

# Year-End Roll-Over (YERO)

## MCC New Year's Eve Test

SR3674



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# Introduction

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- **11/2/06 PRCB discussion**
  - **Action assigned to develop plan/cost/schedule to provide YERO capability that would address concerns raised during 116 discussions**
    - » **Originally due 12/14/06, deferred to 1/25/07**
    - » **Expectation of SSP is clear – YERO capability is a requirement**
- **The team first focused on preparing for possible STS-116 YERO**
  - **Addressed concerns raised by at the 11/2 PRCB**
  - **Multiple integrated discussions were held**
  - **Made significant headway on all YERO technical issues**
- **The team is also working plans for future YERO**
  - **Potential to reduce on-board YERO impacts with Flight Software changes**
  - **Potential to reduce ground YERO recycle impacts with additional testing**
  - **YERO testing, simulations and training to increase awareness and confidence across the community**

# STS-116 YERO Procedures

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- **Part 1: On-board Setup**
  - Completed by crew prior to crew sleep on 12/31
- **Part 1a: Ground Recycle at GMT midnight**
  - Recycle MCC platform to reset time-based dependencies
  - Occurs while crew is asleep
  - 1.5 hour procedure
- **Part 1b: Ground Recycle at Local midnight**
  - Recycle MCC platform to reset time-based dependencies
  - Occurs while crew is asleep
  - 1.5 hour procedure
- **Part 2: On-board PASS**
  - Performed after crew awake on 1/1
  - IPL the PASS set to wipe out references to “old” time
  - Uplink reference data to restore GPC’s
  - 1.5 hour procedure
- **Part 3: Onboard BFS**
  - Bring up the BFS to establish updated time from MTU
  - Uplink reference data
  - 0.5 hour procedure

# YERO Ground Procedures

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- **Existing STS-116 YERO ground procedure is a complete MCC recycle**
  - **Covers unknowns by recycling all hardware and software after the time changes**
- **Procedure is run twice: at GMT midnight and again at Local midnight**
  - **Log-off workstations**
  - **De-allocate servers and activities**
  - **Recycle/reboot servers**
  - **Re-allocate servers and mission activity**
  - **Log-in and configure workstations**
  - **Total time: 1.5 hours (approximately 30 min with users logged out)**
- **Procedures have been tested in previous SAIL and SMS tests and have resulted in no issues**
- **Community was briefed on specific impacts of the ground recycle in preparation for STS-116**
  - **No issues identified**

# Ground Test Rationale

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- **Current ground procedures are acceptable for YERO as-is. However...**
- **Further testing and analysis can reduce the procedure footprint**
  - **Current procedure is brute-force recycle of everything**
  - **Likely NOT required for:**
    - » **Workstations, FEP, and most user software**
  - **Required for:**
    - » **Command and Trajectory servers, MET-based logging & plotting tools**
  - **Length of procedure not likely to change significantly (driver is TRAJ server)**
- **Further testing can reveal unknowns**
  - **SAIL and SMS testing that has been performed to date has only changed Orbiter-based time, not local MCC time (SGMT is used in sims)**
  - **Multiple ways to tell time can make it difficult to clearly identify YERO vulnerabilities**
    - » **On-board: MTU GMT, MTU MET, GPC GMT, GPC MET, etc**
    - » **MCC: FEP GMT, NTP server time, GPS time, etc**
- **Based on this, MOD is planning to perform additional YERO testing and simulations to support YERO readiness efforts**

# Test Plan

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- **The goal of the test is to evaluate MCC hardware and software during time rollover at GMT and Local midnight**
- **Focus is on MCC response to YERO, so on-board procedures will not need to be executed during the test**
  - **Requires SAIL or SMS to provide a source of on-board time and telemetry**
- **Test concept is to have 2 simultaneous activities for comparison**
  - **Control: everything recycled per existing YERO procedures**
  - **Test: only Command and Trajectory servers will be recycled**
- **This does not need to be an integrated test and support from outside of MOD would not be required**

# How to Test

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- **Test can be conducted during the actual New Year's Eve rollover event**
  - **This is the least impact to MCC operations**
- **YERO can also be simulated if steps are taken to isolate ISS operations from the time change**
  - **Utilizes LSOS (Limited Station Operations Support) mode of operations**
    - » **Places ISS operations on separate MCC platform that is isolated from the OPS environment**
    - » **This mode is used to perform MCC facility work, upgrades and testing during continual ISS operations**
      - **Typically occurs several times per year, with each LSOS period lasting 2-3 days (typically scheduled on weekends)**
    - » **There is no functional impact to the ISS flight control team**
    - » **LSOS equipment is single-string**
  - **For a YERO test, ISS would be swung to LSOS for 3 to 4 days during a non-impacting timeframe (per existing LSOS scheduling guidelines)**
    - » **GPS time source would be disconnected from OPS and remain connected to LSOS**
    - » **OPS NTP server (source of MCC time) would then be set ahead to 12/31 for the test**

