

Portable Rapid Test (PRT) Leak Detection System



Technical POC's

(805)982-1808, ESC 411

(805)982-1618, ESC 411

Management POC:

ESC45, 805-982-1674

Y0817 Program Review

May 20, 2004

- **Objective: Develop portable accurate leak detector for regulatory compliance testing of <100K gallon fuel tanks**
- **Driver: Need for rapid, mobile & inexpensive leak detection capability for multiple tanks in a fuel farm**

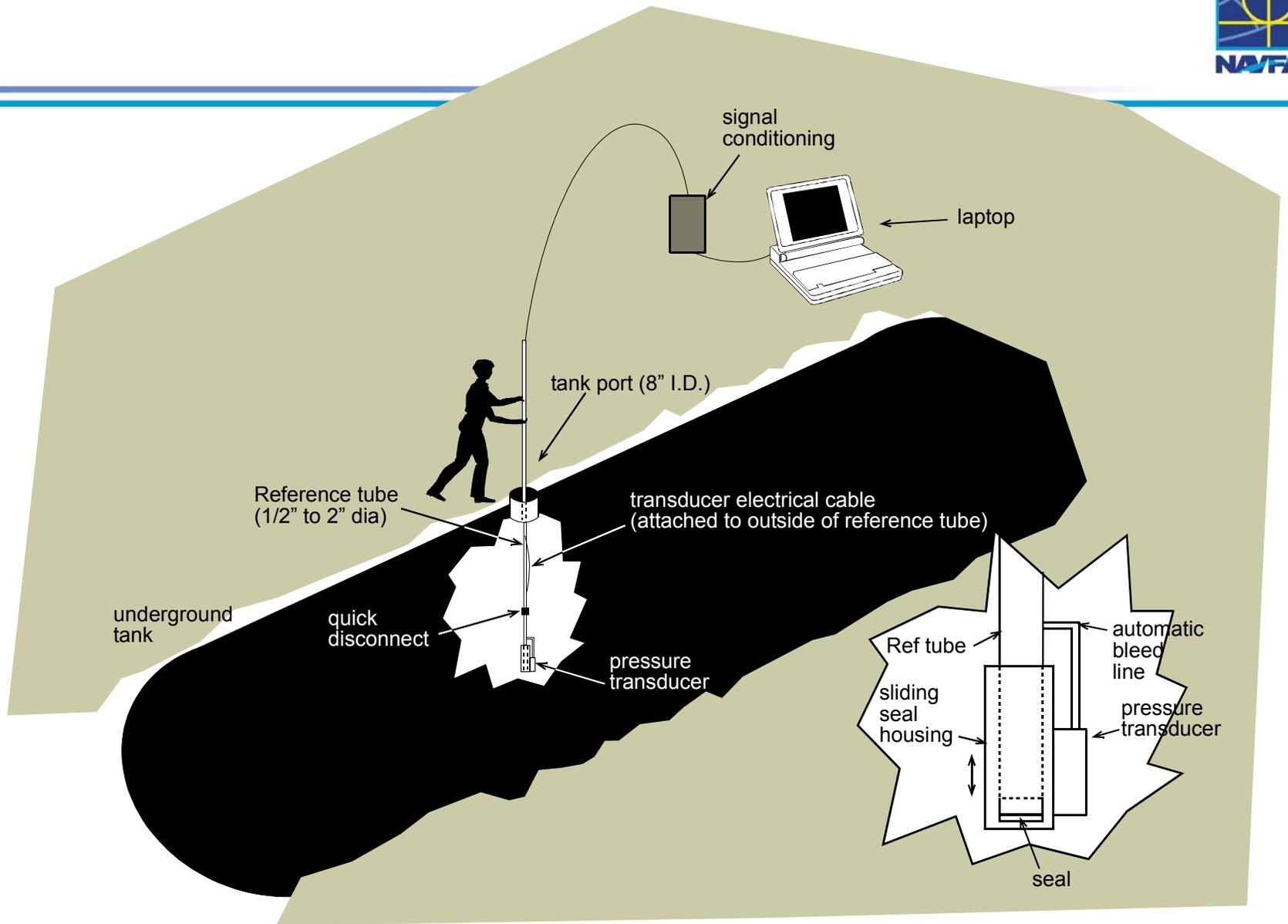
2.iii.02.a “Improved Leak Detection and Prevention Technologies for Underground Storage Tanks (USTs), Underground Pipelines, and Aboveground Storage Tanks (ASTs)”

Priority: High

Technology Description



- **The PRT is based upon the Navy-developed LRDP system**
- **LRDP achieved best performance specs in the industry (.38 gal/hr in 24 h test)**
- **PRT provides high performance plus portability, quick stabilization and short test duration (2 to 8 hrs)**



Benefits/payback

- **Current method: Tracer test for 50K gallon tank**
 - **Monitoring wells installation (\$16K)**
 - **Recurring annual test costs \$36K (for monthly monitoring)**
 - **Long response time (several days)**
 - **Cannot work in all scenarios (e.g., high water table, cross-contamination)**

- **PRT for 50K gallon tank**
 - **Inexpensive (<\$10K)**
 - **Minimal recurring costs**
 - **2 to 8 hour test duration**
 - **Modular design adapts easily to any tank configuration**

Benefits/Payback

Technology	Capital Expend.	Annual Testing	R&D Costs	*Expected Savings	ROI
Tracer	\$16K	\$36K	---	---	---
PRT	\$9K	\$2.4K	\$0.31M	\$85M	274

