

AUGUST 14, 2002
IOM JLV-001-2002-08

TO: E.Burke

FROM: J.Valencia

SUBJECT: MCD-3 resource support assessment during the NSP transition period

REFERENCE: Request from Jeff Berner to perform a study to determine complex
MCD-3 loading during the legacy to NSP transition period.

INTRODUCTION

The Resource Allocation Planning and Scheduling Office (RAPSO) has performed a study to determine the forecast hours of Maximum-likelihood-Convolution Decoder-3 (MCD-3) use requested by CASSINI, CONTOUR, MAP, Mars Odyssey, and SIRTF during the Network Simplification Plan (NSP) implementation. The study examines each NSP downtime period and provides a recommendation for the best window of opportunity to switch one MCD-3 unit from legacy telemetry operations to the NSP environment.

SUMMARY OF STUDY

This study focuses on the period of NSP implementation from mid- October 2002 to late May 2003 as illustrated in figure-1. Antenna downtime for NSP implementation is planned at DSS-14, 15, 24, 25, 34, 45, 54, 63 and 65. CASSINI, CONTOUR, MAP, Mars Odyssey, and SIRTF are identified as missions requiring MCD-3 for telemetry processing. The study is based on quantitative data taken from mission User Loading Profiles (ULP) and viewperiods for input to the FASTER software tool to forecast the hours of MCD-3 utilization at each Deep Space Network Complex (DSCC). The data is provided as a set of graphs that show hours of MCD-3 use by spacecraft at each DSCC. Mission viewperiod overlaps are also provided so that a correlation can be made between requested hours of support and the coincidence of two spacecraft requesting MCD-3 support concurrently over the same DSCC. The study examines and provides an analysis for each NSP antenna downtime period starting with DSS-24 and makes a recommendation on the best window of opportunity to switch one MCD-3 unit from legacy telemetry equipment to the NSP operations environment.

SCOPE OF STUDY

- To estimate the hours of MCD-3 utilization for CASSINI, CONTOUR, MAP, M01O, and SIRTF from 10/02/02 (week-43) through 5/18/03 (Week-20) using the FASTER software tools, User Loading Profiles (ULP), and mission view periods as reference source data.

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- To report the estimated requested hours of MCD-3 support by mission at each DSCC.
- To report significant events and Major Antenna Downtimes

MCD-3 RESOURCE ASSESSMENT

The Network Simplification Plan (NSP) is scheduled for implementation at each DSCC antenna beginning at DSS-24 in week 43, 2002 and ending at DSS-14 and DSS-54 in week 20, 2003. Figure-1 is a Gantt chart of the NSP schedule and shows major antenna downtimes and key project events during the NSP transition period. The missions that require MCD-3 are Cassini, CONTOUR, MAP, M01O, and SIRTF. Cassini, MAP, Mars Odyssey (M01O) and CONTOUR are currently flying and SIRTF is planned for launch in January of 2003.

The study examines the NSP downtime at each antenna (figure-1) and provides analysis and makes recommendations on the best window of opportunity at each complex to switch one MCD-3 unit from legacy operations to NSP. The analysis is based on the estimated weekly hours of requested support and viewperiod overlaps at each DSCC. In addition, this study makes the assumption that the users requested hours for support as indicated by the ULP means that MCD-3 is required for each DSN contact.

The FASTER software forecast tool was used to forecast the aggregate subnet loading of all missions during the NSP transition period. FASTER software tool "Forecast. Ant" was then used to determine the loading hours contributed by Cassini, CONTOUR, MAP, M01O, and SIRTF at Canberra, Madrid, and Goldstone. The data is presented as a set of graphs that show the forecast weekly hours of requested support for each mission noted above at each DSCC. In addition, mission viewperiod overlaps for each DSCC are provided so that a correlation can be made between peak forecast requested hours of support and those missions that have a high coincidence of requiring MCD-3 support concurrently over the same DSCC. This study makes the assumption that there is at each DSCC two MCD-3 units available as schedulable resources and that CASSINI, CONTOUR, MAP, M01O, and SIRTF each require one MCD-3 unit for telemetry data processing per DSN contact.

Goldstone Analysis and Recommendations

Analysis No.1 examines DSS-24 NSP downtime scheduled in weeks 43-49 and references figures-2, 3, and 4. Cassini requested hours for support range from 12 hrs per week to 30 hrs per week as shown in figure-2. M01O requested hours for support range from 45 hrs per week to 62 hrs per week, and MAP is requesting 8 hrs per week.

