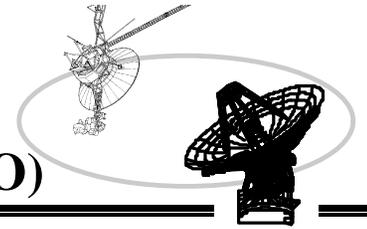


Resource Allocation Planning & Scheduling Office (RAPSO)

Mars Exploration Rovers - 2003 DSN Loading Study

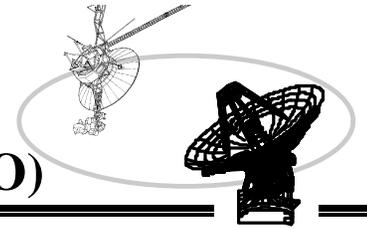
David Morris

September 29, 2000



Topics

- Requirements
- Uncertainties
- Forecast Results
- Analysis
 - Monthly Analysis
 - Scorecard
- Recommendations
 - Dependencies



Resource Allocation Planning & Scheduling Office (RAPSO)

Requirements

Mars Missions:

- 2 Mars Exploration Rovers - 2003

| <u>S/C</u> | <u>Launch Window</u> | <u>Arrival Date</u> |
|------------|----------------------|---------------------|
| MER-A | 6/03 - 6/23/2003 | 01/04/2004 |
| MER-B | 6/27 - 7/17/2003 | 02/25/2004 |

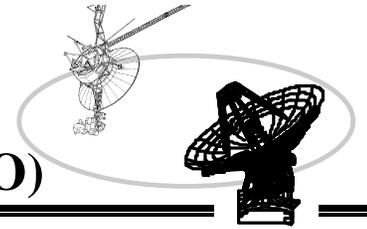
- 1 Spacecraft Orbiting Mars

Mars 2001 Orbiter (M01O)

MGS End of Mission 4/22/2002 or (no PQ) Dec-2002

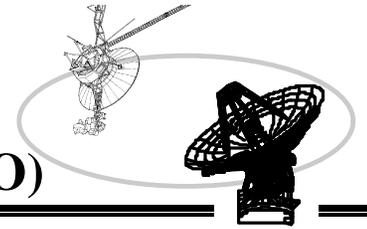
- 2 International Mars Spacecraft

| <u>S/C</u> | <u>Launch/Earth Departure</u> | <u>Arrival Date</u> |
|---|-------------------------------|---------------------|
| Mars Express | 6/01 - ? | 12/25/2003 |
| (Beagle2 Rover has no Direct-to-Earth (DTE) Comm) | | |
| Nozomi | 6/19 | 01/01/2004 |



Requirements

- MERA and MERB:
 - Launch - L+4wks Continuous 34H, 34B
 - TCM +/- 3 Days Continuous 34H, 34B
 - TCM Day Continuous 70M
 - Busy Cruise 7 wks of 2 tracks/day 34H, 34B
 - Light Cruise 9 wks of 3-7 tracks/wk 34H, 34B
 - EDL Testing (Cruise) Daily (M-F) 70M during 1 week
 - VLBI (2 Complex) 1-5 arrays/wk 34H or 34H/70M
 - Approach - EDL Continuous
 MERA 34H; MERB (1) 34H, (2-3) 70M
 Last 2-3 wks 70M only
 - Surface Operations Daily 70M



Resource Allocation Planning & Scheduling Office (RAPSO)

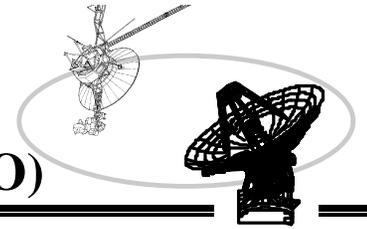
Requirements

DSN Antenna Downtimes - 2003:

| <u>Antenna</u> | <u>Weeks</u> | <u>Description</u> |
|----------------|--------------|--------------------------------|
| • DSS-63 | 31-34 | Ball Joint/ Pad Refurbishment |
| • DSS-45 | 37-43 | Antenna Controller Replacement |

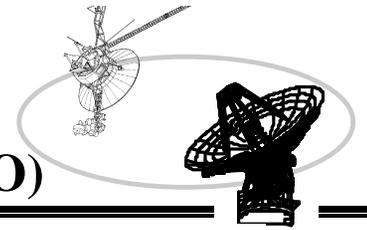
– Proposed for 2003-2004

| <u>Antenna</u> | <u>Duration /Window</u> | <u>Description</u> |
|----------------|-------------------------|--------------------------------|
| • DSS-14 | 7wks Dec-03 - Aug-04 | Antenna Controller Replacement |
| • DSS-43 | 7wks Dec-03 - Aug-04 | Antenna Controller Replacement |
| • DSS-63 | 7wks Dec-03 - Aug-04 | Antenna Controller Replacement |
| • DSS-65 | 16 wks 2003-2005? | Pad Refurbishment/Replacement |

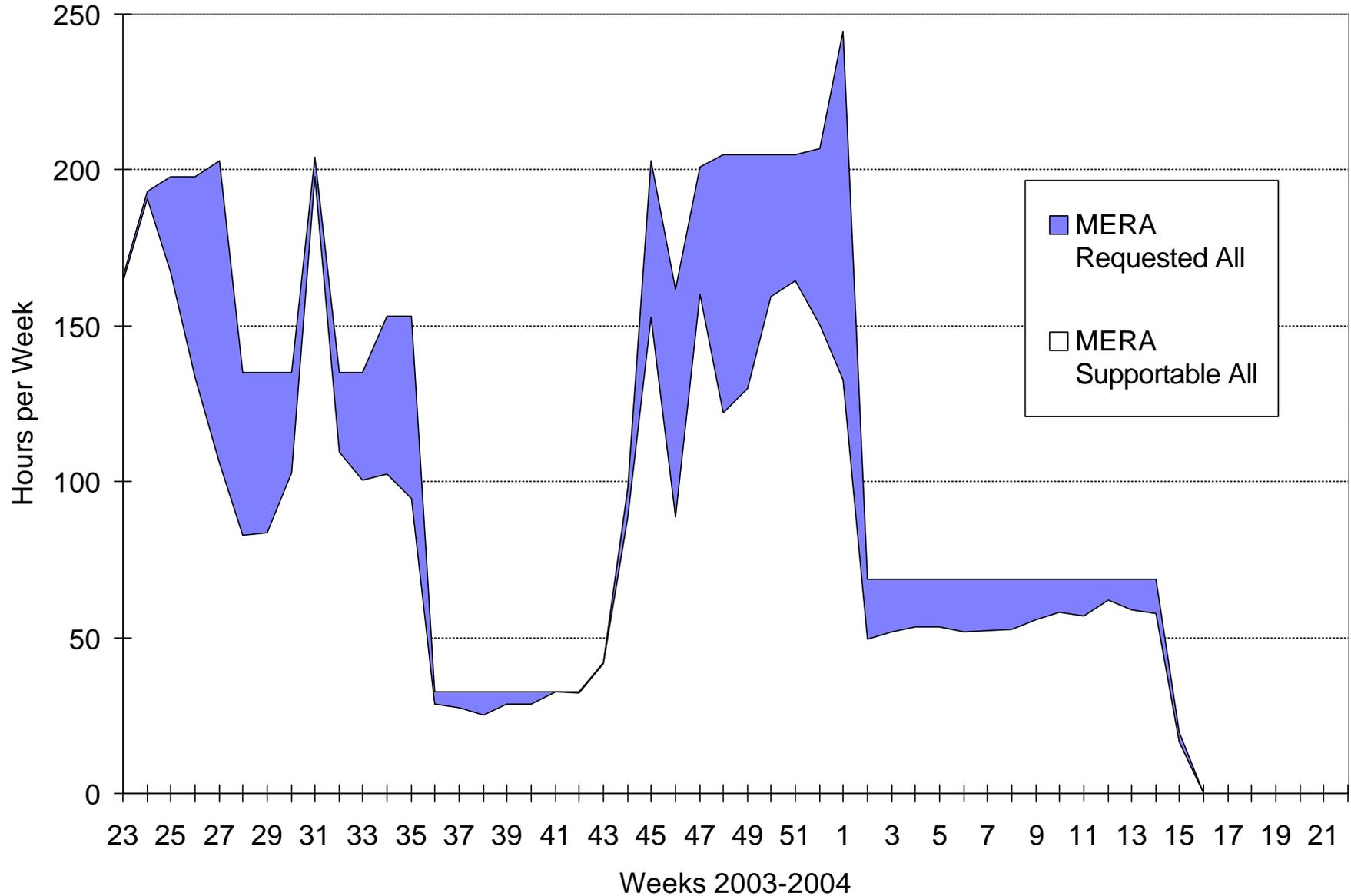


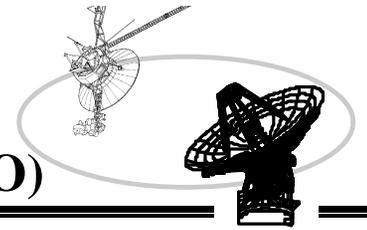
Uncertainties

- MSPA
 - Would M01O MSPA during Surface Ops - How much telecommand time do they need?
 - Can Nozomi's Radio Science (Occultation) Requirement be supported while 'n' missions are supported in an 'n' mission MSPA?
 - Could MEO's 30 days of post-Mars Arrival requirement (*"10-12 hours/day prime telemetry ... and ... telecommand ..., as well as average 4 hours/day prime radiometric"*) be supported with MSPA?
- Equipment Limitations
 - Telemetry Decoding
 - Radio Science Receivers

