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Agenda (1/3)

- Module 1- Introduction (Day 1+ ¼ Day 2)
 - 1-1 General Course Introduction
 - 1-2 Introduction of the Actuation session
- Module 2 – Introduction to Aircraft Aerodynamics, stability and control
 - 2-1 Aircraft Aerodynamics
 - 2-2 Aircraft Stability and Control
- Module 3 - A/C Aircraft configuration for flight controls and high lift
 - 3-1 Arrangement of flight control surfaces and high lift devices
 - **3-2 Cockpit Controls for Flight control System and Engine**

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General

- The cockpit is the control center of the aircraft. All indication and command devices necessary to operate the aircraft are located there. The technical evolution of Aircraft system designs during the last decades are clearly visible.
- Airbus was in the leading role in cockpit design (which reflect the status of the system design)
 - Forward facing cockpit for the A300 in the early 70th
 - 2 man Cockpit for the A310 and all following models
 - Dark cockpit concept
 - Deletion of the mechanical part thanks to fly by wire technology
 - Concentrate on “fly the aircraft” relocate other (cabin cockpit)

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Concorde



A300 B2/B4



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A380



A350



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General

- The following presentation is will address the control elements necessary for primary and secondary flight controls,
 - Control Colum
 - Side Stick
 - Pedals
 - Thrust control
 - Flaps
 - Spoiler

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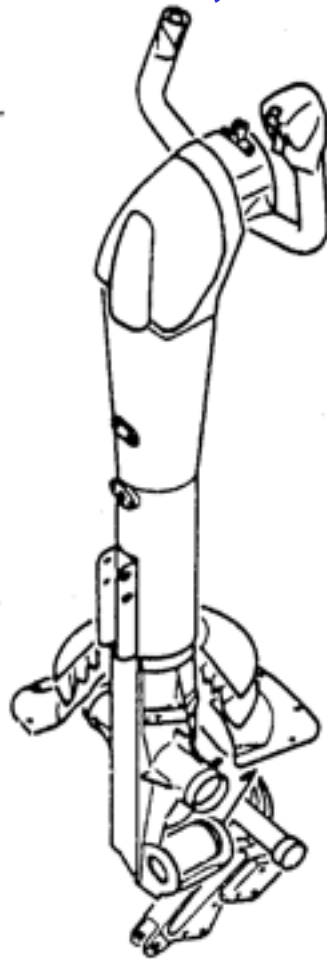
Cockpit Controls, Control Column



- Control column and control wheel are appropriate when large displacements / forces are required
- This is mandatory with mechanical / hydro mechanical flight control systems
- No longer needed with Fly-By-wire

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3-2 Cockpit Controls, Control Colum



- control wheel
- Pitch Trim switches
- Balance weight
- Stick shaker
- Stick pusher

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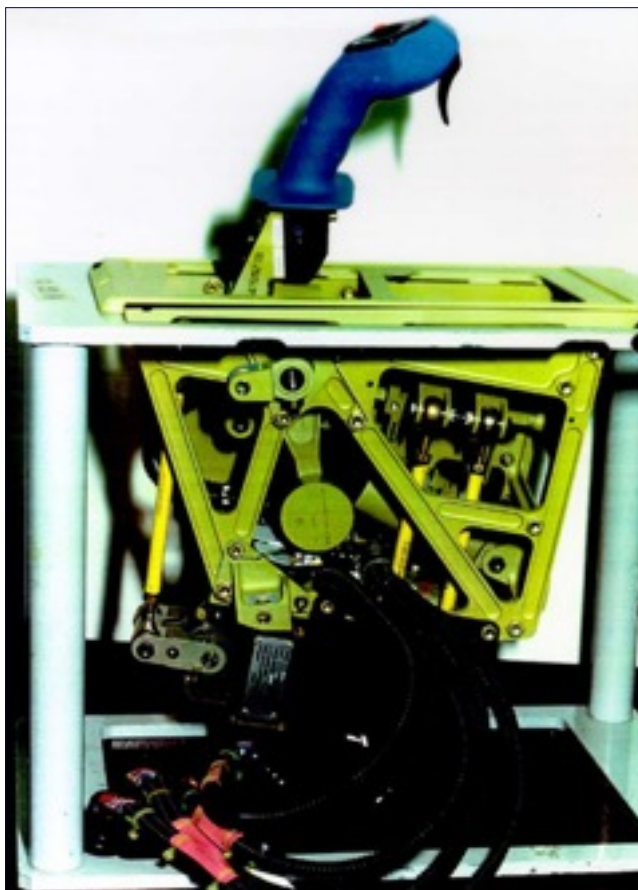
3-2 Cockpit Controls, Side Stick