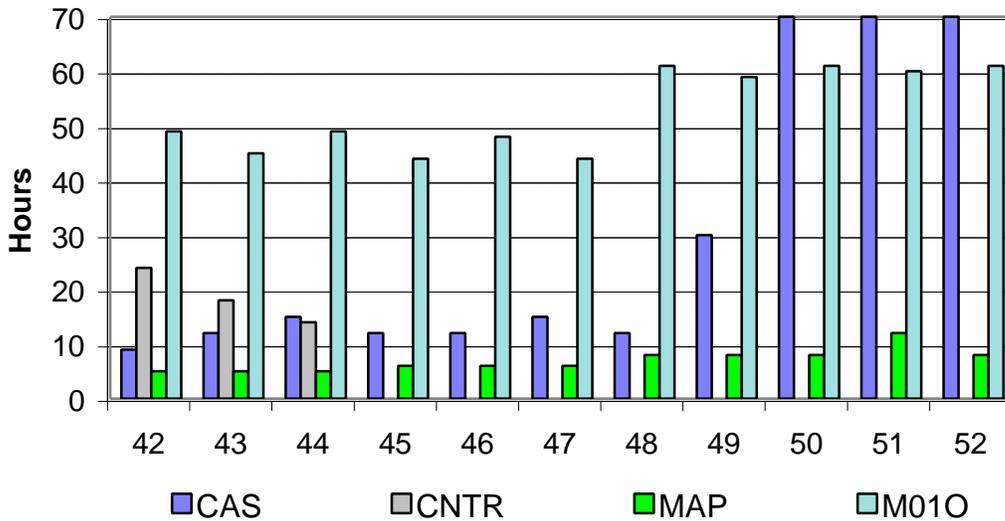


Figure-2: Goldstone forecast hours of MCD-3 utilization in week 42-52 2002

CONTOUR enters hibernation in week 45, 2002 and does not request support until end of hibernation scheduled for week 28, 2003. CASSINI viewperiod overlaps M01O view by approximately 60% in week 43 and decrease to 40% in week-49; MAP viewperiod overlaps M01O view from 9% and increases to 30% in week 49 as shown in figure-3. MAP viewperiod overlaps Cassini view from 60% to 90% in weeks 43-49 as shown in figure-4.

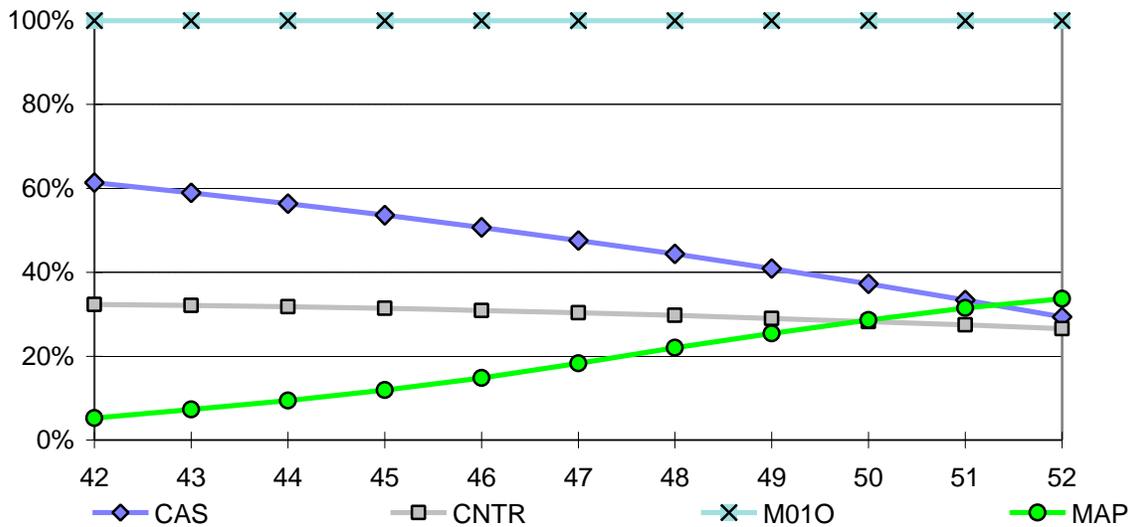


Figure-3: Viewperiod overlaps at Goldstone relative to M01O in weeks 42-52, 2002

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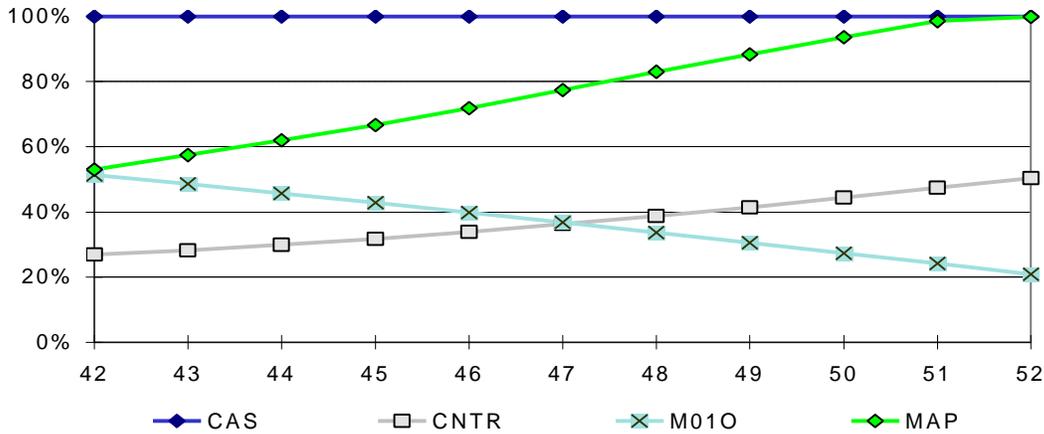


