

AMF2 MAGIC



SPN INTEGRATION TO THE PRP Overview, Cost Estimates, and Labor Tasks

THIS IS A DRAFT DOCUMENT



AMF2 MAGIC Study of Marine Stratocumulus Clouds in the Northeast Pacific Ocean
SPN1 Pyranometer Deployment --- 3June 2012



SUMMARY

This document provides engineering design for integration of the SPN1 Pyranometer into the Portable Radiation Package (PRP) data acquisition system. Both digital (serial) and analog data streams will be ingested into the system.

BACKGROUND



MAGIC will be deployed on one of two Horizon Shipping Inc. container ships. The SPIRIT and the RELIANCE are sister ships. These are older, steam powered, vessels with a good open superstructure and a well exposed mast.



One of the instruments on the deployment will be the Portable Radiation Package, a combination of PSP & PIR broadband hemispheric sensors and the fast rotating shadowband radiometer (FRSR) which is used to separate direct beam from global shortwave irradiance in six narrow bands. (For Magic the PRP will be mounted on the railing of the RADAR van.) This document describes a plan to integrate the SPN1 Pyranometer into the same suite of sensors.



The recommended locations for the PRP and the SPN1 is shown here, marked as PRP, on the back rail of the RADAR van. This location is far removed from the ship mast, which is the only source of shadow to the sensors.

SPN1 PYRANOMETER

From the brochure: “The new SPN1 Pyranometer measures global (total) and diffuse radiation, and sunshine duration – all in one instrument! It is easy to use, needs no routine adjustment or polar alignment, and makes an excellent reference light sensor. The SPN1 is a meteorological class instrument designed for long-term outdoor exposure, and is an affordable alternative to traditional shade-ring pyranometers or other sunshine recorders, and provides some of the same functionality as expensive pyrhemometers as well.

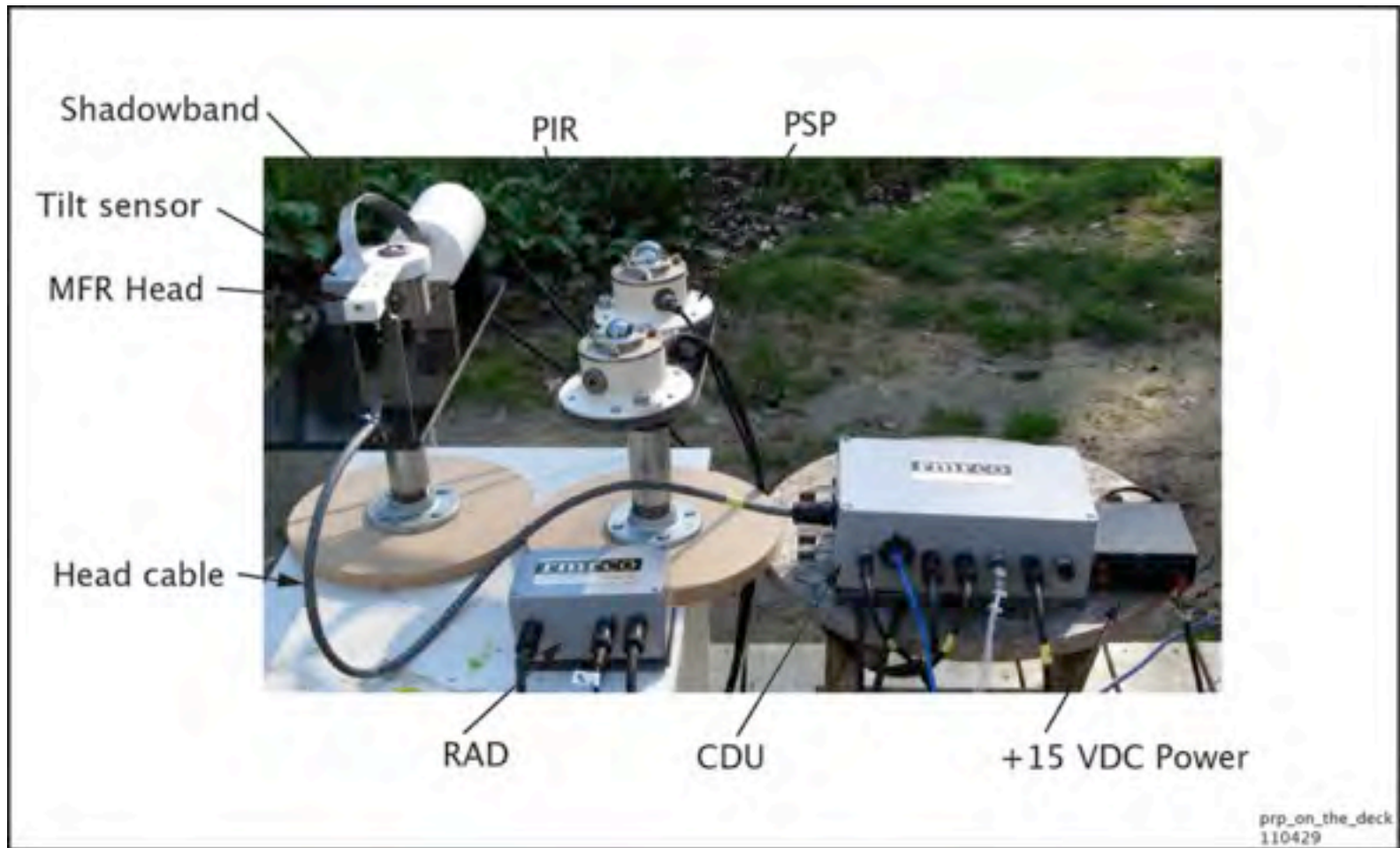
“The SPN1 Sunshine Pyranometer is a high performance instrument offering a unique combination of solar radiation measurements in a single, low maintenance device. It has proven to be an excellent sensor for solar panel manufacturers, wind energy companies or weather related research.”



