Introduction of Integrated Cockpit Avionics In Light General Aviation Airplanes

Jens C. Hennig, Vice President of Operations
General Aviation Manufacturers Association (GAMA)
Presented to NTSB General Aviation Safety Forum
June 19-20, 2012

General Aviation Manufacturers Association

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?

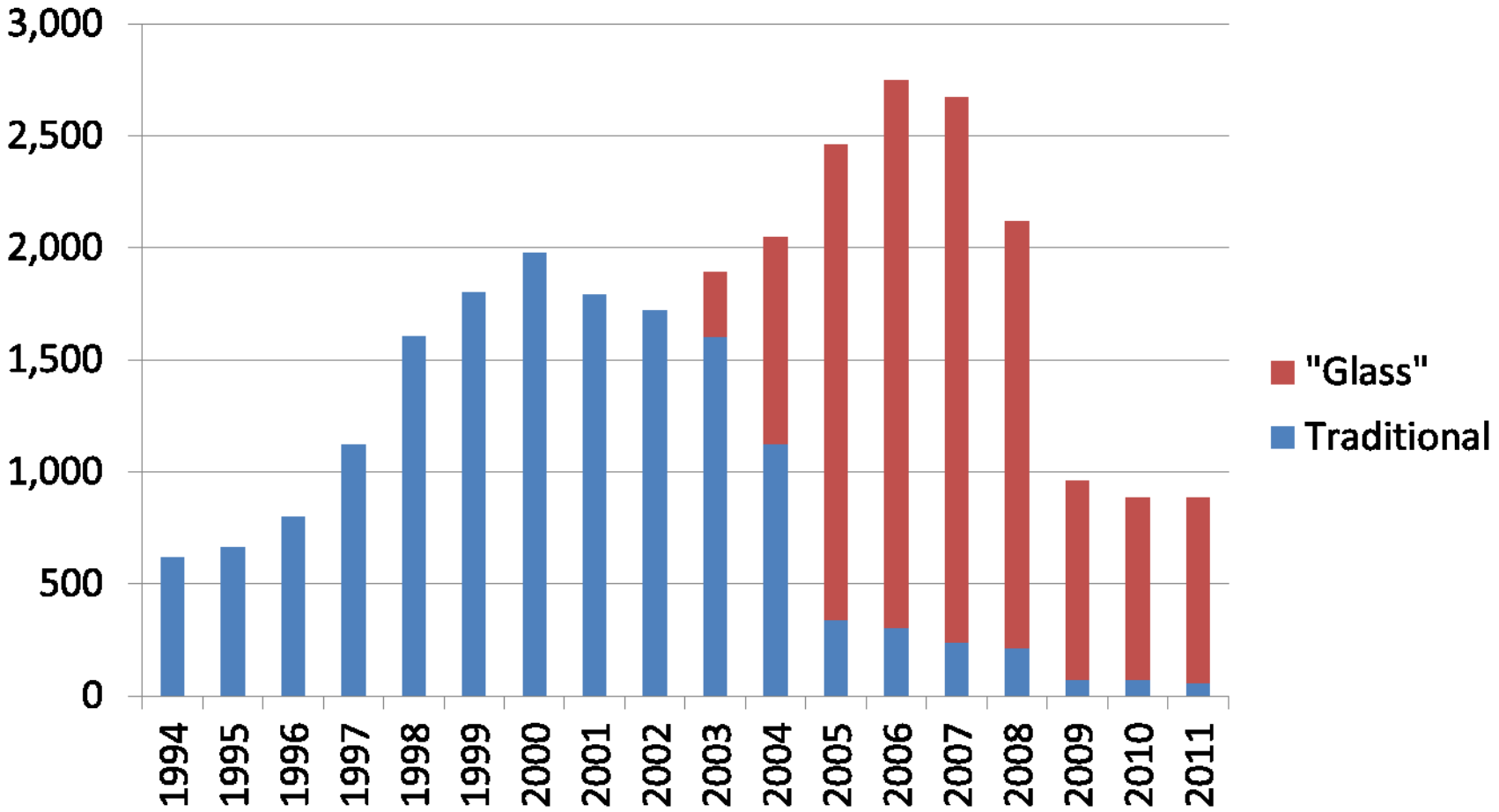
- GAMA Represents Worldwide Manufacturers of General Aviation Aircraft
  - Business Jets
  - Turboprops
  - Piston Engine Airplanes
  - Helicopters
- Founded in 1970
- Offices is Washington, DC and Brussels, Belgium

