

**Runway Incursion
Joint Safety Implementation Team
Detailed Implementation Plan
For
General Aviation (GA) Aircraft Upgrade and Installation**

DRAFT

Statement of Work

The purpose of this project is to reduce runway incursion incidents by improving pilot situational awareness using cockpit moving map technology in GA aircraft. This JSIT recognizes that some aircraft may alternate between commercial and GA classifications, and therefore recommends that the “Detailed Implementation Plan for Commercial Aircraft Upgrade and Installation” be consulted as well. Ultimately, equipment selection will be dependent on not only aircraft operations, but also sophistication of existing avionics and upgrade investment costs for each individual aircraft being considered.

Federal Aviation Administration (FAA) data shows that runway incursion incidents are increasing. The runway incursion Joint Safety Analysis Team (JSAT) has determined that moving map technology is highly effective (the four moving map interventions rated in the top ten out of 146 interventions) for reducing the threat of accidents caused by runway incursions. National Aeronautics and Space Administration (NASA) and the National Transportation Safety Board (NTSB) also support the addition of this technology into the cockpit for the purpose of runway incursion prevention. The FAA Safe Flight 21 Program performed an analysis that estimated 43% of runway incursion incidents (attributable to pilot deviations) could be eliminated using a cockpit moving-map (with airport diagram) that showed own ship position (enabled by GPS). They also estimated that by displaying proximate traffic on the moving map significant additional runway incursion incidents would be eliminated (enabled by Automatic, Dependant Surveillance Broadcast (ADS-B) and Traffic Information Service Broadcast (TIS-B) technologies). Finally, the addition of runway occupancy advisory systems and data-linked, graphical taxi clearance/limit systems will further reduce incursion incidents and accidents.

Operator implementation of moving map technology is voluntary. Several methods of implementation are envisioned in a stepwise fashion to achieve safety and productivity enhancements from moving map technology in the near through long-term. Data requirements and certification issues exist for each method. System-wide improvements to digital map products as well as wide distribution of this data to industry are critical to the success of each method. Cockpit airport moving map display systems shall incorporate industry “best practices” for computer-human interface (CHI) design to enhance and support pilot situational awareness.

Integration of moving map technology into the continuum of current cockpit layouts will require a full range of avionics solutions from stand-alone systems to fully integrated displays. End state incorporation of the varied levels of technology into aircraft will be determined by cost, the need to meet industry safety standards, and the productivity needs of individual operators. The FAA will encourage development of cockpit airport surface moving map displays that are suitable for all types of GA aircraft.

The project requirements were developed from the intervention strategies outlined in the Runway Incursion JSAT list of interventions as follows:

- Promote installation of graphic cockpit displays (airport surface moving map) that depict the airport surface with own-ship position (enabled by GPS), cleared taxi routes and taxi clearance limits to all GA operators. Apply data link technology to allow cockpit display to show ATC cleared routes and clearance limits. Systems should be developed for different equipage schemes.
- Promote installation of graphic displays with traffic information and runway occupancy advisory systems to all GA operators. Systems must be developed for different equipage schemes. ADS-B and TIS-B are the enabling technologies for traffic information.

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The project requirements for the moving map implementation are organized into four phases. The phases are listed in a "best estimate" chronological order. PHASE 1 will address development and installation of cockpit moving map (airport) displays with own-ship position (enabled by GPS). PHASE 2 will add display functionality for data-linked traffic, ground and air, utilizing ADS-B and TIS-B. PHASE 3 will add functionality for runway occupancy advisory systems, and PHASE 4 will add functionality for data-linked taxi routes and clearance limits. Each phase will require the continuing development and certification of cockpit display equipment and the formation of standards, guidelines and procedures for use of the equipment

Lead Organization for Overall Project Coordination (LOOPC): FAA AVR-1

Safety Enhancement 1: General Aviation Cockpit Moving Map Display Installations (SE-63)

The installation of cockpit airport surface moving map displays in all GA aircraft would improve aviation safety by reducing runway incursions through enhanced own ship situational awareness, traffic awareness, runway occupancy advisory systems and graphical taxi clearances. However, due to vast differences in GA operations, it is not practical these aircraft are equipped at the same level.