“The Sunshine Pyranometer provides 2 analogue voltage outputs for global and diffuse radiation, and a digital output for sunshine duration, which can be connected to data loggers, such as the Delta-T DL2e and GP1. Readings can also be obtained directly from the RS232 port.”

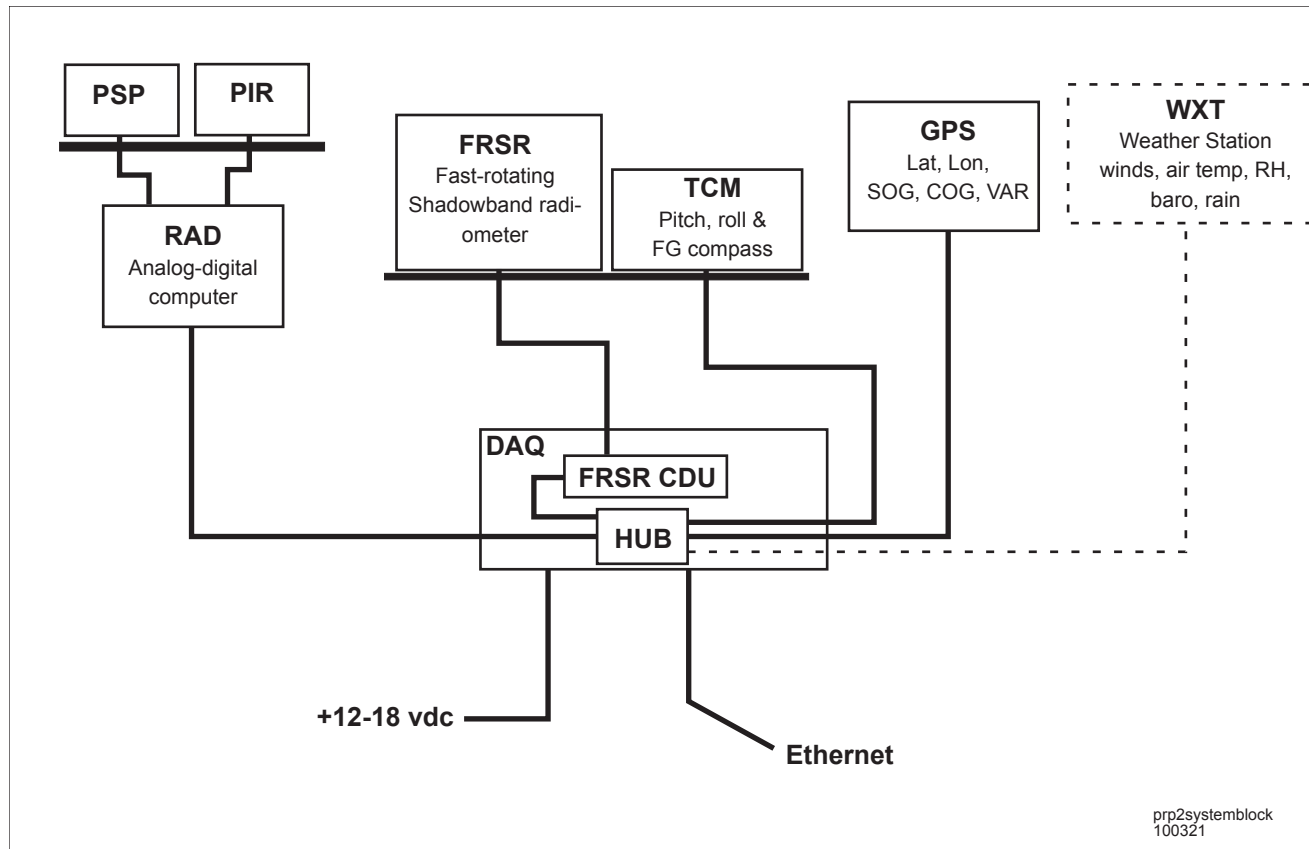
In this document we will follow prior ARM data collection methods. The DAQ has the ability to ingest both serial and analog data and both of these inputs will be developed for the maximum possible flexibility.

