NORTHROP GRUMMAN

A Study to Determine an Alternative Coatings System Environmental Recorder

February 3, 2011

Arcino Quiero, Jr
NGSB–Newport News

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

Purpose:

To evaluate relative equivalency of various commercially available equipment and **to recommend a reliable, efficient, and cost effective** Alternative Coatings System Environmental Recorder (i.e. Data Logger).

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

Goals:

- Improve the reliability of environmental data
- Reduce human intervention in obtaining environmental data
- Increase the Shipyards ability to share and retain environmental data

Deliverables:

- Equivalent and/or superior environmental recorder
- More cost effective environmental recorder
- Obtain information required to develop an alternative coatings system environmental recorder

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

Statement of Work (SOW) – The purpose of this project is to evaluate the relative equivalency of commercially available equipment and recommend a reliable, efficient, and cost effective Alternative Coatings System Environmental Recorder (i.e. Data Logger)

- **Task 1** – Evaluate environmental requirements (NAVSEA Standard Item 009-32)
  - Address the "Intrinsically Safe" issue
- **Task 2** – Evaluate the current recommended system (Veriteq)
- **Task 3** – Evaluate and determine alternative ("equivalent") systems
- **Task 4** – Recommend potential alternative systems

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

NAVSEA Standard Item 009-32 – Environmental Readings

009-32 Revision	Manual Reading	Logger Sample Rate
FY06 Change 2	8 hrs	5 min
FY07	8 hrs	5 min
FY07 Change 1	8 hrs	5 min
FY07 Change 2	12 hrs	5 min
FY08	12 hrs	5 min
FY08 Change 1	12 hrs	5 min
FY09	12 hrs	5 min
FY09 Change 1	12 hrs	5 min
FY09 Change 2	12 hrs	5 min
FY09 Change 3	12 hrs	5 min
FY10	12 hrs	5 min
FY10 Change 1	12 hrs	5 min
FY11	24 hrs	1 hr

For areas where a data logger is not used, environmental readings shall be manually taken every 4 hours and at every evolution involving (G) – points.

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

2009 NAVSEA Standard Specification for Ship Repair and Alteration Committee (SSRAC)

- Problem – Current standard reads: "Veriteq Instruments, Inc., Model No. KT-2000-NEI or equivalent"
- Proposed Change – Veriteq Instruments, Inc., Model No. KT-2000-NEI or equivalent logging device ***with the exception of "intrinsically safe" if approved for use by the safety officer.***
- Change Major √ Minor
- Cost Impact √ Yes No

Not Adopted

2010 NAVSEA Standard Specification for Ship Repair and Alteration Committee (SSRAC)

- Problem – Current paragraph reads: "The preferred method of measurement is using a data logger (Veriteq Instruments, Inc., Model No. KT-2000-NEI of equivalent). Other, more economical equipment is available for use but "or equivalent" has not been defined."
- Proposed Change: Revise paragraph to read: "The preferred method of measurement is using a data logger. Dataloggers shall be capable of logging relative humidity, surface temperature, and dew point at the required intervals. The datalogger shall be accurate to +/- 3% RH and +/- 1 degree Fahrenheit. The temperature humidity data shall be downloadable for reporting in accordance with *3.7.1. **The datalogger shall meet the relevant safety requirements of reference 2.1 and 2.3"***
- Change Major √ Minor
- Cost Impact No Impact Increase √ Decrease

Not Addressed

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

If a device is made safe for flammable environment, it can be either "intrinsically safe" or "explosion proof."

- "*Intrinsically safe*" – is designed to be certified by an independent approving body, so that if it fails during normal use and operation it will not generate enough energy to ignite a flammable mixture of the hazard classes specified.
  - **Class I** – locations may have *flammable gases or vapors* present in quantities sufficient for a fire or explosion.
  - **Class II** – locations where *combustible dusts* are not normally suspended in air or normal operations do not put dusts into suspension.
  - **Class III** – locations which are flammable, due to the presence of easily ignitable *fibers*, but the fibers are not likely to be suspended in the air in quantities sufficient to produce an ignitable mixture.
- "*Explosion-Proof*" – is designed so that if a flammable mixture inside of the device ignites, the flame will not get outside of the device to ignite a flammable mixture outside of it.

