follow taxiway A. This gets them on active runway 15L.
- High alert area 4– If an aircraft is parking west of 15R at C and landed on 15L/R, it requires numerous runway crossings to get to the ramp. (i.e. If an aircraft has just landed on runway 15R and went back to the tanker base, it would have to cross runway 15L, taxi down taxiway B, then cross runways 15L and 15R to get to taxiway C).
- High alert area 5– Near taxiway K where the general aviation (GA) ramp is located and the terminal ramp splits, pilots mistakenly enter the security area from GA ramp. This is an important security issue for the airport.

To mitigate problems, the airport has begun a strong pilot educational program and has been holding regular meetings with the pilots. They have put up a web site to inform them about the high alert areas. Once every six months, the air traffic (AT) controllers drive around the airport movement area to get the pilot's perception of the airport. To solve the problem at high alert area 3, the airport has enhanced the taxiway B centerline with blue paint. This allows AT controllers to use the phraseology "taxi via blue line" to keep the aircraft on taxiway B.

The airport is planning to expand the taxiway M parallel to runway 15R. This would mitigate the excessive runway-crossing problem. There is a risk that this may not happen due to environmental issues in the Santa Barbara area.

Non-technology Recommendations

No recommendations are made at this time.

Technology Recommendations

Both the Technology Assessment Team and the airport have determined that SBA has done all the basic things necessary (i.e. new paint, educational program) to mitigate surface incidents and runway incursions. It was also determined during our visit that technology solutions could also be effective for multiple high alert areas using yellow light emitting diode (LED) lights and addressable signs.

- High alert area 1 – Addressable signs could be an effective solution to enhance pilot awareness.

- High alert area 2 (300 ft wide area) – Yellow LED light could be used to enhance the hold line at 15L.
- High alert area 3 (slight fork) – To raise pilot awareness, addressable signs at the fork and/or in pavement LED to enhance blue line could be installed. .
- High alert area 5 (GA ramp to security) – A combination of red LED to enhance the pavement paint and an addressable sign triggered by sensors (i.e. loop) would raise user awareness.

ARI will be tracking the effectiveness of the local solutions and the Technology Team's recommendations.

Attendance:

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
Dave Kurner	FAA RSP/ Western Pacific	310-725-6681	dave.kurner@faa.gov
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Tracy C. Lincoln	City of Santa Barbara	805-692-6025	Tlincoln@ci.santa-barbaila

FAA/Sarasota-Bradenton International (SRQ)
Runway Incursion Airport Assessment Meeting
August 1, 2002

Purpose

The Federal Aviation Administration (FAA) Technology Assessment Team visited Sarasota-Bradenton International (SRQ) airport on August 1, 2002 to discuss runway incursion trends and mitigation alternatives specific to this facility. SRQ air traffic management and the airport management personnel attended the meeting. The purpose of the meeting was to:

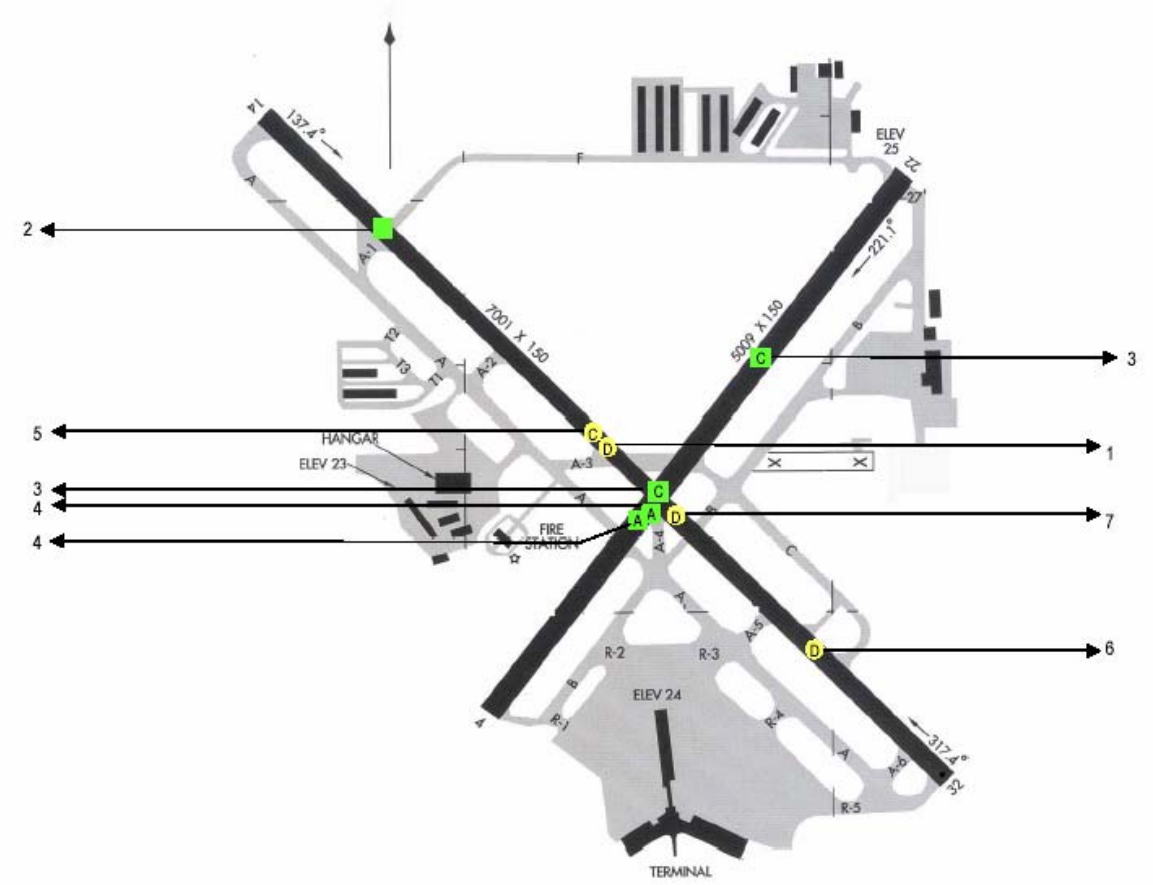
- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight into local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520); and
- Discuss the potential for technology solution(s) to mitigate causal factors.