- Side stick saves complexity
- Side stick saves weight
- Side stick offers unobstructed view on the instruments
- Side stick allows for more freedom in cockpit design
- Side stick does not require space under the cockpit floor
- Side stick allows for the installation of a folding table, comfortable foot rests

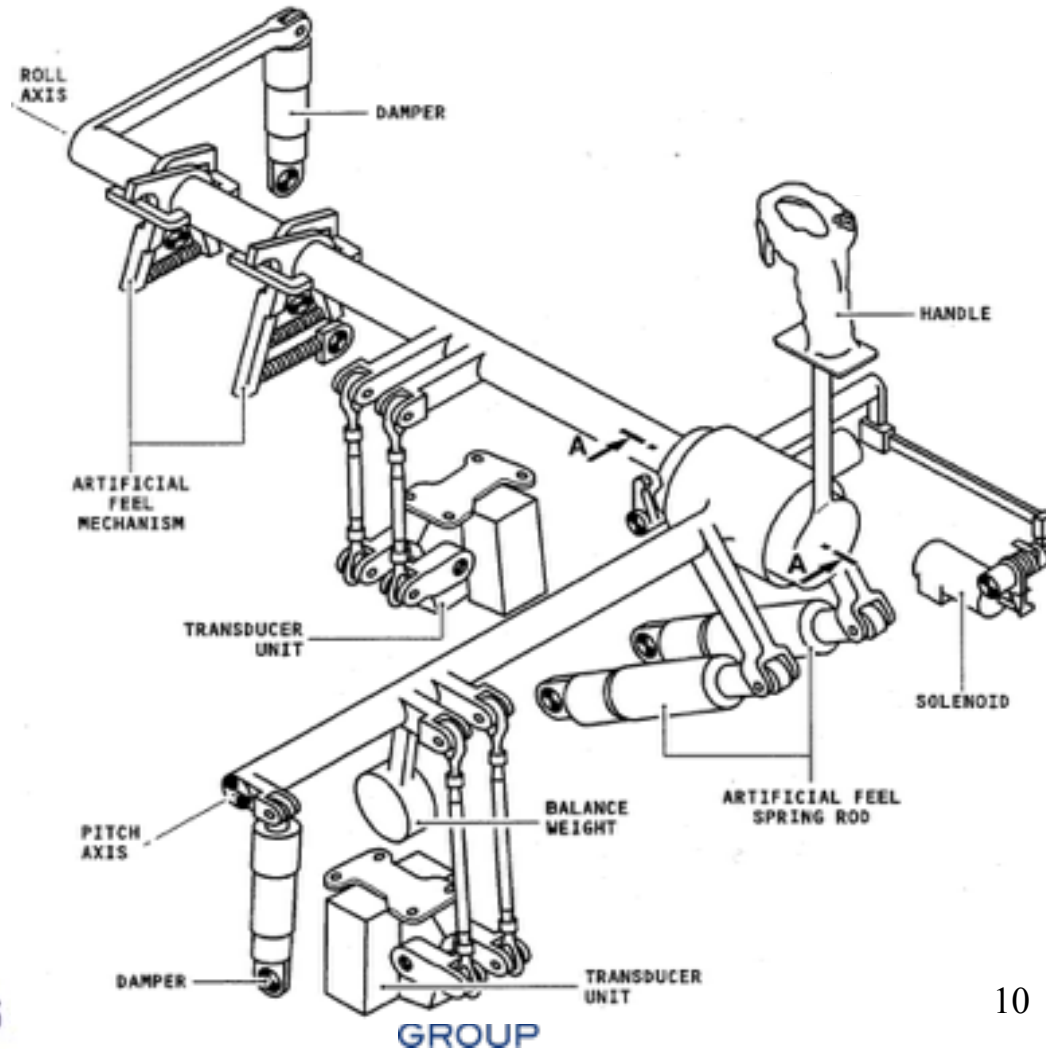
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3-2 Cockpit Controls, first generation side stick (Airbus)



