



Airbus Fly-By-Wire Computers A320 – A350

**Ying Chin (Bob) Yeh, Ph. D., IEEE Fellow
Technical Fellow
Flight Controls Systems
Boeing Commercial Airplanes**

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Airbus (and French) Organizations for Airbus FBW Computers

- **Research**

In 1970, French government modeled SRI International and MIT DraperLabs to create LAAS CNRS research institute for Computing System Technology, with a work force of 750. A sub-group, Informatique critique (dependable computing), has been the main research arm for Airbus FC, consisting of ~20 Ph.D researchers. This group is the computer architect for A320 FBW Computers.

- **Platform Design**

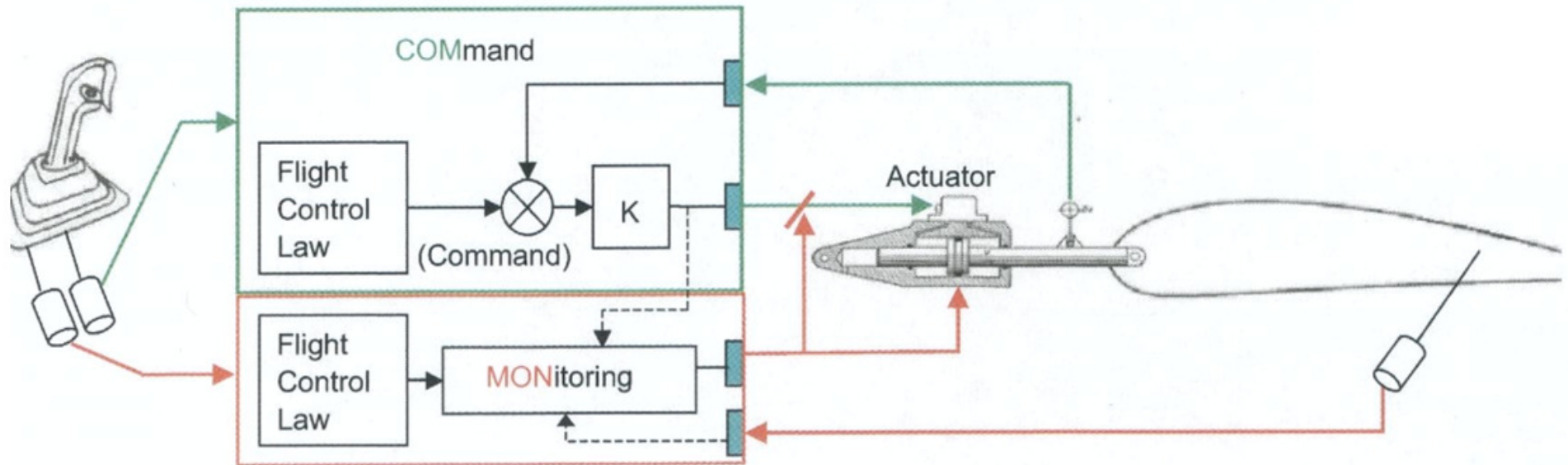
After A320, Airbus creates EYY group to MAKE FBW Computers and being responsible for FBW Computers, Warning Electronics, and Maintenance.



Airbus Fly-By-Wire Computers Design Philosophy

- Active-Standby control of an actuator for a control surface with multiple actuators, other actuators in By-Pass Mode
- Active-Passive control of an actuator among Flight Control Computer channels: upon detecting loss of an active computer channel commands, the passive computer will become active
- Self Monitor computer channel, with Command Lane and Monitor Lane

