Glass Cockpits
Glass Cockpits

• Introduction
• Why Is It Important for A&Ps
• Ingredients That Makeup Glass Cockpits
• Pros/Cons
• Regular Maintenance
• FAA Questions
• Summary
What Is a Glass Cockpit?

• TAA – Technically Advanced Aircraft (FAA)
  ❖ IFR-certified with GPS navigation equipment
    • or
  ❖ Multi-function display (MFD) with weather, traffic, or terrain graphics; and an integrated autopilot

• Defined by Avionics Using (for this discussion):
  ❖ Flat Electronic Displays
  ❖ Power by Microprocessor (computer)
Glass Cockpit Examples

Space Shuttle

Boeing 787
Glass Cockpit Examples

Cirrus S22

Cessna 162
Portable Units
Why Is It Important for A&Ps?

• Pilots are demanding it
  - Reduces Workload & Simplifies Navigation

• FAA is Switching to GPS
  - Reducing VOR and Category I ILS
  - Implementing GPS/WAAS Approaches

• Most New Aircraft Sold with Glass Cockpits

• Older Aircrafts Are Upgrading to Glass Cockpits

• Demand for Avionics Technicians
History

Analog Panel
(Steam Gauges)
Future

Cirrus SR22
with
Perspective Avionics Suite
Software – Heart & Soul

• A Microprocessor (Computer) is a Calculator that Follows Instructions

• The Instructions Are Called Software

• Same Hardware, Different Software, Different Product

• Product Can Be Updated, Fixed and New Features Added by Change Software

• Software Bug is a Mistake in the Instructions
Starting Point

Garmin SL30 NAV/COM
VOR Position Fix

- Tune In Near By VOR Station
- Use OBS on CDI to Find Bearing from VOR
- Draw Bearing Line on Map
- Repeat for Second VOR Station
VOR Navigation Shortcomings

• VOR Signal Limited to Line-Of-Sight
• Limited Accuracy
• Time Consuming Process
• FAA is Planning VOR Station Closers
• Vertical Information Only Provided on ILS Approaches
GPS/WAAS Navigation

- Global Positioning System (GPS) - Space Based Radio Navigation
- Wide Area Augmentation System (WAAS) - Provides Error Correction
GPS/WAAS Advantages

• No Line-Of-Sight Limitations
• More Accurate
• Height Information
• Lower Pilot Work Load
• More Efficient, Flexible, and User-Preferred Route Structures
• International Standard
• WAAS Approaches Replacing ILS
XM Weather

- Weather Data Sent from Satellite
- High Resolution NEXRAD
- Winds Aloft
- TFRs, AIRMETS, TAFs, & SIGMETs
- Subscription Service
Portable GPS

- GPS Based Navigation
- XM Weather
- Windshield, Lap, Yoke or Panel Mounted
- Battery or Plane Power
Portable GPS

- Real-time Tracking Displayed on Map
- “Mini” Instrument Panel
- Automatic Routing Information
- XM Weather Project on Map
- Displays altitude-sensitive alerts
- Electronic Flight Bag (EFB)
GPS & Radio

- WAAS Certified
- Approach and Routing Information Displayed on CDI and HSI
- Common Upgrade to “Steam Gauges”
- Meets TSO C146a Standards for “Sole Means” Navigation
- Drives Autopilot

Garmin
GTN 750
MFD/PFD

- EFIS - Electronic Flight Instrument System
- PFD – Primary Flight Display
- MFD – Multi-Function Display
- Basically a Computer Display
  - Sometimes Computer Brain in Same Unit
Analog Upgrade

- Aspen Avionics EDF1000
- Upgrade Standard “Six-Pack”
- Upgrade With No Mechanical Changes to Panel
- Install One to Three Units
Top of Line GA