Figure-4: Viewperiod overlaps at Goldstone relative to Cassini in weeks 42-52, 2002

Recommendation No1: In week-47, CONTOUR is in hibernation and does not request DSN support, M01O requested hours for support are reduced and has less than 40% viewperiod overlap with Cassini. No Contour support coupled with reduced M01O hours for support in week-47 provides the best opportunity for switching over one MCD-3 unit from legacy to NSP. A caveat is MAP’s viewperiod overlaps Cassini by 80% as shown in figure-4; however, MAP is only requesting approximately 8 hrs of support minimizing MCD-3 contention.

Analysis No.2 examines DSS-25 NSP downtime scheduled in 2003 weeks 7-10 and references figures-5, 6, and 7. SIRTf is in its launch and early orbit phase and is requesting approximately 63 hrs of support per week as shown in figure-5.

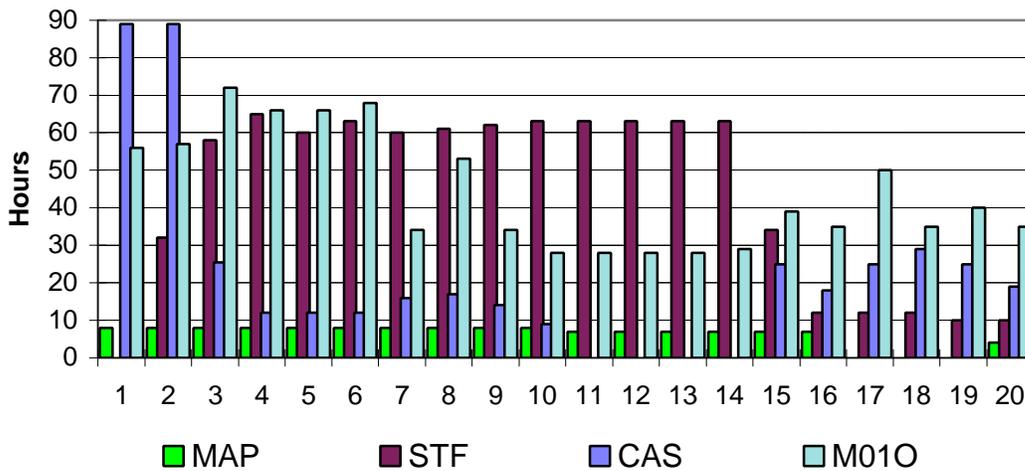


Figure-5: User forecast hours of MCD-3 utilization in weeks 1-20, 2003 at Goldstone

Mars Odyssey requested hours of support range from 35 hrs per week to 55 hrs per week. MAP is requesting approximately 8 hrs per week, and Cassini requested hours of support range from 11 hrs to 18 hrs per week. SIRTf and Cassini viewperiods are opposite of M01O and have 0% viewperiod overlap as shown in figure-6; therefore, have no MCD-3 contention.

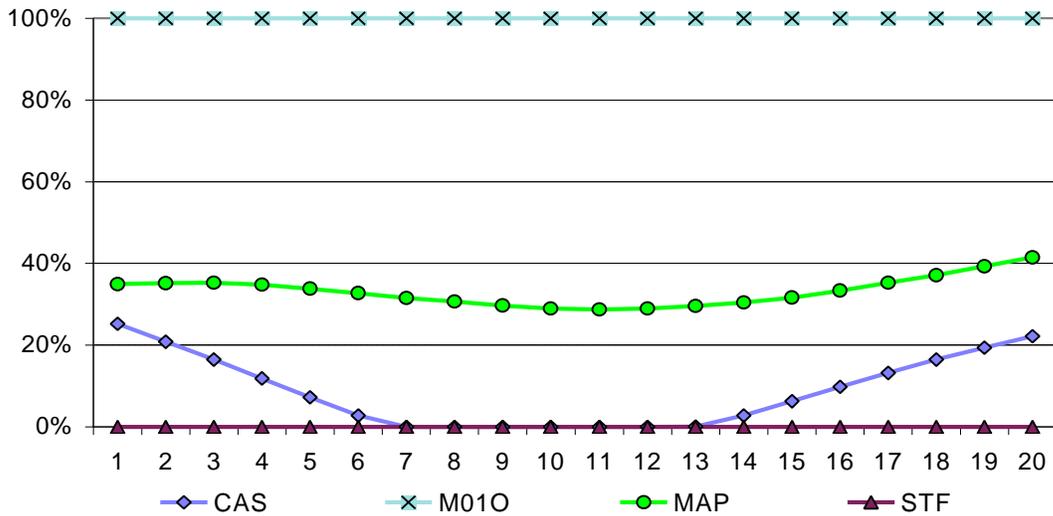


Figure-6: Viewperiod overlaps at Goldstone in weeks 1-20, 2003

MAP has approximately 40% viewperiod overlap with M01O, but is only requesting 9 hrs of support in weeks 7-10. However, Cassini and SIRTf viewperiods overlap 100% and MAP viewperiod overlaps SIRTf by 60% as shown in figure-7.