*** 10 year service life; 250 units installed**

Milestones

	<u>Planned</u>	<u>Revised</u>	<u>Actual</u>
1. Concept design	03/01		08/01
2. Ref. tube fab.	05/01		11/01
3. Prototype design	07/01		07/02
4. Prototype fab.	09/01		12/02
5. Elec pkg, checkout	05/03		12/03
6. Dive tank testing	05/03		05/04
7. Field testing	06/03	06/04	
8. 3 rd Party Evaluation	07/03	07/04	
9. Final doc.	09/03	09/04	

FY00 - Accomplishments



- **Developed new method to stabilize system initial fuel conditions allowing quick leak test starts**
- **Fabricated first prototype of new sliding seal design**
- **Identified candidate pressure transducers for low weight, high precision, diaphragm adaptability, low profile port locations, port bleeding configuration, etc.**

FY01 - Accomplishments



- **System Component Design**
 - Redesign of sliding seal
 - Automatic air bleeding system
 - Modular design for quick tank adaptation
 - Design weight <30lbs
- **Fabricated and tested 2nd generation sliding seal**
- **Working with industry for direct submersion transducer to significantly reduce weight and minimize external piping**

FY02 - Accomplishments

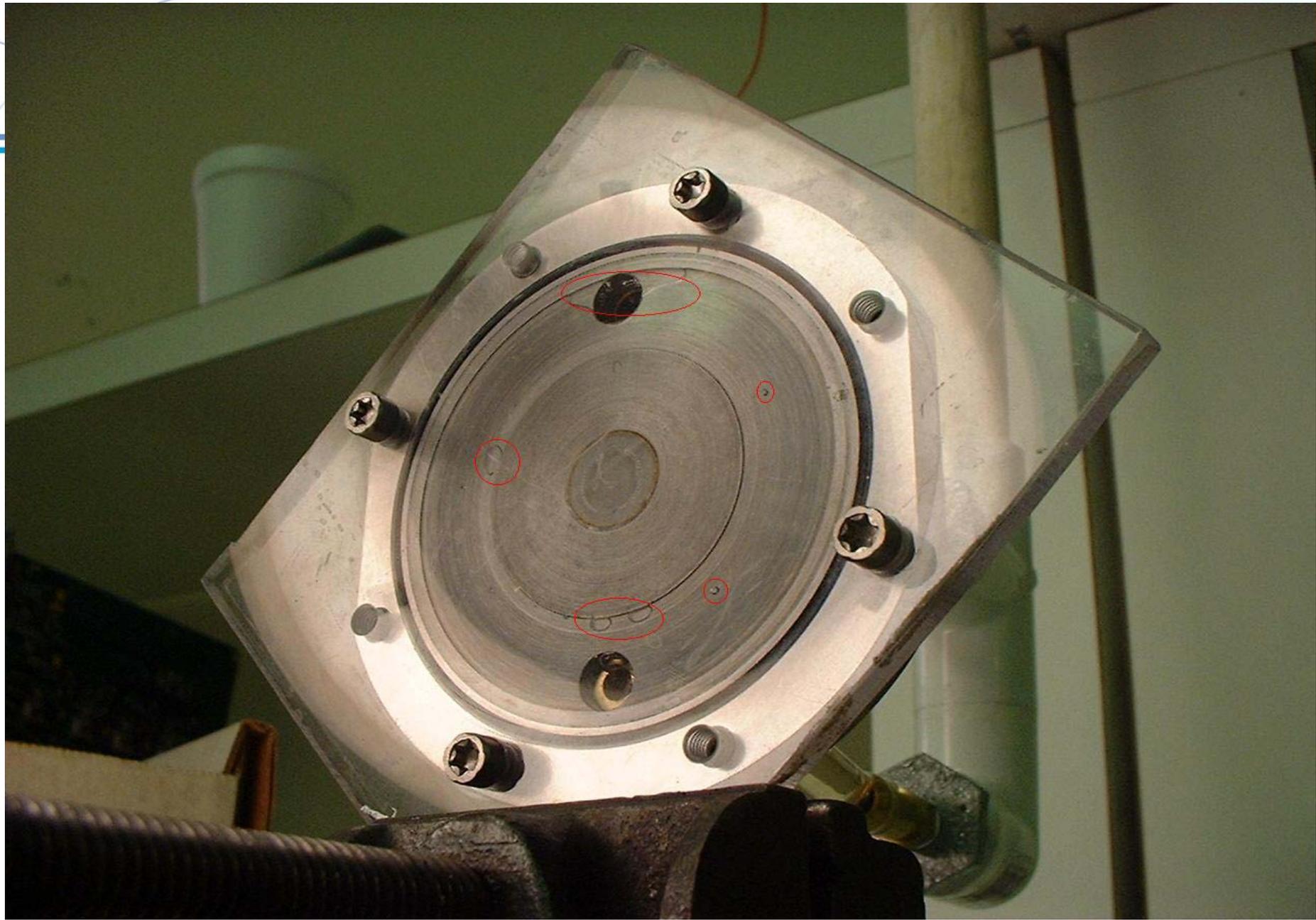


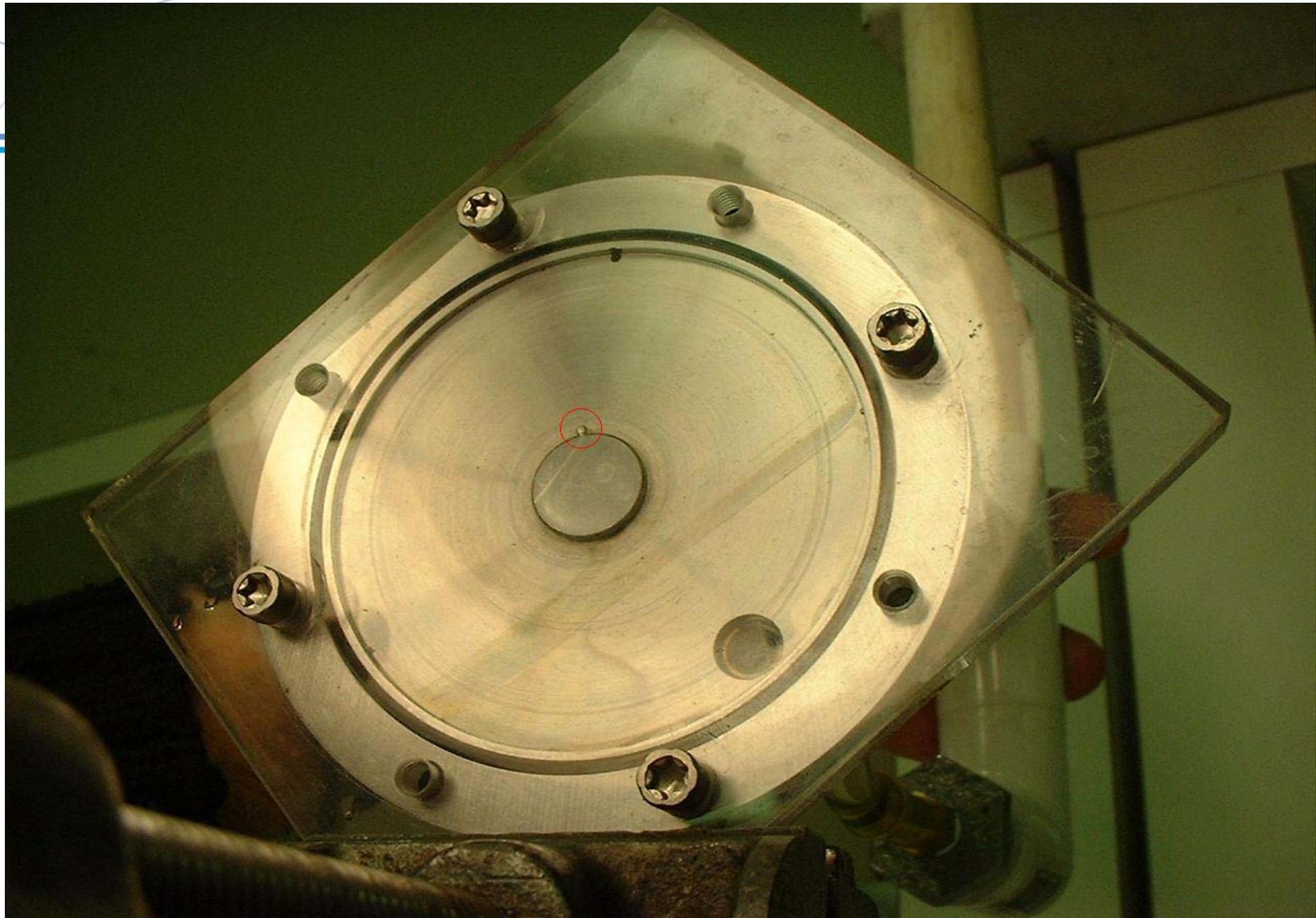
- **Awarded contract to Validyne Engineering for development of direct immersion gauge**
- **Selected Validyne DP103 gauge for adaptation**
- **Conducted laboratory tests of modified DP103**
- **Prepared test report and performance specs**

Results for Laboratory Test of Gauge



