Research to Ops (R2O)
Outline

• Overview
• Operationalization: Process & Issues
• CCMC OWG
• SWFL Potentials for CCMC
Overview

- Operationalization = Research to Ops
- Needs completed ops-relevant research
  - Plenty exists
- Needs ops requirements & funding applied
  - Not so much
- Progressing towards more ops-applied (system-impact) products
Operationalization Process
Simplified

• General Process
  – Have Idea for product (ID model)
  – Apply existing requirements (if any)
  – Promote/Sell
  – Get Advocate(s)/Customer(s)
  – Rewrite Requirements to match product/prototype
  – Start building product/prototype
  – Get funding
  – Rewrite requirements to match product & sponsor
  – Continue building product

• (Continued)
  – Find/Get a host
  – Rewrite requirements to match product & host
  – Finish building the product
  – Final rewrite of requirements
  – Deliver product/prototype & documentation
  – Repeat all for ops version
    • With varied amounts of funding & contractor support loss
  – Integrate the product into ops
  – Maintain/Train product/sw
  – Upgrade (repeat process)?

Complexities: contracting, design, test, validation, classification, accreditation
SMC/SYAG’s Organizational Standard Prototype Process (OSPP)

- Concept phase
  - Concept Statement of Work
  - Project Concept Definition

- Elicitation & Analysis phase
  - Software Requirements Specification
  - Prototype or Visual Storyboard

- Project Management phase
  - Level of Effort
  - Integrated Project Plan

- Detailed Analysis & Design phase
  - Software Design Document
  - Software Test Plan

- Code phase
  - Source Code
  - Unit Test Report
  - Software Users Manual
  - Software Test Description

- Prototype Test & Validation phase
  - Software Test Report

- Demonstration & Delivery phase
Operationalization Process
Players in the Space Wx Ops Arena

- Organizations in the research-to-ops process include:
  - Researchers
    - Gov/DoD Labs, Universities
    - (Commercial Research Entities)
  - Research-to-Ops Units
    - Requirements-generating units
    - RPCs
    - Contract Organizations
    - CCMC
  - Ops Product Hosts & Users
    - Data/Warning/Forecast Centers
    - Anomaly Analysis Groups
    - Radar, SATCOM & Satellite Ops
    - Mission Commanders
    - Soldiers in the Field
      - (technology end users)
Issues with Operationalization

(** = Contribute to “Valley of Death”)

• Multi-Organization Coordination
• **Funding**
• Lack of Customers
• Too many customers (“Multiple Targets”)
• **Changes During Process (“Moving Targets”)**
• **Personnel & Mission Changes**
• Ambiguous Requirements
• Facilities issues

• Env Input Data Requirements
  – Quality
  – Availability
• Asset Data Requirements
  – Specs & Thresholds
  – Lack of validation obs
• Mission Data Acquisition
  – Business rules
• Security classification**
• Politics**
Issue
Funding

• Few space environment research-to-ops programs have ever been an officially “funded program”
  – Not “POMed” (in a program objective memorandum)

• Funding has been “catch-as-catch can”
  – From other organizations/program’s fallout money

• Applicable government organizations (SMC, AFSPC, AFRL, AFOSR, etc) are constrained by the “color” of money they have to spend
  – 6200 = Research
  – 6300 = Applied for Ops Transition
  – Can’t spend one type of $ on a different type of project
Issue
Moving Targets

• Undetermined Hardware / Software Interfaces
  – Mainframe vs PC
  – Stand-alone vs Net Centricity

• Changing Product Requirements
  – From the sponsor/customer
  – Internally, from increasingly more enlightened development personnel

• Change of Customer (Delivery Site) for SEEFS**
  – First to undetermined host site
  – Then to multiple sites (DMO-S, JSPOC, MHPCC, AFWA)
  – Current discussions about host site, user support, env models location
    • Customer Support vs. Host Agency Mandates vs. Config Mngt issue
      – Must have an answer for the war fighter
      – Can’t have two different answers for the war fighter
      – Don’t prefer differing env model outputs available to customers
      – Strong preference for validated models, especially if replacing existing ones
      – SEEFS has various versions of env models imbedded in it’s product generators
      – “Operational prototype” vs. Strip out models vs. Copying of models to the outside
Issue
Personnel & Mission Changes

• Personnel Changes
  – Military moves more often than civilian counterparts
  – Government cutback & military move policies/programs change each yr
    • SMC/SYAG will lose most personnel (from 60+ to 13) in 2007/08 due to realignment, elimination of enlisted programmer career field, and USAF drawdown.
    • AFRL/RVBX will lose several thru 2011 due to HAFB to KAFB relocation

• Mission Changes
  – SMC/SY change from prototyping (OSPP) to producing operational versions & integration [Org. Standard Process (OSP)]
    • Programmers change from prototype coding to documenting new sw requirements & design (SRS & SDD)
    • Criteria change for classification, testing, accreditation, validation
    • Changes to requirements and design
      – Results in some code deletions to focus on customer needs and more acceptable run-times & storage limits for ops support
        » Example: elimination of several output options for Char/D
Issue
Facilities Considerations

• Lack of real time data feeds at SMC’s Research-to-Ops Facility
  – Canned data doesn’t cut it for ops testing

• Inability to execute real product runs due to classification considerations
  – This affects capability to perform true validation

• Not ideal venue for required Operational Evaluations (Ops Evals)
Issue
Operational Evaluation - Difficult
OWG Responsibilities - Lists to Steering Com.