PRP DETAILS



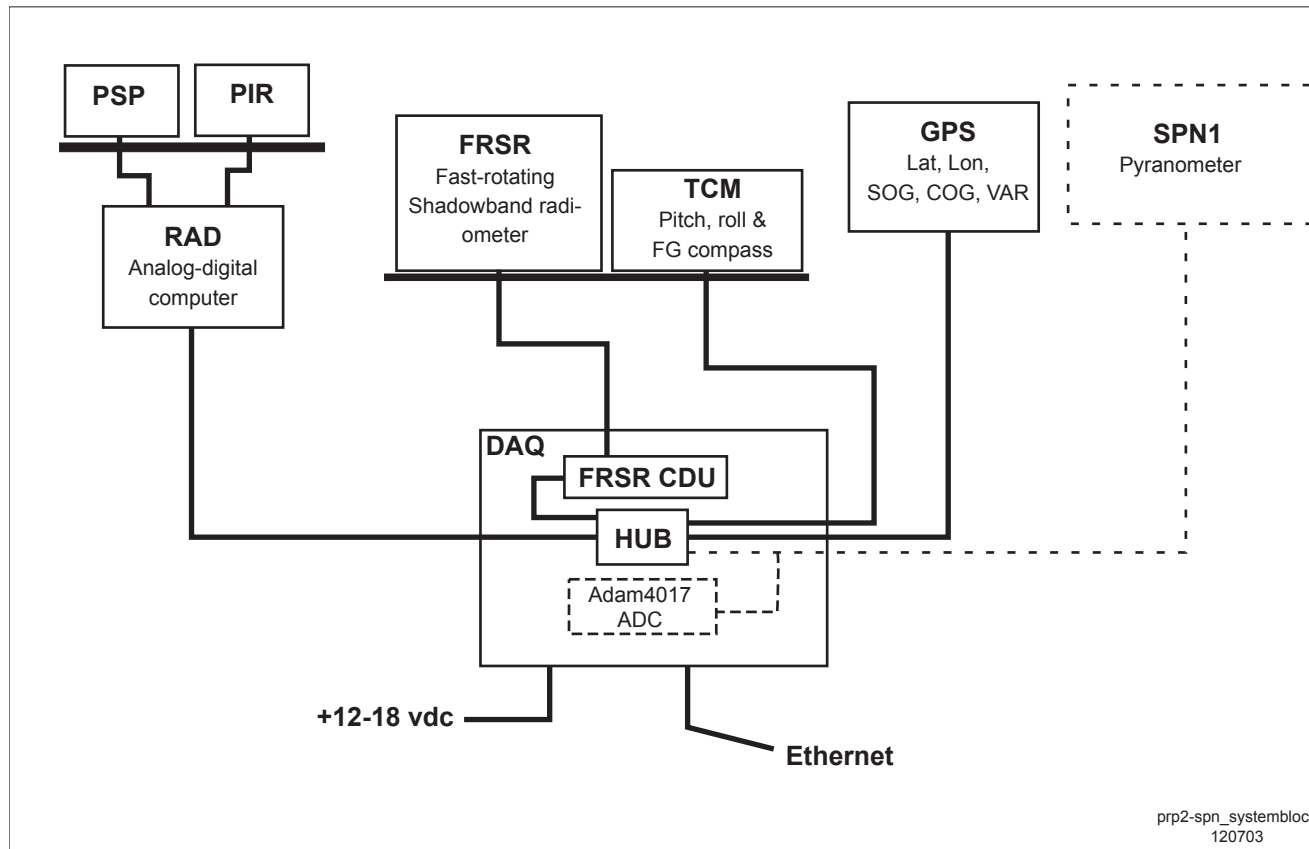
What is the PRP? The Portable Radiation Package (PRP) combines shortwave and longwave broadband radiometers with a RAD interface (Eppley PSP and PIR) with a fast-rotating shadowband radiometer (FRSR) into a single package suitable for radiation measurements from a moving platform such as a ship.

