

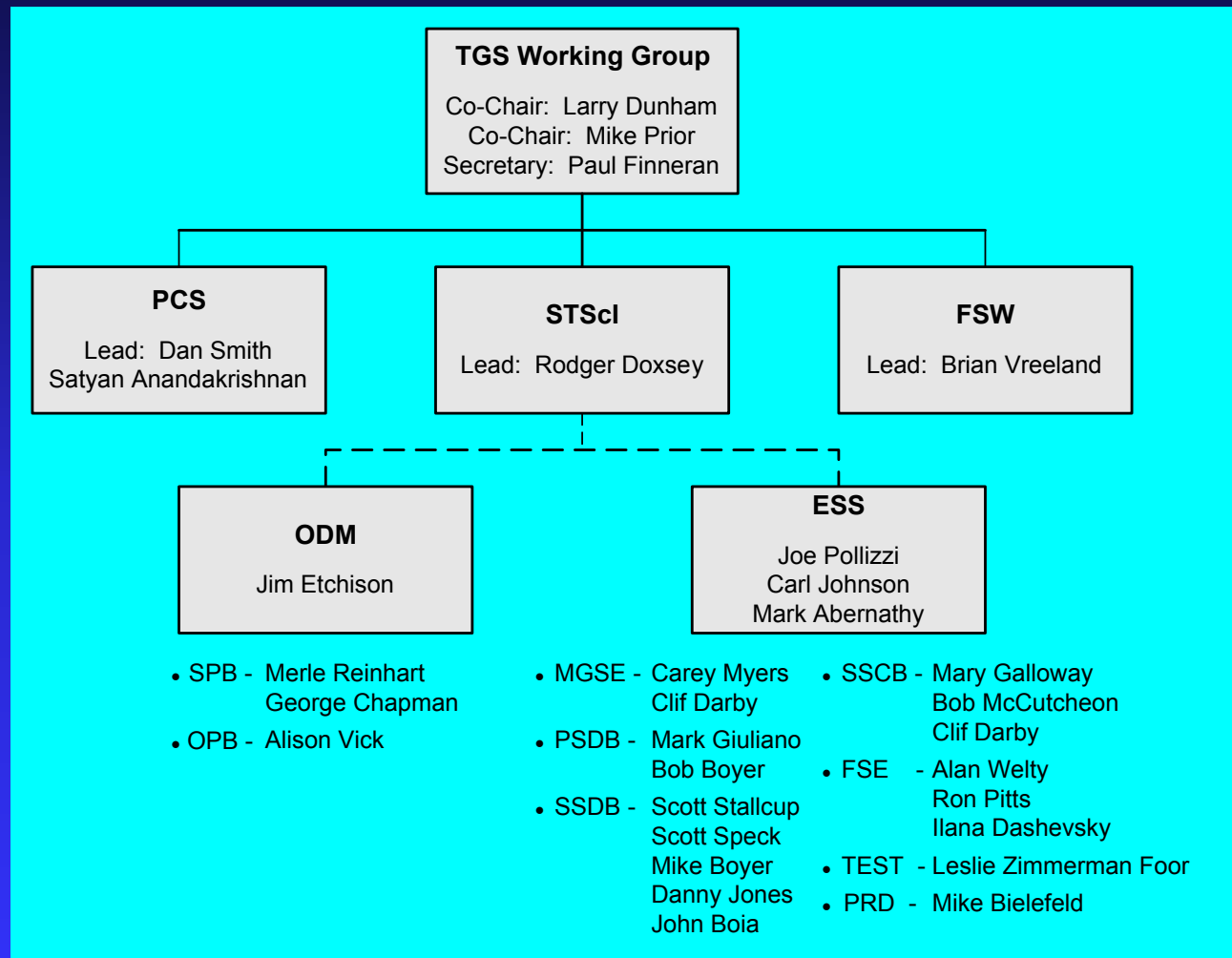


Two-Gyro Science (TGS) Mode Status

HST MSR
January 13, 2004

Carey Myers

TGS Implementation Team



Project-level Status

- ❖ Ops Concept / System Reqts. Review held Sept. 4, 2003
- ❖ System-level requirements
 - **Baselined at Level 4 CCB: October 2003**
 - **Submitted to Level 3 CCB**
- ❖ Preliminary Design Review held Oct. 30, 2003
- ❖ Project status review held Dec. 15, 2003
- ❖ Critical Design Review scheduled for March 2004
- ❖ Three on-orbit tests planned: April, June, and Oct. 2004
- ❖ Operational Readiness Review scheduled for January 2005



