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Aura Fall 2019 IAM Results and Spring 2020 Planning

Michael Von Hendy, a.i. solutions

EOS FDS, esmo-eos-fds@lists.nasa.gov, +1.301.416.5050

Agenda

- Recap Aura Fall 2019 Inclination Adjust Maneuver (IAM) Campaign
 - Series Summary
 - Maneuver Results
- Aura's IAM Performance Trends
- 2020 IAM Campaign Dates and Planning
- Aura Latest Lifetime MLT Predictions

Aura Fall 2019 Series Summary

- Aura performed an inclination maneuver, IAM#63, on October 3rd
- As in the Spring, Aura's Reaction Wheel Assembly (RWA) was successfully utilized to slew to the desired angle for the inclination maneuver
- With very few maneuvers utilizing this new slewing method, the Flight Dynamics System (FDS) team has not developed trending equations for them
 - For the Spring, the results from the previous maneuver were used for inputs into the next maneuver
 - The final maneuver of the Spring, IAM#62, was out of family of the first three of the series in terms of achieved attitude during the burn
 - For the Fall, results from IAM#61 were used as predictions
- The delta-inclination from IAM#63 was very close to predictions and the maneuver was 0.33% cold
 - Achieved similar attitude offsets to IAM#62

Results

Inc #	Date	Burn Dur (sec)	Commanded Yaw (deg)	Achieved Yaw (deg)		Delta Inclination (deg)		Delta RAAN* (deg)	
				Predicted	Definitive	Predicted	Definitive	Predicted	Definitive
63	Oct 3	425.0	-77.5	-76.02	-77.63	-0.00769	-0.00767	-0.00001	0.00480
*Right Ascension of the Ascending Node (RAAN)						Total:	-0.00767		

- Aura's achieved delta-inclination for the maneuver was 0.33% COLD, based on the Constellation Coordinated Plan