Accident Prevention Index:

Resource Requirements:

Avionics costs are based on FAA Safe Flight 21 estimates as contained in Appendix A, and represent the worst-case average cost for the installation of moving map systems. The Safe Flight 21 worst-case costs were based on the avionics, installation (including maintenance and downtime), and certification for PHASE 1 through PHASE 3 of this safety enhancement. PHASE 4 costs could be software and/or hardware upgrades depending on previous installations.

- Output 1 Operator Cost (hardware + installation)-\$1.5K-\$250K—Moving map with own-ship position as the basic system. Systems with traffic information (transmit only or transmit/receive) should be encouraged, depending on operator use. The cost range is based on low end (single/twin engine piston aircraft with electrical systems) to high end (turbojet with integrated cockpits) GA aircraft.

- Output 2
FAA cost—est-10 FTE
NOAA cost—est.-2 FTE/year + \$30K/airport
Industry—est-1/4 FTE /operator

- Outputs 3-5
Operator Cost—est. \$2K/aircraft/function upgrade
FAA Cost—est-1/2 FTE/output
Industry Cost—est-1/4 FTE/output

Completion Date: FY 2002-FY2010

PHASE 1

Output 1

FAA will encourage specified GA operators to install cockpit airport surface moving map displays with own ship position (provided by GPS) in **all next generation, newly designed, and existing GA aircraft.**

Resources: AFS (LOOC), AIR, AND, RTCA, Manufacturers, Operators, Associations, ATP

Timeline: FY 2003 – FY2008

Actions:

- The FAA will provide safety and cost benefit information, National Airspace System (NAS) roadmaps, and any support information to operators to encourage equipage.

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- The FAA (AIR, AFS) should work with operators, associations (AOPA, NBAA, GAMA), and manufacturers to determine the appropriate level of equipment for all classes of GA aircraft. (Appropriate level of equipment could be handheld, portable, electronic flight bag, panel mounted or integrated into an EFIS system). The intent of these systems is for use as supplementary equipment.
- FAA (AND, AIR, AFS) will work with RTCA to establish standards (MASPS, MOPS) for cockpit moving map displays.
- FAA (AIR) will provide airworthiness criteria developed from standards and requirements defined by cooperation with industry for cockpit airport surface moving map displays. Own-ship position will have defined accuracy requirements.
- FAA (AND) will award contracts to avionics manufacturers for the development of cockpit moving map displays.
 - Manufacturers should develop avionics that target all levels of GA aircraft based on cost and use.
- FAA (AFS, AIR) will develop appropriate installation, maintenance, operations procedures and training guidance for use in Non-part 121 aircraft:
 - Certification of moving map display—AIR (LOOC) FY 2001-FY 2007
 - Operation guidance issued—AFS (LOOC)
 - AFM requirements (AFS, AIR)
 - Forward fit aircraft FY 2005-FY 2007
 - Retrofit aircraft FY 2001-FY 2007
 - Advisory Circular (AFS) FY 2002
 - Maintenance guidance issued
 - Advisory Circular Part 25 (ANM) FY 2002
 - Advisory Circular Part 23 -(ACE) FY 2002

Output 2:

FAA will coordinate with the appropriate government agencies for collection of airport survey data, validation of survey data, application of airport attributes (e.g., taxiway, runway labels), and dissemination of airport databases for use in cockpit surface moving maps.

