Information Displays in Aerospace: Past, Present, and Future

Bill Roberson
Assistant Chief Pilot
Airplane Development
The Boeing Company

Opening Thoughts

Why is display technology so important to the aerospace industry?

- **Touches just about every aspect of aviation from design and build to operations and maintenance**
- **Electronic displays have enabled significant progress in safety, efficiency, and human interface within aerospace industry**

A Brief History of Flight Instruments

Early Single Seat Aviation

Model B4V40 Cockpit

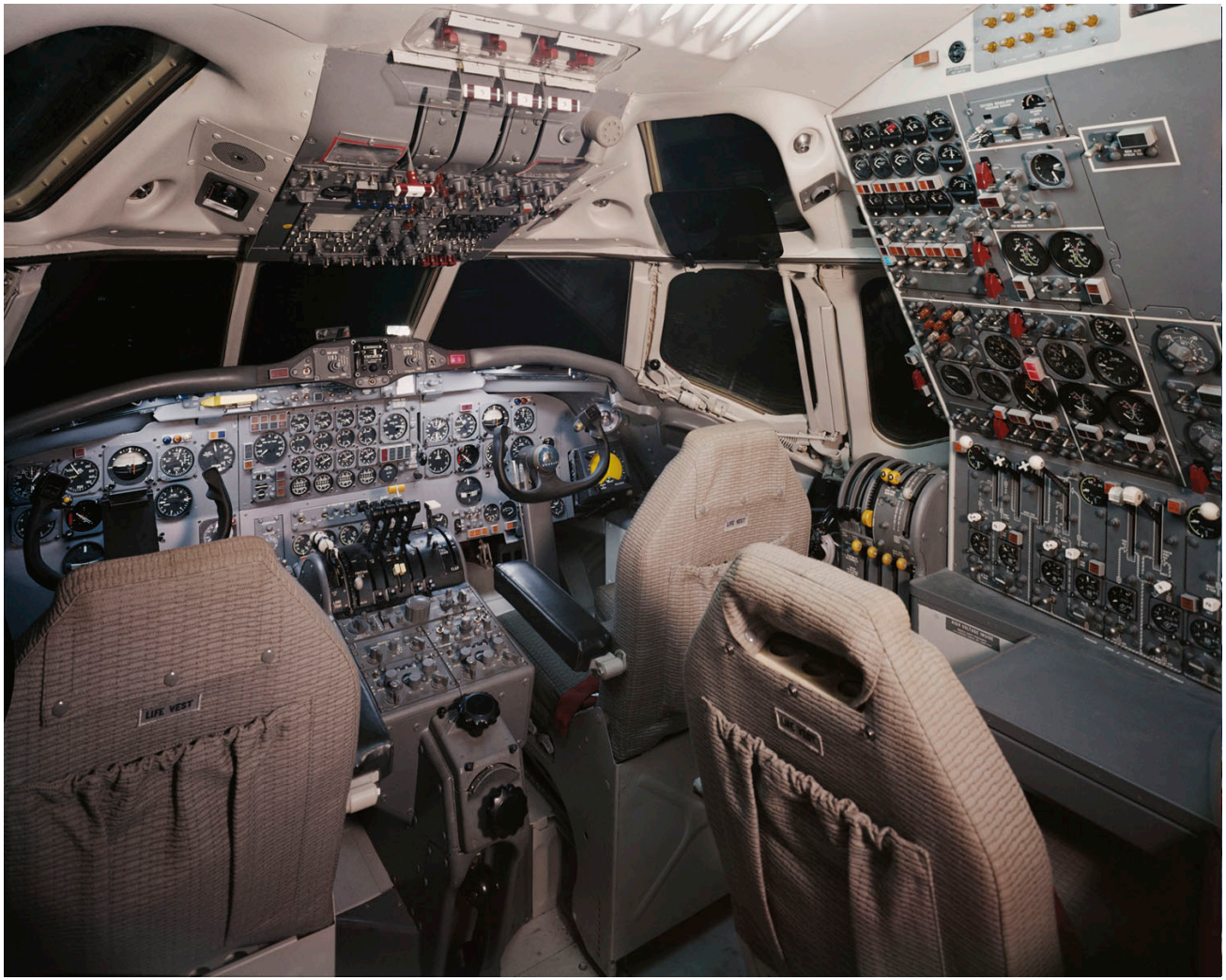
Early Commercial Transport

314 Clipper Control Deck

Transport Aircraft – Last of an Era

377 Stratocruiser

Moving into the Turbo Jet Era



DC-8 Flight Deck

Continuing the Turbo Jet Era

747-200 Flight Deck
A thousand lights, gauges & switches

The Beginning of Electronic Displays

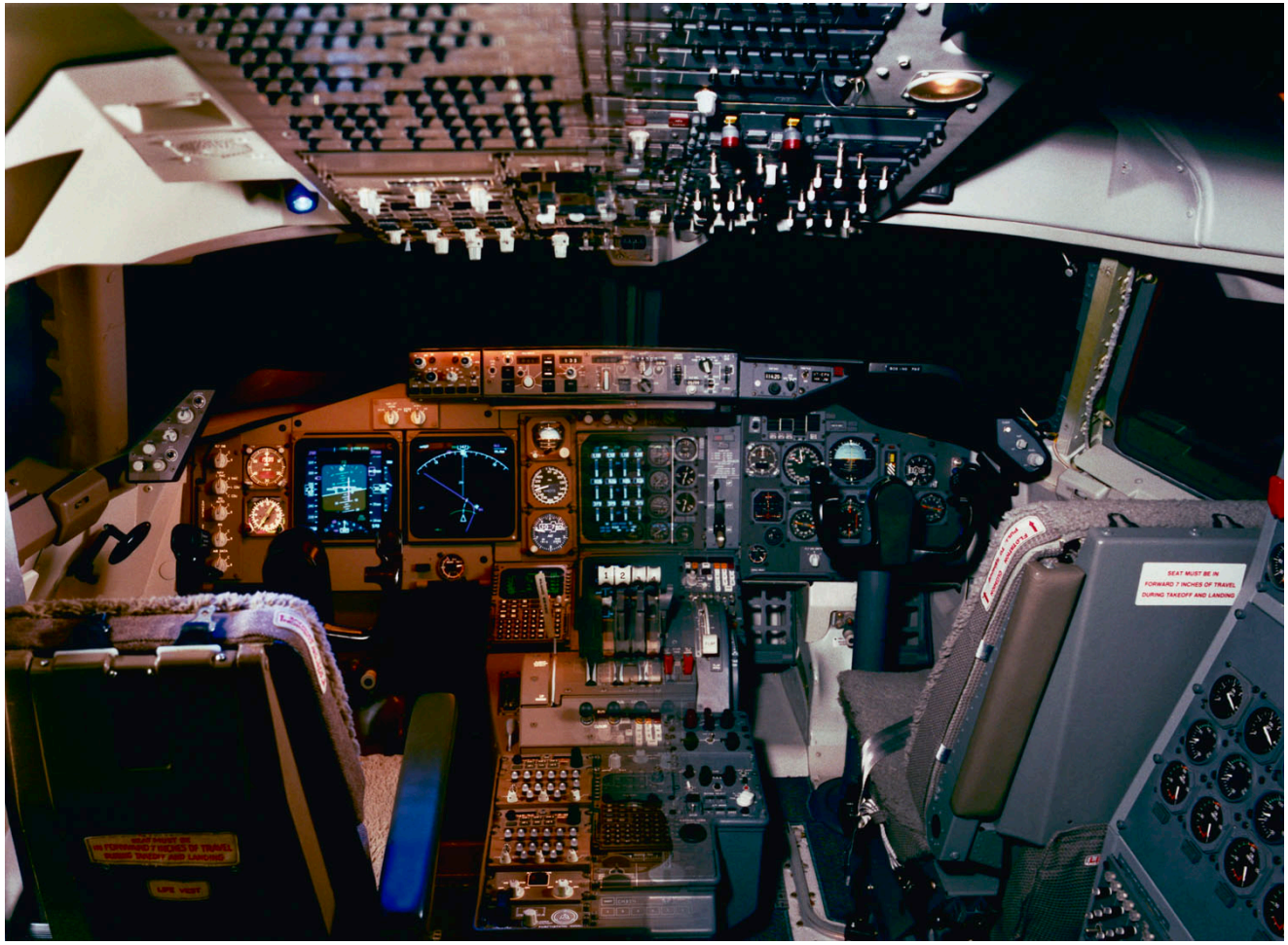
757/767 Flight Deck

Evolving Electronic Displays

757/767/777/787 Flight Deck

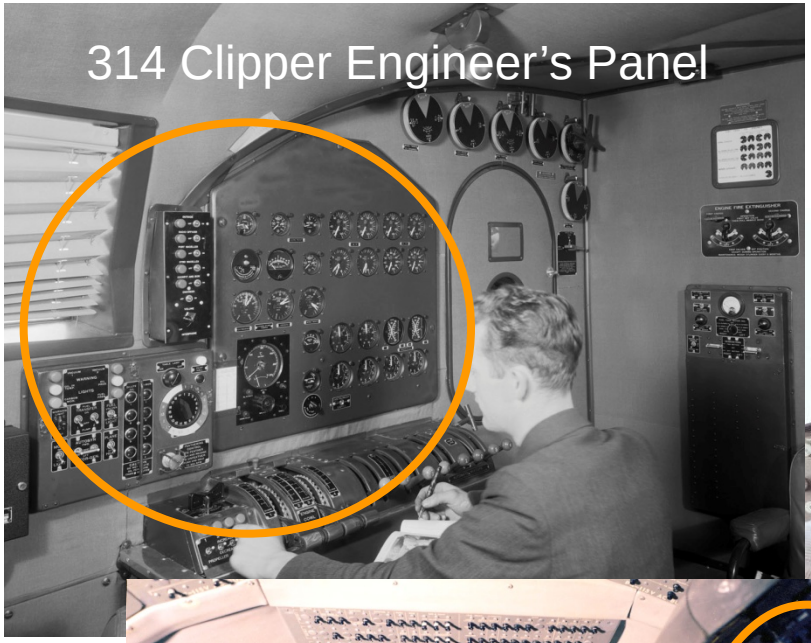
Electronic Displays:

Enabling information from data

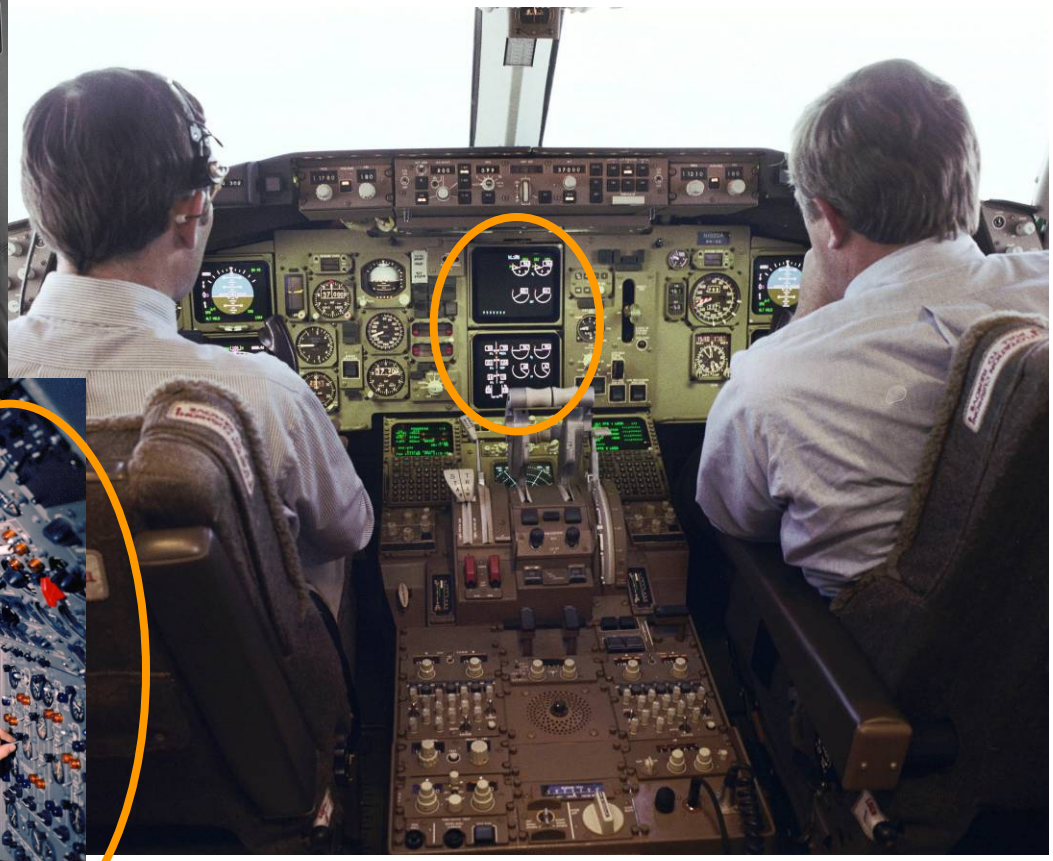


747-400 and 747-200

Engine Instruments / Crew Alerting



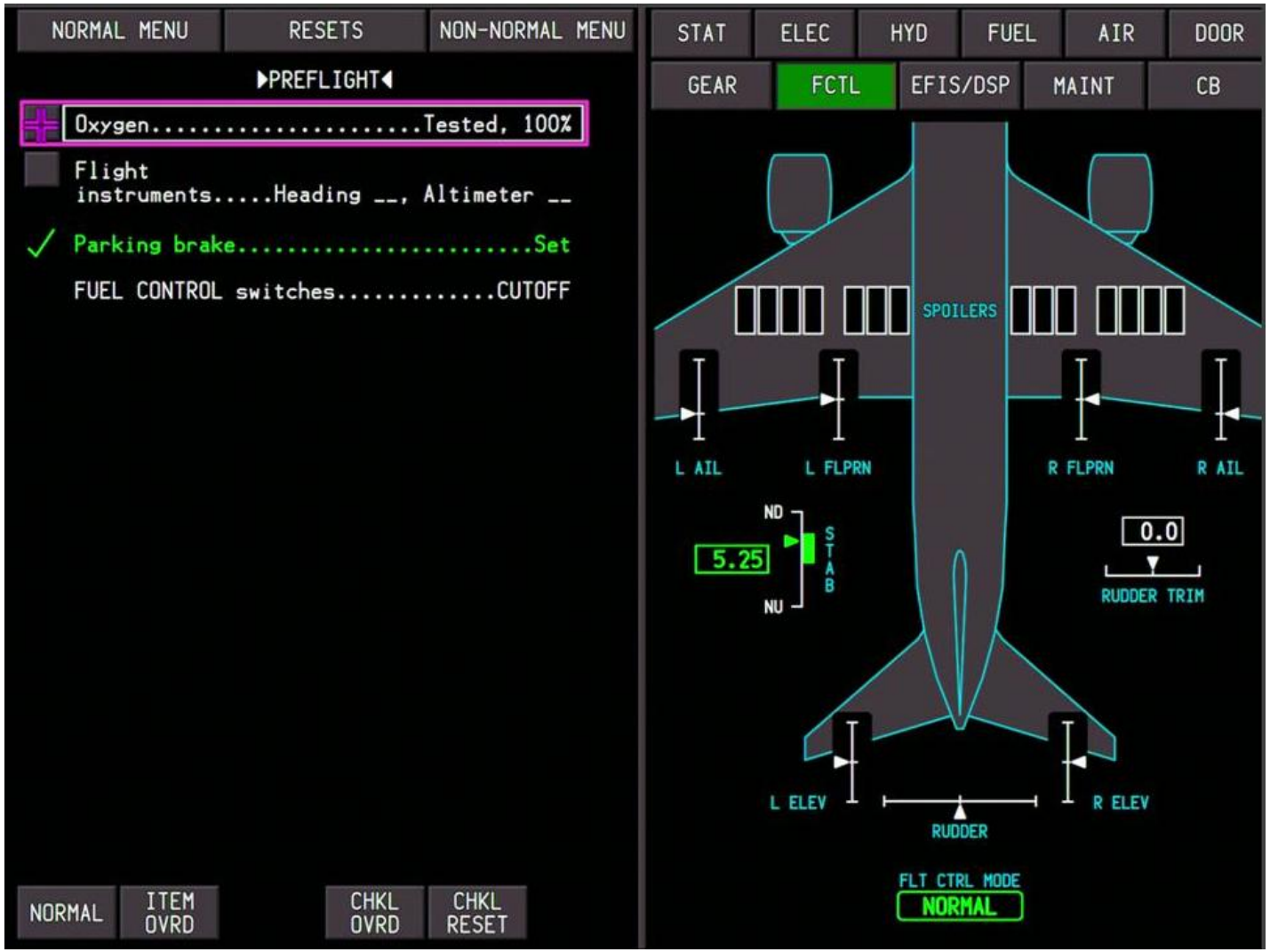
EICAS enabled by CRTs
supported move from 3 to 2 crew