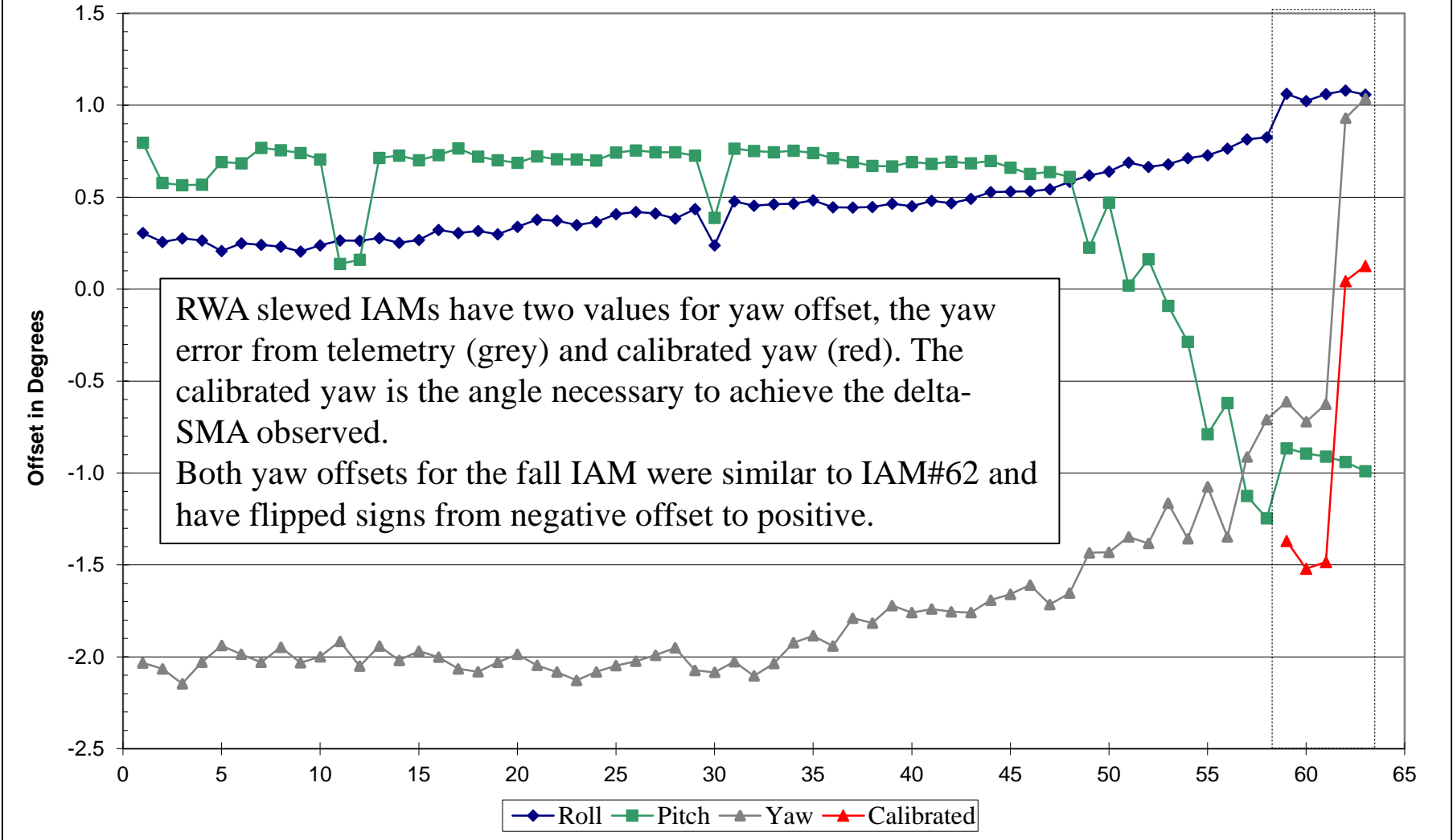
Aura Fall 2019 Performance Trends

- The roll and pitch attitude errors during the burn have continued the trend of previous maneuvers
- As we observed in the last IAM of the Spring series, the yaw offset has flipped signs from previous maneuvers
 - More negative semi-major axis change was achieved than predicted due to the different yaw offset
- The delta-inclination efficiency of the Fall IAM was in family with the Spring series

