

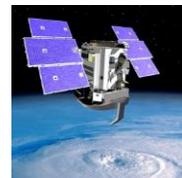


# CloudSat

## Long Range Plans

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## **Operational longevity is most affected by declining end-of-eclipse voltages**

- The battery is slowly aging and the CPR stability heater action in eclipse is increasing
- The combination of these two factors – *mainly CPR heater action* – is resulting in the loss of ~0.3-0.4V/year end-of-eclipse voltage
- Current minimum end-of-eclipse bus voltage ~29.3V  
> UV2/UV3 fault protection set points are 26.50/23.75V
- New battery charging approaches, recently implemented, are increasing battery capacity
- Ball is also investigating a method to reduce the stability heater on time, via a modification to the current DO-Op mode

## **Cumulative rotations on the reaction wheels are also potentially life-limiting**

- Reaction wheels were re-balanced to reduce total revolutions and balance wheel usage
- Recently (2 June 2017), reaction wheel #1 exhibited increased friction at low revolutions per minute (rpms) and while crossing zero
  - ✓ The spacecraft was transitioned to Sun-Point-Spin while the anomaly investigation and recovery efforts proceed. Science observations are currently suspended.
  - ✓ Neither the A-Train Exit Criteria nor any fault protection limits were triggered
  - ✓ Anticipate recovery efforts will return RWA-1 to nominal operations

## **Fuel is not a life-limiting concern at this time**

- CloudSat has sufficient remaining delta-v capacity for at least 4 more years of operational lifetime (~2021)



## **Priority is to continue to Formation Fly with CALIPSO as long as possible**

- Maintain the overlap of CloudSat radar footprint with CALIPSO's lidar footprint within 4km ~90% of the time

## **Continue Inclination Adjust Maneuvers (IAMs) with the A-Train**

- Support the 2018 IAM campaign with reduced (80%) maneuvers

## **CloudSat and CALIPSO ground tracks will begin to drift eastward w.r.t. the MODIS ground track**

- Reduced maneuver size in 2018 IAM campaign will preserve fuel
- Mean Local Time of its Ascending Node (MLTAN) for both satellites will increase
- CloudSat & CALIPSO will continue to formation fly, drifting east together
- Both satellites will remain at the 705 km attitude, drifting east from the rest of the A-Train Constellation

## **CloudSat will remain in formation with CALIPSO until**

- CALIPSO reaches end of life *~or~*
- CloudSat Radar ground foot print reaches a view angle of 40 degrees relative to MODIS
- This is estimated to occur in mid-2020



## **CloudSat will stop the eastward drift when formation flying with CALIPSO is no longer an option**

- CloudSat will execute IAMs to keep its ground track within the 40 degree look angle band in the MODIS swath ~or~
- Begin a slow westward return to its pre-2018 position
- This will enable continued, coordinated observations with Aqua's instrument suite

## **Collision Avoidance Assessments will continue per nominal process**

## **A-Train Exit procedure would be invoked if necessary, to quickly and safely transfer CloudSat to a safe-exit orbit, 7.5 km below the A-Train**

- Pre-built maneuver sequences for A-Train Exit are stored on-board the S/C
- They are updated annually after each IAM campaign

## **Mission options for continued CloudSat science observations, below the A-Train are also being studied**

- Alternatively, it may also be appropriate for CloudSat to proceed to its decay orbit and eventual passivation
- This would ensure compliance with the 25-year re-entry Orbit Debris Mitigation requirement