Airport Surface Safety & Efficiency Solutions

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Agenda

- Air traffic control at and near airports
- Runway incursions & their prevention
- Situational awareness using sensors
- Safety logic & controller alerts
- Airport efficiency tools
- Future systems
The Airport Surface Environment
Runway Incursions

Maintain your focus on the airfield to avoid errors that lead to runway incursions.
The Airport Surface Environment

- Many simultaneous moving objects – some at high velocity & acceleration
- Lots of visual obstructions – some stationary, some temporary, always changing
- Weather effects and day/night operations
- There is a need for relatively inexpensive situational awareness in all weather & visibility conditions
Multilateration Overview
Multilateration Surveillance

- Tracks All Transponder-equipped Targets
  - Mode S
    - Aircraft unique, 24 bit code
  - Mode A/C
    - ATC-assigned, 12 bit code
  - ADS-B
    - Autonomous transmission of ID & position

- Time Difference Of Arrival (TDOA) of Received Signals at Distributed Remote Units
Time Difference Of Arrival

TOAn  Time of Arrival at Remote Unit n

c    Speed of light

Xn   Calculated distance from TDOA algorithm

Rx    Receiver
Position Estimation processing

- Each TDOA value represents an arc
- TDOA arcs for RU1 – RU\textit{n} pairs
- Intersection of all arcs indicates target position
Why Multilateration?

- One Second Update Rate
- Highly Accurate Position (7.5m)
- Highly Reliable ID Information
  - 24 bit Mode S code and/or
  - 12 bit Mode A/C code
- Distributed Sensors
  - Solves Line-Of-Site Problems at Lower Cost
  - Improves System Reliability
- Usually Less Expensive Than Traditional Secondary Surveillance Radar or Surface Movement Radar
Multilateration System

Remote Unit (RU)
1. Receives transmission
2. Decodes transmission
3. Timestamps reception
4. Selects receptions to send to TP
5. Sends ATCRBS or Mode S interrogation (RT RU only)

Central Processing Station (CPS)
1. Combines RU messages
2. Performs multipath processing
3. Performs position estimation
4. Tracks targets

Reference Transmitter (RefTran)
1. Provides common DF17 message to RUs
2. Provides RF link monitoring

Maintenance Display Terminal (MDT)
1. Status Monitoring
2. System Setup
3. System Control

ASTERIX Cat 10/21 Output
How Does ADS-B Work?

The aircraft get their position from the GNSS constellation.

Then they simultaneously broadcast their position and other data to any aircraft, or ground station equipped to receive it.

Ground Stations then transmit the aircraft’s position to Air Traffic Control.

- NextGen surveillance heavily leverages GPS for cooperative surveillance.
- Same remote unit can handle ADS-B as well as multilateration.
Ground Vehicle Equipage

- Seamless aircraft and vehicle surveillance picture
  - ADS-B Squitter Unit
  - Squits Position and Identification Messages
  - Data Received at Remote Units
  - Portable or Permanent Mounts
Airport Efficiency
Airport Management Systems

- Surface Managers, Departure Managers, and Arrival Managers
- Real-time and historic web-based decision support tools
- Predictive tools and alerts
- Post operations investigation, analysis, & reporting

Benefits

- Saves fuel & reduces emissions
- Increases capacity of airport
- Maximizes use of assets
- Accurate revenue capture and audit trails
- Improves passenger experience
Future Systems
Collaborative Decision Making

Integrated CNS
Remote Tower

Integrated Tower
Questions

- What advantages do multilateration sensors provide over a traditional radar sensor?

- What safety and efficiency advantages do automation systems provide in the air traffic management domain?
Thank you and enjoy the rest of your day!