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9th National Remote Sensing Technical Reference Group (NRSTRG) meeting 2012

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Introduction and overview

Adam Lewis

National Earth Observation

Group Leader

Agenda

- Recap of NRSTRG-2011
- Review of 2011 (Alla Metlenko)
- Ground Stations (Mike Pasfield)
- Data Acquisition (Norman Mueller)
- Data Processing and the *Unlocking the Landsat Archive* project (Simon Oliver)
- National Earth Observations from Space Infrastructure Plan (David Hudson)
- Round table discussion (All)
- Conclusion

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Previous meeting

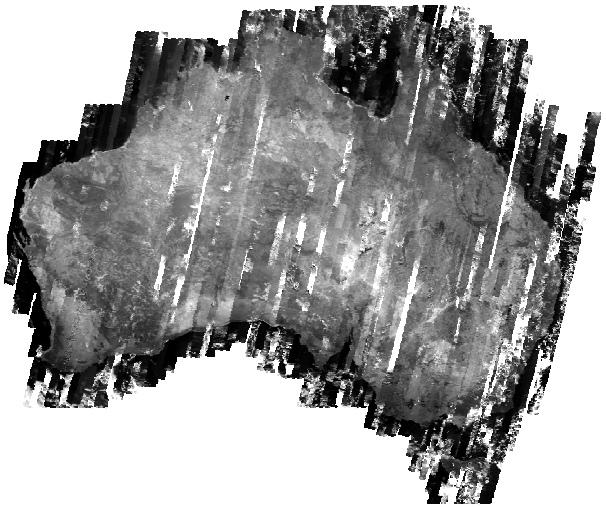
Adam Lewis

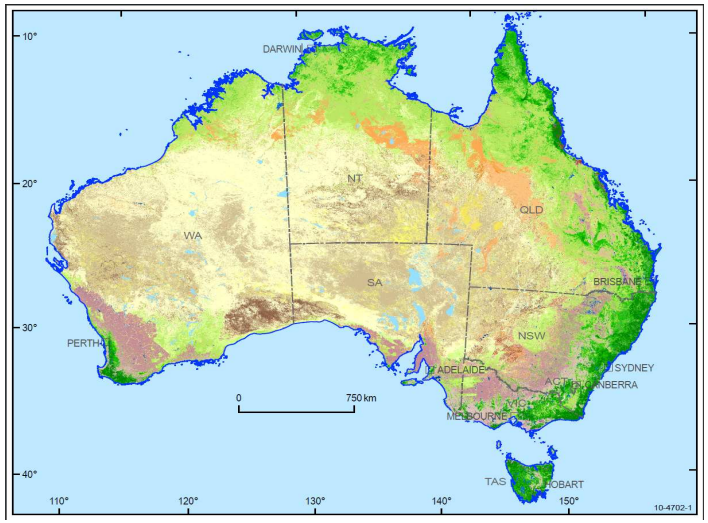
National Earth Observation

Group Leader

Recap - NRSTRG-2011

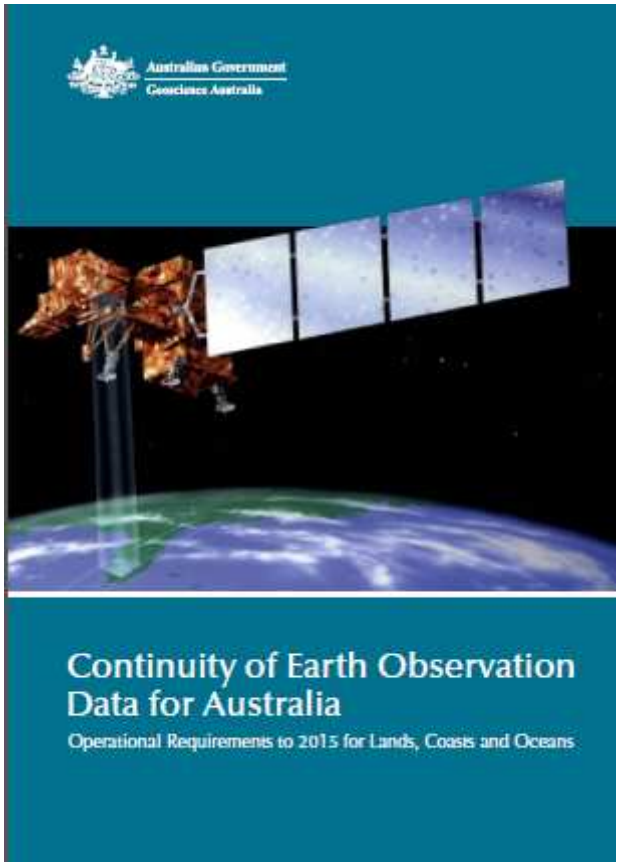
- National Ground Control Point Project – this led to the Australian Geographic Reference Image (AGRI)
- International Forest Carbon Initiative – project now complete
- Landcover analysis – produced the National Map of Australia's Land Cover and associated report and datasets





Recap - NRSTRG-2011

- Discussed public-good requirements for a Defence radar satellite – since then there has been significant work on this question from the Space Policy Unit / SIIC
- EOS components to a national space policy – covered later
- Dinner at Waters Edge
- Australian Basic Earth Observation Scenario - Land and Coastal – Workshop on day-2 which led to the CEODA-Ops report



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Review of NEO Activities since The 8th NRSTRG

Alla Metlenko

Review – Activity Since 8th NRSTRG

February 2011

March 2011

- Participation in '*Sentinels for Science Workshop*', at the European Space Agency (ESA) in Italy
- 45,000 ERS scenes processed for the Australian Geophysical Observing System for studies of crustal deformation

April 2011

- US-Australia Web Enabled Landsat Data workshop held at Geoscience Australia
- NEO hosted a meeting between Dr Stephen Briggs from ESA and Australian government remote sensing stakeholders

Review – Activity Since 8th NRSTRG

May 2011

- NEO visits to state capitals to discuss OGRE access and development
- Adam Lewis, Wenjun Wu and Lan-Wei Wang attended the Landsat Technical Working Group in Sioux Falls

June 2011

- First financial year of the OGRE complete
- Agreement on national priorities for Earth Observation infrastructure

Review – Activity Since 8th NRSTRG

July 2011

- Work started on a 2.4 metre antenna at Alice Springs
- ERS-2 decommissioned, ending 16 years of data reception at TERSS.

August 2011

- GA Open Day

September 2011

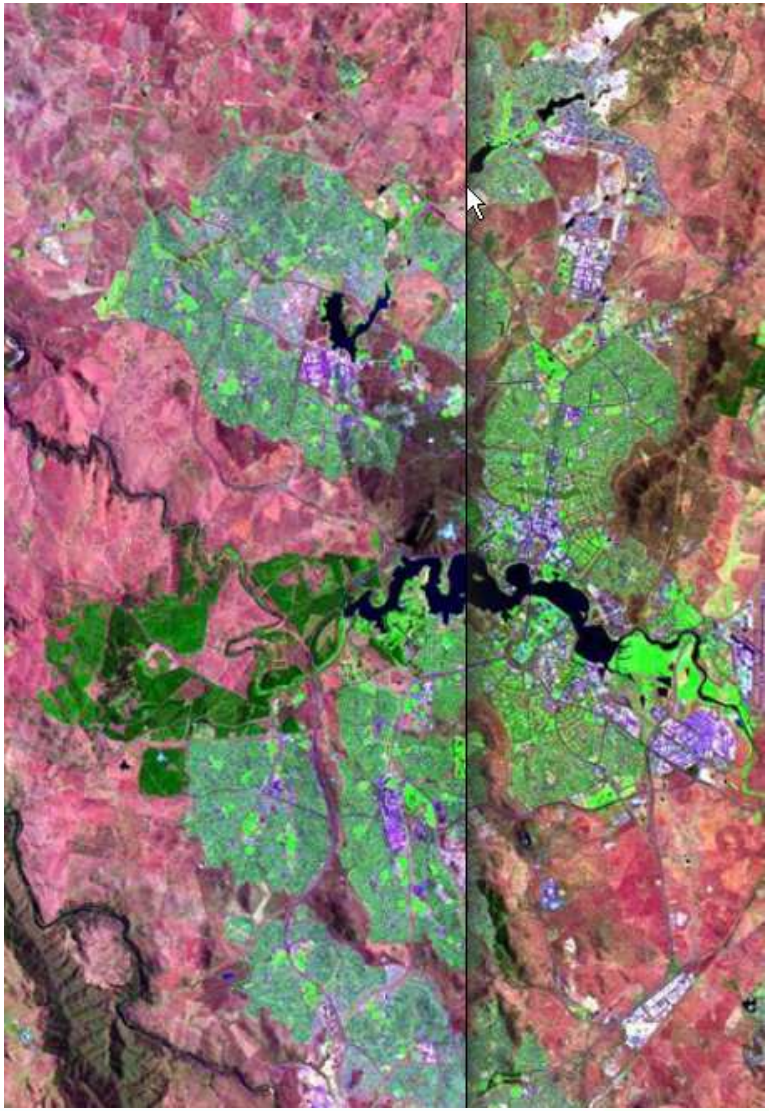
- Minister launches Principles for a National Space Industry Policy (www.space.gov.au)
- NEO's report *Continuity of Earth Observation Data for Australia – Operations* (CEODA-Ops) released