- **Met Intrinsic safety requirements with modified DP103 & P432 carrier demodulator with intrinsic barrier**
- **System resolution = .00002 in of H2O**
- **No gauge overpressure problems**
- **“Oil canning” effect negligible**
- **Excellent bubble expulsion with modified ports and increased diaphragm clearance**





Attributes of Final Fabricated Gauge

- **Special gauge/ref tube mounting hardware**
- **Fill & bleed port modifications for bubble expulsion**
 - **Elimination of threaded ports**
 - **Incorporation of large smooth ports**
 - **Angled ports (min. Impact to production \$)**
 - **Vertical alignment of fill & vent ports**
- **Increased gap between diaphragm & transducer body to eliminate surface tension problems**
- **Use of “O” rings instead of threaded ports**

FY03 Accomplishments



- **Final fabrication of Validyne pressure gauge**
- **Final fabrication of PRT sliding seal**
- **Electronics packaging**
 - **Significant reduction in size/cost of data acquisition system**
 - **Awarded contract for “briefcase” size electronics packaging**

FY04 – Accomplishments to Date



- **Final fabrication of electronics package**
- **Final fabrication of water/fuel tight seal at DP gauge and electric wire interface**
- **Laboratory tests of final assembled system**
- **Dive tank tests of final assembled system**

Submersed Water/Fuel Cable

SINGLE CONDUCTORS-2 UNITS

Awg No. 24(7x0.008")B/C
 DC Resistance @ 20° C ≤ 26.2 Ohms/1000 Ft
 Polypropylene Insulation
 Voltage rating: 600 V
 Color code: Black & White

