DSS-II/GSC-II Project Status

Brian McLean
CASB/ACDSD

CASB Mission Statement
CASB is committed to producing and distributing all-sky digital images, deep object catalogues, and software tools to support operations of current and future ground and space based astronomical observatories, and to provide a research and educational resource to the community.
Operational Goals

- **DSS**: Scan, archive, compress and put on-line, all available Schmidt sky survey plates

- **GSC-II**: Build database to create a deep all-sky catalog with positions, proper motions, magnitudes, colors and classifications from all available observational material and published catalogs

- **Mission Support**: Provide access and tools to use the DSS and GSC for operational support of telescopes and scientific research

  - Images/Catalogs for Observation Planning
  - STIS/(COS) Bright Object Protection (integrated with APT)
  - Update HST GSC with better positions
  - NGST near-IR Guide Stars (K<18)
  - GEMINI & VLT GS (tracking & adaptive optics)
DSS-II Overview

- Scan new survey plates from the Palomar and UK Schmidt telescopes
  - All-sky, minimum 3 bandpasses (J, F, N)
  - 15 µ (1") sampling, 23040x23040 pixels of 1.2 GB each
  - Older 25 µ scans to be replaced as resources permit

- STScI/CASB scan archive (8TB raw data)
  - Raw FITS images on MOD with 8mm tape backup
  - Compressed images on-line (CD jukebox+NAS RAIDarray)
  - Distributed to Data Centers worldwide
  - DSS retrievals are “most requested’ service by community

- Photometric and astrometric calibration of all images
  - calibrations provided in image headers

<table>
<thead>
<tr>
<th>Survey</th>
<th>Number Plates</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSS-I E</td>
<td>880</td>
</tr>
<tr>
<td>POSS-I O</td>
<td>880</td>
</tr>
<tr>
<td>Pal-QV</td>
<td>614</td>
</tr>
<tr>
<td>POSS-II J</td>
<td>897</td>
</tr>
<tr>
<td>POSS-II F</td>
<td>897</td>
</tr>
<tr>
<td>POSS-II N</td>
<td>897</td>
</tr>
<tr>
<td>SERC-J/EJ</td>
<td>894</td>
</tr>
<tr>
<td>SERC-QV</td>
<td>90</td>
</tr>
<tr>
<td>PPARC-ER</td>
<td>288</td>
</tr>
<tr>
<td>AAO-SES</td>
<td>606</td>
</tr>
<tr>
<td>AAO-GR</td>
<td>109</td>
</tr>
<tr>
<td>UKSTU-IR</td>
<td>894</td>
</tr>
<tr>
<td>Special XX</td>
<td>6</td>
</tr>
</tbody>
</table>
### Summary of Plate Processing (June 2002)

<table>
<thead>
<tr>
<th>Survey</th>
<th>Epoch</th>
<th>Plate/Filter</th>
<th>Band</th>
<th>Depth</th>
<th>Scanned</th>
<th>CDROM</th>
<th>Process</th>
<th>DB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pal-QV</td>
<td>1983-85</td>
<td>IIaD+W12</td>
<td>V</td>
<td>19.5</td>
<td>100%</td>
<td>100%</td>
<td>42%</td>
<td>0%</td>
</tr>
<tr>
<td>SERC-J/EJ</td>
<td>1975-87</td>
<td>IIIaJ+GG395</td>
<td>B_J</td>
<td>23.0</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>POSS-I E</td>
<td>1950-58</td>
<td>103aE+red</td>
<td>R</td>
<td>20.0</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
<td>3%</td>
</tr>
<tr>
<td>POSS-I O</td>
<td>1950-58</td>
<td>103aO</td>
<td>B</td>
<td>21.0</td>
<td>55%</td>
<td>15%</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>POSS-II J</td>
<td>1987-00</td>
<td>IIIaJ+GG385</td>
<td>B_J</td>
<td>22.5</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>POSS-II F</td>
<td>1987-99</td>
<td>IIIaF+RG610</td>
<td>R</td>
<td>20.8</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>POSS-II N</td>
<td>1987-01</td>
<td>IV-N +RG69</td>
<td>I</td>
<td>19.5</td>
<td></td>
<td>99%</td>
<td>99%</td>
<td>87%</td>
</tr>
<tr>
<td>AAO-SES/SERC-ER</td>
<td>1990-00</td>
<td>IIIaF+OG590</td>
<td>R</td>
<td>22.0</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>SERC-I</td>
<td>1990-02</td>
<td>IV-N +RG715</td>
<td>I</td>
<td>19.5</td>
<td>96%</td>
<td>96%</td>
<td>96%</td>
<td>86%</td>
</tr>
</tbody>
</table>
GSC-II Overview

