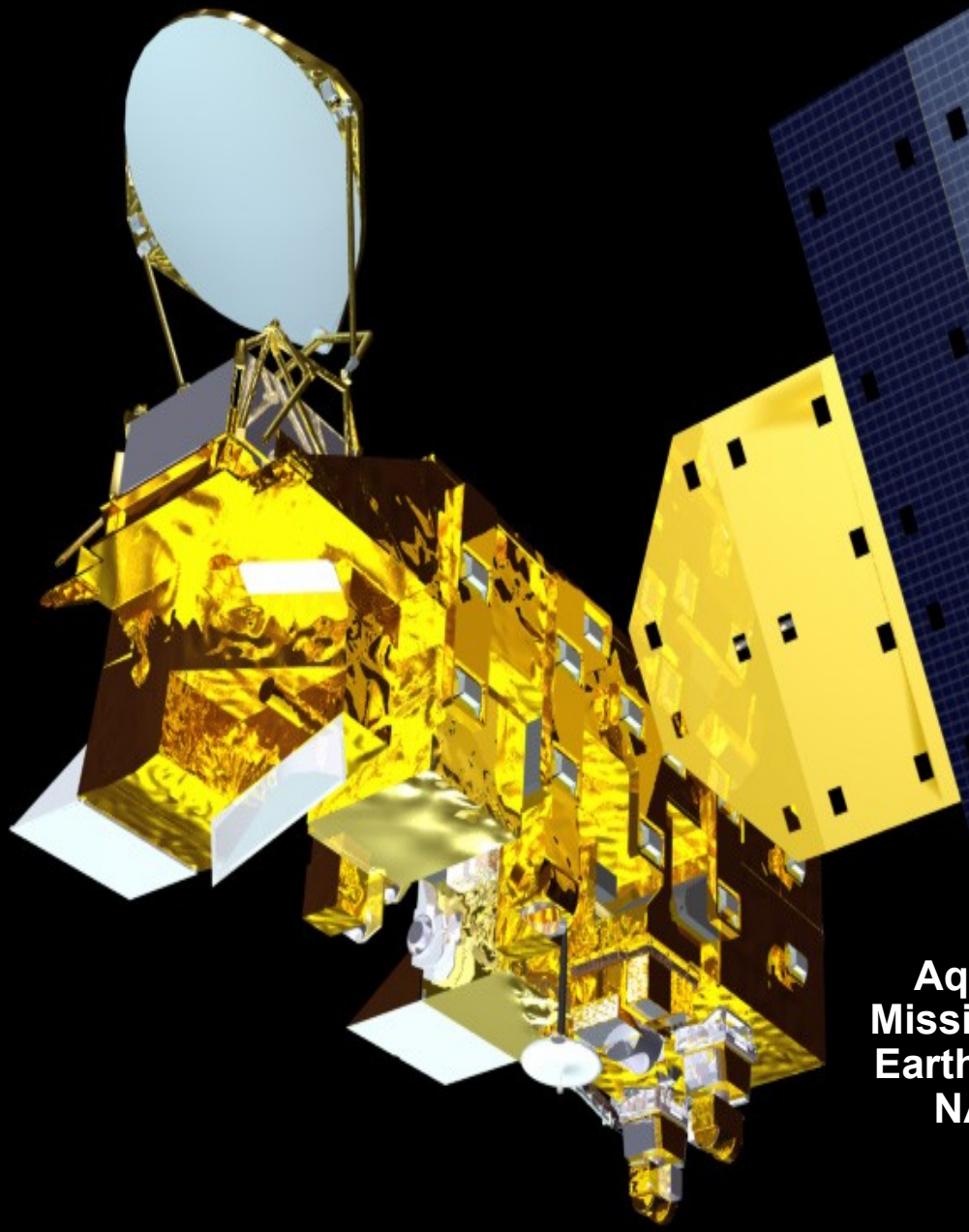
EOS Aqua



Mission Operations Status at the Earth Science Constellation (ESC) Mission Operations Working Group (MOWG) Virtual Meeting

November 16, 2022

Bill Guit

Aqua Mission Director - Code 584/428
Mission Validation and Operations Branch
Earth Science Mission Operations Project
NASA/Goddard Space Flight Center

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Topics

Changes since May 2022 MOWG Meeting are in blue

- **Mission Summary**
- **Spacecraft Subsystems Summary**
- **Recent and Planned Activities & Process Improvements**
  - Aqua A-Train Constellation Exit – Passing/Crossing Events Summary
  - **Refer to separate FDS Presentation for more details**
- **Propellant Usage & Lifetime Estimate & Orbital Decay**
  - Aqua 2022 Lifetime and Decommissioning Analysis (Due: 10/14/2022)
  - Aqua End of Mission Plan (EOMP) – Rev E (December 2021)
- **After-the-A-Train Extended Mission (ATAT) Timeline**
- **Aqua Decommissioning (August 2026)*****
- **Summary**
- **Additional Slides:**
  - Orbit Maintenance Maneuvers
  - Conjunction Assessment High Interest Events
  - Ground Track Error & Mean Local Time History
  - Spacecraft Orbital Parameters Trends & Predictions

***** NOTE: Budget uncertainties for FY24 and beyond are not addressed**

EOS Aqua Mission Summary

Changes since May 2022 MOWG Meeting in blue – NONE***

- **05/04/2002: Launch (6-Year Design Life)**
- **12/02/2008: End of Prime Mission Review**
- **12/08/2015: End of AMSR-E Operations**
- **11/17/2016: A-Train PS Teleconference**
  - Maintain tight Mean Local Time (MLT)
- **10/02/2018: Aqua Decommissioning Review**
- **03/06/2020: Senior Review Proposal #7**
  - Reliability Estimates thru end of CY 2026
  - Consumables through early CY 2022
  - **Proposed After the A-Train Extended Mission**
- **07/08/2020: NASA Earth Science Senior Review Subcommittee Panel Presentation**
- **10/20/2020: Received HQ Guidance**
  - Continue as baselined through at least FY23
- **03/24/2021: Updated Aqua Phase F Plan**
- **02/01/2022: ESMO Annual Review #15**
- **05/04/2022: Aqua 20-Year Anniversary**

*** NOTE: Budget uncertainties for FY24 and beyond are not addressed

Aqua Spacecraft Subsystems

All subsystems configured to primary hardware

Changes since May 2022 MOWG Meeting in blue – NONE !

- **Command & Data Handling (CDH) – Nominal (Solid State Recorder (SSR) holds ~2 orbits of data)**
  - *12/2/2007: FOT SSR Operations Error Anomaly – fully recovered 1/28/2009*
  - *8/16/2020: A Formatter Multiplexer Unit (FMU)/SSR anomaly – Fully Recovered on 9/2/2020*
  - *2/22/2022: SSR Anomaly – Fully recovered 3/23/2022*
- **Communications (COMM) – Nominal**
- **Electrical Power System (EPS) – Nominal (Numerous solar array string failures)**
  - *3/31/2022: Power Controller A (PC-A) Anomaly, Swapped to PC-B, Spacecraft transitioned to Safe Mode, Instruments to Safe, Unable to maneuver (Recovered maneuver capability 4/2/2022)*
    - » *Recovered full spacecraft and instrument operations on 4/14/2022*
  - *Solar Array Regulator Electronics (ARE) power drops and current fluctuations have occurred since 2004*
  - *Most recent power drops: ARE-1A: 7/27/2021 (1 string), ARE-6C: 8/19/2021 (cracked cell)*
  - ***Summary: Estimated that Aqua has lost up to 23 strings of solar cells out of a total of 132 strings.***
    - » ***Aqua continues to have significant power margin out until August 2026***
  - *Battery Cell Anomaly (9/2/2005)*
  - *Solar Array (SA) Panel #8 Thermistor #6 Failure (8/3/2009), SA Offset (Reported 1/17/2009, Corrected 6/29/2010)*
- **Flight Software (FSW) – Nominal**
- **Guidance, Navigation & Control (GN&C) – Nominal**
- **Propulsion (PROP) – Nominal**
  - *Dual Thruster Module (DTM-2) Heater Anomaly (9/8/2007)*
- **Thermal Control System (TCS) – Nominal**

Spacecraft Activities Summary

(May 2022 – 10/31/2022)

Changes since May 2022 MOWG Meeting in blue

- **Aqua ESC/A-Train Member Mission Passing-Crossing Events**
  - 04/03/2022: GCOM-W1 – Covered during May 2021 ESC MOWG Meeting
  - 05/17/2022: OCO-2 – occurred during May 2021 ESC MOWG Meeting
  - 06/30/2022: Landsat-7
  - 09/15/2022: Terra
  - 09/26/2022: Landsat-9
  - **Future Events see FDS Presentation – Aqua "Free Exit" Passing Analysis**
- **19 CRMS High Interest Orbital Debris Events (HIEs):** see slide 24
  - 19 Debris Avoidance Maneuvers (DAMs) PLANNED: 159 Maneuvers Screened
  - 19 Self-mitigated, **No DAMs Executed** –
- **1 Ongoing Spacecraft Bus Anomaly: Solar array (SA) string losses**
  - No new string losses since last MOWG Meeting
    - **Aqua has lost up to 23 of 132 strings (Future Power Margin on slide 12)**
- **0 Instrument Anomalies:**
- **0 Spacecraft Maneuvers:** Last DMUM on 12/1/2021, IAM on 3/18/2021
- **4 Instrument Calibration Maneuvers: 5/11, 6/10, 7/9, summer gap & 11/4**

2022 Completed Activities

(May MOWG thru October 2022)

Completed since May 2022 MOWG Meeting in blue

- **05/04/2022: Aqua 20-Year Anniversary**
  - In-person Celebration at GSFC Visitors Center
- **06/21/2022: FDS Aqua 2022 Lifetime Analysis Status**
  - Aqua can delay PLMs until Aug. 2026 and meet 25-year reentry requirement
- **07/11/2022: Start of 8-week Test Period for 2-Controller Operations**
  - Weekly Status Reports with ESMO Management
- **08/17/2022: Aqua 2022 Lifetime Analysis Presentation (Plots & Tables)**
- **09/01/2022: 2-OCE Ops Operations Readiness Review (ORR)**
- **09/22/2022: Fall EPS ARE State-of-Health Test**
- **10/23/2022: Supplemental EPS ARE State-of-Health Test**
- **10/14/2022: 2022 Aqua Decommissioning/Lifetime Analysis (V1.0)**
  - Update from 08/17/2022-v3 Lifetime Analysis Presentation (Charts and Tables)
- **11/01/2022: EOS (T/A/A) Drifting Orbits Workshop (2-days)**
- **11/16/2022: ESC MOWG Meeting (TODAY)**

Planned Activities

(Mid-to-Long-Term)

Changes since May 2022 MOWG Meeting in blue

- **Aqua/Aura Retrograde Maneuver (RGM) Working Group – Ongoing**
  - January 2022: Limited on-orbit retrograde capability (Emergencies)
  - Free-Drift/Drag-Down Retrograde RMMs (Emergencies)
  - **Focus is on Aura CEMs and PLMs – to be ready by January 2023**
- **11/01/2022: EOS (Terra/Aqua/Aura) Drifting Orbits Workshop**
- **December 2022: EPS Performance Working Group Meeting**
  - Model Solar Array Strings losses using Weibull distribution.
  - Estimate a probability Aqua Spacecraft Bus will function past 2026.
- **December 2022: Decommissioning/Passivation Review**
- **- - - - - - - - - - 2023 - - - - - - - - - - - - - - - - - - -**
- **January 2023: Extended Mission Reliability Assessment for 2023 – 2026**
- **January/February 2023: ESMO Annual Review**
- **March: Senior Review Proposal due (TBD – Hopefully)**
- **Spring 2023: ESC MOWG Meeting (Date/Location are TBD)**
- **November – December: PLMs, Passivation & Disposal (In-Guide Budget)**
  - See Slides 20 and 21