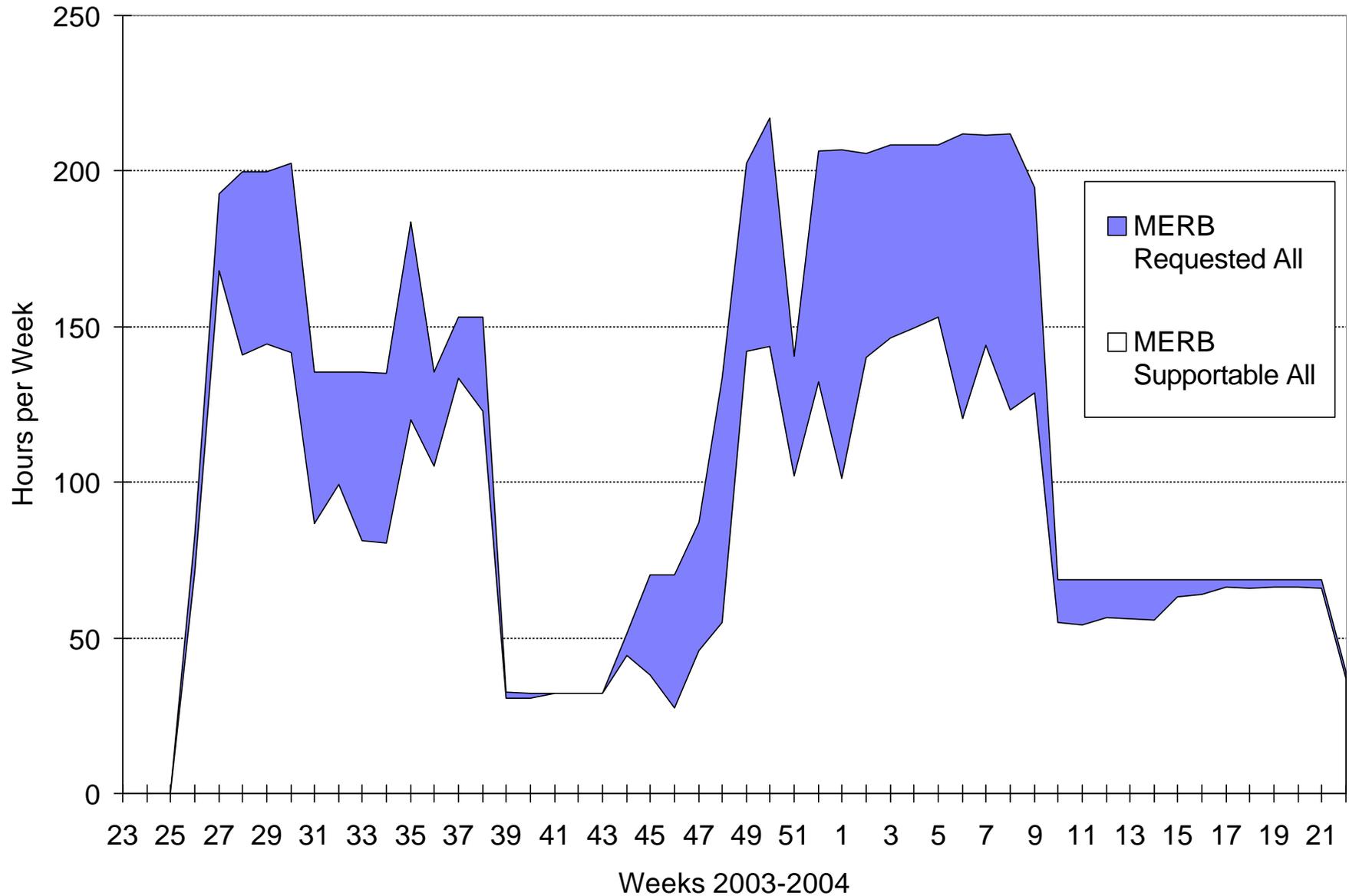


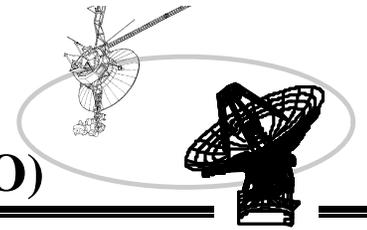
Resource Allocation Planning & Scheduling Office (RAPSO)



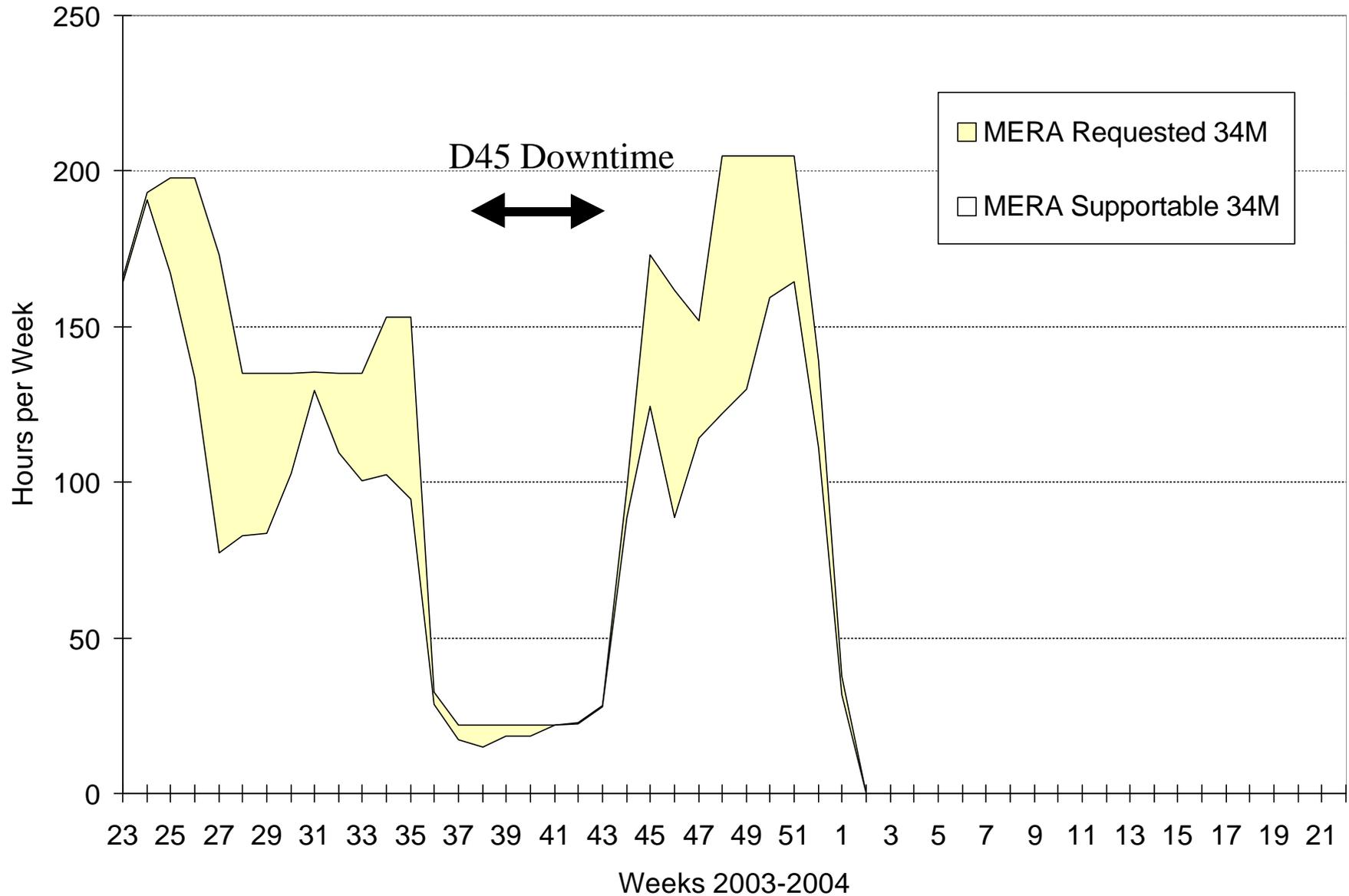


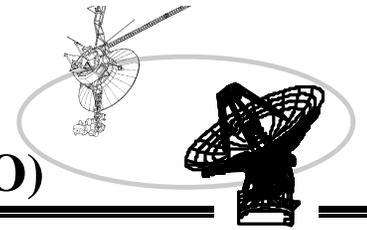
Resource Allocation Planning & Scheduling Office (RAPSO)