Review – Activity Since 8th NRSTRG

- Urban expansion from space web-page launched

October 2011

- Pre-season briefings for 2011/2012 emergency season commence, after flooding and Cyclone Yasi the previous season
- 32nd anniversary of Australia establishing Landsat ground station and processing facility
- Geoscience Australia ceases acquisition of IRS P-6 data



Review – Activity Since 8th NRSTRG

November 2011

- National Map of Australia's Land Cover launched and released at Spatial@gov.au
- Landsat-5 imaging suspended
- OGRE Open Day, Canberra

December 2011

- GA Sponsors Surveying and Spatial Sciences Conference (SSSC) Wellington
- Australian Geographic Reference Image launched at the SSSC

Review – Activity Since 8th NRSTRG

December 2011 (cont)

- TERSS failure of the antenna control units
- Commenced emergency response – NSW floods

January 2012

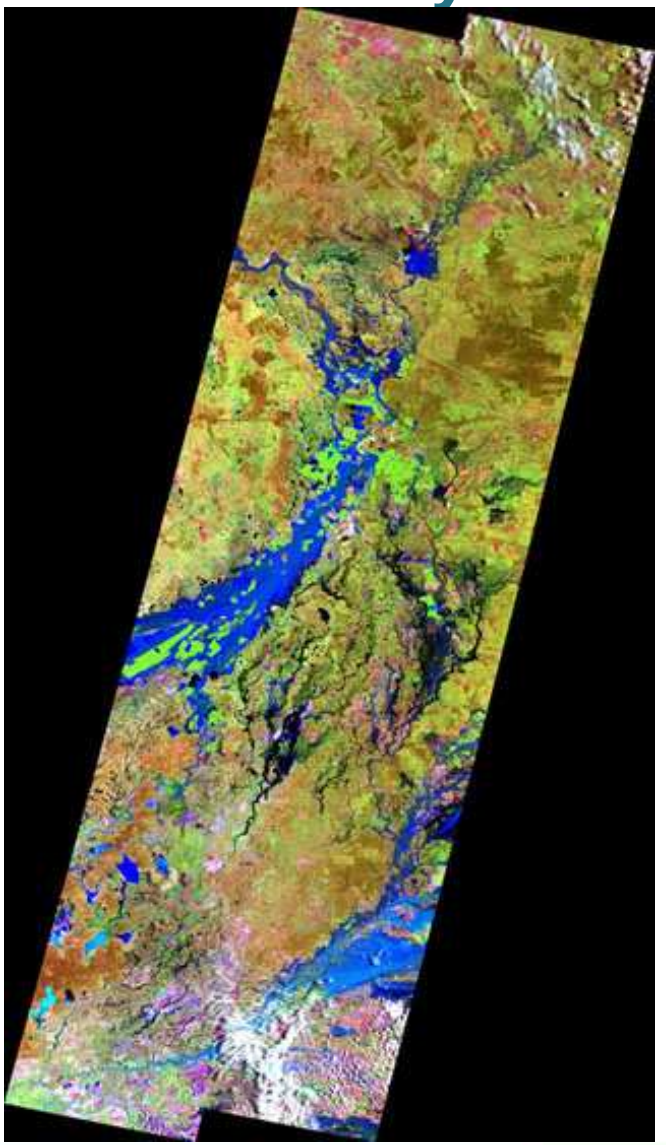
- NEO attend the Landsat Ground Station Operators Working Group in Indonesia - In-principle agreement with USGS to continue International Collaboration on Landsat-8

Flooding in Queensland and NSW February 2012

February 2012

- Commercial Imagery used to track floods for the Darling, Lachlan and Murrumbidgee
- SPOT 4, SPOT 5, DEIMOS-1, TerraSAR-X, COSMO SkyMed, RADARSAT-2
- Almost all imagery captured under whole of government licence

<back>



(SPOT 5 image showing Flooding of the Balonne River and lower Gwyder catchment)

Review – Activity Since 8th NRSTRG

March 2012

- Space policy work – NEOS-IP discussion papers released
- More floods : Shepparton - "*These [GA-MODIS] data appear to be much undervalued…*"

April 2012

- Envisat loss of communication and end of mission announced
- GA attended Sentinel 2 preparatory symposium in Italy – another opportunity to engage with ESA

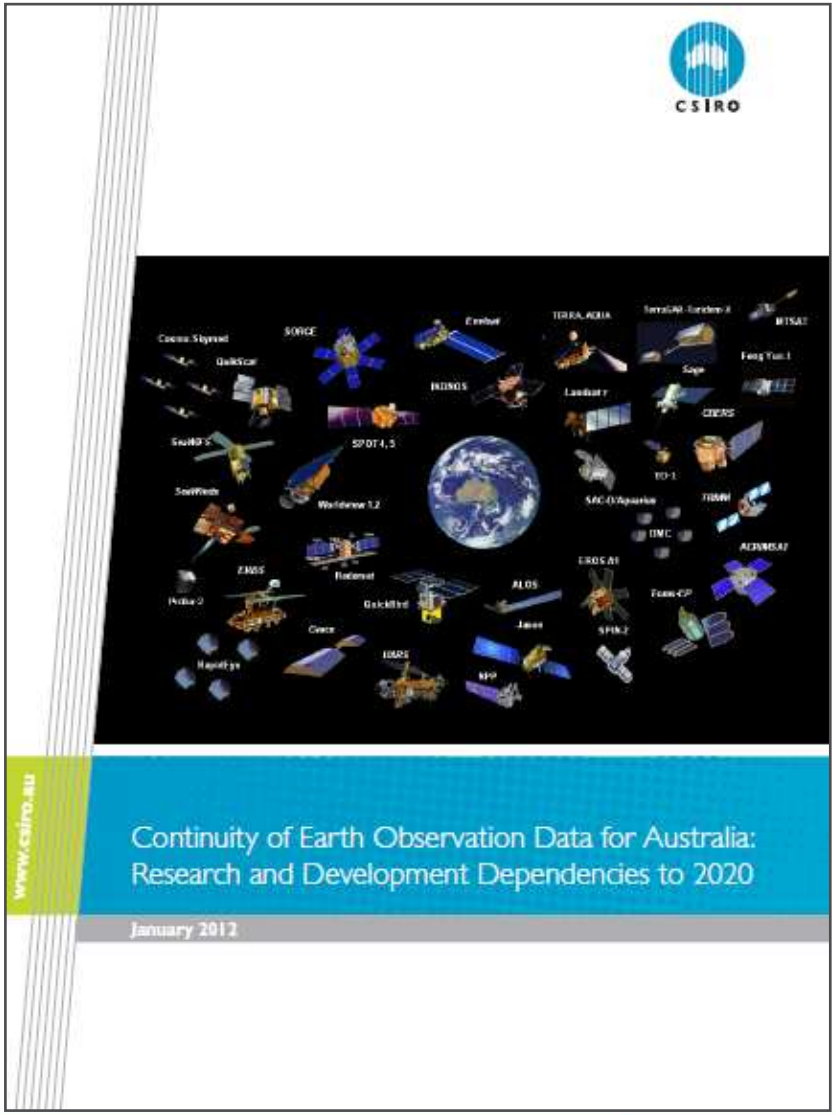
Review – Activity Since 8th NRSTRG

May 2012

- CEODA-R&D report released by CSIRO, a twin to the CEODA-Ops report produced by NEO.

