NASA SHORT-TERM PREDICTION RESEARCH AND TRANSITION CENTER

SCIENCE ADVISORY COMMITTEE RECOMMENDATIONS

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NASA SPoRT
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I. Introduction

This report summarizes program feedback from the Short-Term Prediction Research and Transition (SPoRT) Center's Science Advisory Committee (SAC). The SAC reviewed SPoRT program material from 26-28 August 2014 at the National Space Science and Technology Center in Huntsville, Alabama.

The following individuals comprised the SAC and contributed to the contents of this report:

- Tom Bradshaw (NWS)
- Andy Edman (NWS)
- Larry Friedl (NASA)
- Ming Ji (NWS)
- Sujay Kumar (SAIC/NASA)
- Tsengdar Lee (NASA)
- Christa Peters-Lidard (NASA)
- Greg Mandt (NOAA)
- Dave Radell (NOAA)
- Kim Runk (NOAA)

Prior to the SAC meeting, SPoRT requested that the SAC be prepared to provide the following:

- Feedback on the strengths, weaknesses, accomplishments and failings of the SPoRT program
- Guidance on organizational structure, partners, end users, as necessary, including potential new SAC members
- Direction and emphasis of future activities
- Preliminary feedback at end of meeting (usually in viewchart form)
- A report that summarizes the meeting and provides recommendations for the future (to be delivered within 3 months of the meeting)

SPoRT identified the following anticipated benefits from a thorough SAC review:

- SPoRT scientists – improve focus of activities
- NASA Headquarters program manager – help guide program emphasis
- NOAA program managers – help guide program emphasis to better serve need
- Beneficiaries, partners, and end users – know that SPoRT is determined to provide best quality / services to those who rely on us!

The SAC was given background material on SPoRT's mission and activities, and the previous SAC report from 2012. SAC members evaluated the SPoRT briefings and documented their individual feedback. The SAC then met together to consolidate the input from its members into a coherent preliminary feedback briefing given to SPoRT on the final day. The SAC reconvened

in mid-Oct to finalize their feedback in preparation for completing this report. The SAC is satisfied that this report fulfills their commitment to SPoRT.

II. Overall SPoRT Program Feedback

- Outstanding effort to form a Science Advisory Committee (SAC) and respond to its recommendations SPORT is a stronger program because of it
- SPoRT has been able to maintain remarkable fidelity to its core operating paradigm, with strong relationships with end-users being at its heart. They are consistently able to quickly integrate their products into NWS systems.
- Outstanding work broadening user base to ensure SPoRT viability for years to come. Be careful not to be stretched too thin and prioritize work.
- SPoRT has done a great job of building a team of young and enthusiastic technical experts, which will ensure future success.
- Action needed to ensure transition to long term operations needs to be considered throughout the work on a particular initiative. Work closely with participants to ensure a realistic view of operational viability
- Budget -- SPoRT should be very proud of their ability to maintain stable budget/staffing levels from 2007/8 through the current recession and budget shortages. Not many organizations were able to maintain or grow during this period
- Feedback on the logistics of the SAC Meeting
    - Outstanding meeting facility
    - Well organized pre-meeting preparation and reasonable agenda
    - Very responsive staff to SAC requests
    - The Video Wall is a great capability

III. Overall SPoRT Program Recommendations

- The NOAA and NASA satellite programs (Suomi-NPP, GOES R, JPSS) recognize the value of SPoRT in finding ways to improve the use of satellite data in NWS operations. SPoRT should look for ways to strengthen their strategic relationships with NASA HQ, NESDIS HQ and NWS HQ to maintain a clearly defined role in transitioning satellite data into NWS operations.
- SPoRT has excelled in responding to user requests and requirements (reactive). They need to seek opportunities to proactively share knowledge and provide "suggestions" to their users (NWS) as to what is needed to improve use of satellite data operationally.
- SPoRT has developed a close working relationship with the WFOs and National Centers. This has resulted in a program that has been effective in exposing the field offices to new science and satellite technology, while incorporating forecaster feedback into improved satellite service. This is the core of your success and we strongly encourage SPoRT to continue this approach.
- SPoRT needs to continue successful strategic planning to ensure that they maintain, or have access to, the critical technical expertise needed to be the center of excellence in those areas they want to be involved in.