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

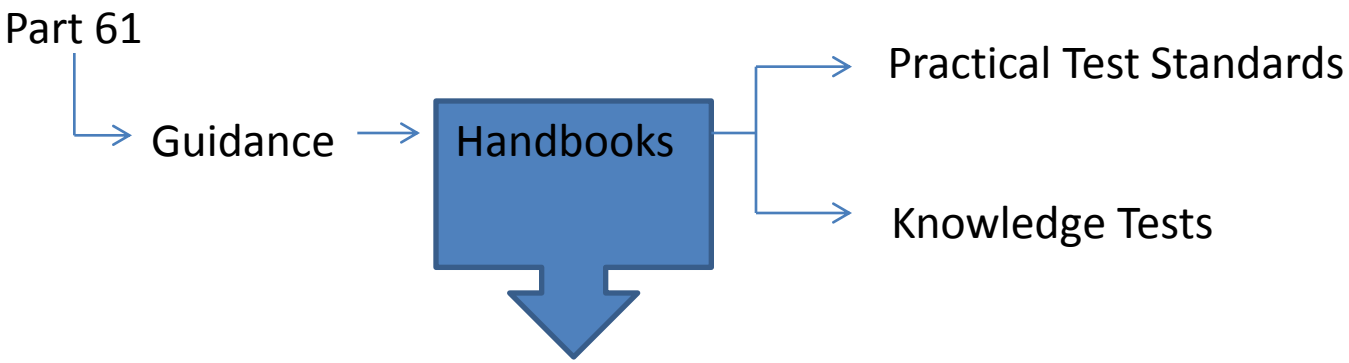
Rate of Adoption in Piston Engine Powered Airplanes



General Aviation Manufacturers Association

Source: GAMA Shipment Data and Survey for NTSB Glass Cockpit Study

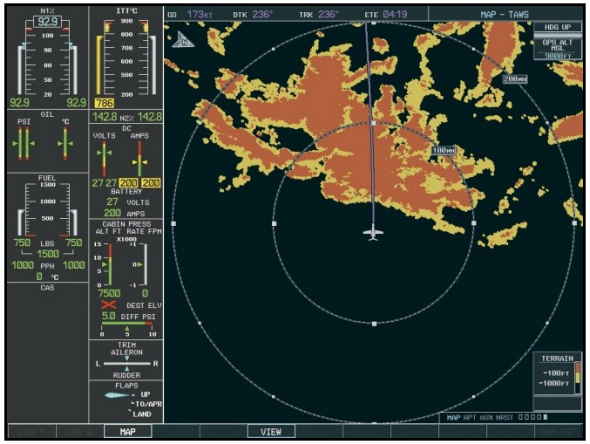
Joint FAA-Industry Activities



- **2005: GAJSC Develops Recommendations to Update FAA Instrument Flying Handbook (IFH), Knowledge Test, and PTS for Glass Cockpits**
- 2007: Instrument Flying Handbook (FAA-H-8083-15A) Published
  - 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)

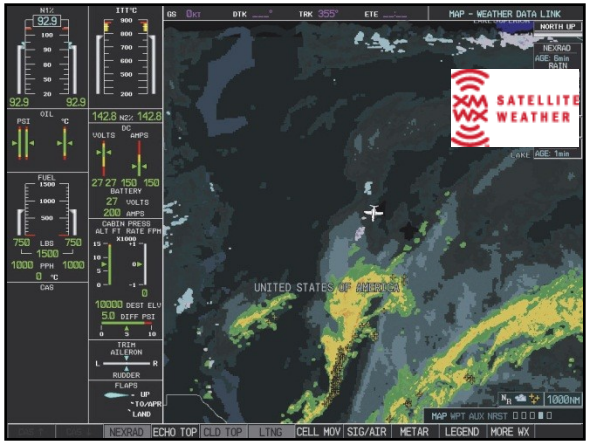
http://www.faa.gov/library/manuals/aviation/