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

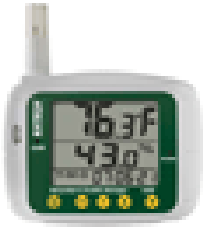
"While an "intrinsically safe" device would meet the safety requirements of OSHA regulations, the National Electric Code, and U.S. Navy documents (including NSTM and Standard Items), it does not appear to be the ***only*** means of meeting these requirements. If the Data Loggers chosen comply with the safety requirements of these references and have the technical capabilities of the Veriteq KT-2000-NEI product, they should be considered equivalent. Validating compliance with safety requirements should not be covered by 009-32. Indeed, there are no such measures ("intrinsically safe" requirements) in 009-32 for lighting, surface preparation and coating application equipment and other types of QA equipment."

J. Peter Ault, P.E., Elzly Technology Corporation

NSRP SP&C Panel Member

Manufacturer Equipment / Model

NORTHROP GRUMMAN

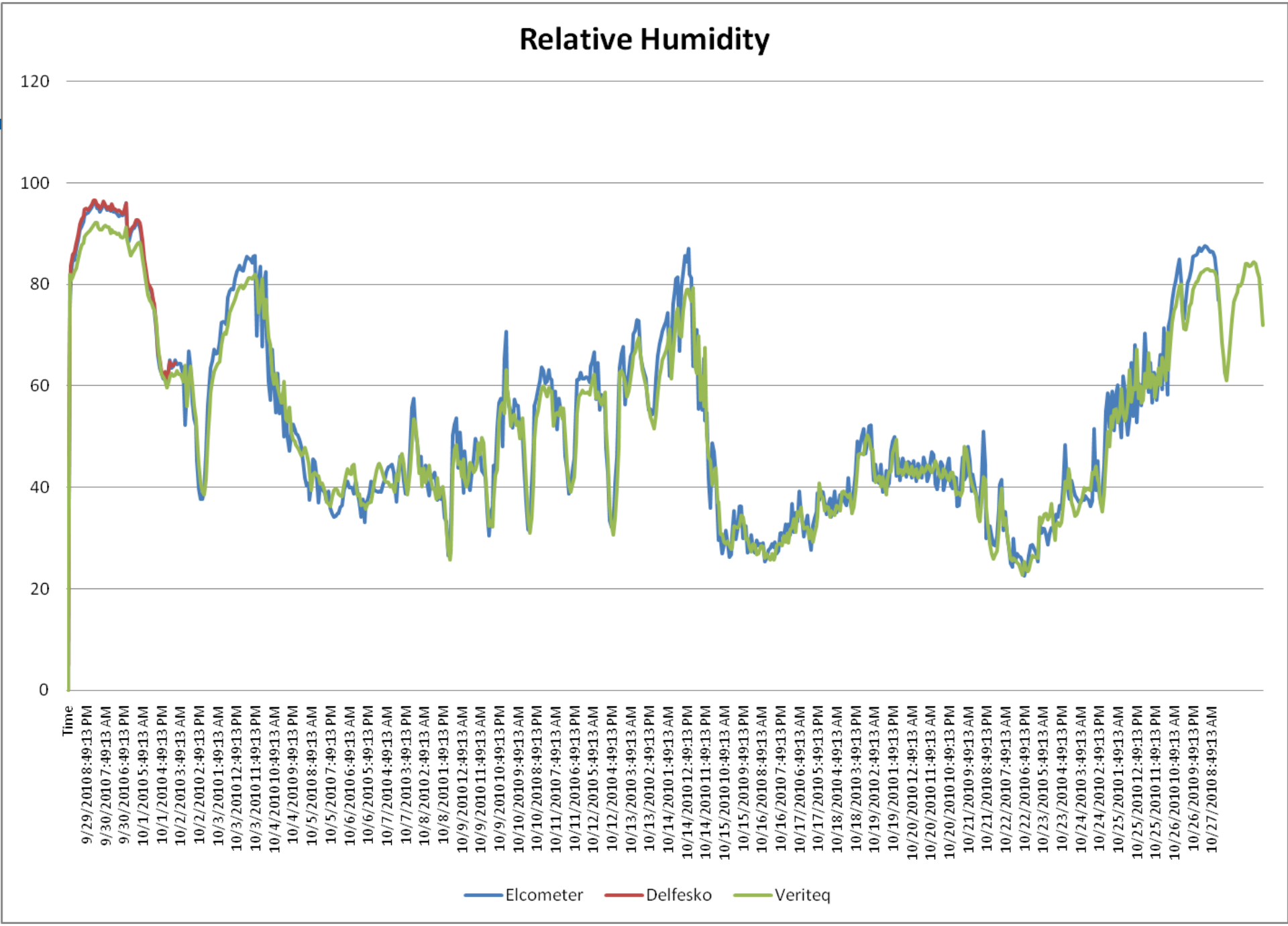


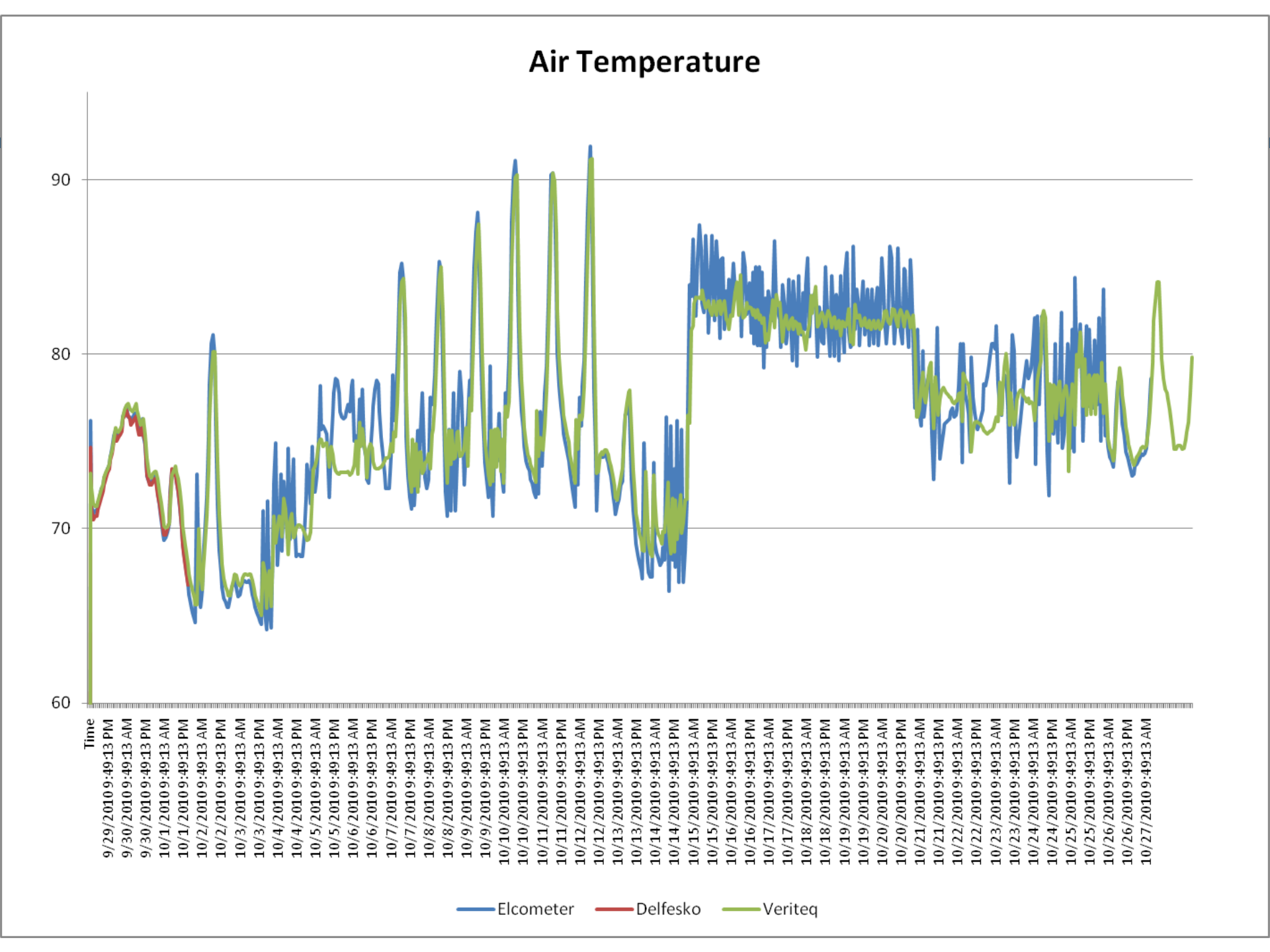
Veriteq KT-2000-NEI	Elcometer G319	DeFelsko / PosiTector	ExTech 42280
Ambient Temperature: Y Surface Temperature: Y Relative Humidity: Y Dewpoint: Y	Ambient Temperature: Y Surface Temperature: Y Relative Humidity: Y Dewpoint: Y	Ambient Temperature: Y Surface Temperature: Y Relative Humidity: Y Dewpoint: Y	Ambient Temperature: Y Surface Temperature: N Relative Humidity: Y Dewpoint: Y
Ambient Temp:-+/- .27 F Surface Temp.: +/- . 27 F Relative Humidity: +/-2%	Ambient Temp:-+/- 1 F Surface Temp.: +/- 1 F Relative Humidity: +/-3%	Ambient Temp:-+/- 1 F Surface Temp.: +/- 1 F Relative Humidity: +/-3%	Ambient Temp:-+/- 1 F Surface Temp.: N/A Relative Humidity: +/-3%
Power Supply: Batteries	Power Supply: 2 AA batteries or via USB Cable	Power Supply: 3 AAA batteries, AC power cable	Power Supply: 4 AA batteries, AC power cable
Battery Life: 10 years (estimate)	Battery life: 40 hours (backlight off) Logging: ~ 400 hours (1 every 10 minutes)	Battery life: 50 hours (estimate)	Battery life: 3 months (estimate)
Calibration: Calibrated in house or sent to Veritwq. Lengthy turn around	Calibration: Calibrated in house or sent to Elcometer. Quick turn around	Calibration: Calibrated by manufacturer only.	Calibration: Calibrated in house. Requires calibration kit: RH300-CAL.
Cost: Starter Kit - $3,730 Amb. Temp / Humidity – $1,260 Surface Temp. - $945 Total: $5,935	Cost: Monitoring Unit – $799 Probe (s) – $130 Total : $929	Cost: Monitoring Unit – $675 Probe (s) – $395 Total: $1,070	Cost: Monitoring Unit – $199 Probe (s) – $49 Total : $248