Background

Runway incursions at SRQ between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	PSOTSRQ97001	PD	D
2	SRQ-T-00-E-001	OE	Accident
3	SRQ-T-97-E-001**	OE	C
4	SRQ-T-97-E-002	OE	A
5	PSOTSRQ00001	PD	C
6	PSOTSRQ00003	PD	D
7	PSOTSRQ00A02	PD	D

** Insufficient data to determine exact location.
Location estimated based upon available data.



Key

= Pilot Deviation
= Operational Error
= Vehicle/Pedestrian Deviation

Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and received a comprehensive presentation on runway incursions and prevention efforts by the facility. The team then provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). An open discussion followed and revealed a sustained and comprehensive runway incursion prevention effort by the facility. The Technology Assessment Team also received an extensive tour of the airport and the tower.

SRQ conducts approximately 200,000 operations a year and about 90% of its traffic is from general aviation planes. Since an accident occurred two years ago), the airport has

been extending taxiway C to full length. This extension is due to be completed by next year. The full-length taxiway C will give controllers more options and flexibility. Runway guard lights will also be installed around taxiway C.

The 87-foot tall tower was commissioned in 1987. During our visit, the airport expressed concerns about the inadequate height of the tower, as well as the current and future extension of the runways and taxiways. These could impact the controller's line of sight.

Taxiway A-3 is a very wide, old runway. The west end of the taxiway is connected to a ramp from the hangar area that also intersects with Taxiway A. This means there is a wide expansion of pavement at the intersection that can create confusion for pilots as they travel this area, especially when they are taxiing from the ramp.

The airport is in the process of conducting an inventory of the signage on the airfield to ensure compliance with Part 139 sign standards. The airport has double size painted hold lines at all taxiway/runway intersections.

Other improvements that the airport has done to minimize the number of runway incursions at SRQ:

- Controlling access from the outside has virtually eliminated the vehicle and pedestrian deviations;
- The airport has begun a strong educational program and conducts safety meetings for pilots every three months. Also, during the period of construction, the airport is conducting pre-construction meetings, safe driving training, and weekly construction safety meetings to discuss airport and airfield familiarization and training.
- The airport vigorously pursues enforcement action against those who violate the airport rules and regulations regarding driving on the Airport Operations Area (AOA). This consists of monetary penalties up to $10,000 and/or banishment from the airport.
- A perimeter road, constructed in recent years, has had a big impact on reducing vehicle/pedestrian deviations (i.e. fuel and construction truck crossings).

Non-technology Recommendations

The downtrend of runway incursions (RIs) at SRQ in recent years is encouraging. SRQ is proactive in reducing and preventing RIs by making several runways and taxiways improvements. SRQ's strong educational program as well as heavy penalties in terms of fines and suspensions also has had a positive impact on reducing RIs.

The Technology Assessment Team noted SRQ's line of sight problems created by the extension of various taxiways and runways and also its concerns regarding the tower height. . The Technology Assessment Team agreed to elevate this concern to FAA headquarters level.

