EASA’s Research Activity for Safety Improvement

General Aviation and European Air Transport System

Third Call FP 7

7-8 July 2009

WARSAW, Institute of Aviation (IoA)

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Mandate for Research Activities

Basic Regulation 216/2008 Article 26 (former 1592/2002, Article 17):

1. **The Agency may develop and finance research to improvement its activities in the its field of competence,**
2. **The Agency shall coordinate its research and development activities so as to ensure that policies and actions are mutually consistent,**
3. **The results of research shall be published.**

- **Article 5: Airworthiness**
  Article 7: Pilots
  Article 8: Air Operations
  Article 17: Agency's tasks
  Article 19: Opinions, CS and GM
  Article 22: Air Operations

" … taking into account the latest scientific and technical evidence … "

Mandate for Research activities

Two fields of research activities

- Short term research in support of safety improvement
  - Defined and financed by the Agency
  - Managed by Executive Directorate (Safety Analysis and Research Department)
  - Additionally pre-normative studies by Rulemaking Directorate in support of rulemaking activities
- Long term research
  - Financed e.g. by EU Framework Programmes and MS
  - Results and finale „market ready“ product available in some distant time

Sources of research proposals

- Safety analysis/occurrence reporting
- Accident Investigation Reports & Safety Recommendations
- Experts from EASA Directorates
- ESSI / Safety Team (ECAST, EGAST, EHEST)
- European Aviation Research Partnership Group (EARPG)
- others

Research Coordination and Partnership

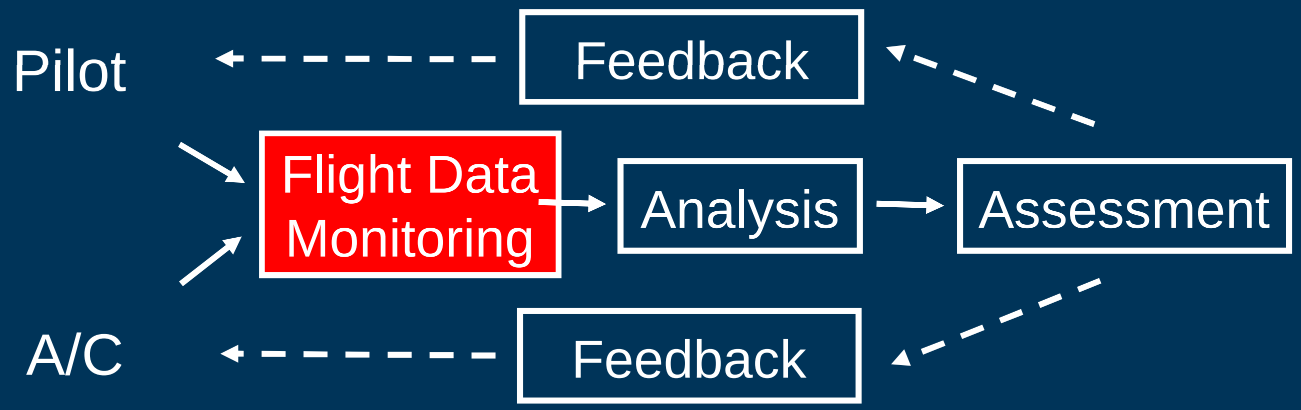
- Internal Research Committee
- EC DG RTD and DG TREN, ACARE
- European Aviation Research Partnership Group (EASA, ESSI and Safety Teams, NAAs, EC, EUROCONTROL)
- Helicopter Safety Research Management Committee
- EASA/FAA/TCCA research cooperation
- Industry and research institutes

Example Project Investigation of the technical feasibility and safety benefit of a light aeroplane operational Flight Data Monitoring (FDM) System