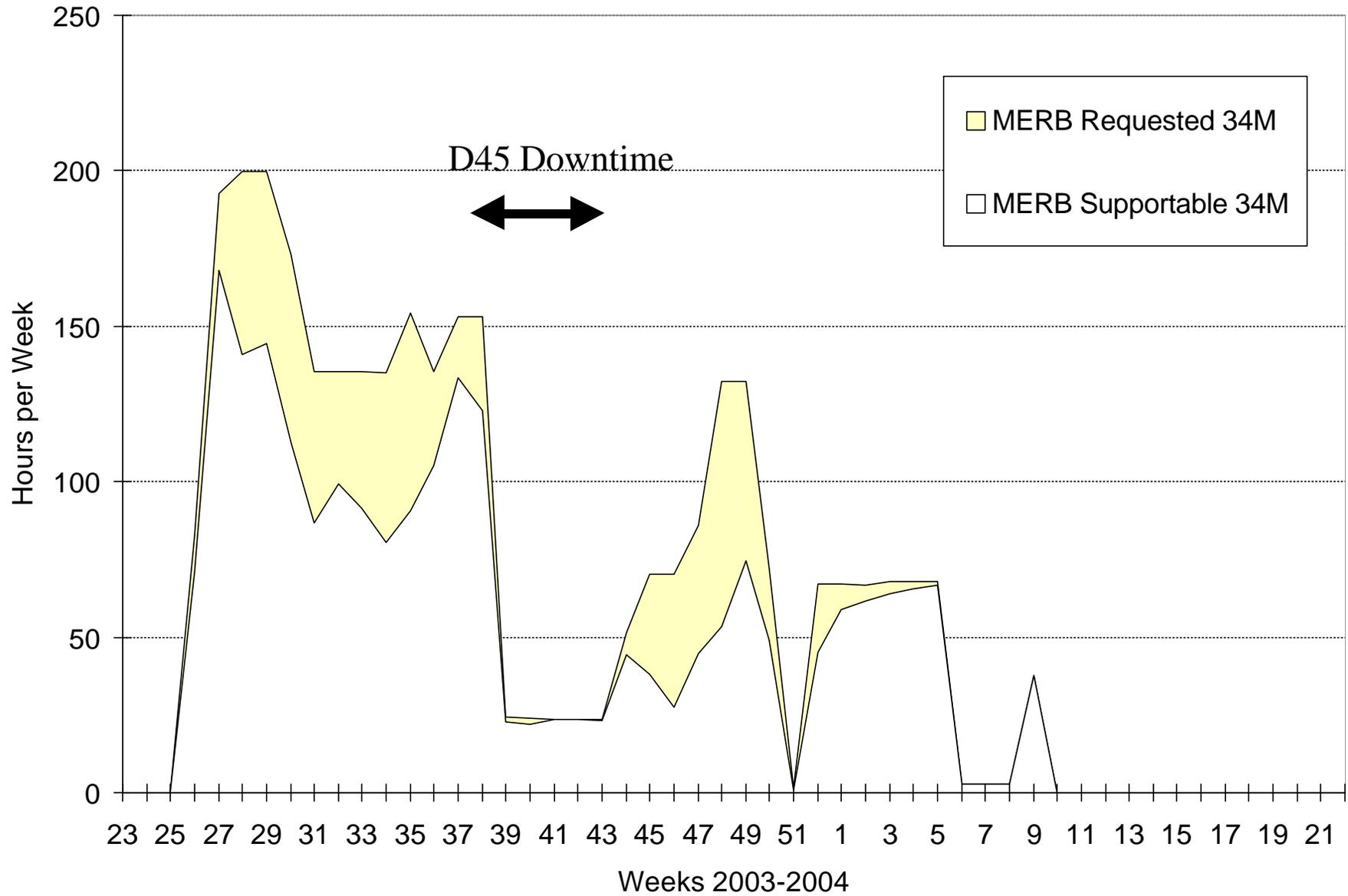


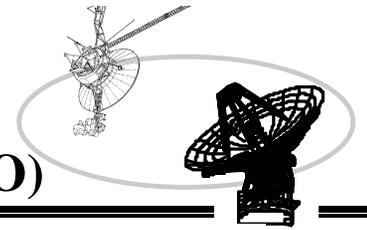
Resource Allocation Planning & Scheduling Office (RAPSO)



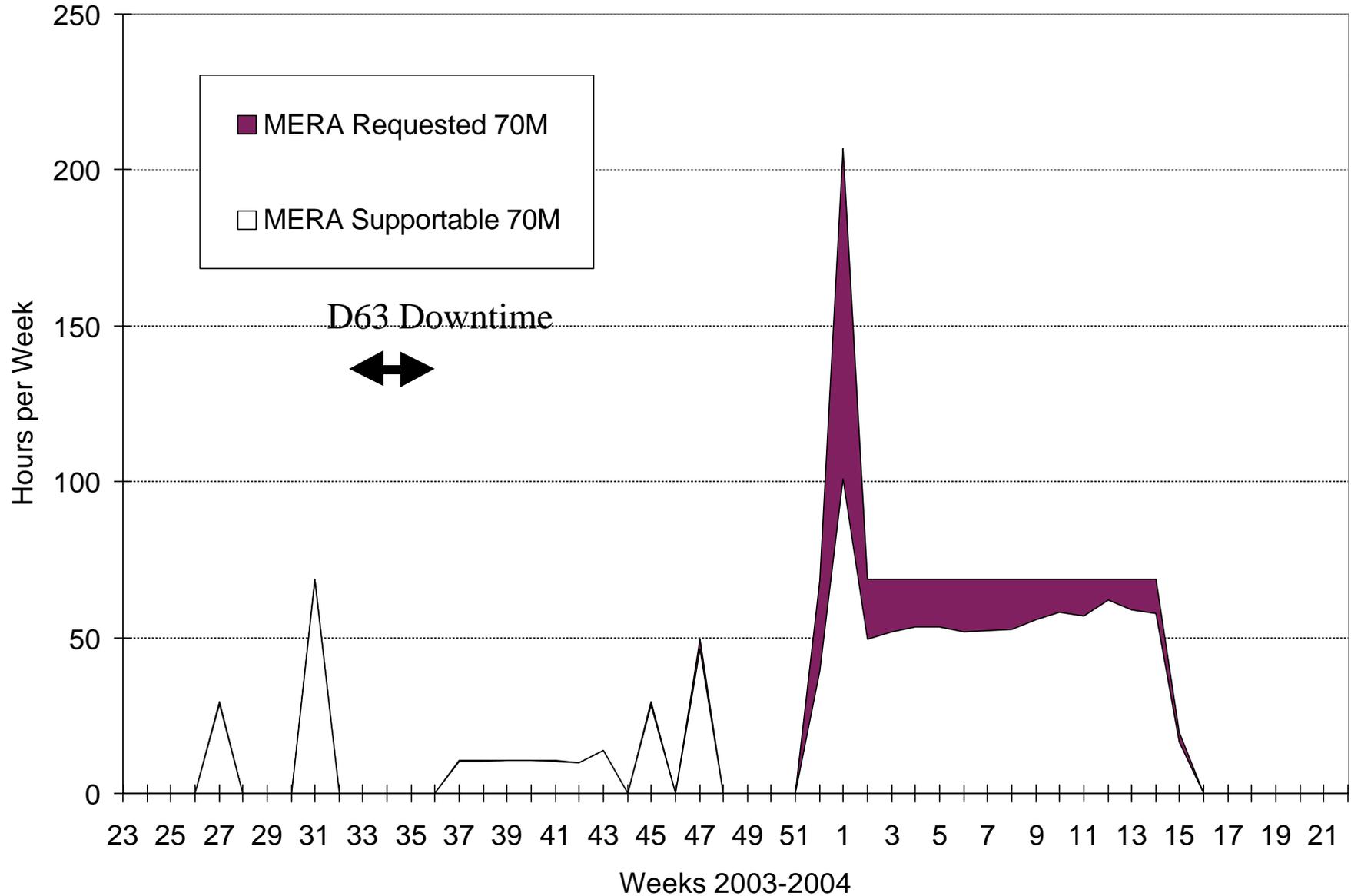


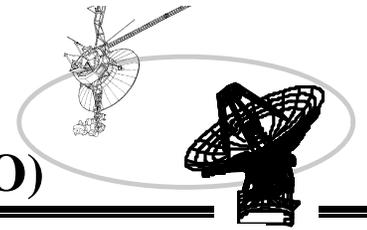
JPL Resource Allocation Planning & Scheduling Office (RAPSO)



