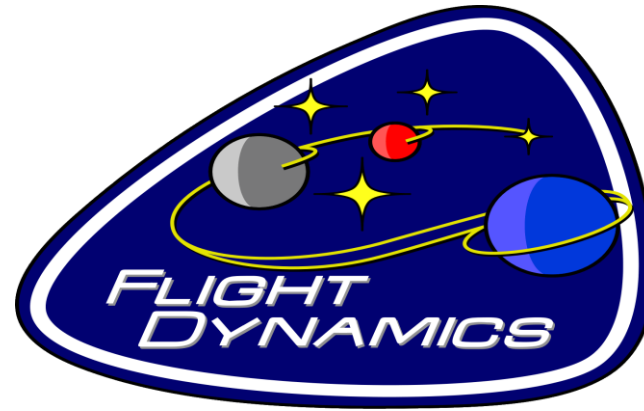




ISS Trajectory Operations

POIWG #54

TOPO/Grant Farrokh

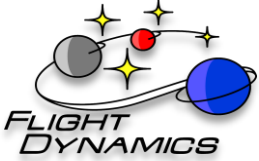
Approved for Public Release

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Agenda

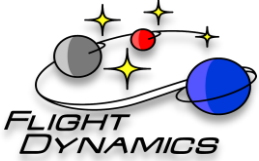
- Trajectory Products Overview
- Altitude Strategy
- Cygnus Reboost Status
- Debris Environment
 - Conjunction concern levels and how to interpret them





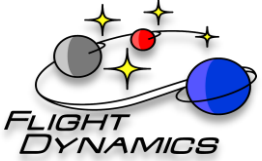
Products

- Planning Products
 - TOPO-01 – 2 year planning ephemeris and ancillary data
 - Updated twice per year
 - TOPO-02 – Increment-length planning ephemeris and ancillary data
 - Updated weekly
 - TOPO-52 – 8-week “Short Term Plan” ephemeris and ancillary data
 - Updated weekly
- Real-time Products
 - 15-day TOPO Console ephemeris and ancillary data
 - Updated 3 times per week (Monday, Wednesday, and Friday)
- As-Flown
 - Best Estimated Trajectory (BET)
 - Weekly estimation of as-flown trajectory
 - Longer ephemeris and ancillary products available upon request



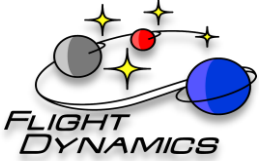
Products Accuracy

- Many factors affect the overall accuracy of trajectory products.
 - Orbital Perturbations, changes in VV schedules, reboost delta-V adjustments, and atmospheric drag.
 - 8-week Short Term Plan (TOPO-52) ephemeris stated accuracy is +/- 6 minutes acquisition time after 3 weeks
 - Short Term Plan will be redelivered if this accuracy cannot be met due to realtime events (DAMs, flight plan changes, etc.)
 - 15-day TOPO Console ephemeris is updated 3 times per week
 - Updated more frequently after significant trajectory events
- Solar maximum has made atmospheric drag more dynamic and generally more difficult to predict.
 - TOPO realtime products remain within accuracy limits, but have become less accurate with increasing atmospheric activity.



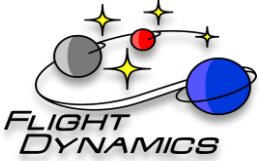
Altitude Strategy

- Current ISS altitude strategy is to maintain an operational altitude of $416\text{km} \pm 2 \text{ km}$.
- Reboosts are typically scheduled to be once per month.
- Reboost magnitudes are selected to maintain Russian Visiting Vehicle launch/landing targets.
 - Temporary exceedances to the altitude strategy are sometimes needed to maintain the Russian VV plan.
 - Debris avoidance maneuvers are selected to clear conjunction risk, and may result in exceedance to the altitude strategy.
- Please contact the TOPO group if your mission objective is dependent on ISS altitude.



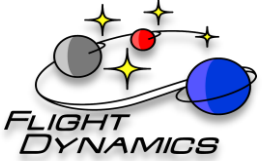
Cygnus Reboost

- Cygnus reboost was successfully demonstrated with NG-17, NG-18, and NG-19
 - Cygnus will not be utilized for debris avoidance maneuvers
- ISS attitude for Cygnus reboosts 180, 90, 0 LVLH
 - Deboost attitude 0, 90, 0 LVLH
 - The thrusters on Cygnus will be pointed through the CG of ISS as much as possible
 - Could incorporate some small radial components into the burn
- NG-20 Cygnus reboosts planned for 5/24 and 6/7.



Conjunction Concern Levels

- Conjunction concern levels are at TOPO discretion and depend on the specifics of the conjunction and proximity to VV ops and/or other dynamic events.
- **High Concern:** “The team should be focused on this conjunction event.”
 - Current Pc is yellow/red/black, PDAM planning has been kicked off, and/or trending indicates Pc will remain at actionable levels
- **Medium Concern:** “The team should be aware of this conjunction event.”
 - Current Pc is yellow/red/black <36 hours to TCA, preliminary PDAM planning by TOPO is in work, and/or trending indicates Pc may stay at or reach actionable levels
- **Low Concern:** “The team does not need to focus on this conjunction event.”
 - Green Pc with stability in the updates or current Pc is yellow/red/black with >36 hours to TCA with the potential to go green



Questions?

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