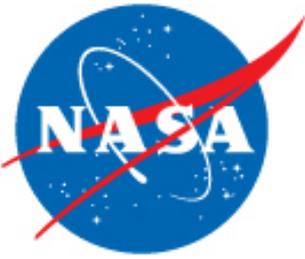


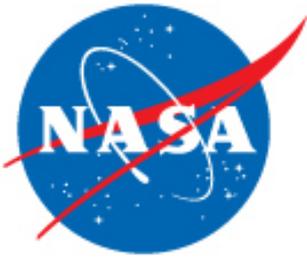
Adaptation of the Agile Scrum Methodology for the Implementation of Multi-Mission Relay Coordination Software

Daniel Allard
Jet Propulsion Laboratory (JPL),
Caltech



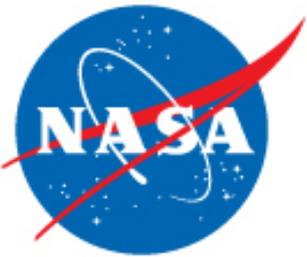
Biography

- Daniel Allard, Senior Software Engineer
 - daniel.a.allard@jpl.nasa.gov
 - B.S. Engineering Tufts University, 1991
 - Mission systems software developer for 22 years at JPL
 - Supported missions include Cassini, Mars Exploration Rovers (MER), Phoenix, Mars Odyssey Orbiter, Mars Reconnaissance Orbiter (MRO), Mars Science Laboratory (MSL), Mars Express Orbiter
- Expertise in web service and mission support software development