June 2012

- Contract signed for DMCii data acquired via the OGRE panel to help gap-fill medium resolution data. Data can be distributed from GA under a Creative Commons Attribution Licence.
- Geoscience Australia Distributors Agreements conclude



Business As Usual – Product Support

All Landsat Data are now processed using the USGS-provided Landsat Product Generation System (LPGS)

- Product Specifications for TM and ETM+
- Orthorectified and Path products
- Where images are too cloudy or the data are faulty a system corrected Map product is produced
- Map-oriented images are not standard products
- Data specifications and processing parameters are provided on a memory stick

Production of MSS

- USGS has developed a processing capability to process all MSS data - GA will not duplicate this

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Ground Stations and communications

Mike Pasfield

National Earth Observation

Operations

Outline

Alice Springs

- TERSS
- Darwin
- Data communications

Ground Stations – Alice Springs

Ground Stations – Alice Springs

9m and 5m antennas operating nominally

New 2.4m X/L band antenna installed and in final phase of commissioning – will be tasked to acquire Suomi-NPP and MODIS data

New demodulators purchased (6) and being commissioned in preparation for Landsat-8 (CVG-AVTEC HDRM)

New virtual machine computing infrastructure installed and being commissioned – will replace existing ingest system

New 2.4m X/L band antenna

New 2.4m X/L band antenna

Ground Stations – TERSS

Ground Stations – TERSS

Complete failure of the antenna control unit experienced 26/12/2011

After many months of work ACU was restored to operational level in May 2012

Additional failures with storage have not yet been resolved. Solutions expected in June

Anticipate TERSS to be operating nominally by July 2012

Given the continuing difficulties and the likely future pressure on spectrum at the current site, options for the longer term future of the facility need to be considered

Ground Stations - Darwin

GA is assisting Dept of Climate Change (DCCEE) with construction of a new Australian Government 9m X-band antenna in Darwin

On track to be operational in October 2012

GA/DCCEE discussing arrangements for ongoing operation of antenna and data processing

The antenna will facilitate Australia's work with regional nations through programs such as the International Forest Carbon Initiative (IFCI)

Future applications will be determined by DCCEE and AusAid, but could possibly include regional support in emergency situations

Ground Stations – data communications

Alice Springs to Canberra

- 100 Mbps data communications link expected in July
- will enable all data to be transmitted to Canberra on acquisition in Alice Springs
- NEO will implement a ‘process as soon as received’ workflow

TERSS to Canberra

- continue to rely on existing 2 mbps link for now
- investigating other possibilities

Ground Stations – data communications

Darwin to Canberra

- the project includes a communications link to allow Near-Real-Time transmission of data to Canberra for processing

Canberra to *and from* USGS

- investigating use of AARNet for communications with the USGS
- 2000-2010 data have been repatriated to USGS via AARNET
- Pre-2000 data repatriation may commence in July
- For Landsat-8 GA will be seeking to receive data from USGS routinely to maintain the national archive
- Data exchange may also be needed for processing of historic MSS data (GA will not re-develop MSS processing systems).

Ground Stations – Questions?

Morning Tea

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Data Acquisition

Norman Mueller

National Earth Observation

Science and Strategy

Evolving the way we ensure access to Earth Obs

Platform continuity (Past):

- eg Continuity for the Landsat TM sensor

Data stream continuity (Today):

- eg Continuity for the data stream such as Optical Low Resolution
- Covered through the Continuity of Earth Observations Data in Australia (CEODA) Ops and R&D reports

Variable continuity (Future):

- eg Continuity for the variable which is being measured such as ocean colour
- Covered through the proposed Rolling Review of Requirements within the Infrastructure Plan discussed later today

CEODA-Ops and CEODA R&D

Today's platform continuity types:

- Optical Low Resolution
- Optical Medium Resolution
- Optical High Resolution
- SAR C-Band
- SAR L-Band
- SAR X-Band
- Passive Microwave Radiometry
- Radar Altimetry
- Hyperspectral Imagery
- Lidar
- Ocean Colour

CEODA R&D

Table ES-1 Priority Data Types: Satellite 5-Year Supply Continuity Risk and Key Providers

Priority EO Data Type	5-year continuity risk	Current key providers (and missions)	Future key providers (and missions)	Predominant Latency Requirement
Optical: Low Resolution	Low	NASA (MODIS) NOAA/EUMETSAT (AVHRR) JMA (MTSAT series)	ESA/EC (Sentinel-3 series) NOAA (NPP/JPSS series) JAXA (GCOM-C series) JMA (MTSAT series)	Hours/Weeks
Optical: Medium Resolution	High	USGS (Landsat-5/7)	USGS (LDCM) ESA/EC (Sentinel-2 series)	Days/Weeks
Optical: High Resolution	Low	USA commercial providers (Worldview, GeoEye)	USA & European commercial providers (Worldview, GeoEye, Pleiades) Airborne operators	Days/Weeks
SAR: C-band	Low	ESA (Envisat) CSA (Radarsat)	ESA/EC (Sentinel-1 series) CSA (Radarsat & RCM)	Weeks
SAR: L-band	No current supply	-	CONAE-ASI (SAOCOM-1A) JAXA (ALOS-2)	Weeks
SAR: X-band	Low	ASI (COSMO-SkyMed) DLR (TerraSAR-X)	ASI (COSMO-SkyMed series) DLR (TerraSAR-X series)	Weeks
Passive Microwave Radiometry	Medium	NASA (Aqua – just concluded) NOAA/DoD (DMSP series) JAXA/NASA (TRMM) ESA (SMOS)	JAXA/NASA (GCOM-W series) NASA (GPM, Aquarius, SMAP) NOAA/DoD (DMSP series) ESA (SMOS) ISRO (Megha-Tropiques, RISAT-3)	Hours
Radar Altimetry	Medium	EUMETSAT-NOAA (Jason series) ESA (Envisat)	EUMETSAT-NOAA (Jason series) ESA/EC (Sentinel-3 series)	Hours
Hyperspectral Imagery	High	NASA (EO-1)	DLR (EnMAP) ASI (PRISMA) METI/JAXA (ALOS-3)	Weeks
Lidar	High	NASA (CALIPSO)	ESA/JAXA (EarthCARE)	Weeks
Ocean Colour	Low	ESA (MERIS) NASA (MODIS) ISRO (OCEANSAT)	ESA/EC (Sentinel-3 series) JAXA (GCOM-C series) ISRO (OCEANSAT) NOAA (NPP/JPSS series)	Hours

CEODA R&D

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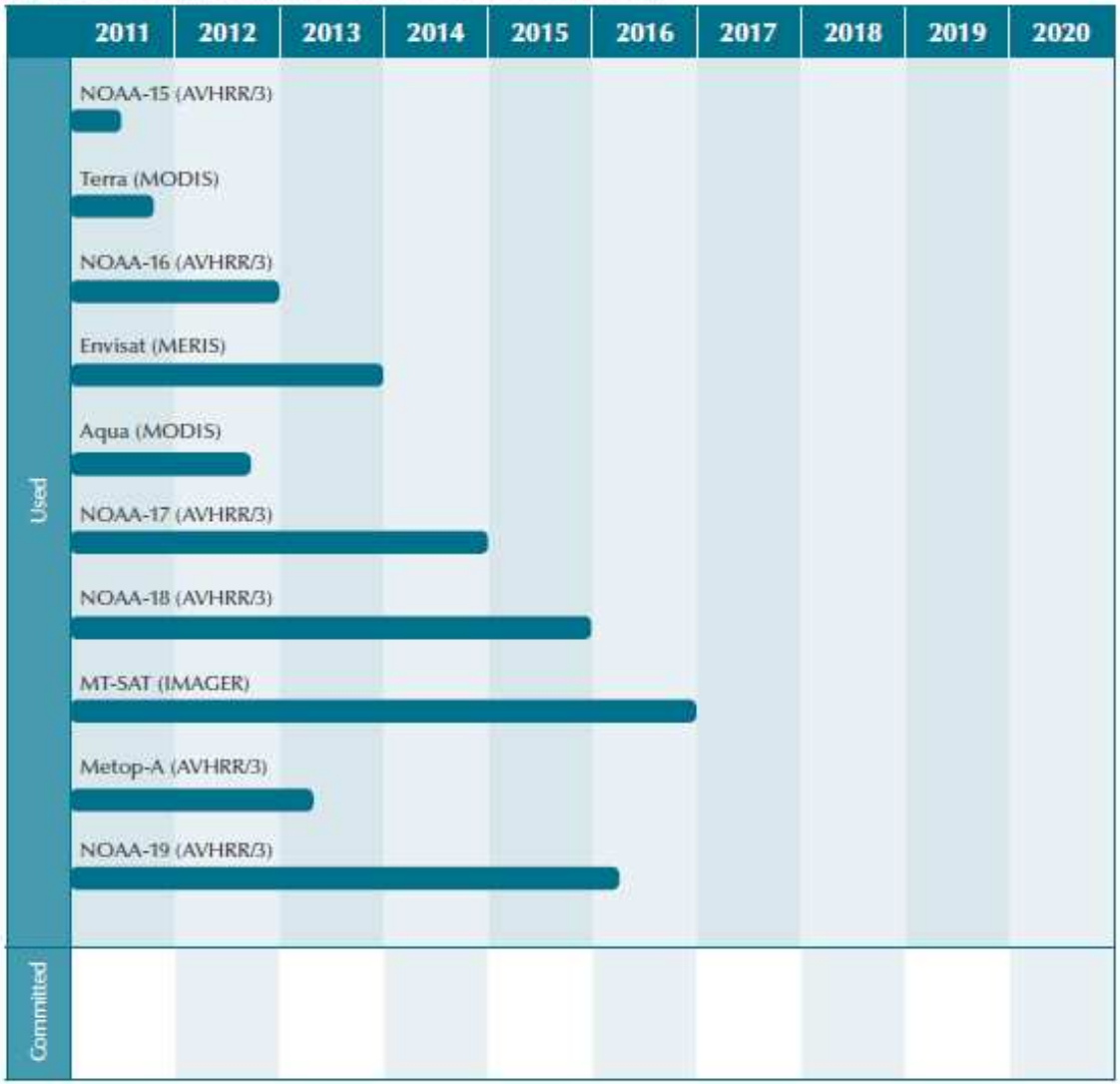
Optical: Medium Resolution	High	USGS (Landsat-5/7)	USGS (LDCM) ESA/EC (Sentinel-2 series)	Days/Weeks
Optical: High Resolution	Low	USA commercial providers (Worldview, GeoEye)	USA & European commercial providers (Worldview, GeoEye, Pleiades) Airborne operators	Days/Weeks