- In branching out into too many diverse areas, SPoRT may find it difficult to sustain these initiatives over a long period
- Traditional satellite-derived quantitative precipitation estimates (QPE) continues to receive low scores from the forecast community. However there are interesting results emerging about the performance of soil moisture. In addition, there was a very good conversation during the review about exploring a multi data/ data fusion such as GOES-R and GPM approach to improving QPE. We would encourage a focused, more comprehensive, effort to explore alternative approaches to QPE which could yield better results.
- SPoRT should seek opportunities for closer interactions with NWS National Centers and other modeling centers. For example in soil moisture modeling, SPoRT should work with the National Water Center, WPC, RFCs, SMAP Program and other programs, to determine how SPoRT work can be used in flood guidance
- SPoRT should build on the excellent relationship with NWS WFOs by building stronger link with NWS national programs (e.g. AWIPS, Training, Dissemination, NOAA Testbeds and affiliated Proving Grounds)
- Focus efforts at WFOs applying a defined time frame "demonstration period" for an explicit purpose (e.g. gain feedback on research, transition product into the WFO, gain feedback in order to help NWS implement product nationwide).
- SPoRT should pay attention to the SLI and commercial land imaging development. Many disaster monitoring activities may have a natural follow on activities there.
- SPoRT needs to redefine its modeling niche within the vision of NWS, and partnering with JCSDA to focus on working under national modeling frameworks.
    - SPoRT has focused on local and regional modeling. The HRRR and soon the GFS will be operational using non-hydrostatic framework at convection-permitting scales.
    - SPoRT should define their vision for satellite assimilation into their land product models. Current strategy is focused only on soil moisture assimilation. There are many other sources of hydrological remote sensing data including soil moisture, snow, terrestrial water storage, land surface temperature. SPoRT should coordinate with LDAS efforts happening at other agencies

IV. Specific Session Feedback, Recommendations, and Suggestions

A. Session 2: Products, Training Assessment

A.1. Feedback

- Good interaction with users during periods of evaluation of Red, Green, Blue (RGB) capabilities. Extensive surveys capture very focused feedback. An example of interaction: Snowfall Rate was evaluated by three offices in Eastern Region. SPoRT helped STAR organize this evaluation.
- Training
    - Excellent use of multiple ways of training
    - Good use of short and very focused training
    - Some of the best satellite training available at WFOs is from SPoRT. SPoRT has successfully adapted many of the best practices of WDTB, COMET and training centers in terms of developing and delivering efficient training to NWS field staff

- It will be good to quantify the reasons for the 'small impact' of the product being used. Is the 'small impact' feedback due to the poor quality of the product itself, the poor quality for the particular case or due to the lack of familiarity/training to the product?
- One-pagers are very popular with NWS forecast staff. These are perhaps good models for other Cooperative Institutes (CIs).
- End user involvement and buy-in is crucial to successful research-to-operations (R2O) transition. Inclusion of training is also important. One of the keys to SPoRT's success (and favorable reputation among forecasters) is that they begin with identification of a practical forecast problem, then match that to a specific product, capability, or tool. They are also committed to reiterating until solution is deemed as ready for operations.
- Ozone RGB overlaid with potential vorticity makes a visually appealing display that is easy to interpret when diagnosing possible stratospheric intrusion associated with a tropopause fold. Very good work!
- Lots of opportunity (and need) to explore improvements to some RGB combinations, and to investigate optimal versions for operational implementation

A.2. Recommendations

- SPoRT has extensive experience in satellite training for (NWS) users. NWS should include SPoRT in the NWS training development team for Satellites (GOES/POES) (Action John Ogren, Leroy Spayd to make initial contact to explore how to incorporate into national training program)
- The SPoRT product assessment program is a huge success. Continue with the rigorous product assessment paradigm that you've developed, which could perhaps be used as a model for other CIs.
- SPoRT may want to consider centralized training material outlet with an automatic notification service. SPoRT has a lot of experience communicating with the users using multiple channels. SPoRT may expand these channels to include notification service.
- Would like to see more SPoRT interactions and collaboration with other satellite research groups like NOAA-CREST (CUNY) and NESDIS STAR. These groups could potentially benefit from SPoRTs success with training development and product assessment.