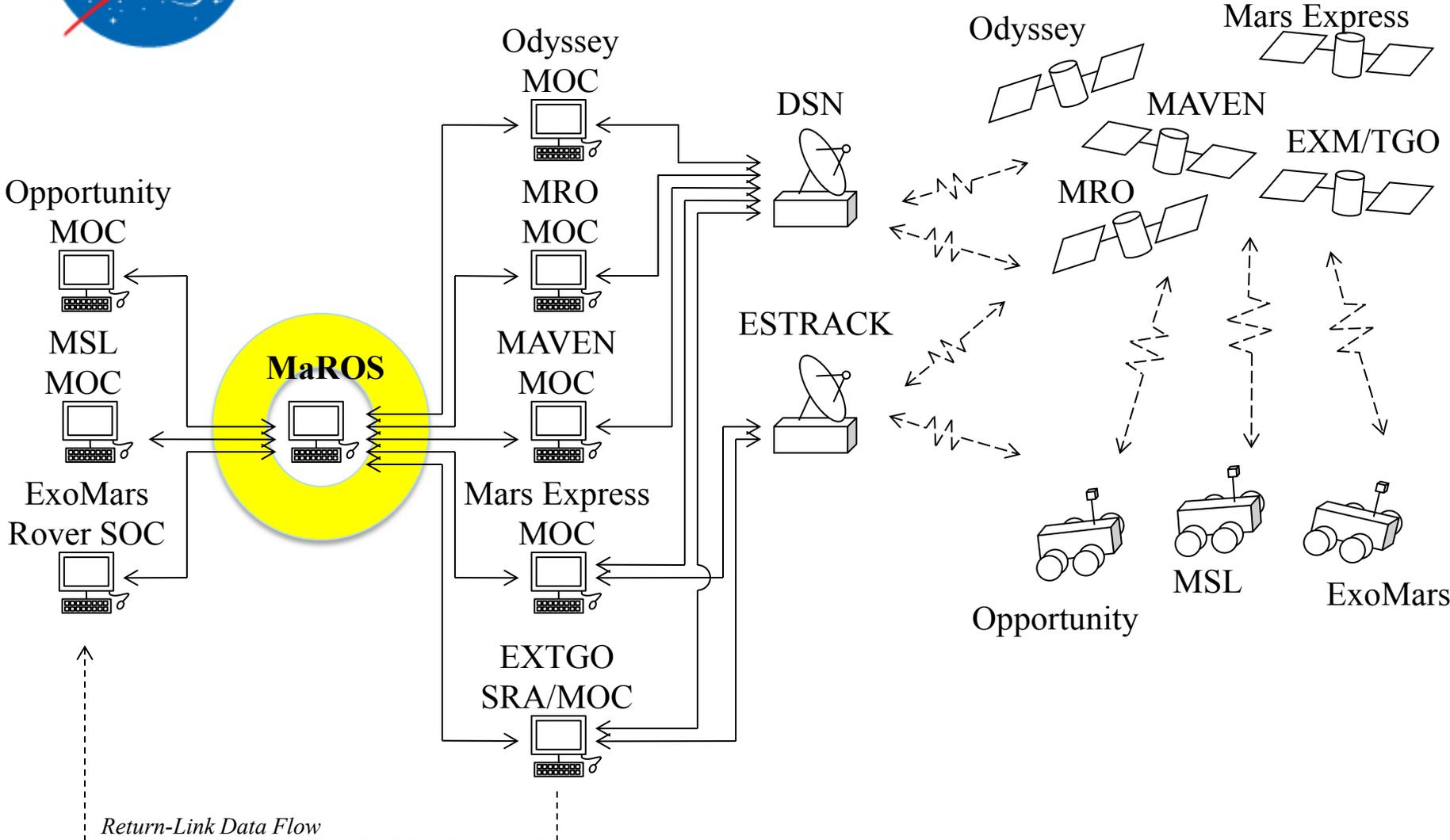


Mars Relay Operations Service (MaROS) Project Overview

- Web service supporting all relay planning and coordination activities between landers and orbiters at Mars
 - Hosted at JPL, supports all active Mars Network missions
 - MSL, MER, Odyssey, MRO, MEX
- Implementation from late 2008 through today, in operations since 2010
 - Supported by weekly user group meeting including representatives from each mission
- Small task, 3-4 part time developers mostly half time or less

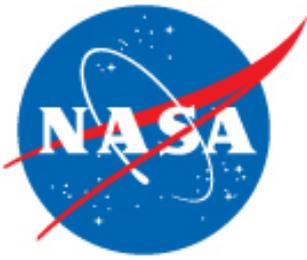


Service Context



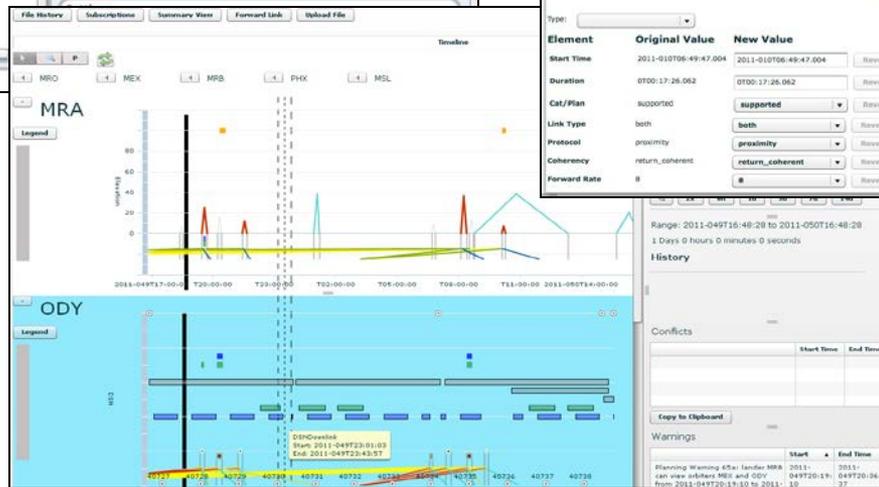
March 16, 2013

Agile Development of Mars Relay Operations Service (MaROS)



User Interfaces

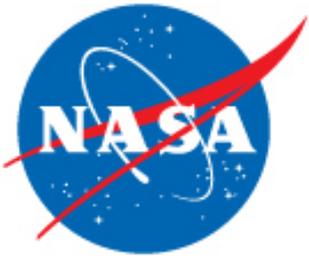
Relay Functions Portal



Visualization

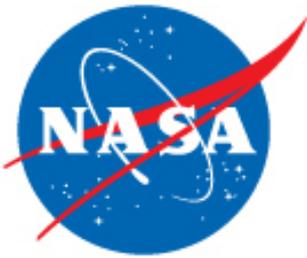
| Select | Conflicts | Overflight ID | Req/Ack Type | Start Time | Duration | Cat/Plan | Type | Fuel | Rtn | Vel | Elev | LNUT | List Bit | Unsaved Changes |
|--------------------------|-----------|---------------------|--------------|-----------------------|----------------|-----------|------|------|-----|-----|------------------|------|----------|-----------------|
| <input type="checkbox"/> | | ODY_MRB_2011_010_01 | implemented | 2011-010706:49:47.004 | OT00:17:26.062 | supported | both | 8 | 8 | | | | | |
| <input type="checkbox"/> | | | request | 2011-010706:49:47.004 | OT00:17:26.062 | normal | both | 8 | 8 | | 79.6041797650821 | | | |
| <input type="checkbox"/> | | ODY_MRB_2011_010_02 | request | 2011-010717:45:12.780 | OT00:09:15.048 | disable | | | | | | | | |
| <input type="checkbox"/> | | | geometry | 2011-010717:45:12.780 | OT00:09:15.048 | | | | | | 4.09658471728846 | | | |

