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Collision Analysis Update for ORS-1 Balloon Deployment

June 15th, 2018

Overview

- The results presented here update the probability of collision analysis for ORS-1's balloon deployment due to a change in the spacecraft mass properties
- Initial conditions: Falcon 9 (F9) Second Stage pre-separation orbit and attitude
- ORS-1 inputs:
  - Mass = 3.296 kg ± 1.5%, C_d = 1.0
  - Cross-sectional area:
    - Minimum = 1.97 m^2 (21.2 ft^2)
    - Maximum = 28.98 m^2 (312 ft^2)

  Note: Use of minimum or maximum cross-sectional area was not observed to effect the probability of collision results
- Potential timing scenarios for ORS-1 were evaluated by Monte Carlo analysis (2500 runs each) of SSO-A's full mission separation sequence:
  1. Deployment of ORS-1 balloon 6 hours after separation from the LoFF (minimum recommended deployment time interval based on the previous 2.23 kg spacecraft mass properties)
  2. Deployment of ORS-1 balloon 10 hours after separation from the LoFF

Results and Conclusions

- Scenario 1 (balloon deployment after 6 hours)
  - Higher mass means that ORS-1 deploys slower than the original analysis assumed
  - Separation from other spacecraft is correspondingly smaller
  - Observed probability of collision for ORS-1: 4.8e-3

- Scenario 2 (balloon deployment after 10 hours)
  - Allows more time for ORS-1 to drift away from other spacecraft before balloon deployment increases collision volume
  - Observed probability of collision for ORS-1: 0.4e-3

- Spaceflight recommends that ORS-1's balloon be deployed ≥10 hours after separation from the LoFF in order to reduce the risk of collision with other spacecraft on the SSO-A mission