Resources: ATA-100 (LOOC), AVN, AFS, AIR, NOAA/NGS, NACO, NIMA, Manufacturers, and Data Providers

Timeline: Begins in FY 2001-FY2004

Actions:

- FAA (ATA-100) will provide NOAA/NGS with prioritized survey schedule.
- NOAA/NGS will acquire/provide airport survey data for all Part 139 airports that meet the requirements of RTCA SC-193 Airports document.
- National Aeronautics Charting Organization (NACO), AVN-500, will apply attributes to NOAA/NGS survey data and make available to the industry in appropriate formats.
- FAA infrastructure must be established to prioritize, collect and revise airport data for all Part 139 airports.

PHASE 2

Output 3:

The FAA will encourage specified GA operators to upgrade cockpit moving map displays to **add air/ground traffic functionality to cockpit surface map displays**. This output applies to all types of GA aircraft that have installed cockpit moving map displays. ADS-B and TIS-B are the enabling technologies for this output. This technology should be made available for all classes of GA aircraft.

Resources: AFS (LOOC), AIR, AND, RTCA, Manufacturers, Operators.

Timeline: FY 2002-FY 2007

Actions:

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- FAA (AND, AIR, AFS) will work with RTCA to establish standards (MASPS, MOPS) for air/ground traffic on a cockpit moving map display.
- FAA (AND) will continue to fund development of moving map displays to add air/ground traffic functionality.
 - Aircraft/avionics manufacturers should make this functionality available for all cockpit moving map displays.
- FAA (AFS, AIR) will establish certification requirements and procedural requirements for air/ground traffic functionality.

PHASE 3

Output 4:

The FAA will encourage specified GA operators to upgrade, cockpit moving map displays to **add runway occupancy advisory systems to cockpit moving map displays**. This output applies to all types of GA aircraft that have installed cockpit moving map displays. This technology should be made available for all classes of GA aircraft.

Resources: AFS (LOOC), AIR, AND, RTCA, Manufacturers, Operators

Timeline: FY 2002-FY 2008

Actions:

- FAA (AND, AIR, AFS) will work with RTCA to establish standards (MASPS, MOPS) for runway occupancy alerting on a cockpit moving map display.
- FAA (AND) will continue to fund development of moving map displays to add runway occupancy alerting functionality.
 - Aircraft/avionics manufacturers should make this functionality available for all cockpit moving map displays.
- FAA (AFS, AIR) will establish certification requirements and procedural requirements for this functionality.

PHASE 4:

Output 5:

The FAA will encourage specified GA operators to upgrade cockpit moving map displays to **add data linked taxi clearance and clearance limit functionality to cockpit moving map displays**. This output applies to all types of GA aircraft that have installed cockpit moving map displays. This technology should be made available for all classes of GA aircraft.

Resources: FY 2007-2010

Timeline: AFS (LOOC), AIR, AND, RTCA, Manufacturers, Operators

Actions:

- FAA (AND, AIR, AFS) will work with RTCA to establish standards (MASPS, MOPS) for data linked taxi clearance and clearance limits on a cockpit moving map display.
- FAA (AND) will continue to fund development of moving map displays to add data linked taxi clearance and clearance limit functionality.
 - Aircraft/avionics manufacturers should make this functionality available for all cockpit moving map displays.
- FAA (AFS, AIR) will establish certification requirements and procedural requirements for this functionality.

Relationship to Current Aviation Initiatives

- Creation of Runway Safety Program Office within the FAA
- Regional Runway Safety Program Managers added to FAA Regional Offices
- Runway Safety Program Office in conjunction with Runway Incursion JSIT created Top Ten Initiatives For Reducing Runway Incursions
- Joint Industry/Government Runway Incursion Summits
- FAA published guidance material (AC, HBAT, PTS, etc.)
- Runway Safety Actions Teams (RSAT)
- Linking of Runway Safety Program Initiatives to Runway Incursion Joint Safety Implementation Team Initiatives
- Safeflight 21 Runway Surface Roadmap
- NAS Operational Evolution Plan (OEP)
- RTCA activities
- NASA Aviation Safety Program, Runway Incursion Prevention Systems (RIPS)

Performance Goals and Indicators

- Goal: Reduction of runway incursions where a pilot deviation was the causal factor.
 - Indicator: Reduction in the number and rate of runway incursions resulting from pilot deviations as measured by the FAA Runway Safety Program office by 2007.
- Goal: All Non-part 121 aircraft equipped with cockpit moving map displays
 - Indicator: Actual aircraft equipage will meet or exceed Safeflight 21 Cost/Benefit equipage projection.

