



# Lessons Learned in Transitioning Research to Operations: Applications to Space Weather

Presentation at the 11<sup>th</sup> Conference on Space Weather

by

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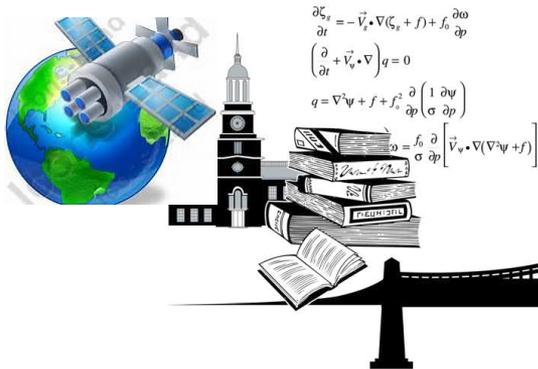
February 4, 2014

# Bridging the Valley of Death

Need for operational community to use advances coming out of the research community - transitioning science and technology from research to operations is difficult!

Successful R2O organizations serve as a “bridge over the valley of death” and rely on proven principles which are characteristic of these R2O programs

- NASA Short-term Prediction Research and Transition (SPoRT)
- NASA Applied Meteorology Unit (AMU)



# Short-term Prediction Research and Transition (SPoRT) Project

Focused on transitioning unique NASA and NOAA observations and research capabilities to the operational weather community to improve short-term weather forecasts on a regional and local scale.

- ❖ Established in 2002
- ❖ Successful paradigm for end user involvement – footbridge over the “valley of death”



## Observables and solutions to weather forecast problems

- low clouds, fog, smoke and events causing obstructions to visibility
- data void regions (coastal and ocean regions)
- atmospheric processes leading to severe storm development, lightning detection and lightning safety
- data assimilation for improved short-term forecasts



# Applied Meteorology Unit (AMU)

Supporting America's Space Program through  
Infusion of Weather Technology into Operations



The AMU bridges the gap between research and operations to improve weather support to the National Space Program by

- Testing, evaluating and developing new technology and techniques
- Transitioning improved capability to operational customers
- Facilitating technical exchange between research and operations
- Providing technical expertise to improve operation, maintenance and modernization of existing resources

Success based on stakeholder involvement in the entire tasking process

- Quasi-annual cycle including survey of spaceflight operations weather community: the stakeholders
- Stakeholders select projects and set priorities for AMU staff
- AMU staff work closely with stakeholders throughout each project to include testing and training

Projects cover wide range of operational needs to include

- Lightning and severe weather, low- and upper-level wind assessment, high resolution NWP and data assimilation, sensor evaluations, climatologies, statistical studies, weather analysis and display system integration, etc.

# Principles of Successful R2O Organizations

## 1) Functioning R2O entity should be external to benefiting or end user organization

- protection from external budgetary pressures
- strive for multiple funding supporting common cause
- use interagency agreements / partnerships to guide work
- ❖ SPoRT has NASA and NOAA funding to transition research data to operations and MOU and IAAs provide overarching collaborative guidance.
- ❖ AMU funded by NASA with USAF and NWS operational customers. MOU for guidance.

**Avoid implementing R2O team in end user environment**

# Principles of Successful R2O Organizations

## 2 Staffing tailored to R2O needs

- need broad range of competencies with advanced degrees
- staff should have a blend of research / operational experience
- flexibility of staff assignments to address changing needs
  
- ❖ SPoRT has modelers, atmospheric remote sensing scientists, decision support system experts - researchers and forecasters
- ❖ AMU staff members experience in both research and operations – pair staff with end users