Technology Recommendations

No technology recommendations are made at this time. In general, SRQ has done a good job in reducing and preventing RIs.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Runway Incursion Airport Assessment Meeting
Sarasota (SRQ)
8/1/02
Sign in Sheet

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
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FAA/Teterboro (TEB)
Runway Incursion Airport Assessment Meeting
June 11, 2002

Purpose

On June 11, 2002, the Federal Aviation Administration (FAA) Technology Assessment Team visited Teterboro Airport (TEB) to discuss runway incursion trends and mitigation alternatives specific to this facility. TEB air traffic and airport management personnel attended the meeting. The purpose of the meeting was to:

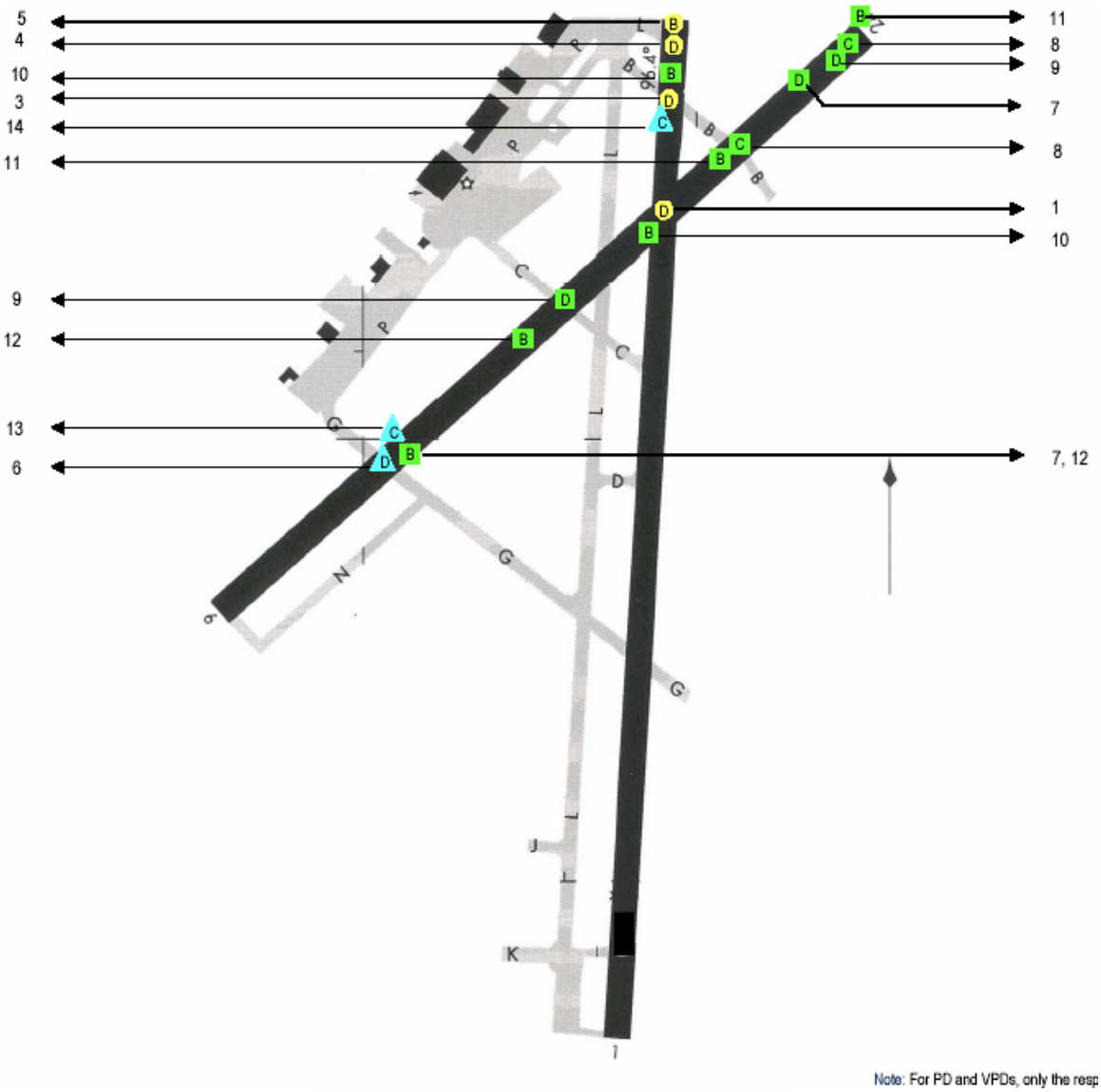
- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight into local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520); and
- Discuss the potential for technology solution(s) to mitigate causal factors.