GLASS ENABLED CAPABILITIES

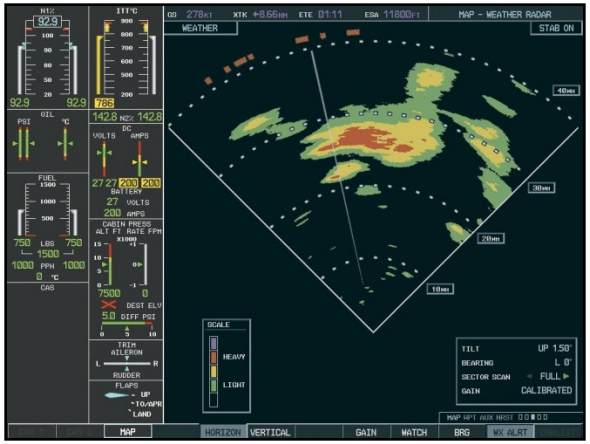


Terrain

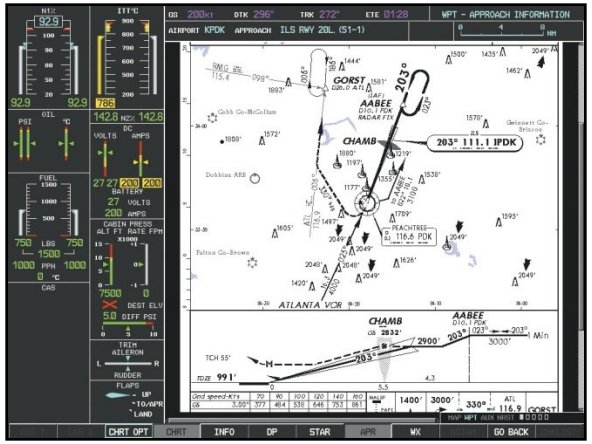
Traffic



Weather (Satellite / FIS-B)



Weather (Radar)