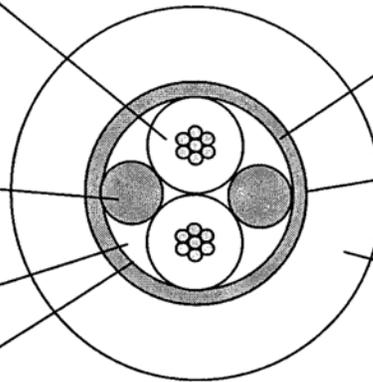
SOLID WIRES-2 UNITS

Awg No. 18(Solid) Bare copper
 25 Pounds Min. Breaking Strength

INTERSTICES WATERBLOCKED

TAPE

Mylar tape



SHIELD

Bare Copper Braid
 90% Min. coverage

TAPE

PVC/Mylar tape

JACKET

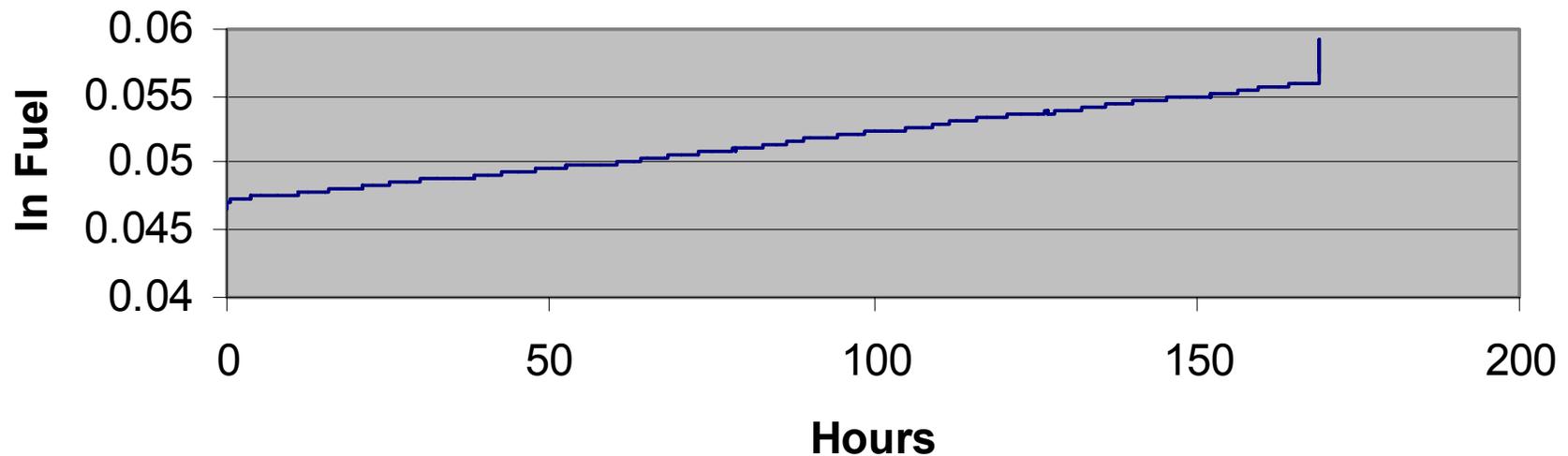
Polyurethane
 Thickness: 0.050" Nominal
 Color: Black

PRT System Laboratory Tests

PRT Laboratory Tests



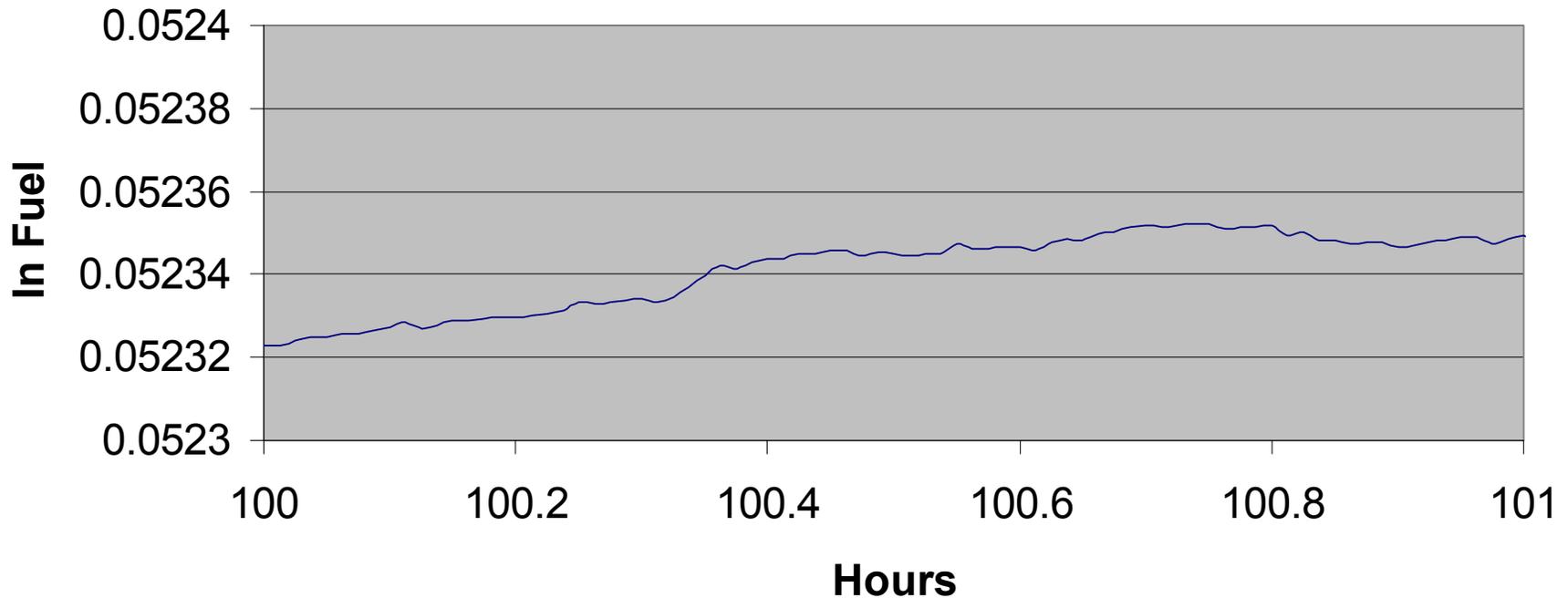
Lab Test - PRT in fuel bucket
Start 5/1/04 @ 1530
LR = .0000553 in Fuel/hr
LR = .024 gal/hr in 50K gal Tank



