Presentation Overview

• Definition of Runway Incursion.

• Motivation for the Runway Incursion Prevention System.

• Results to Date.

• Future Research.
According to the FAA a Runway Incursion is defined as:

“All occurrence at an airport involving an aircraft, vehicle, person, or object on the ground, that creates a collision hazard or results in the loss of separation with an aircraft taking off, intending to take off, landing, or intending to land.”

FAA Report # AV-1998-01

NOTE: Definition only valid for airports with a control tower.
NASA Addition to Runway Incursion Definition

- NASA includes runway transgressions into their definition of runway incursions.
  
  » A transgression is a type of runway incursion involving only one vehicle.

- A transgression takes place if an aircraft wanders onto an active runway without authorization, but does not interfere with another aircraft.
Motivation for the Runway Incursion Prevention System

- Runway Incursions are listed in the National Transportation Safety Board’s “Most Wanted List” of safety improvements.
- Surface movement has increased due to the rise in airport traffic.
- Airport facilities need to increase safety.
  » From 1972 to 1997 there were 719 deaths and 20 aircraft lost due to runway incursions.

NTSB website
Runway Incursion Categories

- **Pilot Deviations**
  - An incursion caused by any pilot that violates FAA regulations with regards to Air Traffic Control directions.

- **Operational Deviations**
  - An incursion caused by the failure of Air Traffic Control to maintain proper aircraft separation.

- **Vehicle/Pedestrian Deviations**
  - An incursion caused by any vehicle or pedestrian which strays into an active runway without authorization from Air Traffic Control.
The Runway Incursion Prevention System (RIPS)

- The RIPS program was developed by NASA in response to the growing problem of runway incursions.
- This is a cooperative effort involving NASA, the FAA, industry, and universities.
  - OU is involved with the LAAS segment of RIPS.
- Uses existing technology in such a way to alert aircraft of obstacles in their path.
Collins MMR/ADS-B
Pallet

• **Multi-Mode Receiver (MMR)**
  » Contains a hardware and software capable of receiving GPS and VHF broadcasts.
  » Uses GPS and differential corrections to calculate user position for all phases of flight.

• **Automatic Dependent Surveillance and Broadcast (ADS-B)**
  » Requires no outside stimulus.
  » Dependent upon the MMR for position information.
  » Broadcasts position data and aircraft ID via a 1090MHz transponder squitter used for aircraft surveillance.
Simplified Block Diagram of RIPS/ADS-B

USER_i

Display

ADS-B

Position, Velocity, Time

GPS

LAAS

ADS-B

Position, Velocity, Time

USER_i

ADS-B

Display

ADS-B

AIR TRAFFIC CONTROL
Example of User Display

HUD Guidance

Electronic Moving Map

RUNWAY CONFLICT

RUNWAY CONFLICT

NASA RIPS POT

Avionics Engineering Center
FAA Ground System
Avionics Engineering Center’s Role in RIPS

The Avionics Engineering Center (AEC) performs the following functions:

- Provide LAAS ground station.
- Provide expertise in LAAS.
- Assess LAAS performance:
  - LAAS position accuracy.
  - VDB coverage and continuity.
Local Area Augmentation System

- Provides differential corrections for GPS users in the local area around the airport.
- Uses known ground station position to calculate the differential range corrections.
- The differential corrections are transmitted by the LAAS ground facility (LGF) via a VHF data broadcast (VDB).
Avionics Van Testing

- OU van used as a surface vehicle during the RIPS testing.
- Van testing conducted in order:
  - Determine LAAS accuracy.
  - VHF data broadcast signal coverage.
- Van was outfitted with both GPS and VHF receivers.
- Initial testing of RIPS has shown some interoperability problems between the LGF and the MMR.
TEST VAN CONFIGURATION

- Harris VDB Receiver
- Novatel GPS Receiver
- Ashtech Z-12 Receiver
- Battery
- Ohio University Communication Interface
- External Computer
- Keyboard
- Video
- Ethernet

Connections:
- 115 Vac
- RS 232
- Using Adapter
- Pre-amp
- DC Injector
- DC Source
- Splitter
- DC Block
- L1/L2 Passive

Avionics Engineering Center
Test Van Route
Future Study on the Interoperability between LGF and MMR

- LGF and MMR have been independently manufactured and both designed to RTCA specifications.
- Interoperability issues have occurred during testing periods.
  - Inconsistent use of Earth rotational corrections.
  - Inconsistent use of altitude reference (geoid vs. ellipsoid).
- Perform detailed data analysis to assess LGF adjustments made for the interoperability issues.
- Research into these phenomena are to be conducted by the Avionics Engineering Center.
- Determine the readiness of LAAS for airport surveillance and guidance systems.
ANY QUESTIONS?