

Technical Specifications

September 29, 2009

Radar Wind Profiler

1. Introduction and Overview

The ARM program currently has six radar wind profilers (RWPs) in operation world-wide with four sites at the Southern Great Plains (SGP), one at the North Slope of Alaska (NSA) and one with the ARM Mobile Facility (AMF). This network provides a continuous depiction of atmospheric profiles of wind speed and direction to 3-6 km or more in clear air conditions and profiles of water/particle fall speed to as high as 14 km during precipitation. These data can also be used to estimate the height of the mixed layer within the planetary boundary layer as well as stratified stable layers. The current systems are limited to 5 pre-defined pointing positions, from which the horizontal wind profile is calculated based on the geometry of those beams

The second ARM mobile facility (AMF2) is designed to be capable of operating from a moving ship. When trying to operate the current version RWP from a ship, the motion of the ship marginalizes the usefulness of the pre-defined beams of the RWP. Even if the instrument is placed on a stabilized platform, the motion of the ship about the vertical axis is still extant. In addition, the metal super structure of a ship causes considerable ground clutter and scattering from the extended, moving sea surface contaminates the Doppler spectrum of the returned signal, thus further complicating data retrieval.

When the RWP phased array antenna has individual control over the phase and amplitude of all the array elements, it can provide arbitrarily pointed beams and so compensate for ship motion (so long as the ship orientation is known). Moreover, by appropriate amplitude shading of array elements, the side lobes near 90 degrees can be decreased so as to minimize ground clutter from both the ship and the sea surface. Thus this specification is for a relatively small RWP with full beam control capable of deployment with the AMF2.

2. Operational Specification

Beam-steered radar wind profiler with following specifications:

- Operating frequency of 1290 Mhz or equivalent
- Nominal peak transmit power 1 kW approximate

Technical Specifications

September 29, 2009

- Capable of arbitrary beam pointing control so as to implement stability control
- Beam pointing to 1 deg or better increments
- Beam pointing rate at 1 Hz or better
- Beam width 10 deg or less
- Antenna physical size approximately 3m X 3m (or less)
- Multiple transmit pulse lengths (.400 – 2.800 μ s)
- Variable, selectable coherent integration times
- Selectable spectral size and averaging
- Nominal 4 km range in normal clear air atmospheric conditions with 1.400 μ s pulse length
- Amplitude shading (or equivalent) of antenna elements to minimize sidelobes and ship/sea clutter

3. Software and Data Specifications

- Data content similar in content (but need not be identical) to current Vaisala LAP-3000 profilers
- Data reported at user-selected ranges
- Data to include spectral data and spectral moments from chosen pointing directions
- Data to include calculation of wind profiles and velocity along selected pointing directions averaged over user-defined time periods with quality control (% acceptable signals, e.g.) indicator
- Data to include signal amplitude/power in snr or C_n^2 or equivalent
- Support wireless data transfer
- Operating system capable of responding to external input of desired beam pointing direction to enable motion control
- The computer system, with the instrument application shall provide the necessary functionality to perform instrument control and to deliver instrument measurements to the ACRF data system
- The instrument computer shall generate hourly files of data and metadata (i.e., logs, hardware metadata, etc). Provide an explanation in the proposal if this condition cannot be met.
- The instrument computer shall have an FTP server
- Files to be delivered by the instrument computer to the ACRF data system shall be placed in a directory readable and writable by the data system user

Technical Specifications

September 29, 2009

using the ftp server

- The files placed in the collection directory by the instrument control process shall follow a file naming convention which ensures unique names for an arbitrarily long time series of files. The vendor shall provide scripting or other mechanism to allow ACRF instrument administrators to define the file name syntax
- The data system collection process shall validate that the instrument PC is synchronized with local NTP server. This requires that the instrument computer OS shall run a Network Time Protocol (NTP) compatible time synchronization mechanism. It recommended that MS Windows based systems use Dimension 4, Version 5.0 or later. Each ACRF measurement facility includes a GPS based NTP time reference
- The instrument application shall execute under an operating system (OS) that has operating system vendor provided support for security patches and OS updates for at least a 3 year period after system delivery to ACRF

4. Documentation

- Comprehensive users manual
- Trouble shooting guide
- Spare parts list
- Selected maintenance procedures

5. Mechanical Specifications

- Supporting electronics 19" rack mountable
- Instrument computer 50GB or greater solid-state hard drive if possible
- Antenna hardened against vibration, salt water environment
- Antenna size preferred less than 3 m X 3 m
- Antenna supplied with adequate tie-downs for land or ship deployment
- Antenna able to recover from water intrusion

6. Environmental Specifications

- Electronics at least -10 – 40 C operating range
- Antenna capable of operating during precipitation
- Antenna capable of operating between –40C and 45C.

7. Electrical Requirements

120/240 VAC, 50/60 Hz electrical supply

Technical Specifications

September 29, 2009

8. Safety

RF radiation levels outside of clutter fence less than 3.0 mW/cm^2

9. Site Installation

- Capable of straightforward/easy dismantling and installation within a few hours
- Appropriate tie-downs for installation either on ship or land

10. Instrument Support

- Include plan for phone real-time support
- Site visits as necessary
- Maintenance support option

11. Deliverables

- Electronics, cables, antenna, clutter fence
- Manuals, supporting documentation as above
- Acceptance test
- Progress reports