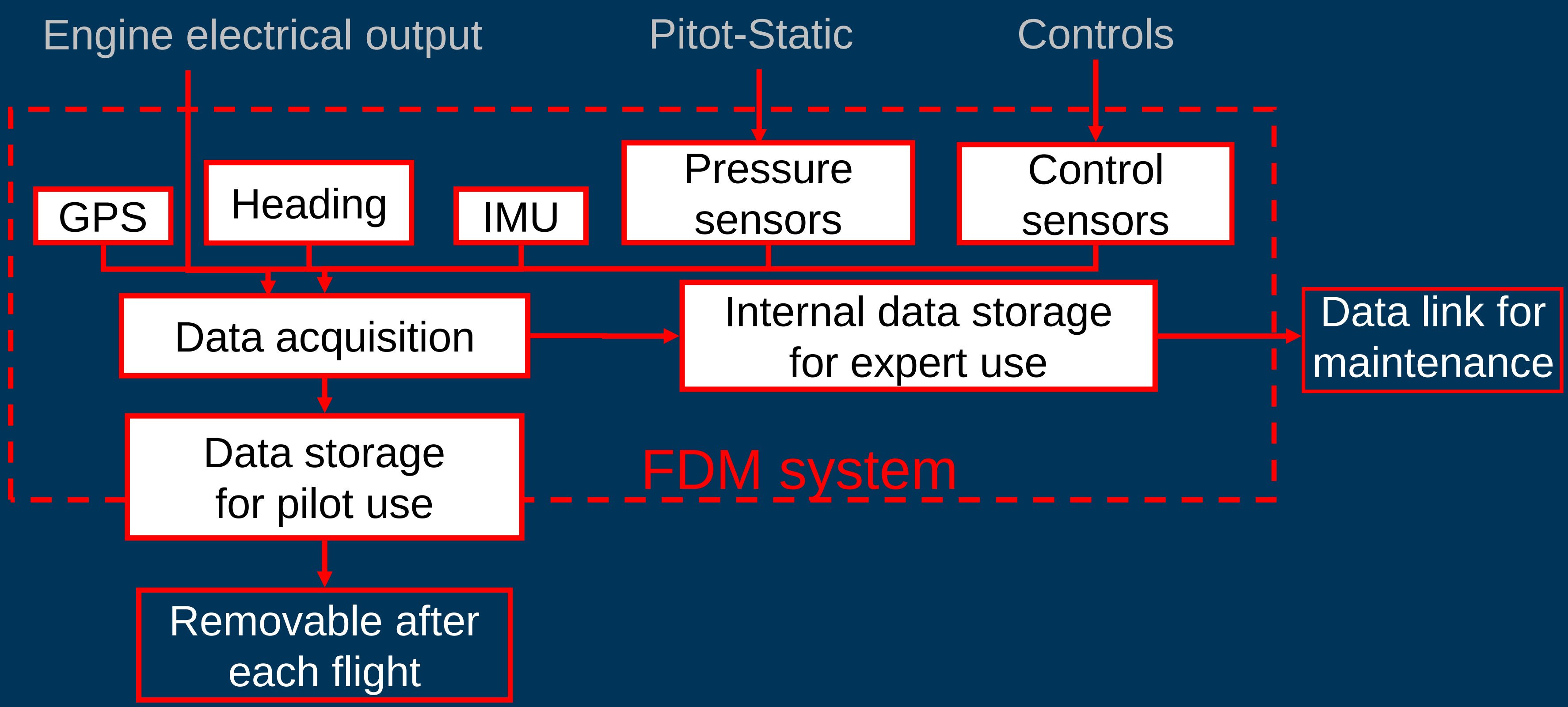
- **EASA/2007/OP 18: Investigation of the technical feasibility and safety benefit of a light aeroplane operational Flight Data Monitoring (FDM) System**
  - **Contractor: Technische Universität Braunschweig, Institute for flight Guidance (DE)**
  - **Final Report approved March 2009**

- **Objectives:**
  - **Feasibility of an integrated FDM system on light aeroplanes** (low cost system, < 5000 €; < 2 €/h data analysis)
  - **Demonstrate potential safety benefit**
  - Detection of unusual behaviour or situations that may be hazardous;
  - Identification of potential problems where safety margins may be eroded;
  - Means to observe the history of a flight and show the boundaries of safe flight;
  - Provision of data for the investigation of specific incidents;
  - Automatic detection of abnormal situations;
  - Support training, maintenance, accident investigation.