An example of Airbus FBW COM/MON-based Monitoring

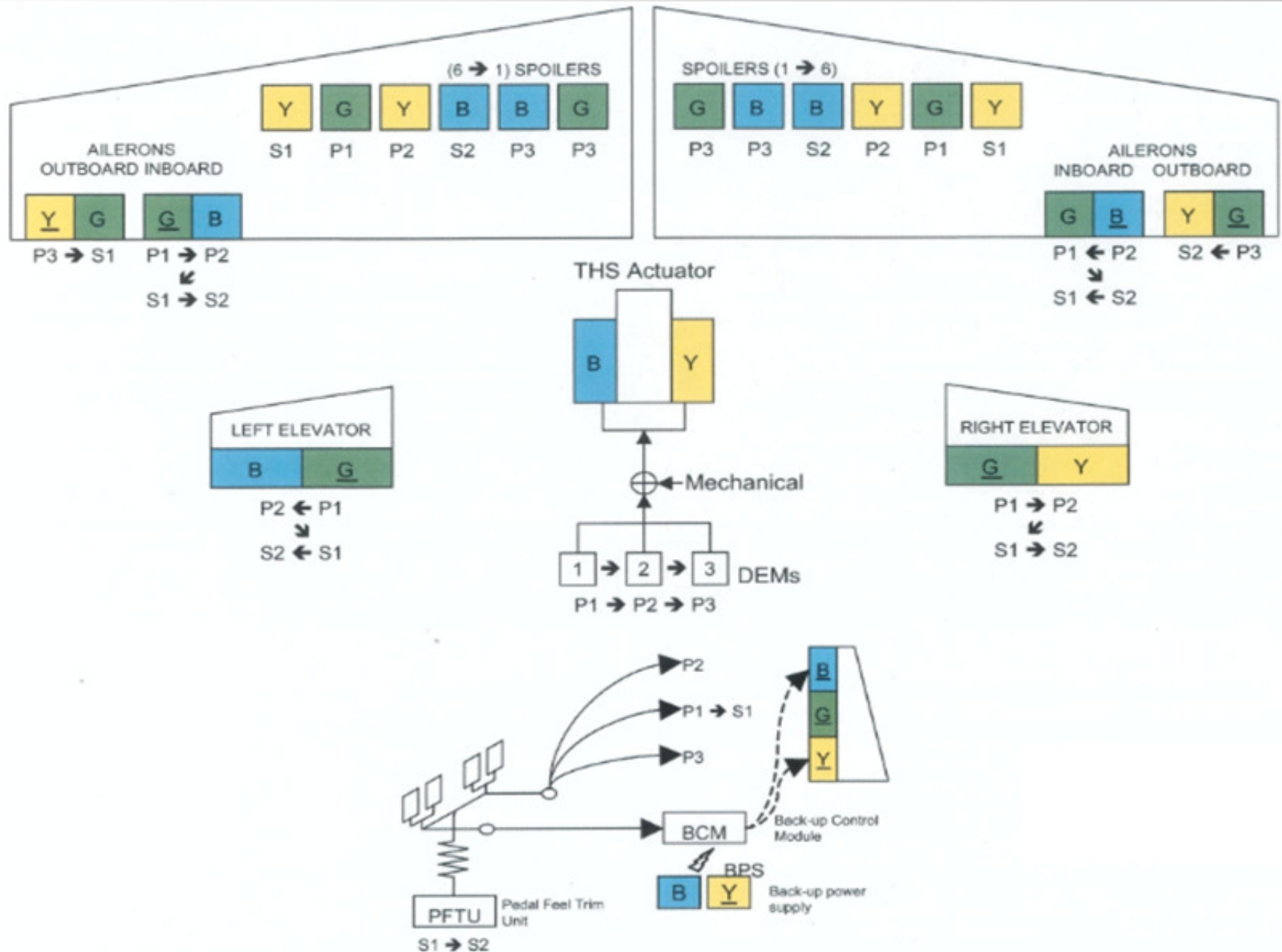




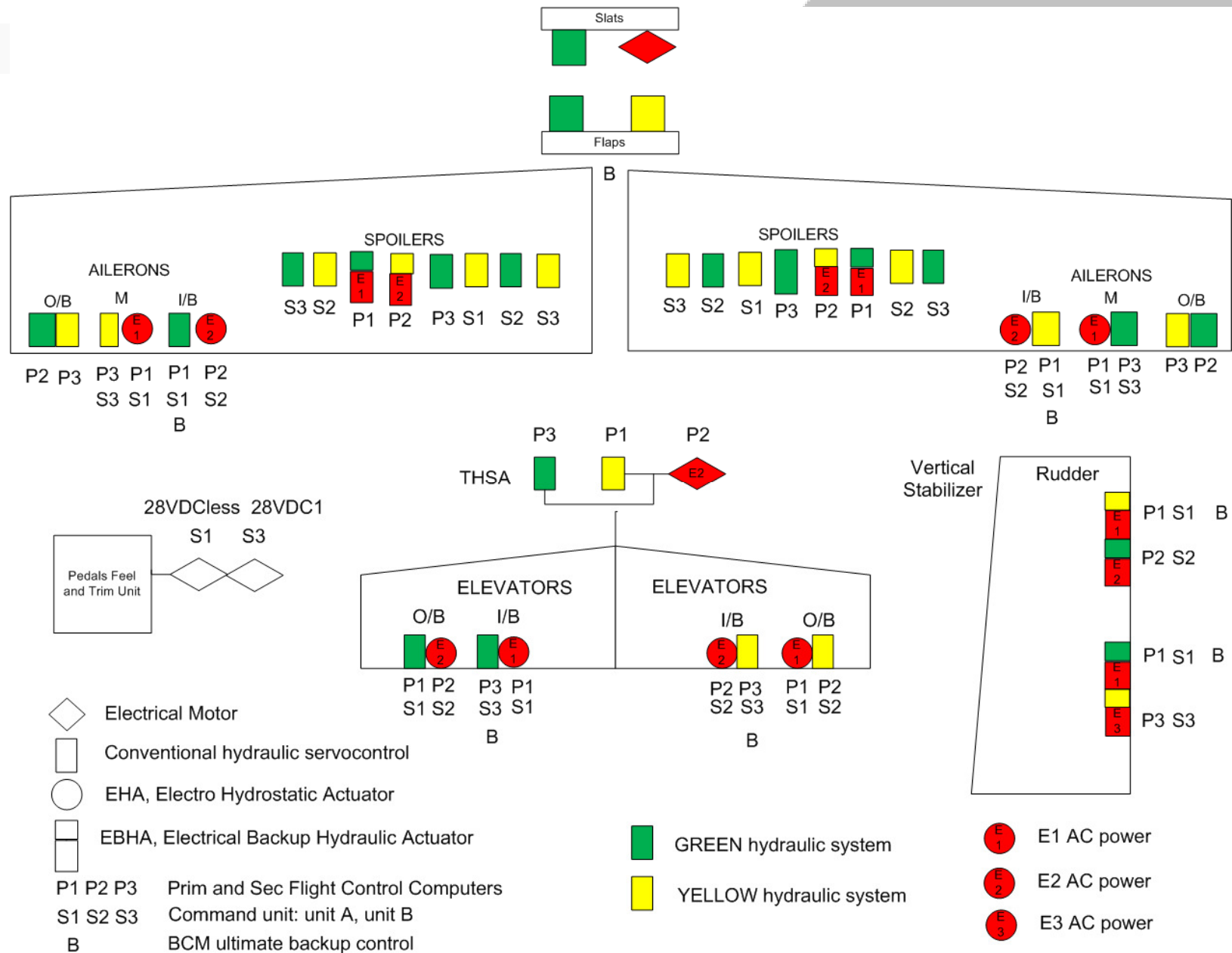
Evolution of Airbus FBW Computers

- A320 (Architect: LAAS, Platforms: Thompson CSF and Sfena, now Thales)
Dual-Dual ELAC (Elevator & Aileron): Thompson CSF, Motorola 68010 based
Triple-Dual SEC (Spoiler & Elevator): Sfena Aerospatiale, Intel 80186 based
- A330/340 (Platform: Airbus EYY)
Triple-Dual PRIM (Elevator, Aileron, Spoiler), Intel 80386 based
 - Auto-coded SW design with Assembler in COM and PL/M in MON**Dual-Dual SEC (Elevator, Inboard Aileron, Spoiler), Intel 80286 based**
 - Hand-coded SW design with Assembler in COM and Pascal in MON
- A340-500/600 (Platform: Airbus EYY)
Triple-Dual PRIM, Intel 486 DX4 (32 MHz)
Triple-Dual SEC, DSP Sharc (40 MHz)
- A380 (Platform: Airbus EYY)
Triple-Dual PRIM, Power PC 755 (66 MHz – 98 MHz), Auto-coded COM & Hand-coded MON
Triple-Dual SEC, DSP Sharc (40 MHz), Auto-coded COM & Hand-coded MON
- A350 (same triple-dual channel as A380, Processors updates unknown)