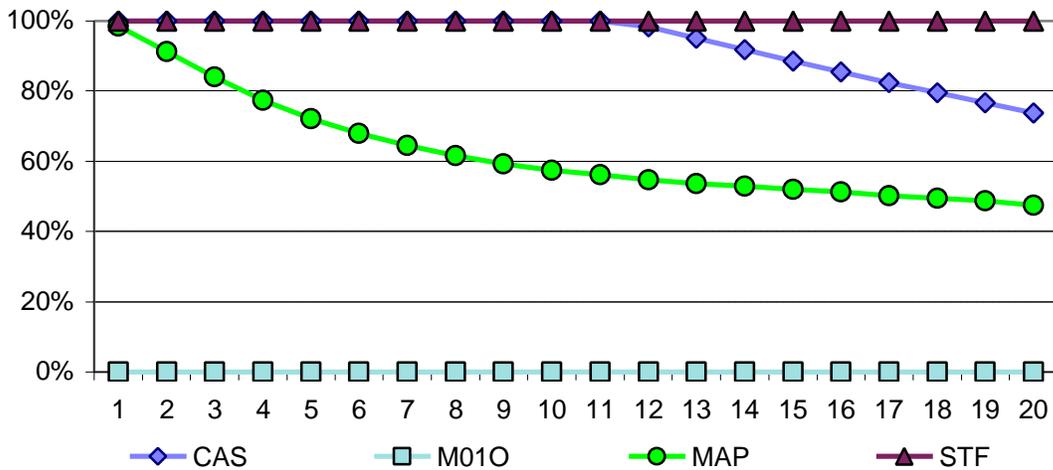


Figure-7: Viewperiod overlaps at Goldstone relative to SIRTf in weeks 1-20, 2003

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Recommendation No.2: In week-10, M01O and Cassini hours of support are reduced as shown in figure-5. Reduced hours for support coupled with SIRTf and Cassini viewperiods opposite M01O provide a good opportunity for switching one MCD-3 unit from legacy to NSP. A caveat is SIRTf's viewperiod overlaps Cassini by 100% and MAP's viewperiod overlaps both SIRTf and Cassini by approximately 60% as shown in figure-7 potentially requiring two MCD-3 units to meet support requirements in weeks 7-10.

Analysis No.3 examines DSS-15 NSP downtime scheduled in 2003 weeks 11-15 and references figures-5, 6, and 7. SIRTf continues its launch and early orbit phase and is requesting approximately 63 hrs of support as shown in figure-5. M01O is requesting approximately 28 hrs of support, MAP is requesting approximately 8 hrs per week and Cassini has no support in weeks 11-14. Mars Odyssey viewperiod is opposite SIRTf and Cassini views and have 0% viewperiod overlap as illustrated in figure-6. There is no MCD-3 contention between M01O and SIRTf, or M01O and Cassini. MAP has approximately 40% viewperiod overlap with M01O, but is only requesting approximately 8 hrs of support per week. However, Cassini and SIRTf have 100% overlapping viewperiods and MAP overlaps SIRTf's viewperiod approximately 55% as shown in figure-7 potentially requiring two MCD-3 units to meet support requirements in weeks 11-15

Recommendation No.3: In week-14 Cassini does not request support; reduced Cassini support coupled with opposing M01O and SIRTf views provides a good opportunity to switch one MCD-3 unit from legacy to NSP. A caveat is MAP viewperiod overlaps SIRTf by approximately 55% and M01O by 35%, but MAP is only requesting 8 hrs of support minimizing MCD-3 contention.

Analysis No.4 examines DSS-14 NSP downtime scheduled in 2003 weeks 17-20 and references figures-5, 6, and 7. SIRTf enters its prime mission phase and reduces support to approximately 12 hrs per week as shown in figure-5. M01O requested hours for support range from 45 hrs per week to 50 hrs per week. MAP has no support in weeks 17-19 and Cassini requested hours for support range from 20 hrs to 30 hrs per weeks. SIRTf and M01O have opposite views and have no MCD-3 contention. MAP has approximately 40% viewperiod overlap with M01O, but is only requesting approximately 8 hrs of support per week. Cassini and SIRTf viewperiods overlap from 75% to 80 % and MAP viewperiod overlaps SIRTf by approximately 50% in weeks 17-20 as shown in figure-7.