PRT Lab Tests – System Noise Example

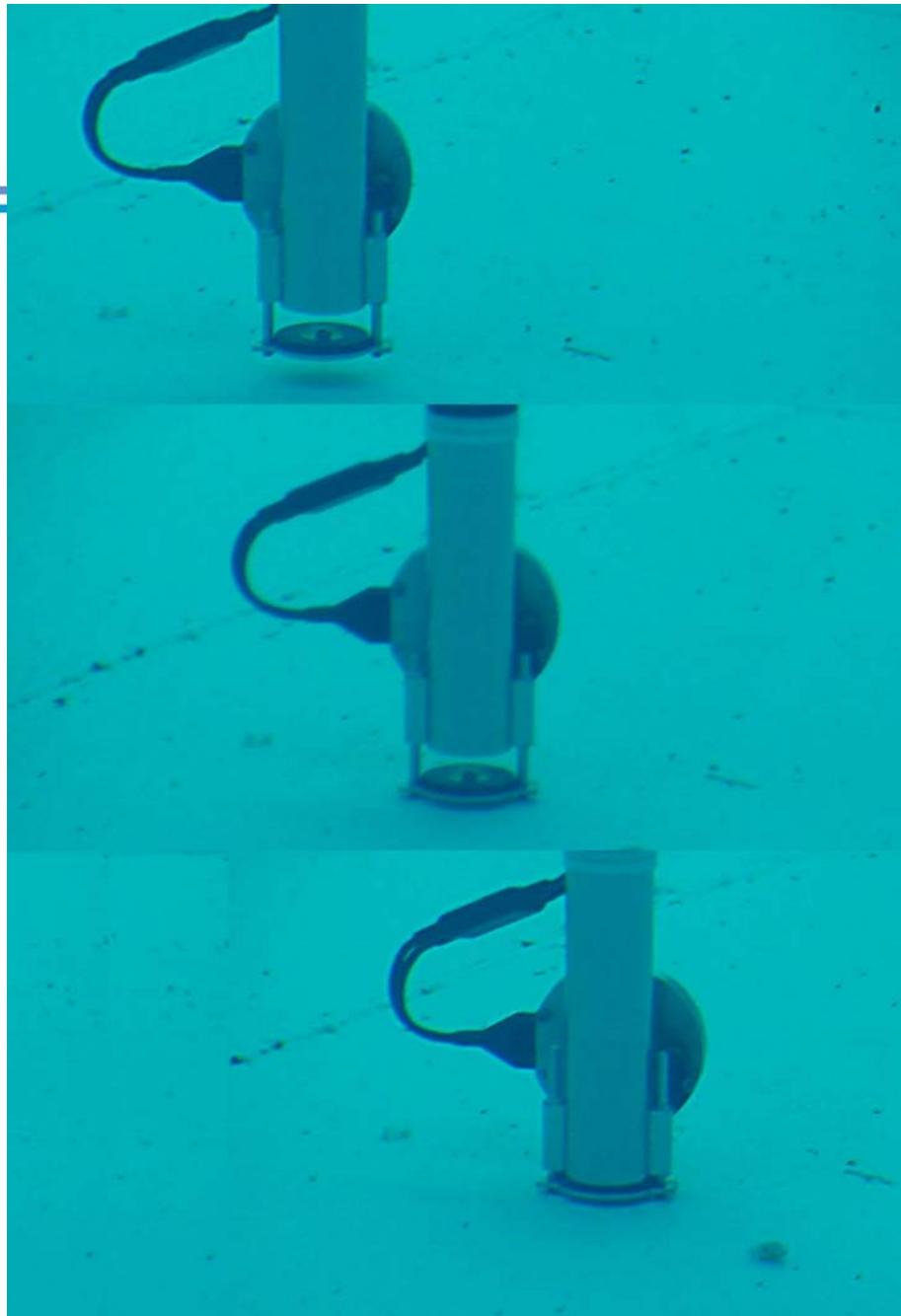


**Lab Test - PRT in fuel bucket
Start 5/1/04 @ 1530
Very Low System Noise**