Background

Runway incursion data at TEB between 1997-2000 according to the FAA Runway Safety Report:

Key Locator	REPORT	RI Type	RI Category
1	PEATTEB00002	PD	D
2	PEATTEB97004*	PD	ID
3	PEATTEB98001	PD	D
4	PEATTEB99001	PD	D
5	PEATTEB99002	PD	B
6	V99TEBATAC047	VPD	D
7	TEB-T-00-E-003	OE	D
8	TEB-T-00-E-004	OE	C
9	TEBT00E005	OE	D
10	TEB-T-97-E-001	OE	B
11	TEB-T-97-E-002	OE	B
12	TEB-T-98-E-001	OE	B
13	V00TEBATCT001	VPD	C
14	V97TEBATCT42	VPD	C

* Insufficient Location Data



Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and received a comprehensive presentation on runway incursions and prevention efforts by the facility. The team then provided a brief overview of FAA's current and on-going technology development efforts (Appendix A). An open discussion followed and revealed a

sustained and comprehensive runway incursion prevention effort by the facility. The Technology Assessment Team also received an extensive tour of the airport and the tower.

TOWERS: Period Report

From 1997 To 2002: TEB: (Calendar Year)

		ITINERANT			LOCAL			
FACILITY	**DATE**	**AC**	**AT**	**GA**	**MIL**	**GA**	**MIL**	**TOTAL**
TEB	1997	163	22414	181378	700	2600	0	207255
TEB	1998	134	23329	198466	346	1604	0	223879
TEB	1999	292	28565	218542	476	2982	0	250857
TEB	2000	171	48049	226575	555	7497	0	282847
TEB	2001	143	64235	175076	287	8478	0	248219
TEB	2002	115	41425	76850	131	442	0	118963
Total		**1018**	**228017**	**1076887**	**2495**	**23603**	**0**	**1332020**

TEB is a busy airport with 250,000 operations per year (approximately 810-840 operations daily during weekdays). On certain days, TEB has conducted more operations than John F. Kennedy International Airport (JFK). The close proximity of TEB to Newark International Airport (EWR) has a significant impact on the operation of TEB, affecting its arrival and departure streams and increasing delays. The increase in traffic at TEB after September 11, 2001 has also contributed to the overall delay. Another factor, according to TEB, is that there are five positions of operation but only four allocated frequencies. This forces the airport to share one frequency between arrival and gate-hold operations.

Aircraft exiting from the fixed base operator and flight school, located in the northeast corner of the airport, have to cross three runways (Runway 6-24 two times) while taxiing for departure on Runway 6 (via Taxiways B, P and G). The high number of runway crossings increases the chance for runway incursions at those intersections.

There is a wide expanse of pavement at the intersection of Taxiways L, B and P that could create confusion for pilots as they cross this area (especially when pilots are taxiing down Taxiway L or are leaving from the First Aviation ramp).

Many pilots are under pressure from their employers for on-time performance and have taken clearances meant for others, causing runway incursions.

The airport plans to add/extend a number of parallel taxiways that will significantly reduce the number of runway crossings. These improvements will be completed in three to five years. Also, in the next year or two, many of the taxiways intersecting Runway 6-24 will be made high-speed exits. Taxiway P will be relocated closer to and parallel with Runway 6-24. It will also be extended. This project will start next year. Taxiway N will be extended to help reduce multiple runway crossings. These projects will clean up a

number of intersections. According to TEB, the extension of Taxiway N will dramatically reduce runway crossings by as much as 50%.

Non-technology Recommendations

At this time, the Technology Assessment Team is making no recommendations. TEB has been proactive in reducing and preventing runway incursions by making several taxiway and intersection improvements.

Technology Recommendations

The Port Authority is currently pursuing the purchase of ASDE-X for TEB and has strong support from National Air Traffic Controllers Association (NATCA). The Technology Assessment Team believes ASDE-X is the right solution for TEB. Several complex and high alert intersections at TEB could benefit from addressable message boards and/or enhanced hold short LED technologies.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Runway Incursion Airport Assessment Meeting
Teterboro (TEB)
6/11/02
Sign in Sheet

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
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FAA/Knoxville McGhee-Tyson (TYS)
Runway Incursion Airport Assessment Meeting
December 11, 2001

Purpose

The Federal Aviation Administration (FAA) Technology Assessment visited Knoxville McGhee-Tyson (TYS) on December 11, 2001 to discuss runway incursion trends and mitigation alternatives specific to this facility. TYS air traffic management and the airport management personnel attended the meeting. Even though TYS was not on the original list of airports to be visited by the team, the Surface Technology Assessment Program (AND-520) was contacted by the regional Runway Safety Program manager and the Airport Authority to conduct a technology assessment in order to determine if technology solutions could be beneficial at TYS to mitigate runway incursions and surface incidents. The decision was made to follow the same process that the Technology Assessment Team has been using to conduct visit at other airports. The purpose of the meeting was to:

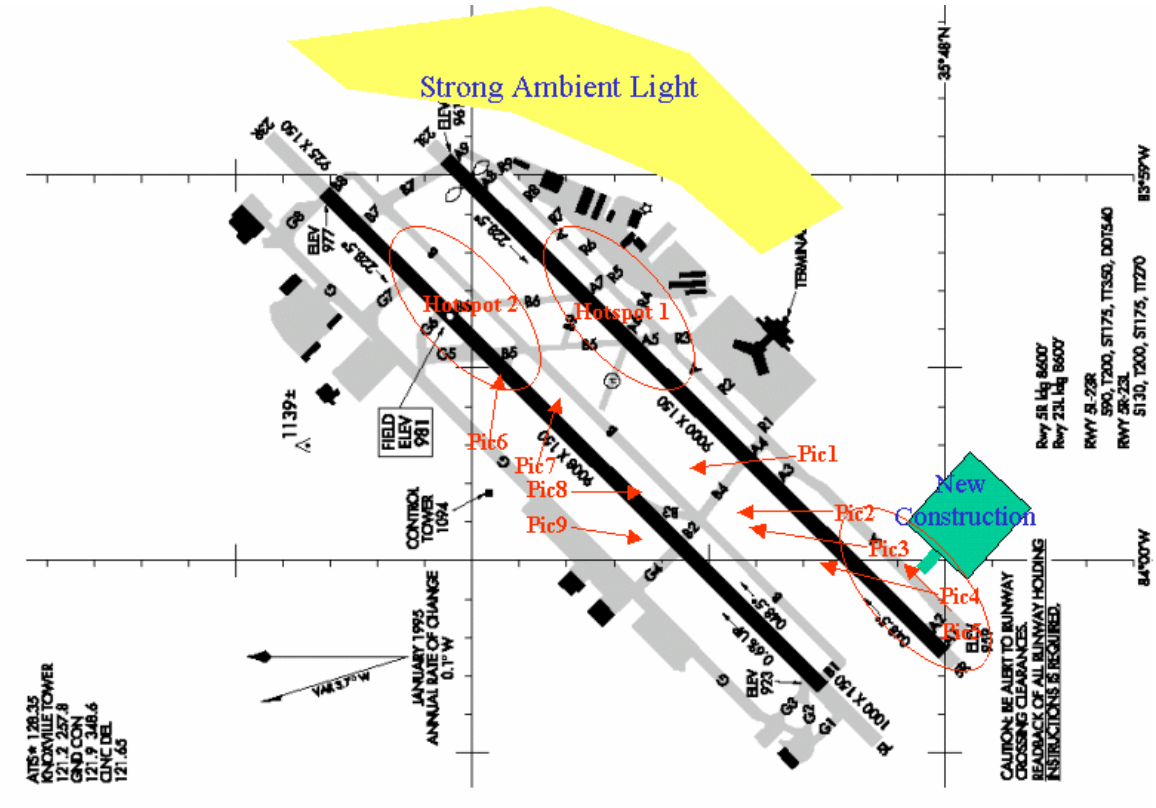
- Conduct a two-way interchange to gain a better understanding of local runway incursion causal factors;
- Gain insight into local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520); and
- Discuss potential for technology solution(s) to mitigate causal factors.

Assessment/Fact Finding

The Technology Assessment Team reviewed the meeting objectives and provided a brief overview of AND-520 current and on-going technology development efforts. (See attached briefing). The regional Runway Safety Program manager and TYS personnel reviewed the current runway incidents at TYS and its prevention program. An open discussion followed providing insight to runway incursion prevention effort by the facility.

One of the problems that Knoxville McGhee-Tyson (TYS) airport has is the height of the tower. The TYS tower was built about 14 years ago with a height of less than 90 feet. Since then, the runways have been extended from 6000 feet to 9000 feet. TYS is also expanding with a new cargo and maintenance area near intersections A1 and A2. At those intersections, taxiway A is lower than its parallel runway. From the tower perspective, controllers can, at best, only see the top of aircraft at the east end of the taxiway. The air traffic controller has no way of seeing if a vehicle crosses the hold-short line due to the obstruction of higher ground. The ambient light around the airport in the evening and early morning creates extremely difficult conditions for controllers to pick out traffic on taxiway intersections A5 through A9. Many times, air traffic controllers lose visual contact with the traffic on the ground. The figures below show the airport diagram depicted with potential high alert intersections and strong ambient light at the

TYS. The arrows and identification spots associated with the arrows indicate the locations and the direction of the camera shots.