Recommendation No .4: In week-18 MAP does not request support and M01O viewperiods are opposite SIRTf. No request for MAP support coupled with a 0 % viewperiod overlap between SIRTf and M01O provides a good opportunity for switching one MCD-3 unit from legacy to NSP. A caveat is SIRTf's viewperiod overlaps Cassini by 80%, but SIRTf's support request is approximately 12 hrs in week 18 minimizing MCD-3 contention.

Canberra Analysis and Recommendations

Analysis No.1 examines DSS-43 NSP downtime scheduled in 2003 weeks 1-06 and references figures-08, 09, and 10. Beginning in Week-02 SIRTf has launch and early orbit phase and its requested hours for support range from 44 hrs per week to 75 hrs. Cassini's hours of support range from 10 hrs per week to 35 hrs per week and MAP and M01O are not requesting support as shown in figure-08. SIRTf's view overlaps Cassini approximately 65% in Week-2 and increases to 75% in Week-6 as shown in figure-9.

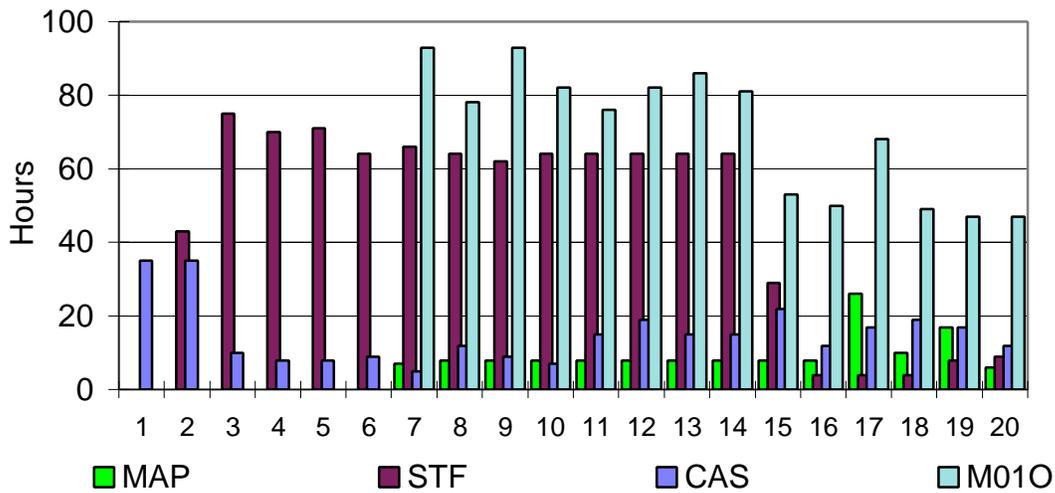


Figure-8: User forecast hours of MCD-3 utilization in weeks 1-20, 2003 at Canberra

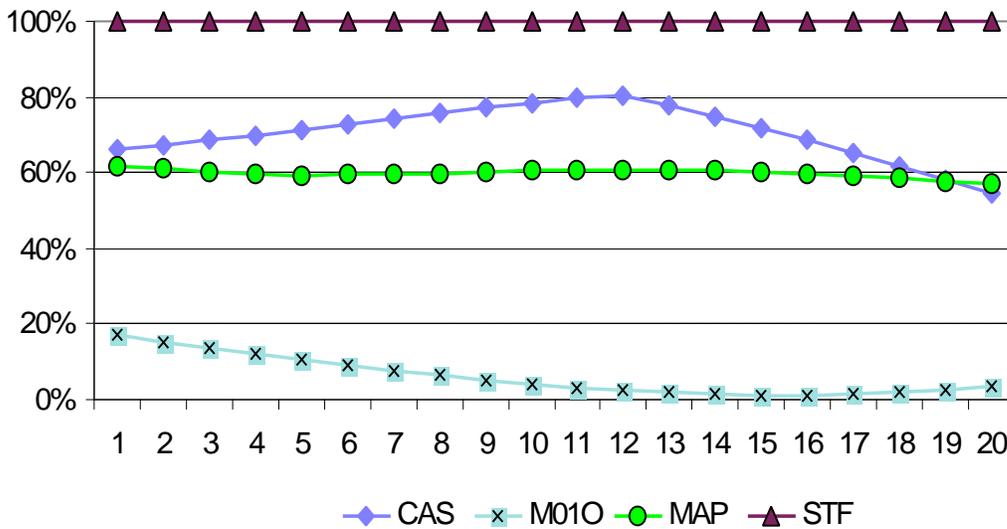


Figure-9: Viewperiod Overlaps at Canberra relative to SIRTf in weeks 1-20, 2003

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Recommendation No.1: In weeks 3-6 MAP and M01O do not request support and Cassini reduces support to 10 hrs per week. No MAP or M01O support coupled with reduced Cassini support provides a good window for switching one MCD-3 unit from legacy to NSP. A caveat is SIRTf has approximately 70% viewperiod overlap with Cassini, but reduced Cassini support minimizes MCD-3 contention in weeks 3-6.