Programmatic Approach

Organizational Strategy

The Runway Incursion JSIT identified Jim Walton, UPS Airline, as the JSIT project lead for Runway Incursion Aircraft Equipment/Vehicle Upgrade/Installation subgroup. The project lead will coordinate implementation activities outlined in the Implementation Plan and will provide progress reports to the Runway Incursion JSIT until receipt of CAST G Level approval. Implementation is viewed as a shared responsibility between the FAA and interested GA parties. The FAA offices of primary responsibilities (OPR) for this plan are AVR, (AFS and AIR) and AND. The primary responsibility for industry is shared between CAST and JSC member organizations.

Implementation Activities

Major activities include the establishment of avionics standards and requirements for moving map systems, the standards and infrastructure for the survey of airports and dissemination of airport databases, and the certification and operational approval of moving map systems in GA aircraft. These activities will provide avionics to pilots that will reduce runway incursions by improving airport surface and airport traffic situational awareness.

Key Products and Milestones

Cost Benefit Analysis (Safeflight 21)	3 months
Safeflight 21 Runway Surface Roadmap	3 months
NAS Operational Evolution Plan (OEP)	In progress
FAA Runway Safety Program office campaign to encourage equipage And periodic publication of status of industry moving map equipage	36 months
Display and ADS-B Standards	
ADS-B MASPS	Complete
1090 Link MOPS	Complete
1090 Rev A Link MOPS	In Progress
UAT Link MOPS	In Progress
TIS-B MASPS	18 months
TIS-B MOPS	18 months
CDTI MOPS	12 months
Ongoing Moving Map Development	
SF 21 Capstone Phase 2 contract award	In progress
Contract Due Date	9 months

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Key Products and Milestones (Cont.)

FAA assistance to manufacturers for Moving Map development /certification Safe Flight 21 Coordination with vendors and FAA Standards/Certification	In Progress
FAA (AFS, AIR) will develop appropriate installation, maintenance, operations procedures and training guidance for use in GA aircraft:	
Certification of moving map display—AIR (LOOC)	First certification—FY 2002
Operation guidance issued—AFS (LOOC)	
Advisory Circular (AFS)	FY 2002
Maintenance guidance issued—AFS (LOOC)	
FAA (ATA) will provide NOAA/NGS with prioritized survey schedule	
Initial 75 airport surveys contracted by SF 21	October 2002
Prioritization for remaining Part 139 airport surveys	12 months
NOAA/NGS will acquire/provide airport survey data for all Part 139 airports that meets the requirements of RTCA SC-193 Airports document.	In Progress
National Aeronautics Charting Organization (NACO), AVN, will apply attributes to NOAA/NGS survey data and made available to the industry in appropriate formats.	In Progress
FAA infrastructure must be established to prioritize, collect, revise, and distribute airport data for all Part 139 airports.	24 months

Risk Description

- Added cost of avionics procurement and installation.
- Resistance to voluntary equipage by some operators.

Risk Mitigation Plan

- Communication to operators of the combined safety and operational benefits associated with voluntary equipage of moving map display technologies.
- Development of low cost upgrades with limited yet beneficial enhancements.

Impact on Commercial or International Applications

- *Opportunity to set the standard for improved situational awareness through the use of cockpit airport moving map technologies. Opportunity for an exchange of information between FAA and ICAO/JAA to educate, train, and increase the awareness of most international operators through use of moving map technologies. ICAO and JAA are represented on CAST. Both have adopted Runway Incursion prevention procedures and have similar programs.*