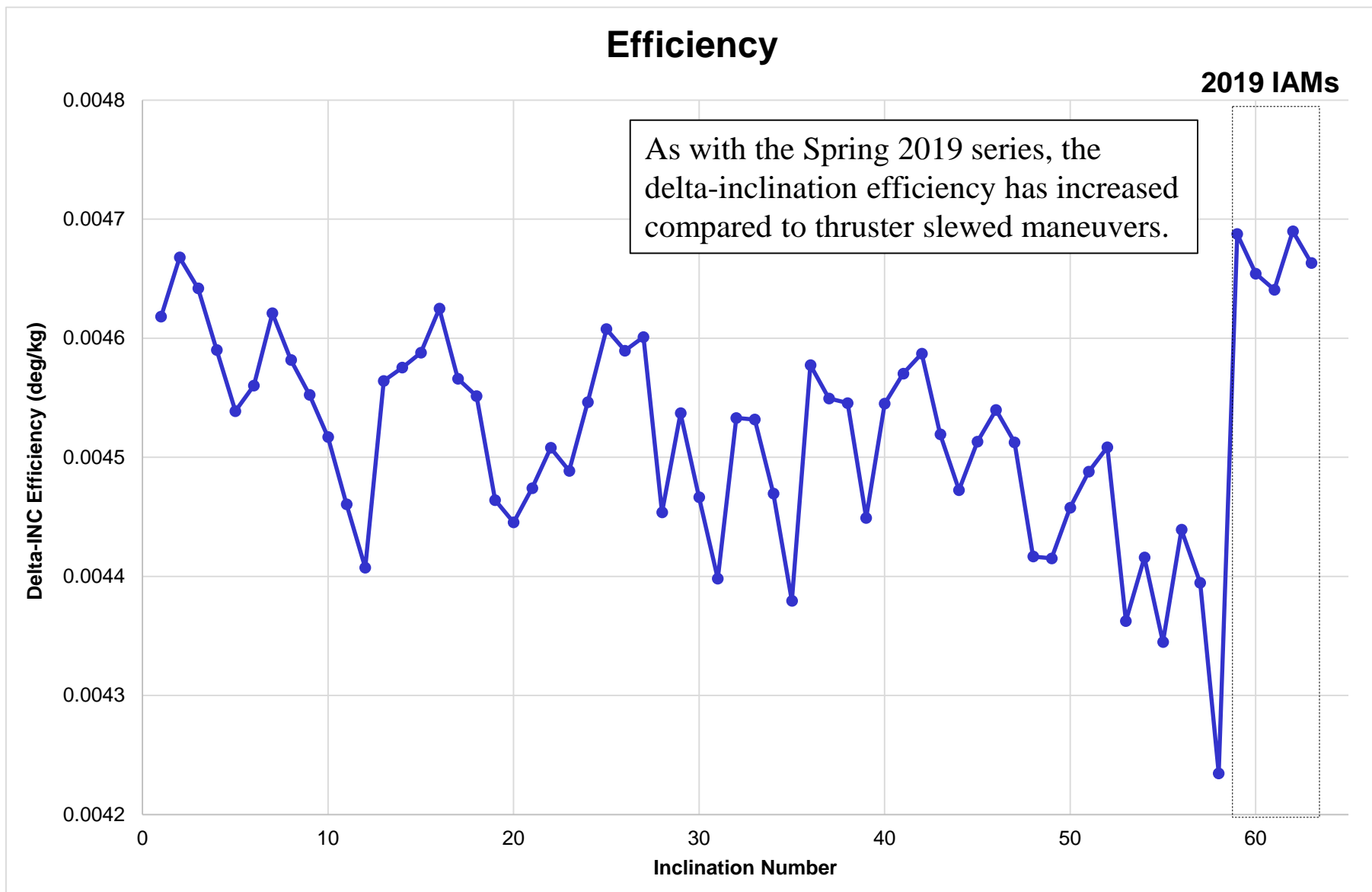
Aura's IAM Performance

Aura Average Roll, Pitch, and Yaw Error during INC

2019 IAMs



Aura's IAM Performance



Aura Spring 2020 IAM Campaign Planning

- The Aura Spring 2020 IAM plan consists of 4 inclination maneuvers
 - Continue using RWA to slew
- Aura's predicted ideal burn date occurs March 12, 2020
 - Since burn can be centered on node with RWA slewed maneuvers, the ideal date is no longer a factor in efficiency
- Proposed plan has 2 maneuvers occurring before the ideal burn date, and 2 after
 - March 4 (IAM #64)
 - March 11 (IAM #65)
 - March 18 (IAM #66)
 - March 25 (IAM #67)
- Dates are set so Aura maneuvers a day before Aqua

Proposed Aqua/Aura 2020 Maneuver Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
February 23	24	25	26	27	28	29
March 1	2	3	4 Aura IAM#64	5 Aqua IAM#67	6	7
8	9	10	11 Aura IAM#65	12 * Aqua IAM#68	13	14
15	16	17	18 Aura IAM#66	19 Aqua IAM#69	20 **	21
22	23	24	25 Aura IAM#67	26 Aqua IAM#70	27	28
29	30	31	April 1 Aura Back-up	2 Aqua Back-up	3	4
5	6	7	8	9	10	11

*Aura Ideal Date on March 12

**Spring Equinox on March 20

Note: Golden Week in Japan starts April 29

Predicted Maneuver Performance

- The following predictions are based on maintaining phasing with the nominal Aqua plan
 - Results from IAM#63 used in predictions