A.3. Suggestions

- SPoRT should consider what data can be used as observations that serve to calibrate model output, so that a fused imagery/modeled forecast might be produced?
- The product focus seems very qualitative, e.g., delivery of images that forecasters can display using AWIPS. SPoRT should determine how this strategy can evolve to be more quantitative
- Although not presented at this session about the multi-media communications, SPoRT should continue to use blogs, facebooks, twitter, web pages, and email to communicate with the users. This approach would supply success stories to be used as part of the training and outreach program.
- Note that the SPoRT model of developing collaborative relationships to focus on pooling resources to address a specific forecast problem is a proven and effective paradigm

should continue. Stay committed to this formula to the extent possible, with the understanding that resources and demand may restrict this capability to some degree.

B. Session 3: GOES-R/JPSS Proving Ground Activities

B.1. Feedback

- It is very positive that SPoRT works with Algorithm Working Groups (AWGs) developers to transition new/updated products.
- Total Lightning
  - Good ties to WFOs through Proving Grounds and the leveraging of existing testbed capabilities
  - Good work on recognizing the need for changes in the products in support of NCEP Centers.
  - Total Lightning effort is very good
  - Continue the deliberate sharing of examples other than the traditional severe storm warning decision process.
- OCONUS
  - SPoRT's responsiveness to OCONUS challenges and willingness to work with AK, the Pac Region, and Puerto Rico in person has yielded great results.
  - 24-hr Microphysics proposal - new product for testing. Good example of working issues with a capability to make it more useful to the users.

B.2. Recommendations

- SPoRT should look for opportunities to integrate data from multiple systems to identify solutions to NWS forecast problems, as opposed to focusing on individual products
- The AK fused product (GOES and Polar) is a very interesting approach to data fusion of two disparate data sets. We would encourage SPoRT to explore more concepts like this.
- Forecasters keep saying RGB is hard to use. SPoRT needs to work with the forecasters to find ways to make it easier. Consider such actions as putting a graphic on the image to help identify the type of weather phenomenon in the image.

B.3. Suggestions

- SPORT should consider enabling increased use of satellite data in enhanced probabilistic forecasting approaches. Consider work on the following issues:
  - Is there uncertainty estimate associated with each product (e.g., QPE, GLM,)
  - The trainings should incorporate uncertainty/probabilistic nature of the products/forecasts (e.g., forecaster confidence in data - toward probabilistic knowledge/estimates on Wx events)

C. Session 4: Decision Support System

C.1. Feedback

- SPoRT sample plug-ins to ingest and display HMS data in AWIPS has great potential.
- The SPoRT Experimental Products Development Team (EPDT) is a success story.
  - Should be considered a model for how a collaborative developmental community should operate. Could have significant influence on projects like Virtual Lab.

  - All three presentations were forward looking and very professional--OGC approach is something NWS should be paying attention to.
  - With the potential expansion plans, there should be a mechanism in place to prioritize projects.
- SPoRT's participation in AWIPS governance activities is very important and commendable.

C.2. Recommendations

- Web Based Data Delivery, OGC core infrastructure, and cloud architecture directions are very exciting and visionary. The SAC enthusiastically endorse and encourage the movement into OGC/WBDD. Continue to pursue this direction.
  - SPoRT should brief the AWIPS - Next team.
  - SPoRT should be aware of the NWS GIS project (Luis Cano, DISS Portfolio lead) which will define NWS GIS standards. SPoRT should coordinate with the NWS GIS project and seeking opportunities to influence NWS on OGC applications.
  - Communicate your ideas to NASA HQ, NESDIS, and NWS.
- Examine and consider consolidating AWIPS development/assistance. It seems as though currently, it's product-dependent. This leads to some question as to whom to contact in any given situation. Should have one or two key AWIPS support personnel.
- SPoRT should continue to participate closely in AWIPS governance activities.