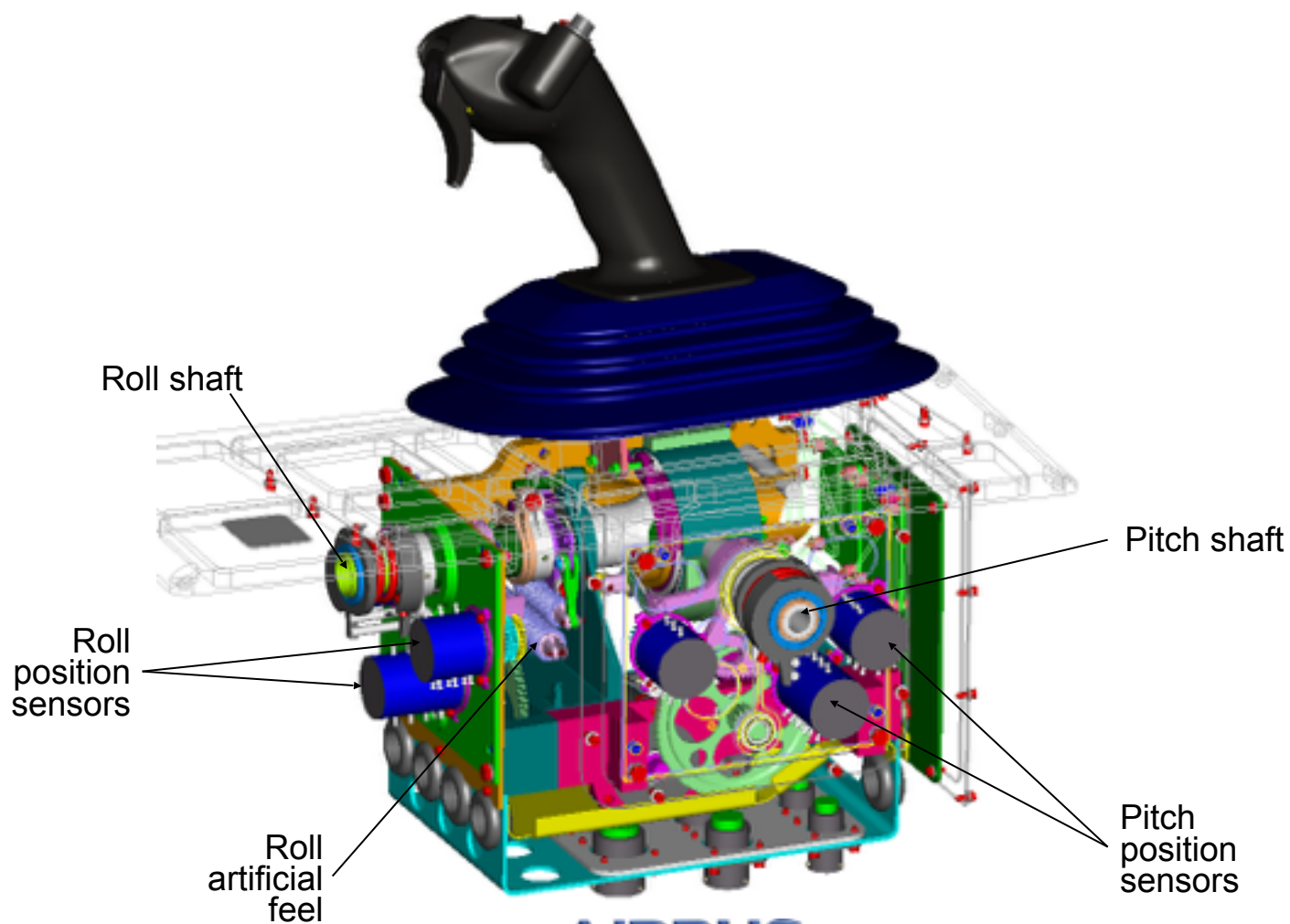
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3-2 Cockpit Controls, first generation side stick (Airbus)



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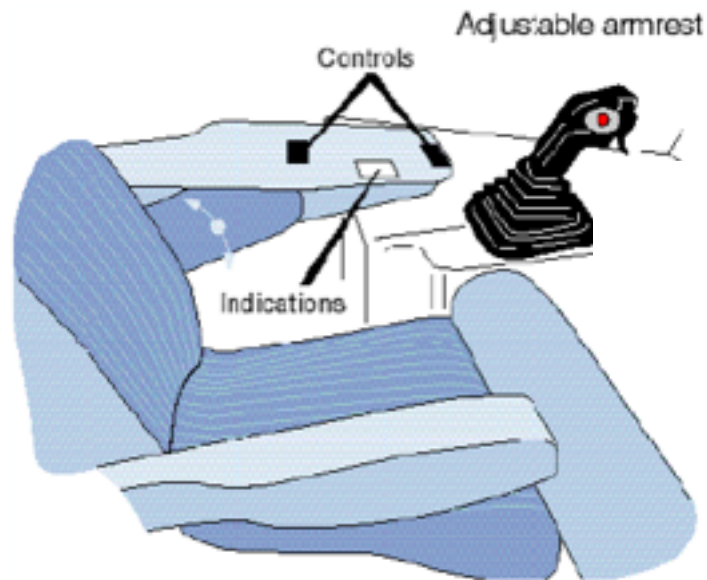
3-2 Cockpit Controls, 3rd. generation side stick (Airbus)



