



The need for a Dynamic Pressure Calibration Standard

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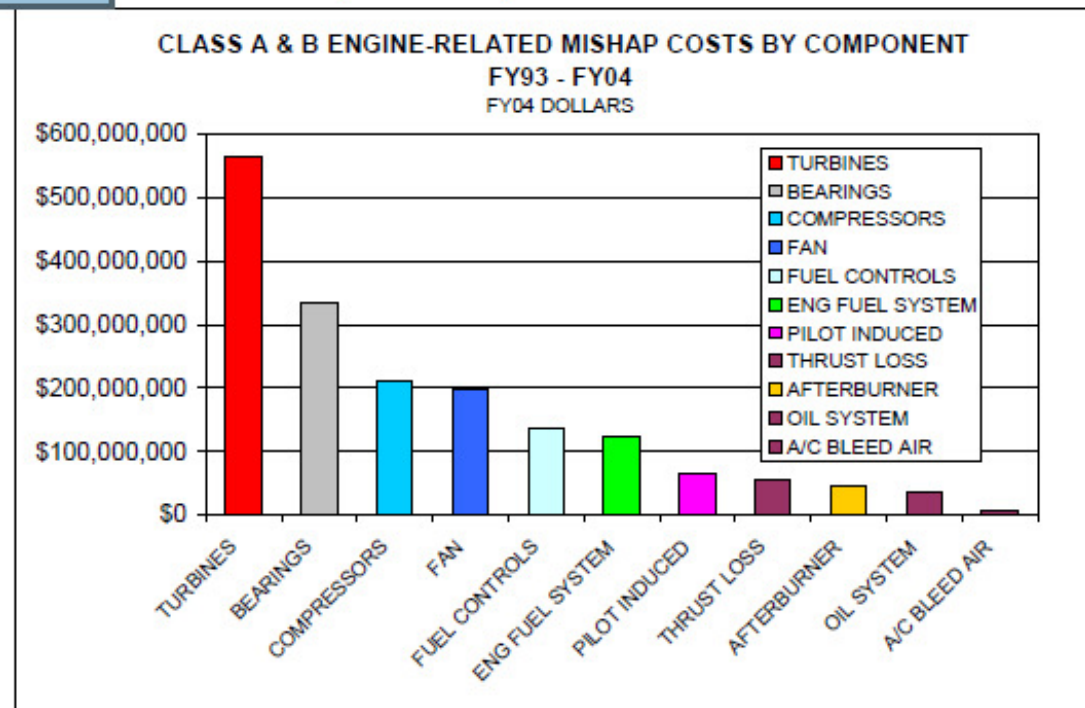
8th International Workshop

Analysis of Dynamic Measurements

The need for standardization



Cost of Class A & B Mishaps by Component Area



Approved for public release; distribution is unlimited.

A huge “user” consumer exists



Addressing critical turbine engine test and evaluation instrumentation development

PIWG



BLADE TIP TIMING THERMOGRAPHIC PHOSPHORS BLADE TIP CLEARANCE WIRELESS DYNAMIC PRESSURE

ABOUT PIWG

PIWG MISSION AND ACTIVITIES

PIWG ORGANIZATION

JOIN PIWG

EVENTS

SENSOR SPECIFICATIONS

STANDARDS

LAB GAP MATRIX

PIWG COLLABORATIONS

ISA 107: Advanced Instrumentation Techniques for Gas Turbine Engines

Under the auspices of the International Society of Automation (ISA), the above Standards Committee was created to develop standards to ensure the measurement accuracy of the various parameters necessary to safely and reliably operate a gas turbine engine.

[Click here for Standards Subcommittee brochure](#)

Scope of work:

This Standards Committee will organize, provide for sufficient participation, and manage subcommittees (writing/working groups) to support the projects it selects. Initially it started

The need for standardization

- **Manufacturers of Commercial Excitation Devices**
 - PCB/TMS (Models: 901,903,907,913,905)
 - Kistler (Models: 6904,6906,6909)
- **Existing Standard**
 - ISA-37-16-01-2002A Guide for Dynamic Calibration of Pressure Transducers
- **PIWG Users Group**
 - PIWG- lead by Kulite, Meggitt, Siemens, GE, Boeing, PW, Rolls-Royce, Alstom, MTU, Honeywell, Dytran, Kistler, others
- **No ties to National Metrology Institutes**

