



Pressure measurements at Airbus Helicopters

3AF workshop, Toulouse, 20.03.2014

Agenda

Pitot static calibration

Air inlet

Pressure blast

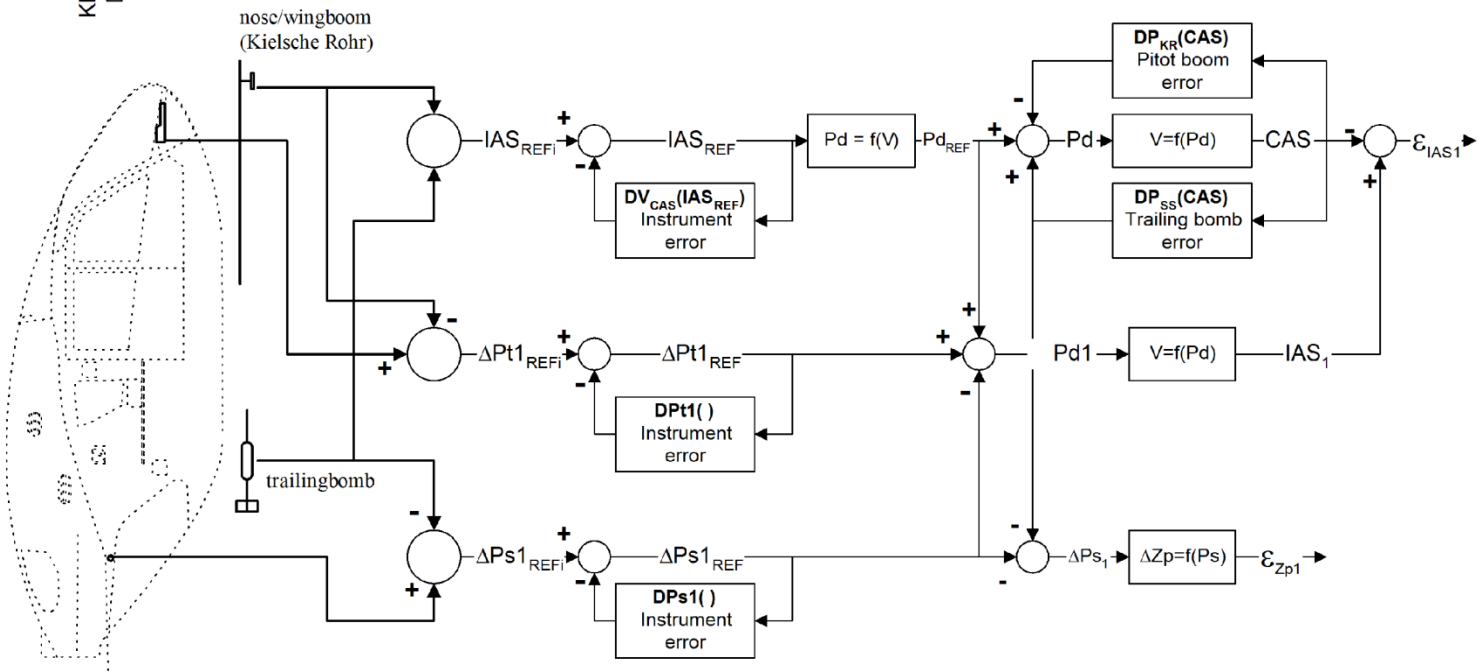
Skin pressures

Pitot Static Calibration: Principle

Annex D to
KB D/EM7-436/97
Dated 25.04.97

$$Pd_{[mmHg]} = 10331 \left\{ \left[1 + 0,2 \left(\frac{V}{V_0} \right)^2 \right]^{3,5} - 1 \right\}$$

$$V_{[kn]} = V_0 \left\{ \frac{1}{0,2} \left[\left(\frac{Pd_{[mmHg]}}{10331} + 1 \right)^{\frac{1}{3,5}} - 1 \right] \right\}^{\frac{1}{2}}$$