PRP BLOCK DIAGRAM (Current)



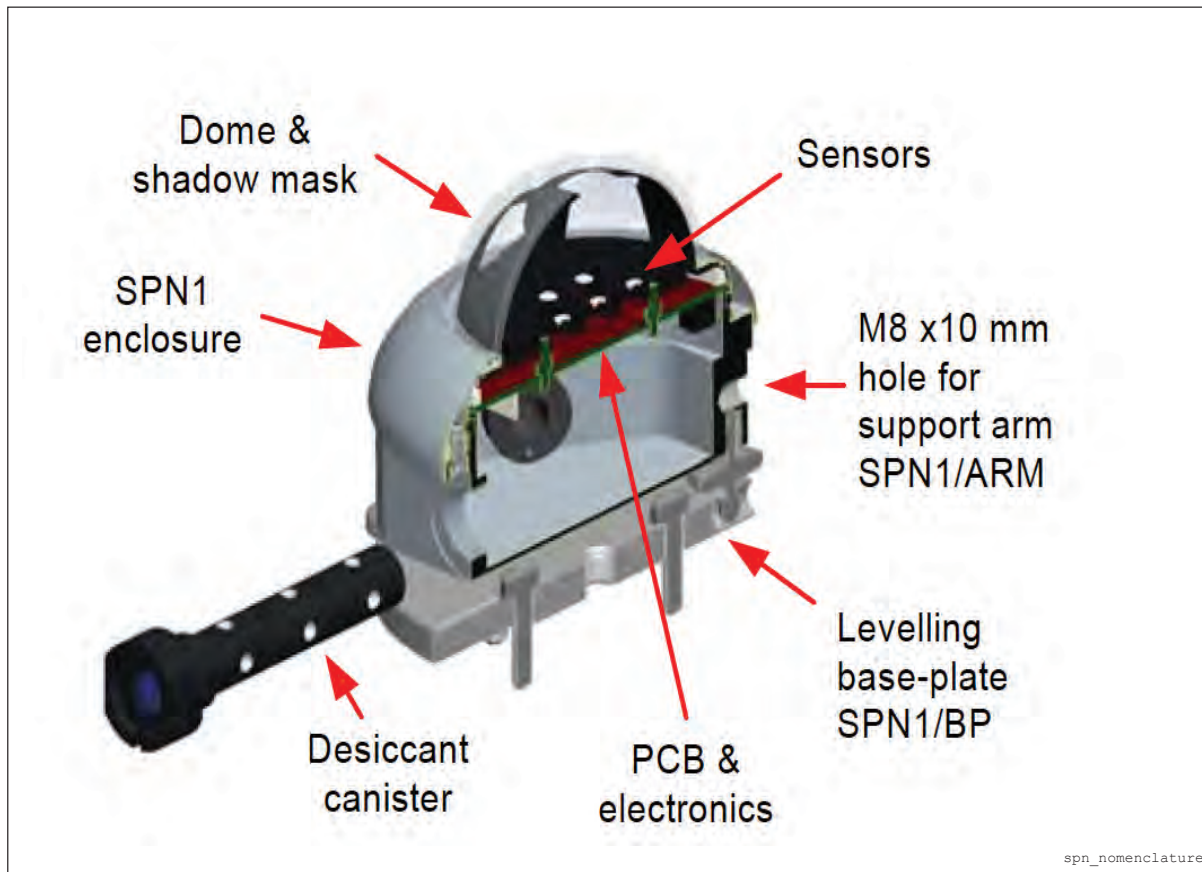
PSP: Eppley Precision Spectral Pyranometer. **PIR:** Eppley Precision Infrared Radiometer. **RAD:** RMR Co. Radiometer Analog to Digital interface. **FRSR:** Fast Rotating Shadowband Radiometer. **TCM:** Precision Navigation Inc. Tilt Compass sensor. **GPS:** Garman GPS17x. **WXT:** in the original design a possibility for the Vaisala WXT weather transmitter. (Note SPN1 will go here.) **DAQ:** RMR Co. Data Acquisition system; modular analog/serial ingest to ethernet. **CDU:** Control Data Unit for the FRSR. **HUB:** ICP PDS-style serial to ethernet converter.