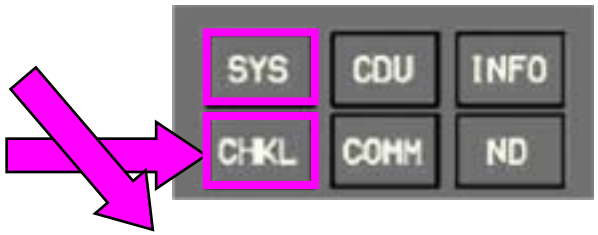
707

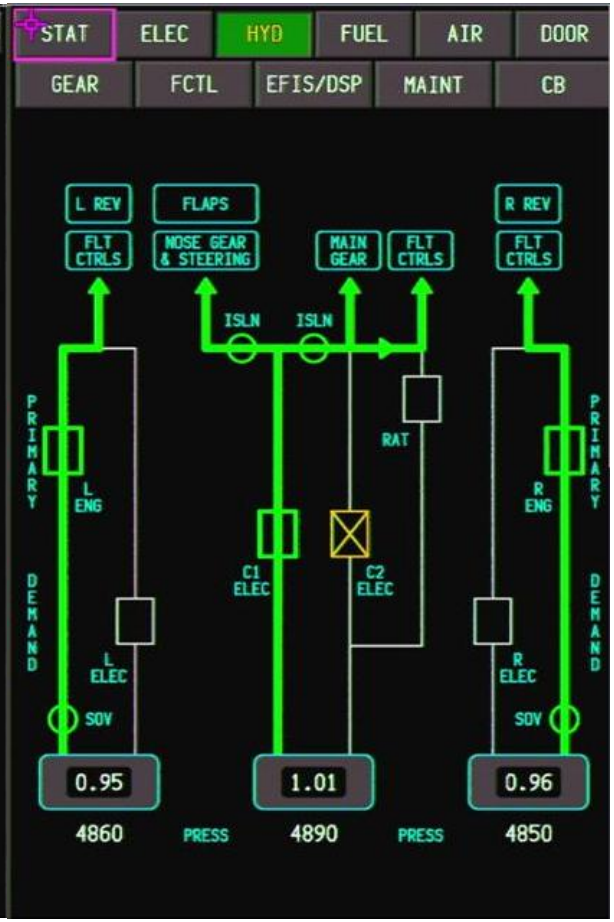
Engine Instruments / Crew Alerting

Electronic Checklist & Synoptics



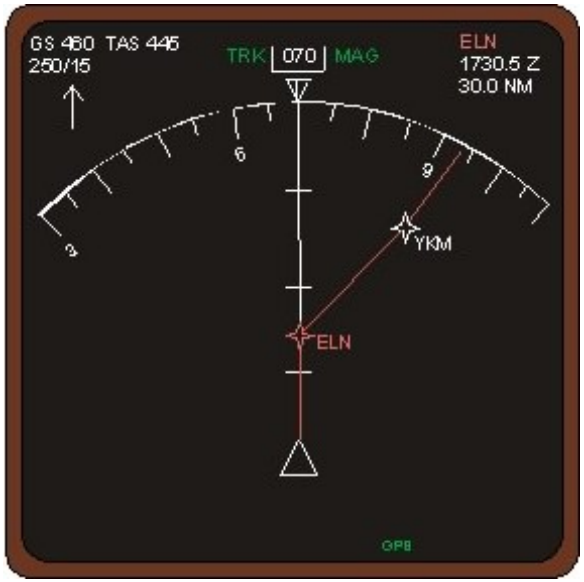
Integration & Linkage of Information



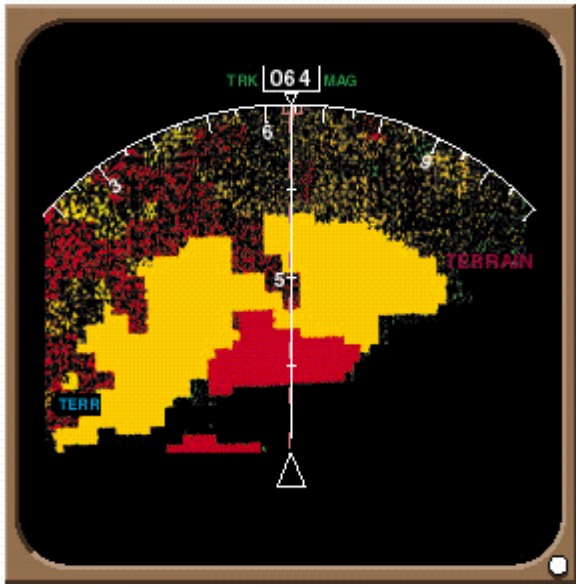


Navigation Display

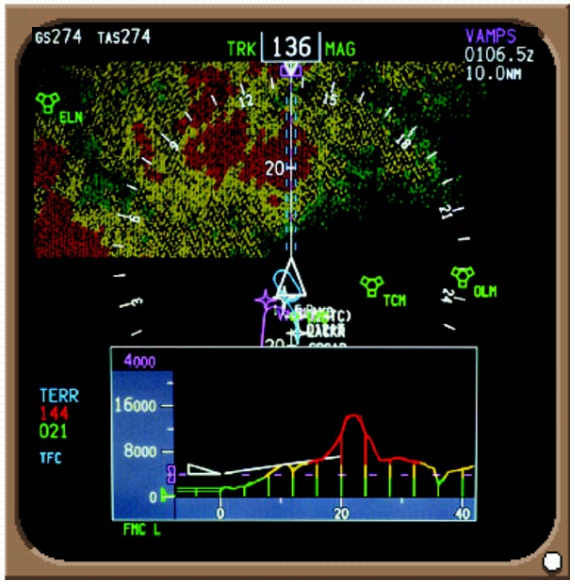
Basic Navigation Display with Flight Plan Path