Measuring ranges: 5 and 50 mbar

Tappings on pitot and static pressure lines through T-connector

Pitot Static Calibration: Current Instrumentation



~0,5m longer as blade tip



Pitot Static Calibration: Current Instrumentation

Usage

- On prototype H/C
- On customer H/C

Current issues

- Difficult gauge use because of manual needle reading
- Difficult calibration because of hysteresis and friction – although calibration of major importance
- Limited use for climb and descent because of lag error

Pitot Static Calibration : instrumentation upgrade initiated at AH Inc. to be continued at AHD

Pressure gauges → high precision transducers + state of the art data acquisition and recording
Pitot perch (Kielsches Rohr) + static pressure trailing bomb → pitot static trailing bomb



Pitot Static Calibration: Misc.

Test order

- Stabilized method vs. quasi static
- Slow continuous airspeed sweep in level flight, in accelerating or decelerating flight, ~ 1 kts / sec
- Display in cockpit for Pitch=f(IAS) for different CG simulations according to different attitudes
- Reduction of flight time by suppression of reconfigurations / ballast
- Stabilization criteria used in data reduction process
- Further analysis needed for climb/descent

Validation

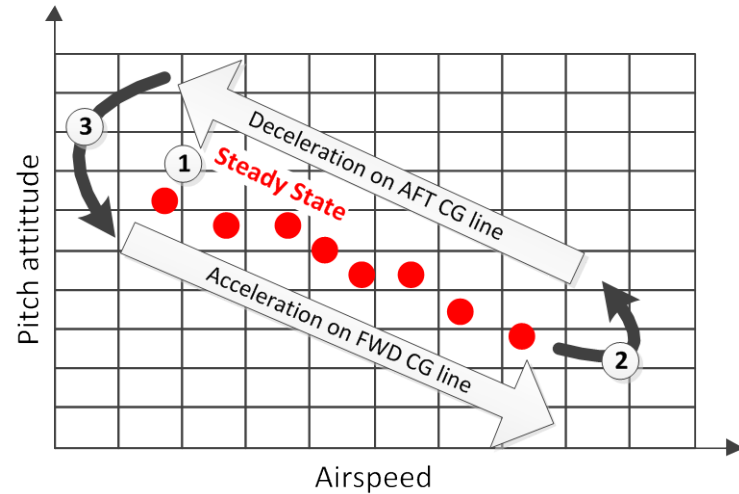
- Comparison with GPS method
- Verification on some points over the complete speed range on level flight

Flight safety

- Many discussions with Q!

Other usage on research prototype

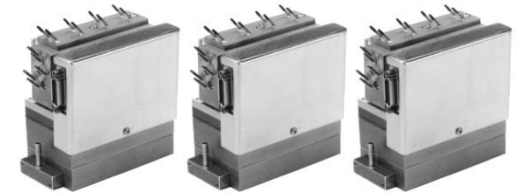
- Swivel-head air data boom



Air inlet measurement

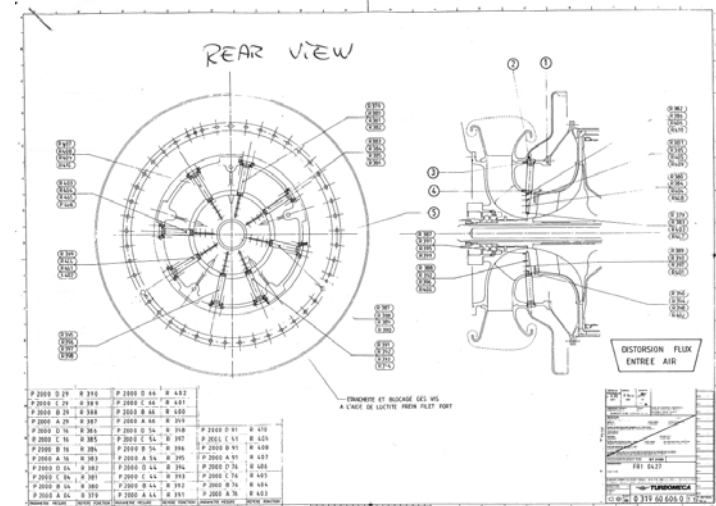
Pressure scanner system for array measurements