Ongoing Process Improvements

Completed since May 2022 MOWG Meeting in blue

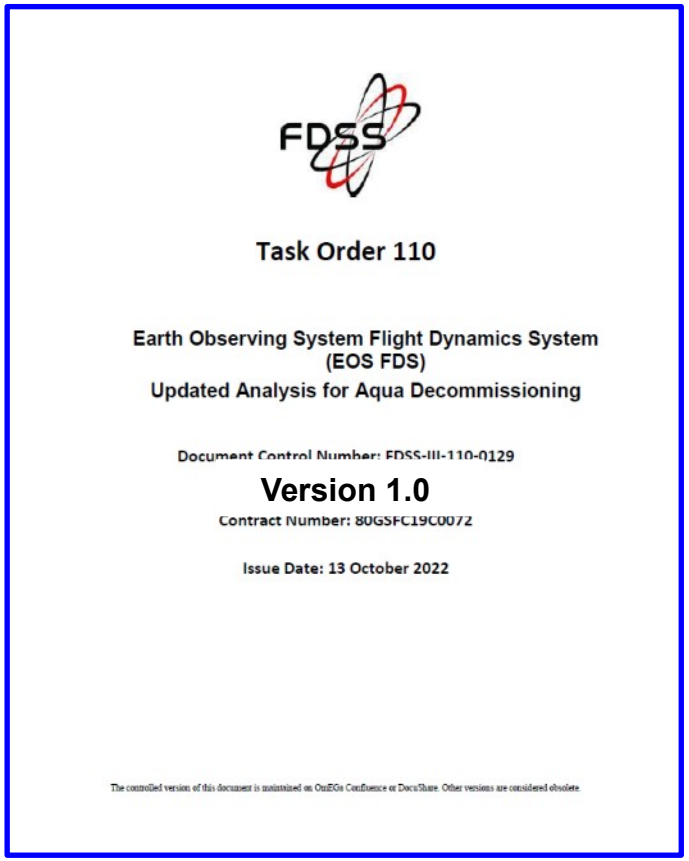
- **Aqua/Aura Maneuver Working Group: Reestablished in May 2016**
  - Develop retrograde maneuver capability **[DONE – Limited emergency use only]**
  - Develop more fuel-efficient propulsive maneuvers (IAMs, CEMs & PLMs) **[DONE]**
  - **Next Step: Finalize Aura CEMs & PLMs to be ready by January 2023**
- **EOS Automation (EA): Multi-year/Multi-phase development**
  - **2-Controller (OCE) Operations Implemented [DONE] – Delayed by COVID-19**
- **Collision Risk Management System (CRMS) – Initiated in 2015**
  - **Operating with CRMS Release 10.0 [DONE], Next Step: Release 11.0 March 2023**
- **CARA Devolution: ESMO quasi-devolved since October 2019**
  - ESMO Pilot Program Parallel Operations: 3/26/2019 – 10/2/2019 **[DONE]**
- **NASA Guidance on Collision Avoidance: December 9, 2020**
  - NASA Interim Directive (NID) 7120.132 CA for Space Environment Protection
  - Spacecraft CA and Collision Avoidance Best Practices Handbook
  - 11/23/2021: NASA Policy Requirement (NPR) for "NASA Spacecraft Conjunction Analysis and Collision Avoidance for Space Environment Protection", intended to replace NASA Interim Directive (NID) 7120.132 (May 2022 Draft 43 under review)
  - **05/12/2022: Final ESMO MOCA CONOPS signed off**

Aqua Propellant Usage

(October 2022)

Changes since May 2022 MOWG Meeting in blue

- **2006: Initial Aqua lifetime fuel analysis**
- **2008: Detailed Aqua & Aura lifetime analyses**
  - Presented to A-Train MOWG and at Aqua EOPM Review
- **September 2012: Initial Aqua Decommissioning Plan**
- **August 2013: Updated Decommissioning Plan**
  - Updated Constellation Exit Plan
- **September 2014: Updated Decommissioning Plan**
- **December 2016: Updated Decommissioning Plan (V1.1)**
- **November 2017: Updated Decommissioning Plan (V1.1)**
- **July 2018: Updated Decommissioning Plan (V1.0)**
  - 08/02/2018 IAM required update to document and IAM Plans
- **November 2018: Updated Decommissioning Plan (V2.0)**
- **July 2019: Updated Decommissioning Plan (V1.0)**
  - 10/02/2019 IAM required update to plots and figures only
- **July 2020: Updated Lifetime Analysis Presentation**
  - Updated DAS Solar Flux Models
- **February 2021: Updated 2020 Decommissioning Plan (V1.0)**
- **Summer 2021: Updated Lifetime Analysis Presentation**
- **February 2022: Updated 2021 Decommissioning Plan (V1.0)**
- **Summer 2022: Updated Lifetime Analysis Presentation**
  - 08/17/2022: 2022 Lifetime Analysis (v3) – Plots & Tables (v4 on 8/18)
  - 10/13/2022: 2022 Lifetime Analysis Final Full Document
- **Annual updates will be provided each Fall (started in 2017)**
  - Final will be produced 60 days before start of decommissioning



FDSS

Task Order 110

Earth Observing System Flight Dynamics System
(EOS FDS)
Updated Analysis for Aqua Decommissioning

Document Control Number: FDSS-III-110-0129

Version 1.0

Contract Number: 80GSFC19C0072

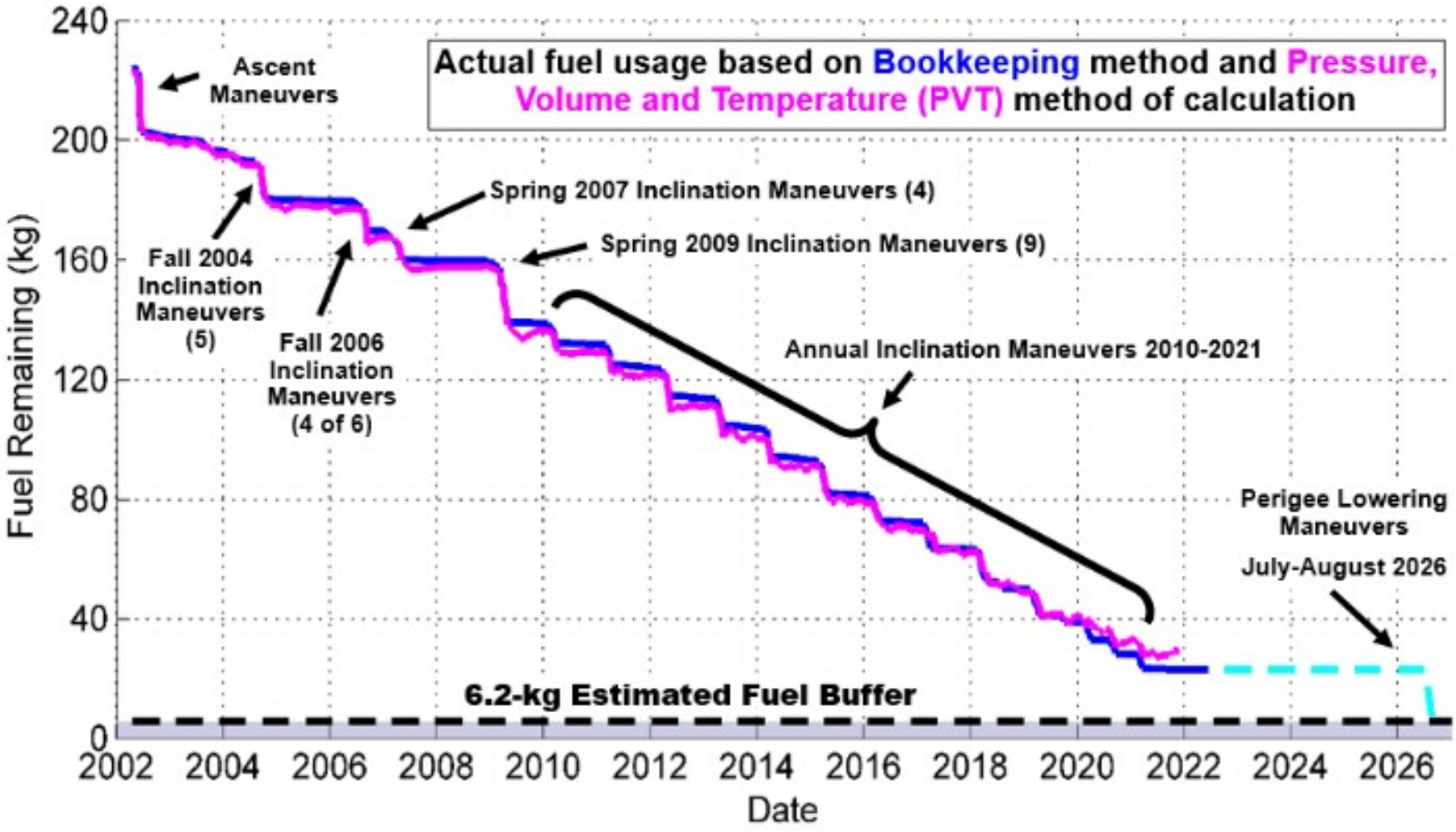
Issue Date: 13 October 2022

The controlled version of this document is maintained on OneEOs Confluence or DocuShare. Other versions are considered obsolete.

Updated: 10/13/2022
(Full Document)

Fuel Usage: Actual & Predicted

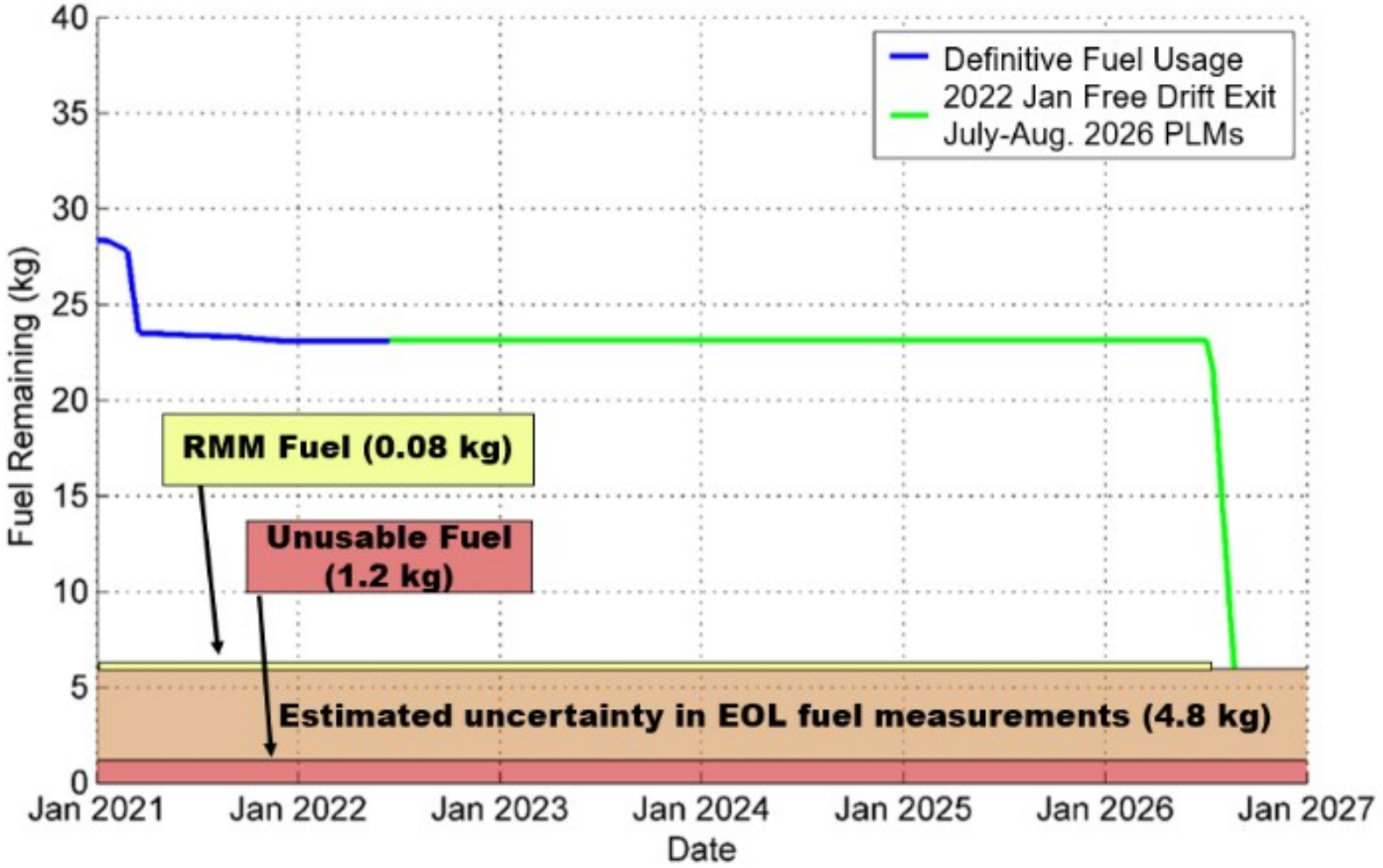
(Updated September 2022)