✓ 1) List of OWG Members
   - Reps from AFWA, AFRL, NASA, SEC, SMC

✓ 2) List of Parameters & Metrics Used/Needed in Operations:
   - List of input & output parameters for data and models used at the various space weather operational sites, to include error bars.

✓ 3) List of Validations Needed in Operations

✓ 4) Operational Hardware System & Software Requirements:

✓ 5) Applicable Notes to the CCMC Steering Committee & Science Working Group (SWG)

OWG plans to update all previously delivered lists by Feb ‘08
## List of OWG Members:

### Membership - Nov 2007

<table>
<thead>
<tr>
<th>Organization</th>
<th>Name/Title</th>
<th>Phone Number</th>
<th>Email</th>
</tr>
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<tbody>
<tr>
<td>AFWA</td>
<td>Matt Sattler/Capt Anderson</td>
<td>402-294-3373</td>
<td><a href="mailto:Sattlerm@afwa.af.mil">Sattlerm@afwa.af.mil</a></td>
</tr>
<tr>
<td>NOAA/SEC</td>
<td>Kent Doggett (co-chair)</td>
<td>303-497-3317</td>
<td><a href="mailto:Kent.A.Doggett@noaa.gov">Kent.A.Doggett@noaa.gov</a></td>
</tr>
<tr>
<td>NASA/SRAG</td>
<td>Steve Johnson</td>
<td>281-483-5323</td>
<td><a href="mailto:A.S.Johnson1@jsc.nasa.gov">A.S.Johnson1@jsc.nasa.gov</a></td>
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<tr>
<td>AFRL/VSBX</td>
<td>Stephen Quigley (chair)</td>
<td>719-556-2889</td>
<td><a href="mailto:Stephen.Quigley@cisf.af.mil">Stephen.Quigley@cisf.af.mil</a></td>
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<tr>
<td>SMC/WXT</td>
<td>Christopher Cox (Maj)</td>
<td>719-556-8732</td>
<td><a href="mailto:Christopher.Cox@cisf.af.mil">Christopher.Cox@cisf.af.mil</a></td>
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CCMC OWG
Validations Needed

3) List of Validations Needed in Ops: Primary AFSPC & SMC Need of CCMC!

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<tr>
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<tr>
<td>The following list does not consider whether or not a particular model or models reside currently at the CCMC.</td>
</tr>
<tr>
<td>This desire for a validation should be considered a recommendation for that model to be acquired and validated by the CCMC.</td>
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<td>This list does not provide information on the types of metrics that would be desired for such a validation, but the OWG is willing to provide assistance in developing such metrics and/or validation processes to the CCMC.</td>
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<td>Validation of Foster’s Sub-Auroral Polarization Stream (SAPS) Model (best compared to other SAPS mod, MHD mod trough, or combined auroral/SAPS mod)</td>
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<td>Data validation of forecast produced by JHU/APL Radiation Belt Environments model forced by HAF solar wind output</td>
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<td>Comparative validation of the WSA solar wind model against the HAF solar wind model (Ghee Frye may have done some of this)</td>
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<td>Comparative validation of the Smithtro Relativistic Electron Forecast Model against the JHU/APL Rel (recol vel of both against ground truth for abs vs relative)</td>
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<td>Comparative validation of the Costello Kp prediction algorithm against the JHU/APL Kp prediction algorithm (done already?)</td>
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<tr>
<td>Comparative validation of the Proton prediction System (PPS) model against the PROTON model</td>
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<td>Li/Temerin Dst prediction against the JHU/APL Dst Prediction</td>
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<td>Data validation of the JHU/APL Radiation Belt Environments model forced with observed Dst vs forecasted Dst.</td>
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4) Operational Hardware System & Software Requirements:

– This list will provide requirements and considerations regarding hardware available for use at the various operational sites, model/product generation timeline constraints, and current/anticipated software constraints and standards.
5) Notes to the Steering Committee & SWG:

- This list will provide OWG questions, comments, recommendations and other applicable information to the CCMC Steering Committee and SWG, to include:
  
  - Other operational considerations and models for the CCMC
  - Notes on known uses of CCMC products or web resources by the operational organizations
  - Notes on CCMC educational support with respect to operations
  - Requests for OWG info to be published on the CCMC web site
  - OWG Administrative Information (meetings planned, minutes, etc)
  
  • NOTE: Most recent/new input to the Steering Committee relates to CCMC CONOPS and associated organization representatives to CCMC
AFRL SWFL
Potential Near-Term Applications to CCMC

– TBD potential work by AFRL’s newly formed Space Weather Forecast Lab (SWFL)
  • SMEI into AFWA Ops
    – Potential for (comparative) validation of SMEI data used in HAF model, etc
  • New Satellite Launch and Deployment (SaLaD) support product development may require validation of auroral oval applications (Hardy vs Ovation, etc)
  • Potential for creation of new products for SWPC
    – GPS effects/error product (solar radio bursts, scintillation, etc)
    – Meteor Effects (METE) product?
    – Note: Well-organized potential new models/products into SWPC review process and committee
The End