Analysis No.2 examines DSS-34 NSP downtime scheduled in 2003 weeks 6-14 and references figures-08, 09, and 10. SIRTf and M01O request for support is high during these weeks. SIRTf is in launch and early orbit phase and is requesting approximately 63 hrs of support per week. Mars Odyssey request for support ranges from 75 hrs per week to 94 hrs per week as shown in figure-8. Cassini's requested hours for support range from 8 hrs to 19 hrs per week, and MAP is requesting 8 hrs per week. Cassini viewperiods overlaps SIRTf's view by approximately 75% in Week-06 and increases to 80% in week 13 as shown in figure-9. M01O viewperiods are opposite SIRTf and Cassini and have nearly 0% overlap as shown in figure-10 and create no MCD-3 contention. MAP has approximately 40% viewperiod overlap with M01O, but MAP is only requesting 9 hrs of support in weeks 6-14.

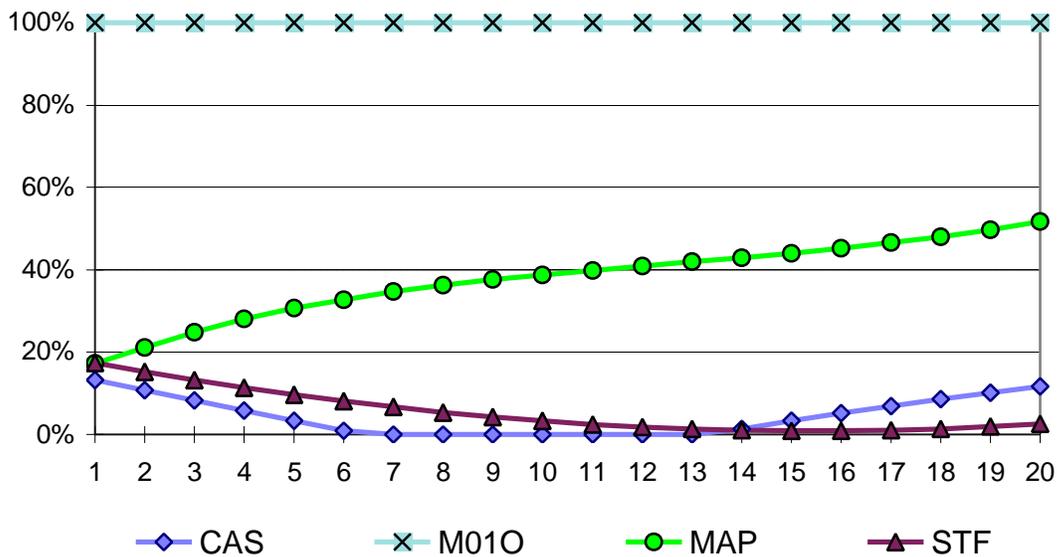


Figure-10: Viewperiod Overlaps at Canberra relative to M01O in weeks 1-20, 2003

Recommendation No.2: In week-10 M01O viewperiods are opposite SIRTf and Cassini and have nearly 0% viewperiod overlaps as shown in figure-9; therefore have no MCD-3 contention. In addition, Cassini support is reduced to 8 hrs. Reduced Cassini support coupled with opposing M01O viewperiods with SIRTf and Cassini provides a good window for switching one MCD-3 unit from legacy to NSP. A caveat is Cassini has approximately 70% viewperiod overlap with SIRTf, but Cassini's reduced support to 8-hrs in Week-10 minimizes MCD-3 contention.

Analysis No.3 examines DSS-45 NSP downtime scheduled in 2003 weeks 15-18 and references figures-8, 9, and 10. SIRTf is in its Prime Mission Phase and significantly reduces support as shown in figure-8. M01O request for support ranges from 49 hrs to 69 hrs per week. Cassini request for support ranges from 12 hrs to 22 hrs per week and MAP request for support ranges from 8 hrs to 28 hrs per week. In week-15 Cassini viewperiods overlaps SIRTf's view by approximately 70% and decreases to 60% in week-18 as shown in figure-9. M01O viewperiods are nearly opposite SIRTf and Cassini and have 0% overlap as shown in figure-10 and minimize MCD-3 contention. MAP has approximately 40% to 50% viewperiod overlaps with M01O.

Recommendation No.3: In week-20 M01O viewperiods are opposite SIRTf and Cassini and have nearly 0% overlap as shown in figure-9; therefore create no MCD-3 contention. Reduced Cassini support in week-20 coupled with opposing M01O viewperiods with SIRTf and Cassini provides a good window for switching one MCD-3 unit from legacy to NSP. A caveat is Cassini has approximately 60% viewperiod overlap with SIRTf in week-20, but Cassini reduces support to 11hrs minimizing MCD-3 contention.