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3-2 Cockpit Controls, Side Stick features

- Displacement preferred over force signal with no displacement
- Location, forward tilt, inboard tilt and toe-out orientation selected for carefully taking into account the wrist anatomy and achieving a proper uncoupling between pitch and roll
- Adjustable armrest
- No variable feel forces
- Damping
- Captain and First Officer side sticks not interconnected
- Side sticks held in neutral position when auto pilot engaged, with overridable additional feel force threshold



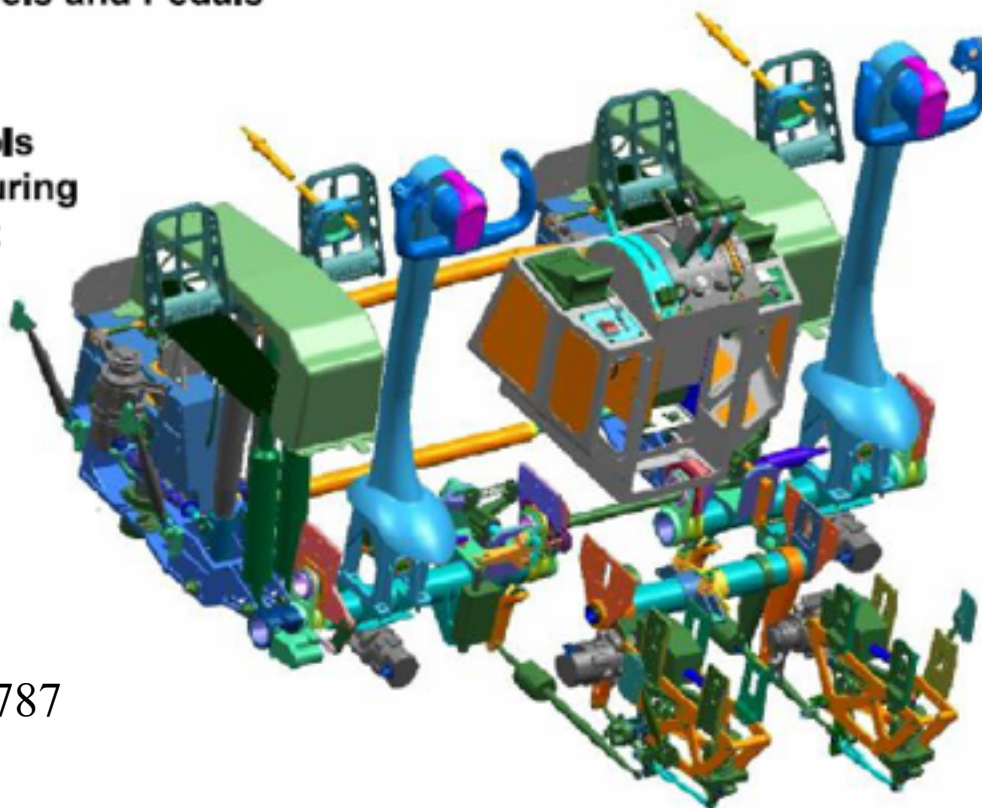
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3-2 Cockpit Controls, Conventional cockpit controls for FBW systems