Differential sensor modules, measuring range 170, 350 mbar
Central unit output Arinc429, Ethernet



Array in inlet, pressure tubes routed up to sensors in cabin
Reference pressure Ps

Installation example on Turbomeca

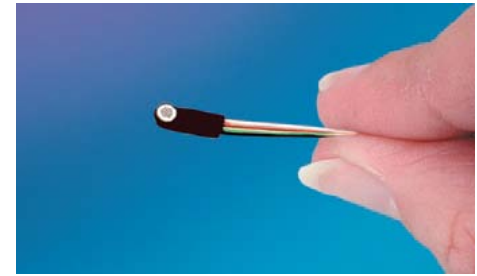
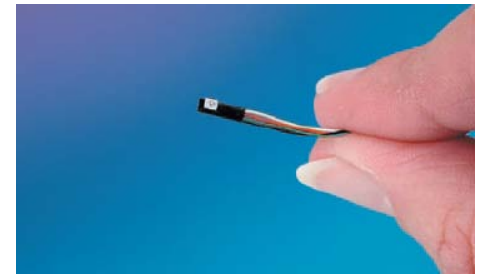


Pressure blast

Pressure measurements on surface during firing

Ultra- and miniature transducers Kulite LL-072, -080, 3.5 bar

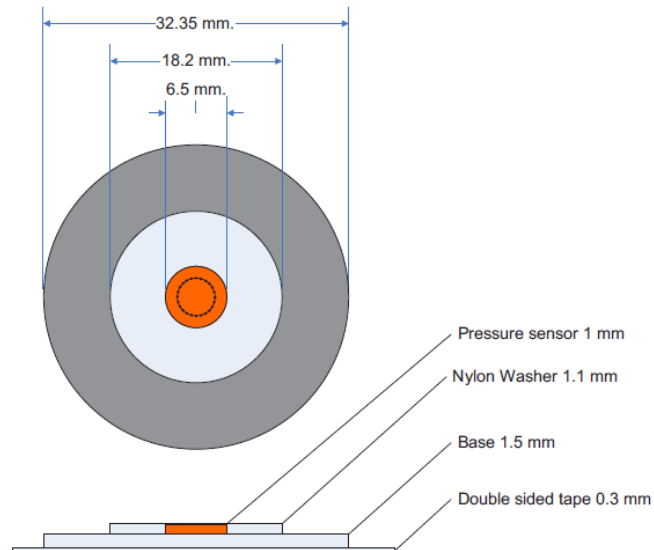
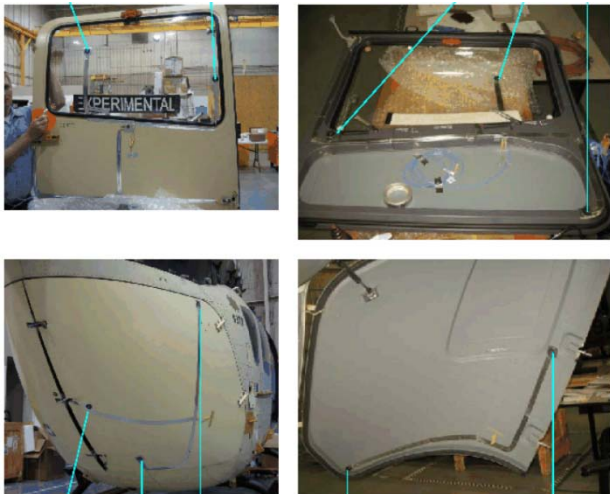
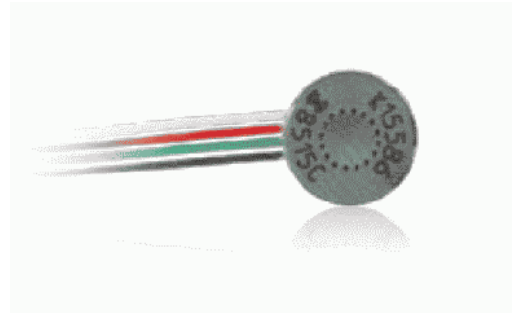
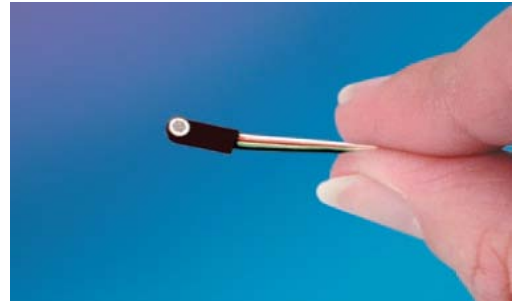
Installation example on EC135 S858 on doors