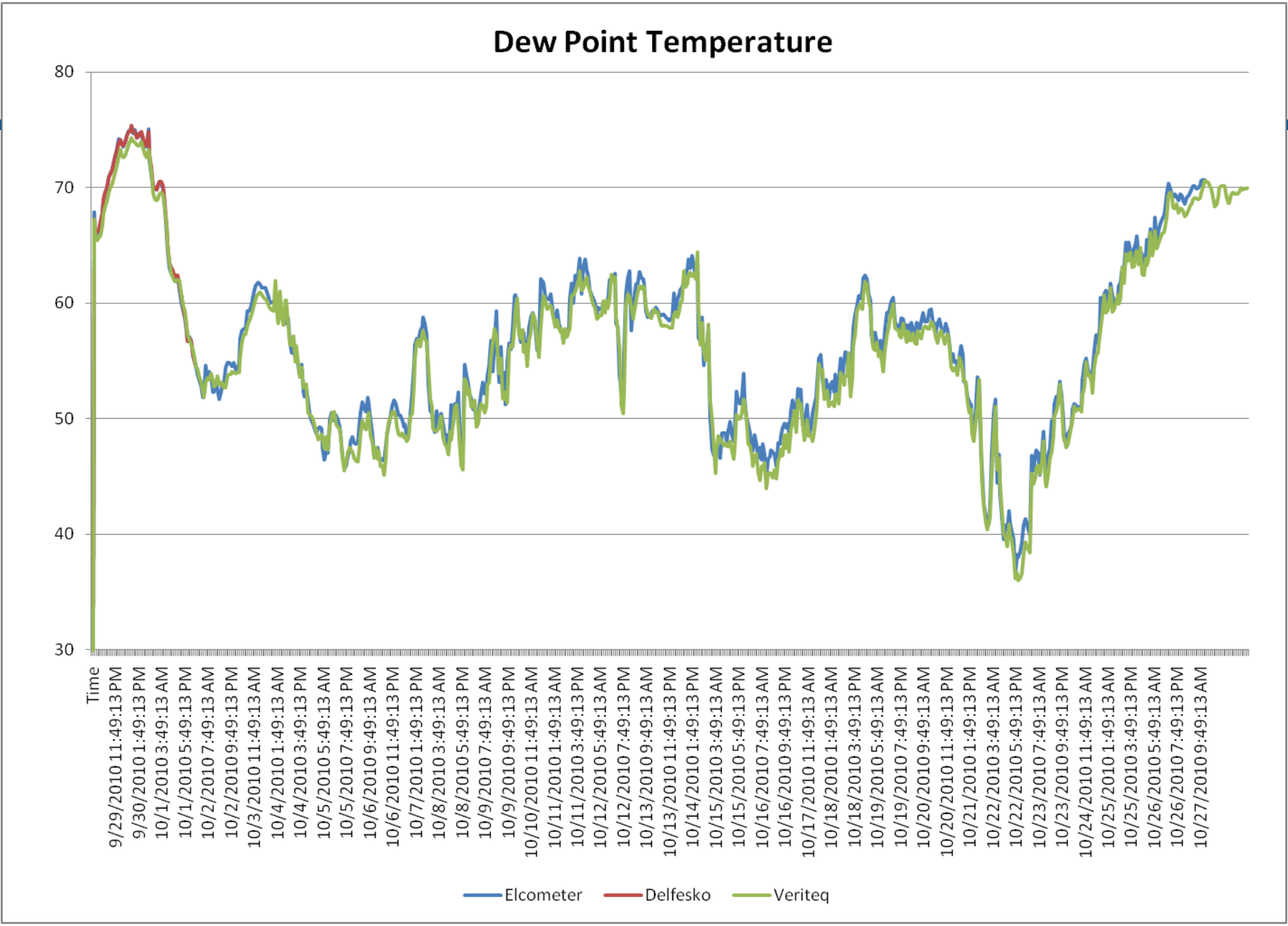
Technical Approach

NORTHROP GRUMMAN

- To get an accurate account of how well data from the various data loggers correlate, units were placed in a climate controlled paint storage facility.
- Parameter Set-Up
  - Dataset included: Relative Humidity, Air Temperature, and Dewpoint Temperature
  - One dataset recorded every hour
  - Limits: Temperature – 60-85 F & Relative Humidity – 50-85%
- Data Recovery – Each system has software that is used to download recorded data. For this project, a dedicated, non-networked computer is being used.
- Battery life – Status is checked every two days. Data may be lost or corrupted if level is too low. Therefore, batteries will be changes when units indicate 25% life remaining.