Electronic Charts

Surface Map / Traffic

ANALYZING SAFETY IMPACT

Glass – Not Homogenous
PFD versus MFD Capabilties

PFD Functionality

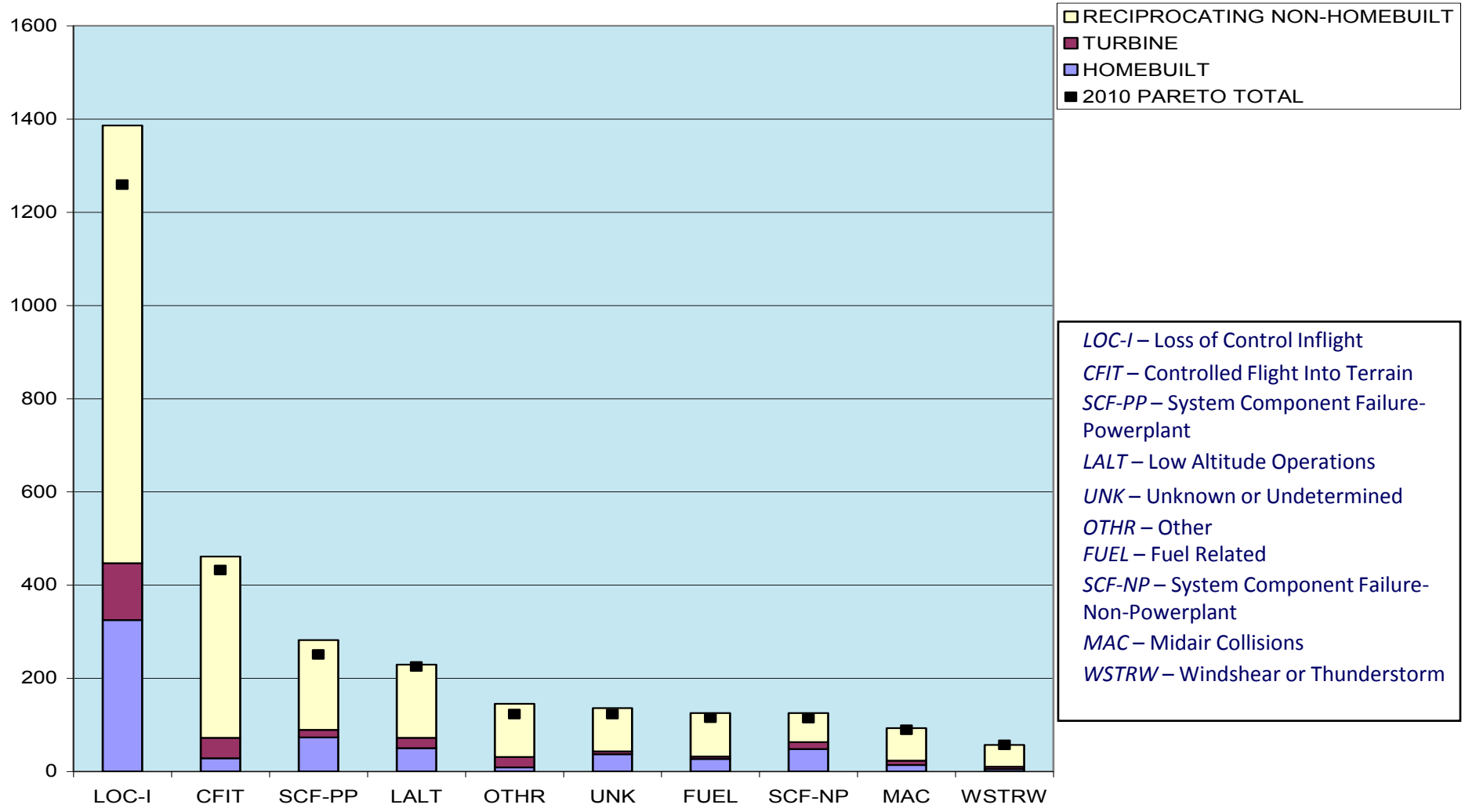
- Primary Flight Instruments

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



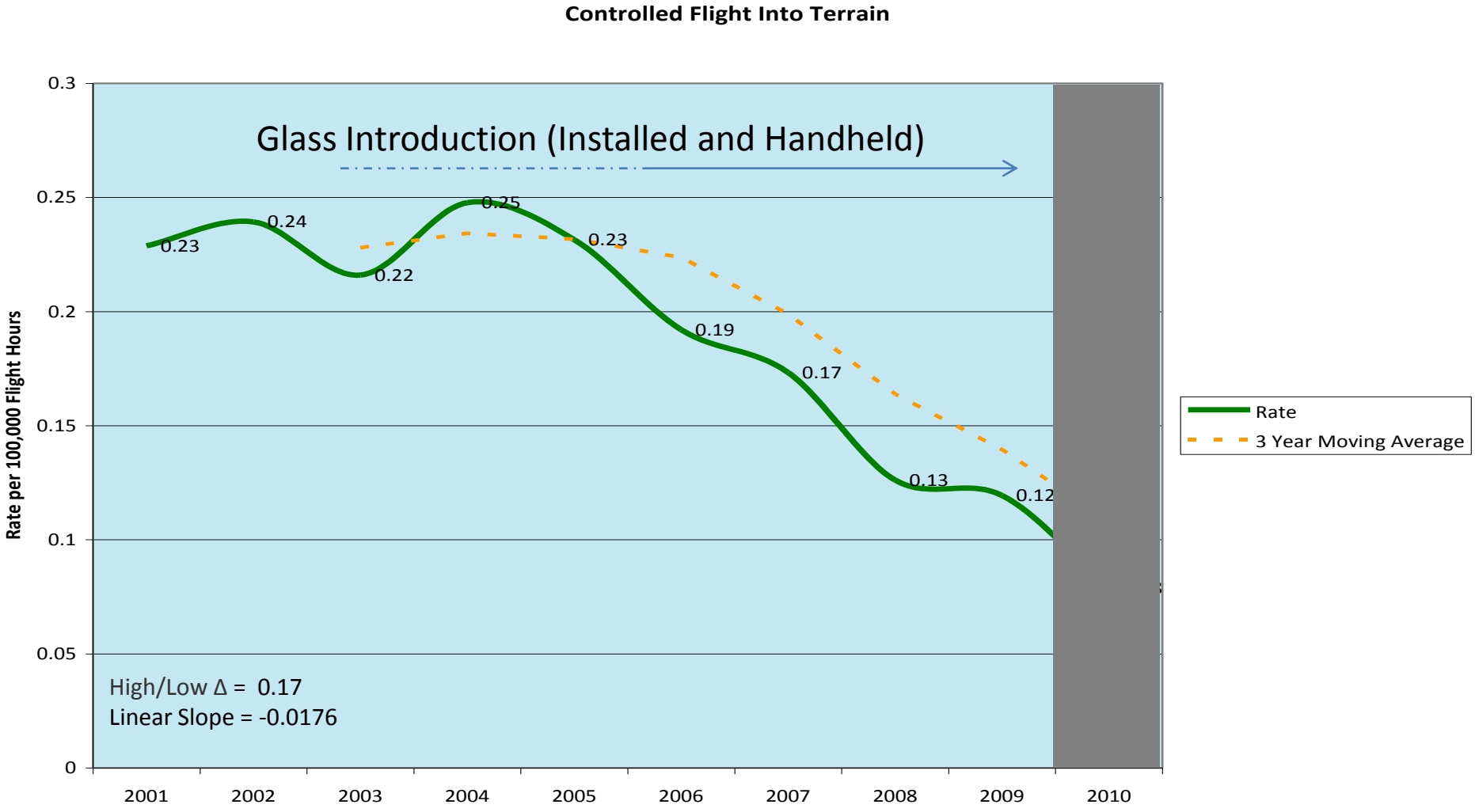
LOC-I – Loss of Control Inflight
CFIT – Controlled Flight Into Terrain
SCF-PP – System Component Failure-Powerplant
LALT – Low Altitude Operations
UNK – Unknown or Undetermined
OTHR – Other
FUEL – Fuel Related
SCF-NP – System Component Failure-Non-Powerplant
MAC – Midair Collisions
WSTRW – Windshear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

General Aviation Manufacturers Association

Source: Analysis by FAA (AVP) for GAJSC

GAJSC GA Accident Rate CY2001 – CY2010, CFIT

Source: NTSB Aviation Accident/Incident Database. FAA GA Survey Data 2001 – 2010.
Note: 66% of fatal accidents have been finalized for 2010.



General Aviation Manufacturers Association

Source: Analysis by FAA (AVP) for GAJSC

Potential Riskier Behavior Offsets Glass Benefits to Aggregate Safety

- Analysis: While Glass is 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

Jens C. Hennig
Vice President of Operations
Email: Jhennig@GAMA.aero
Phone: (+1) 202-393-1500

QUESTIONS? COMMENTS?