Optical Low Resolution: State of play in 2011

Figure 4-2 Used and Committed Sensors: Low Resolution Optical



Optical Low Resolution: Suomi-NPP

National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project

Designed to replace NOAA and the Defence Meteorological Satellite Program (DMSP)

Revised to civilian only application

Designed to measure clouds, aerosols, ocean colour, surface temperature, fires and albedo

Evolution of MODIS, AVHRR, SeaWiFS, OLS

Launched 28th Oct 2011

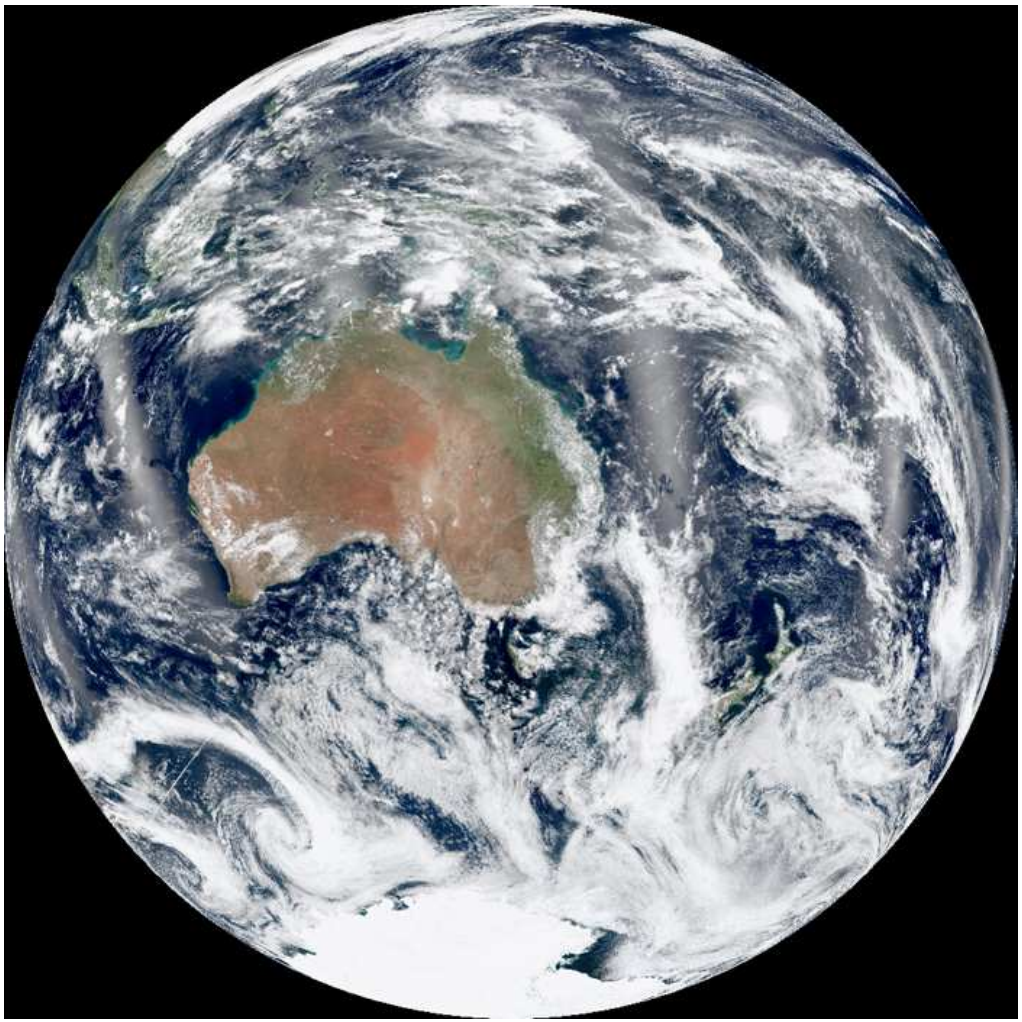
GA to begin reception (possibly July 2012) and processing (tba)

- Ongoing joint discussions between GA/Bureau/CSIRO/NCI

Comparison of 22-band NPOESS VIIRS with MODIS bands

NPOESS VIIRS		MODIS	
Band number	**Central wavelength (µm)**	**Band number**	**Central wavelength (µm)**
M1	0.412	**8**	0.412
M2	0.445	**9**	0.443
M3 (blue)	0.488	**3 (blue)**	0.469
M4 (green)	0.555	**4 (green)**	0.555
M5 (red)	0.672	**1 (red)**	0.645
M6	0.746	**15**	0.748
M7	0.865	**2**	0.858
M8	1.240	**5**	1.240
M9	1.378	**26**	1.375
M10	1.61	**6**	1.640
M11	2.25	**7**	2.13
M12	3.7	**22**	3.959
M13	4.05	**23**	4.05
M14	8.55	**29**	8.55
M15	10.763	**31**	11.03
M16	12.013	**32**	12.02
DNB	0.7	**No equivalent width**	No equivalent width
I1	0.64	**1 (red)**	0.645
I2	0.865	**2**	0.858
I3	1.61	**6**	1.64
I4	3.74	**22**	3.959
I5	11.45	**31**	11.03