Navigation Display with Terrain



Navigation Display with VSD



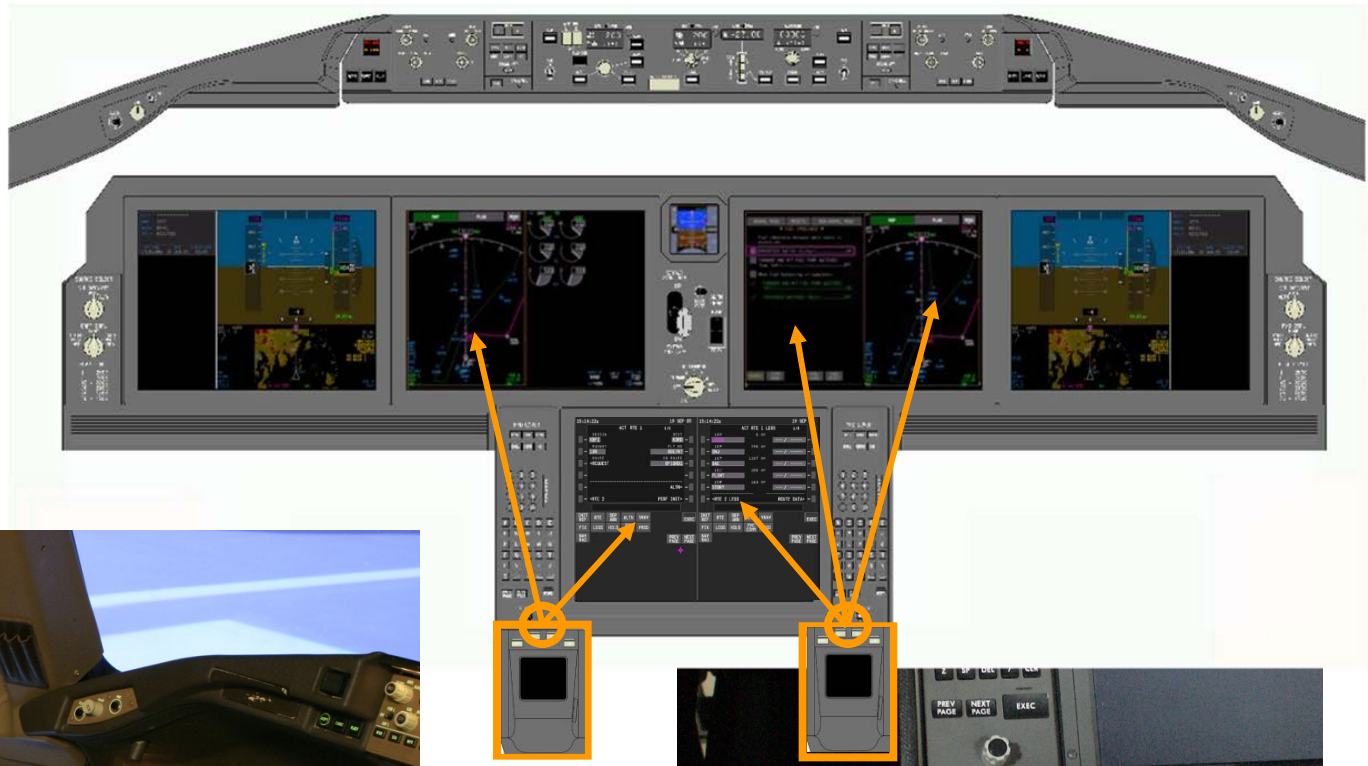
Enhanced Navigation Display - 787

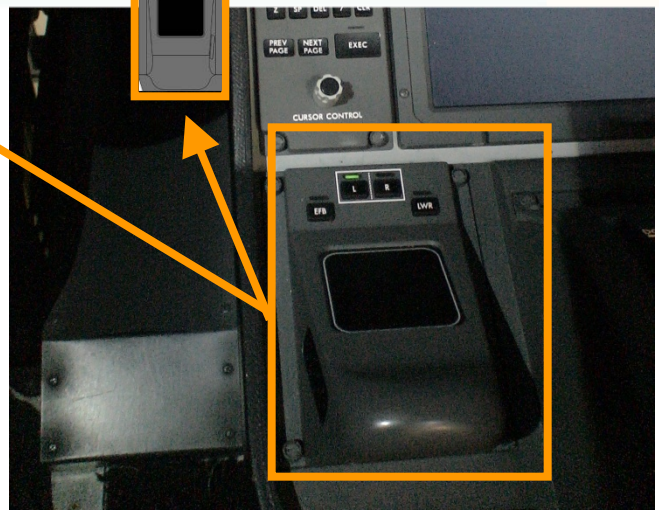
Enhanced Navigation Display - 787

Surface Navigation

Airport Moving Map on the 787

Interactive Flight Deck Displays

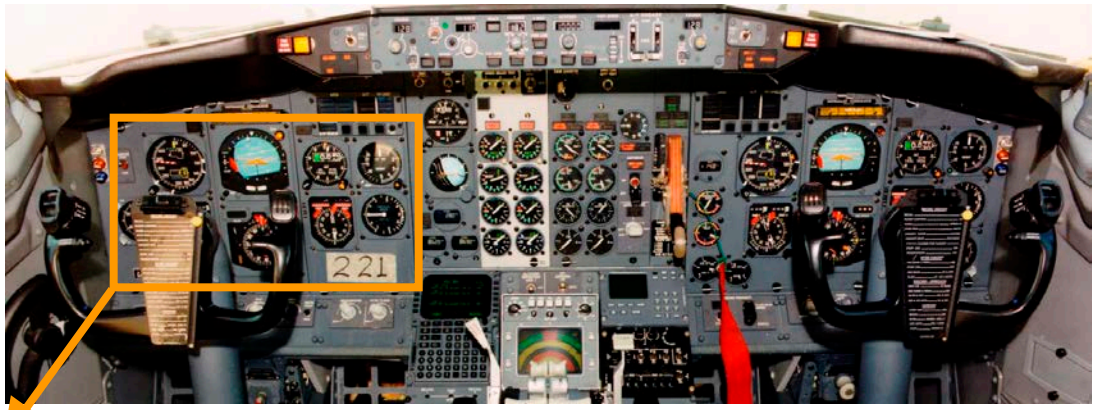




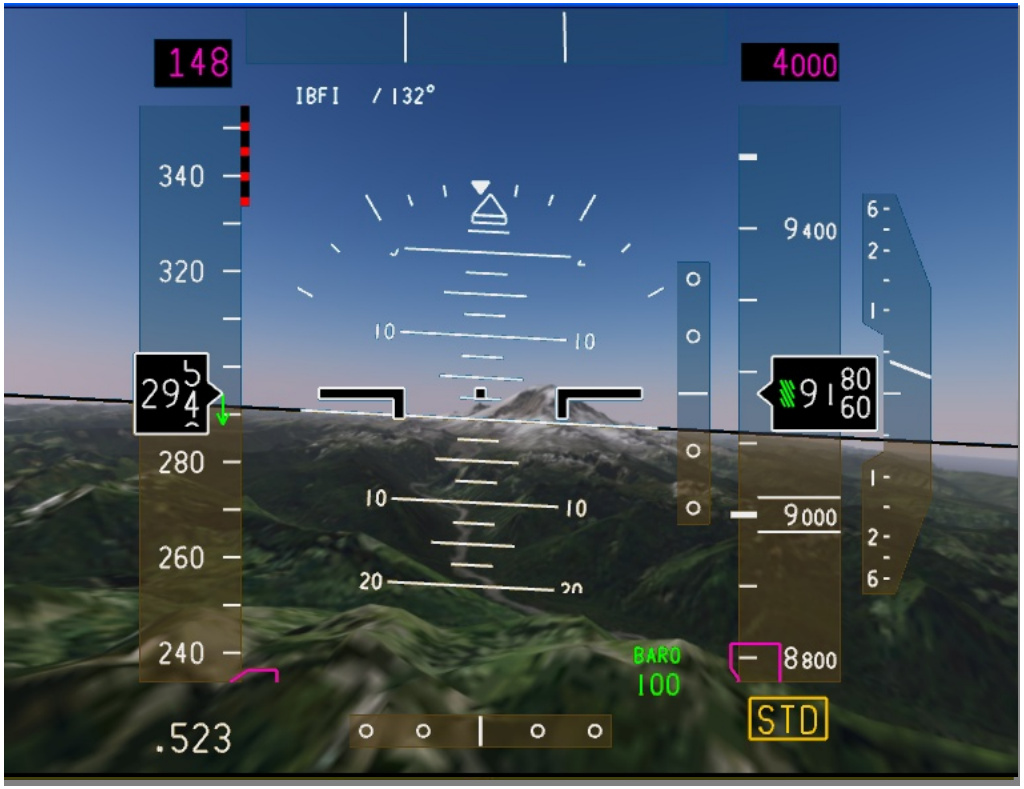
Going to Paperless

Primary Flight Information

Growth of Situation Awareness



Synthetic Vision Displays



Head-Up Displays

Superimposing on the outside view

Enhanced Vision Displays

Enhancing the outside view

Normal
HUD

HUD w/
EVS

Photo Courtesy
Rockwell-Collins International

Displays in Training Simulators

An early flight simulator

Displays in Training Simulators

Full motion devices with wide field of view out the window visuals

Displays in Training Simulators

T-45 trainer with wide field of view visuals