C.3. Suggestions. None identified.

D. Session 5: Modeling and Data Assimilation

D.1. Feedback

- Good communication with users
- Good examples of practical, effective use of radiance assimilation to improve regional weather modeling (refinement of atmospheric rivers, improved depiction of stratospheric intrusions and influence on cyclogenesis, non-convective winds, cloud top representation). These activities highlight the value of a comprehensive, two-way iterative research-to-operations (R2O), and operations-to-research (O2R) processes.
- Using GSI for assimilation of hyperspectral IR data is a good example of the O2R approach.
- Collaboration with NOAA Water Center could produce some important advances for hydrologic forecasting, enhanced streamflow and routing prediction, flood and flash flood potential, etc.
- LIS -- very good work -- need to use to improve Flash Flood Guidance – the WPC uses FFG heavily in support of flash flood forecast program,
- SPoRT has done a great job with the transition of MODIS GVF data into LIS modeling efforts. It will be great to see the full range of MODIS/VIIRS data products being used (LAI/Albedo/Emissivity). The switch to some of these datasets will be warranted due to significant changes in model versions that are expected soon.

D.2. Recommendations

- Highlight individual, short-term cases that demonstrate the impact of soil moisture data assimilation
- Consider revising the strategy for assimilating SMAP data to employ radiance assimilation - the product assimilation strategy used for SMOS will not be viable if expedited assimilation of SMAP is desired.
- Consider using standard approaches such as drought percentiles/indices through formal tools such as LVT, for situational awareness applications.
- Consider expanding the suite of models within LIS to be better aligned with NWC/OHD/RFC/NCEP - beyond the Noah land surface model. Similarly, streamflow routing models can be employed to assist with flood risk assessments instead of land model alone.
- SPoRT should note that the operational approach in data assimilation is to assimilate radiance. Keep in mind that part of the "O2R" concept (using operational system to conduct research where practical) is to enable effective Research-to-Operations transitions.
- Recommend SPoRT focus on collaborating with WFOs in conducting "local studies" using operational model guidance to address science issues/improving forecasts. Note: the notion of "local studies" excludes running local model for operational use.
- LIS work should be high priority. Drought and flooding potential products should be the near-term opportunity.

D.3. Suggestions

- Apply insight about soil moisture conditions to issues like drought forecasting and flood potential which deserves visibility among operational forecasters.
- The use of data assimilation and ensembles, provides a unique opportunity to develop probabilistic forecast measures (e.g. probability of drought/flood risk)

E. Session 6: SAC Discussion with SPoRT End Users

E.1. Feedback

- It was very helpful to have standard template for WFO briefings.
- WFOs were very engaged in the telecon.
- It is clear that SPoRT is very aware of the issues that their partner WFOs were most concerned about.
- These efforts should not "stop here" (at these WFOs), but be part of an end-to-end approach leading to the eventual NWS-wide field deployment of these products.
- For products not destined for operations, based on user feedback or otherwise, there needs to be a clear termination point for SPoRT involvement with partners, as well as the data sets.
- Kudos to SPoRT team. Many high praises from the users on the telecon.

E.2. Recommendations

- SPoRT should participate in the discussions on how to help train forecasters on the very popular NT Microphysics capability
- As SPoRT expansion proceeds, ensure that strong "connectivity" with end-users continues. Consider a "customer satisfaction survey" to ensure that your relationship with WFOs and other end-users remains at a satisfactory level
- SPoRT should look to cultivate relationships with the Satellite Liaisons.

E.3. Suggestions. None identified.