Suomi-NPP: VIIRS Blue Marble Image – Acquired 4th January 2012



Optical Low Resolution: GCOM-C

Spatial resolution: 250, 500 and 1000m

1150 - 1400km swath width

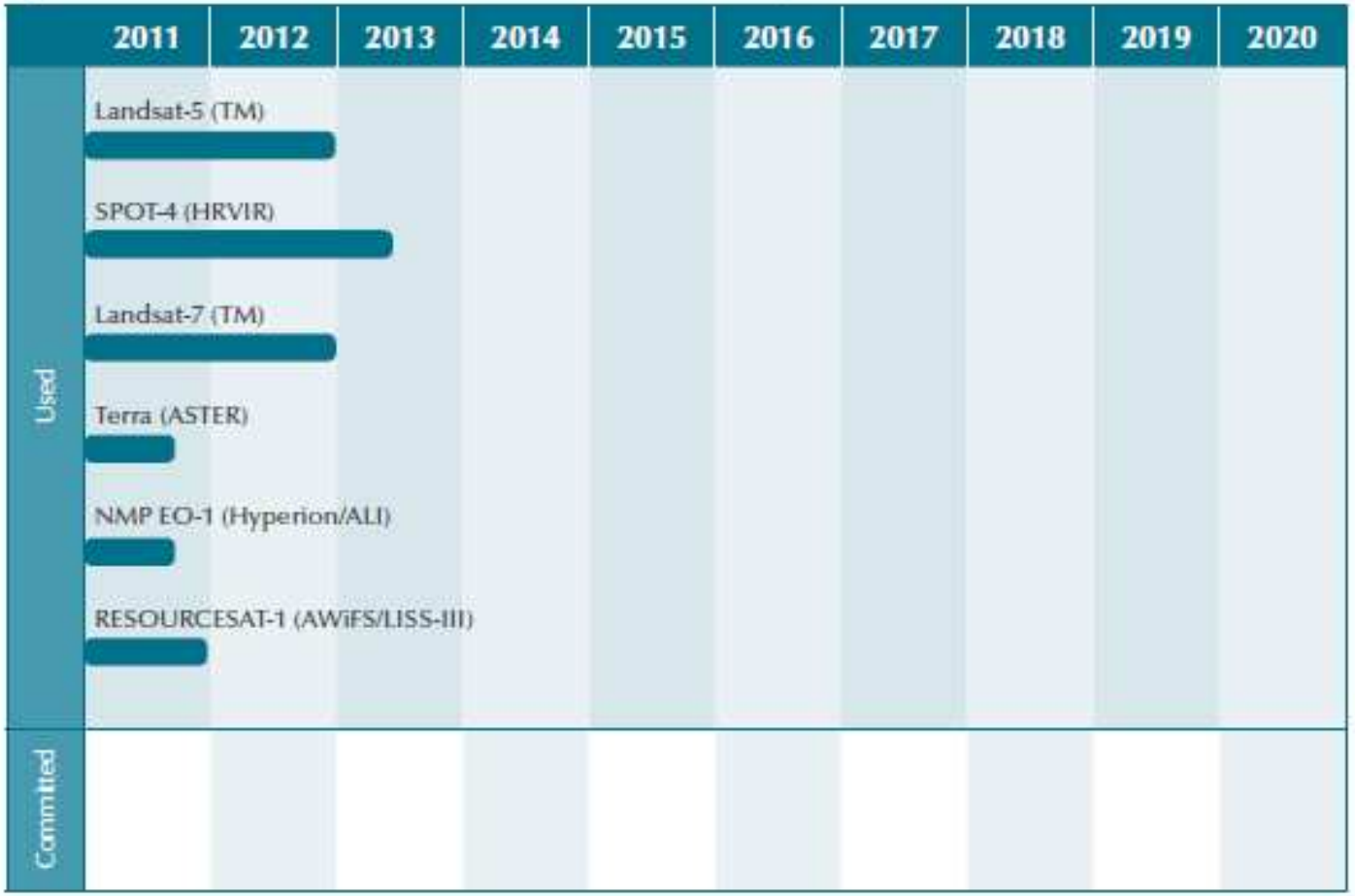
Planned launch : December 2013

5 years design life time

Space Policy Unit in early discussions with JAXA

Optical Medium Resolution: State of play in 2011

Figure 4-4 Used and Committed Sensors: Medium Resolution Optical



Optical Medium Resolution: GMES Sentinels

Long term, systematic earth observation programme

Climate science focus

Planned free data policy

Budget discussions continue between ESA and the EU

Dates from CEOS as of 8 June 2012:

Mission	Mission Instrument(s)	Launch Date	EOL Date	Status	Lead Agency
Sentinel-1 A	C-Band SAR	30-Oct-13	31-Jan-21	Approved	ESA
Sentinel-2 A	MSI (Sentinel-2)	30-Jun-14	27-Sep-21	Approved	ESA
Sentinel-3 A	OLCI, SLSTR, SRAL	30-Apr-14	30-Aug-21	Approved	ESA

Optical Medium Resolution: Sentinel 2

13 spectral bands (VIS, NIR & SWIR)

Spatial resolution: 10, 20 and 60 m

290 km swath width

5 days repeat cycle (cloud free) with 2 satellites

Sun synchronous orbit at 786 km mean altitude

7 years design life time, consumables for 12 years

Planned launch : 2013

Sentinel 2 comparison

Optical Medium Resolution: Landsat 8

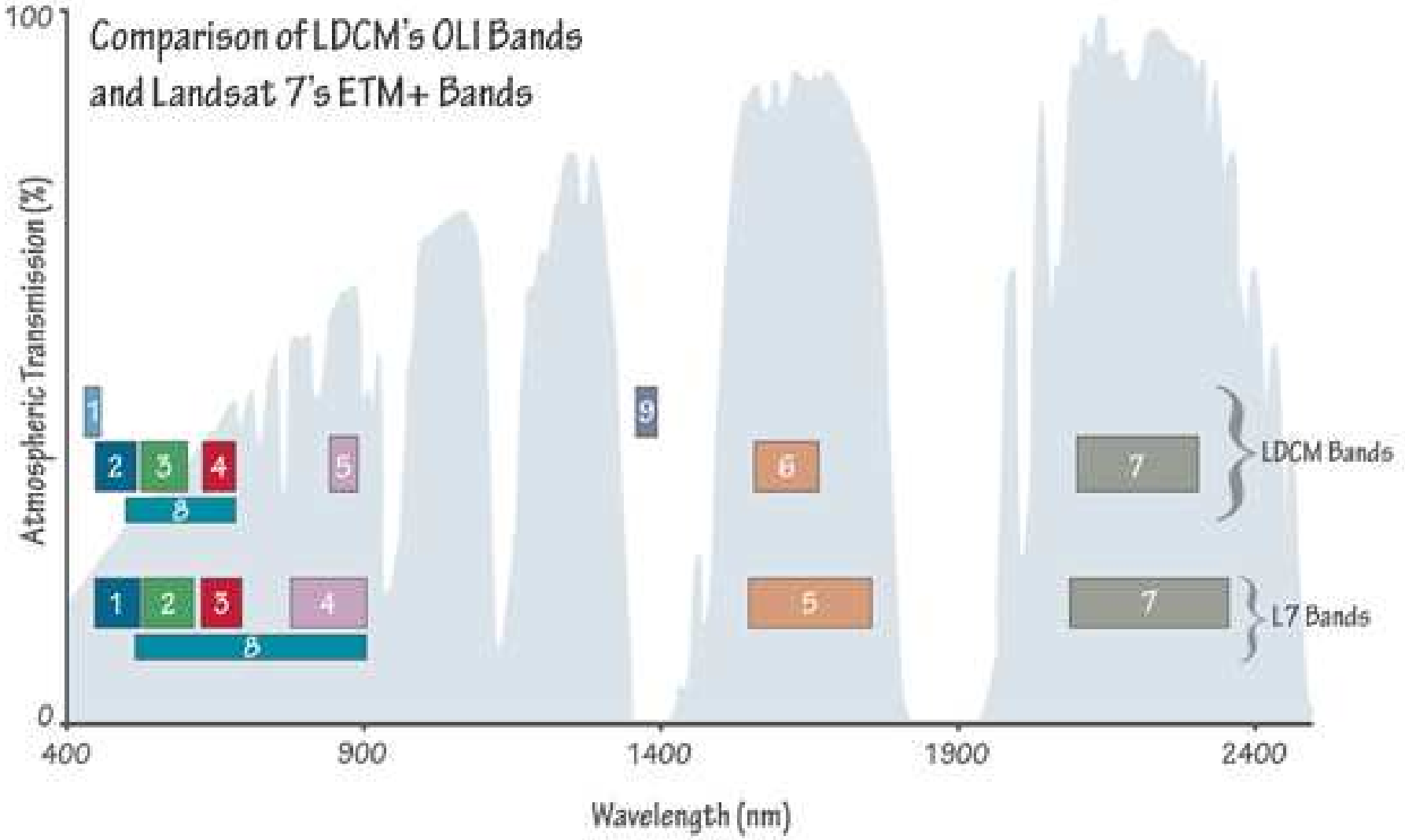
Landsat 8 to continue the Landsat legacy

Scheduled to launch in January 2013

GA is upgrading it's reception and processing facilities to provide data

Expect to continue the current Landsat product lines

Landsat-8 v. ETM+ spectral sampling



Optical Medium Resolution: CBERS-3

CBERS-3:

- Multispectral imager
- 20 m resolution, 120 km swath, 4 bands (RGB, NIR)
- Panchromatic and multispectral imager
- 5 m resolution, 60 km swath, 4 bands (RGB, NIR)

Possible challenges

- Highly committed to international forest work
- Limited duty cycle
- Multiple instruments require more downlink equipment
- Joint China-Brazil flight operations

Australian delegation visiting Beijing in late June regarding CBERS-3 and other topics including access to data during emergency situations

Optical Medium Resolution: Terrestrial Ecosystem Dynamics

TerEDyn is a proposed constellation of low-cost Landsat augmentation satellites

- 4 bands: green to SWIR
- Improve frequency of Landsat observations to an 8-day revisit
- 30m spatial resolution

Seeking NASA funding

GA provided a letter of support and the offer to use the Alice Springs facility

Minister for Science also attached a letter of support to the funding application to NASA