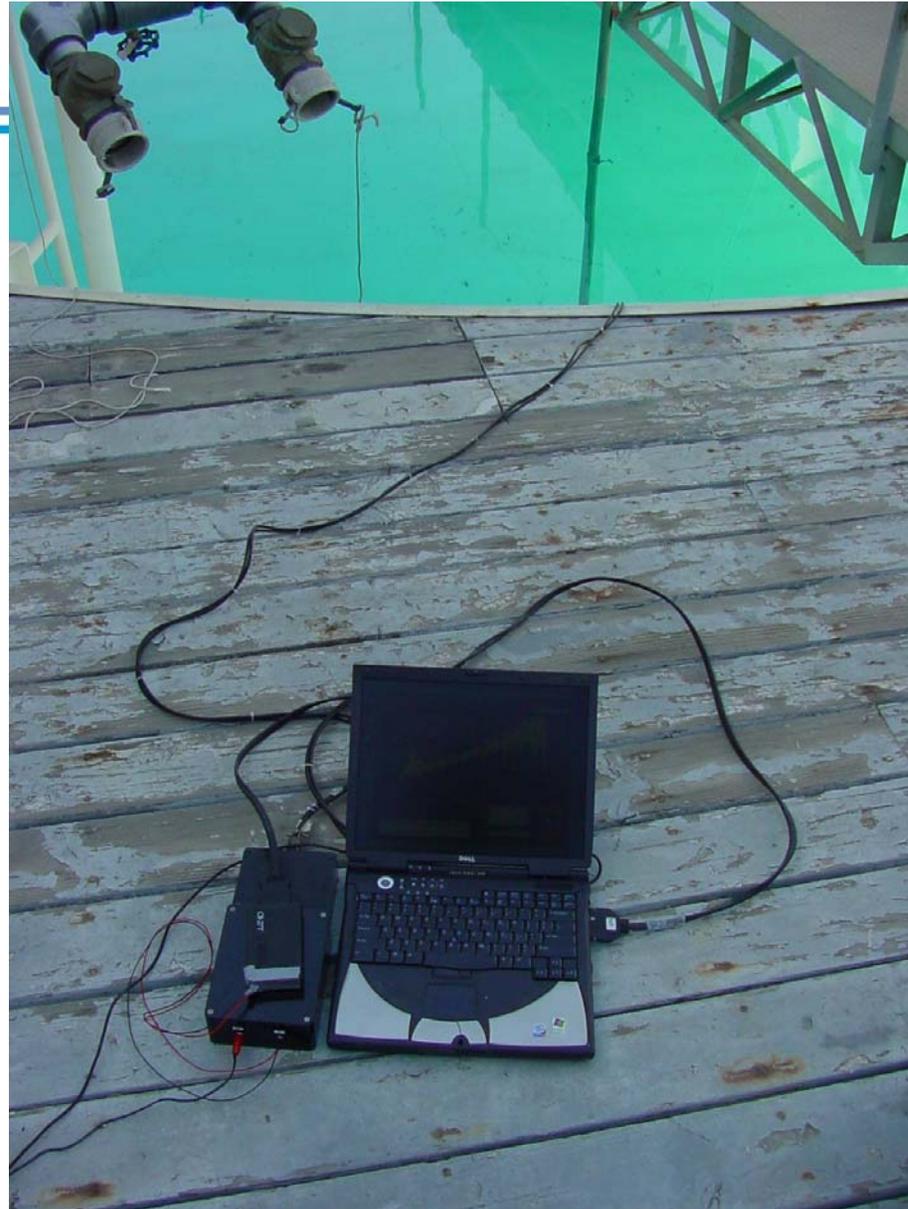


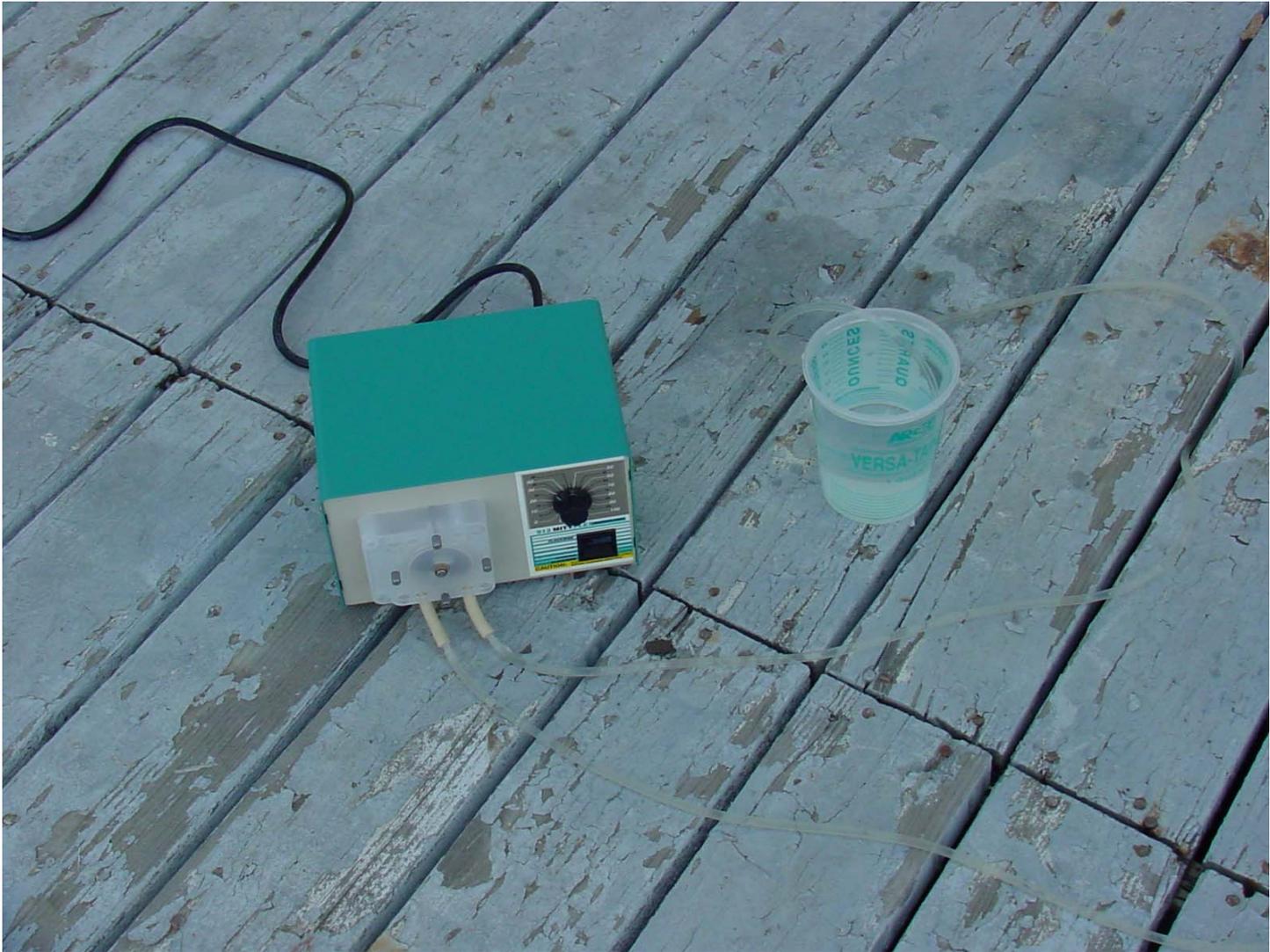
PRT System Dive Tank Tests





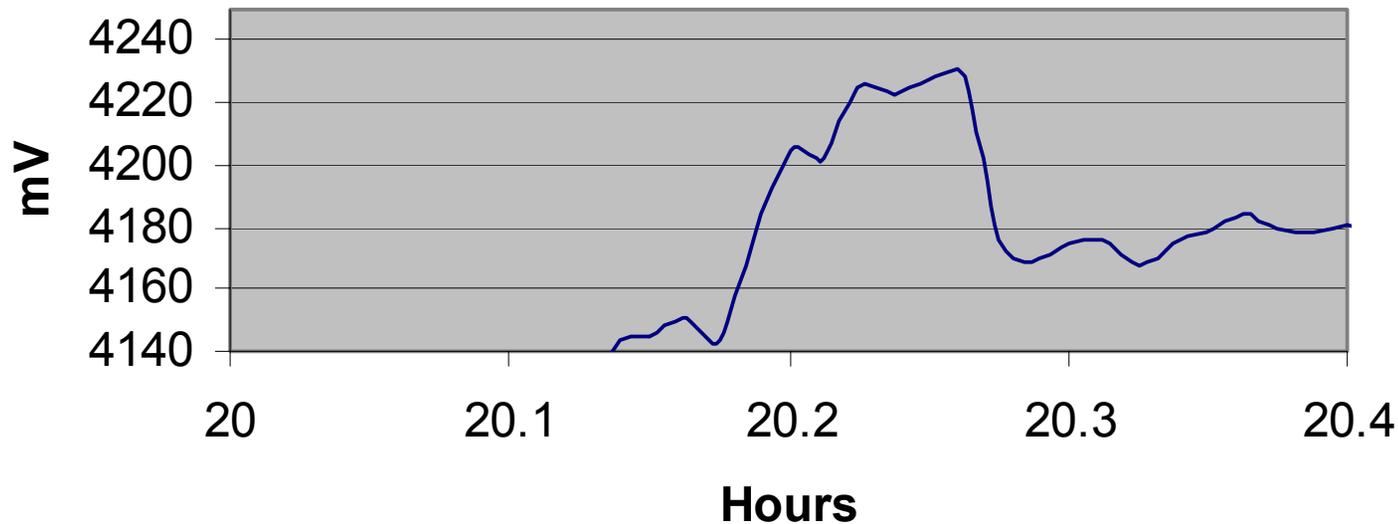