Skin pressure

Kulite differential sensor LL-080 350 mbar with pressure reference tube
Installed on Horizontal stabilizer, for research applications

Endevco absolute sensor 8515C, 3,5 bar
Installation example on EC145 S9377 on doors



Questions?

Thank you for your attention!

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DON'T FORGET !

Registration open

www.etc2014.de

Opening ceremony presentations

Red Bull Stratos

Telemetry & Data Distribution

EC145 AFlight

etc2014
European Telemetry and Test Conference

in cooperation with
SENSOR+TEST 2014
June 3-5 2014
Nürnberg - Germany



SENSOR+TEST 2014
DIE MESSTECHNIK-MESSE
The Measurement Fair



Preliminary Schedule

Nuremberg, Germany

										Exhibition	Registration	
Monday 02.06.2014	AM	Travelling of attendees									Closed	Open
	PM	13:30-17:30	Short Courses	Level 2 - Room Dublin Video Standards & Distribution	Level 2 - Room Zürich Spectrum Analysis and Network Analysis	Level 2 - Room Cannes Introduction and comparison of modernized GNSS	Level 2 - Room Tunis IRIG 106 Basic	Level 1 - Hall Madrid Telemetry Radio Frequency Signal Transmission, along with IRIG 106-13				
Tuesday 03.06.2014	AM	09:30-11:00	Weißwurst Frühstück (Bavarian veal sausage Breakfast) in Cafeteria of etc2014 Village								09:00-18:00	Open
		11:00-12:30	Level 1 - Hall Madrid etc2014 Opening Session									
	PM	13:30-17:30	Technical Sessions	Level 0 - Room Venedig 1 Sensors & Applications	Level 0 - Room Venedig 2 Data Link		Level 2 - Room Cannes Data Management	Level 2 - Room Tunis ICTS General Session (Int. Consortium for Telemetry Spectrum)				
				20:00- ...	Sensor + Test & etc2014 Exhibitors event							
Wednesday 04.06.2014	AM	09:30-13:00	Technical Sessions	Level 0 - Room Venedig 1 Video	Level 0 - Room Venedig 2 C-Band & New Modulations		Level 2 - Room Cannes MDL User Meeting (Measurement Description Language)			09:00-18:00	Open	
	PM	14:00-18:00	Short Courses	Level 0 - Room Venedig 1 From Analog to Digital Video - An Overview of Video Formats and Interfaces	Level 0 - Room Venedig 2 An Introduction to OFDM Data Transmissions	Level 1 - Hall Madrid Flight Test Networks	Level 2 - Room Cannes Fundamentals of IRIG 106 Chapter 10 Digital Recording Standard	Level 2 - Room Tunis Test & Evaluation of Telemetry Radio Frequency Subsystems & IRIG 118-12				
				20:00- ...	Bavarian Dinner in Restaurant Heilig Geist Spital, Old Town of Nuremberg (Entrance 19:30)							
Thursday 05.06.2014	AM	09:30-12:30	Technical Sessions	Level 0 - Room Venedig 1 Methods & Standards	Level 0 - Room Venedig 2 Acquisition Systems 1		Level 2 - Room Cannes Networks & Acquisition Systems			09:00-17:00	Open	
	PM	13:30-16:00	Technical Sessions	Level 0 - Room Venedig 1 GNSS & Antennae	Level 0 - Room Venedig 2 Acquisition Systems 2		Level 2 - Room Cannes ETSC Open Meeting (European Telemetry Standardisation Committee)					

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