



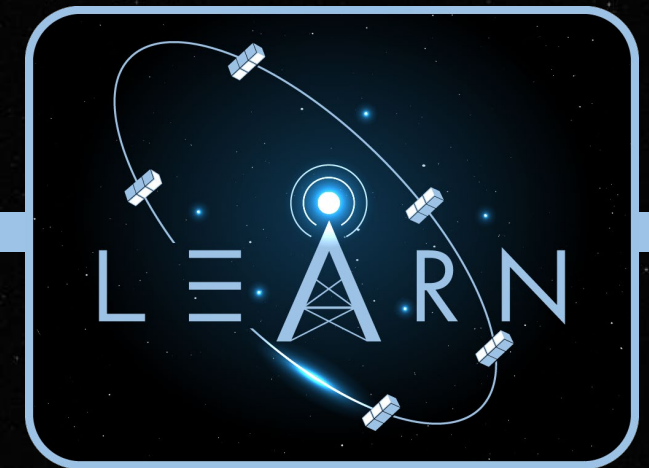
# Systems Engineering Best Practices Workshop

Jeff Homan

Manuel Vega

Disclaimer: The information in this presentation package does not represent official guidance from NASA. The information reflects the discussion that occurred at the In-Person LEARN Forum during the SE Best Practices workshop with the LEARN community for the benefit of those who could not attend.

National Aeronautics and Space Administration [Small Satellite Learning from Experience, Achievements and Resolution Navigation Forum](#)





# Systems Engineering Best Practices



- The LEARN Forum participants were divided into 2 groups for a best practices workshop on the second day
  - Project Management
  - Systems Engineering
- For the systems engineering session, the conversation was focused on
  - Technical documentation
  - Risk management
  - Engineering activities
- The following slides reflect the discussion and were presented in the afternoon to the entire LEARN group



# SE Best Practices: Technical Documentation



- Documents require context; how does it fit into mission success? How will it be used? Can be used for next publication/conference?
- Substance over format
- Collaboration is better for document generation, both to involve the team and spread knowledge to prepare for turnover
  - Configuration management is a challenge; need to baseline revisions and allow people to work in sandboxes for next revisions
  - Not all tools provide ease of use for external partners
- S3VI should provide examples/templates for document trees, requirements, and key deliverables
  - Projects must focus on entrance/exit criteria and think about contents of documents, not just check the boxes
  - Formats can be negotiable; does not always need to be 100+ pg report, sometimes can be brief or PowerPoint – **Tailor!**
  - Don't duplicate content across documents



# SE Best Practices: Risk Management



- Formal risk management tools typically not needed for scope of CubeSat projects
  - Keep it scaled to the mission; a spreadsheet with 5x5 for top risks
  - Not so worried about exact wordsmithing
  - Capture planned risk mitigation actions and track progress
- Need to educate team ahead of time to declutter what is really a risk vs an issue
- New folks - upfront, go thru the interlinking between processes / documentation
- Ask what keeps them up at night
- Approach every member of the team to elicit potential risks
- Need to understand how the risks interplay between the subsystems



# SE Best Practices: Engineering Activities



- Pushing multiple software changes at once is problematic - incremental changes are better. Hard to find issues otherwise (time consuming).
- Early testing vs. last minute testing - earlier is better, but can be hard to prioritize
- Use requirements to prioritize critical testing
  - Consider project risk tolerance to evaluate compressing tests
- Don't assume any datasheet is correct - test it like you'll fly it
- Cannot assume just because component is advertised as TRL 9 that testing is not needed; ask vendors questions about failures, but may not get all the info
- TRL is subjective (particularly for COTS parts)
  - Failures are not well reported, one success in space but multiple failures is still can be considered TRL 9
  - What subsequent changes to HW/SW the systems might bring it down a TRL?
  - Detailed heritage assessment can help determine what TRL really is



# Wrap-Up

National Aeronautics and Space Administration Small Satellite Learning from Experience, Achievements and Resolution Navigation Forum

