





Presentation for the GSAW 2007 Conference

Chris Scolese NASA Chief Engineer March 29, 2007

The Critical Link Between Space and Earth

- A properly designed ground system is critical to mission success.
 - Provides mission controllers and data users with necessary access to spacecraft
 - Smart design leverages existing standards, capabilities, and infrastructure and keeps costs down.



• Cardinal rule: keep it simple.

Things should be made as simple as possible, but not any simpler. - Albert Einstein

Mission Development Time vs. Operations Time

Mission	Development Time (years)	Operations Time (years)
Terra	6	7 (ongoing)
MER	3	3 (ongoing)
MGS	3	10
Mars Odyssey	4	6 (ongoing)
TOMS-EP	5	10 (ongoing)
Landsat 4	3	18.5
Landsat 5	3	27 (ongoing)
POES**	3	15
UARS	4*	14
TIMED	4	5 (ongoing)
Swift	4	2 (ongoing)
GRO	4*	9 years
HESSI	4	5 (ongoing)
AVERAGE	~3.8	~10.1

- Ops time exceeds development time on average
- Begin using ground systems capability around time of I&T

* Development time does not include Challenger-related delays

** Average development and operations times

Built to Last

Ten Years and Three Billion Miles . . .

1001-1044

Has most of the sight poor test, from Another to Mate, the cold will up a the second of second the second of the of passivelying " that has present til dage melt pass. I will be mont al he month on interaction of and local subscript of

÷

10.000 den de the Division of the and the second second lines in ----

THE STATE OF LOSS AND

and the second Time Descent Contra a s di sen "e

in, if this far he builder with on to Perso press of Fight and this proves aland in a little ignest of an is the in testing the

States and states

Contraction of the and the Warm

An electricity integring spectrometer and mile in maniput the comparison of Party 1

A logi- could be sping biomer and commu-Section 2

A contribution optical information protocols for with the const to provide order means of the contrasts of Parts and Theorem, place comparison and theorem Substantiation on the container.

30 11-20 20 state to be the same and will be disasted toward. tern er menn fleigen beit Dients Monal Para

Reading detection interpreter and in a state intel in Arrest

Adap 1915

ef state performa fit be des

States in

Particle instrument and is measure the sector of the order wired second Palm

(iii) Radio separateuro la stady Robel annucleority adarentes da landing of oute serves lanced or to the part by give astronom on book.

And the second s

Technical Challenges

Interoperability

- Multiple vehicles and systems demand common protocols and standards that leverage commercial approaches
- Standardized interfaces
- Software key driver as hardware becomes more common and COTS-oriented
- Scalability Suitable for both large- and small-scale use
- Flexibility Easy to service and upgrade technology
- Cost Effectiveness Components, equipment, standards, development time

Agency Requirements for Ground Systems

NPR 7120.5D applies to all current and future NASA **space flight programs and projects** (including spacecraft, launch vehicles, instruments developed for space flight programs and projects, research and technology developments funded by and to be incorporated into space flight programs and projects, **critical technical facilities** specifically developed or significantly modified for space flight systems, and **ground systems** that are in direct support of space flight operations).

Applicable program/project reviews include:

- Critical Design Review (CDR)
- Production Readiness Review (PRR)
- Operations Readiness Review (ORR)
- Flight Readiness Review (FRR)

Other product lines will be addressed by:

- NPR 7120.7 NASA Institutional Infrastructure and Information Technology Program and Project Management Requirements
- NPR 7120.8 NASA Research and Technology Program and Project Management Requirements

Ground Systems: The Center of the Architecture

from integration...









...to operations

THIS PAGE LEFT BLANK