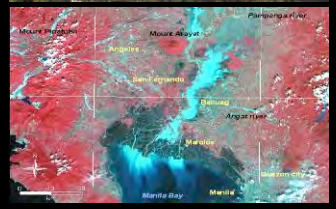

DMCii / SSTL Report

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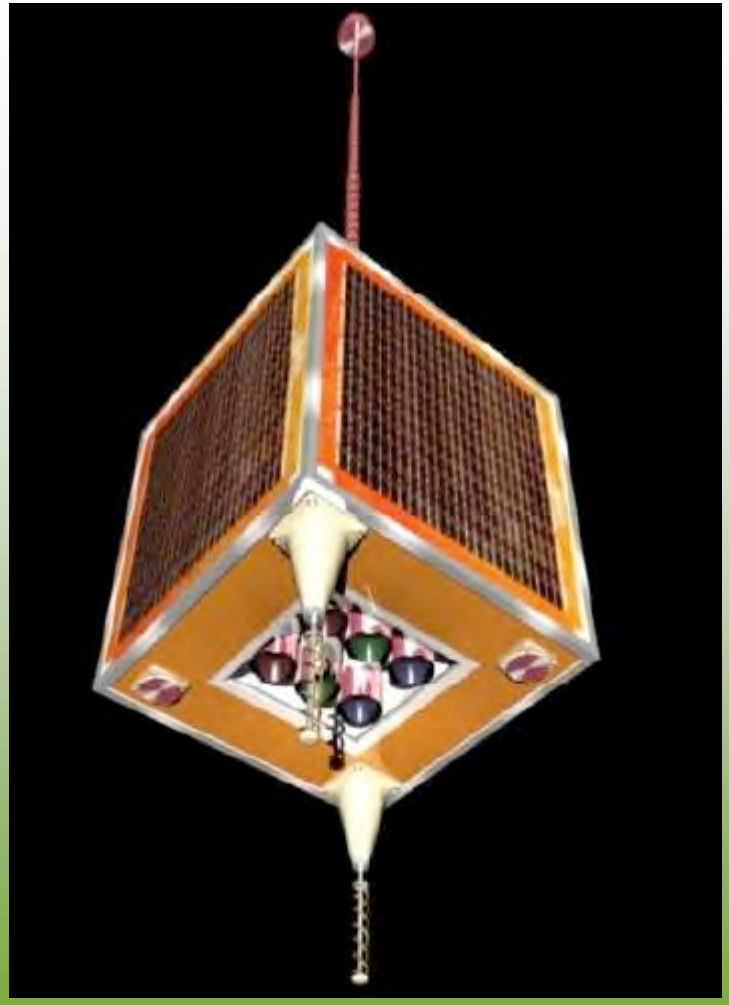
Areas of Development

- Revised calibration procedures
  - Use of “gold” standard
  - Cross-calibration
  - Need for additional well characterised and automated sites
- QA/QC of total systems
  - Includes pre-launch, level products and validation
  - Modular and quantitative

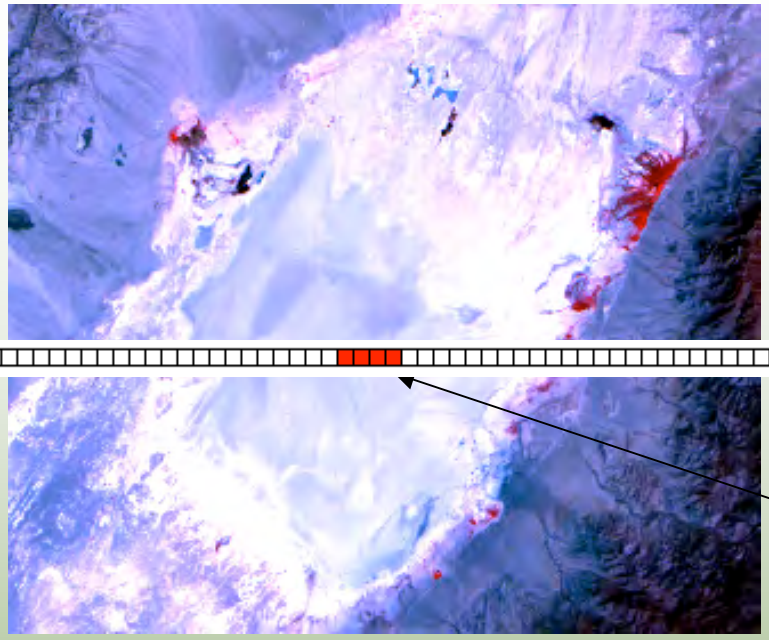
Calibration - Current

- Currently all satellites used in constellation have independent absolute calibration over RRV, lot of co-ordination, lot of field work with higher costs.
- Older satellites have gravity-gradient booms so can only point at Earth. So the Moon is out of the question