Fuel Usage: Predicted Available

No Exit in 2022, Free-Drift, PLMs in June 2026

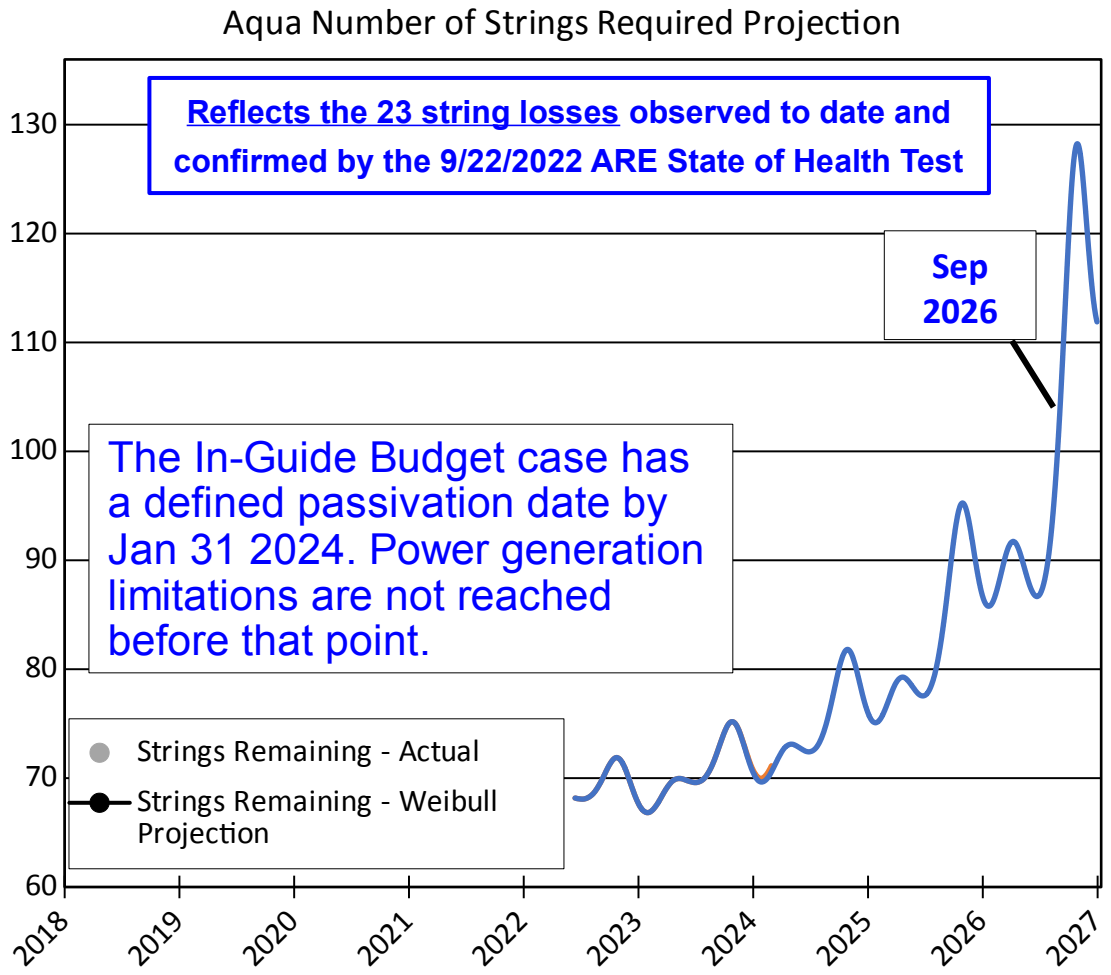
(Updated September 2022)



Solar Array Strings Required Free-Drift, Drag-Down Constellation Exit

(Updated August 2022)

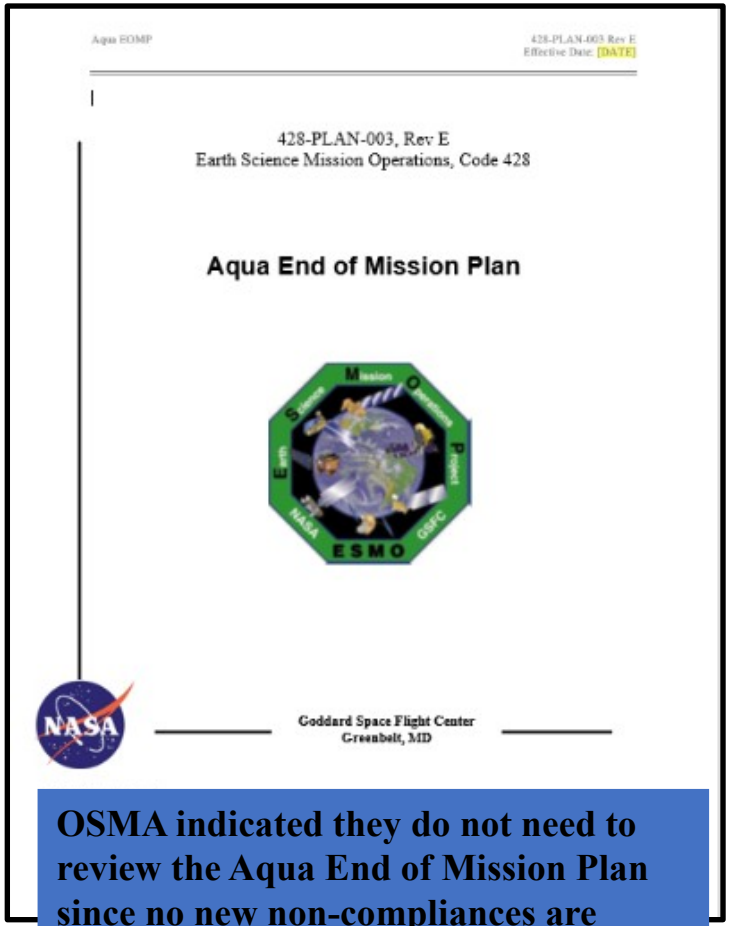
- The number of strings required depends on what power is need to meet the Power per String requirement
- The Strings Remaining projection comes from the Code 371 Weibull Analysis.
- 2773 W is the Minimum Required Power for Loads and Battery Charging
- Power Generation Limit for this power load occurs with ~101 strings
- **Power generation limitations are not reached before September 2026**



Aqua End of Mission Plan

KEY: Updates since May 2022 MOWG Meeting in blue – NONE

- **Initial draft February 2009**
- **"Interim" End of Mission Plan: May 2011**
- **End of Mission Plan (Rev A): February 2013**
- **End of Mission Plan (Rev B): June 2015**
  - Safely exit the A-Train Constellation (19 km)
  - Passivate to the extent possible for uncontrolled reentry
  - Aqua has five (5) approved waivers for passivation
    - Pressurant Passivation
    - Large Object Collision Probability
    - Small Object Collision Probability
    - Orbital Lifetime (30-Year)
    - Re-entry Risk (Un-controlled)
  - **Waivers were approved in May 2013**
- **End of Mission Plan (Rev C): August 2017**
  - Includes ~4.4 km exit from A-Train in early 2022
- **End of Mission Plan (Rev D): November 2020**
  - Latest Annual Lifetime Estimate (November 2019)
  - Retrograde maneuver slews on reaction wheels
  - A-Train Exit January 2022, Immediately lower perigee
- **End of Mission Plan (Rev E): December 2021**
  - **January 2022 Free-Drift Exit, Perigee Lowering June 2024**
    - **End of Science Mission August 2026 (Decommissioning and Disposal)**
- **Final 90 days before Decommissioning Review**


Aqua EOMP

428-PLAN-003 Rev E
Effective Date: [DATE]

428-PLAN-003, Rev E
Earth Science Mission Operations, Code 428

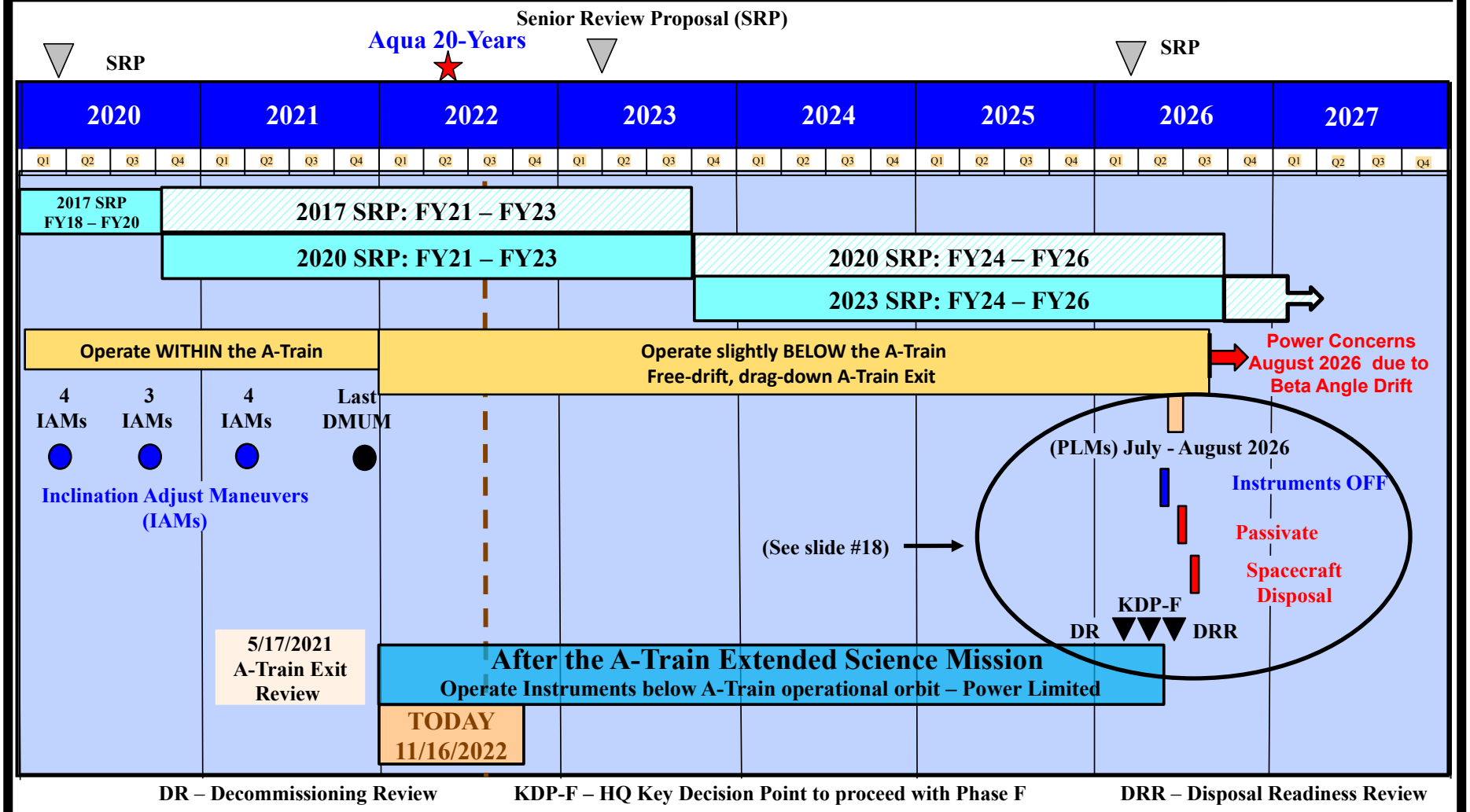
Aqua End of Mission Plan

Goddard Space Flight Center
Greenbelt, MD

OSMA indicated they do not need to review the Aqua End of Mission Plan since no new non-compliances are triggered by the extension.