Relay Request Management



Adopted Aspects of Scrum Methodology

- Sprint development phases
 - “Locked” development task list sprint-by-sprint
 - Pre-sprint planning meetings
 - Burn-down charts using Google Docs
 - End-of-sprint user demos
- Daily video tag-ups via Google+
 - Supports our distributed development



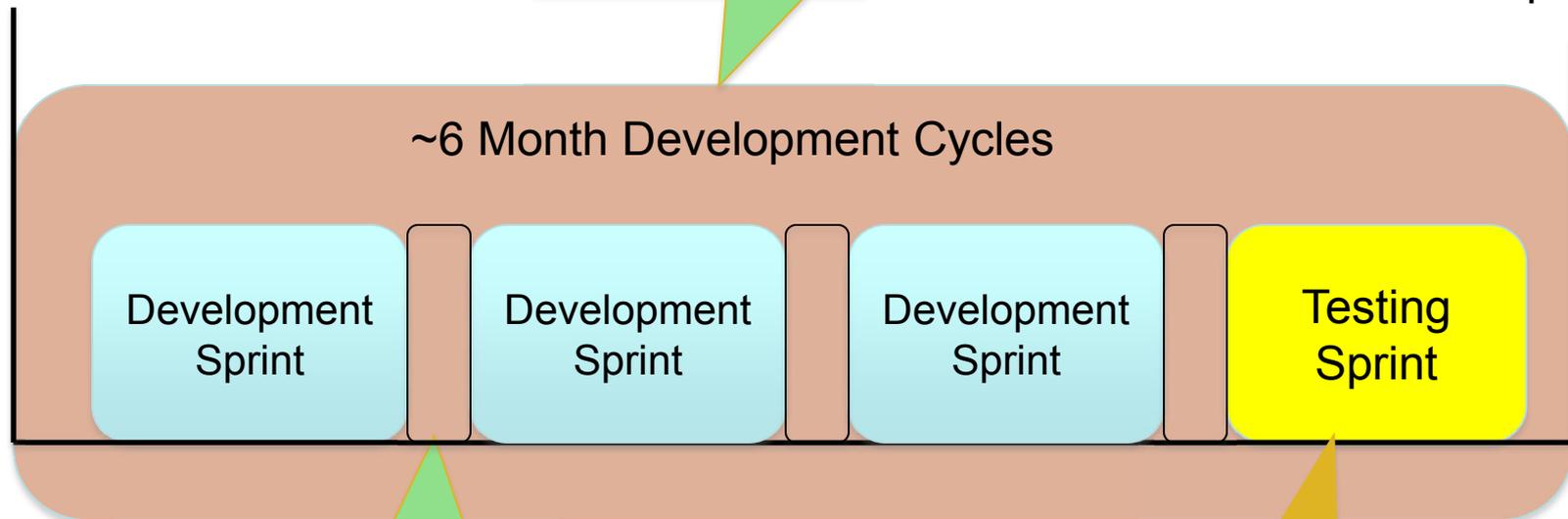
Sprints Within Waterfall

Typical Major Phase

Start of new major phase

~Three sprints, three to four weeks per sprint

Ops Deployment



~6 Month Development Cycles

Development Sprint

Development Sprint

Development Sprint

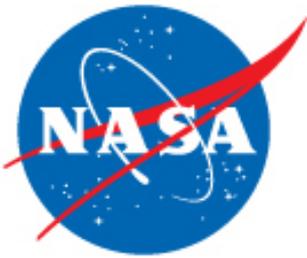
Testing Sprint

Week of downtime for sprint planning and user demo between sprints

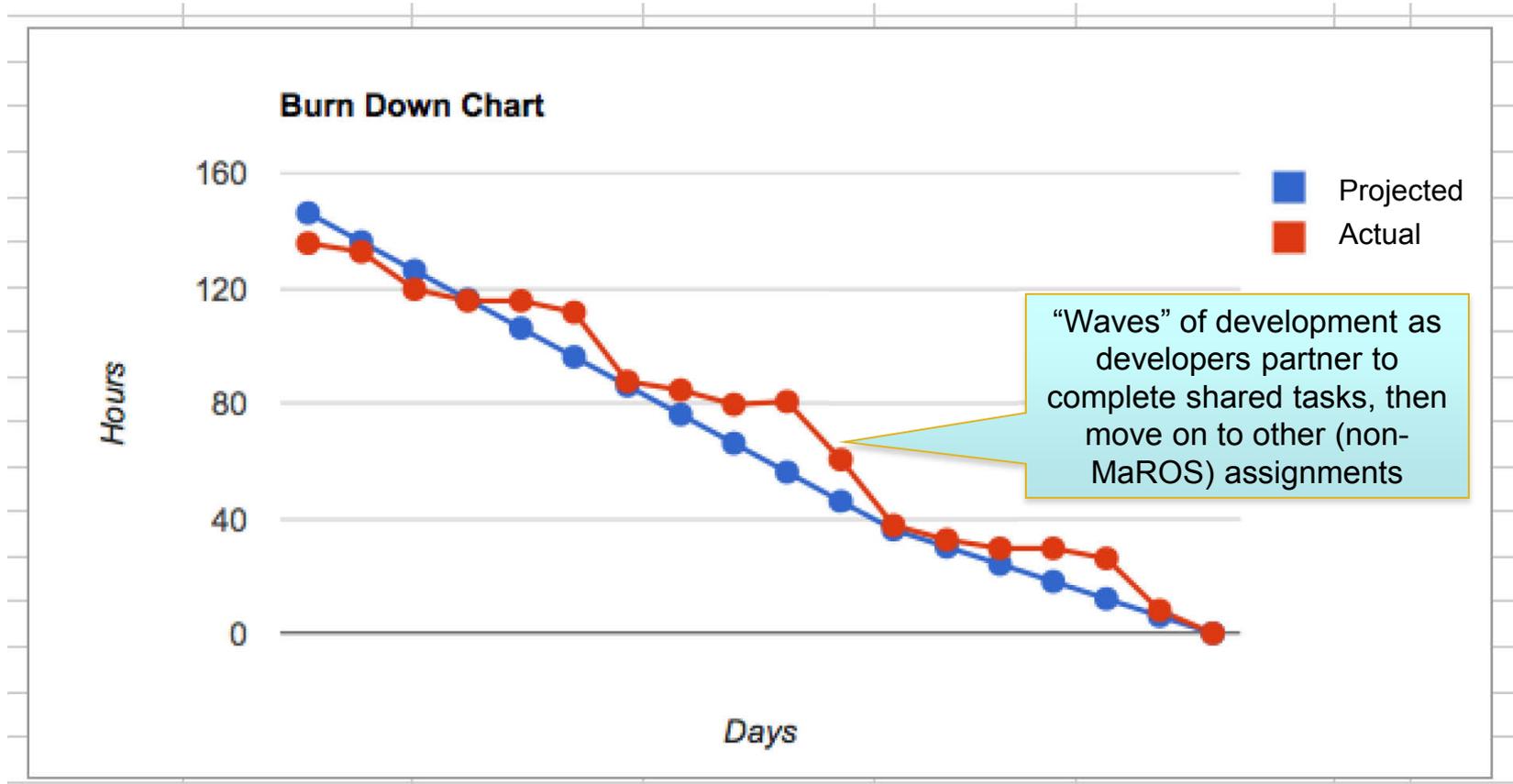
Proper sprinting during test phase can be problematic (can't manage a burn down, etc.)

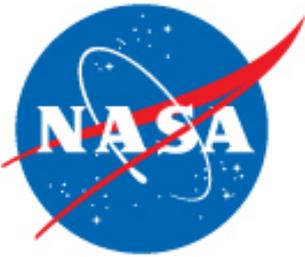
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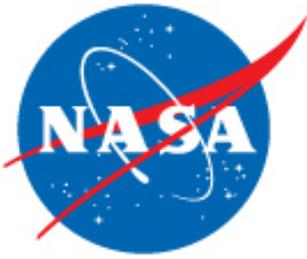
MaROS Burn Down: Part-Time Development Signature





Lessons Learned

- Scrum adoption challenges
 - Not institutionally mandated, so no institutional support
 - The process can 'grow stale' if the dev team isn't on top of it
 - Difficult to justify some Scrum overhead (e.g. Burn-down setup) when the team size is around ~1.5 developers
 - Fared poorly during test-and-bug-fix cycle, due to constant sprint content updates
- Scrum value added
 - Sprint themes added focus to work, generally better quality end-product
 - Users very happy with regular feedback loop via demos
 - Made the most difference with multiple developers working together on a shared sub-task



References and Acknowledgements

References:

- [1] Allard, Daniel A., et al, “Mars Relay Operations Service (MaROS): Managing Strategic and Tactical Relay for the Evolving Mars Network”, IEEE Aerospace Conference, Big Sky MT, 2012
- [2] Gladden, Roy E., “Mars Relay Operations Service (MaROS): Rationale and Approach”, AIAA SpaceOps 2010 Conference, Huntsville, AL, April 2010.

Acknowledgements:

- Current development team: Roy Gladden (Task Lead), Dan Allard (Lead Developer), Frank Hy, Hayk Arutyunyan

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