Safety benefit cycle



Block diagram for FDM system

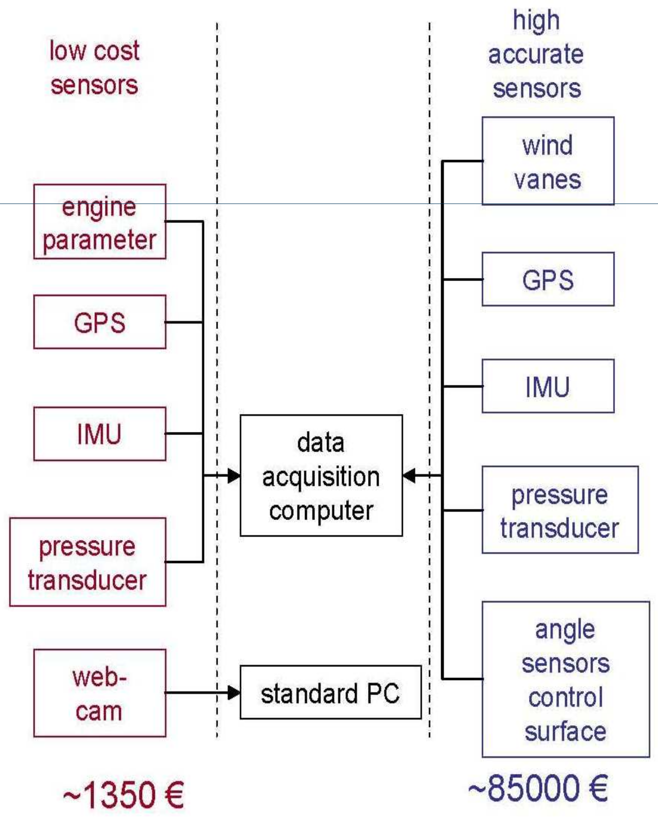


Example Project Investigation of the technical feasibility and safety benefit of a light aeroplane operational Flight Data Monitoring (FDM) System

Initial flight test

- focus on comparison of precision and low-cost sensors

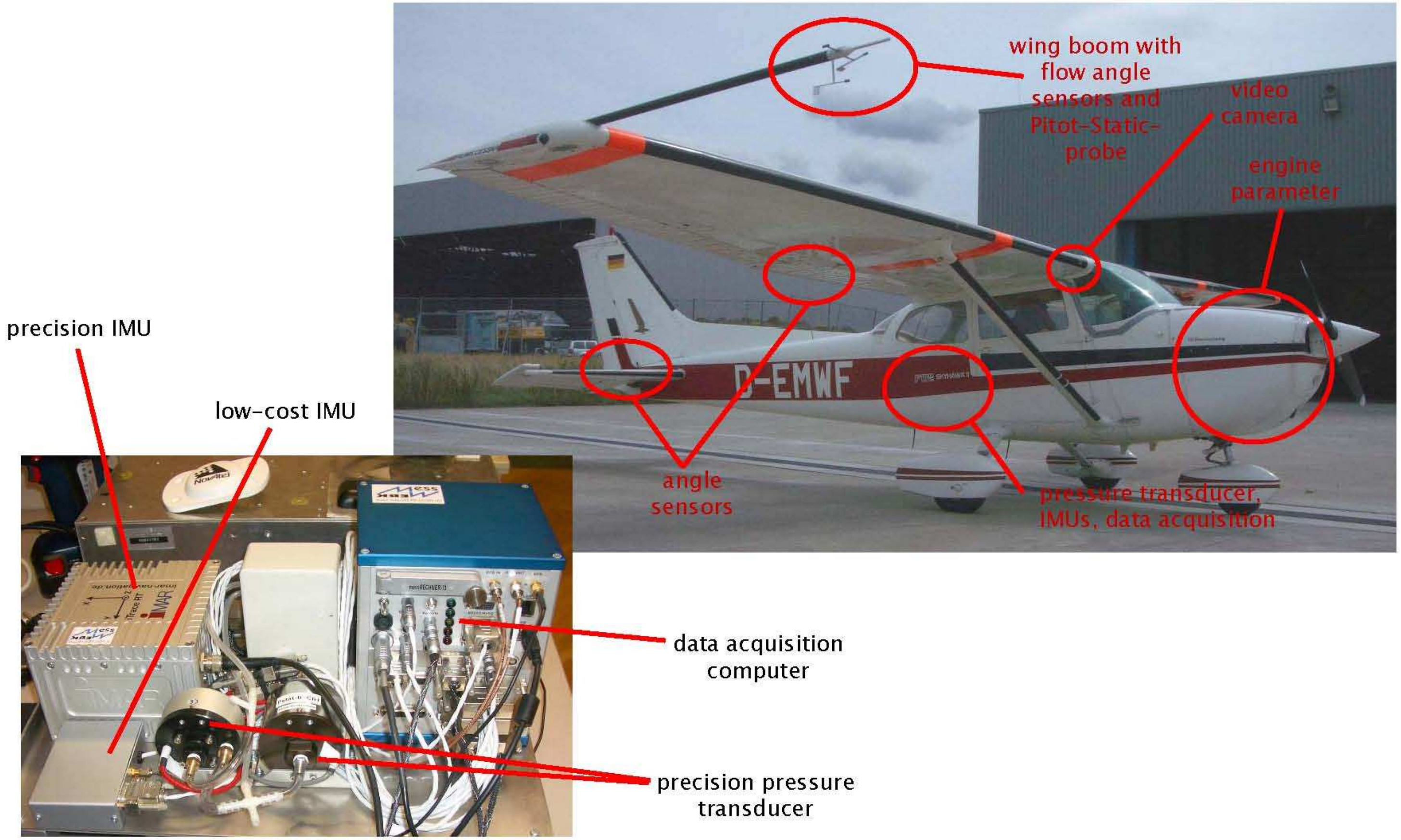
- pressure
- GPS
- Inertial measurement unit (IMU)