Non-Technology Recommendations

The Technology Assessment Team believes a taller tower and/or surveillance solution is needed to address TYS visibility problem.

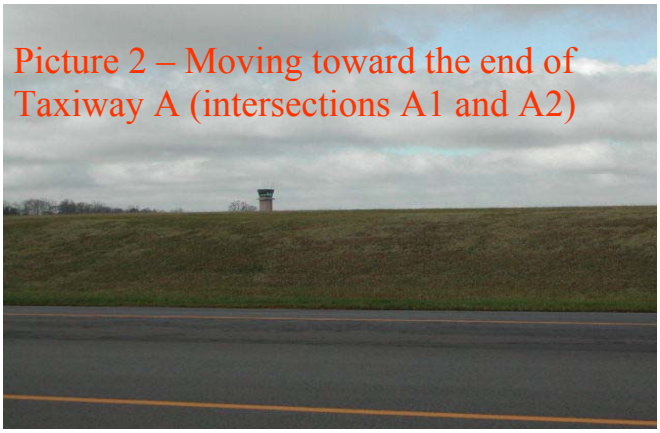
Technology Recommendations

Technology solutions (i.e. addressable message boards) could be effective at the high alert intersections. AND-520 and TYS airport authority will be assessing the potential solution(s) for one or more high alert intersections in the coming months.

ARI will be tracking the effectiveness of the local solutions and the Technology Assessment Team's recommendations.

Picture 1 – Warning sign

Picture 2 – Moving toward the end of Taxiway A (intersections A1 and A2)



Picture 3 – Tower view disappears completely

Picture 4 – Looking back to the tower toward tower

List of Attendees

Name	Organization	Phone	Email
Anna Cohen	FAA / RSP Southern Region	404-305-5558	Anna.Cohen@faa.gov
Dan Cilli	FAA Southern Region	404-305-5596	Daniel.Cilli@faa.gov
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FAA/North Las Vegas Airport (VGT)
Runway Incursion Assessment Meeting
August 1, 2001

Purpose

The Federal Aviation Administration (FAA) visited North Las Vegas August 1, 2001 to discuss runway incursion trends and mitigation alternatives specific to this facility. VGT air traffic management and airport management personnel attended the meeting. The visit at VGT took place before the Technology Assessment Team formed and the survey process established. However, the purpose of the meeting was the same:

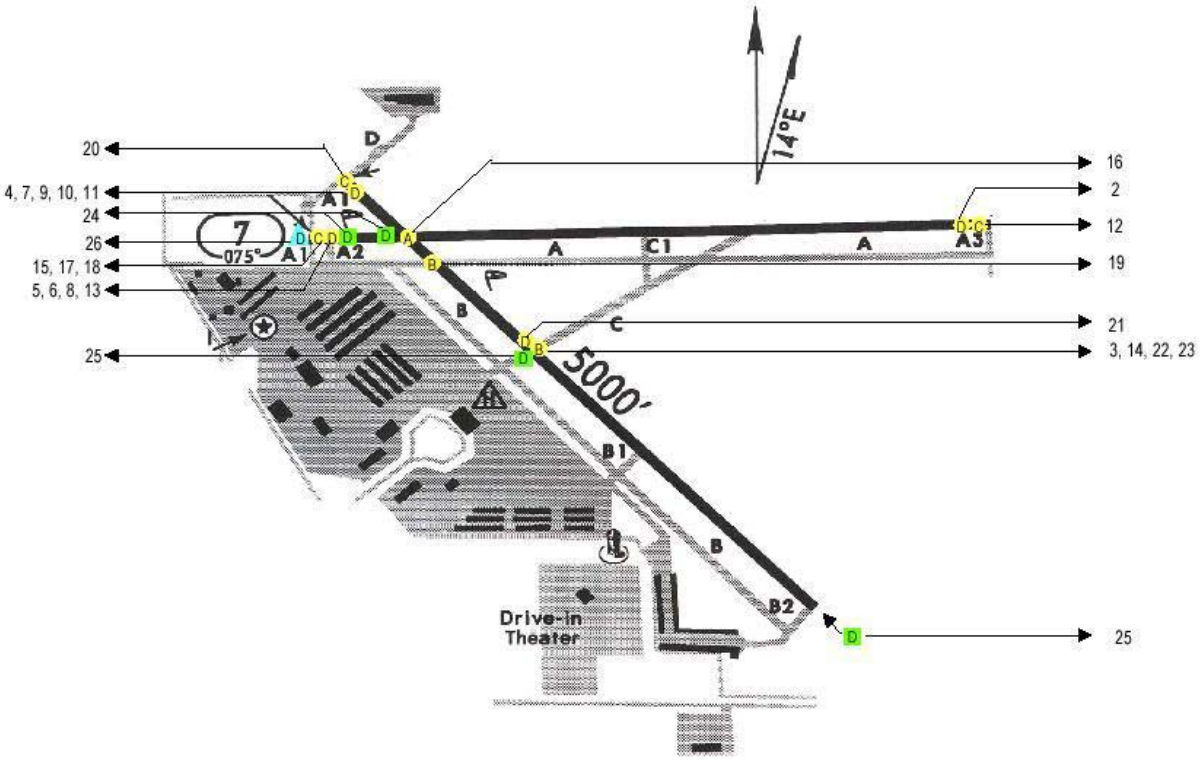
- Conduct a two-way interchange to a gain better understanding of local runway incursion causal factors;
- Gain insight into local runway incursion reduction initiatives;
- Describe current and near future surface technology projects of the FAA Surface Technology Assessment Product Team (AND-520); and
- Discuss the potential for technology solution(s) to mitigate causal factors.