– This version reflects the Aqua Over-Guide Budget Request –

Aqua After-the-A-Train
Extended Mission Timeline



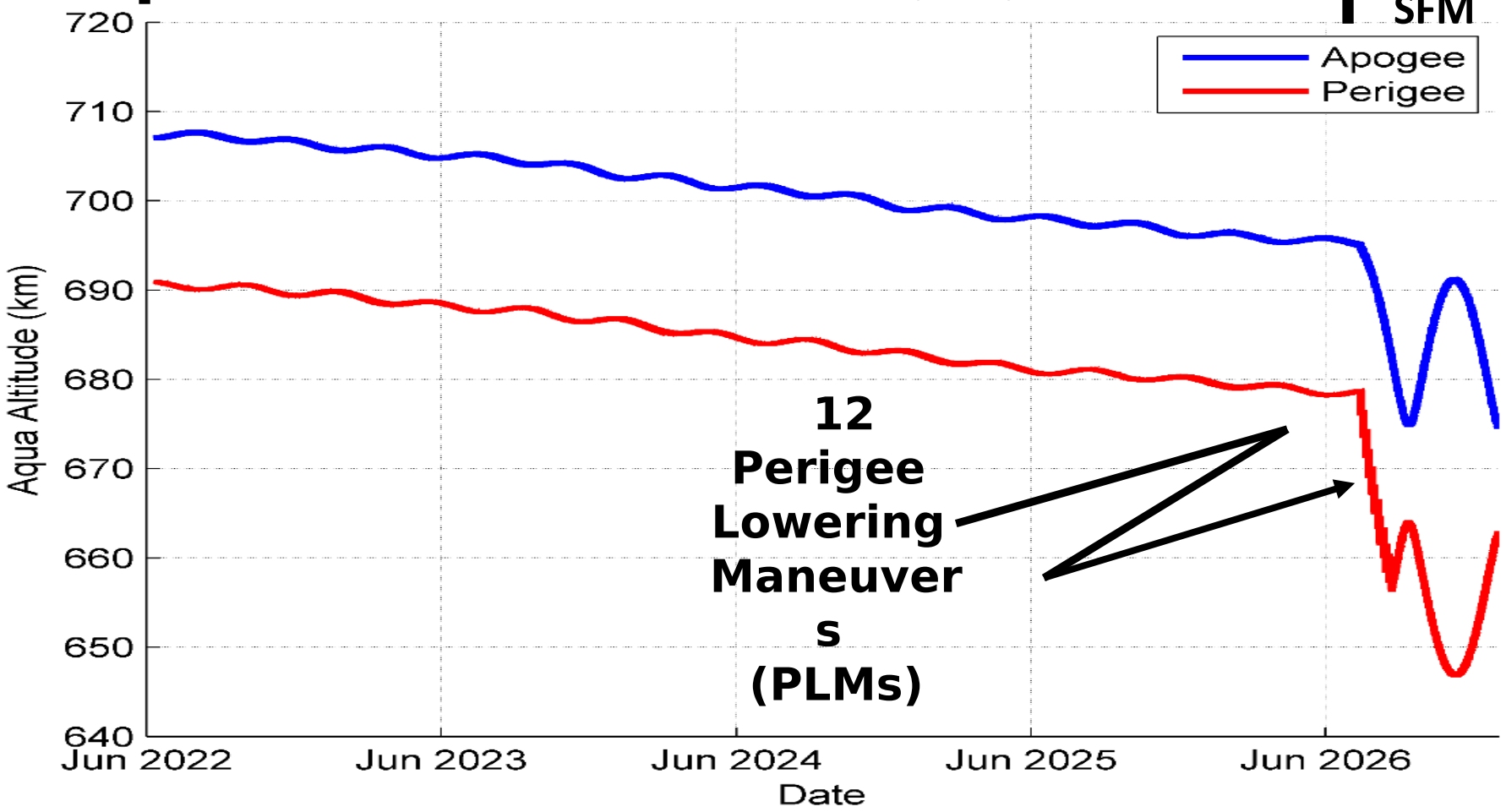
January 2022 Free-Drift/No-Exit

July – August 2026 PLMs (12)

Passivate/Decommission August 2026

Schatten Solar Flux Model (SFM)

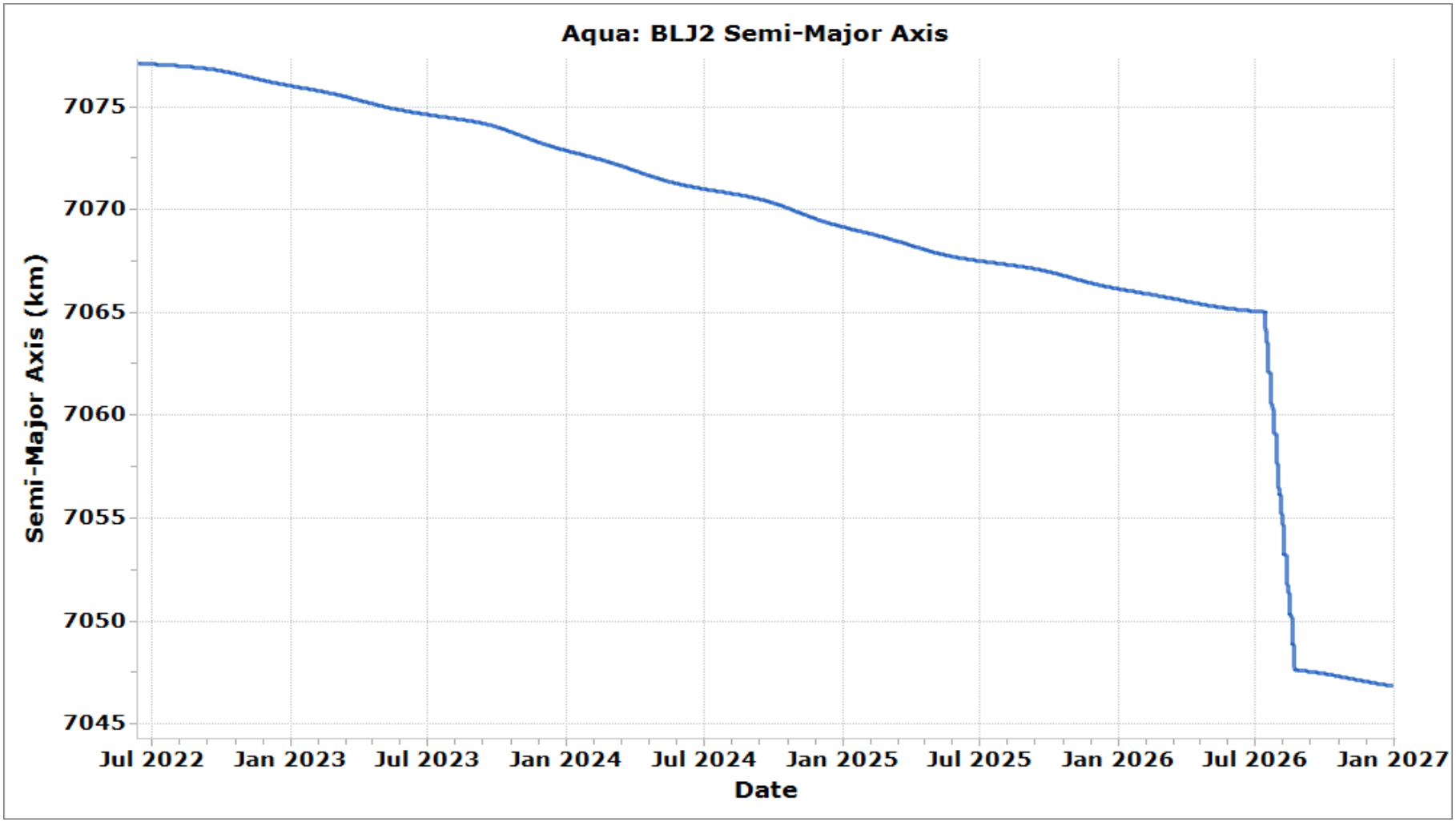
DAS SFM



Semi Major Axis (SMA)

Free-Drift, Drag-Down Constellation Exit

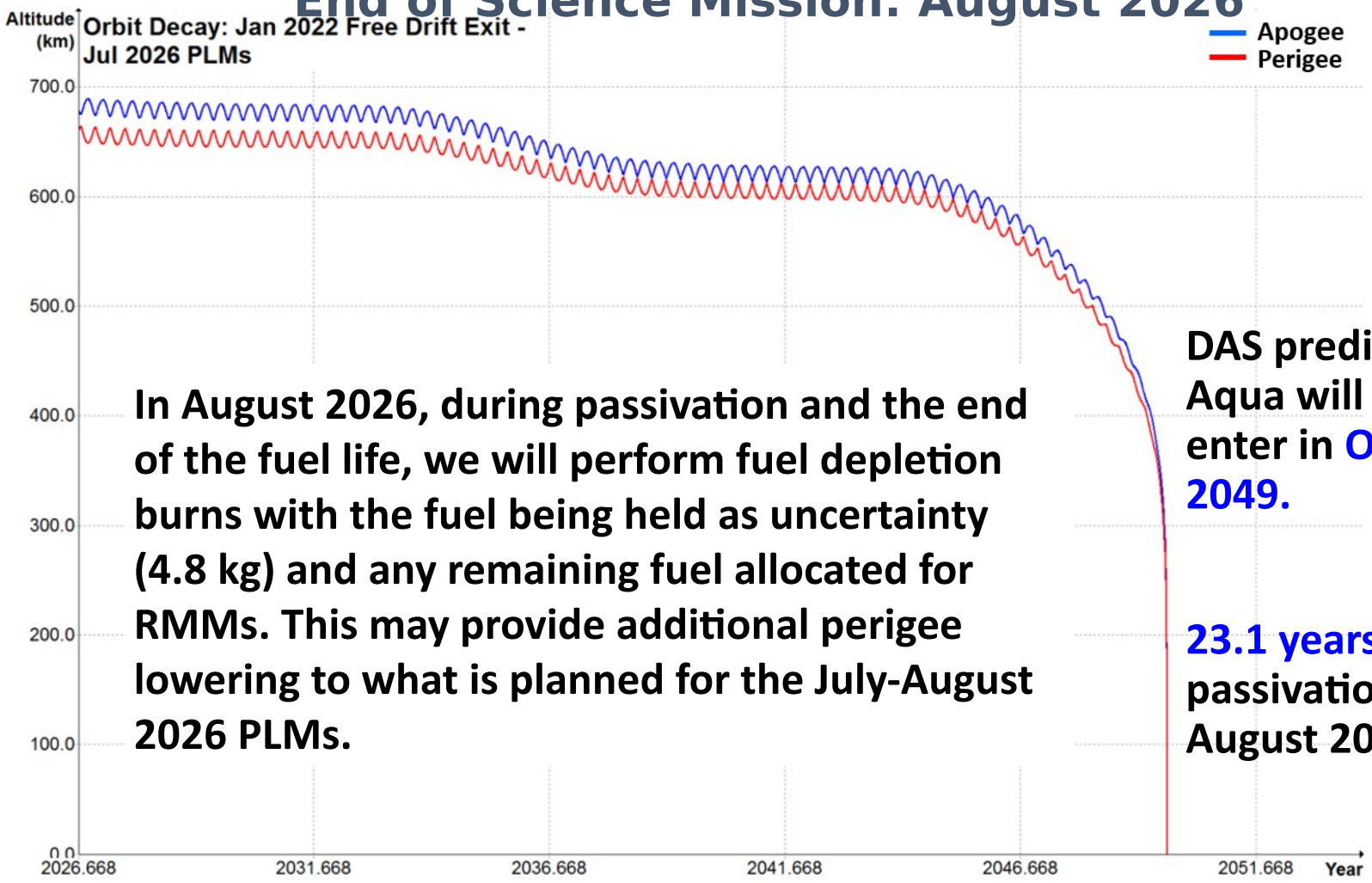
July – August 2026 PLMs



January 2022 Free-Drift/No-CEMs

July – August 2026, PLMs

End of Science Mission: August 2026



In August 2026, during passivation and the end of the fuel life, we will perform fuel depletion burns with the fuel being held as uncertainty (4.8 kg) and any remaining fuel allocated for RMMs. This may provide additional perigee lowering to what is planned for the July-August 2026 PLMs.