Optical Medium Resolution: Gap filling

Landsat 7

- Continuing to acquire, and operating well

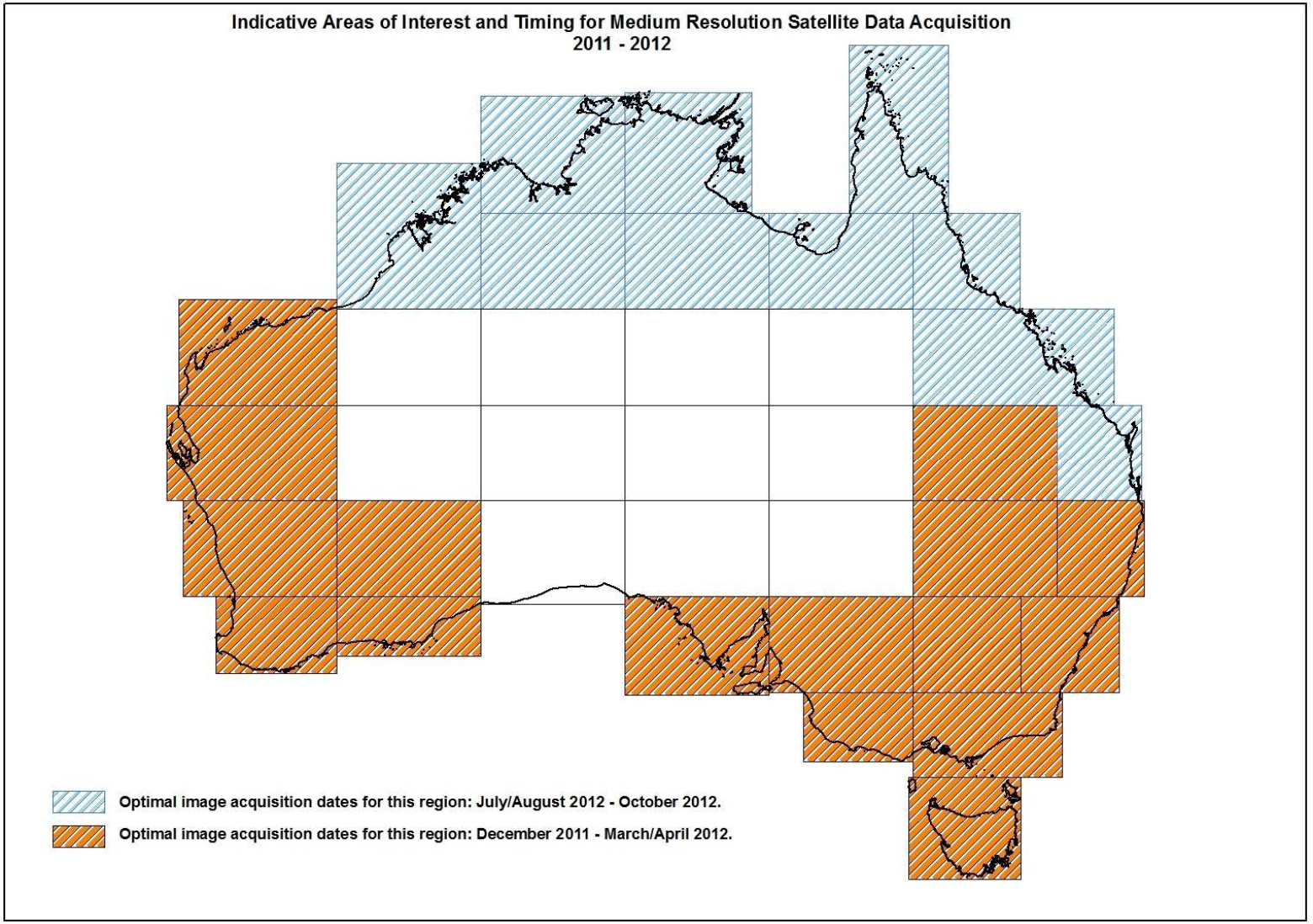
IRS-P6

- Contract terminated

New GA Tender - DMCii successful

- One northern Australia coverage this and next winter
- One southern Australia coverage last and next summer
- **Creative Commons Attribution**
- Expected cost of transfer via HDD

Optical Medium Resolution: DMCii tasking



Optical Medium Resolution: DMCii specifications

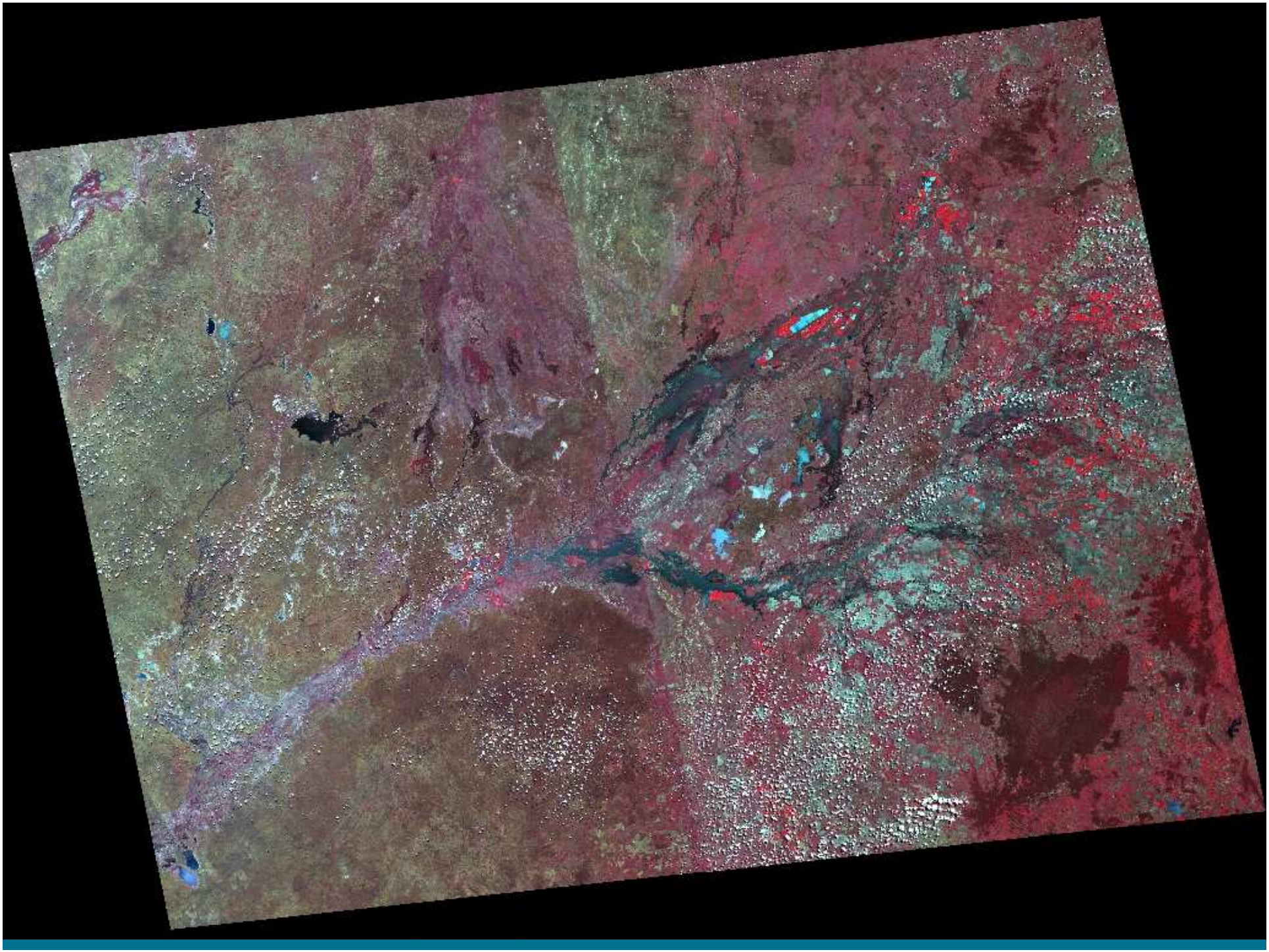
Second generation DMC satellites:

- UK-DMC2, DEIMOS-1, NIGERIASAT-X
- Spatial resolution: 22m
- Spatial accuracy: <17m
- Spectral bands: Green, Red, NIR
- Radiometric calibration accuracy:

  <5% absolute, <1% relative to Landsat 7

Experience in applications

- 2012 floods in NSW and Queensland



Optical Medium Resolution: ALOS data

- GA-JAXA MoU ended in 2011
- GA holds a significant archive of ALOS data (over 100,000 scenes)
- Discussions with JAXA up until May 2012 have not found an agreed way forward, e.g., in which GA could continue to use the data as a public-good dataset
- GA will retain the archive until ~2016 as required under the surviving terms of the MoU
- For practical purposes ALOS data should be sourced from the commercial provider

Optical, Geospatial, Radar, and Elevation Supplies and Services Panel (OGRE)

OGRE Performance October 2010 – June 2012

- 11.8TB data acquired (11.0TB stored in EODS)
- Total contract value of $5,984,695
- 8 users from Federal and State government agencies
- 33 suppliers
- EOIs received from 30 new suppliers Jan – June 2012

OGRE Operational Activities

Standardised metadata and XML schema for EOS imagery to support improved data handling and discoverability

Revising operational model, including:

- Service catalogue (what GA does and doesn't provide)
- Improved governance framework
- Improved community engagement plan

Govdex (www.govdex.gov.au)

- OGRE Community of Practice
- Forum for cooperative procurement discussions
- Request an account from OGRE@ga.gov.au

More info (New today)

www.ga.gov.au/earth-observation/ogre.html

Lunch

Australian Government
Geoscience Australia

Data Processing

Simon Oliver

Unlocking the Landsat Archive

Technical Lead

Outline

Unlocking the Landsat Archive project

- Background and vision
- ULA consortium
- Project outline and responsibilities
- Workflow implementation
- Project progress
- Project components