Background

Runway incursion data at VGT between 1997-2000 according to the FAA Runway Safety Report:

Key Locatr	REPORT	RI Type	RI Category
1	PWPTVGT00001*	PD	C
2	PWPTVGT00003	PD	D
3	PWPTVGT00004	PD	B
4	PWPTVGT00005	PD	D
5	PWPTVGT00006	PD	D
6	PWPTVGT00008	PD	D
7	PWPTVGT00012	PD	D
8	PWPTVGT00017	PD	D
9	PWPTVGT00024	PD	D
10	PWPTVGT00028	PD	D
11	PWPTVGT00033	PD	D
12	PWPTVGT00035	PD	C
13	PWPTVGT00036	PD	D
14	PWPTVGT00037	PD	B
15	PWPTVGT00038	PD	C
16	PWPTVGT97001	PD	A
17	PWPTVGT98001	PD	C
18	PWPTVGT98004	PD	C
19	PWPTVGT98A02	PD	B
20	PWPTVGT98A04	PD	C
21	PWPTVGT99004	PD	D
22	PWPTVGT99005	PD	B
23	PWPTVGT99006	PD	B
24	VGTT00D003	OE	D
25	VGT-T-97-E-001	OE	B
26	V00VGTATCT001 VWPTVGT00001	VPD	D

*Insufficient Location Data



Assessment/Fact Finding

As of February 2001, the following has happened at the VGT airport:

1) A new Air Traffic Control Tower (ATCT) has been built;
2) A third runway (12R/30L) has been constructed;
3) A centerfield and additional taxiways were added;
4) An expansion ramp parking area was added; and
5) An instrument landing system was installed.

Common taxi routes and taxiways are closed on a daily basis. Facility personnel are providing routine assistance to pilots attempting to taxi in and around these areas. Additionally, the construction is creating a distraction on the airport, demanding additional awareness on the part of facility personnel as they ensure pilots do not taxi into areas that are temporarily closed.

Coming off the runway, aircraft are switched from local control to ground control. Frequently, a runway crossing occurs. If pilots were to stay on local control, they would have a better awareness of what is occurring on the other runways. However, the local

controller is responsible for watching aircraft and getting read-backs, therefore, he/she may not have time to watch the taxiway operations. This procedure needs to be customized to work at individual airports, and most often when there are parallel runways. The majority of runway incursions are pilot deviations (with 74% of them Part 91 operations).

International Civil Aviation Organization airport standards have been used since 1992, but some pilots are still not aware of them. Visual cues such as hold lines are difficult to see when taxiing westbound in the afternoon/evening due to sun and sand. There is a need to emphasize flight education and the use of runway guard lights.

The airport is doing an excellent job in communicating with users. Surface safety brochures were mailed out to pilots, while a website and newsletter was created to gain everyone's awareness and address unfamiliar areas.

Non-Technology Recommendations

The installation of more elevated runway guard lights at identified "high alert" areas such as the runway holding position marking for Runway 7 and Runway 12 on Taxiway A-1 is in process, and the Runway Safety Action Team (RSAT) is monitoring the status of the progress. The Technology Assessment Team believes that the runway incursions and surface incidents at VGT could largely be solved by local solutions (i.e. education and communication) that were being implemented at the time of this visit. Also, the construction of the new tower and runway/taxiway are due to be completed by early 2002.

The RSAT will keep monitoring the trend of runway incursions and provide recommendations if other technical assessment visits are necessary.

Technology Recommendations

No technology solutions are recommended to VGT at this time. After the visit to VGT, the airport initiated a new procedure to have the pilots stay on local control until they cross the runways.

