National HF Radar Technical Steering Team Meeting
July 19-20, 2011

NCAR
Boulder, Colorado

Summary

The annual meeting spanned July 19, 2011 and the morning of July 20, 2011. The goals of the meeting were to 1) revisit the Tiger Team topics from the 2010 meeting held in Washington, DC and 2) discuss the buildout of the national HF radar network based on the working assumption of a $5M available budget as proposed in the President's FY2012 Budget request.

The attendees were:

Don Barrick (technical expert)
Bill Birkemeier (by phone) (USACE, Federal Partner)
Pat Burke (NOAA CO-OPS, Federal Partner)
Bill Burnett (NOAA NDBC, Federal Partner)
Pierre Flament (U Hawaii, elected by RA vote)
Scott Glenn (Rutgers U, elected by RA vote)
Ming Ji (NOAA NWS Ocean Prediction Center, Federal Partner)
Mike Kosro (technical expert)
Jeff Paduan (Naval Postgraduate School, elected by RA vote)
Nick Shay (U Miami, elected by RA vote)
Eric Terrill (Scripps Institution of Oceanography, elected by RA vote)

Unable to attend were Steering Team members Larry Atkinson (Old Dominion U, elected by RA vote) and Rich Patchen (NOAA CSDL, Federal Partner).

Tiger Team Topics from 2010

1) Freshwater HF Radar (Jeff Paduan, Lead)

This Tiger Team report has been pending while awaiting the conclusion of the University of Michigan/CODAR Ocean Sensors field experiment that took place in May 2011. Data and analysis performed by Chad Whelan (CODAR Ocean Sensors), Lorelle Meadows and Chris Ruf (both U Michigan) were provided to the Steering Team prior to the meeting. The full Steering Team discussed some of the technical points of the experiment in order to provide input to Jeff for the Tiger Team report.

One of the most interesting results was the extremely clear correlation, seen at both 5 MHz and 42 MHz transmit frequencies, of the theoretical attenuation of HF power with range that was seen in the measurements made during this experiment. Other

measurements will help clarify the maximum useful ranges of HF radar under a couple of different wave regimes as well as under the diurnal variation of external radio frequency noise and interference. The other results will be discussed in the final Tiger Team report.

2) Waves and HF Radar (Don Barrick, Lead)

This Tiger Team had been developing a report for several months but had reached somewhat of an impasse as to how to characterize the difference between the utility and operational readiness of mapping wave parameters versus reporting average wave parameters for an area representing a larger radar cell. The two Tiger Team members who are not on the Steering Team (Josh Kohut, Rutgers U and Brian Haus, U Miami) called in for this portion of the meeting. Thus, all Tiger Team members were in attendance.

There was an extended and lively debate but there were some prevailing technical opinions. One specific idea was that significant wave height (SWH), a scalar quantity, could be a useful and robust output from the existing HF radars. Also recognized by the Steering Team was that SWH by itself does not meet the needs for wave measurement as delineated in the IOOS National Operational Wave Observation Plan. Other scalar parameters for wave direction and period can also be output, but full directional spectra -- e.g., "first-five spectral coefficients now produced robustly by *in situ* current measurements-- have not matured sufficiently. There have been successes with mapping the spatial variability of wave parameters. However, this is an area that deserves more research and development effort with differing opinions among the Steering Team as to the ultimate feasibility of wave mapping. Development of appropriate quality control procedures, file formats and metadata would be necessary for any wave parameter to be delivered operationally. The final Tiger Team report will articulate the nuances of this topic.

3) Modeling and Data Assimilation (Rich Patchen, Lead)

The Steering Team reiterated that this topic is vital to the widespread utility of HF radar surface current data. The ability to assimilate HF radar-derived surface currents into forecast models was noted as a necessary capability for a mature HF radar observing network.

An outline of the report has been distributed but, presently, this report requires a restart so that progress can be made. It was recognized that the modeling community has a number of success stories to tell which will be detailed in the Tiger Team report.

4) Technical Reasons for a Budget Line for HF Radar (Scott Glenn, Lead)

Because of the $5M request in the FY12 President's Budget, this topic has been rendered moot. See below for discussions of the FY12 Budget item.

Discussions of the FY12 $5M in the President's Budget

The Steering Team provided technical opinions based on empirical evidence from many years of operating HF radars throughout the US (some operators have been operating HF radars for more than 18 years). A performance metric for the national HF radar network has been put forward in the Congressional Justification document that requires an 80% uptime and 80% spatial coverage ("80/80 metric") for each HF radar. The following technical opinions and facts lead the Team to conclude that the national HF radar network can make progress toward meeting this metric in an operational status at a realistic funding level of approximately $7.6M.

1) The Steering Team estimates that the required funds for annual operations and maintenance (O&M), recurring costs and spare parts of the existing 124 radars is approximately $6.6M.
2) In addition to O&M, a number of tasks (see table below) are required annually at the national level to fully operationalize the network. The costs of these tasks total approximately $1M.
3) Combining 1) O&M support for all 124 radars with 2) the additional necessary tasks for operationalizing the national radar network yields a **total annual support of approximately $7.6M**.
4) Tasks for FY2011 at the national level comprised approximately $700K.
5) In the FY2011 proposals from the RCOOSes, approximately $3.3M was designated in regional HF radar tasks including O&M, data analysis and product development.
6) With a budget limited to approximately $5M, and by prioritizing radars in accordance with the FY12 OMB passback language (see below), the necessary O&M, recurring costs and spare parts for approximately 60% of the existing radars in addition to a number of key HF radar tasks (approximately $1M) can be supported.
7) To meet the 80/80 metric for as many existing radars as funding allows, it is reasonable that new radars would not be purchased during FY12.
8) The Steering Team notes that limiting the budget to $5M and prioritizing radars will lead to a non-uniform level of O&M across the network, that is, 40% of the radars will suffer from a sub-optimal level of O&M support.
9) The Steering Team notes that the potential $5M in the President's Budget plus the $3.3M proposed by the RCOOSes in FY11 (total = $8.3M) is more than sufficient to fund the entire network including the key national-level tasks ($7.6M).

The following table assumes that 75 radars (about 60% of the total IOOS network) can be designated for O&M funding for FY12 (column A). In column B are the costs of all the radars presently in the network along with the key tasks necessary for the network transition to operations.

Item/Task	**A. FY2012 Cost Priority 1 Radars**	**B. FY2012 Cost All Radars**
O&M*	2786	4569
Recurring Costs**	750	1230
Spare Parts***	500	820
New Radars	0	0
SAROPS – STPS Mtce	150	150
SAROPS – OI & Data Flow	75	75
Servers	350	350
QC Dev	150	150
Archiving - NODC/NDBC	100	100
Meetings – Steering Team	30	30
GEO	100	100
ORFM Services & Travel	60	60
Total	**5051**	**7634**

- *Assumes the Plan recommendations of 2 HFR technicians per 7 radars at an encumbered salary of $130K each.
- **Recurring costs based on $10K per year per radar.
- ***Spare parts costs based on $100K in parts (roughly cost of one complete radar) for every 15 radars.

OMB Passback Language:

"*Passback provides and (sic) additional $5M to improve monitoring of near shore*

currents using technologies such as HF Radar. The utility of HF Radar was most recently highlighted during the deepwater spill with real-time network data provided by OR&R, to provide trajectory maps and to identify oil that might make its way into the loop current. Funds should be prioritized on the operation of existing radar systems located in regions of offshore oil production (and) in the vicinity of major ports and harbors."