The New GSC-II and it's Use for HST

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Limitations of GSC-I (Reference Frame)

- Constructed from Sky Survey Plates (1976-1984)
  - Used 3 different reference catalogs

    AGK3 (0° to +90°), SAOC (-60° to 0°), CPC (-90° to -60°)
  - Bright stars from external catalogs
- Required GO's to provide target coordinates in GSC-I reference frame

Limitations of GSC-I (Epoch)

- Guide Stars have proper motion so relative position errors between Guide Stars and Target are increasing with time
- Target acquisition failures for small aperture instruments
- GS acquisition failure rate increasing

Limitations of GSC-I (Depth)

- 20 million Stars to 15th magnitude in a single bandpass
- Not faint enough for ground-system software to know if 20th magnitude blue stars were in FOV of a MAMA detector
  - Health & Safety Issue
  - Required visual inspection of target fields

Goals for GSC-II

- Reduce GS & SI acquisition failure rate
  - Improve relative position errors
  - Improve prediction of GS FGS magnitude
- Simplify procedure to provide coordinates
  - Use standard reference frame
- Provide deeper catalog for automated “Bright Object Protection”

GSC-II Overview

- GSC-II constructed with more recent epoch plates
  - POSS-II and AAO-SES (+ earlier surveys)
  - multiple observations in multiple bands
- Improved astrometric reference catalogs on standard ICRS frame (ACT, TY2)
- Improved astrometric reduction technique
  - Refraction pre-correction, equidistant projection, 2nd order poly, correction mask

GSC-II Properties

- ~1 billion objects to plate limits in at least 3 bands (J,F,N) over entire sky
  - Preliminary versions already in use for BOP
- ~0.25” (1-sigma) absolute astrometry over the entire sky on the standard ICRS reference frame
- ~0.3mag (1-sigma) stellar photometry
- ~95% classification

Cycle 15 Phase 2 Changes

- GO provides target coordinates on the ICRS reference frame
- New value for coordinate frame keyword in phase 2 proposal preparation [ICRS]
- NGSS uses keyword as switch for which GSC catalog to use for Guide Star Selection

Cycle 15 Coordinates

- Get target coordinates from ANY source using ICRS reference frame (e.g. GSC-II, SDSS, 2MASS, FIRST)
- Measure coordinates from deep CCD images using GSC-II as reference catalog for astrometry
- Measure target coordinates from DSS image using FITS WCS keywords which have GSC-II astrometry

Cycle 15 Tools

- Web and APT access to GSC-II to directly look up object coordinates
- Web and APT access to updated DSS
  - Headers now include FITS standard WCS keywords that have ICRS-based astrometry
- GSC-I to GSC-II Conversion tool
  - Provides GSC-II coordinate for GSC-I object ID or transforms RA,Dec using mean offset over the HST FOV

Current Status

- GSC 2.3 Catalog available
- DSS/WCS header updates completed
- Conversion tool available
- APT software updated
- Ground System Software updated
- On-orbit tests scheduled for late 2005
- GSC-II will become default catalog for cycle 15 observations

Future Plans

- Update astrometry of images in HST archive to increase scientific value
  - Almost all ACS and most WFPC images contain objects that are in GSC-II which allows an astrometric recalibration
  - If recalibration is not possible then propagating the updated GS coordinates into the WCS will provide some improvement

(see poster “A Significant Astrometric Improvement for Archival ACS Data using GSC-II” A. Koekemoer, B. McLean et al)