## How to Test (cont.)

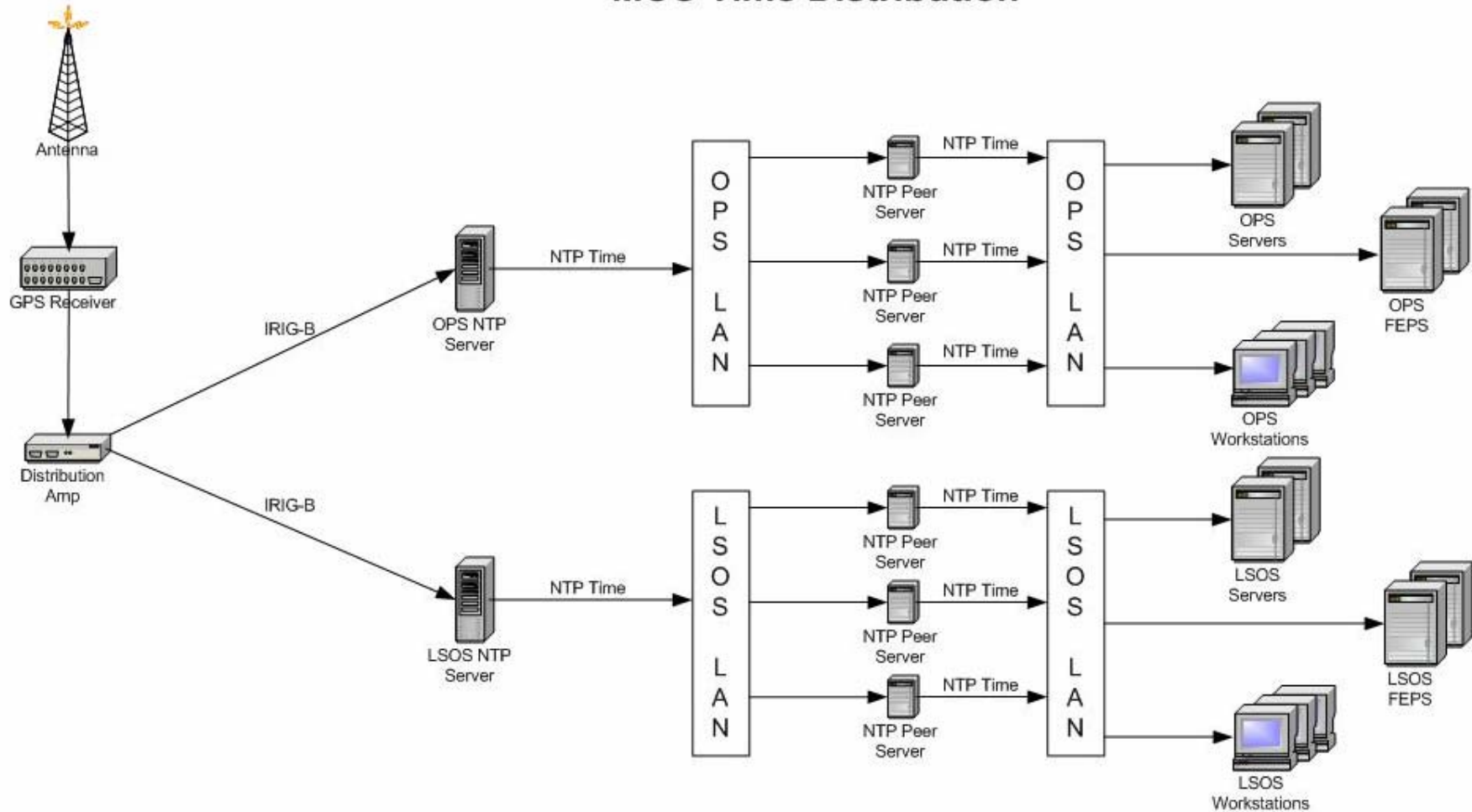
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- **LSOS YERO Test (cont.)**
  - This will be a fully functional test of YERO
    - » The source of time in the MCC is the NTP Server
    - » Everything in the MCC OPS environment will believe that it is 12/31
    - » Equivalent to the Y2K test configuration
  - Recovery from this test involves restoring the OPS environment from backups and checkpoints and then regression testing to ensure all traces of future time have been erased
- Based on this, either a New Year's Eve or a LSOS test would be adequate to evaluate Ground YERO procedures



# MCC Time Distribution

## MCC Time Distribution



## Other Factors

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- **There will continue to be MCC hardware and software changes between now and the time that YERO is needed**
  - **Most significant is MWSOR (MCC Workstation/Server/Ops Replacement), replacing workstations and servers along with re-hosting software from UNIX to Linux**
    - » **Currently underway – user software will be ready for testing in Spring of 2007**
    - » **Replacements will continue through 2009**
  - **These changes may require additional testing or invalidate the results of previous testing**
- **Potential changes to how YERO is managed on-board may modify ground procedures**
  - **It may be desired to watch on-board YERO occur before performing MCC recycle**
- **Additional testing, simulations and training will very likely be needed to increase community confidence in YERO**
- **This makes it highly desired to be able to simulate MCC YERO response without being constrained to a single opportunity on New Year's Eve**

# Decision

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- **Based on these factors, MOD has decided to not proceed with a 12/31/06 YERO test and to instead pursue YERO testing in LSOS mode later in 2007**
  - **Allows test to cover more issues/concerns (MWSOR)**
- **Deferring this test from New Year's Eve does not impact any organization outside of MOD**
  - **Was not planned to be an integrated test**
  - **Orbiter response can be adequately simulated (does not require a New Year's Eve test)**
- **Additional YERO tests and simulations will be scheduled as required to achieve program requirement of having YERO capability through the end of Shuttle**

# Future Work

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- **MCC software audits are under consideration to supplement YERO testing**
- **Integrated YERO simulations are under consideration to build SSP-wide confidence and comfort**
- **Reviews are underway with the Flight Software community to evaluate alternatives to the current YERO procedure**
- **KSC YERO supportability will continue to be assessed**
  
- **This plan is currently scheduled to come to PRCB on 1/25/07**
  
- **Expectation of SSP is clear – YERO capability is a requirement**
  - **Integration is occurring at Orbit Flight Techniques as well as SICB, FOICB and OCCB**
  - **Ground-rule: no YERO during critical dynamic phase (ascent, entry, dock/undock)**