



# **STS-133 Year-End Rollover (YERO) Summary**

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# YERO Background

- At one second passed GMT 365/23:59:59, the Master Timing Unit (MTU) rolls over to GMT 001/00:00:00. GPC(s) will fault down to lowest ID GPC's internal time and will continue to clock up passed GMT 366/00:00:00
- An 'MTU TIME' OFS message will be annunciated, accompanied by an SM Alert tone.
- Both GMT and MET will continue to clock up on GPC time.
- Need to perform YERO procedure to get back on MTU time.
  - MTU oscillator time is a more accurate time source vs. GPC oscillators.

# Flight Rules

A1-59

## ACTIVITIES DURING YEAR END ROLLOVER/LEAP SECOND INCORPORATION

IF POSSIBLE, CRITICAL PHASES OF MISSIONS WILL NOT BE PERFORMED DURING AN OCCURRENCE OF A MASTER TIMING UNIT (MTU) YEAR END ROLLOVER OR AN INCORPORATION OF A LEAP SECOND.

- Flight Rule currently in generic flight rules as written above
- Does the flight rule need to specify/identify which critical phases of flight are a constraint?
  - Rendezvous
  - EVAs
  - Ground targeted critical burns
  - Proximity Operations
  - UNDOCK
  - Deorbit Prep
  - etc.

# Flight Rules (cont.)

A7-13

## GPC MAJOR FUNCTION CONFIGURATION

- H. IF A MISSION IS TO CONTINUE PAST THE YEAR END ROLL OVER (YERO), TIME PERMITTING, A FREEZE DRY WILL BE CREATED/UPDATED WITHIN 24HRS PRIOR TO THE PLANNED YERO RECOVERY PROCEDURE COMPLETION.
- I. POST YERO, FREEZE DRY GPC(S) WILL BE UPDATED ASAP.
- J. POST YERO, UPLINKS TO THE BFS WILL BE PERFORMED ASAP.

- Current flight rule does not include these sections
- These rules try to protect for a GPC failure occurring before and/or after YERO procedures have been completed.
  - Section H. protects for a primary GNC GPC failure which occurring before completing of the YERO procedure. Suffering a GNC GPC failure before running the YERO procedure will complicate the current YERO procedure due to an old GMT time not meeting software requirements to recognize YERO occurrence.
  - Section I. protects for a primary GNC GPC failure occurring after completing of the YERO procedure. If a good FD GPC is not performed and a GPC fails before we can do so, the YERO procedure will need to be performed again.

# Flight Rules (cont.)

## ULF2\_A7-1

### TIME MANAGMENT

- C. FOR YEAR END ROLLOVER OF MTU GMT, THE ONBOARD TIME WILL BE MANAGED AS FOLLOWS:
1. ONBOARD TIME WILL BE ALLOWED TO TRACK GPC INTERNAL TIME, THUS DRIFTING FROM THE MTU TIME DURING CREW SLEEP OR YERO DELAY. ALLOWED TO DRIFT IN EXCESS OF 100 MS.
  2. THE PASS GPC'S WILL BE FORCED BACK TO MTU TIME BY PERFORMING PRIMARY GPC INITIALIZATION.

- Flight Rule currently in the Flight-Specific Annex
- Allows the onboard time to remain on GPC internal time for a period of TBD hours to allow the YERO recovery procedure to be delayed. GPC internal clocks are not as accurate as the MTU; thus, it is anticipated that the onboard time accuracy will exceed the 100 millisecond flight rule limit (reference Rule {ULF2\_A7-1A}, TIME MANAGMENT).

# Procedures

- Onboard crew procedure (ORB OPS FS)
  - Will be performed at GMT YERO or can be delayed (limit 12-24hrs) if YERO falls during crew sleep.
- Ground procedures (FCOH)
  - Will have ground reconfiguration steps near GMT YERO

# Onboard Procedure Overview

- Assumptions:
  - DPS System in a single G2 configuration
  - RMS in a safe configuration
  - If docked, Station in control of mated stack
  - Performed during quiescent operations.
  - Leap second will not be incorporated.
- Will adjust onboard MET to rollover with GMT for ground Trajectory processing issue.
- If required for YERO Delay, force GPC 1 and 4 to GPC time to avoid nuisance alarm (during crew sleep).

# Onboard Procedure Overview (cont.)

- Configure the vehicle for YERO
  - Power On/Off Primary logics and drivers depending on config. (Off for docked operations)
  - Take KU Band to standby
  - Turn on LRUs needed for OPS 3 and configure NBAT to minimize time without an active GNC GPC.
- Mode GPC 1 and 4 to STBY
- Mode GPC 1 to RUN (GPC performs primary GPC init and will acquire MTU time)
  - If GPC fails, activate latest freeze dry GPC



# Onboard Procedure Overview

## (cont.)

- Enable G3 Archive Retrieve (is disabled during primary GPC init)
- Perform an OPS 3 Transition
  - Software recognizes YERO has occurred and resets necessary major function base time-related parameters.
  - Docked DAP : INTRL/PULSE/PULSE/PULSE
  - Undock DAP : INTRL
- Mode GPC 4 to run and perform an SM OPS 2 Transition.
- Re-establish MCIU I/O to recover crew insight to RMS (ground without data due to fixed format 129)

# Onboard Procedure Overview

## (cont.)

- Activate BFS for uplink (requires PASS OPS 3 to allow BFS to track)
  - Mode BFS to OPS 3 for remainder of uplinks.
  - Secure BFS
- Load nominal orbit TFL
- Perform GNC OPS 2 Transition
- Perform a set expansion and contraction to update the Freeze Dry GPC(s).

# Ground Procedures?

- FCOH
  - Current published procedure is not up to date. Does not include a YERO test data performed DEC 2008
  - Most of the actions are done before GMT YERO
  - Will not have to recycle workstations anymore