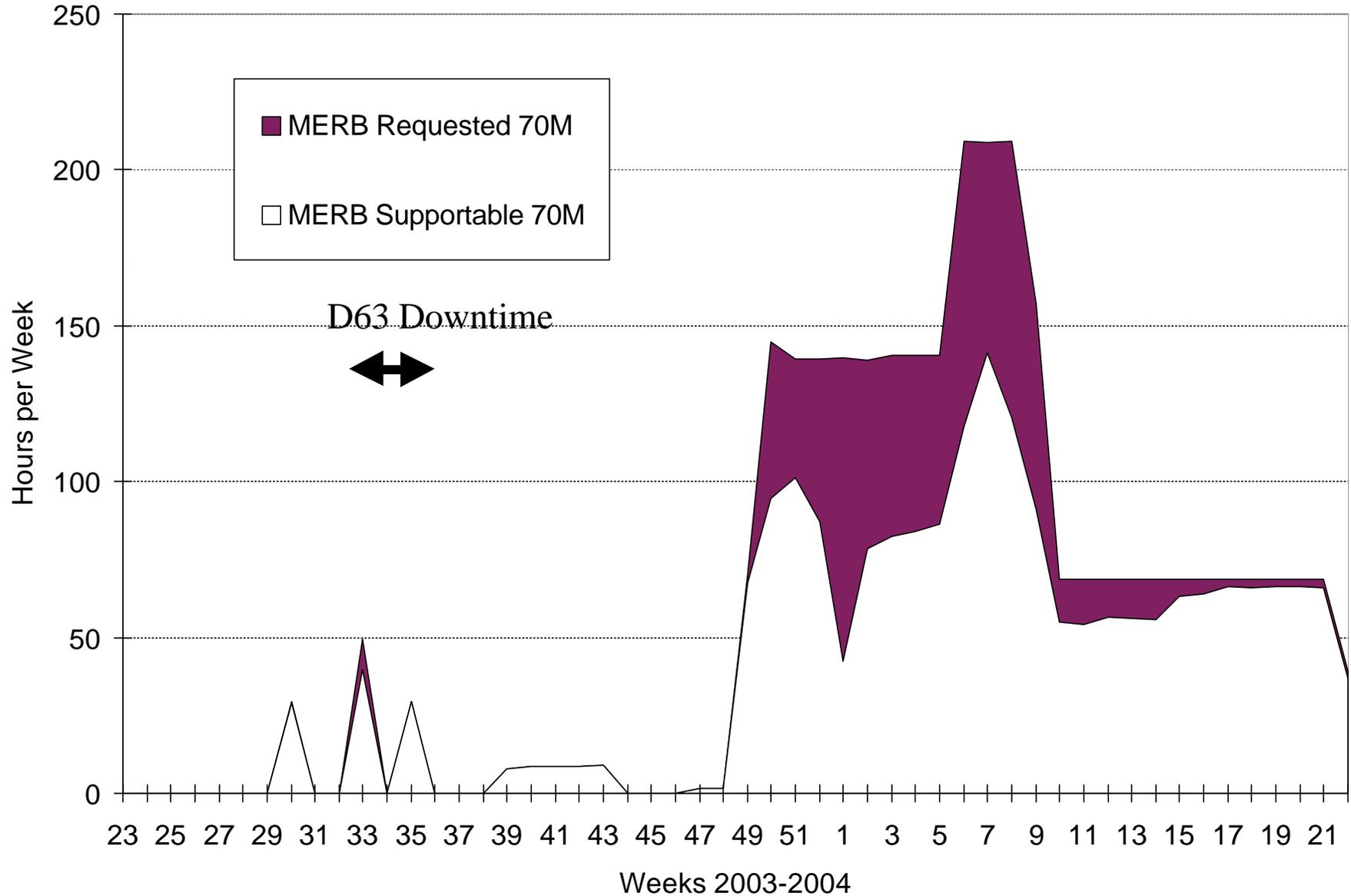


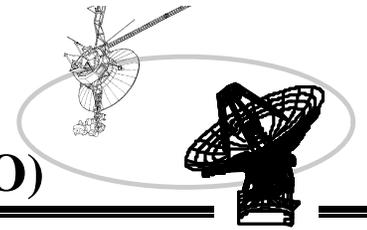
Resource Allocation Planning & Scheduling Office (RAPSO)



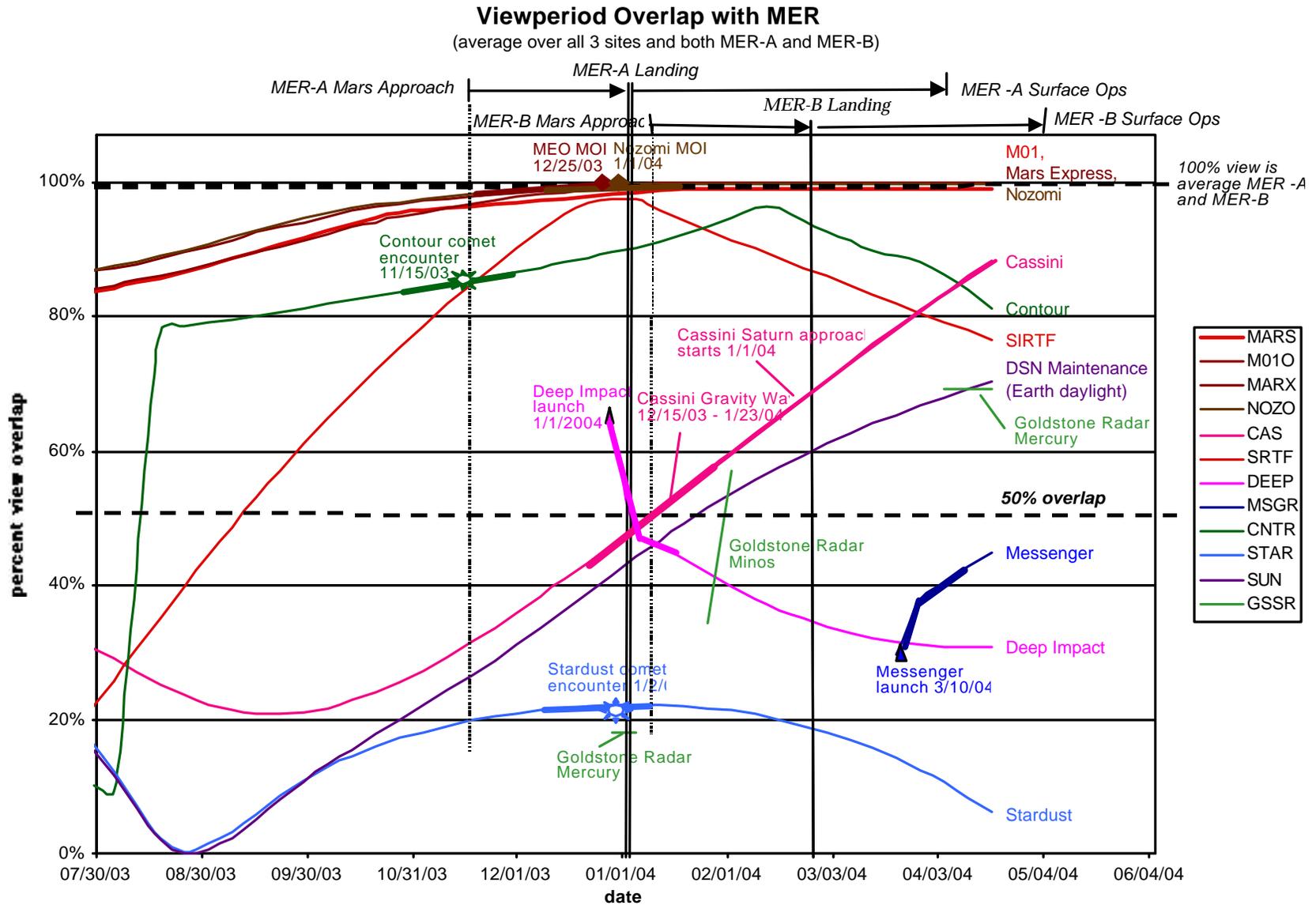


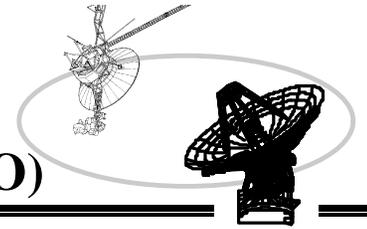
Resource Allocation Planning & Scheduling Office (RAPSO)





Resource Allocation Planning & Scheduling Office (RAPSO)

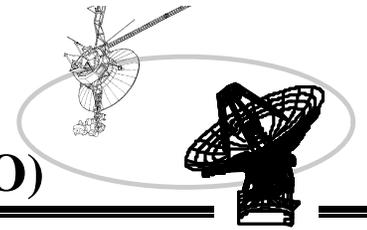




Resource Allocation Planning & Scheduling Office (RAPSO)

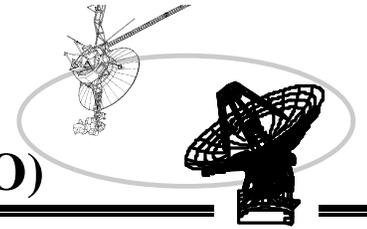
Concurrent S/C Activities in late 2003 - early 2004