European Aviation Safety Agency

Example Project Investigation of the technical feasibility and safety benefit of a light aeroplane operational Flight Data Monitoring (FDM) System

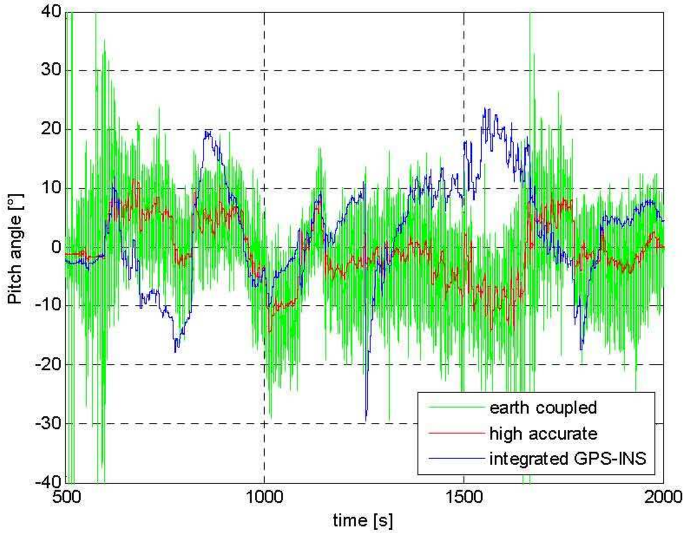
Initial flight test

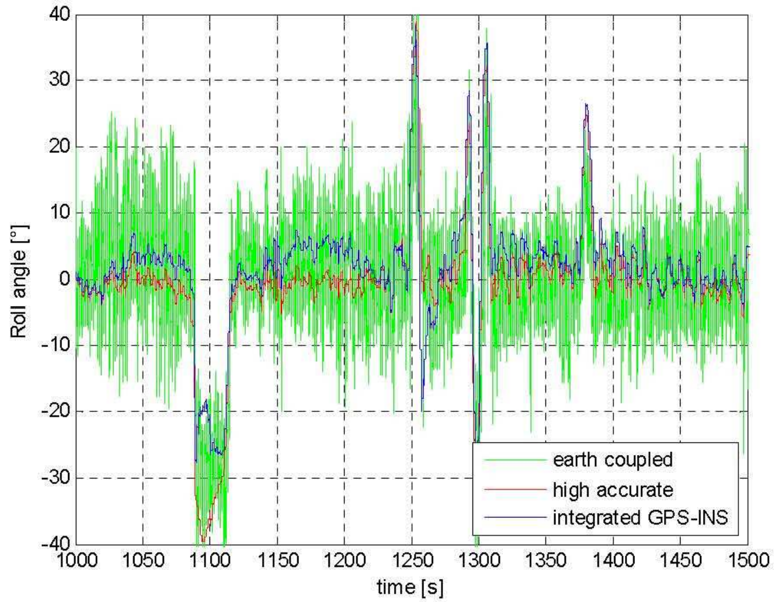


Example Project Investigation of the technical feasibility and safety benefit of a light aeroplane operational Flight Data Monitoring (FDM) System

Results – IMU

pitch angle





roll angle

Example Project Investigation of the technical feasibility and safety benefit of a light aeroplane operational Flight Data Monitoring (FDM) System