Processing Management Application

- Background
- What it does and why it’s important

Unlocking the Landsat Archive

GA Earth Observation history

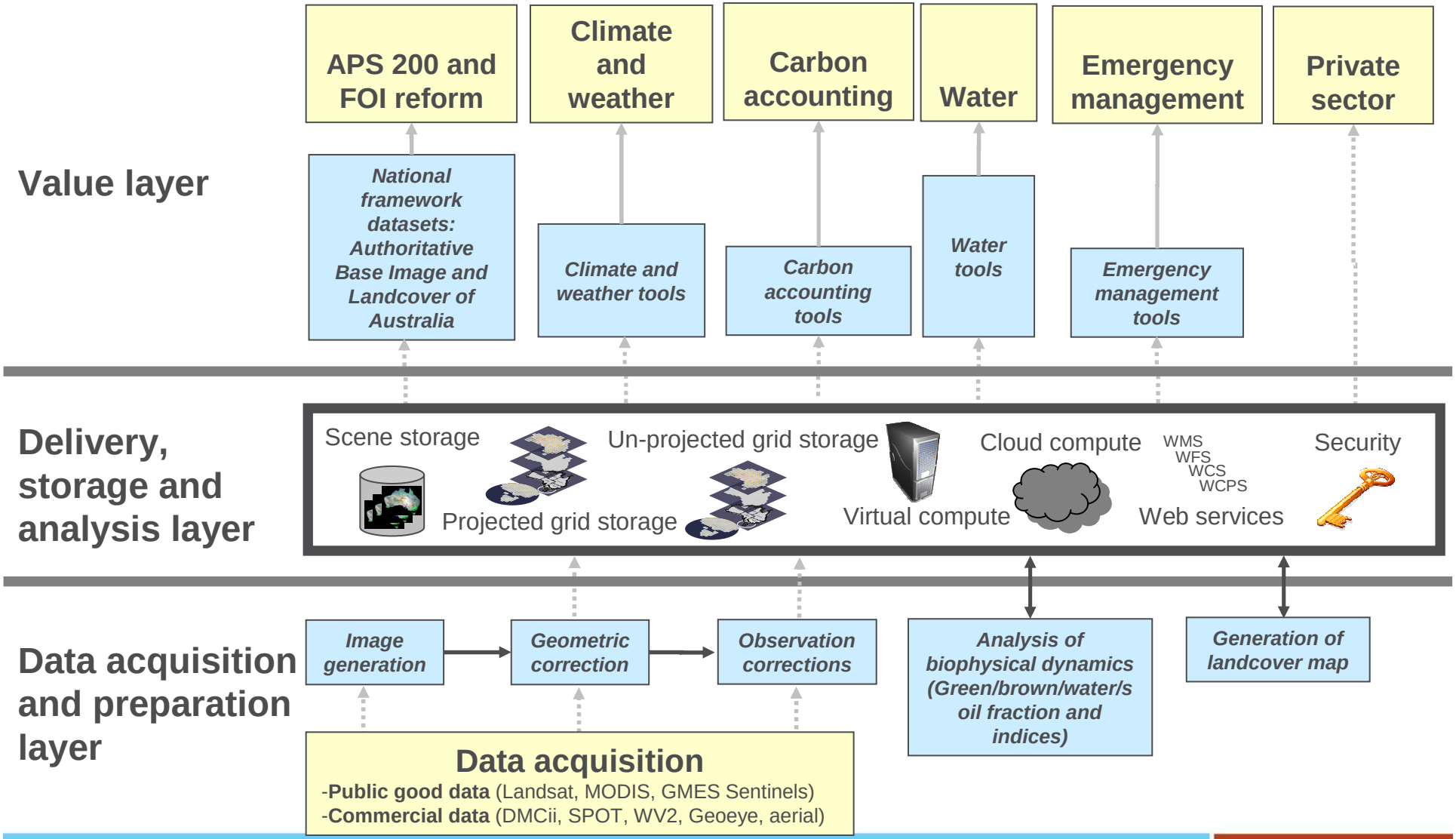
Bespoke products

- Quality Assessment overhead
- Interactive product definition
- Low throughput

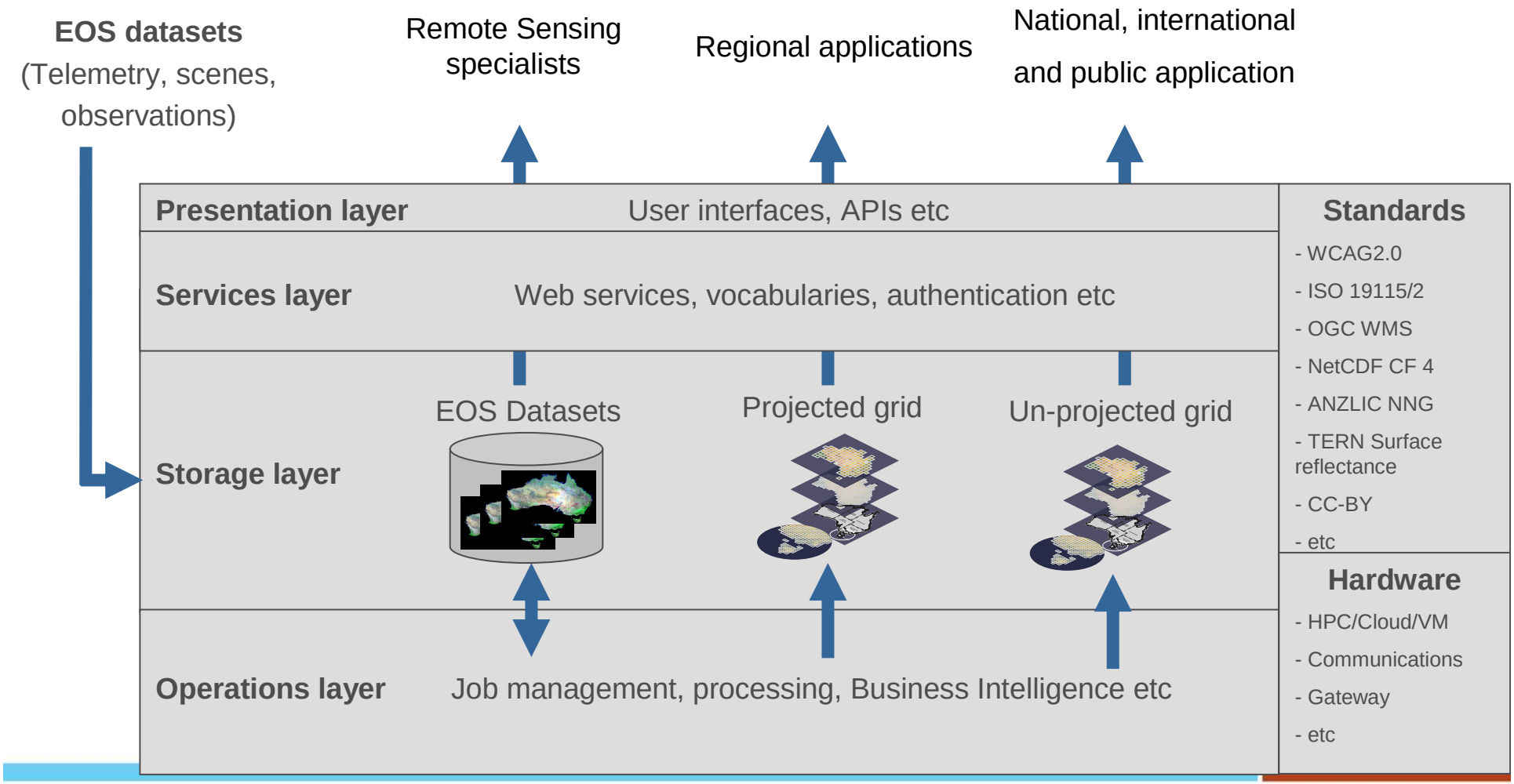
Applications coupled to life of satellite

- Inter-sensor comparison difficult
- Mission specific applications

The vision for Earth Observations



Delivery, storage and analysis layer



Delivery, storage and analysis layer

EOS datasets
(Telemetry, scenes, observations)

Remote Sensing specialists

Regional applications

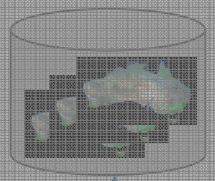
National, international and public application

