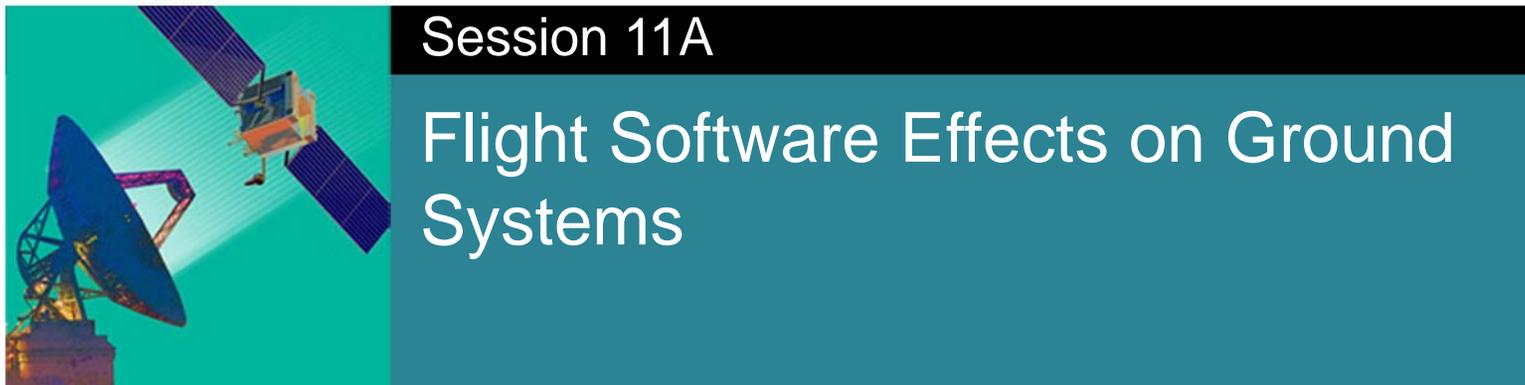


Working Group Outbrief

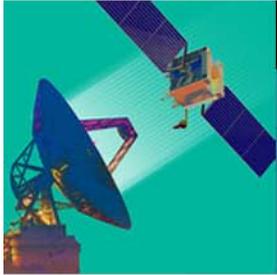
# Ground System Architectures Workshop



Session 11A

Flight Software Effects on Ground  
Systems

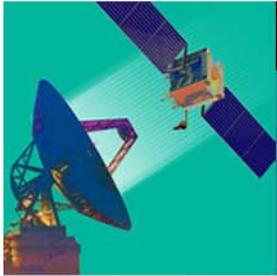
*Alan Unell, The Aerospace Corporation*



## Session Goals

- There are significant areas where flight software impacts the ground and vice versa.
- The session attempts to identify areas that create conflict between space and ground and to elicit techniques that could foster more collaboration and smoother development and operations.

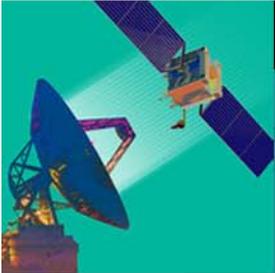
# Ground System Architectures Workshop



## Presenters/Panelists

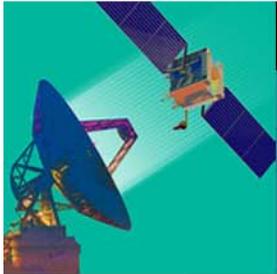
- Suzanne Dawes is a Senior Project Leader at the Aerospace Corporation specializing in human factors
- Lawrence Miller is Principal Scientist in the Computers and Software Division at the Aerospace Corporation and has been a flight software chief engineer
- Nathaniel Parsons is flight software engineer at the Applied Physics Laboratory of Johns Hopkins University
- Nestor Peccia is head of the Data Systems Infrastructure Division, department of Engineering at the Operations Centre of the European Space Agency (ESA/ESOC), Darmstadt, Germany

# Ground System Architectures Workshop



## Key Points

- Common Services on space vehicles and in ground systems that are mandated to be used can save significant cost and schedule.
- Many OPS issues are attributed “pilot error”.
  - Where is the panic button/slow moving telemetry that goes unnoticed can kill a vehicle
  - Operator overload is an indicator of FSW/GSW design problems.
  - Fixing OPS problems by adding more procedures makes the system more complicated and increases OPS risk instead of reducing it.
- Flight software and ground software are often developed without much interaction
  - Lack of communication and cooperative testing leads to disconnects
- What operator’s need to do their jobs is not often considered until very late in development
- Cross-pollination between FSW development and OPS is a valuable improvement.



## Conclusions

- ESA has chosen to standardize a significant portion of space vehicle and ground system software to save cost and schedule.
  - Heavy initial investment that is now paying dividends.
- Bringing OPS into the picture very early will reap benefits in a more supportable system
  - Easier anomaly resolution
  - Funding issues
- Increased exercising of FSW and GSW in common frameworks can make for easier OPS
  - Early development of a prototype GS that operates with simulated vehicles to test out procedures can help make flight and ground software more cooperative.
  - There are COTS tools that can help.
  - Robust failure/anomaly testing with ops personnel early in development can positively influence both operations and flight software.