List of Attendees

Name	Organization	Phone	Email
Jaime Figueroa	FAA HQ / AND-520	202-267-3038	Jaime.Figueroa@faa.gov
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Appendix F:
Synopses of AND-520 Emerging Technologies

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Synopses of AND-520 Emerging Technologies

The following is a brief summary of the two technologies selected from the Broad Agency Announcement (BAA) process: Ground Marker (GM) and Addressable Message Boards (AMB).

In addition, the Surface Technology Assessment Product Team (AND-520) is testing and evaluating other technology, including in-ground Light Emitting Diodes (LED), the Airport Lighting Project, and the Laser Hold Line. The initial assessment results indicate that these technologies show promise and warrant a full operational assessment at selected test sites.

Ground Marker: This demonstration contract was awarded to Airspec, Limited, and the demonstration was conducted at the Federal Aviation Administration (FAA) William J. Hughes Technical Center (WJHTC), Atlantic City, New Jersey, in November 2001. The final report was issued in January 2002.

Ground Marker consists of a low power 75MHz radio communication system that is used for localized transmission of voice messages containing appropriate information to pilots. These messages are received via the 75 MHz marker receiver installed in instrument equipped aircraft.

The ground marker concept was successfully demonstrated at the FAA test facility in Atlantic City and found to be a potentially effective pilot situational awareness enhancement tool. It will be further developed and formally tested at key site(s).

Addressable Message Boards: This demonstration contract was awarded to Technology Planning Incorporated, and the demonstration conducted at the College Park Airport, Maryland (CGS) in October 2001. The final report was issued in January 2002.

The SMART Board is an addressable electronic sign that can display programmed advisory messages on a Light Emitting Diode (LED) display at taxiway/runway intersections of interest. The original demonstration proposal was broader in scope and included a system control function display that was found to be problematic from a human factors perspective. However, the pilot visual aid (i.e. the board itself) was found to be a potentially effective situational awareness tool. The Quick-Look report was issued in June 2002 with favorable results. The board will be formally evaluated for its operational effectiveness at key site(s).

In-Ground LED: This demonstration contract was awarded to Daniel, Mann, Johnson, Mendenhall, Holmes and Narver (DMJMH+N) and the demonstration is currently being conducted at the Eppley Airfield in Omaha, Nebraska. The operational demonstration period commenced on July 19, 2002 and is planned to conclude on December 31, 2002. The final report will be issued in March 2003.

The In-Ground LED is a commercial transportation grade light strip with Light Emitting Diodes encased in a linear strip of clear plastic. The light strips can be fashioned into patterns or insignias and illumination automatically controlled to provide intuitive guidance and marking information. The intent of the In-Ground LED light strips is to accentuate runway and taxiway signage and markings (i.e. hold-short lines) that may become obscured during low light and low visibility weather conditions. The LED will be installed at other key site(s) for evaluation purposes.

Airport Lighting Project

Runway Guard Lights (RGLs) are currently required by the FAA for airports that have an approved Surface Movement Guidance and Control System (SMGCS) plan to conduct operations during low visibility conditions. The RGLs enhance the standard visual cues, sign and markings, used to mark the location of the holding position. Because RGLs are an international standard and are visible in both day and night operations, RGLs may provide added surface safety during all-weather conditions. The FAA is conducting an evaluation of the use of RGLs for all-weather conditions to establish a minimum standard for the use of RGLs for non-SMGCS locations. The airports selected for this evaluation project are North Las Vegas (VGT) and Long Beach (LGB) Airports. The application criteria for the use of RGL will be develop at the completion of the evaluation.

Laser Light Hold Lines

The Laser Enhancement Program is designed to emphasize hold position markings by projecting a bright light across the first solid line of the hold position markings. The laser and optic assembly adjacent to and slightly above the area projects a line or shaped beam of laser light along the surface. This equipment will illuminate a solid "yellow" line across a hold position line at least 75 feet wide.

In addition, it was designed to identify the position of the hold line in adverse weather conditions by illuminating airborne particles (rain, snow, fog) at/near the hold line. This creates a low profile three-dimensional line that is far more noticeable than traditional low visibility lighting aids. The technology has the capability to project lines in red and yellow laser illuminations. In areas that are subject to snow accumulations that can cover up painted markings, the laser lines will provide the location, layout, color, and importance of these markings.

Flashing PAPI

The Flashing PAPIs will be used to provide warning to aircraft pilots on final approach when other aircraft or vehicles are actively on the runway. The concept behind the Flashing PAPI system is to use the normal PAPI already at the airport and overlay runway occupancy information onto the standard guidance information. By flashing the PAPI lights when a critical area on the runway is occupied, the pilot gains immediate safety information while still receiving guidance information from the PAPI lights.