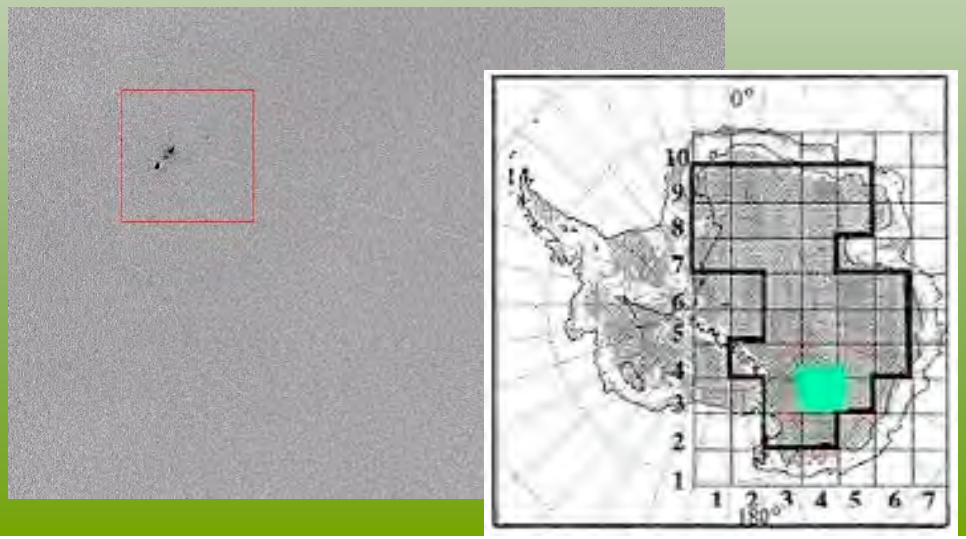
Calibration - Current

- Large linear arrays of which nine pixels calibrated over RRV
- Use DOME-C in Antarctica to transfer absolute of nine pixels to rest of array
- Lots of overpasses, flat and stable target
- Use Pacific at Night as dark reference



Absolute Calibration
Railroad Valley Nevada

Calibrated
Pixels (9)



Current Calibration - Problems

- Co-ordination and data collection
- Variable quality of final calibration
- Newer satellites launched late in the year (two planned for October 2008) will miss the 2008 Absolute Campaign over RRV
- Small variations in response noticeable between satellites in constellation

Proposed Calibration

- Concentrate efforts on a single satellite “Gold” standard, with 6-10 good acquisitions per season over RRV (Landsat suggestion was 4-6)
- As spacecraft in the constellation are in more than one orbital plane transfer the calibration from one to another using the Antarctica site (DOME-C)
- Intersections over same site within 30 seconds to a minute of each other are possible (others within tens of minutes) but very stable atmospheric conditions usually.
- New satellites launched late in the season can have updated calibration for at least three months using cross-calibration over DOME-C
- Gives uniform calibration across the constellation and excellent absolute when the “Gold” standard is well calibrated

