ARM’s First Value-Added Product Code Sprint:
a successful development acceleration paradigm

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2017 ARM/ASR PI Meeting
What is a code sprint?

“A **sprint** is a get-together of people involved in a project to further a **focused development** of the project. Sprints typically last from one week up to three weeks.”

Wikipedia
What is a code sprint?

“A sprint is a get-together of people involved in a project to further a focused development of the project. Sprints typically last from one week up to three weeks.”

Wikipedia

And why did we try one?

ARM Value-Added Product (VAP) development has historically taken more time than we’d like and resources are limited.

Could intensive in-person collaboration between ARM developers and science leads make a difference?
Goals for ARM’s VAP Code Sprint

- Scanning ARM Cloud Radar (SACR) Data ✓
- Four advanced SACR algorithms already coded up ✓

```c
for (i = 1; i <= n, i++) {
    for (j = 1; j <= n; j++) {
        for (k = 1; k <= j; k++)
            p = p * 20 * z;
    }
}
```
Goals for ARM’s VAP Code Sprint

Scanning ARM Cloud Radar (SACR) Data  ✓

Four advanced SACR algorithms already coded up ✓

ARM Value Added Products

Brookhaven Science Associates
Goals for ARM’s VAP Code Sprint

Sprint Objectives

Convert 4 advanced SACR scientific codes into official ARM VAPs:

- SACRADV-VAD: Vertical profiles of horizontal wind speeds / directions
- SACRADV-QVP: Quasi-vertical profiles of polarimetric variables
- SACRADV-3D3C: 3D Cartesian gridding, cloud cover, CFADs

Science Leads: Pavlos Kollias, Eugene Clothiaux, Mariko Oue, Katia Lamer
Developers: Tami Toto, Meng Wang, Karen Johnson
Sprint nuts and bolts
June 23 – 30, 2016

Day 1:
• Assign science lead and developer for each VAP
• Split into groups to develop VAP Implementation Plans

Days 2-7
• Gather in a common room
• Code, asking questions, sharing solutions, consulting ADI* experts
• Discuss day’s progress, plan next day
• Document each VAP’s status, issues, next day’s goals in code sprint ‘diary’

Activities included:
• Refining input sources
• Designing output formats
• Revising implementation plans
• Converting coding language
• Optimizing code for speed
• Validating with test data

* ADI = ARM Data Integrator – suite of libraries, tools, interfaces used in VAP development
# Sprint Results

<table>
<thead>
<tr>
<th>Product</th>
<th>End-of-sprint Status</th>
<th>Post-sprint Tasks / Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SACR ADV - VAD</td>
<td></td>
<td>* Many data issues handled</td>
</tr>
<tr>
<td></td>
<td>* Converted to Python</td>
<td>* ARM standard format</td>
</tr>
<tr>
<td></td>
<td>* Implemented in ADI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Validated (1 test file)</td>
<td></td>
</tr>
<tr>
<td>SACR ADV - QVP</td>
<td></td>
<td>* Optimized for speed</td>
</tr>
<tr>
<td></td>
<td>* Implemented in ADI</td>
<td>* Many data issues handled</td>
</tr>
<tr>
<td></td>
<td>* ARM standard format</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Completed, OLI in Evaluation</td>
</tr>
<tr>
<td>SACR ADV – 3D3C</td>
<td>Cloud Fraction:</td>
<td>* Converted and implemented in ADI</td>
</tr>
<tr>
<td></td>
<td>* Implemented in ADI</td>
<td>* Validation issues handled</td>
</tr>
<tr>
<td></td>
<td>* Validated results</td>
<td>* Data issues handled</td>
</tr>
<tr>
<td></td>
<td>Gridding:</td>
<td>* Processing speed remains very slow…</td>
</tr>
<tr>
<td></td>
<td>* Language conversion begun</td>
<td></td>
</tr>
</tbody>
</table>

![Image of HSRHI input](image1.png)

![Image of PPI input](image2.png)

![Image of CWRHI input](image3.png)
What Worked?
Development was jump-started!

- **Focused time!**
  Avoids email sidetracks, meetings, telecons, unrelated conversations

- **Science sponsor – Developer interaction very helpful**
  Speeds understanding of code and avoids wrong assumptions

- **Multiple developers together**
  Speeds resolution of technical issues

- **Learning opportunities**
  Broadens skill sets

- **Building relationships within program**
  Encouraging scientific ↔ technical communication

- **VAPs available for evaluation!**
The rest of the story...
Post-sprint issues and tasks

<table>
<thead>
<tr>
<th>Post-sprint remaining work / issues</th>
<th>Resulting tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need more than a ‘case study’</td>
<td>Process data for Evaluation dataset</td>
</tr>
<tr>
<td>Data oddities, quirks</td>
<td>Analyze, add code to resolve</td>
</tr>
<tr>
<td>Code runs too slowly</td>
<td>Analyze, and recode for speed</td>
</tr>
<tr>
<td>Output must meet ARM standards</td>
<td>Modify output formats, reprocess</td>
</tr>
<tr>
<td>DQRs belatedly discovered</td>
<td>Modify codes to handle or omit data</td>
</tr>
<tr>
<td>Competing work priorities</td>
<td>Context switching</td>
</tr>
<tr>
<td>etc.</td>
<td>etc.</td>
</tr>
</tbody>
</table>
VAP Development Paradigms

All other assigned projects, meetings, etc.

VAP X, development as usual

Development Timeline (months)
VAP Development Paradigms

- **VAP X, development as usual**
- **All other assigned projects, meetings, etc.**

Development Timeline (months)
VAP Development Paradigms

- VAP X, development as usual
- All other assigned projects, meetings, etc.

Development Timeline (months)

- pre-sprint
- post-sprint

Highly idealized
VAP Development Paradigms

Development Timeline (months)

VAP X, development as usual

suggest expanded pre-sprint
for a shortened post-sprint

All other assigned projects, meetings, etc.

post-sprint

highly idealized
Recommendations for future sprints

- **Thoughtful selection of sprint target products**
  - Mature codes (tested extensively, on diverse data)
  - High impact potential
  - Select within context of ARM VAP priorities
  - Consider ease of creating official ARM VAP

- **More pre-sprint work**
  - Literature reviewed by developer
  - Implementation plan developed
  - Code previewed by developer
  - Input data quality reviewed

- **Science lead commitment, post-sprint**
  - Consult on issues if needed
  - Review results prior to evaluation release
ARM VAP Code Sprint

Related Posters:

#115 SACRADV VAD
#116 VAP Code Sprint

Lunchtime Tutorial:
Science Product Development through Community Collaboration and the Open Source Framework

Thanks!
Questions or Comments?