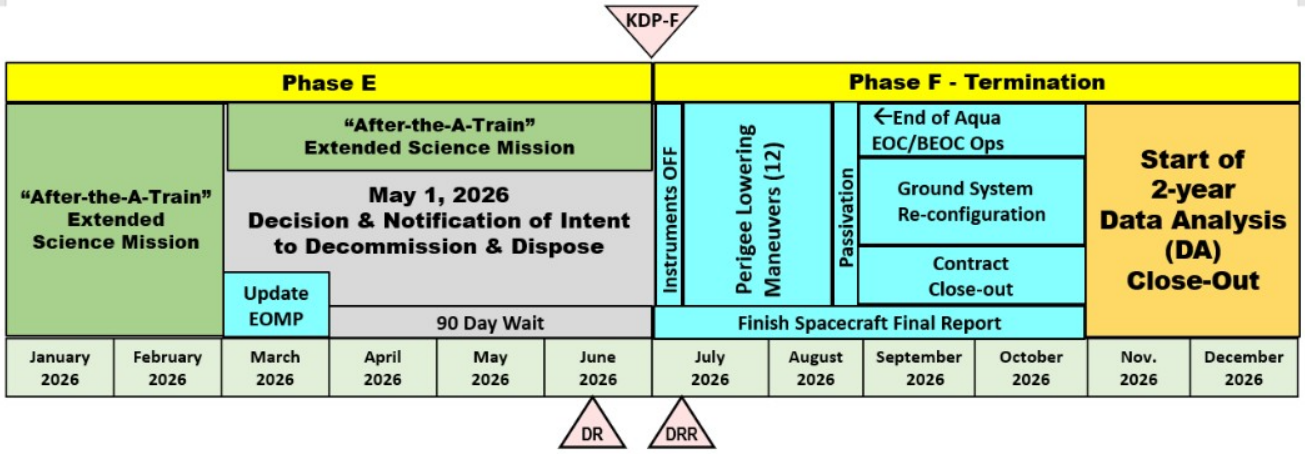
DAS predicts that Aqua will re-enter in October 2049.

23.1 years after passivation in August 2026.

Aqua Decommissioning
(September 2025 – August 2026)

KEY: Updates since May 2022 MOWG Meeting in blue

- Aqua Decommissioning Engineering Peer Review (DRAFT): October 2, 2018
- Overview presented at Fall 2020 ESC Mission Operations WG Meeting
- Aqua A-Train free-drift, drag-down Constellation Exit in January 2022
  - Planned 4 plus years of extended science operations after A-Train constellation exit
  - Planned Perigee lowering in summer 2026 (Reentry in 23.1-years)
  - Project Scientist and ESMO Management agree to hold some fuel in reserve for Debris Avoidance Maneuvers (DAMs) during the extended "After the A-Train" science mission
- Decommissioning and Disposal in late 2026 (see figure below)
  - Aqua Spacecraft Decommissioning and Disposal outlined in End of Mission Plan
  - Current EMOP: Revision E, December 2021
  - Decommissioning and Passivation Readiness Review (Nov/Dec 2022) – Early 2023 TBC
  - Figure below updated to reflect PLMs in July – August 2026



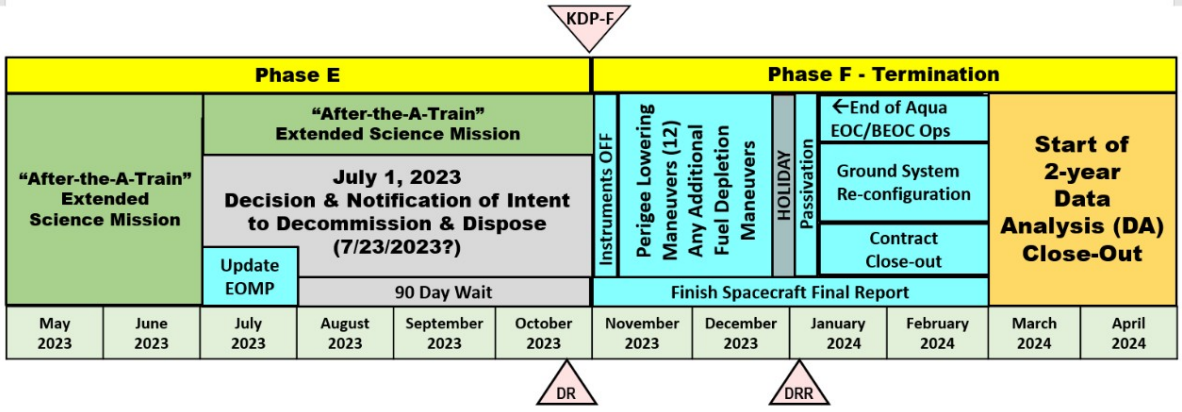
Summary

KEY: Updates since May 2022 MOWG Meeting in blue

- **Spacecraft Status – GREEN**
- **Instrument Status – GREEN**
  - AIRS and MODIS: Nominal Operations
  - AMSU: Nominal Operations except for Channels 1, 2, 4, 5 and 7
  - CERES: Nominal Operations except for CERES-Fore instrument
  - AMSR-E: Powered Down 3/3/2016
  - HSB: Survival Mode since 2/5/2003
- **Data Capture/L0 Processing Status – GREEN**
  - SSR Data Capture September 2022 **100%**
  - SSR Data Capture to 09/30/2022: **99.83+%**
- **Data Latency – Excellent**
- **Ground Systems:**
  - Responding to new security requirements and upgrades to obsolete hardware or COTS systems, as required
- **Flight Operations:**
  - 06/24/2022: FOT EOS Automation (EA) Status – 2-OCE Operations Concept Review (OCR)
  - 06/30/2022: Test Readiness Review (TRR), 07/11/2022: Start of 8-Week Test Period
  - **09/01/2022: Operations Readiness Review (ORR)**

Aqua 2023 Decommissioning
(If No Extension to Current Mission)

- **Decommissioning outlined in End of Mission Plan (Rev E Dec 2021)**
  - **Decommissioning and Passivation Readiness Review**
    - » Target was Nov/Dec 2022 ␣ Early 2023 Date To Be Determined
    - » 02/01/2023: Final Passivation Plan
  - **Perigee Lowering Maneuvers (PLMs) 11/7/2023 – 12/21/2023 (12 PLMs)**
    - » 07/01/2023: Intent to Decommission
    - » 10/20/2023: Decommissioning Review
    - » 10/27/2023: KDP-F
    - » 11/02/2023: End of Science Data Collection
    - » 01/04/2024: Disposal Readiness Review
    - » 01/10/2024: Passivation
  - **DAS predicts that Aqua will re-enter in August 2049, over 25 years after passivation in Jan 2024. Dwell Time of 25.6 years**



Fall 2023 Decommissioning
Aqua Maneuver Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29 OCT	30	31	1 NOV	2	3	4
5	6	7 **PLM #1**	8	9 **PLM #2**	10	11
12	13	14 **PLM #3**	15	16 **PLM #4**	17	18
19	20	21	22	23 **HOLIDAY**	24	25
26	27	28 **PLM #5**	29	30 **PLM #6**	1 DEC	2
3	4	5 **PLM #7**	6	7 **PLM #8**	8	9
10	11	12 **PLM #9**	13	14 **PLM #10**	15	16
17	18	19 **PLM #11**	20	21 **PLM #12**	22	23
24	25 **HOLIDAY**	26 **PLM Back-up**	27	28 **PLM Back-up**	29	30
31	1 **HOLIDAY**	2	3	4	5	6

Additional Slides

Orbit Maintenance Maneuvers
Inclination Adjust Maneuver Performance
Conjunction Assessment High Interest Events
Ground Track Error & Mean Local Time History
Spacecraft Orbital Parameters Trends & Predictions

Orbit Maintenance
— No Changes —

- **<u>Mission Requirement</u>: Perform Drag Make-Up Maneuvers (DMUMs) to maintain Aqua's ground track error (GTE) with respect to the World Reference System (WRS-2) within +/-10 Km at the Descending Node (A-Train Requirement/Goal)**
  - Changed from +/-20 Km Mission Requirement with DMUM #19 (1/12/05)
  - 162 DMUMs have been performed to date. **Last DMUM #162 on 12/1/2021 was FINAL DMUM for Aqua**
  - Variation in performance from –20.9% (cold) to +27.1% (hot) #108 was 20.9% COLD, #162 was 35.2% HOT
- **<u>Control Box Excursions</u>: Since 2012 there have been 7 Control box Excursions**
  - **4 on +10km front-side:**
    - 11/4/12 to 11/14/12, 10/23/13 to 10/24/13, 3/6/14 to 3/10/14 and 3/16/2015 to 4/2/2015
  - **3 on -10km back-side:** 11/7/13 to 12/14/13 (Emergency DAM on 10/24/13 and DAM on 11/28/13)
    - 4/2/2016 to 5/7/2016 and 7/29/2018 to 8/21/2018 (DAM on 7/12/2018)
- **<u>Mission Requirement</u>: Perform inclination adjust maneuvers (IAMs) to maintain the Mean Local Time (MLT) as measured at the Ascending Node between 1:30 and 1:45 MLT (Mission Goal starting in 2011: 13:35:45 +/- 45 seconds)**
  - **73 Inclination Adjustment Maneuvers (IAMs) performed to date**
    - Fall 2003 (1), Spring 2004 (1), Fall 2004 (5), 2005 (NONE)
    - Fall 2006 (4 of 6 - cancelled final 2 burns), Spring 2007 (4 - interrupted 2-weeks), Spring 2008 – NONE (per PARASOL request)
    - Spring 2009 (9), Spring 2010 (3), Spring 2011 (3), Spring 2012 (4)
    - Spring 2013 (4 with #3 being delayed 1-week), Spring 2014 (4), Spring 2015 (5)
    - Spring 2016 (4 with one having to be re-scheduled), Spring 2017 (4)
    - Spring 2018: (5 with one having to be re-scheduled due to PMCOC), Summer 2018 #61 on 8/2/2018
    - Spring 2019: (4 planned on: 3/7 (#62), 3/14 (#63), 3/22 ▭ 4/4 (#64), 3/28 ▭ 4/11 (#65), Fall 2019: 10/02/2019 IAM #66
    - Spring 2020 (4): 3/5 (67), 3/12 (68), 3/19 (69) ▭3/26 (PMCOC), 4/2 (70) – Yaw slew performed with reaction wheels
    - Fall 2020 (3): 8/20 (#71), 8/27 ▭ 9/10 (#72) & 9/3 ▭ 9/17 (#73) – Yaw slew performed with reaction wheels
    - Spring 2021 (4): 2/25 (#74), 3/4 (#75), 3/11 (#76) and 3/18 (#77) **– FINAL IAMs for the Aqua Mission**

Aqua Conjunction Assessment High Interest Events (HIEs) – 2022

2022	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TOTAL	3	0	5	8	5	2	3	5	4				35
Tier 1	0	0	0	0	0	0	0	0	0				0
Tier 2	0	0	0	0	0	0	0	0	0				0
Tier 3	3	0	5	8	5	2	3	5	0				35
Tier 4	0	0	0	0	0	0	0	0	0				0

2013: 28 CARA HIEs – 9 required significant action
2014: 34 CARA HIEs – 14 required significant action
2015: 26 CARA HIEs – 16 required significant action
2016: 21 CARA HIEs – 4 required significant action
2017: 16 CARA HIEs – 11 required significant action

Tier 1 – Notify (email/phone), Tier 2 – Conduct Briefing,
Tier 3 – Plan Maneuver, Tier 4 – Execute Maneuver
Tier 4 – Postponed and/or replanned Maneuver