Displays enable cost effective trainers

787 Flight training device

Displays in Aircraft Maintenance

Portable maintenance displays

Displays in Airplane Design

Historical View

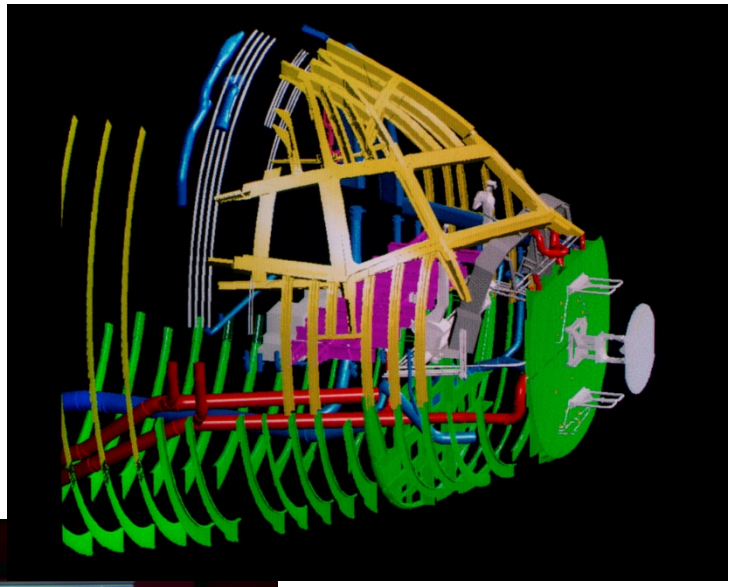
Drafters circa 1920s

Drafters circa 1960s

Displays in Airplane Design

Airplane design today!

Designing the 777
On CATIA



Designing the 777
and the 787

Displays to Enhance Passenger Experience

Stratoliner passenger cabin

737-NG In-flight Entertainment

747-400 Entertainment Console

Displays as Enablers

- **CRTs enabled Moving Maps, Electronic Checklists, System Synoptics**
- **LCDs enabled common displays with multiple display configs, i.e., 737 Classic EFIS and 737 NG (with 777 formats)**
- **HUDs enabled safer and low visibility approaches**

- **What will future display technology enable?**

Future Needs for Aviation

- **Continued enhancements to safety**
- **Increased capacity and efficiency in flight operations**
- **Move to paperless (facilitates integration and database updates)**
- **Continued emphasis on reduced non-recurring time and cost**
- **Continued pressure on recurring cost, power and weight**

What might the future hold?

- **Virtual windows - flight crew and passengers**
- **Touch-enabled display and control**
- **Head Worn Displays for maintainers and pilots**
- **Fully immersive 3-D computer design**
- **High reliability, low cost, light weight**
- **Easily upgradeable – economically support the 30-40 year airframe life cycle**

Summary

- **We have seen where we have been**
- **We know where we are today**
- **We have discussed some of the possibilities for the future**
- **It is up to us <u>together</u> to determine where we will go next**
- **An exciting future is before us**

Questions?