Madrid Analysis and Recommendations

Analysis No.1 examines DSS-65 NSP downtime scheduled in 2003 weeks 2-6 and references figures-11, 12, and 13. SIRTf has launch and early orbit phase support and is requesting 30 hrs to 64 hrs of support per week. M01O requested hours for support range from 50 hrs per week to 70 hrs per week and MAP is requesting approximately 9 hrs per week. Cassini is requesting 64 hrs in Week-2 and 19 hrs in week-3 and does not request support in weeks 4-6 as shown in figure-11.

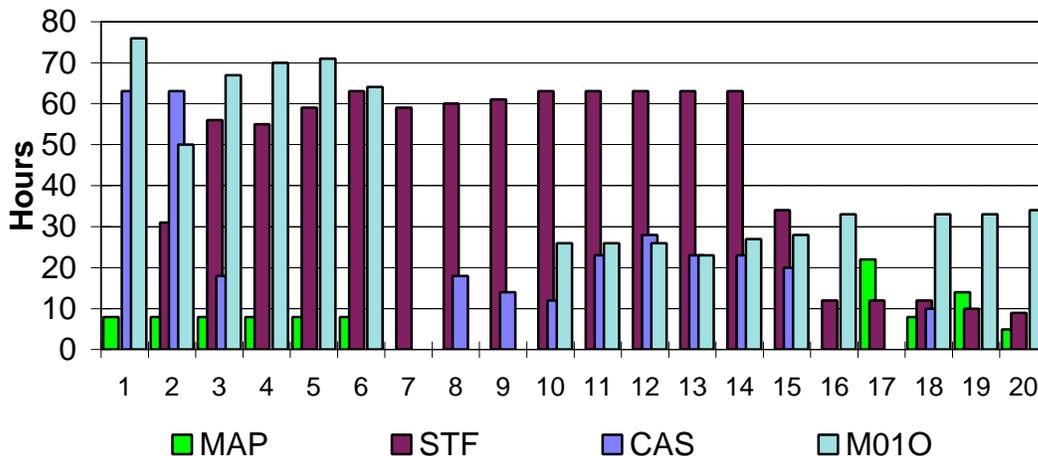


Figure-11: User forecast hours of MCD-3 utilization in weeks 1-20, 2003 at Madrid

SIRTF and M01O have opposite viewperiods and Cassini view overlaps M01O by 20% and decrease to 0% in Week-6 minimizing contention with MCD-3. MAP has approximately 40% viewperiod overlap with M01O, but is only requesting approximately 8 hrs of support. However, Cassini and SIRTF viewperiods overlap 100%, and MAP viewperiod overlaps SIRTF by 98% in Week 02 decreasing to 90% in Week-3 as shown in figure-13 potentially requiring two MCD-3 units to meet support requirements.