Scheduling System Status

- ❖ Phase I requirements completed
 - Ops Concept / Functional Reqts. Review held October 24th
 - Phase I requirements document ready for signature
- ❖ Draft updates to ICD-11 and ICD-T1 out for review
- ❖ Draft update to ICD-26, Part 2 completed
- ❖ SPIKE prototyping work ongoing
- ❖ Science impact studies ongoing
- ❖ Design Review scheduled for February 2004

Interface Control Documents

ICD	Name	Changes	System Component					Status
			STScI			CCS / SAC	FSW	
			SPSS / SCS	CMD	PASS			
ICD-11	HST Science Scheduling to Mission Scheduling	Modify FHST statement; expand AUTO statement	X	X	X			Out for review
ICD-26, Pt 2	PASS to PDB	Update for two-gyro spacecraft characteristics, constraints and restrictions, and commanding	X		X			Draft changes available
ICD-T1	HST CCS to P&S	Add SAC and FSW star catalogs			X	X	X	Out for review

Note: ICD updates may be viewed at <http://hst.nasa.gov/sepg/web/dev/2gyrotab.htm>



SPIKE Prototyping Efforts

- ❖ Since July 2003 the SPIKE team has been developing prototype two-gyro scheduling capabilities
 - The purpose of this effort is to provide tools that can be used to characterize and analyze the impact of two-gyro constraints on HST scheduling
 - ❖ The tools are supporting the science impact studies being performed by M. Reinhart, G. Chapman, and A. Vick
 - The prototype will also form the basis of the final implementation of SPIKE two-gyro support



SPIKE Study Support Status (1 of 2)

- ❖ CVZ scheduling study support – Completed
 - SPIKE already modeled FHST visibility
 - Verified correctness of the model
- ❖ All-sky target availability study support - Completed
 - Added FHST overlap constraints to SPIKE
 - Integrated with SPIKE constraint and visualization tools
 - Integrated with orientation restrictions
 - Model refined to parameterize attitude uncertainties and sun angle limits



SPIKE Study Support Status (2 of 2)

- ❖ Current cycle scheduling study support - In progress
 - Complete SAA modeling
 - Perform TRANS preparation work to account for less visibility time due to extended PCS acquisition times
 - Requires no TRANS code changes
 - ❖ Model times via input parameters
 - ❖ Use existing TRANS orbit fill capability to shrink orbits
 - ❖ Rebuild TRANS with new visibility model table

Science Impact Studies

- ❖ CVZ scheduling study (nearly complete)
 - Evaluated north and south CVZs
 - Number of usable orbits varies from ~7 to 15 per day
 - Scheduling efficiency $> \sim 50\%$ is implied
- ❖ All-sky target availability study (in progress)
 - Three test proposals, 600 visits each (5° grid, $+60^\circ$ to -60° declination)
 - Use varying pointing uncertainty, varying sun angle limits
 - Expect to be completed by design review
- ❖ Current cycle scheduling study (begin Feb.)
 - Evaluate what percentage of entire cycle is schedulable