**Need staff with diverse expertise - research AND operations experience**

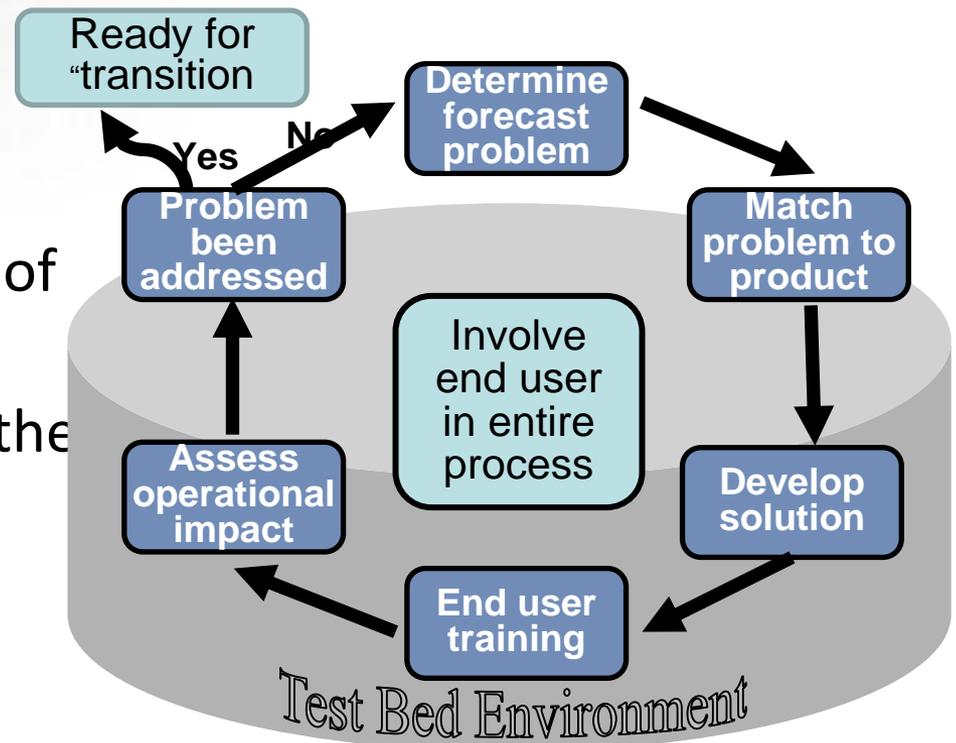
# Principles of Successful R2O Organizations

## 3) Limit scope of research and operations

- draw on “low hanging fruit” of research community
- focus on transition
- involve end user in process

- ❖ SPoRT draws on successes of research community
- ❖ AMU focuses on bridging the gap between research and operations

**Involve end user in the entire process**



The SPoRT Paradigm

# Principles of Successful R2O Organizations

## 4) Develop tasks based on customers / end user input with overarching guidance from supporting organizations

- identify end user problems / tasks within organizational scope
- develops ownership in process by end user
- greater confidence end product fits user needs and will be used
- ❖ SPoRT addresses end user forecast problems additional guidance from stakeholders and external advisory committees
- ❖ AMU holds annual task meetings with users / stakeholders to define scope of work

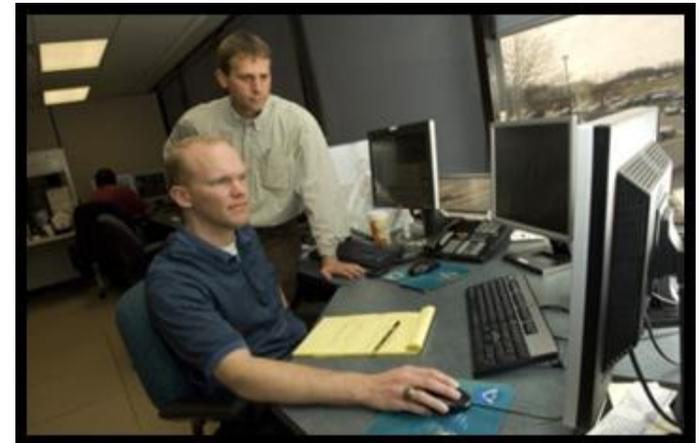
**Focus on end user problems and forecast challenges**

# Principles of Successful R2O Organizations

## 5) Collocate R2O staff with end user

- allows regular interaction between R2O team and users
- understand mission and operational constraints

- ❖ SPoRT is collocated with Huntsville NWS WFO at the NSSTC with a 24/7 open door policy.
- ❖ AMU is adjacent to Range Weather Operations at the Cape Canaveral Air Force Station allowing daily interactions



**Collocation of R2O staff difficult for existing organizations. Consider other mechanisms for regular interaction.**

# Summary

Transitioning science and technology from research to operations is very important but difficult! Following some proven principles used by long-standing R2O projects can improve chances of success.

- R2O entity should be external to benefiting organization
- need staff with diverse expertise - research AND operations experience
- limit internal research – draw from community as needed
- be user focused, look to them for tasks and forecast problems, and involve end user in the entire process
- collocation of R2O staff is important for regular interaction

Merceret, F. J., T.P. O'Brien, W. P. Roeder, L. L. Huddleston, W. H. Bauman III, and G. J. Jedlovec, 2013: Transitioning Research to Operations: Transforming the “Valley of Death” Into a “Valley of Opportunity”. *Space Weather*, **11**, 1-4.