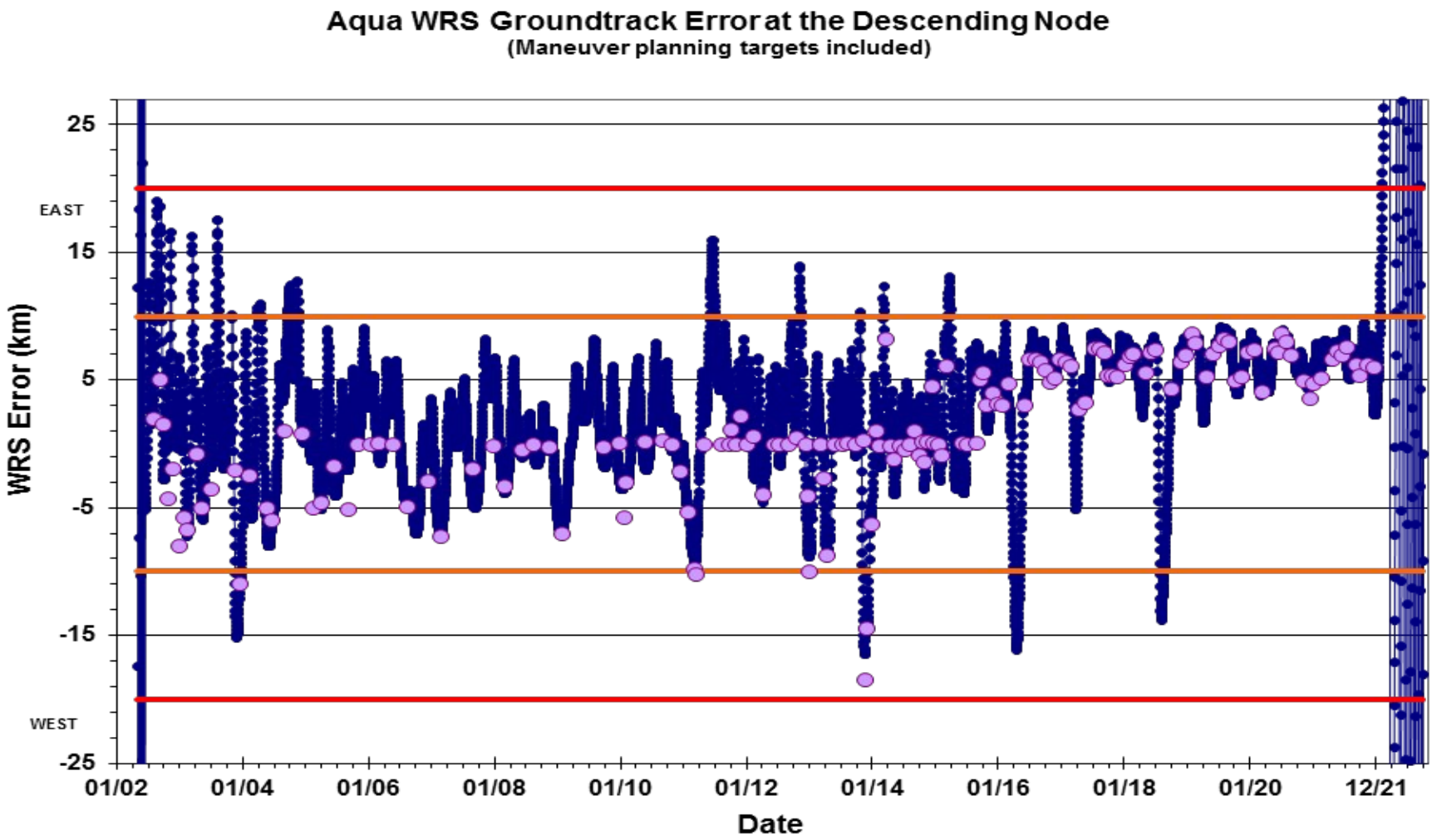
2018: 19 CARA HIEs – 13 required significant action (T3 & T4), 18 DAMs Planned, 1 DAM Executed, 1 Maneuver (IAM #60) postponed (T4)
2019: 14 CARA HIEs – 11 required significant action (T3 & T4), 9 DAMs Planned, 1 DAM Executed, 1 Maneuver (IAM #64) postponed (T4)
2020: 16 CRMS HIEs – 12 required significant action (T3 & T4), 12 DAMs Planned, 0 DAMs Executed, 1 Maneuver (IAM #67) postponed (T4)
2021: 23 CRMS HIEs – 21 required significant action (T3 & T4), 21 DAMs Planned, 0 DAMs Executed, 2 Maneuver postponed (T4)

2022 thru 9/30/2022: (35 CRMS HIEs – 35 that required significant action (Tiers 3 & 4)

28. 08/09/2022: CA vs. 40502 at 04:49:29 GMT – DAMs planned and screened (19), Self-mitigated (T3)
29. 08/12/2022: CA vs. 30238 at 20:03:48 GMT – DAMs planned and screened (3), Self-mitigated (T3)
30. 08/27/2022: CA vs. 19311 at 06:43:49 GMT – DAMs planned and screened (2), Self-mitigated (T3)
31. 08/31/2022: CA vs. 39554 at 18:43:46 GMT – DAMs planned and screened (11), Self-mitigated (T3)
32. 09/04/2022: CA vs. 37093 at 07:46:08 GMT – DAMs planned and screened (5), Self-mitigated (T3)
33. 09/08/2022: CA vs. 87741 at 04:43:56 GMT – DAMs planned and screened (9), Self-mitigated (T3)
34. 09/23/2022: CA vs. 81372 at 00:35:36 GMT – DAMs planned and screened (10), Self-mitigated ((T3)
35. 09/28/2022: CA vs. 270102 at 00:14:16 GMT – DAMs planned and screened (12), Self-mitigated (T3)

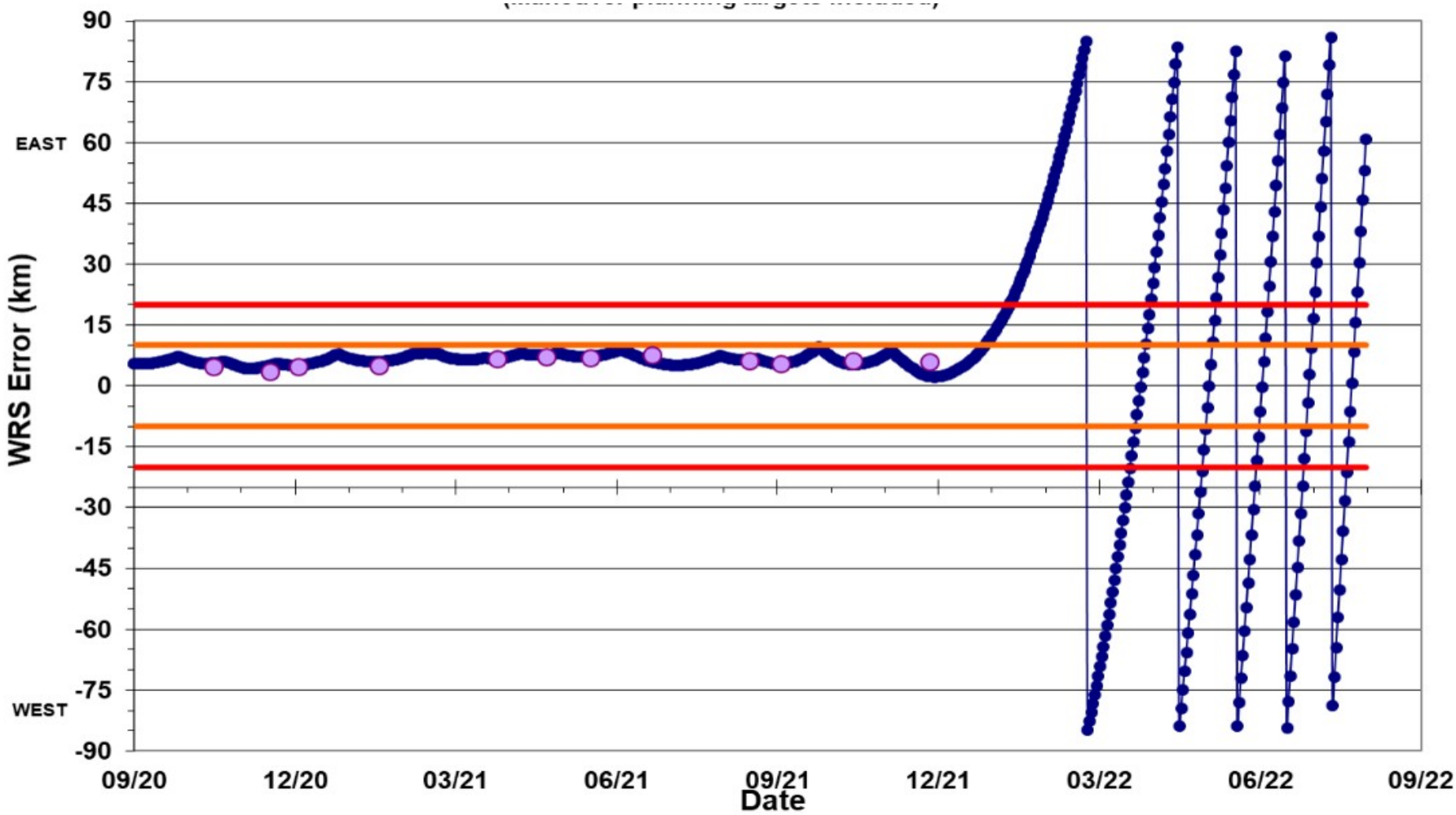
WRS Ground Track Error (GTE)

(As of September 30, 2022)