Current QA/QC

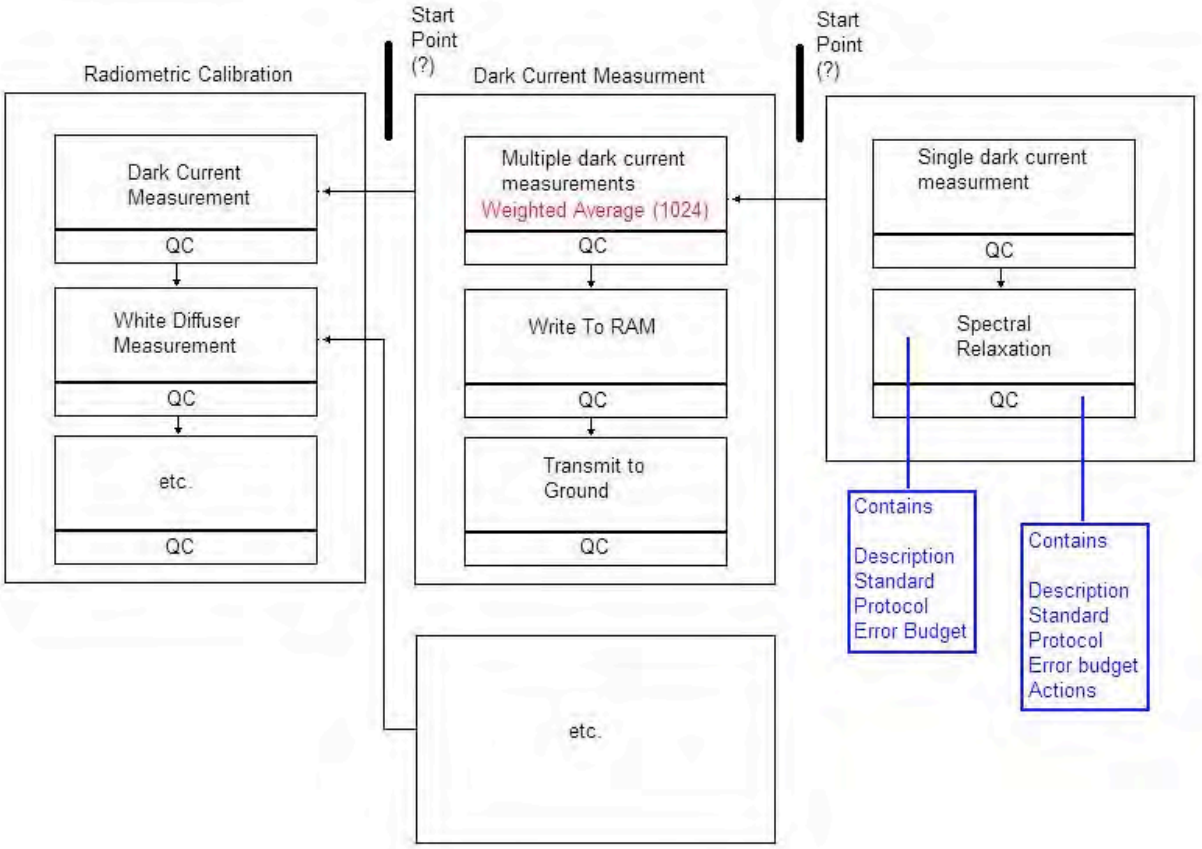
- Few automated checks and lots of manual intervention.
- Decisions are pass / fail and hence low quality data can be above the border and still pass
- Lag between a problem being seen in the data and its identification and correction.
- Procedures can be quite ad-hoc in nature and hence only specific to a limited range of problems
- Variable level of control within the processing chain

Revised QA / QC

- Based on the results from an ESA study led by NPL on Multi-Mission Generic Quality Control
- Covers more than the level products generation, also covers pre-launch and any validation activities
- Full end to end QA / QC
- QA forms part of the modules in best-practice protocols (methods)
- QC are elements between modules that evaluate the processing result.
- Full traceability throughout the entire processing chain.