Kistler Pressure Calibrators

○ 6906 – 10,000 bar

○ 6909 – 5,000 bar



PCB & TMS have a wide selection

Range			Turnkey Calibration Workstation	Upgrade of Existing PCB Product to Turnkey System	Upgrade of 9155D
psi	MPa	bar			
150	1	10.3	K9903C	K9903C01	9155D-903
1,000	6.8	68.9	K9907C	K9907C01	9155D-907
15,000	103	1034	K9913C	K9913C01	9155D-913
100,000	689	6895	K9905C	K9905C01	9155D-905

K9903C

- **Max Pressure = 10 bar**
- **'Step' Input**
- **Pneumatic Media**
- **3 to 5 ms rise time**



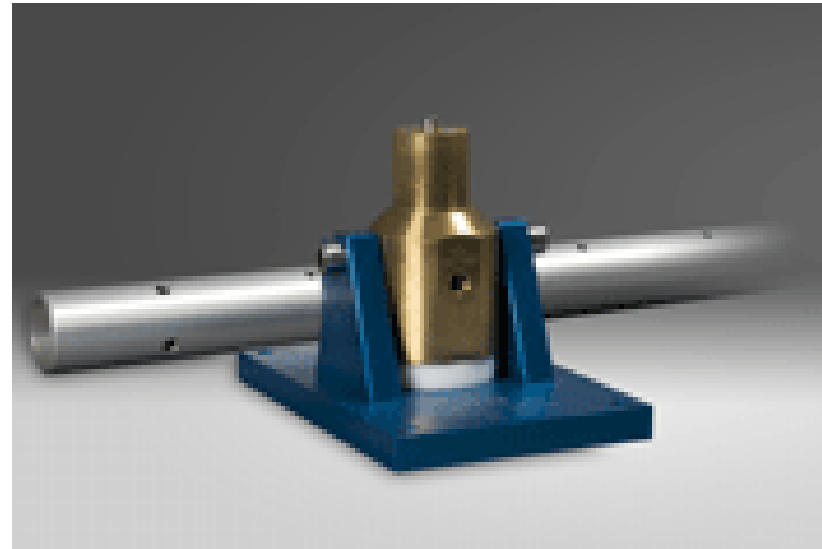
K9907C

- Max Pressure = 69 bar
- 'Step' Input
- Helium Gas
- 30 50 μ sec rise time



K9913C

- **Max Pressure = 1034 bar**
- **Impulse (Hammer) Input**
- **Silicon Oil Media**
- **Dropped Masses**



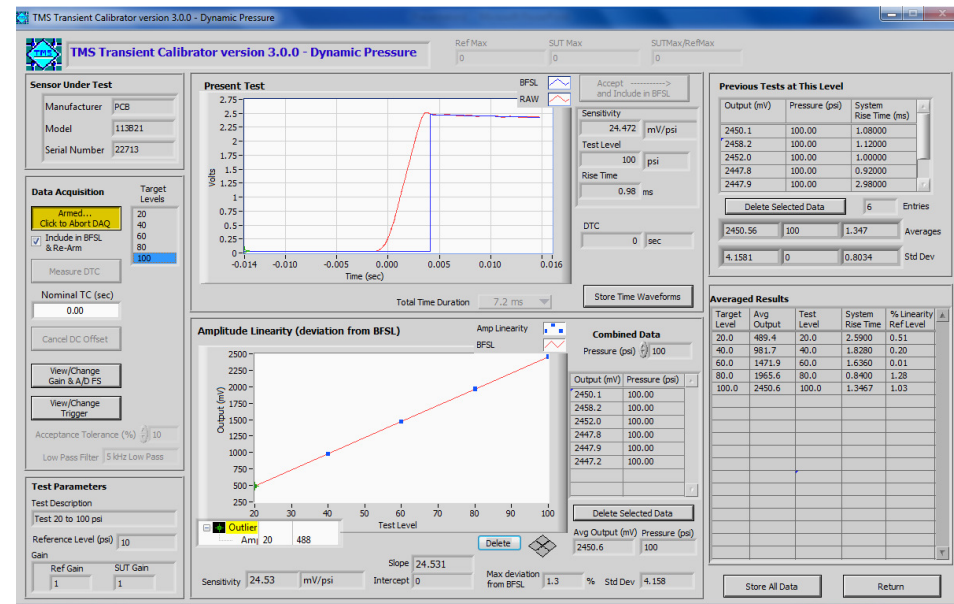
K9905C

- **Max Pressure = 6905 bar**
- **'Brass' Calibration**
 - Quasi-Static Input
 - Ballistics
 - 117B Series Conformal Sensors Only