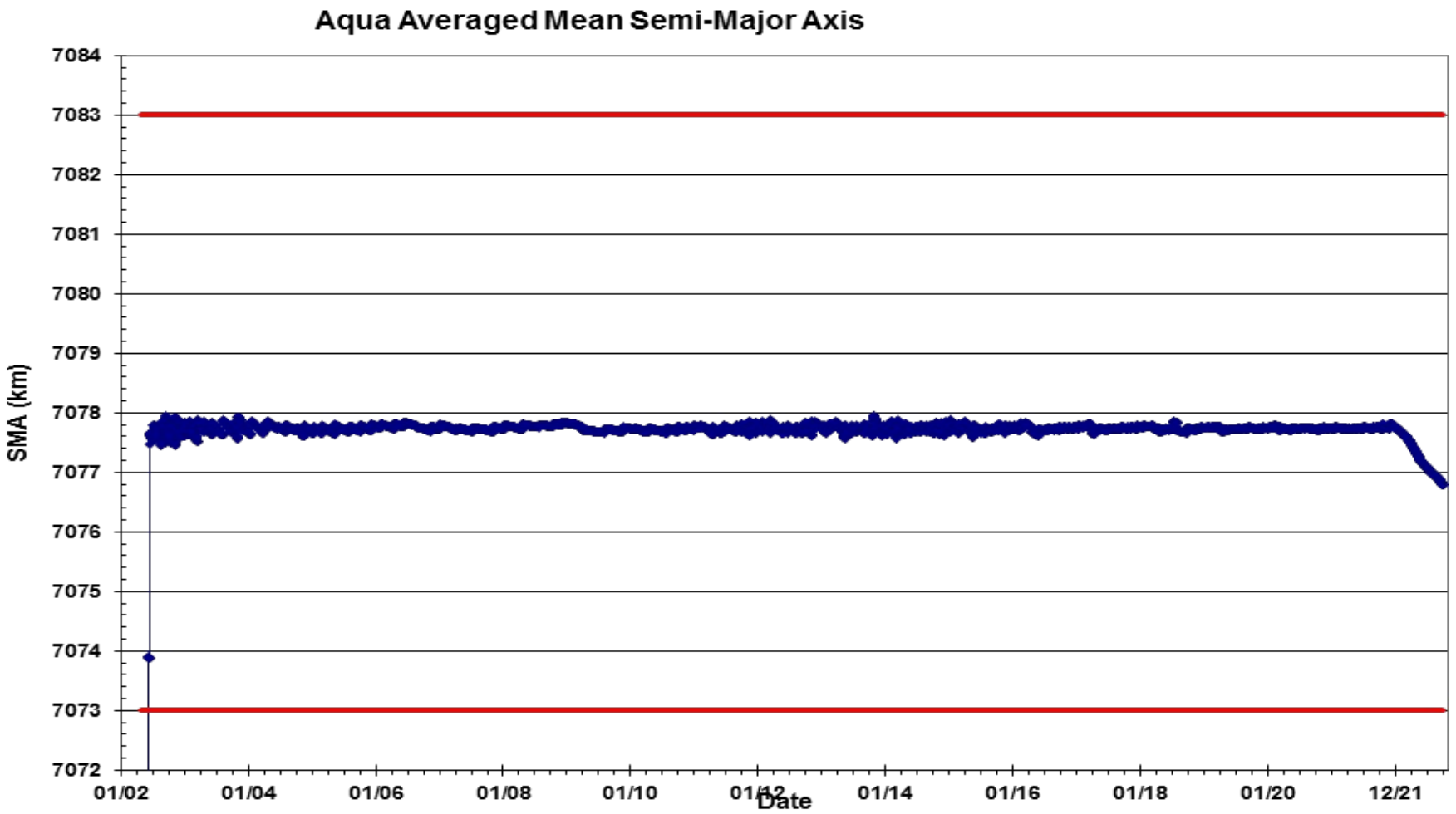
Aqua WRS Ground Track Error

@ Descending Node As of September 1, 2022



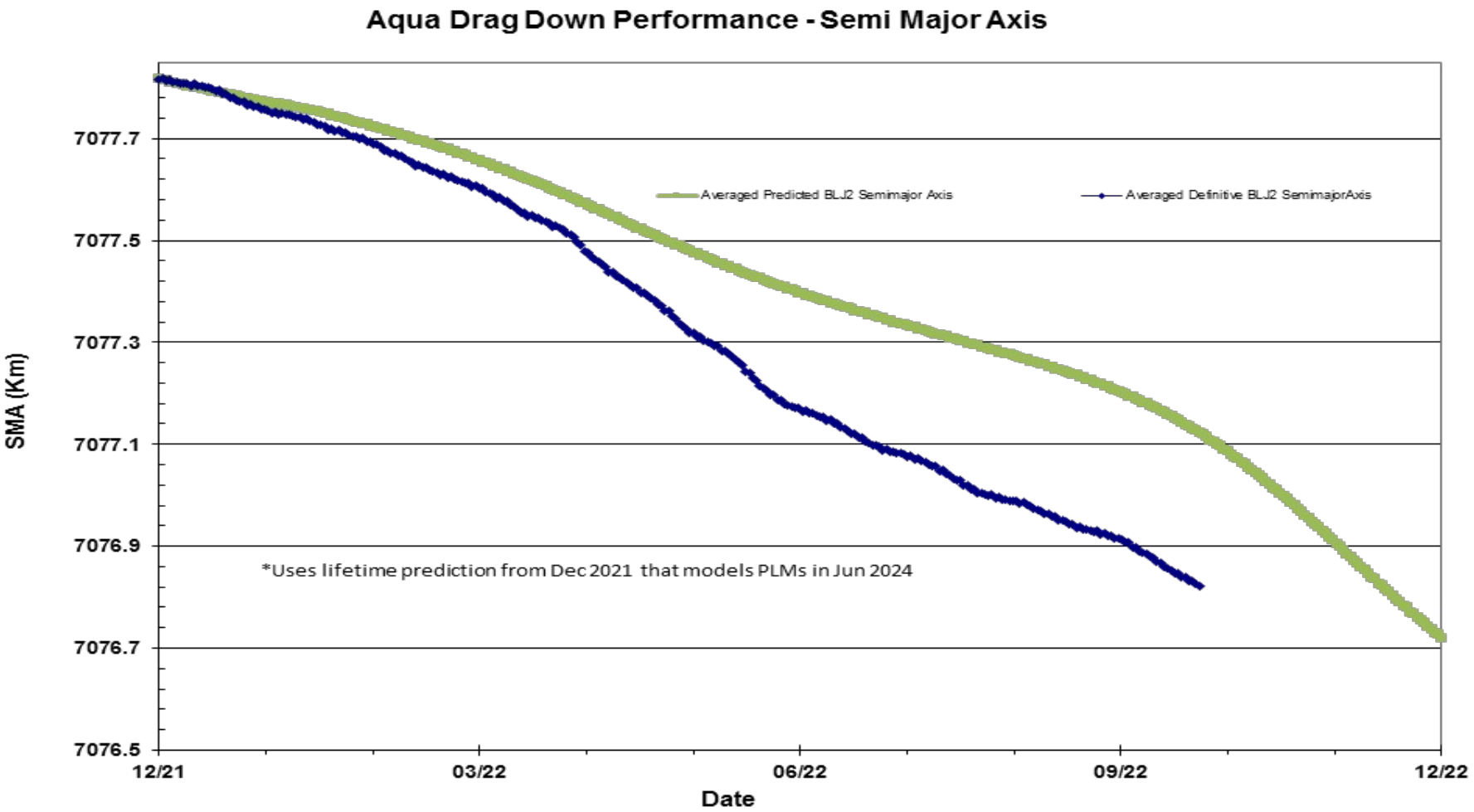
Aqua Mean Semi-Major Axis

(Updated September 30, 2022)



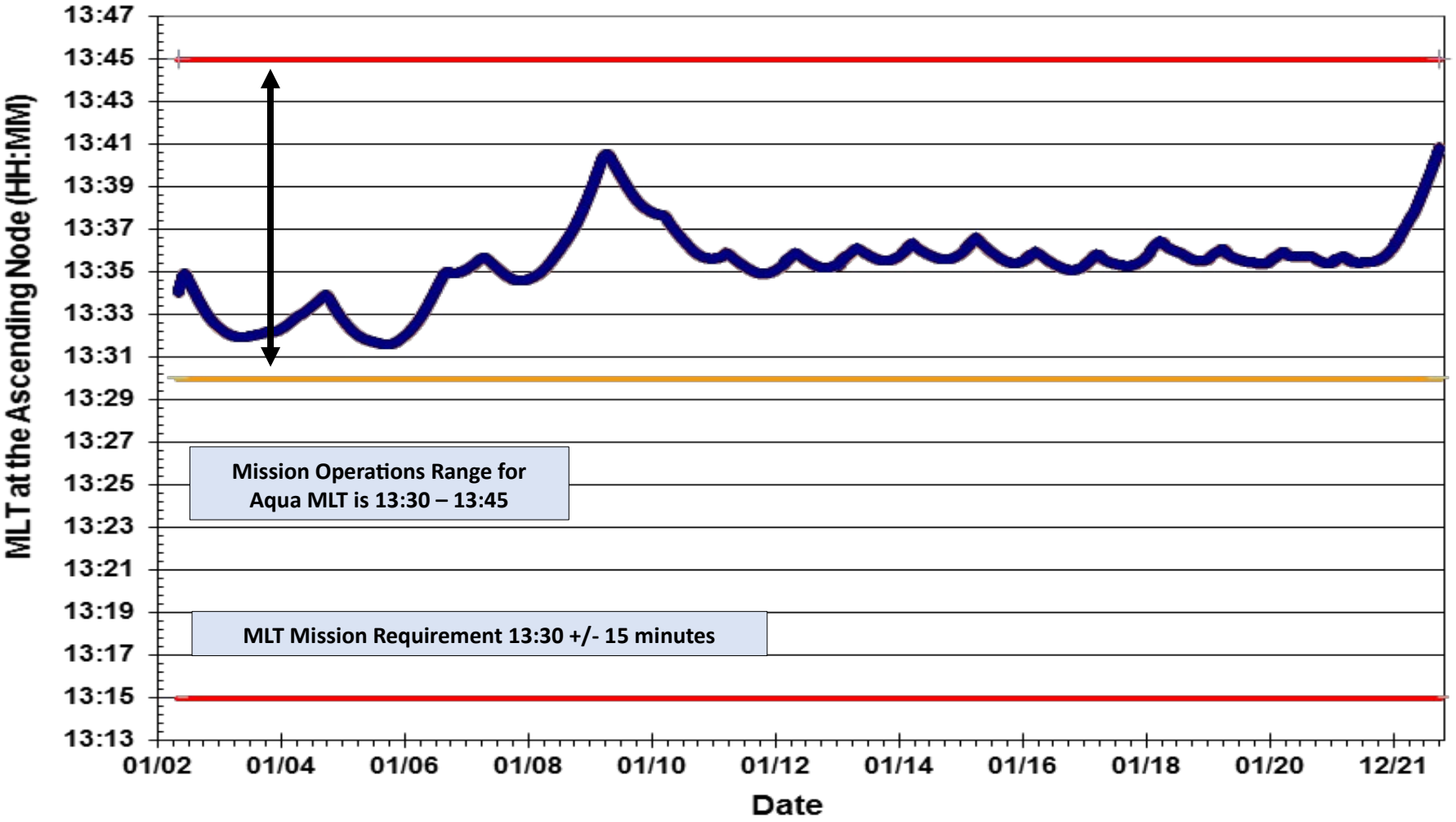
Semi Major Axis (SMA)

Free-Drift, Drag-Down Performance as of 9/26/2022

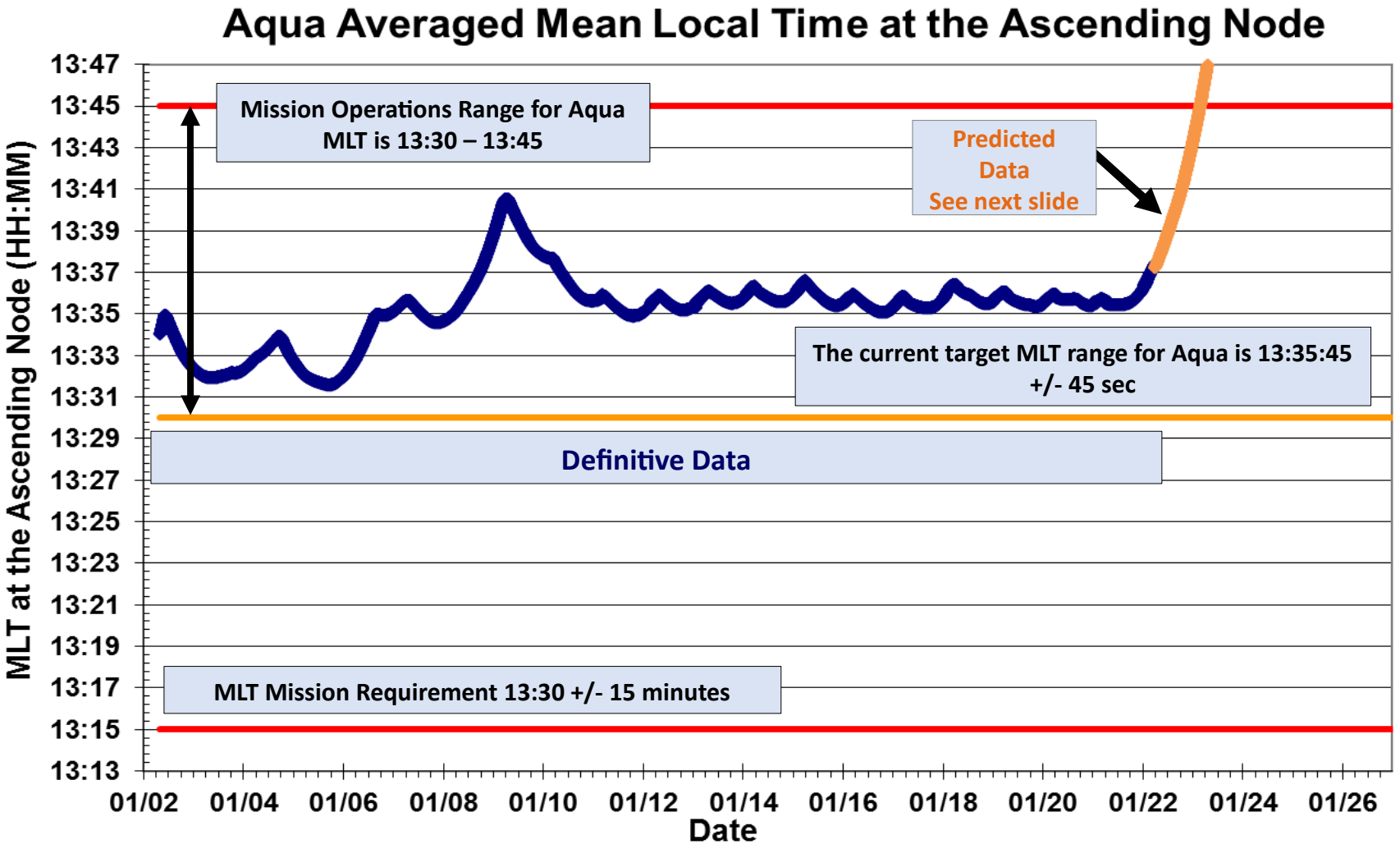


Aqua Mean Local Time (MLT)