PRT Dive Tank Test - Calibration

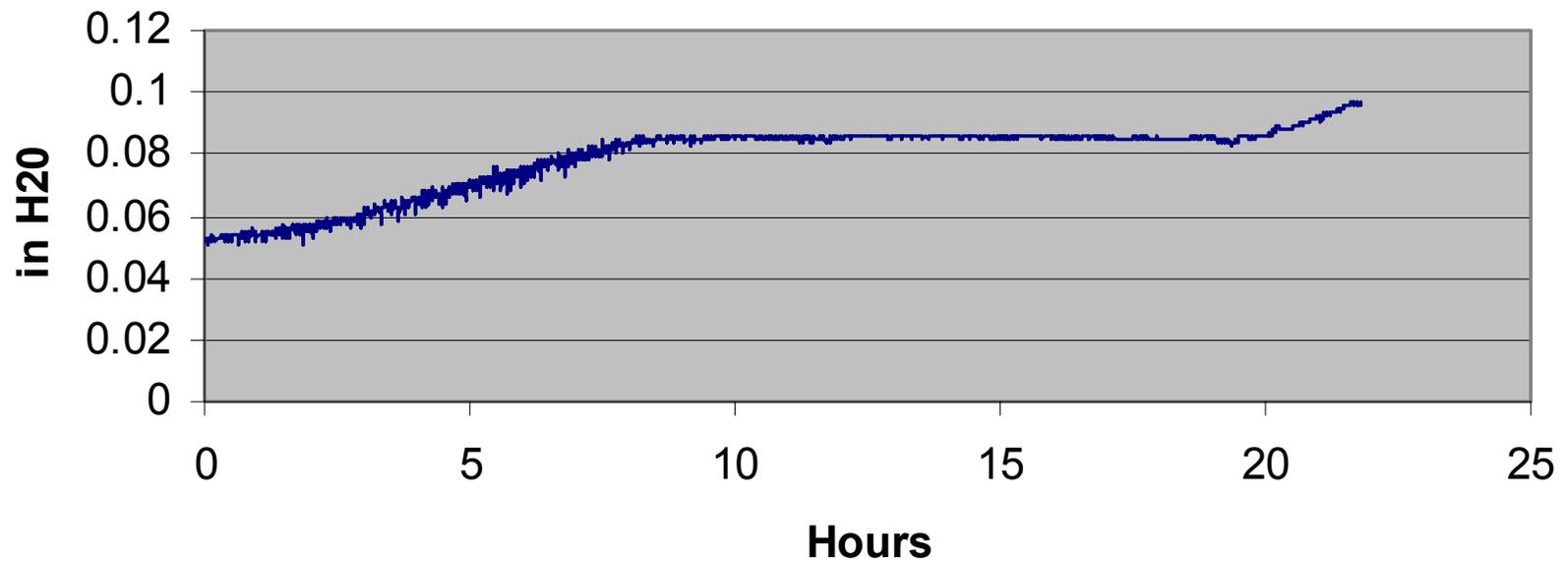
DP Gauge in Dive Tank
Start 5-13-04 @ 11:12 AM
CAL: 2 Quarts Removed
CAL = .00131in/62mV = .0000211 in/mV