- Some significant events: arbitrarily selected
 - 4 spacecraft doing Mars Approach, Landing/Orbit insertion and initial operations
 - No real plan for accomplishing this exists yet. Requesting special study from RAP.
 - MEO uses Perth, Nozomi uses Japanese antenna, which helps lessen DSN demand.
 - After September MEO conference, develop integrated radioNav strategy?
 - Cassini gravity wave experiment
 - Experiment is placed at Cassini opposition (January 4, 2004) ± 20 days (December 15, 2003 - January 23, 2004)
 - Request continuous 34m HEF at Madrid and Canberra, 34m BWG at Goldstone (for K_a -band). Most obvious conflict at end of Madrid segment.
 - Cassini gravity wave experiment is a “Class A” mission requirement
 - This is the third of three experiments. first: late November 2001 - January 2002; second: late December 2002 - January 2003.
 - Required data type is continuous Doppler (and ranging?).
 - Concurrent spacecraft pointing/orientation data is also required (1 measurement per 4 seconds?); telemetry could be buffered and sent once a day?
 - Stardust Wild-2 flyby
 - Stardust Wild-2 flyby on January 2, 2004, 19:20 UTC.
 - Approach TCMs: December 3, 23, 31, 2003; January 1, 2, 2004 (E-30d, E-10d, E-2d, E-18hr, E-6hr).
 - Flyby data return, continuous 70m: E-2d through E+3d; E+5d through E+8d; E+10 through 13d.
 - Critical return-to-Earth TCM on February 2, 2004.
 - Deep Impact launch January 1, 2004, requests continuous 34m coverage for 20 days(?).
- DSN requests for 2003 and 2004 are incomplete, immature, or missing.



Resource Allocation Planning & Scheduling Office (RAPSO)

| Spacecraft | Coverage request | Request timeframe | Significant activity |
|-------------------------------------|--|---|--|
| 70m subnet | | | |
| MER-A | one 8-hr 70m track per day | Jan 4 – April 6, 2004 | Mars Landing, January 4, 2004 91-sol surface operations January 4 – April 6, 2004 |
| MER-B | one 8-hr 70m track per day | Feb 25 – TBD 2004 | Mars Landing, February 25, 2004 TBD-sol surface operations February 25 – TBD, 2004 |
| Mars 01 Orbiter | two 8-hr 70m per day | Oct. 30 2003 – all 2004 | Prime Science, Themis (10/29/03-8/1/04), plus MER relay; negotiate 70m sharing agreement / MSPA after landing |
| Stardust | near-continuous 70m | Dec. 31 2003 – Jan 15 2004 | Comet flyby Jan 2; data return, January 2-15 2004 |
| SIRTF | two 1-hour 70m tracks per day | January – July 2004 | Prime mission Science |
| Cassini | TBD | January 1 – July 1 2004 | Saturn Approach (SOI July 1, 2004) |
| 34m subnet | | | |
| MER-A | continuous 34mHEF | Nov 21 2003 – Jan 5 2004 | Mars Approach, begins November 21, 2003 Mars Landing and sol 2 array, January 4-5, 2004 |
| MER-B | continuous 34mHEF | Jan 11 – Feb 26 2004 | Mars Approach, begins January 11, 2004 Mars Landing and sol 2 array, February 25-26, 2004 |
| Mars Express Orbiter | 12 hrs/day on 34mBWG, or 70m (S-band uplink, X-band downlink) | entire MER mission MEO uses Perth antenna, reduces DSN load. | Mars Approach, starts Dec. 1 2003? Mars Orbit Insertion December 25, 2003 (and aerobraking? TBD) |
| Nozomi (Planet-B) | 34m BWG, or 70m (S-band uplink, X-band downlink) Goldstone & Madrid only?) | Dec 8 2003 – Jan 5 2004 Nozomi uses other antennas, uses DSN for radioNav only | Mars Approach, starts December 8, 2003 (should be earlier?) Mars Orbit Insertion, January 1 2004/08:43 UTC Mars Orbital support: periap raise 1/5/04, then radio science only? (working group meeting in November) |
| Stardust | 34m HEF | Nov 9 2003 – Feb 2 2004 peaks in January | Comet Wild-2 encounter on January 2, 2004 + approach TCMS Comet data return, Jan 2-15 2004 TCM for return-to-Earth, February 2 2004 |
| SIRTF | two 1-hour 34m tracks per day | 2003 | Prime mission Science |
| Deep Impact | 34m continuous | January 2004 | Launch through launch +30d (fits nicely with Cassini view) |
| GSSR (Goldstone Solar System Radar) | DSS-14 (Goldstone 70m) only | Jan 30 – Feb 5 2004 | Asteroid Minos observation Potential problem depending on landing site. |
| DSN antenna daylight maintenance | Occasional high priority | all 2004 | Required maintenance: Negotiate Note: northern winter on Earth; shorter days imply specific conflict |
| Cassini | continuous 34m HEF, except Goldstone BWG (for Ka-band) | Dec 15 2003 to Jan 23 2004 Jan 4 2004 ± 20days | 40-d gravity wave experiment, opposition ±20 days (D.M.: Madrid-Goldstone segment is tough) |
| | TBD | April 1, 2004 on | Saturn Approach (SOI July 1, 2004) |
| MUSES-C | 34m | Feb 9 – Mar 28 2004 | |
| Messenger | Continuous 34m | Mar 10 - Mar 25 2004 | Launch March 10, 2004 (Venus 1 encounter June 24, 2004!) |
| Comet Nucleus Tour | none | | Comet encounter over by Nov 15 2003. assume hibernation mode |
| Rosetta | none | | assume hibernation mode |



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

June 2003 Weeks 23-26

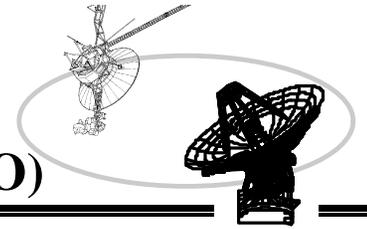
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|-----------------------------|------------|-------|---------|
| MER-A | Launch (6/3), Early Cruise | 34M | 8 | 21 |
| | VLBI (wk 25-26) | 34M | 1 | 1 |
| MER-B | Launch (6/27), Early Cruise | 34M | 8 | 21 |
| M010 | Mapping | 34M | 7 | 14 |
| MEO | Launch (6/1) | 24, 54 | 8 | 7 |
| NOZO | Earth-Mars Transfer (6/19) | 24, 54 | 8 | 5-10 |
| CAS | Sup. Conjunction (wk 25-26) | 25, 45, 65 | 8 | 21 |
| DSS | Routine Maintenance | All | 6-8 | 1-2 |
| STAR | Pre-TCM | 34H | 4 | 2-14 |

Analysis:

The 34H, 34BWG subnets are at maximum utilization in the Mars view. M010 requires two 7-hour passes daily. MEO launches and may use S-band for the first weeks of launch and need 34B1 at Goldstone and Madrid; Nozomi will need about seven passes from the same antennas during MEO launch. The Cassini and Stardust VP overlaps the Mars view by about 40% and both require 34H for 20kW (Cassini uses D25 for Ka band); DSS Maintenance will force them to use 34B antennas once per week. The Mars VP overlaps DSS maintenance for 3 hours. Contention on the 70M subnet is low for time inside the Mars VP.

Recommendation:

Usage of 70M by M010, Cassini and Stardust would allow MERA and MERB to use 34H, D26 and D34. Contention would remain at D54 with Nozomi during MERB launch in week 26.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

July 2003 Weeks 27-31

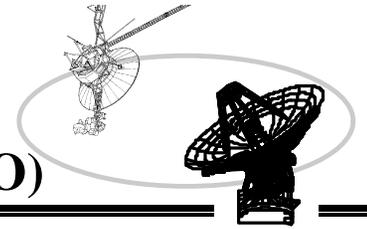
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|-----------------------------|------------|-------|---------|
| MER-A | TCM, Busy Cruise | 34M | 8 | 14-21 |
| | VLBI | 34M | 1 | 1 |
| | Semaphore Test, TCM (wk 31) | 70M | 8 | 7 |
| MER-B | Early Cruise, TCM | 34M | 8 | 14-21 |
| | VLBI | 34M | 1 | 1 |
| M010 | Mapping | 34M | 7 | 14 |
| NOZO | Post Earth-Mars Transfer | 24, 54 | 8 | 5-10 |
| CAS | Sup. Conjunction (wk 27-29) | 25, 45, 65 | 8 | 21 |
| CNTR | Pre-Earth Swingby | 34H | 4-8 | 7 |
| | DSS Downtime (wk 31) | 63 | 168 | |
| DSS | Routine Maintenance | All | 6-8 | 1-2 |
| | STAR TCM, Post-TCM | 34H | 4-8 | 2-14 |

Analysis:

The 34H, 34BWG subnets are at maximum utilization in the Mars view. M010 requires two 7-hour passes daily. Nozomi will need 34B1 at Goldstone and Madrid. The Cassini, Contour (only at Canberra) and Stardust VP overlaps the Mars view by about 40% and all require 34H for 20kW (Cassini uses D25 for Ka band); DSS Maintenance will force them to use 34B antennas once per week. The Mars VP overlaps DSS maintenance for 2-3 hours. Contention on the 70M subnet is low for time inside the Mars VP. MERA semaphore test occurs when DSS-63 begins its Downtime.