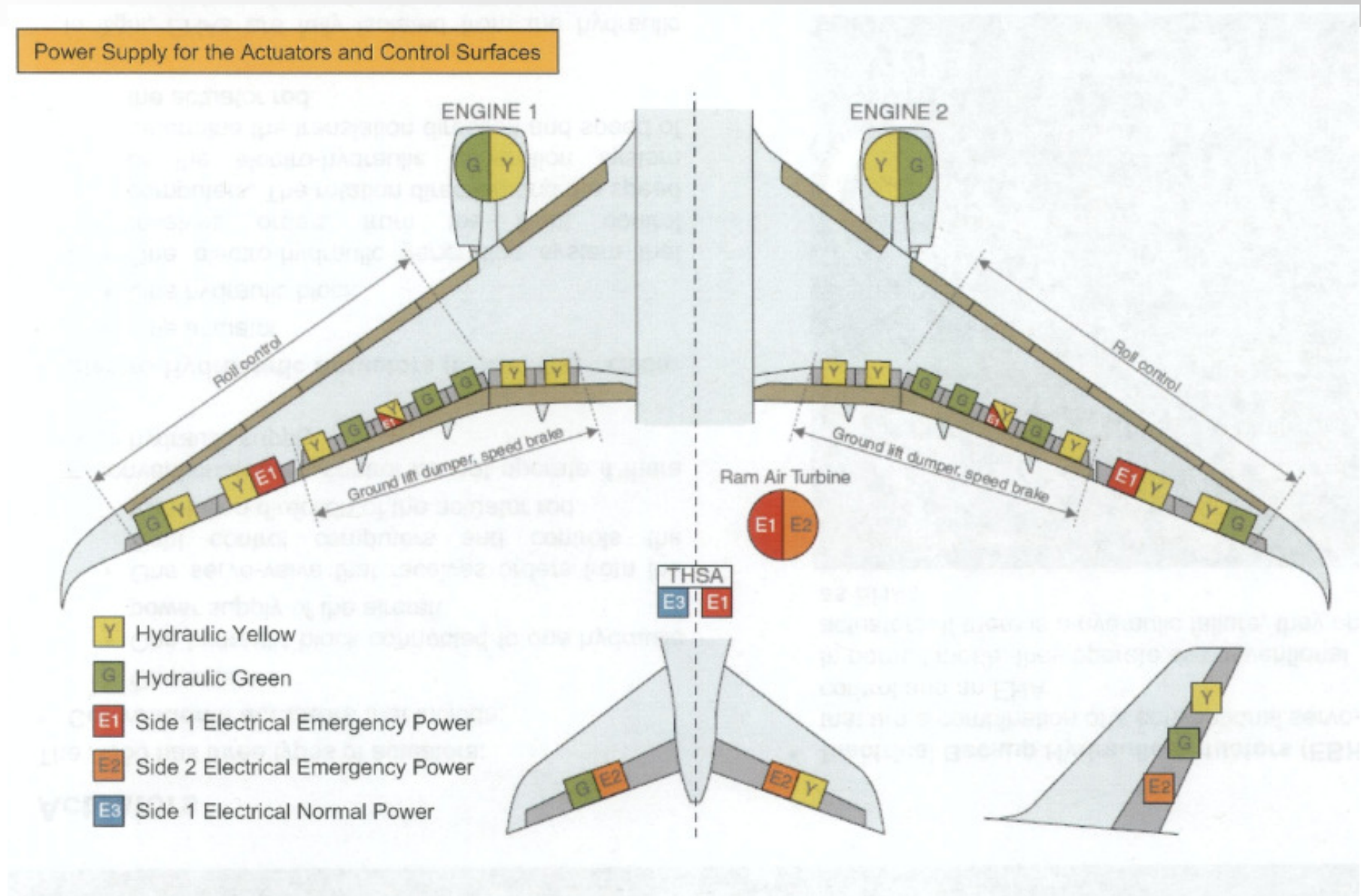
A340 FBW Architecture



A380 Flight Controls Architecture



A350 FBW Architecture



Ultimate Back-Up

- A320
Mechanical linkage to THS & rudder
- A330/340
Ditto, plus Back-up Yaw Damping to improve Dutch Roll damping
- A340-600
Ditto, Rudder becomes fully electrical (see next sheet, BPS and BCM), analog BCM
- A380
Ditto, for Yaw control plus BPS + Analog BCM to power:
 - **Electrical pitch back- up (elevator) linked to side-stick**
 - **Electrical roll back-up (aileron) linked to side-stick**
 - **Pitch Trim (Trim Hand Wheel is replaced by Switches)**

(note: FC System Architecture contains 2H/2E and Electrical RAT supply EHA and EBHA in case of total engine flame-out)
- A350
Ditto, with digital BCM as depicted next sheet

A350 FC Backup System

- **An Electrical Backup System (EBS) controls the aircraft in the case of the failure of:**
 - All the PRIMs and all SECs, or**
 - The Electrical power supply of the PRIMs and the SECs**
- **The EBS is totally segregated from the normal flight control system and has:**
 1. **A Backup Power Supply (BPS)**