**Conventional Control Columns,
Wheels and Pedals**

Captain and First Officer Controls are Linked

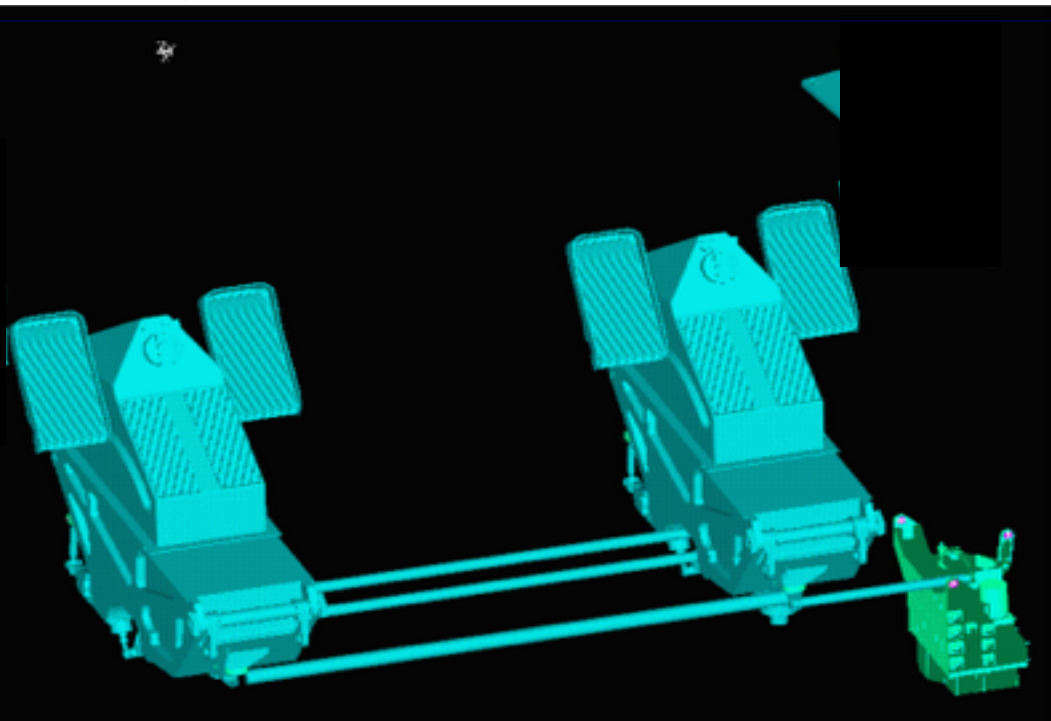
**Pilot Controls
Backdriven During
Autoflight**



B777 / 787

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3-2 Cockpit Controls, Rudder Pedals

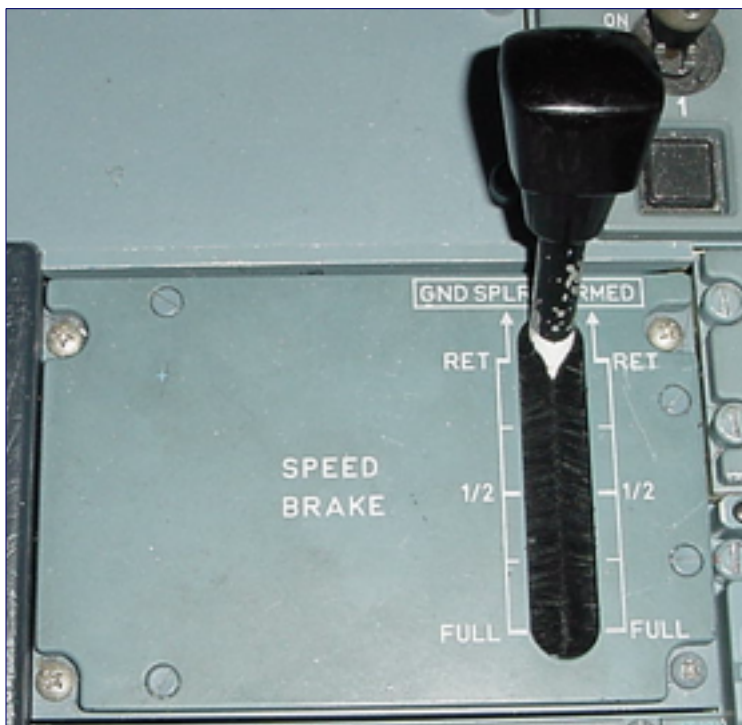


- Use of rudder pedals is limited :
 - On ground
 - For take-off and landing in case of cross wind
 - For compensating an engine failure

- Captain and first officer rudder pedals are mechanically coupled
- Also provides "manual" braking function, with mechanical coupling as well.
- Longitudinal position adjustment necessary
- Issue with foreign objects

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3-2 Cockpit Controls, Airbrake control



- Airbrakes lever has two functions :
 - Extend / retract airbrakes
 - Arm / disarm the ground spoiler function
- Spoilers are electrically controlled, the lever does not move under automatic ground spoiler operation
- Thanks to electrical control, lever travel is in % of full travel ; a given lever position may correspond to various airbrake settings according to configuration.
- Automatic retraction of airbrakes the lever does not move

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3-2 Cockpit Controls, Pitch Trim control



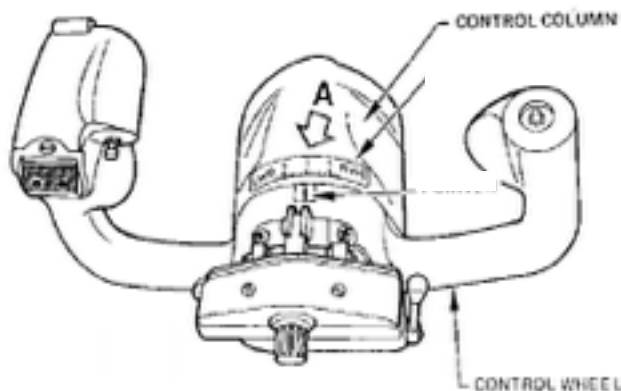
■ When the THS actuator is mechanically controlled:

- Two interconnected pitch trim wheels are used
- Control is in position
- Trim wheel position indicates THS position
- A "green band" covers the allowable range of THS setting for take off

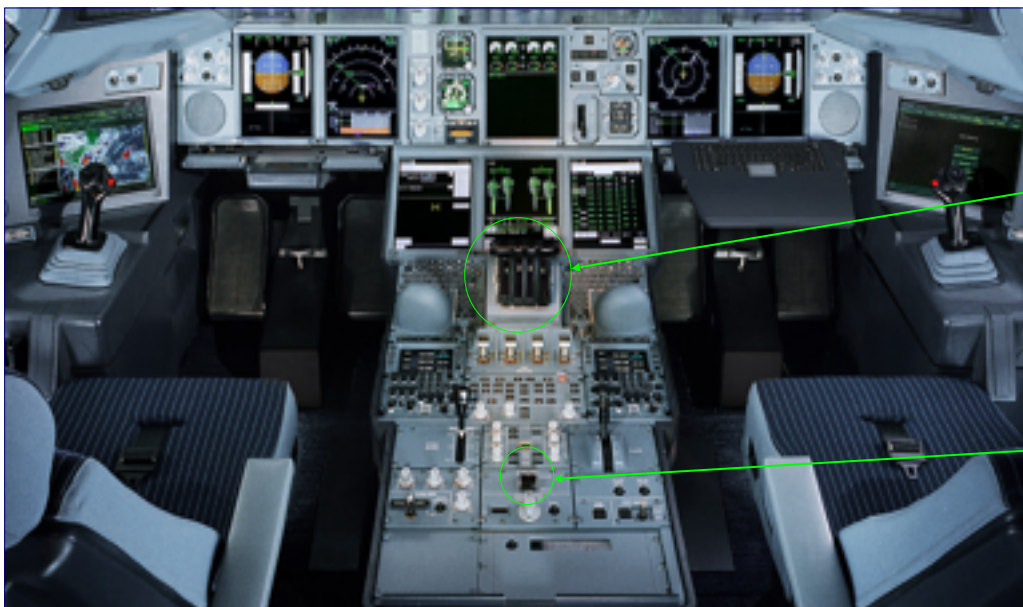


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3-2 Cockpit Controls, Pitch Trim control



- Because of frequent use on WB family the THS is also controllable by trim switches on control wheel



- On A380, mechanical control of THS actuator is removed
- No trim wheels
- No mechanical position indication
- THS position indication on PFD
- Trim switches



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End of session
thank you!

