Introduction of Integrated Cockpit Avionics In Light General Aviation Airplanes

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Briefing Overview

- **Who is GAMA?**
- **Introduction of Integrated Glass Cockpits**
  - Agate and NASA
  - Early Adopters
  - Joint Industry-Government Activities
- **Glass Enabled Capabilities**
  - Terrain
  - Traffic
  - Weather
- **Analyzing Safety Impact**
- **Data Recording on Small Airplanes**
Who is GAMA?

• GAMA Represents Worldwide Manufacturers of General Aviation Aircraft
  – Business Jets
  – Turboprops
  – Piston Engine Airplanes
  – Helicopters
• Founded in 1970
• Offices is Washington, DC and Brussels, Belgium
HISTORY OF GLASS INTRODUCTION
Technology Development

• 1990s: NASA Funded Research through AGATE
  – New FAA Certification Policy

• 2000s: Initial Product Introductions
  – Avidyne
  – Garmin
  – Other such as Chelton, L-3 Avionics and Honeywell
Rate of Adoption in Piston Engine Powered Airplanes

Source: GAMA Shipment Data and Survey for NTSB Glass Cockpit Study
Joint FAA-Industry Activities

- 2005: GAJSC Develops Recommendations to Update FAA Instrument Flying Handbook (IFH), Knowledge Test, and PTS for Glass Cockpits

  - Parallel Chapters: I. Analog and II. Electronic

- Additional Publications Since 2007:
  - Aviation Instructors Handbook (FAA-H-8083-9A)
  - Pilot Handbook of Aviation Knowledge (FAA-H-883-25A)
  - Advanced Avionics Handbook (FAA-H-8083-6)

http://www.faa.gov/library/manuals/aviation/
GLASS ENABLED CAPABILITIES
<table>
<thead>
<tr>
<th>Terrain</th>
<th>Traffic</th>
<th>Weather (Satellite / FIS-B)</th>
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<tbody>
<tr>
<td>Weather (Radar)</td>
<td>Electronic Charts</td>
<td>Surface Map / Traffic</td>
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ANALYZING SAFETY IMPACT
Glass – Not Homogenous
PFD versus MFD Capabilities

PFD Functionality
• Primary Flight Instruments

MFD Functionality
• Terrain / Map
• Weather
• Traffic
GAJSC Pareto CY2001-CY2011

Source: NTSB Aviation Accident/Incident Database.
Note: 66% and 5% of fatal accidents have been finalized for 2010 and 2011 respectively

LOC-I – Loss of Control Inflight
CFIT – Controlled Flight Into Terrain
SCF-PP – System Component Failure-Powerplant
LALT – Low Altitude Operations
UNK – Unknown or Undetermined
OTHR – Other
FUEL – Fuel Related
SCF-NP – System Component Failure-Non-Powerplant
MAC – Midair Collisions
WSTRW – Windshear or Thunderstorm

Source: Analysis by FAA (AVP) for GAJSC
GAJSC GA Accident Rate CY2001 – CY2010, CFIT

Note: 66% of fatal accidents have been finalized for 2010.

Controlled Flight Into Terrain

Glass Introduction (Installed and Handheld)

High/Low Δ = 0.17
Linear Slope = -0.0176

Source: Analysis by FAA (AVP) for GAJSC
Potential Riskier Behavior Offsets Glass Benefits to Aggregate Safety

• Analysis: While Glass seems to provide benefit against certain types of accidents (such as, TAWS-B / Terrain Impact on CFIT), aggregate GA safety record remains unchanged

• Hypothesis: Pilots use glass cockpit equipped aircraft for more challenging missions while leveraging enhanced situational awareness

• NTSB Safety Study Analysis of Mission Profile
DATA RECORDING IN GA
Current Technologies

• Various Types and Categories
  – Dedicated Recorders:
    • ED-112 (Primarily Part 25 Aircraft)
    • ED-155 (New Standard Recognized by ICAO)
    • Pre-ED-155 and other FDM Recorders
  – Integrated Glass Cockpits with Recording Capability (such as, Avidyne Entegra, Garmin G1000)
  – Existing Equipment with Recording Capability (such as, ECU, FADEC)
  – Handheld Equipment (such as, Garmin G-196)
NTSB Policy Review Needs

• NTSB’s Historical Experience with ED-112 (and Older Standards Going Back to Tape)

• NTSB Developing Experience and Policy for GA Dedicated Recorders and Other Recording Equipment
  – Opportunity to Leverage Manufacturer Expertise
  – Impact on the Timeliness of Data Recovery
  – Policy Differences
BACKUP
Timeline of Glass Introduction

- 1990s: AGATE / SATS Research and Development
- 2000: GAJSC WX JSAT/JSIT: Develop WX Data Link for GA; Promote Benefits Driven Deployment of FIS;
- 2000: *Recommended Practices and Guidelines for Part 23 Cockpit/Flight Deck Design*
- 2002: FAA Establishes “FAA-Industry Training Standards” (FITS) Program
- 2003: CGAR FITS Research Launched
- 2003: Manufacturers Announce “Glass”
  - July: Cirrus Design Introduce PFD / MFD Avidyne “All Glass Fleet” (Previously MFD Only)
  - September: Diamond DA-40 w/ Garmin G1000
  - October: Cessna 182 / 206 w/ Garmin G1000
- 2004: GAJSC FITS / TAA Working Group
- 2005: GAMA Requests Update of FAA Training Handbooks
  - GAJSC Personal Aircraft Working Group
- 2006: AOPA ASF TAA Safety Study
- 2008: FAA Aviation Instructors Handbook
- 2010: NTSB Publishes Safety Study *Introduction of Glass Cockpit Avionics into Lights Aircraft*
GAMA Interactions with NTSB on Glass Cockpit and General Aviation

- NTSB Highlights “Glass Cockpits (TAA)” as High Interest Accident Types in Workshop Presentation in September 2006 in Wichita