BACKUP

Timeline of Glass Introduction

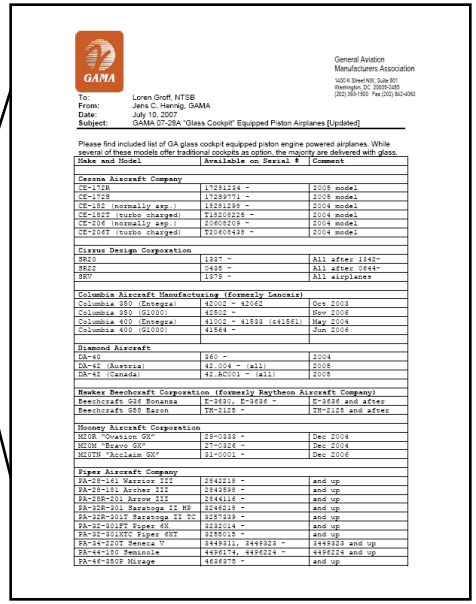
- 1990s: AGATE / SATS Research and Development
- 1999: GAJSC CFIT JSAT/JSIT: Promote Development of Low-Cost Displays; Develop Part 23 SVS to Reduce Risk of Low Visibility Flying;
- 2000: GAJSC WX JSAT/JSIT: Develop WX Data Link for GA; Promote Benefits Driven Deployment of FIS;
- 2000: *Recommended Practices and Guidelines for Part 23 Cockpit/Flight Deck Design*
- 2002: FAA Establishes "FAA-Industry Training Standards" (FITS) Program
- 2003: General Aviation Technically Advanced Aircraft: FAA—Industry Safety Study
- 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
- 2004: *Recommended Practices and Guidelines for an Integrated Cockpit/Flight Deck in a 14 CFR Part 23 Certificated Airplane*
- 2005: GAMA Requests Update of FAA Training Handbooks
  - GAJSC Personal Aircraft Working Group
- 2006: AOPA ASF *TAA Safety Study*
- 2007: FAA Instrument Flying Handbook
- 2008: FAA Aviation Instructors Handbook
- 2009: FAA Advanced Avionics 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

- GAMA Contacted by NTSB Summer 2007 for Information about Glass Cockpit Equipped Fleet and Provides Technical Information July 10, 2007

- GAMA Invited to Review Technical Portion of Draft Study and Provides Feedback December 10, 2009



GAMA

General Aviation Manufacturers Association
1400 K Street NW, Suite 801
Washington, DC 20005-2485
(202) 393-1500 Fax (202) 842-4063

To: Loren Groff, NTSB
From: Jens C. Herring, GAMA
Date: July 10, 2007
Subject: GAMA 07-28A "Glass Cockpit" Equipped Piston Airplanes [Updated]

Please find included list of GA glass cockpit equipped piston engine powered airplanes. While several of these models offer traditional cockpits as option, the majority are delivered with glass.

Make and Model	Available on Serial #	Comment
Cessna Aircraft Company		
CE-172S	172S11234 -	2005 model
CE-172S	172S9771 -	2005 model
CE-182 (normally asp.)	18281298 -	2004 model
CE-182T (turbo charged)	T18208225 -	2004 model
CE-206 (normally asp.)	20608209 -	2004 model
CE-206T (turbo charged)	T20608438 -	2004 model
Cirrus Design Corporation		
SR20	1327 -	All after 1342-
SR22	0435 -	All after 0644-
SR1	1379 -	All airplanes
Columbia Aircraft Manufacturing (formerly Lancair)		
Columbia 350 (Integra)	42002 - 42062	Oct 2003
Columbia 350 (G1000)	42502 -	Nov 2006
Columbia 400 (Integra)	41002 - 41833 (41861)	May 2004
Columbia 400 (G1000)	41864 -	Jun 2006
Diamond Aircraft		
DA-40	360 -	2004
DA-42 (Austria)	42.004 - (all)	2005
DA-42 (Canada)	42.AC001 - (all)	2005
Hawker Beechcraft Corporation (formerly Raytheon Aircraft Company)		
Beechcraft G36 Bonanza	E-2630, E-2636 -	E-2636 and after
Beechcraft 58S Baron	TH-2125 -	TH-2125 and after
Mooney Aircraft Corporation		
M20R "Ovation GX"	29-0339 -	Dec 2004
M20M "Bravo GX"	27-0326 -	Dec 2004
M20TN "Acclaim GX"	31-0001 -	Dec 2006
Piper Aircraft Company		
PA-28-161 Warrior III	2842218 -	and up
PA-28-181 Archer III	2843598 -	and up
PA-28R-201 Arrow III	2844116 -	and up
PA-28R-201 Saratoga II HP	2248218 -	and up
PA-32R-301T Saratoga II TC	3257329 -	and up
PA-32-301FT Piper 6X	3232014 -	and up
PA-32-301XTC Piper 6XT	3258015 -	and up
PA-34-220T Seneca V	3449311, 3449323 -	3449323 and up
PA-44-180 Seminole	4496174, 4496224 -	4496224 and up
PA-46-350P Mirage	4636375 -	and up