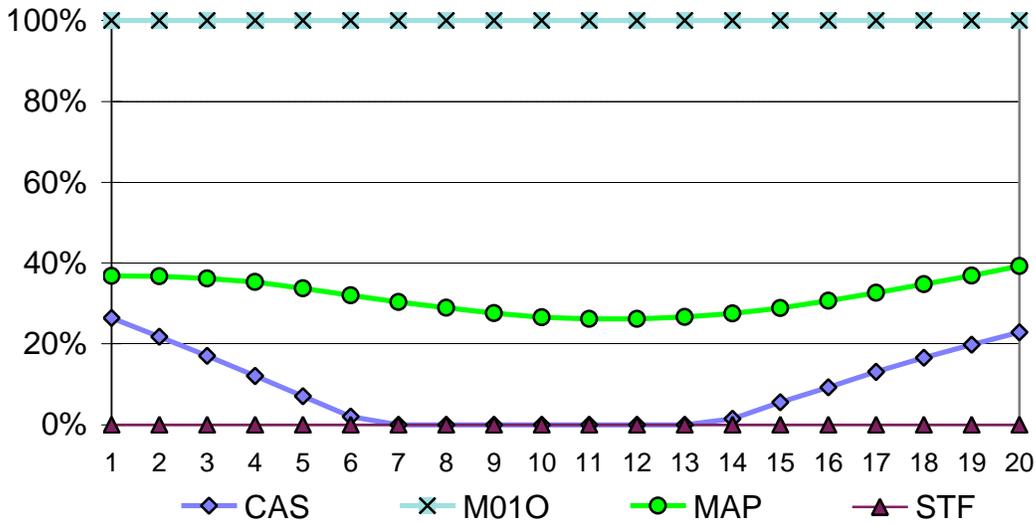


Figure-12: View period Overlaps at Madrid relative to M01O in week 1-20 2003

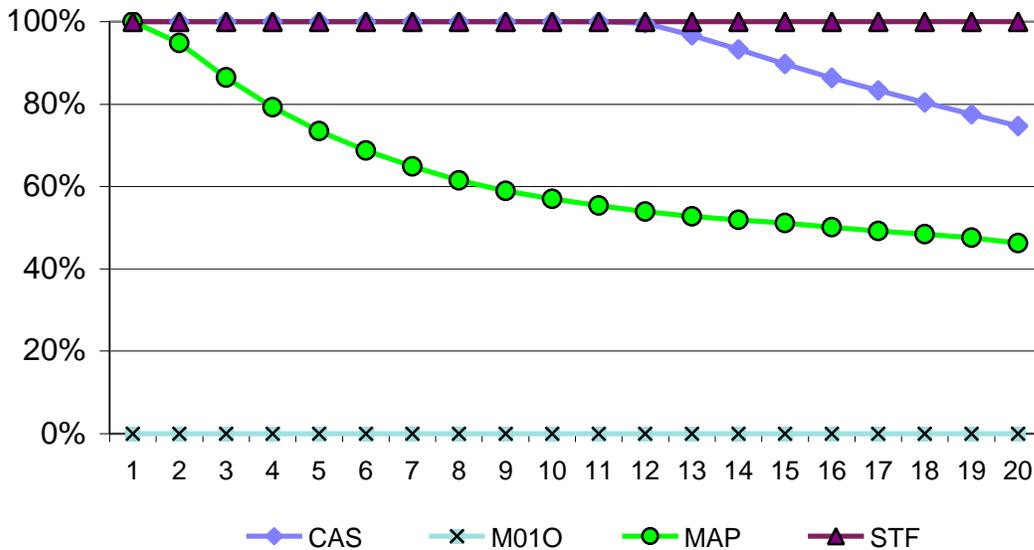


Figure-13: View period Overlap at Madrid relative to SIRTF in weeks 1-20, 2003

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Recommendation No.1: In weeks 4-6 Cassini does not request support and SIRTf's viewperiods are opposite M01O. No Cassini support and opposing SIRTf and M01O viewperiods in weeks 4-6 provides a good window for switching one MCD-3 unit from legacy to NSP. A caveat is MAP's viewperiod overlaps SIRTf by approximately 70% in week-6, but MAP is only requesting 8 hrs of support minimizing contention with MCD-3. An important observation is SIRTf is the only mission requesting support in Week-7, but is outside of DSS-65 NSP downtime as shown in figure-11.

Analysis No.2 examines DSS-63 NSP downtime scheduled in 2003 weeks 7-14 and references figures-11, 12, and 13. SIRTf has launch and early orbit phase support and is requesting approximately 63 hrs of support per week as shown in figure-11. M01O is requesting approximately 28 hrs for support in weeks 10-14 only, and Cassini's requested hours for support range from 12 hrs per week to 28 hrs per week. MAP does not request support. Mars Odyssey viewperiods are opposite SIRTf and Cassini and have 0% viewperiod overlap as illustrated in figure-12; therefore, M01O does experience an MCD-3 contention with SIRTf, or Cassini in weeks 7-14. However, Cassini has 100% viewperiod overlap with SIRTf in weeks 7-14 as shown in figure-13.

Recommendation No.2: In week-9 MAP and M01O do not request support and Cassini reduces its requested support to 15 hrs. No MAP or M01O support coupled with reduced Cassini support in week-9 provides the best window for switching one MCD-3 unit from legacy to NSP. A caveat is that SIRTf has 100% viewperiod overlap with Cassini in weeks 7-14.

Analysis No.3 examines DSS-54 NSP downtime scheduled in 2003 weeks 17-20 and references figures-11, 12, and 13. SIRTf is in its prime mission phase and has reduced support to approximately 10 hrs per week. M01O is requesting approximately 33 hrs per week, and Cassini is requesting approximately 10 hrs of support in week-18 only. MAP's requested hours for support range from 5 hrs per week to 22 hrs per week. Mars Odyssey viewperiods are opposite SIRTf and create no MCD-3 contention, but M01O overlaps Cassini's view from 18% to 22% as illustrated in figure-12. Cassini's viewperiod overlaps SIRTf between 75% and 90 % in weeks 17-20 as shown in figure-13.

Recommendation No.3: In week 20 Cassini does not request support, and SIRTf and M01O have opposite viewperiods coupled with MAP's reduced support provides a good window for switching one MCD-3 unit from legacy to NSP.

CONCLUSION

This special study was completed on August 13, 2002 and examined the period of NSP implementation from late October 2002 to late May 2003. CASSINI, CONTOUR, MAP, Mars Odyssey, and SIRTf are identified as the missions requiring MCD-3 for telemetry processing. The study performed an analysis and assessed the loading on the

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MCD-3 resources at each DSCC during the NSP transition period and makes recommendations on the best window of opportunity to transition one MCD-3 unit from legacy telemetry configuration to NSP operations environment.

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Figure-1: NSP and Major Antenna Downtime Schedule