Relative Humidity
120
100
80
60
40
20
0
Time
9/29/2010 8:49:13 PM
9/30/2010 7:49:13 AM
9/30/2010 6:49:13 PM
10/1/2010 5:49:13 AM
10/1/2010 4:49:13 PM
10/2/2010 3:49:13 AM
10/2/2010 2:49:13 PM
10/3/2010 1:49:13 AM
10/3/2010 12:49:13 PM
10/3/2010 11:49:13 PM
10/4/2010 10:49:13 AM
10/4/2010 9:49:13 PM
10/5/2010 8:49:13 AM
10/5/2010 7:49:13 PM
10/6/2010 6:49:13 AM
10/6/2010 5:49:13 PM
10/7/2010 4:49:13 AM
10/7/2010 3:49:13 PM
10/8/2010 2:49:13 AM
10/8/2010 1:49:13 PM
10/9/2010 12:49:13 AM
10/9/2010 11:49:13 AM
10/9/2010 10:49:13 PM
10/10/2010 9:49:13 AM
10/10/2010 8:49:13 PM
10/11/2010 7:49:13 AM
10/11/2010 6:49:13 PM
10/12/2010 5:49:13 AM
10/12/2010 4:49:13 PM
10/13/2010 3:49:13 AM
10/13/2010 2:49:13 PM
10/14/2010 1:49:13 AM
10/14/2010 12:49:13 PM
10/14/2010 11:49:13 PM
10/15/2010 10:49:13 AM
10/15/2010 9:49:13 PM
10/16/2010 8:49:13 AM
10/16/2010 7:49:13 PM
10/17/2010 6:49:13 AM
10/17/2010 5:49:13 PM
10/18/2010 4:49:13 AM
10/18/2010 3:49:13 PM
10/19/2010 2:49:13 AM
10/19/2010 1:49:13 PM
10/20/2010 12:49:13 AM
10/20/2010 11:49:13 AM
10/20/2010 10:49:13 PM
10/21/2010 9:49:13 AM
10/21/2010 8:49:13 PM
10/22/2010 7:49:13 AM
10/22/2010 6:49:13 PM
10/23/2010 5:49:13 AM
10/23/2010 4:49:13 PM
10/24/2010 3:49:13 AM
10/24/2010 2:49:13 PM
10/25/2010 1:49:13 AM
10/25/2010 12:49:13 PM
10/25/2010 11:49:13 PM
10/26/2010 10:49:13 AM
10/26/2010 9:49:13 PM
10/27/2010 8:49:13 AM
Elcometer
Delfesko
Veriteq


Air Temperature
90
80
70
60
Time
9/29/2010 9:49:13 PM
9/30/2010 9:49:13 AM
9/30/2010 9:49:13 PM
10/1/2010 9:49:13 AM
10/1/2010 9:49:13 PM
10/2/2010 9:49:13 AM
10/2/2010 9:49:13 PM
10/3/2010 9:49:13 AM
10/3/2010 9:49:13 PM
10/4/2010 9:49:13 AM
10/4/2010 9:49:13 PM
10/5/2010 9:49:13 AM
10/5/2010 9:49:13 PM
10/6/2010 9:49:13 AM
10/6/2010 9:49:13 PM
10/7/2010 9:49:13 AM
10/7/2010 9:49:13 PM
10/8/2010 9:49:13 AM
10/8/2010 9:49:13 PM
10/9/2010 9:49:13 AM
10/9/2010 9:49:13 PM
10/10/2010 9:49:13 AM
10/10/2010 9:49:13 PM
10/11/2010 9:49:13 AM
10/11/2010 9:49:13 PM
10/12/2010 9:49:13 AM
10/12/2010 9:49:13 PM
10/13/2010 9:49:13 AM
10/13/2010 9:49:13 PM
10/14/2010 9:49:13 AM
10/14/2010 9:49:13 PM
10/15/2010 9:49:13 AM
10/15/2010 9:49:13 PM
10/16/2010 9:49:13 AM
10/16/2010 9:49:13 PM
10/17/2010 9:49:13 AM
10/17/2010 9:49:13 PM
10/18/2010 9:49:13 AM
10/18/2010 9:49:13 PM
10/19/2010 9:49:13 AM
10/19/2010 9:49:13 PM
10/20/2010 9:49:13 AM
10/20/2010 9:49:13 PM
10/21/2010 9:49:13 AM
10/21/2010 9:49:13 PM
10/22/2010 9:49:13 AM
10/22/2010 9:49:13 PM
10/23/2010 9:49:13 AM
10/23/2010 9:49:13 PM
10/24/2010 9:49:13 AM
10/24/2010 9:49:13 PM
10/25/2010 9:49:13 AM
10/25/2010 9:49:13 PM
10/26/2010 9:49:13 AM
10/26/2010 9:49:13 PM
10/27/2010 9:49:13 AM
Elcometer
Delfesko
Veriteq


