

## Electromechanical Actuation Systems for Aircraft

### Business Aircraft

#### Overview:

Electromechanical actuation systems are widely used in aircraft for various tasks. Starting with comfort features (as seat positioning resp. control stick/pedal adjustment) the most popular applications are secondary flight control actuation systems as landing flap actuation systems (to deploy and retract the flaps).

This report presents our experiences especially with sport and business aircraft.

#### Landing flap actuation systems

The combination of high cruising speed with low landing speed calls for large efficient landing flaps. Even with ultralight aircraft the actuation forces can reach levels beyond the capability of the pilot. In this case electromechanical actuation systems offer proven solutions. The design depends on the type of landing flap and on the available space. The photograph to the right shows a landing flap actuation system for a Fowler-type flap.



**Landing flap drive system:** the main motor gear box unit drives four spindle actuators which move the Fowler-type landing flaps. The actuators are connected to the main drive unit by flexible shafts (not shown on the photograph).

In contrast to hydraulic actuation systems electromechanical systems are very simple to operate (straight from the electrical power bus) and practically maintenance-free.

A landing flap actuation system comprises (besides the actuators and the drive system motors) also various safety devices. They enable a safe flight even in the case of a failure. Some of these devices are brakes to counteract the aerodynamic forces and flap position supervising circuits to ensure a symmetric operation of the left and the right flap.

### Other types of actuation systems

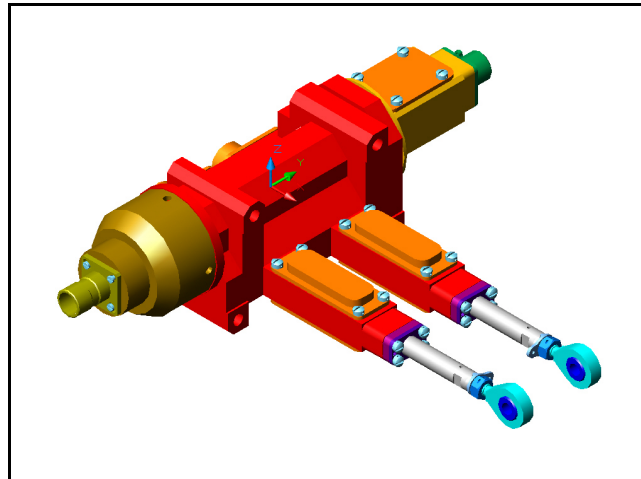
Besides the landing flap there are many trim surfaces with are electromechanically operated (see the CAD picture on the right side). But also throttles of the power plant are sometimes electromechanically operated ("fly-by-wire"). Other actuation systems operate the retractable landing gear or floats/sponsons or variable-pitch propellers.

An important topic of our research activities is the application of electromechanical actuation systems to primary control surfaces for aircraft and helicopters. Here the reliability is of utmost importance (besides weight and size).

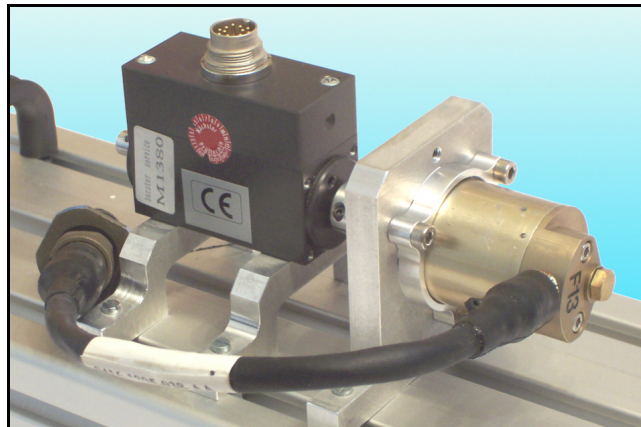
### Qualification

The severe safety standards in the aviation business requires on one hand theoretical assessments (stresses, FMEA), but on the other hand also extensive experimental tests (e.g. according to RTCA DO-160). The photograph on the right side shows a typical qualification test stand which is also used for testing the series actuators.

The quality assurance system (according to ISO 9001) requires that all steps during mounting and testing are documented and reviewed.



**CAD picture of a trim actuator:** the trim actuator puts the aircraft in a stable flight condition without action from the pilot.



**Test stand:** verification of a throttle actuator regarding torque and actuation angle at different operating voltages.

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