AN APPROACH TO ASSESS SAFETY CONSIDERING INTEGRITY OF DATA OF ADS-B BASED AERIAL SYSTEMS

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Outline

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• Motivation
• Surveillance Technologies
  – What is surveillance?
  – ADS-B in Air Traffic Control
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Safety Analysis Group

a Research Group at “Computer and Digital Systems Engineering Department” (PCS) in the School of Engineering at USP (Poli-USP).

Academic Research and Consultancy Projects related to Computer-Based Dependable-Critical Systems (mainly Safety, Reliability and Availability)

Our main research topics:

Safety and Risk Analysis Methodologies
Certification to Safety
Fault Tolerance (including Software Quality aspects)
Safe Software
Redundancy Techniques (HW / SW)
Human Reliability / Usability
Motivation
Motivation

“The improvement in situational awareness for pilots greatly increases safety”

(FAA, 2010)
Surveillance Technologies?

What is surveillance?
“Aeronautical Surveillance System provides the aircraft position and other related information to ATM and/or airborne users””

(ICAO, 2012)
What is Surveillance?

Air Traffic Control architecture

(VISMARI; CAMARGO JR, 2009)
What is Surveillance?

• Main Roles of Surveillance:
  – Monitor expectations of aircraft movements
  – Monitor actual trajectories of aircraft
  – Indicate when expectations and trajectories do not match
  – Can be used as the basis alerting systems
  – Alert ATC when aircraft deviates or when there is a conflict

• Influences separation distances and efficiency of a given airspace
Surveillance Technologies?

ADS-B in Air Traffic Control
ADS-B in Air Traffic Control

• Information provided by ADS-B
  – Position: obtained from GNSS
  – Integrity
    • HPL (Horizontal Protection Level)
    • HFOM (Horizontal Figure of Merit)
  – Altitude
  – Identification: provided by the Transponder
Integrity of Data using ADS-B

RAIM Technique
RAIM Technique

• Receiver Autonomous Integrity Monitoring
RAIM Technique

2 measurements — cannot determine if one is erroneous.

3 measurements — can detect if there is one erroneous measurement, but cannot determine which is erroneous.

4 measurements — 4 equations, 4 unknowns leads to one solution, zero measurement residuals.

5 measurements — solution determined in least squares sense, can detect if there is one bad measurement.

4 or more measurements — can detect and isolate an erroneous measurement.

6 or more measurements — can detect and isolate a bad measurement.

(Hegarty & Chatre, 2008)
Safety Assessment Methodology
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• Qualitative Approach (Relative Method)
  Reference Scenario
  X
  Proposed Scenario

• Quantitative Approach (Absolut Method)
  – Numerical analysis of aeronautical system metrics
Safety Assessment Methodology

Computational Model (LabView™)

Test Bed
Safety Assessment Methodology

PIpE-SEC architecture (Concept)
References


THANK YOU FOR YOUR ATTENTION

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