Dew Point Temperature
80
70
60
50
40
30
Time
9/29/2010 11:49:13 PM
9/30/2010 1:49:13 PM
10/1/2010 3:49:13 AM
10/1/2010 5:49:13 PM
10/2/2010 7:49:13 AM
10/2/2010 9:49:13 PM
10/3/2010 11:49:13 AM
10/4/2010 1:49:13 AM
10/4/2010 3:49:13 PM
10/5/2010 5:49:13 AM
10/5/2010 7:49:13 PM
10/6/2010 9:49:13 AM
10/6/2010 11:49:13 PM
10/7/2010 1:49:13 PM
10/8/2010 3:49:13 AM
10/8/2010 5:49:13 PM
10/9/2010 7:49:13 AM
10/9/2010 9:49:13 PM
10/10/2010 11:49:13 AM
10/11/2010 1:49:13 AM
10/11/2010 3:49:13 PM
10/12/2010 5:49:13 AM
10/12/2010 7:49:13 PM
10/13/2010 9:49:13 AM
10/13/2010 11:49:13 PM
10/14/2010 1:49:13 PM
10/15/2010 3:49:13 AM
10/15/2010 5:49:13 PM
10/16/2010 7:49:13 AM
10/16/2010 9:49:13 PM
10/17/2010 11:49:13 AM
10/18/2010 1:49:13 AM
10/18/2010 3:49:13 PM
10/19/2010 5:49:13 AM
10/19/2010 7:49:13 PM
10/20/2010 9:49:13 AM
10/20/2010 11:49:13 PM
10/21/2010 1:49:13 PM
10/22/2010 3:49:13 AM
10/22/2010 5:49:13 PM
10/23/2010 7:49:13 AM
10/23/2010 9:49:13 PM
10/24/2010 11:49:13 AM
10/25/2010 1:49:13 AM
10/25/2010 3:49:13 PM
10/26/2010 5:49:13 AM
10/26/2010 7:49:13 PM
10/27/2010 9:49:13 AM
Elcometer
Delfesko
Veriteq