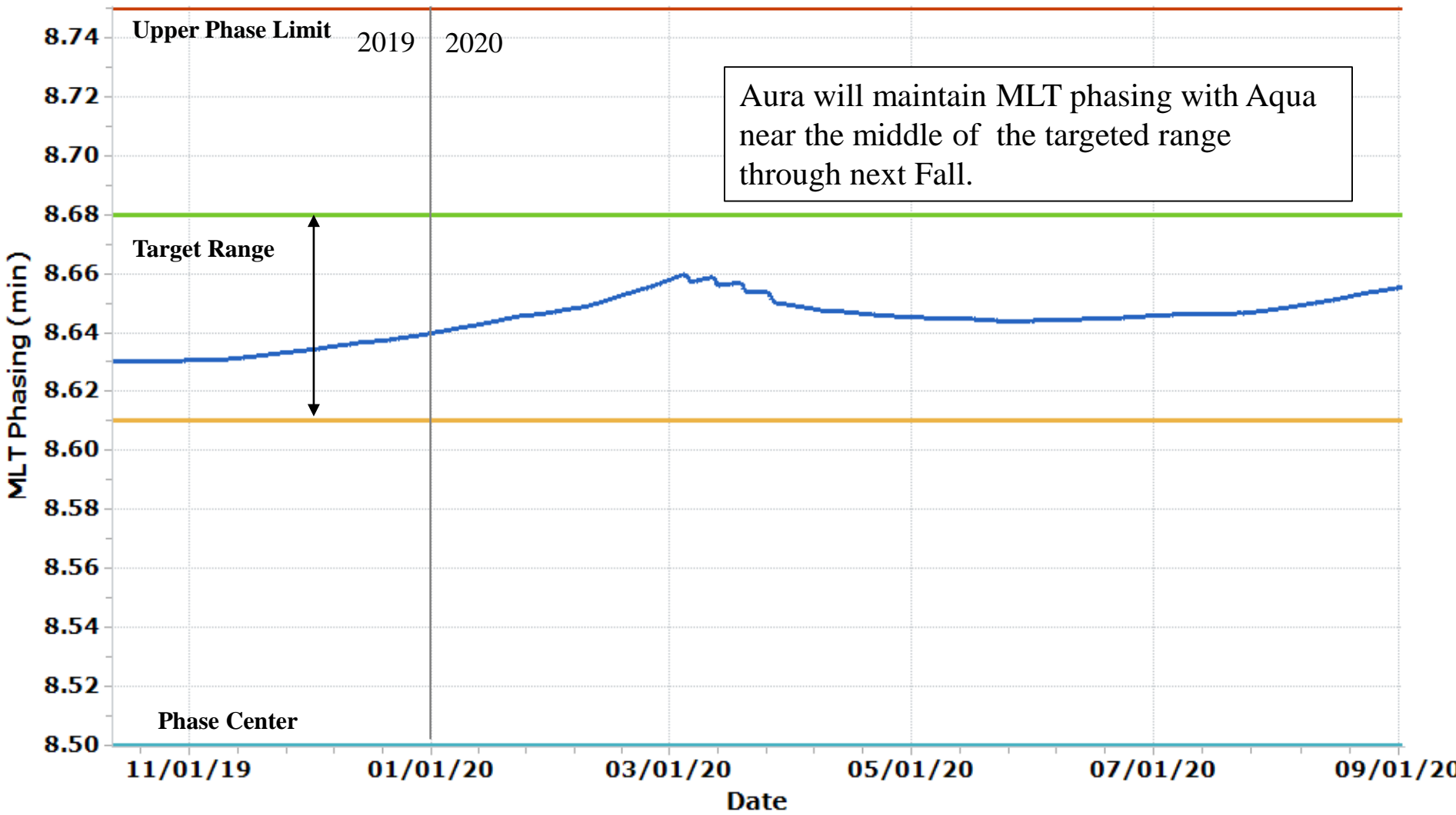
Inc #	Date	Commanded Yaw* (deg)	Duration (sec)	Delta SMA** (m)	Delta Inc (deg)	Delta RAAN (deg)
64	Mar 04	-75.0	375.0	13.26	-0.00671	-0.00001
65	Mar 11	-75.5		-1.29	-0.00669	-0.00001
66	Mar 18			-1.28	-0.00667	-0.00001
67	Mar 25			-1.27	-0.00665	-0.00001
				Total:	-0.02672	-0.00004

*Preliminary angles

**Semi-Major Axis (SMA)

Predicted Pre- and Post- Spring 2020 IAM MLT

Aura: MLT Phasing



Summary

- Similar to the Spring series, Aura used the RWA to slew to the necessary angle for IAM#63
- While the delta-inclination performance was close to predictions, the yaw error during the burn was more negative than predicted
- The Spring 2020 IAM series will have 4 maneuvers and is predicted to keep Aura near the middle of the MLT phasing control box prior to the Fall 2020 series