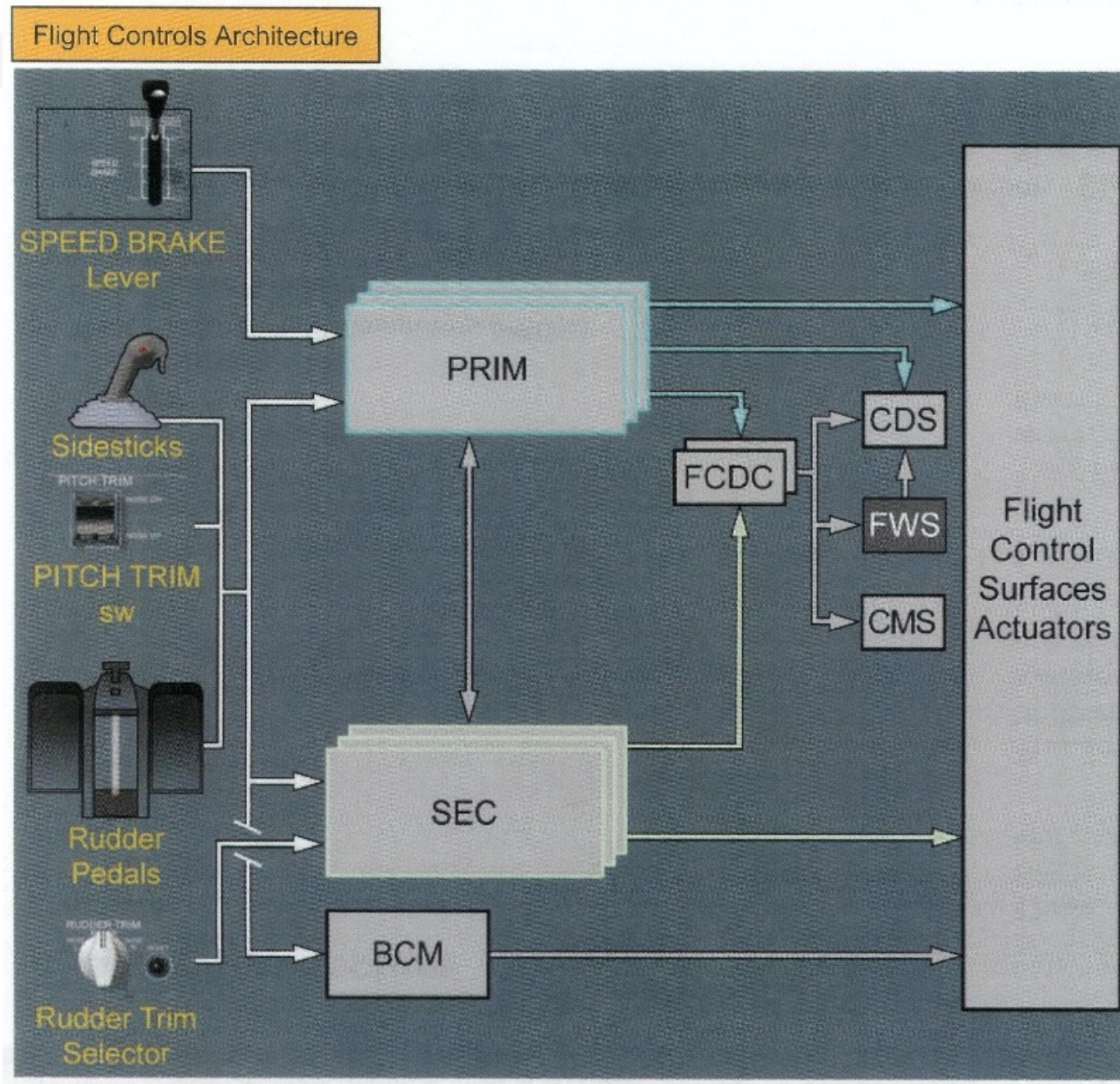
The BPS is an electrical generator that is activated in the case of computer or electrical generation failure. The yellow hydraulic supplies the BPS.
 2. **A Backup Control Module (BCM)**

The BCM controls and monitors:

 - **The inboard aileron**
 - **The elevators**
 - **The rudder**
- **The direct control laws apply whenever the EBS is active, with the following features:**
 - **Pitch motion damping**
 - **Yaw damping**
 - **Direct roll**



Airbus 350 FBW Computers: Normal Electronic Signal and Ultimate Back-up Control Module (BCM)



Airbus 380 Data Communication: FC and IMA

non essential functions (warning, maintenance, ...) located on shared resources