ADDING THE SPN1

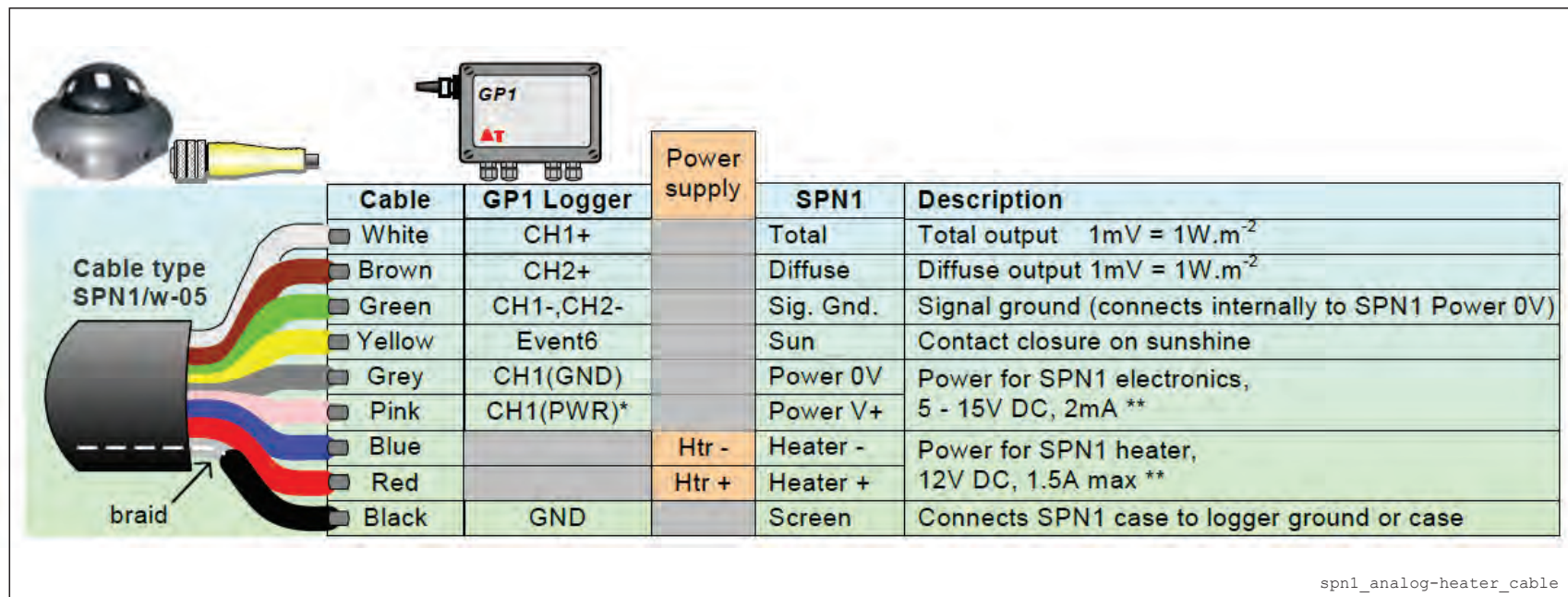


In order to add the SPN1 to the PRP data acquisition system we will add an analog-to-digital module, the Adam 4017. The 4017 is a remarkably robust and accurate 16 bit 8-channel ADC. The RS485 serial interface connects directly with the ICP PDS hub.