Recommendation:

Usage of 70M by M010, Cassini and Stardust would allow MERA and MERB to use 34H, D26 and D34. Contention would remain at D54 with Nozomi in weeks 27-31. May need to move D63 Downtime one week.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

August 2003 Weeks 32-35

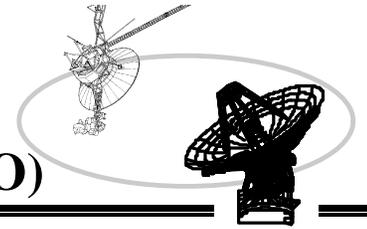
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|-------------------------------|--------|-------|---------|
| MER-A | Busy Cruise | 34M | 8 | 14 |
| | VLBI | 34M | 1 | 1-5 |
| MER-B | Busy Cruise, TCM | 34M | 8 | 14-16 |
| | Semaphore Test (wk 33), TCM | 70M | 8 | 3-5 |
| | VLBI | 34M | 1 | 1 |
| M010 | Mapping | 34M | 7 | 14 |
| NOZO | Cruise | 24, 54 | 8 | 5 |
| CNTR | Earth Swingby | 34H | 8 | 7 |
| DSS | Downtime (wk 32-34) | 63 | 168 | |
| GNS | Pre-Earth Recovery (wk 34-35) | 34B1 | 4-8 | 7-10 |

Analysis:

The 34H, 34BWG subnets are at maximum utilization in the Mars view. M010 requires two 7-hour passes daily. Nozomi will need 34B1 at Goldstone and Madrid. Genesis begins transit back to Earth from L2; contention will occur with Nozomi and other Mars missions on 34B1 subnet. After the Contour Earth Swingby on August 13 (wk 33), its VP overlaps the Mars view by about 75% and requires 34H for 20kW. Contention on the 70M subnet is low for time inside the Mars VP. MERB semaphore test occurs during the D63 Downtime. D63 is available for MERB TCM

Recommendation:

Usage of 70M by M010 would allow MERA and MERB to use 34H, D26 and D34 in week 32. Contention with Contour on the 34H (one pass daily) would remain through week 34. Contention is expected at D54 with Nozomi and Genesis in weeks 32-34. Some coverage at 26M antennas for Genesis may reduce this contention.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

September 2003 Weeks 36-39

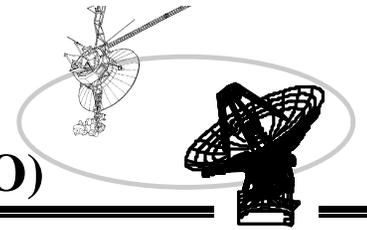
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|-----------------------------|--------|-------|---------|
| MER-A | Minimum Cruise | 34M | 8 | 3 |
| | VLBI | 34M | 1 | 1 |
| MER-B | Busy Cruise | 34M | 8 | 14 |
| | VLBI | 34M | 1 | 1-5 |
| M010 | Mapping | 34M | 7 | 14 |
| NOZO | Cruise, TCM | 24, 54 | 8 | 5-10 |
| CNTR | Post Swingby, Pre-Comet | 34H | 4 | 7 |
| DSS | Downtime (wk 37-39) | 45 | 168 | |
| GNS | Prime Earth Recovery (9/20) | 34B1 | 4-8 | 7-21 |

Analysis:

The 34H, 34BWG subnets are at maximum utilization in the Mars view. D45 begins a seven-week Downtime September 8. M010 requires two 7-hour passes daily. NOZO will need 34B1 at Goldstone and Madrid. Genesis continues its transit back to Earth from L2; contention will occur with Nozomi and other Mars missions on 34B1 subnet. Contour's pre-Comet Encke and post Earth Swingby support overlaps the Mars view by about 75% and requires 34H for 20kW. Contention on the 70M subnet is low for time inside the Mars VP.

Recommendation:

Usage of 70M by M010 and Contour would allow MERA and MERB to use D15, D26 and D65. Contention would remain at 34B1 with Nozomi and Genesis and prohibit its use by MERA, MERB or M010. Some coverage at 26M antennas for Genesis may reduce this contention.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

October 2003 Weeks 40-44

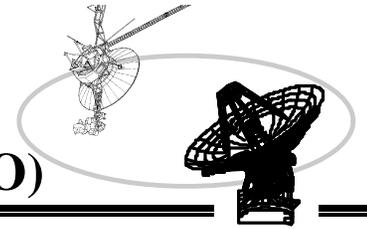
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|----------------------------|---------|-------|---------|
| MER-A | Minimum Cruise, TCM | 34M | 8 | 3-10 |
| | VLBI | 34M | 1 | 1 |
| MER-B | Minimum Cruise | 34M | 8 | 3-5 |
| | VLBI | 34M | 1 | 1 |
| M010 | Mapping | 34M,70M | 7 | 14 |
| NOZO | Cruise | 24, 54 | 8 | 5 |
| CNTR | Pre-Comet Encke Enc. | 34H | 4-8 | 7 |
| DSS | Downtime (wk 40-43) | 45 | 168 | |
| GNS | B/U Earth Recovery (10/09) | 34B1 | 8 | 21 |

Analysis:

The 34H, 34BWG subnets are at maximum utilization in the Mars view. D45 completes its seven-week Downtime October 25. M010 requires two 7-hour passes daily and begins to require 70M in week 44. NOZO will need 34B1 at Goldstone and Madrid. Genesis continues its transit back to Earth from L2; contention will occur with Nozomi and other Mars missions on 34B1 subnet. Contour's pre-Comet Encke support overlaps the Mars view by about 75% and requires 34H for 20kW. Contention on the 70M subnet is low for time inside the Mars VP.

Recommendation:

Usage of 70M by M010 and Contour would allow MERA and MERB to use D15, D26 and D65 until D45 returns to service. Contention in week 40-41 would remain at 34B1 with Nozomi and Genesis (if the Backup EDL date is used) and prohibit its use by MERA, MERB or M010. Since both MERA and MERB are in minimum Cruise, there should not be any impact to them. Some coverage at 26M antennas for Genesis may reduce this contention.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

November 2003 Weeks 45-48

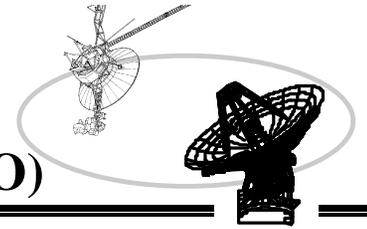
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|-----------------------------|--------|-------|---------|
| MER-A | Checkout, Approach, TCM | 34M | 8 | 14-21 |
| | VLBI | 34M | 1 | 1-5 |
| | Semaphore Test, TCM (wk 45) | 70M | 8 | 3-5 |
| MER-B | Minimum, Busy Cruise | 34M | 8 | 7-14 |
| | VLBI | 34M | 1 | 1 |
| M010 | Mapping | 70M | 7 | 14 |
| NOZO | Cruise | 24, 54 | 8 | 5 |
| CNTR | Comet Encke Enc. (11/13) | 34H | 8 | 7-21 |
| DSS | Routine Maintenance | All | 6-8 | 1-2 |
| STAR | Pre-TCM, Pre-P/Wild2 | 34H | 4-8 | 3-16 |

Analysis:

The 34H, 34BWG subnets are at maximum utilization in the Mars view. M010 requires two 7-hour 70M passes daily. Nozomi will need 34B1 at Goldstone and Madrid. Contour's Comet Encke support overlaps the Mars view by about 75% and requires 34H for 20kW. Stardust's viewperiod overlaps Contour and just begins to impact the Mars view with the support required. Contention on the 70M subnet is low for time inside the Mars VP, but little excess time remains in weeks 45 and 47.

Recommendation:

Usage of 70M by M010 and MERA constrain its use for overloaded 34M subnets in weeks 45-47. 75% of MERA support can be met by the 34H subnet. Contour's reduction in week 47 should allow the VLBI tests to be done. MERB needs to move to 34BWG where contention in week 47-48 would remain at D54 with Nozomi.