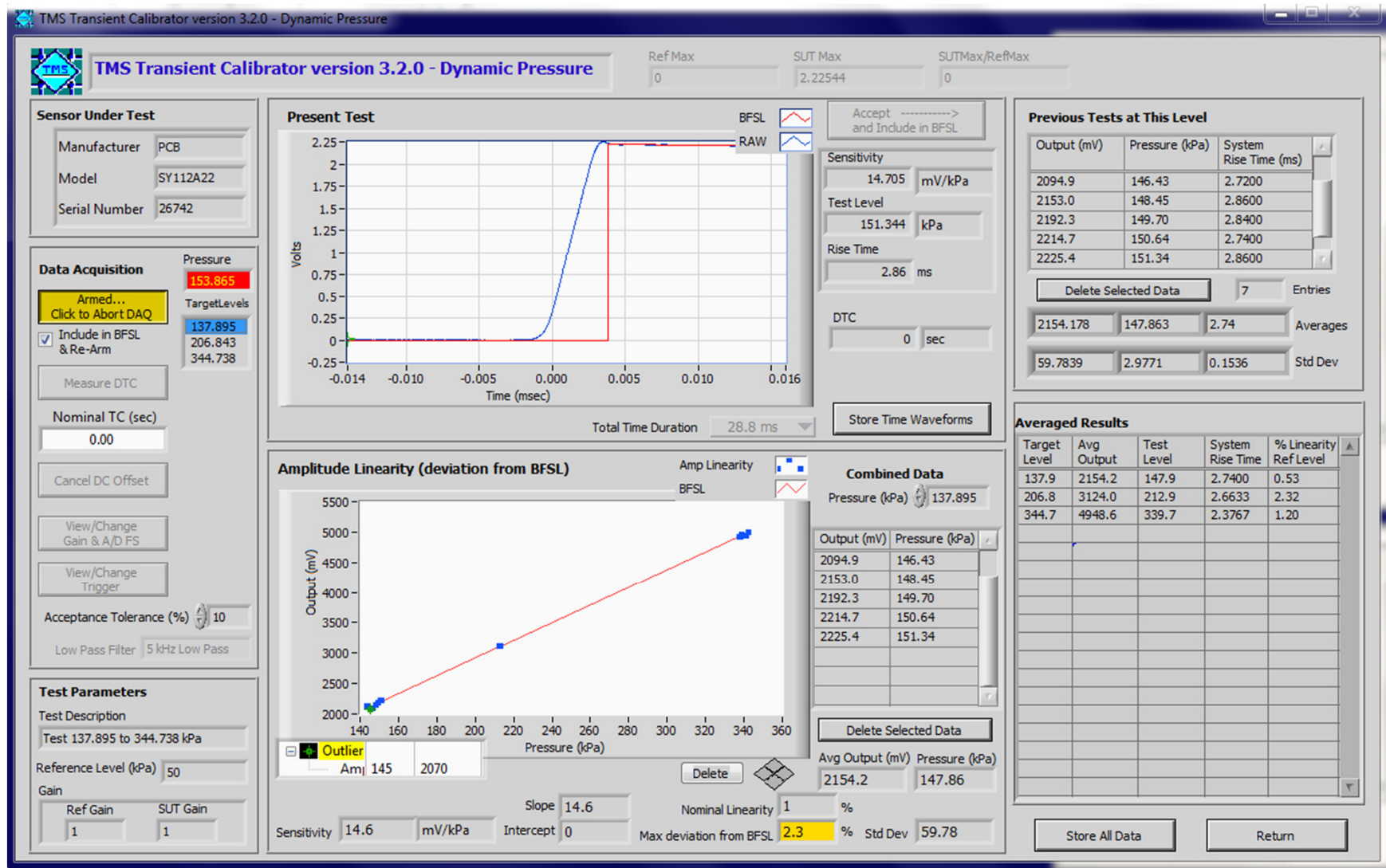


Pressure Calibration Software

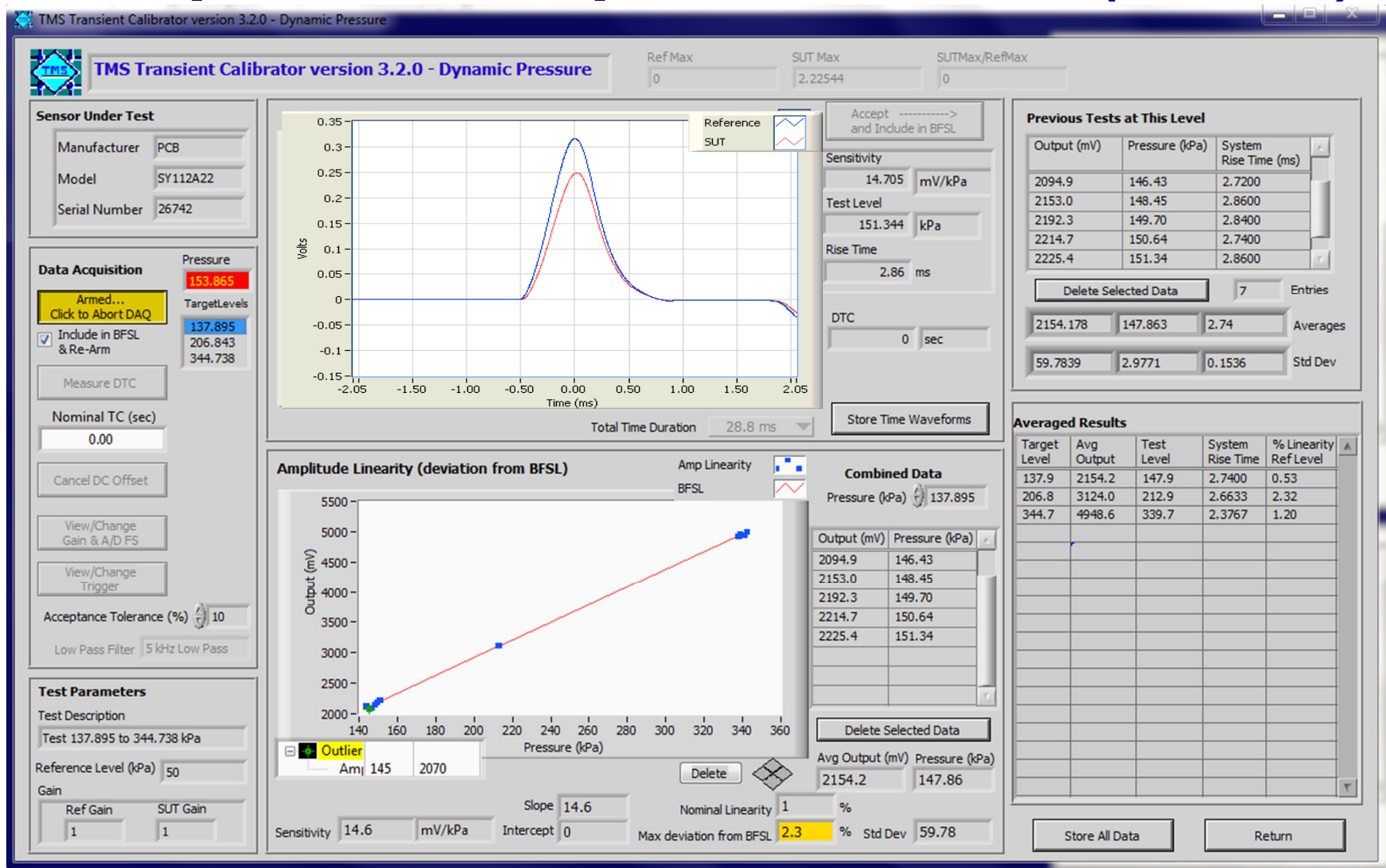
- Derived from field proven, mature shock option
- Interactive editing
- Visual BFSL display
- Auto accept
- Level selection