SPN1 NOMENCLATURE



SPN1/w-05 ANALOG & HEATER CONNECTION



Analog cable wiring.

White (Total output) and Brown (Diffuse output): 0V – 1.3V

Green: Signal ground

Yellow: relay closure to ground when sunshine.

Grey / Pink: Power Gnd / +V (>5 vdc).

Red / Blue: Heater +/- 12V 1.5A (max, depends on air temp)

SPN1-RS232 SERIAL CONNECTION

Note: 120604. There is not much in the manual about the serial connection nor about the serial interface. Software, setup, all assume you are buying their loggers and interface hardware which is unnecessary.

ANALOG VOLTAGE INTERPRETATION

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DAQ WIRING

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DAQ SOFTWARE w SPN1

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SPN1 SPECIFIC SOFTWARE MODULES

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SOFTWARE ORGANIZATION

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SPN1 DATA FILES

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EXPECTED COSTS

| | DESCRIPTION | EACH | QTY | TOTAL |
|---|---|------|-----|-------------|
| SPN INTEGRATION - MISC EXTRA COSTS | | | | |
| PARTS | | | | |
| | Plate, radiometer. A larger plate to accomodate PSP,PIR & SPN | 250 | 1 | 250 |
| | Cable, SPN. Modify the SPN cable for the PRP enclosure. Impulse MCIL8 plug. | 125 | 1 | 125 |
| | Adam4017 | 240 | 1 | 240 |
| | Misc hardware | 25 | 1 | 25 |
| | TOTAL PARTS | | | 640 |
| TASKS | | | | |
| | Install Adam4017 8 hrs | 35 | 8 | 280 |
| | Assemble radiometer plate. 2 hrs | 35 | 2 | 70 |
| | Data collection software | | | 0 |
| | Write processing code | | | 0 |
| | Burn-in testing | 35 | 4 | 140 |
| | TOTAL LABOR | | | 490 |
| | TASK TOTAL | | | 1130 |

TASK SUMMARY

- System design document, schematics, procedures. Data definition and file formats.
- Write simulation software.
- Design and build new mounting plate for PSP, PIR, and SPN1.
- Modify DAQ enclosure with new modules, wiring, and cable.
- Upgrade G ingest software, write avgspn.pl averaging software.
- Prepare computer. Prepare virtual machine operation.
- Testing and burn in.
- Packing and shipping to ANL. ANL field test (July/August)

SPN SCHEDULE

| MILESTONE | 6/4 | 6/11 | 6/18 | 6/25 | 7/2 | 7/9 | 7/16 | 7/23 | 7/30 | 8/6 | 8/13 | 8/27 | 9/3 | 9/10 | 9/17 | 9/24 | 10/1 |
|-------------------------------|-----|------|------|------|-----|-----|------|------|------|-----|------|------|-----|------|------|------|------|
| DESIGN PLAN COMPLETE | █ | | | | | | | | | | | | | | | | |
| SPREADSHEET/ORDER PARTS | | █ | | | | | | | | | | | | | | | |
| RECEIVE PARTS | | | | █ | | | | | | | | | | | | | |
| DESIGN RADIOMETER MOUNT PLATE | | | █ | | | | | | | | | | | | | | |
| RECEIVE MOUNT PLATE | | | | | █ | | | | | | | | | | | | |
| RECEIVE PRP FROM ANL | | | | | | █ | | | | | | | | | | | |
| ASSEMBLY COMPLETE | | | | | | | █ | | | | | | | | | | |
| SETUP FOR TEST AT ARGONNE | | | | | | | | █ | | | | | | | | | |
| TEST COMPLETE AT ANL | | | | | | | | | | | █ | | | | | | |
| OUTLINE SOFTWARE, DEFINE I/O | | | | | | | | | | | | | | | | | |
| SIMULATION CODE | | █ | | | | | | | | | | | | | | | |
| RAW INGEST CODE | | | █ | | | | | | | | | | | | | | |
| AVERAGING CODE | | | | | █ | | | | | | | | | | | | |
| DOCUMENTATION, MANUALS | | | | | | | | | | | █ | | | | | | |
| INSTALL ON SHIP | | | | | | | | | | | | | | | | | █ |

Dates above are the beginning of each week. Milestones are complete in the designated week.