Resource Allocation Planning & Scheduling Office (RAPSO)

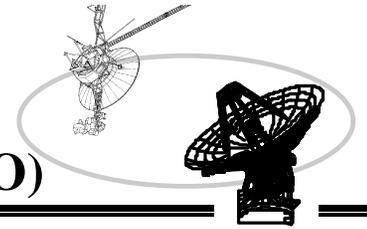
Monthly Analysis

December 2003 Weeks 49-52

| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|----------------------------|------------|-------|---------|
| MER-A | Approach, TCM | 34M | 8 | 14-21 |
| | VLBI | 34M | 1 | 2 |
| | TCM (wk 52) | 70M | 8 | 7 |
| MER-B | Busy Cruise, TCM | 34M,70M | 8 | 14-21 |
| | VLBI | 34M | 1 | 1-5 |
| M010 | Mapping | 70M | 7 | 14 |
| MEO | Approach, MOI (DSCC 10,60) | 34M | 12 | 3-7 |
| NOZO | Cruise | 24, 54 | 8 | 5-10 |
| CAS | Gravity Wave (wk 51-52) | 25, 45, 65 | 8 | 21 |
| CNTR | Comet Encke Enc. (wk 49) | 34H | 8 | 3 |
| DSS | Routine Maintenance | All | 6-8 | 1-2 |
| STAR | Pre-TCM, Pre-P/Wild2 | 34H | 4-8 | 14 |

Analysis:

The 34H, 34BWG subnets are near the maximum utilization in the Mars view. Both MERA and MERB Earth Range exceeds 1 AU in this month. Nozomi plans to arrive at Mars January 1, 2004 and will need 34B1 at Goldstone and Madrid, while Mars Express approaches and arrives at Mars needing daily support from DSCC 10 and 60. Contour's Comet Encke support overlaps the Mars view in week 49 by about 75% and requires 34H for 20kW. Cassini begins their search for Gravitational Waves in week 51 with about a 40% viewperiod overlap with Mars. Stardust's viewperiod begins to impact the Mars view. Contention on the 70M subnet is high for time inside the Mars VP. M010 requires two 7-hour 70M passes daily. MERA and MERB begin to request one to three 70M passes daily.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

December 2003 Weeks 49-52 (cont.)

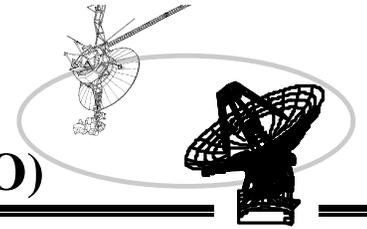
Passes/Week Requested by Mars Missions:

| 70M: Week | 49 | 50 | 51 | 52 | User |
|--------------|-----------|-----------|-----------|-----------|----------------|
| | 00 | 00 | 00 | 07 | MERA |
| | 07 | 14 | 14 | 14 | MERB |
| | 14 | 14 | 14 | 14 | M01O |
| Total | 21 | 28 | 28 | 35 | 70M Use |

| 34M: Week | 49 | 50 | 51 | 52 | User |
|--------------|-----------|-----------|-----------|-----------|------------------|
| | 21 | 21 | 21 | 14 | MERA |
| | 14 | 07 | 00 | 00 | MERB |
| | 03 | 07 | 07 | 07 | MEO (DSCC 10,60) |
| | 02 | 05 | 05 | 05 | NOZO (D54) |
| Total | 40 | 40 | 33 | 26 | 34M Use |

Recommendation:

Usage of 70M by M01O, MERB and MERA exceed capacity. Some part of this support either has to use 34M or find non-DSN 64M or 70M antennas. Non-DSN antennas do not help if unique telemetry decoders or two-way radiometric data are necessary. 1 AU Earth Range was stated as the limit of 34BWG 4kW transmitter usefulness for MER. Cassini's viewperiod overlap is significant enough to limit continuous coverage with 34H subnet because of complex overlap between Madrid and Goldstone. M01O needs to use only D14 and D43 so that either MERA or MERB can use D63 in this month.



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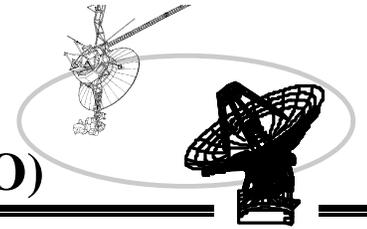
Monthly Analysis

January 2004 Weeks 01-05

| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|-------------------------------|------------|-------|---------|
| MER-A | Approach, EDL, Surf. Ops | 70M | 8 | 7-21 |
| | EDL (01/03) | 34M | 8 | 4 |
| MER-B | Late Cruise, Approach | 34M,70M | 8 | 21 |
| | VLBI | 34M,70M | 1 | 1-2 |
| M010 | Mapping | 70M | 7 | 14 |
| MEO | Post MOI (DSCC 10,60) (wk1-4) | 34M | 12 | 3-7 |
| NOZO | Pre and Post MOI (wk 1-2) | 24, 54 | 8 | 5-10 |
| | Occultation | 70M | 3 | 3 |
| CAS | Gravity Wave (wk 1-4) | 25, 45, 65 | 8 | 21 |
| DEEP | Launch Phase (01/02) | 34M | 8 | 5-19 |
| DSS | Routine Maintenance | All | 6-8 | 1-2 |
| STAR | Comet P/Wild2 Enc., TCM | 34H,70M | 4-8 | 14-18 |

Analysis:

The 34H, 34BWG subnets are near the maximum utilization in the Mars view. MERA EDL is January 3 and both 34H and 70M antenna are required for the day. MERA Surface Ops requires a daily 70M pass. MERB is in Late Cruise and beginning its Approach phase. Nozomi's MOI is January 1, 2004 and will need 34B1 at Goldstone and Madrid. Mars Express post MOI requires daily support from DSCC 10 and 60. Cassini concludes their search for Gravitational Waves in week 4 with about a 50% viewperiod overlap with Mars. Contention on the 70M subnet is high for time inside the Mars VP. M010 requires two 7-hour 70M passes daily. MERA and MERB request one to three 70M passes daily. Stardust's viewperiod impacts the Mars view.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis January 2004 Weeks 01-05 (cont.)

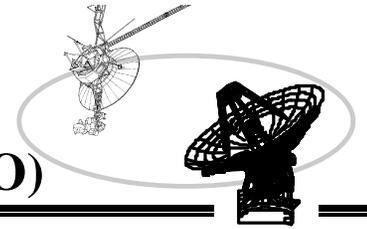
Passes/Week Requested by Mars Missions:

| 70M: Week | 01 | 02 | 03 | 04 | 05 | User |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------------------|
| | 21 | 07* | 07* | 07* | 07* | MERA *-MSPA Potential |
| | 14 | 14 | 14 | 14 | 14 | MERB |
| | 14 | 14 | 14 | 14 | 14 | M01O |
| Total | 49 | 35 | 35 | 35 | 35 | 70M Use |

| 34M: Week | 01 | 02 | 03 | 04 | 05 | User |
|--------------|-----------|-----------|-----------|-----------|-----------|------------------|
| | 04 | 00 | 00 | 00 | 00 | MERA |
| | 07 | 07 | 07 | 07 | 07 | MERB |
| | 07 | 07 | 07 | 05 | 00 | MEO (DSCC 10,60) |
| | 05 | 02 | 00 | 00 | 00 | NOZO (D54) |
| Total | 23 | 16 | 14 | 12 | 07 | 34M Use |

Recommendation:

Usage of 70M by M01O, MERB and MERA exceed capacity. Some part of this support either has to use MSPA, 34M or find non-DSN 64M or 70M antennas. During this month four spacecraft will be at or orbiting Mars. Non-DSN antennas do not help if unique telemetry decoders or two-way radiometric data are necessary. 1 AU Earth Range was stated as the limit of 34BWG 4kW transmitter usefulness for MER. Cassini's viewperiod overlap is significant enough to limit continuous coverage with 34H subnet because of complex overlap between Madrid and Goldstone. Deep Impact launches January 2, 2004 and requires 10 days of continuous support. Deep Impact has nearly the same viewperiod as Cassini and will similarly affect Mars Missions. Stardust uses both 70M and 34M support. When they use continuous 70M, this restricts the full use of the Mars viewperiod for Mars missions by about 6 hours per day. If MSPA is used to support M01O and MERA on the 70M subnet, then MERB can only use one 70M pass per day and must find 34H for the other passes. Since both Cassini and MERB would require D45 and D65, one of these missions must move to the 34BWG and compromise their requirements unless there were sufficient uplink power for either mission to use them.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

February 2004 Weeks 06-09

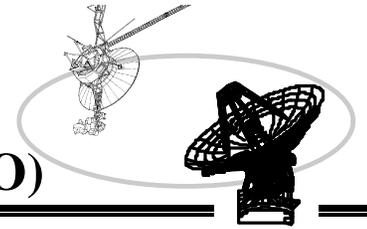
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|--------------------------|---------|-------|---------|
| MER-A | Surface Ops | 70M | 8 | 7 |
| MER-B | Approach, EDL, Surf. Ops | 70M | 8 | 7-21 |
| | EDL (02/25) | 34M | 8 | 4 |
| | VLBI | 34M,70M | 1 | 2 |
| M010 | Mapping | 70M | 7 | 14 |
| NOZO | Occultation | 70M | 3 | 3 |
| DSS | Routine Maintenance | All | 6-8 | 1-2 |
| STAR | TCM | 34H | 4 | 2-14 |

Analysis:

Contention on the 70M subnet is high for time inside the Mars VP. M010 requires two 7-hour 70M passes daily. MERA and MERB request one to three 70M passes daily. The 34H, 34BWG subnets are available for additional support to these missions. MERA Surface Ops requires a daily 70M pass. MERB is in its Approach phase and will land February 25.