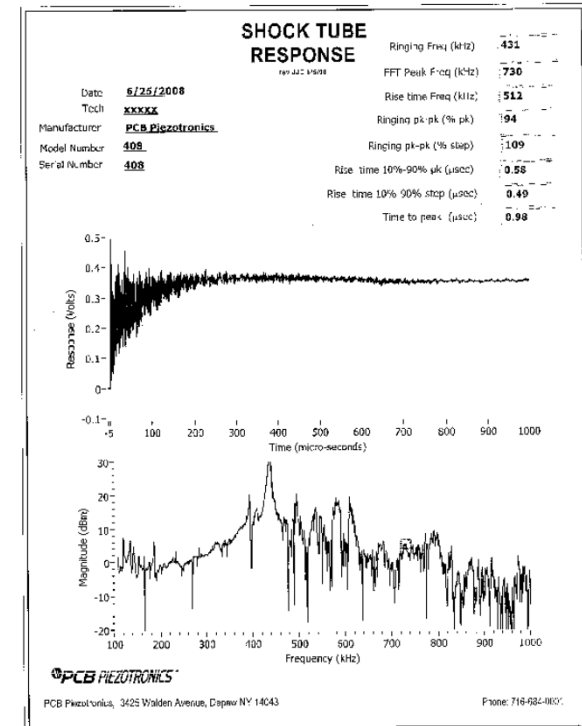
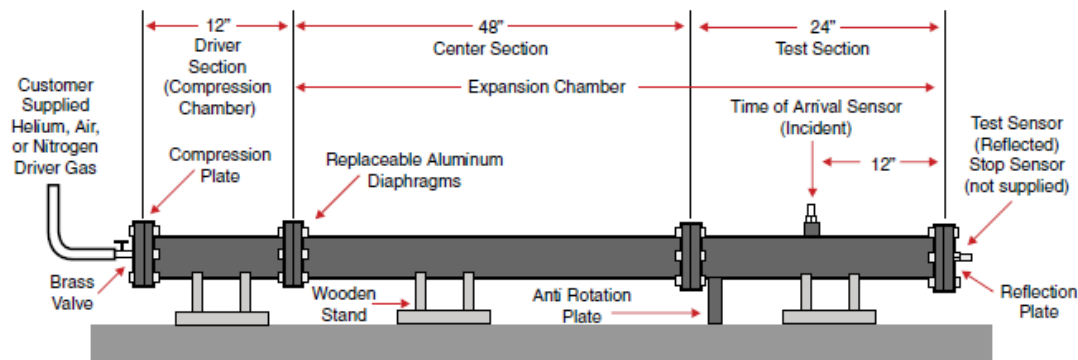
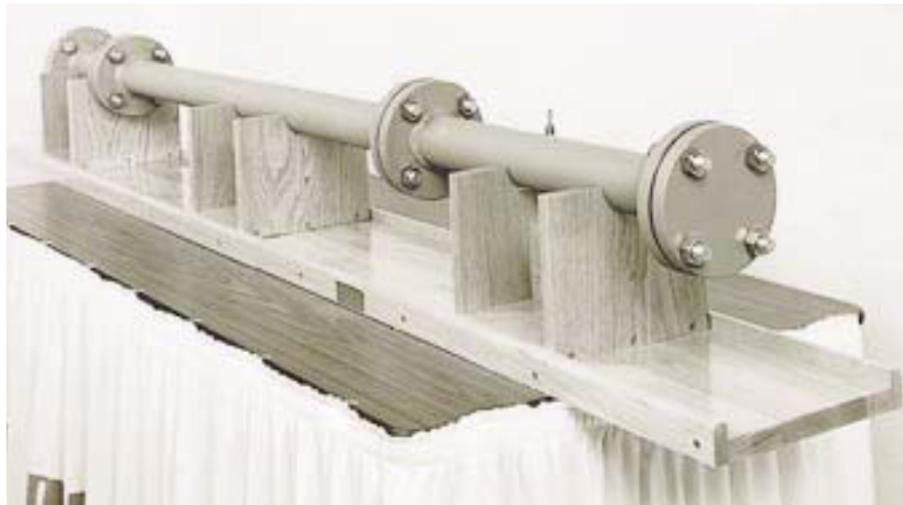
‘Step’ Data Acquisition Software (K9903C, K9907C)



Impulse Data Acquisition Software (K9913C)



PCB 901C Shock Tube



Dynamic Pressure Cal Devices

- **Similar to 16063-22 - coverage would be by “excitation device”:**
 - Shock Tube
 - Low Pressure Gas
 - High Pressure Gas
 - Low Pressure Hydraulic
 - High Pressure Hydraulic
- **Sensors/Signal Conditioning**
 - Piezo-Charge
 - Piezo-IEPE
 - Strain Based
 - Mems

Standardization Efforts

○ **ISA**

- ISA 107 Advanced Instrumentation Techniques for Gas Turbine Engines
- ISA 107.5 is driven by Propulsion Instrumentation Working Group (piwg.org)
- ISA 107.5 Focused on hot section pressures in gas turbines
- A Key driver is the desire to run lean but reliable

○ **ISO**

- TC108 SC3 WG6 created a preliminary work item 10/2013
- Group leader chosen (Schiefer)
- Looking for participants (hint-hint)

Dynamic Pressure Standard Outline

- **Scope**
- **Normative references**
- **Terms and definitions**
- **Uncertainty of measurement**
- **Apparatus**
 - General considerations
 - Shock tube
 - Low pressure pneumatic
 - High pressure pneumatic
 - Low pressure hydraulic
 - High pressure hydraulic
 - Oscilloscope
 - Computer with data-processing capability
 - Filters
 - Other requirements
- **Ambient conditions**
- **Preferred rise time durations**
- **Method**
 - Test procedure
 - Data acquisition
 - Signal processing
 - Piezo-Charge
 - Piezo-IEPE
 - Strain Based Fatigue
 - Microelectromechanical Systems
- **Reporting calibration results**
- **Annex A**
- **Annex B**
- **Bibliography**

Thank you

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