F. Session 7: Disaster Response

F.1. Feedback

- How will non-NOAA data (eg. ASTER) be used since it is not NOAA/NWS operational? What are the plans to 'operationally' incorporate non-NOAA satellite data into an NWS-operational system?
- SPoRT's applied science exploratory projects are outstanding examples of the potential for high resolution, satellite-based products to inform disaster response and recovery operations for resource positioning or risk management decisions (pre vs. post event power outage, storm damage scars, hail damage swaths, etc.). This will clearly be a growth area. Success in this area will strengthen NASA and NOAA partnerships with FEMA and will contribute in a meaningful way to the National Response Framework.
- SPoRT's concepts and framework for tornado and hail damage detection are first class -- the NWS needs to evaluate these.
- Support for web and mobile clients is a rapidly growing need. The flexibility, reliability, and scalability offered by developing a core infrastructure founded on WMS within OGC standards applications is exciting and compelling. SPoRT should continue work in this area.
- SPoRT's efforts to automate and streamline at least some of the processing steps are commendable. This will decrease the time need to deliver the project, and require fewer SPoRT resources.

F.2. Recommendations

- The work with the experimental DNB RGB imagery for use in disaster response is very impressive. Demand is almost certain to increase. Commendable innovation and initiative shown by the SPoRT team to provide the data, and react promptly to modify the data on the fly to make it easier for users to interpret.
    - Would like to engage NASA SPoRT in integrating DNB RGB imagery for disaster response into NWS DSS Boot Camp. It's important for meteorologists who go on-site to an EOC to become familiar with experimental tools and data sets that might be available on an incident AND to understand how to properly interpret them for EM decisions.

F.3. Suggestions.

- Make DAT Summit (Jul 2014) info available to SAC members if they wish

- SPoRT should begin considering to what degree it is prepared to become a TRUE operational, on-demand provider of disaster response data (e.g. TS power outages), and what resources will be required.

G. Session 8: Other Related and Supporting Collaborations

G.1. Feedback

- Key partners need to be identified now with some of the new science analysis/forecast issues objectives. For example, who will SPoRT work within the realm of aerosols and food/water security to transition any potential products or algorithms, etc. to transition any potential products to operations?
- Interesting experiments in cloud-based VM NWP guidance (Amazon EC-2 based capability for generating WRF-EMS using IaaS). Q: For what categories of applications does cost-benefit analysis suggest value of metered cloud service as compared to building a high performance computing system?
- Very creative way to bring it additional opportunities to SPoRT. An excellent paradigm for R2O. There is a large burden on SPoRT to be maintain close strategically connection to operational agencies, to ensure their transition projects are appropriately aligned with these agencies' strategic directions.
- SPoRT needs to be careful that any work with a "direct transition" into EMC doesn't become simply "doing work for" EMC, as opposed to bringing mature S&T into improved operational models.

G.2. Recommendations

- Expand collaboration efforts with non-traditional partners and explore emerging service sectors will likely broaden SPoRT's reach, visibility, and value. As long as staffing and resources allow these activities to remain viable without adversely impacting existing commitments, see no reason to oppose this direction.
- SPoRT to maintain a close collaboration with MDL which "owns" the VLab. SPoRT could be a conduit enabling WFOs to conduct local studies on the IDP environment using WRF-EMS, and conducting model evaluation/validation studies, other projects.

G.3. Suggestions

- Actively participate/leverage the NWS centralized development/testing environment Through the Virtual Lab to engage the NWS field (regions, national centers).

H. Session 9: Looking to the Future

H.1. Feedback

- SPoRT vision, goals, and objectives had a lot of good details
- Excellent process (Strategic Planning Workshop, SWOT Analysis) supporting SPoRT Strategic Planning.

H.2. Recommendations

- Provide background justification and prioritization for Programmatic and Strategic Objectives. New NOAA/NWS Goal, ROSES Funding, JPSS-GOES-R Funding, SAC Direction, SPoRT Personnel interest/technical background, etc (Sjoberg)
- With funding coming from an increasingly broader non-NOAA community evaluate membership of SAC for future SAC meeting.
- NWS now has STI and an annual AOP process.
  - Recommend intentional synergy with the AOP process to facilitate strategic prioritization
  - Working on the "OSIP" backlog of problems(field requirements), ensure these are strategically coordinated and prioritized

H.3. Suggestions

- The focus towards international applications is great. LIS modeling efforts also span regions such as Middle East, North Africa, Afghanistan. SPoRT could be a good fit to take on the transition to continued operations.
- Coupling LIS with SMAP and GPM to produce soil moisture products for the forecasters is a low hanging fruit and should be captured.