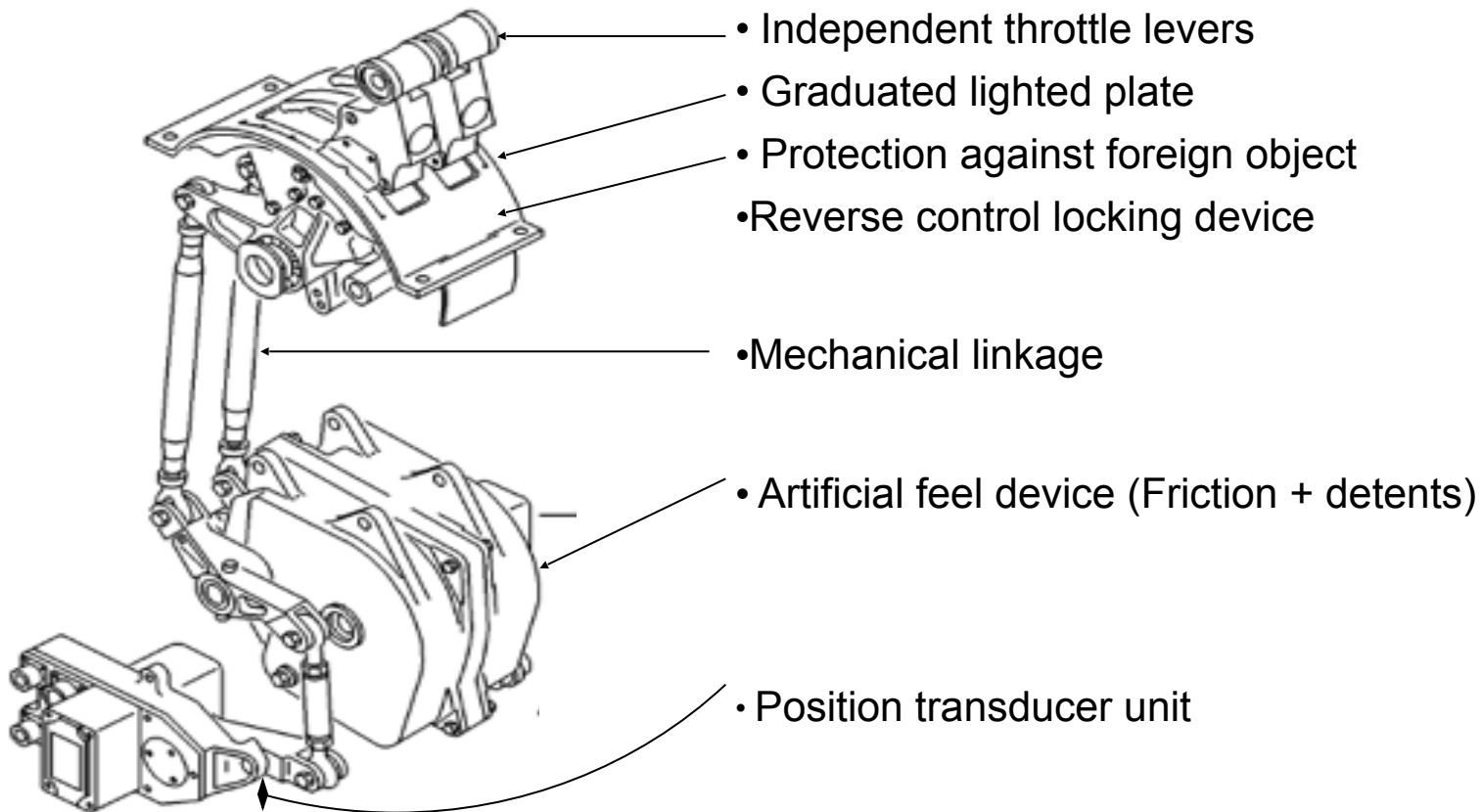


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Back up material Engine control

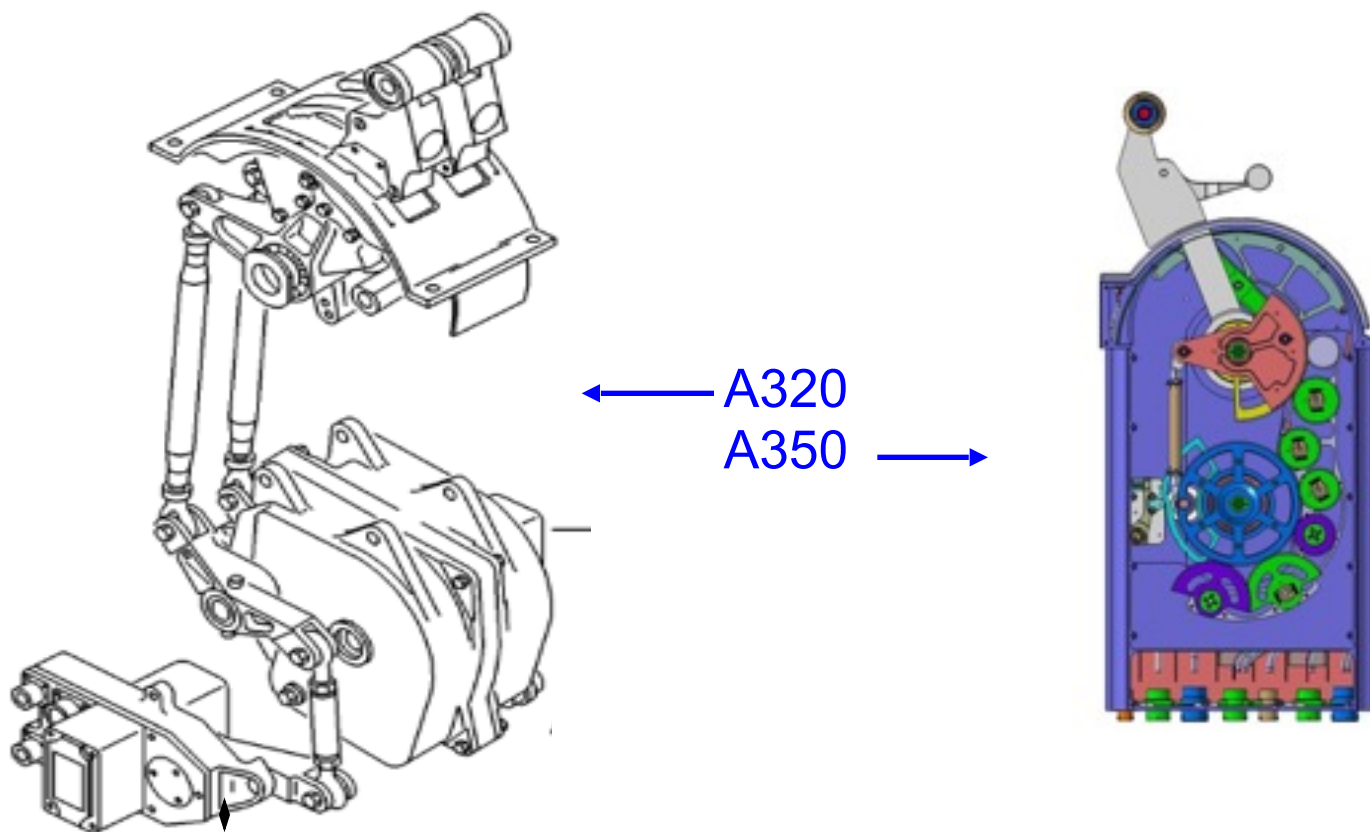
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3-2 Cockpit Controls, Engine control : Throttle Control Assembly