• Cirrus SR22 with Garmin G1000
• Flight Instrument, Engine Instruments, Radios, Navigation, Weather, Autopilot and Charts on PFD/MFD
• Keyboard Input
• Synthetic Vision System (SVS)
• Video
Glass Cockpit Video

• Video
Glass Cockpit - Pros

• Easier Navigation
• Integration of Information in Smart Display
• Electronic Maps and Charts
• Smart Engine Operation
• WAAS Approaches
• Emergency Assistance
• Situation Alarms
• No Moving Parts
Glass Cockpit - Cons

• No Standard User Interface
• Higher Learning Curve for Pilots
• New Learning for “Analog” Pilots
• Susceptible to Electrical Failure
• Complex Electrical System
  ❖ Battery Backup
  ❖ Dual Alternators
  ❖ Dual Buss
• New Procedures for Mechanics
Diamond DA42 Crash Lesson

• All Electric Airplane with Electronic Engine Control Unit
• Dead Battery
• Engines Started with GPU
• Aircraft Crashes During Takeoff – Engines Failed – Low Power for Engine Control Unit
• Airplane Needed Supplemental Power from Battery During Takeoff
• Lesson Learned – Fully Charge Battery
Regular Maintenance

- Annual – Check Cables, Connectors, Buttons, Servos, Airspeed, Indicator Vertical Speed Indicator, Buttons and Lights
- 24 Months - Pitot/Static Leak, Altimeter & Transponder Test
- 1000 hours/3 Years – Clean Servos and Apply Grease to Output Gears
Regular Maintenance

- 5 Years – Update Earth Magnetic Field Software
- 10 Years – Change Battery
- Periodically Install Software Update
  - Don’t Interrupt Update Process – Leave Power On!!!
- Owner Can Install Regular Chart & Map Data Updates
FAA Question
Data transmitted between components in an EFIS are converted into:
A. digital signals
B. analog signals
C. carrier wave signals
FAA Question

Data transmitted between components in an EFIS are converted into:

A. digital signals
FAA Question
The Function of a CRT in an EFIS is to:
A. allow the pilot to select the appropriate system configuration for the current flight situation
B. display alphanumeric data and representations of aircraft instruments
C. receive and process input signals from aircraft and engine sensors and send the data to the appropriate display
FAA Question
The Function of a CRT in an EFIS is to:

B. display alphanumeric data and representations of aircraft instruments
FAA Question
The function of a symbol generator (SG) in an EFIS is to:
A. display alphanumeric data and representation of aircraft instruments
B. allow the pilot to select the appropriate system configuration for the current flight situation
C. receive and process input signals from aircraft and engine sensors and send the data to the appropriate display
FAA Question

The function of a symbol generator (SG) in an EFIS is to:

C. receive and process input signals from aircraft and engine sensors and send the data to the appropriate display
FAA Question
The function of a display controller in an EFIS is to:
A. display alphanumeric data and representations of aircraft instruments
B. allow the pilot to select the appropriate system configuration for the current flight situation
C. receive and process input signals from aircraft and engine sensors and send the data to the appropriate display
The function of a display controller in an EFIS is to:

B. allow the pilot to select the appropriate system configuration for the current flight situation
Glass Cockpit - Summary

• TAA – Technically Advanced Aircraft are Here
• GPS/WAAS is Becoming a Must
• Low Maintenance
• More Complicated Electrical System
• Learn Your Computer Skills
Cessna’s Version of G1000
Pilot Interface

- PFD
- Audio Panel
- MFD
System Brain

- Integrated Avionics Unit (IAU)
Position and Navigation

- Attitude & Heading Reference System (AHRS)
- Magnetic Sensor
- Air Data Computer
- GPS/WAAS Receiver
Radios

- Mode-S transponder
- XM Satellite Radio
- Cessna Uses External Garmin NAV/Com Radios
Sensors and Servos

- LRU – Receiving/Processing Signals from Engine and Airframe Sensors.
- Autopilot Servo
- Outside Air Temperature Probe
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