



Specialist in System Development

Approach Monitoring System

Real-Time Measurement for Aerial Refuelling Operations



Mission & Control Systems



AMS laser transmit and receive unit



Dr. Jean Blondeau
Director of Research &
Development

In the course of flight refuelling manoeuvres, the most critical moments are final approach and engagement of probe and drogue.

The suppliers of refuelling hardware defined a range of safe speed differences between receiver and tanker aircraft but there is no reliable and objective way for the receiver pilot to know this speed in real time.

Up to now the whole safety system relies on the subjective speed impression of the pilot and on intensive training.

This task is very difficult because the manoeuvre happens under variable illumination conditions and the speed has to be estimated visually along the centre line aircraft axis, which is more difficult than a lateral view. Furthermore, there

is no standard system to support de briefings with objective speed figures. The consequences of approaches with wrong speed range from failed connection to events like hose backlash, whip hit on the aircraft and material damage.

As part of its long association with the Airbus Multi Role Tanker Transport (MRTT) programme FTI Group has developed and built a sensor system that significantly improves hose-and-drogue refuelling.

The Approach Monitoring System (AMS) measures closing speed and 2-dimensional coordinates, accurately and real-time.

Dr. Jean Blondeau

Functional principle

The camera of AMS records picture sequences within which every second picture is illuminated by an IR flash. The controller unit subtracts the unilluminated pictures from the illuminate ones in order to keep only the reflector position and shape information. The reflector displacement from picture to picture divided by the time between frames is the speed information, which is scaled by the controlling unit using the calibration values.

The system output is:

- Z coordinate of the reflector respective to an a/c reference
- X coordinate of the reflector respective to an a/c reference
- X speed of the reflector respective to the a/c or to the drogue reflector

These data are supplied as:

- Text information on the monitor display
- Analogue output for analogue evaluation
- Digital output for digital evaluation
- Optional beep channel for possible feed-back to the pilot

Specifications of monitoring system

- No electronics/active components in the receiver a/c
- No electronics/active components on the hose/drogue
- Functionality day and night
- No disturbance for other systems
- Working range: -10 m/s to +10 m/s
- Precision: 0.2 m/s

The installation of small catadioptric reflectors (in the jet canopy and in the drogue) is accepted

Realisation

The basic AMS consists

- An NIR camera
- An NIR laser flash illuminator synchronised with the camera
- A control and analysis unit

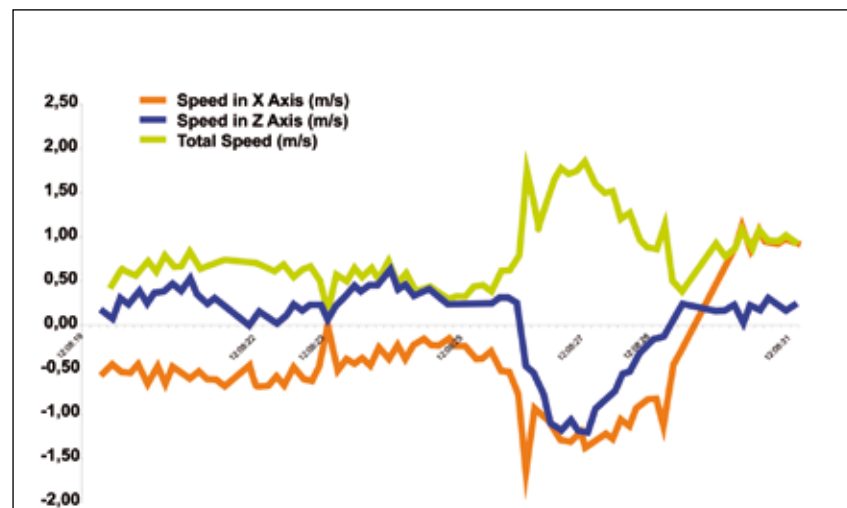
All three units are concentrated in a common housing that can be installed behind a cabin window. A catadioptric reflector is fit in the jet and the drogue is also equipped with reflectors.

Uses of the system

AMS can be used as a simple and mobile monitoring system which helps training the pilots and speeding up the acceptance tests of new installations of flight refuelling systems. An integration of AMS technology into the hose deployment controller is possible. This would allow a quick rewind of the hose to compensate a too quick approach.

Further applications

The same principle of NIR-flash triggered video analysis can be used for many other applications, for example to monitor helicopter landings on a ship deck or to measure structural deformations in flight. Through the smart use of video analysis and shape recognition algorithms only a catadioptric reflector is required on the test object. This avoids the need for additional sensors, strain gauges and wiring harnesses. It allows the testing of various aircraft models with only minimum modifications required. The innovative solutions of AMS have opened up other opportunities in video analysis for FTI Group. The Refuelling Monitor (Receiver Surveillance System for A310 MRTT of the German Airforce, developed by FTI Group) combines the principles of AMS with the latest digital image processing technologies to produce high quality, real-time video images for testing and regular aircraft operations.



Analysis of docking manoeuvre

FTI Group

www.ftigroup.net
info@ftigroup.net

FTI Engineering Network GmbH
Ludwig-Erhard-Ring 8, Dahlewitz
D-15827 Blankenfelde-Mahlow

phone: +49 33708 4409-0
fax: +49 33708 4409-60