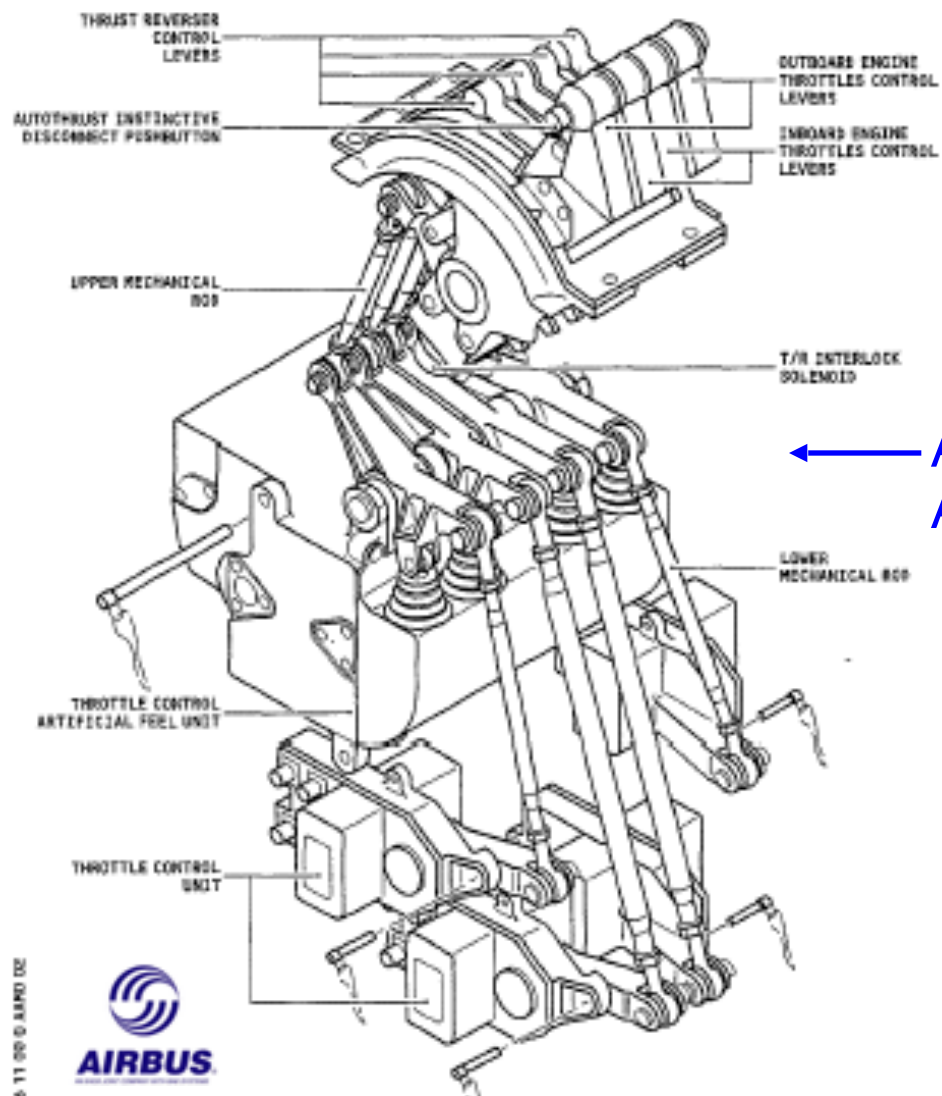
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