PRT Dive Tank Test

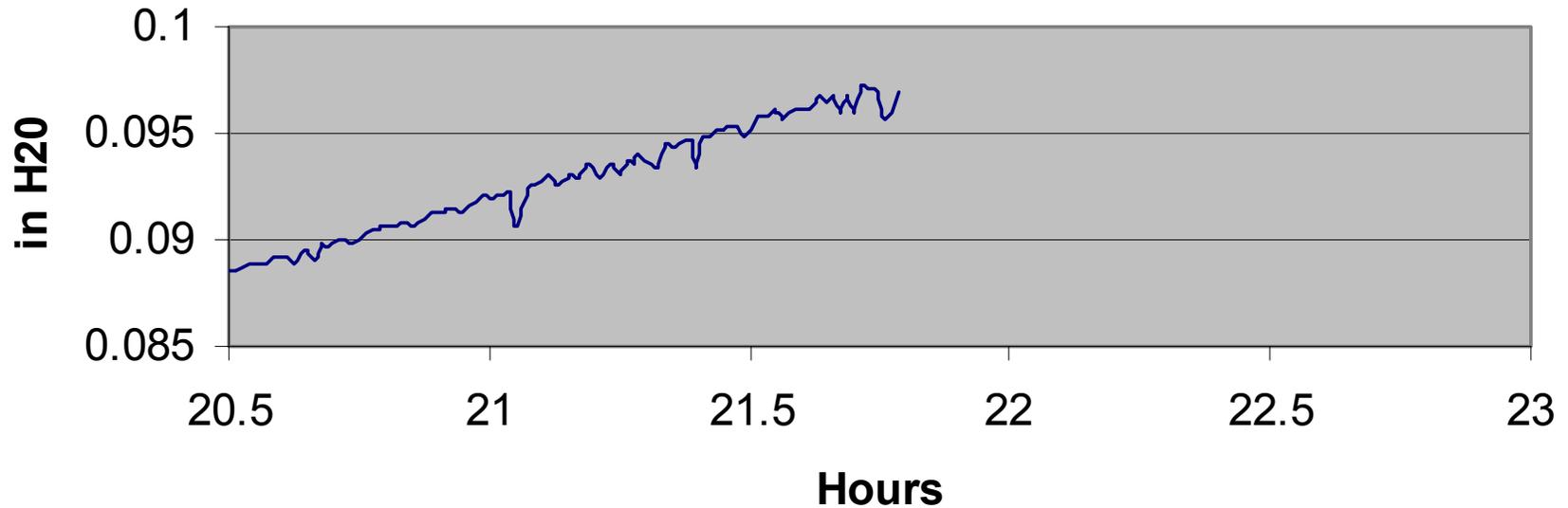


DP Gauge in Dive Tank
Start 5-13-04 @ 11:12 AM
Induced Leak at end of test = 2.25 gal/hr



Dive Tank Test Induced and Measured Leak

DP Gauge in Dive Tank
Start 5-13-04 @ 11:12 AM
Induced Leak at end of test = 2.25 gal/hr
Measured LR = 2.32 gal/hr



- **Validyne Engineering**
- **Vista Engineering**
- **DESC and NAVPET**
- **Red Hill, San Pedro, Pt. Loma, North Island, Pt. Mugu**
- **CERF**
- **CAL/EPA**
- **EPA Leak Detection Workgroup**
- **ITRC?**

Implementation Plan & Progress



- **3rd Party EPA Certification**
- **EPA Leak Detection Workgroup Listing**
- **DESC, NAVPET and DoD Implementation**
- **Validyne Engineering Industrial Sales**
- **Vista Engineering Leak Detection Services and Sales**
- **Navy & DoD tanks (Pt. Loma, Pt. Mugu)**
- **California State Water Resources Control Board - Underground Storage Tank Program**
- **ITRC?**

Summary

- **Portable**
- **Modular**
- **Short test duration: 2-8 hrs.**
- **High Precision-meets monthly & annual testing requirements**
- **Highly Cost-effective - modified Validyne gauge production cost will not increase**
- **Possible application for vapor leak detection (MTBE loss problem)**
- **Exceeded design goals of gauge sensitivity, noise floor and system size and weight**
- **PRT system ready for field and 3rd party certification testing in a fuel UST**