FDM safety benefit

- Realistic for less than 5000 €

- Pilots: self analysis
  student training
- Operator: supervision a/c operations
  fleet statistics
  maintenance
- All: accident investigation
- Legislation: data base

Example Project

Safety aspects of Light Aircraft Spin Resistance

- **EASA/2008/OP 03:**
  Safety aspects of Light Aircraft Spin Resistance Concept
  - **Contractor: Technische Universität Braunschweig, Institute for flight Guidance (DE)**
  - **Approval of Final Report: End of 2009**

- **Objectives:**
  - Primary objective:
    Investigate safety criteria and relevant test methods which will form the fundamental basis for proposing a change to CS-23.221
    and any additional explanations for inclusion as interpretive Advisory Material (AMJ) and Flight Test Guide material.
  - Demonstrate the criteria are satisfactory by testing an existing spin resistant aircraft.
  - Secondary objective:
    Increase awareness of the design concept within European industry, and to stimulate European designs.

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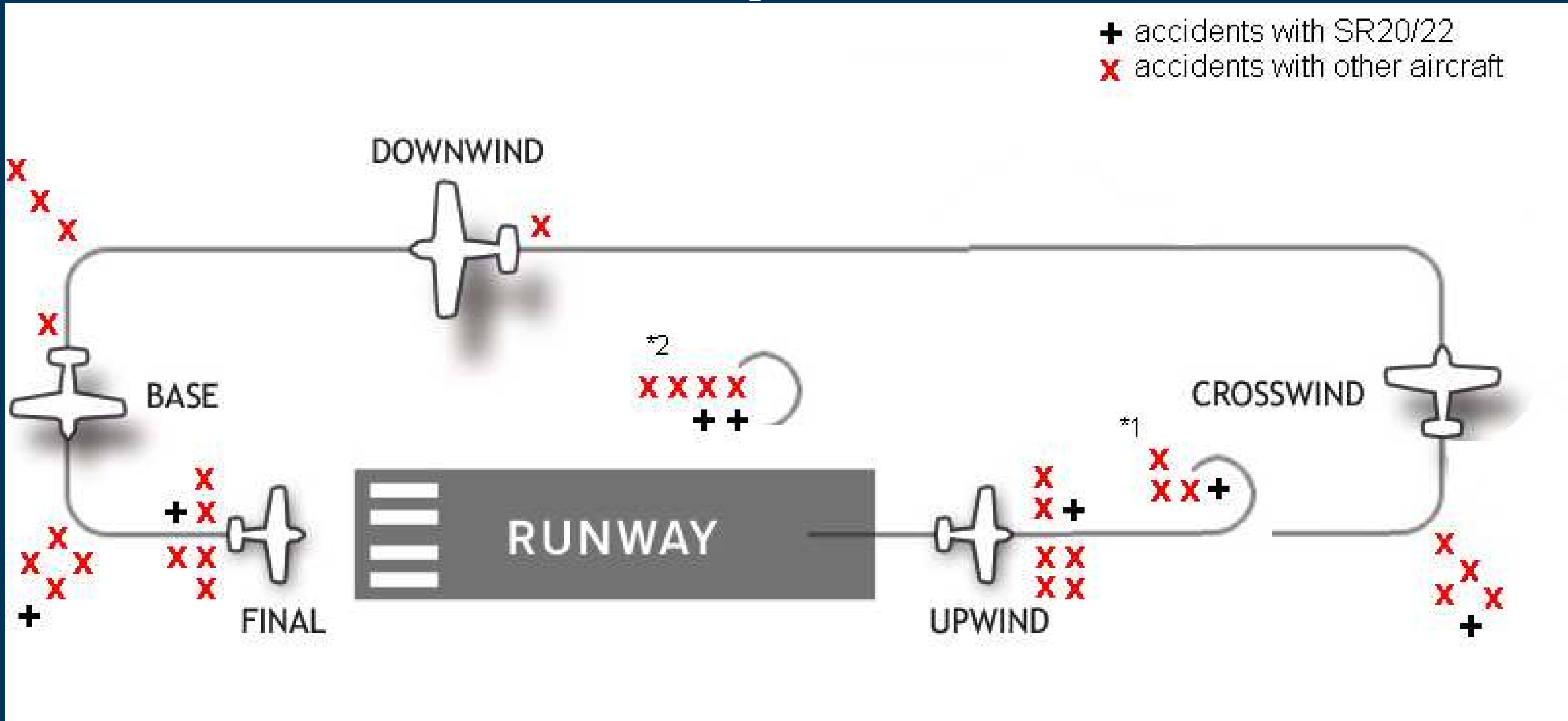
Example Project