Findings to Date

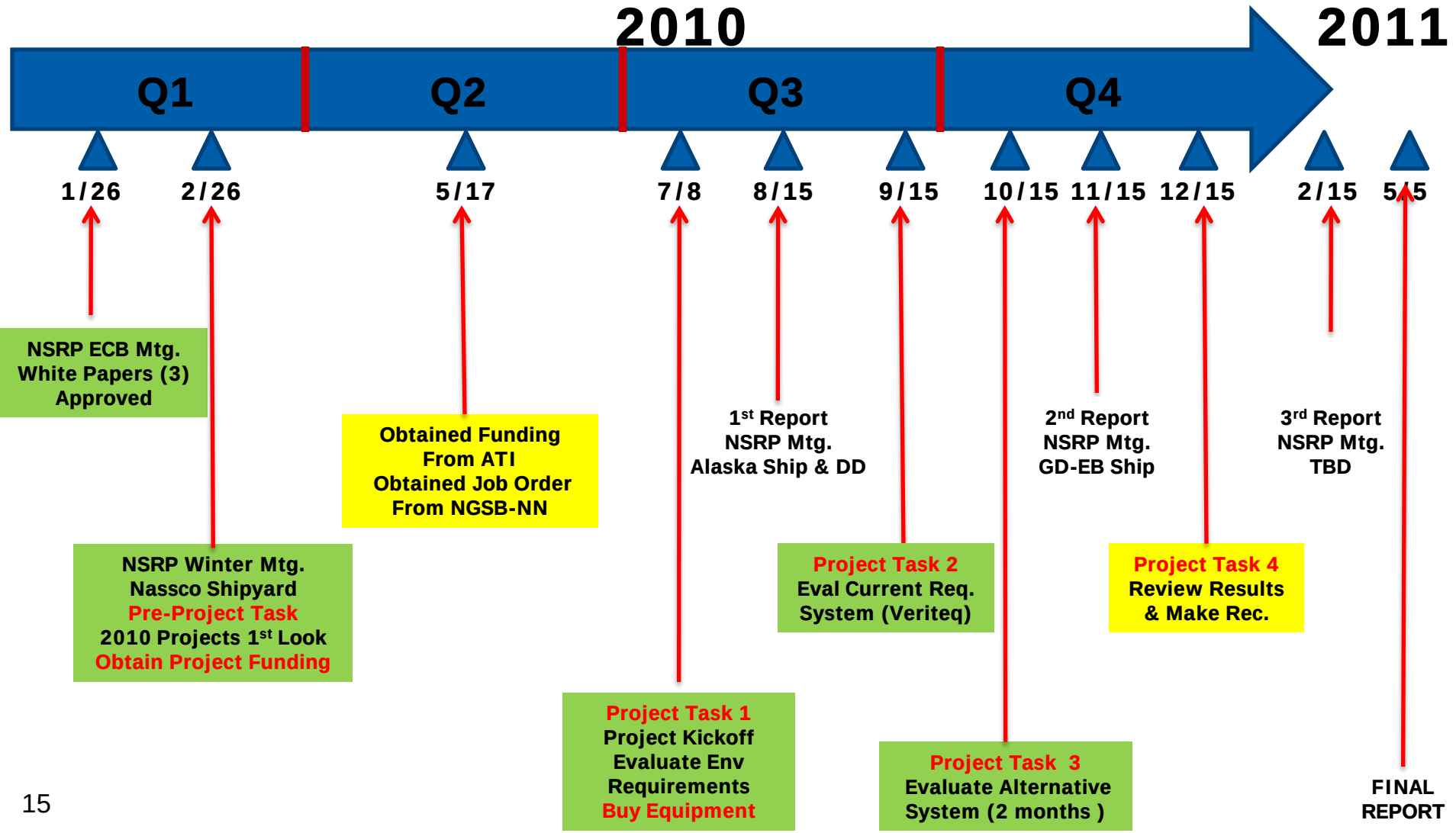
NORTHROP GRUMMAN

- ExTech does not have sleep mode. This allows the unit to turn on when acquiring data and shut off when complete. Therefore battery life is very short (2 days estimate). As a result, it was decided to exclude this unit from the study.
- Of the three units tested, only the Elcometer and Veriteq collected data for the entire test cycle. The DeFelsko unit stopped acquiring data after a few days. The data logging function may have been inadvertently shut off.
- Data shows that relative humidity and temperature followed the same trend, with only a 3-5 average variation.
- Dew Point data showed larger gaps. This is likely due to manual calculation used for the Veriteq. The formula used, indicates greater accuracy for RH greater than 50%.
- Batteries lasted 5+ weeks. The Elcometer unit had 75% battery life remaining. The DeFelsko unit had less 25% remaining. This was probably due to the auto logging issues. Veriteq's remaining battery life was approximately 50%.

NORTHROP GRUMMAN

Alternative Coatings System Environmental Recorder

Plan of Action and Milestones (POA&M)




NORTHROP GRUMMAN