Recommendation:

Usage of 70M by M010, MERB and MERA exceed capacity. Some part of this support either has to use MSPA, 34M or find non-DSN 64M or 70M antennas. During this month up to five spacecraft will be at or orbiting Mars; the DSN has requirements to track only four. Non-DSN antennas do not help if unique telemetry decoders or two-way radiometric data are necessary. 1 AU Earth Range was stated as the limit of 34BWG 4kW transmitter usefulness for MER. If MSPA is used to support M010 and MERA on the 70M subnet, then MERB can only use one 70M pass per day and must find 34H for the other passes.



Resource Allocation Planning & Scheduling Office (RAPSO)

Monthly Analysis

March-May 2004 Weeks 10-22

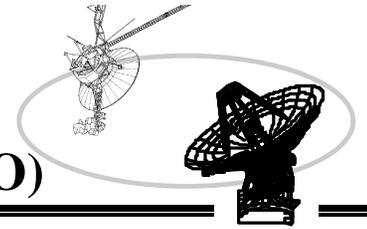
| USER | ACTIVITY | ANT | HOURS | PASS/WK |
|-------|-------------------------|-----|-------|---------|
| MER-A | Surface Ops (EOM 04/05) | 70M | 8 | 7 |
| MER-B | Surf. Ops (EOM 05/27) | 70M | 8 | 7 |
| M010 | Mapping | 70M | 7 | 14 |
| NOZO | Occultation | 70M | 3 | 3 |
| DSS | Routine Maintenance | All | 6-8 | 1-2 |

Analysis:

Contention on the 70M subnet is high for time inside the Mars VP. M010 requires two 7-hour 70M passes daily. MERA and MERB Surface Ops each request one 70M pass daily. The 34H, 34BWG subnets are available for additional support to these missions.

Recommendation:

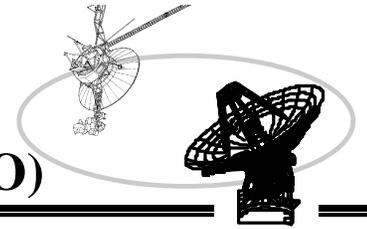
Usage of 70M by M010, MERB and MERA exceed capacity. Some part of this support either has to use MSPA, 34M or find non-DSN 64M or 70M antennas. During this month up to five spacecraft will be at or orbiting Mars; the DSN has requirements to track only four. Non-DSN antennas do not help if unique telemetry decoders or two-way radiometric data are necessary. 1 AU Earth Range was stated as the limit of 34BWG 4kW transmitter usefulness for MER. If MSPA is used to support M010, MERA and MERB on the 70M subnet, then can only one can use 70M transmitter at one time; the others may want to use the 34H for the other passes.



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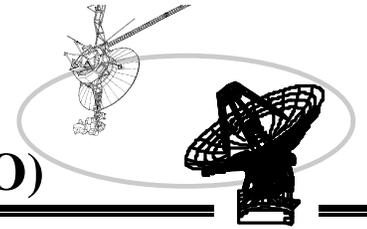
Results

| Month | 20 kW on the BWG | Add'l BWG CAN | Add'l BWG MAD | Add'l 70M Ant. | MSPA # of S/C |
|--------|------------------------|---------------------|---------------------|----------------------|---------------------|
| Jun-03 | X | | X | | |
| Jul-03 | X | | X | | |
| Aug-03 | X | | X | | |
| Sep-03 | | X | X | | |
| Oct-03 | | X | X | | |
| Nov-03 | X | | X | | |
| Dec-03 | X | | X | X | 2 |
| Jan-04 | X | | X | X | 4 |
| Feb-04 | | | | X | 3 |
| Mar-04 | | | | | 3 |
| Apr-04 | | | | | 2 |
| May-04 | | | | | 2 |



Recommendations

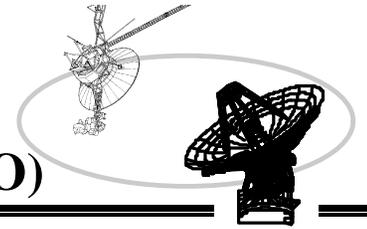
- Add 20 kW Transmitters to 34BWG
 - Provide Flexibility for All Users
- Add Madrid 34M BWG Antenna
 - Consistent Nozomi and Mars Mission Contention At D54
- “Automate” Multiple Spacecraft per Antenna
 - Two Spacecraft is Absolute Minimum
 - Three Spacecraft is Useful for About Three Months



Recommendations

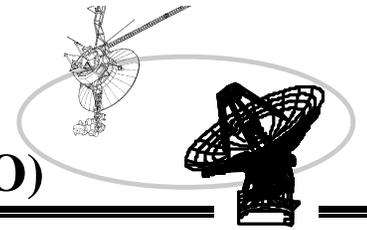
Dependencies:

- DSN Implementations / Maintenance
 - X-band Uplink at D63
 - NSP - Reliability of MSPA
 - D65 Foundation or Pad Stability
 - 70M Fitness in 2004
- Other Spacecraft Missions:
 - Genesis Launches in February 2001
 - MGS EOM in 2002



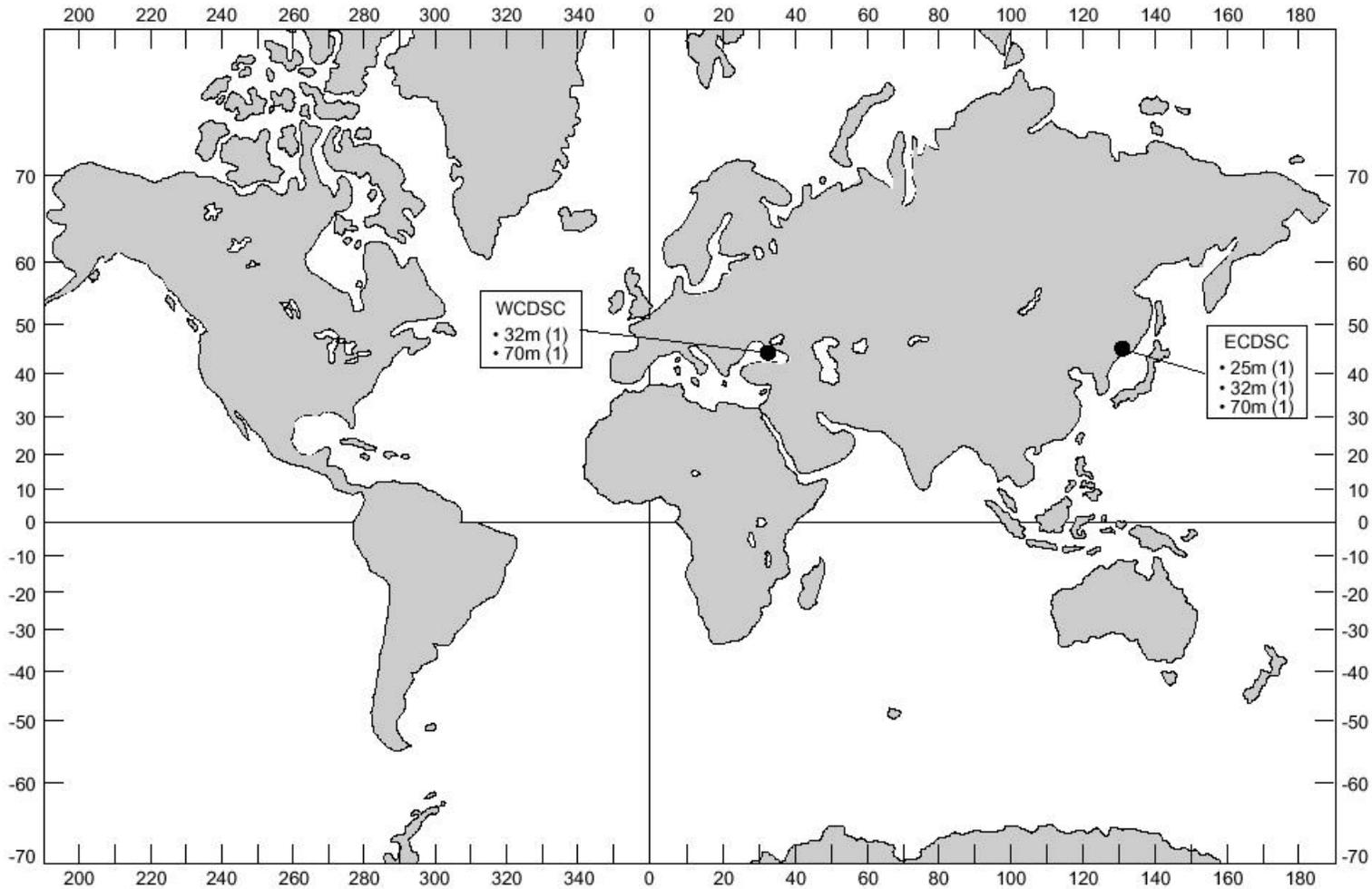
Resource Allocation Planning & Scheduling Office (RAPSO)

BACKUP CHARTS



Resource Allocation Planning & Scheduling Office (RAPSO)

RSA TRACKING SYSTEM STATION LOCATIONS



6445-4788