Safety aspects of Light Aircraft Spin Resistance

Position of stall/spin related accidents



Example Project

Safety aspects of Light Aircraft Spin Resistance

History of spin regulations

1949 – Elimination of mandatory spin training from US regulations

70ies – 80ies – Extensive research by NASA on Spin Resistance

1991 – Implementation of Spin Resistance into FAR23

3 options of certification:
- spin recoverable
- incapable of spinning
- spin resistant

1996 – Option „incapable of spinning" removed

Example Project

Safety aspects of Light Aircraft Spin Resistance

Possible solution

- Revised spin resistance paragraph:
  - Spin recoverable after „any input"
  - Improvedrepresentatives of operational situations
  - Maximum loss of height while recovery: 300ft
  - Probable manoeuvre:
    - **PWR 30..50%, bank 30deg, speed rate 5kn/s, rudder +30..50%,
      full aileron against direction of turn**
- Improved stall warning (Conventional spin testing necessary)
- True envelope protection (No spin testing necessary)

Example Project

SIoBiA - Safety Implication of Biofuels in Aviation

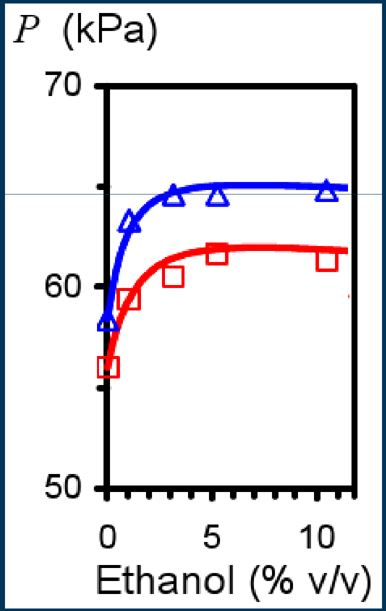
- **<u>EASA/2008/OP 34:</u>**
  SIoBiA - Safety Implication of Biofuels in Aviation
  - **Selected contractor: Fachhochschule Aachen**
  - **Approval of Final Report: End 2009**

- **Objectives:**
  - **Evaluate danger potentials originating from potentially increased ethanol content in MOGAS, especially**
    - Vapour locking
    - Materials incompatibilities, e.g. tank, seals, pipes
    - Phase separation
    - Carburettor icing
  - **Identify potential advantages for the environment if an increased amount of ethanol would be admixed to MOGAS**

Example Project

SloBiA - Safety Implication of Biofuels in Aviation

Vapour Locking



Accidental rise in vapour pressure if differently ethanol-admixed MOGAS or AVGAS brands are mixed

Material incompatibilities

Do parts manufactured from traditional materials work for raised levels of ethanol admixtures?

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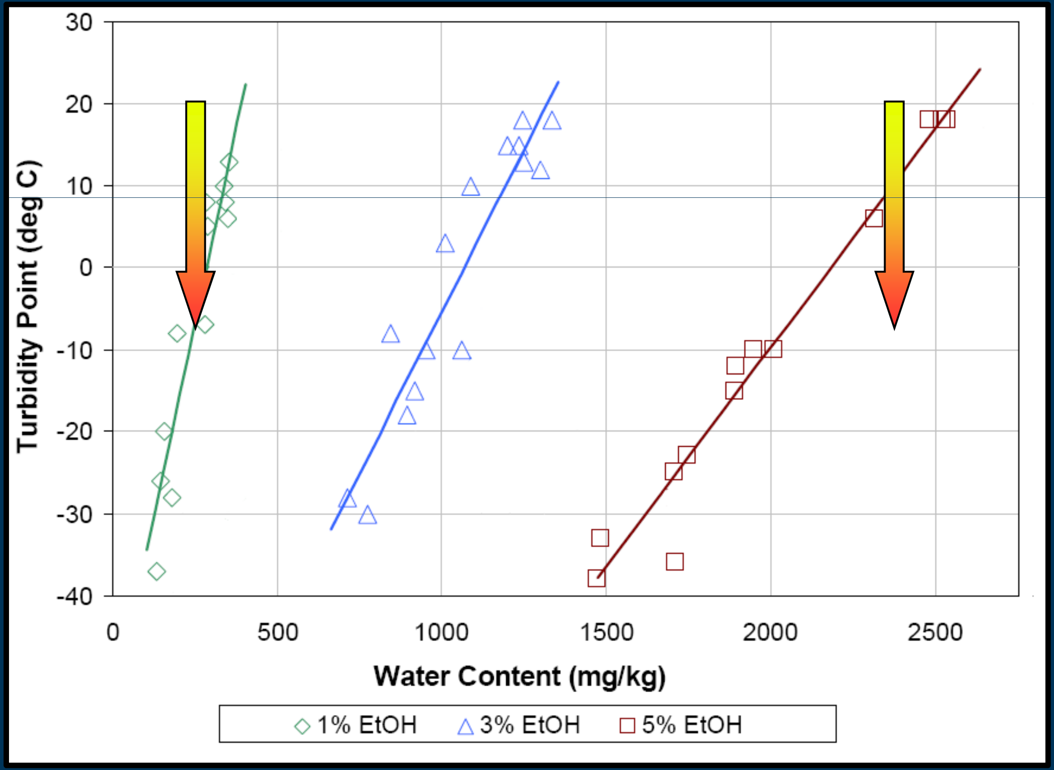
Example Project