@ Ascending Node as of September 30, 2022

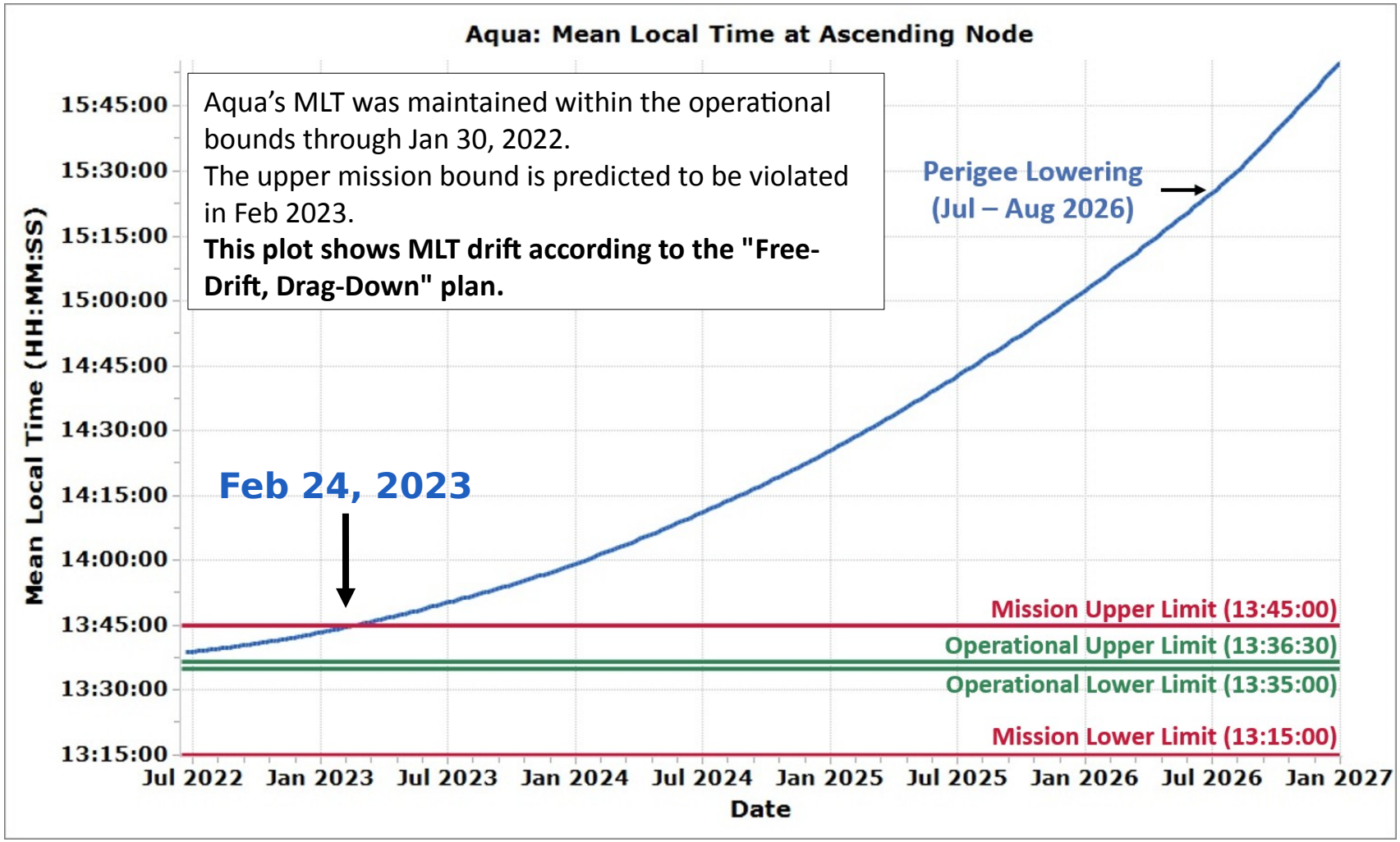


Aqua Definitive and Predictive MLT @ Ascending Node (Updated April 2022)



Aqua Predicted Mean Local Time (MLT) at Ascending Node

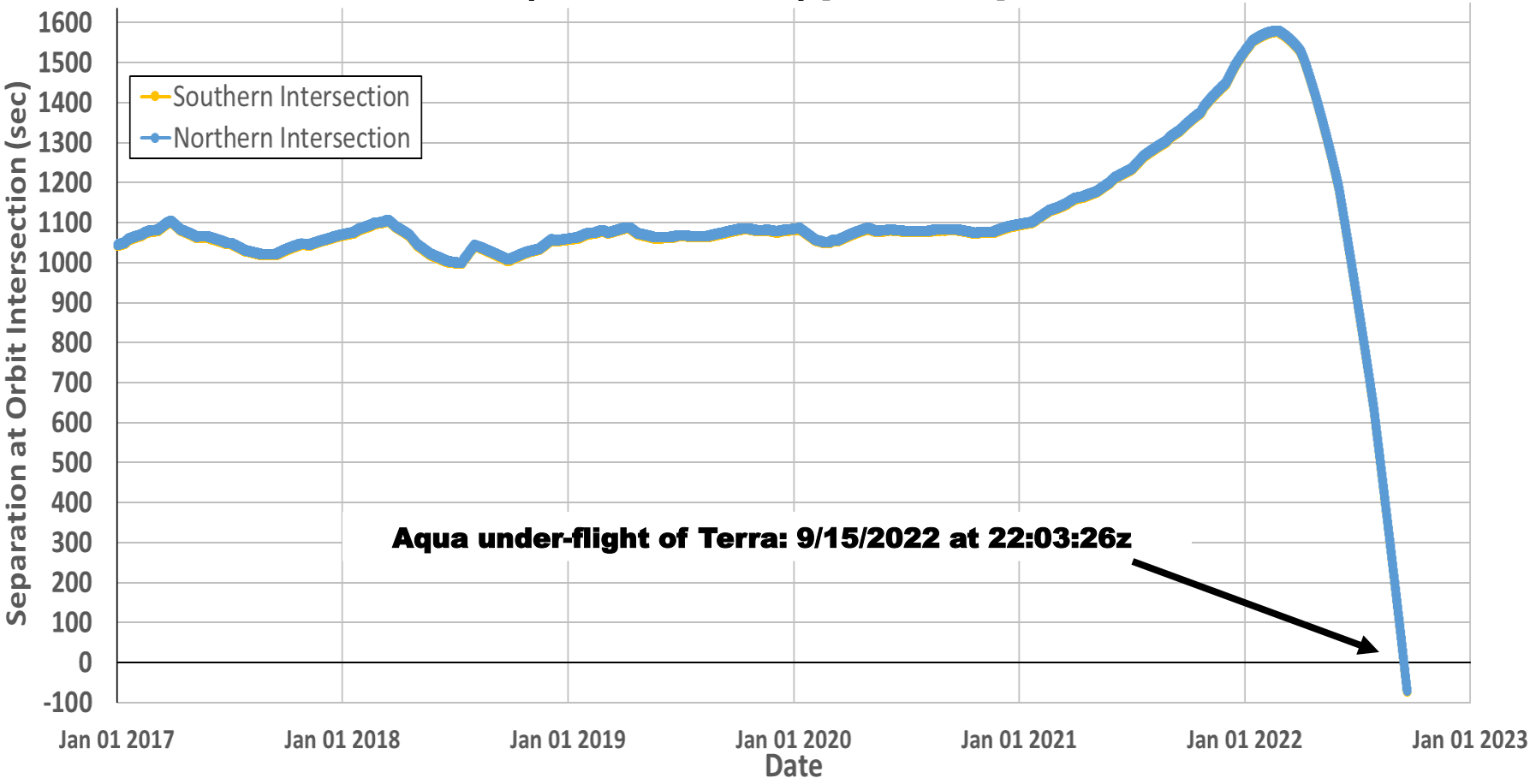
(Updated September 2022)



Terra to Aqua Phasing

(Updated September 2022)

Terra used to go through the orbital intersection point about 17.5-minutes (~1050-seconds) prior to Aqua.



Questions ?

A-Train on Nov 19, 2022, at 1:30pm EST
(Constellation Visualization Tool)

Abbreviations / Acronyms List

AIRS –	Atmospheric Infrared Sounder
AMSR-E –	Advanced Microwave Scanning Radiometer for EOS
AMSU –	Advanced Microwave Sounding Unit
ARE –	Array Regulator Electronics
BEOC –	Backup EOC
BP –	Best Practices
CA –	Conjunction Assessment
CAM –	Command Authorization Meeting
CARA –	Conjunction Assessment Risk Analysis
CDH –	Command & Data Handling
CEF –	CERES Fore
CEM –	Constellation Exit Maneuver
CERES –	Clouds and the Earth's Radiant Energy System
COTS –	Commercial Off the Shelf
CRMS –	Collision Risk Management System
CVT –	Constellation Visualization Tool
DA –	Data Analysis
DAM –	Debris Avoidance Maneuver
DAS –	Debris Assessment Software
DMUM –	Drag Make-up Maneuver
DTM –	Dual Thruster Module
EA –	EOS Automation
EDT –	Eastern Daylight Time
EOC –	EOS Operations Center
EOL –	End of Life
EOM –	End of Mission
EOMP –	End of Mission Plan
EOPM –	End of Prime Mission
EOS –	Earth Observing System
EPS –	Electrical Power System
ESC –	Earth Science Constellation
ESMO –	Earth Science Mission Operations
FDS –	Flight Dynamics System
FDSS-III –	Flight Dynamics Support Services III Contract
FOT –	Flight Operations Team
FSW –	Flight Software
FY –	Fiscal Year
GCOM-W1 –	Global Change Observation Mission for Water (1)
GMT –	Greenwich Mean Time
GN&C –	Guidance Navigation & Control
GTE –	Ground Track Error
HIE –	High Interest Event
HQ –	Headquarters
HSB –	Humidity Sounder for Brazil
IAM –	Inclination Adjustment Maneuver
JAXA –	Japan Aerospace Exploration Agency
kg –	kilogram
km –	kilometer
L0 –	Level-Zero
m –	meter
min –	minute
MLT –	Mean Local Time
MMOD	Micrometeorite Orbital Debris
MOCA –	Mission Operations Conjunction Assessment
MODIS –	Moderate Resolution Imaging Spectroradiometer
MOU –	Memorandum of Understanding
MOWG –	Mission Operations Working Group
NASA –	National Aeronautics & Space Administration
NID –	NASA Interim Directive
OCE –	Operations Control Engineer
OCO-2 –	Orbiting Carbon Observatory-2
Ops –	Operations
ORR –	Operational Readiness Review
PLM –	Perigee Lowering Maneuvers
PMCOC –	Post Maneuver Conjunction of Concern
PROP –	Propulsion
PS –	Project Scientists
PVT –	Pressure, Volume, & Temperature
RMM –	Risk Mitigation Maneuver
RW –	Reaction Wheels
s or sec –	second
SA –	Solar Array
S/C –	Spacecraft
SEU –	Single Event Upset
SME –	Subject Matter Expert
SSR –	Solid State Recorder
TBC –	To Be Confirmed
TBD –	To Be Determined
TCS –	Thermal Control System
TRR –	Test Readiness Review
US –	United States
USGS –	United States Geological Survey
WRS –	World Reference System