SIBACK
SmartInceptor Unit

Conventional side sticks are said to be passive sticks because the force feel feedback is realized by mechanical springs. Active sticks are called active because the force feel feedback is produced and actively adapted by electric motors. Active control of electric motors enables several active functionalities such as inceptor back drive (i.e. inceptors moving following AP orders), virtual coupling between left pilot and right pilot inceptors, tactile cueing (vibrations, force variations for e.g.).
In the AIS, motors are mounted in a direct drive configuration. There is indeed no gear train between the grip and the motor shaft. The mechanical transmission joint is designed such that the motors never complete entire rounds, but operate on a theoretical quadrant up to 140°.
Motor torque and velocity requirements are dictated by force and speed at grip level.
The AIS Control System is constituted with 2 Smart Inceptor Control Unit (BICU). Each integrates one Channel.
Each BICU control both Inceptors and communicate with Flight Control System.
BICU is an electronic equipment based on power, numerical and analog functions embedded in a specific mechanical casing.
BICU internal architecture consists on a COM/MON design.
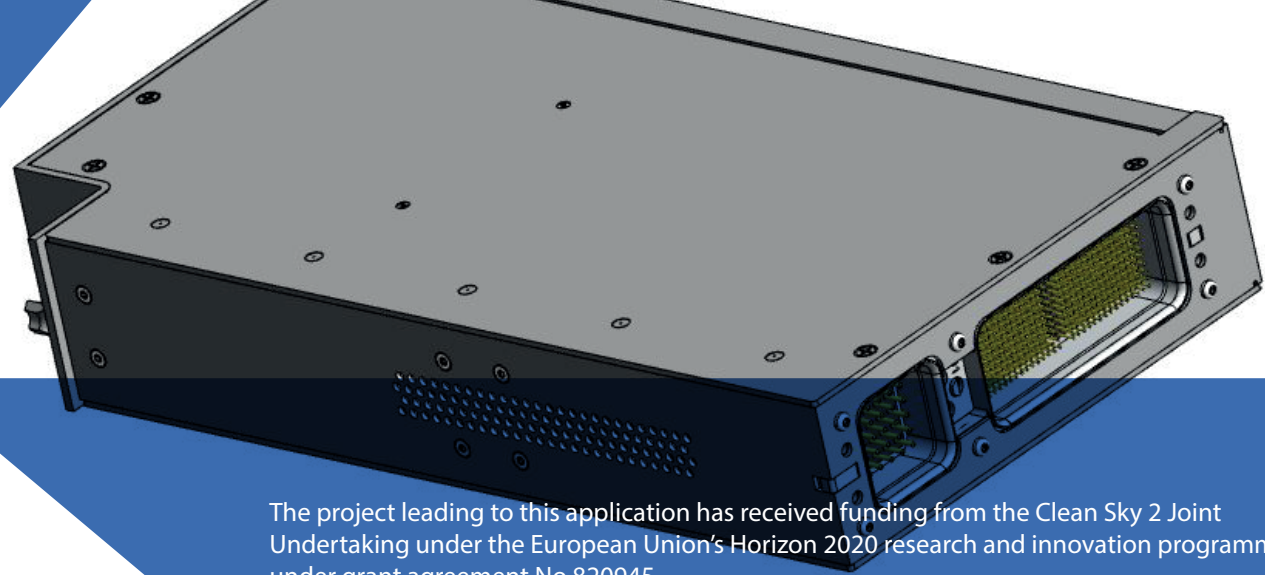
1 FDP board
- To support external connectors to aircraft and AIU.
- Input/Output EMI filtering and lightning protections.
- Internal boards interconnection

2 MON lane
- 28VDC power inputs filtering
- 28VDC power switching to actuator power supply
- Internal Power Supply and Power distribution/Transparency to control unit
- Three phases power inverters to drive AIU motors
- DC power outputs to drive brakes
- AIU GRIP switches acquisition
- AIU positions acquisition
- AIU forces acquisition
- Brakes currents sensing
- Motors currents sensing
- AIU Brakes temperatures acquisition
- Motors control loop (Current)
- Configuration interface (supplier interface)
- Communication with MON lane
- Communication with FCCs
- Communication with opposite BICU (COM lane)
- Actuation control loop
- AIS System Mode Management

3 COM lane
- 28VDC power inputs filtering
- 28VDC power switching to actuator power supply
- Internal Power Supply and Power distribution/Transparency to control unit
- Three phases power inverters to drive AIU motors
- DC power outputs to drive brakes
- AIU GRIP switches acquisition
- AIU positions acquisition
- AIU forces acquisition
- Brakes currents sensing
- Motors currents sensing
- AIU Motors temperatures acquisition
- Power bridges and actuators protection
- Configuration interface (supplier interface)
- Communication with COM lane
- Communication with FCCs
- Communication with opposite BICU (MON lane)
- Actuation control loop
- AIS System Mode Management
- Motors and actuation monitoring
- Grip Switching Consolidation

4 INTerco board
- To ensure signals interconnection between both CTRL boards (COM and MON lanes)

BICU provides the following main features:

- Position acquisition of Pitch and Roll axis of both AIUs
- Force acquisition of Pitch and Roll axis of both AIUs
- Manage the virtual mechanical coupling between the 2 AIUs
- Grip Switches acquisition of Both AIUs
- Control in force, position and Speed Pitch and Roll axis of both axis
- Communicate with Flight Control computers
- Communicate with other BICU