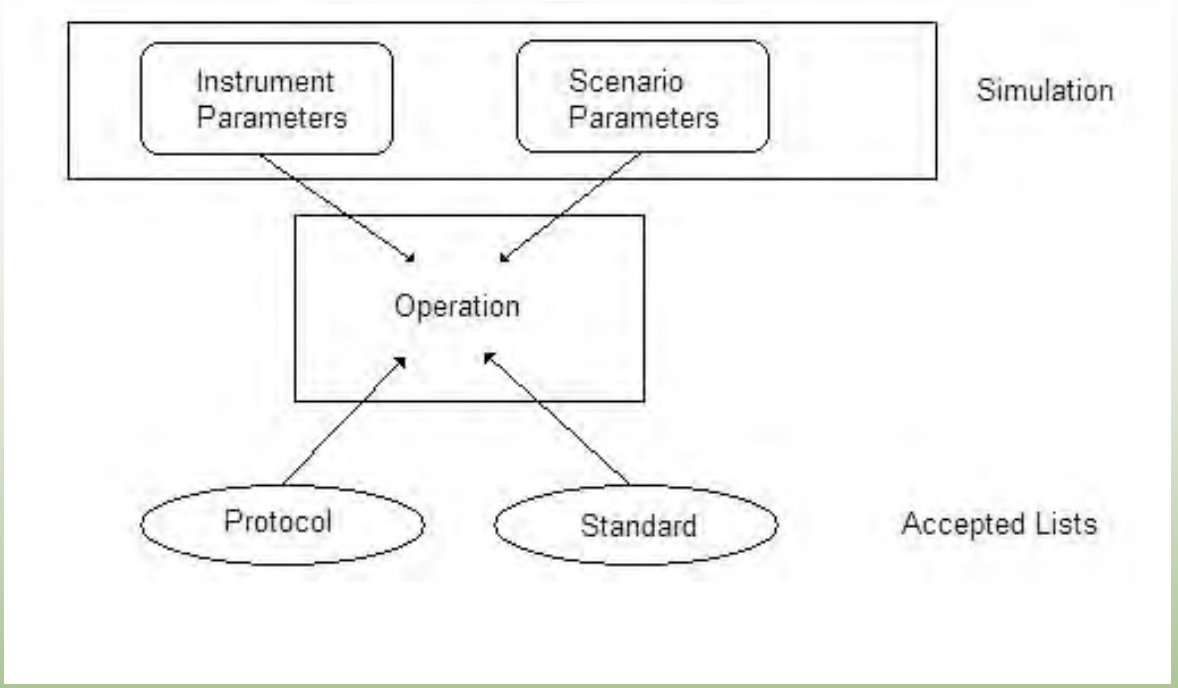
Revised QA / QC

- Simple modules with directly associated QC
- Protocols within a module encapsulate the QA
- Modules aggregated into larger modules
- Error budget so traceability
- Generic level for creating thin operational structures
- Physical structure for implementation



Revised QA / QC

- Modules carry out the operation (dark current measurement for example)
- Protocols used for operation are “Accepted Protocols”, that is validated to some degree by the community
- Standards used for the operation are “Accepted Standards” again validated
- Traceability allows simulation of the processing chain with suitable parameter files



Revised QA / QC - Advantages

- Provides a **generic** “thin” framework for building new processing and QA/QC procedures rapidly and in a systematic manner
- Can be easily translated to corresponding **physical** implementation structures with addition of instrument specific modules as required
- Each module has a defined **protocol** which encapsulates best practice in terms of operation
- Each module has a defined **error budget** for quantitative estimation within a structured QA/QC scheme
- Modules use defined **standards** (quantified error) when necessary

Revised QA / QC - Advantages

- As each module has an error budget, the overall **quantified error** can be traced throughout all operations
- Out of bounds conditions or trends leading to out of bounds conditions can be identified and localised easily within the structure
- Remedial QC can be performed to reduce the effects of instrumental ageing without human intervention or re-processing (in some cases)
- Modules can be simply replaced by updated modules as required (with improved protocols or QC) without affecting the rest of the processing chain.
- Additional modules can be added to deal with unusual system behaviours without affecting the rest of the system
- Modular structures can be created rapidly using a point and click interface
- By adding simulation elements (instrument parameter files, scenario files) it is possible to populate the modular structure and assess errors prior to launch or to simulate changes in procedures.

Satellite launches from SSTL (2008-2009)

- Deimos-1 (Spain) 22m three band imager
- UK-DMC-2 (UK) 22m three band imager
- NX (Nigeria) 22m three band imager
- NigeriaSat-2 (Nigeria) 5m four band imager with 2.5m PAN
- Five Rapideye Satellites (Germany) 6.5m five band imager

Conclusions – Calibration Needs

- New program envisages the NEED for a South American test site supported in the same manner as RRV
- NEED to be more closely involved with the Franco-Italian group at DOME-C (met. records, snow measurements, sun photometer and any BRDF)
- NEED to expand cross-correlation activities with other (non-SSTL) systems with on-board calibrators
- NEED to have automated test sites throughout the world eventually with accuracies approaching the RRV example

Conclusions – QA / QC

- An automatic method is being developed that provides full traceability in the QA / QC process
- The structure is modular with a proposed point and click interface
- The structure will allow simulation of pre-launch through level processing through validation
- There is a NEED for additional support in developing this area with trial implementations with other groups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