SIoBiA - Safety Implication of Biofuels in Aviation

Phase separation



If gasoline accidentally contains much undetectable, solved water before take-off, a phase separation, induced by a temperature drop in the tank, may impose a more severe threat in MOGAS with larger ethanol content

Example Project

SIoBiA - Safety Implication of Biofuels in Aviation

Methodology

- Flight experiments
- Dynamic vapour pressure determination
  for simulated a/c fuel systems on custom test rig
- Cool-down experiments of water-containing gasolines
- Temperature drop determinations in carburettors of
  grounded a/c engines, operated with ethanol-admixed
  MOGAS

Example Project

SIoBiA - Safety Implication of Biofuels in Aviation

Work Packages:

- Literature survey
- Phase separation
- Icing
- Vapour locking
- Material incompatibility
- Life-cycle analysis of biofuels in aviation
- Identification of measurement methods for solved water in fuels
- FMEA

Example Project

SIoBiA - Safety Implication of Biofuels in Aviation

Phase Separation

- Perform flight experiments
  - **to get information on realistic temperatures,**
  - **temperatur changes along a mission,**
  - **vibration levels,**
  - **tank breathing, pressures**
- Chemical analysis
  - **of commercially available ethanol blends**
  - **=> Different BOBs (basestock for oxygenated blending) for different EtOH admixtures.**
- Turbidity analyses on temperature ranges identified by flight missions for selected ethanol blends:
  - **Perform controlled, well-stirred cool-down experiments to identify turbidity points in a repeatable manner.**

Example Project

SIoBiA - Safety Implication of Biofuels in Aviation

- Long-Term Fuel Composition Changes
  - Objective:
    Determination of fuel quality changes due to long-term storage (up to 6 months, with prior, intermediate and final sample analysis)
    - **Storage with differing boundary conditions (complete fill, half fill)**
    - **Exposure to environmental influences (temperature changes, solar irradiation, atmospheric pressure**
    - **Tanks equipped with original venting system**
    - **Experiments performed with E0 and custom-mixed E10**

Future Projects

Prior Information Notice PIN on EU web site TED http://ted.europa.eu

- Study on regulation of ground de-icing and anti-icing services in EASA member states
- Aviation fuel under extreme cold weather conditions
- Safety implications from the use of hardware design tools for programmable airborne electronic hardware items
- Pulse oxygen system to protect passengers
- Power reserve for rotorcraft
- De-icing of smaller helicopters
- Significance of pre-load upon impact behaviour of composite structure — composite material equivalence to metallic structure
- Study on sampling and measurement of aircraft particulate emissions — SAMPLE II
- Engine icing — mixed phase and ice crystals conditions
- Water behaviour in fuel under cold temperature conditions
- Suitability of existing minimum performance standards (MPS) for Mode S transponders
- Instrument approach systems on oil and gas platforms
- Composite damage metrics and inspection (high energy blunt impact threat)

More on EASA Internet

- **Research**

  http://www.easa.europa.eu/ws_prod/g/g_sir_research.php

- **Procurement**

  http://www.easa.europa.eu/ws_prod/g/g_procurement_main.php

Questions ?

Thank You!