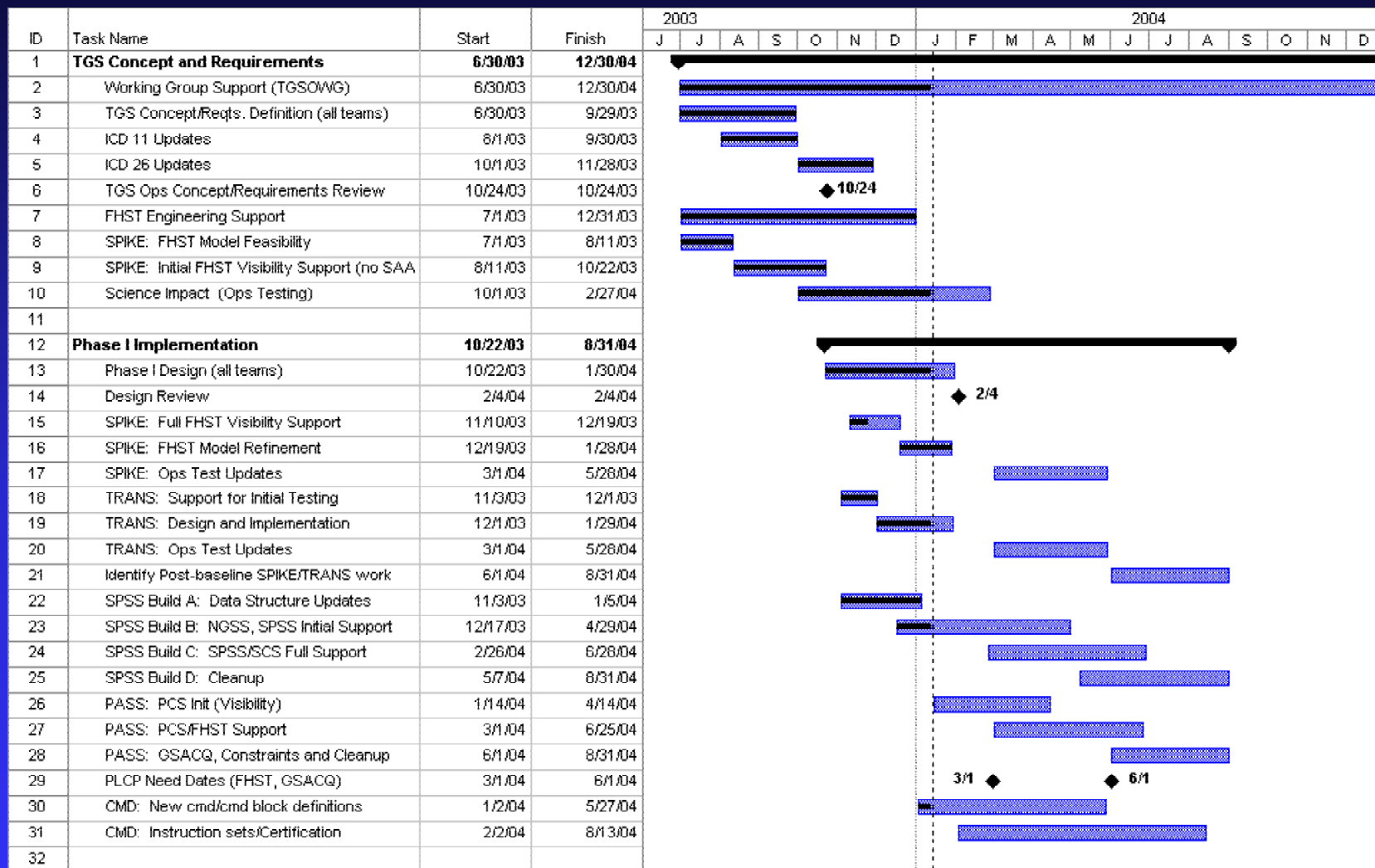
Scheduling System Design and Implementation

- ❖ Design underway for FHST visibility window calculation in SPSS and PASS
- ❖ MAP/AutoMAP approach documented and approved by TGSOWG
- ❖ Design underway for scheduling TGS SUs in SPSS
- ❖ SPSS Build 46.0 (TGS Build A) delivered: provides initial database updates to support TGS

Testing

- ❖ Test verification descriptions being written
- ❖ Test cases being put into DOORS and linked to requirements for traceability
- ❖ Draft test plan being generated (for Design Review)

TGS Implementation Schedule (1 of 2)



Risks (1 of 2)

- ❖ SPSS scheduling algorithms are complex, and there are many event scenarios to consider; some scenarios may be missed
 - Mitigation: Begin design process with definition of scenarios; develop test cases for each
- ❖ Overlap of flight software two-gyro work with scheduling system software implementation might cause late-breaking requirement changes
 - Mitigation: Incorporate flexibility into design; parameterize data; implement software in phases, with well-defined areas first
- ❖ Onboard testing of two-gyro mode operations does not occur until late in the scheduling system software implementation; unanticipated design changes may be needed
 - Mitigation: Incorporate flexibility into design; parameterize data; incorporate updates in Phase II

Risks (2 of 2)

- ❖ Different occultation algorithms between SPIKE, SPSS, and PASS scheduling systems could limit the capability to generate two-gyro science plans. Under three-gyro mode, FHST visibility mismatches have been minor; for two-gyro mode, they may become a significant problem
 - Mitigation: Start with CVZ observations to minimize mismatches; ensure that SPSS is more restrictive than PASS; review the study on algorithmic differences; consider integrating SPSS algorithm into PASS (Phase II)
- ❖ Pointing error inherent under two-gyro control may cause antenna / communications problems
 - Mitigation: Consider applying attitude uncertainty to antenna area in PASS; minimize time under large attitude uncertainty

Issues

- ❖ Scheduling system issues currently being worked through OBADWG
 - **FHST / GOB**
 - ❖ Is it required for every GSACQ, or only the first in the sequence, or at all?
 - ❖ Is it before, at, or after GSACQ?
 - **Magnetic field alignment impact on scheduling**
 - ❖ Currently evaluating the problem and generating requirements
 - ❖ Need to evaluate impact to scheduling algorithm in SPSS
 - ❖ Designing a magnetic field modeling tool for SPSS
 - + **May benefit PASS (HGA scheduling)**
 - ❖ Designing a calendar post-analysis tool to check for bad magnetic field alignments
 - ❖ Need to update implementation schedule