- All-sky catalog of positions, proper motions, magnitudes and colors
  - Use all available images: DSS-I/DSS-II images + unpublished (QV,XO)
  - Complete to a minimum of V=18 (Goal is plate limited)

- GSC-II will have multiple observations for ~2 billion objects

- Used commercial OODb
  - All observed object parameters stored in db, ~3TB final size
    - “Master Index” links all observations and catalogs to individual objects on the sky.
    - Recalibrations can be applied within db
    - Export catalog as binary FITS tables

- GSC-II project is partially funded by external partners
  - OATo, GEMINI, ESO, ESA/ST-ECF and ESA/SA
  - Receive prepublication data access for telescope operations and science projects
GSC-II Goals

- **Positions**
  - < 0.50" absolute; average across a single plate; < 0.20" relative, over 1/2° field
  - < 0.15" adherence to ICRS reference frame, average over all plates

- **Proper Motions**
  - Errors due to limited time baseline between observation epochs
  - Typically 5-30 mas/year in North and 20-40 mas/year in South

- **Photometry**
  - 0.2mag error between 12-18 magnitude

- **Classification:**
  - 95% accuracy within two magnitudes of plate limit
Overview of Precision

- **Photometry**
  - Zero pt. error less than <0.04mag
  - Rms errors vary from 0.15mag near sequence to 0.28mag at edges

- **Astrometry**
  - Zero pt. offsets are negligible <0.01”
  - Rms errors vary from 0.15” in plate center to 0.5” at edge
  - Magnitude equation < 0.1” not corrected yet

- **Classification**
  - 90-95% to 18th mag
  - Known errors with bright stars – corrected by final release date
Catalog Releases

PREVIOUS RELEASES

- **GSC 2.0**
  - Delivered 7/99
  - Sky coverage prioritized for GEMINI SV, HST BOP
  - Two-passbands (J,F), without proper motions
  - Deliverable to GEMINI and ESO/VLT only

- **GSC 2.1.0**
  - Delivered 3/00
  - Same as GSC 2.0, but with available sky coverage
  - Preliminary astrometry, photometry, classification

- **GSC 2.1.1**
  - Delivered 8/00
  - Same as GSC 2.1.0, increased sky coverage
  - Improved Photometric calibration with GSPC 2
  - Improved Astrometric calibration with Tycho 2

- **GSC 2.2.0**
  - Delivered 06/01
  - Complete sky coverage in 2 passbands
  - Magnitude limited (F<18.5, J<19.5)
  - Initial community release (www, data-centers)

- **GSC 2.2.1**
  - Delivered 06/01
  - Complete sky coverage in 2 passbands
  - Plate limited
  - Internal consortium release for Telescope Operations and Science Teams

PLANNED RELEASES

- **GSC 2.3**
  - Estimated March 2003
  - Adds available XE, XO, QV plates + IR (XI, XN)
  - Recalibration with final astrometric masks, magnitude equation and vignetting function
  - Reclassification with final decision trees
  - Proper motions computed

- **GSC 2.n+**
  - “Maintenance Mode”
  - Inclusion of 2MASS data (HST science planning/NGST)
  - Galaxy photometry
  - Improved global error analysis and removal of systematic errors
    - color corrections
    - proper motion corrections
HST Pointing

- Improved positional accuracy of Guide Stars
  - More recent epoch of observation
  - More accurate astrometry (reduced systematic errors)
  - Proper motions
  - ICRS reference frame
- NGSS will select GSC-I or GSC-II based on RPS2 keyword
- Requires addition of dynamic WCS updates to DSS retrieval with GSC-II astrometry
- Plan to test GSC-II using selected cycle 12 calibration observations
- General GO usage for cycle 13
HST Astrometry

- Future observations using GSC-II will have improved astrometry for aligning with observations at other wavelengths = Better Science
- Archived observations using GSC-I can be ‘updated’ with GSC-II positions.
  Can be accomplished either
  - ‘On-the-fly’
  - Updated headers in archive
- Schedule TBD
Observation Planning

- DSS and GSC-II already integrated into APT
  - http services
  - In process of switching DSS from CDROM jukebox to RAIDarray for improved reliability and response.
  - GSC-II Export catalog also on RAIDarray.
- Bright Object Protection

- Plan to merge 2MASS data into database
  - Provide IR data for HST science planning
  - Create GS catalog for NGST pointing
Summary

- DSS approaching completion
- GSC-II completed next year
- Worked with APT to integrate DSS and GSC-II
- Plans already in place for transition of HST pointing from GSC-I to GSC-II
- Discussions started for implementing improved astrometry of HST images from the archive