Focus of the Unlocking the Landsat Archive Project

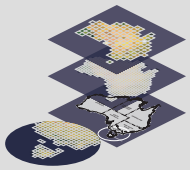
Service

Storage layer

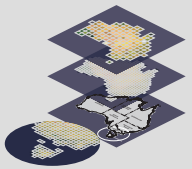
EOS Datasets



Projected grid



Un-projected grid



Operations layer

Job management, processing, Business Intelligence etc

Standards

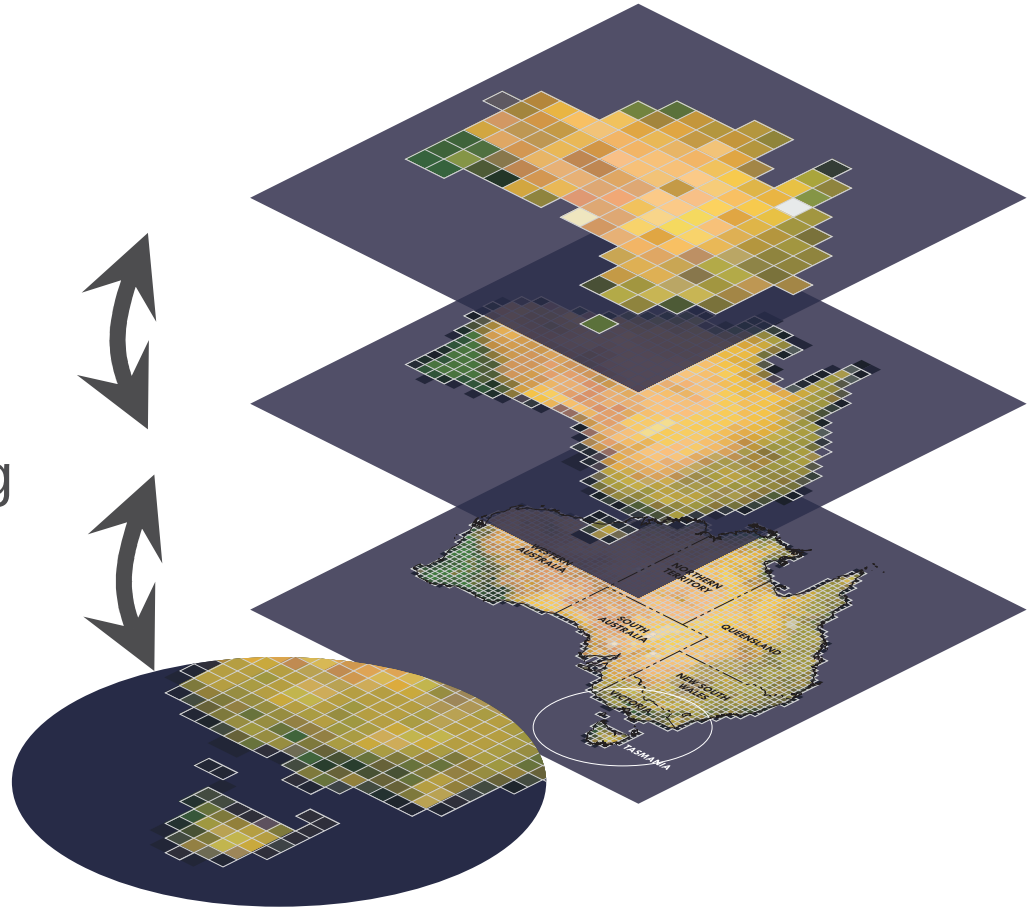
- WCAG2.0
- ISO 19115/2
- OGC WMS
- NetCDF CF 4
- ANZLIC NNG
- TERN Surface reflectance
- CC-BY
- etc

Hardware

- HPC/Cloud/VM
- Communications
- Gateway
- etc

National Computational Infrastructure

Australian Space Research Program (ASRP) “Unlocking the Landsat Archive” grant



Consortium members

Lockheed Martin Australia

Geoscience Australia

Victorian Partnership for Advanced Computing

National Computational Infrastructure – Australian National University

Cooperative Research Centre for Spatial Information

Project outline

$3.5M to EOFY 2012 (July 2013)

2000 to 2010 Landsat data – online

Main components:

1. Level 1 standard terrain correction – using USGS Landsat Product Generation System

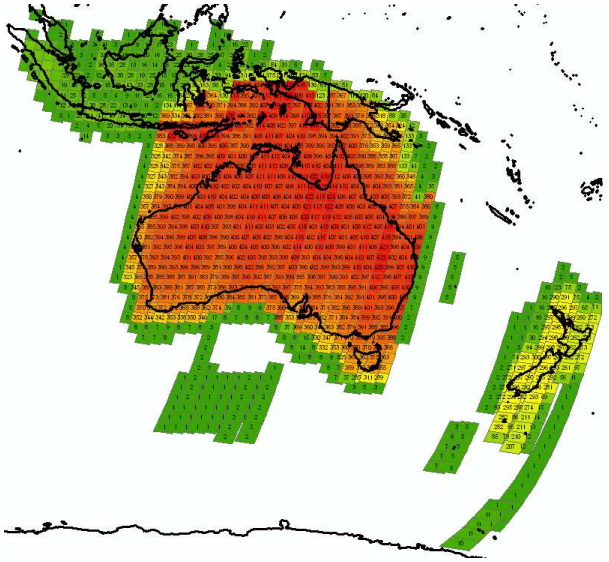
2. Physics-based surface reflectance correction (Nadir BRDF Adjusted Reflectance - NBAR)

3. Fractional cover (green, brown, bare)

4. Land cover

5. National Nested Grid

- a sensor agnostic system for time-series analysis
- eResearch infrastructure



Project responsibilities

Geoscience Australia are handling the data and science components of the workflow:

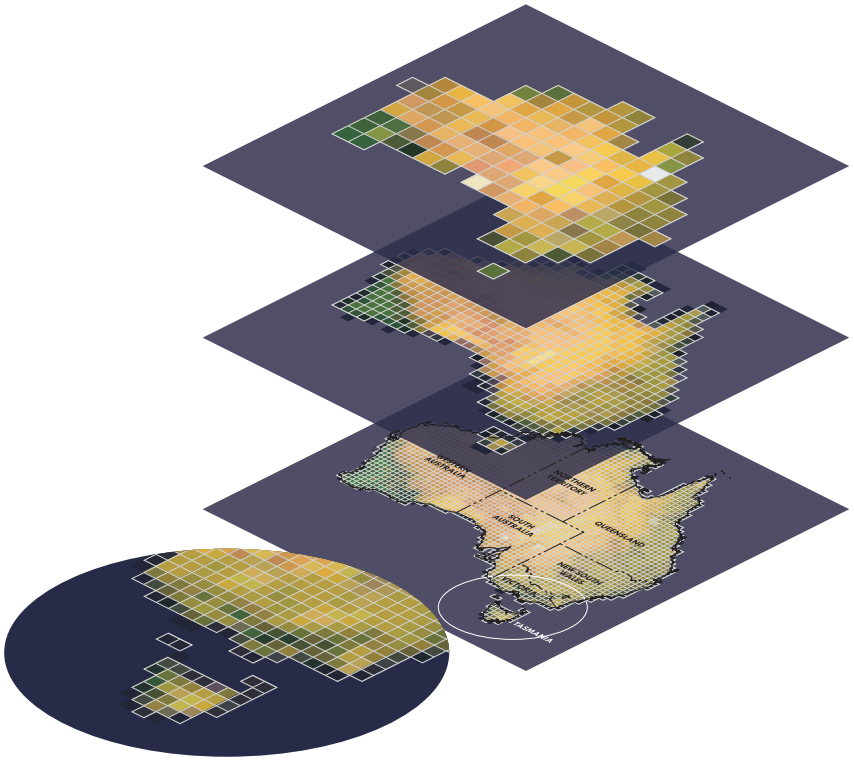
- Archive telemetry transfer to NCI;
- Formatting to provide input to Level 1 Production System
- L1T product specification and production implementation;
- NBAR - science&software development;
- Pixel Quality Assessment - science&software development;
- Per-scene Fractional Cover - science&software development;
- Temporal Land Cover - science&software development;

Project responsibilities

Geoscience Australia continued..,

Contribute to:

- Grid Specification
- Grid front end design
- Front end to scene based products



Project responsibilities

Lockheed Martin Australia handle overall project management and are responsible for:

- implementation of the workflow processing system at NCI;
- drawing together relevant stakeholders to establish a standard reference framework for the communication of gridded satellite data products;
- at project conclusion hand over a well documented account of the open platform system for the development of future satellite processing needs of partners;
- contribute to the strengthening of relevant international relationships;

Project responsibilities

Lockheed Martin Australia continued..,

- provide the capability which enables Australia to make major contributions to the international earth observation community, especially in the Oceania and South East Asian regions;
- Metadata – pixel level…

Project responsibilities

NCI will provide storage and processing capability.

CRCSI will contribute to the definition of the National Nested Grid (NNG) specification

VPAC will provide the main software development activity relating to the storage mechanisms of the project.

Project benefits

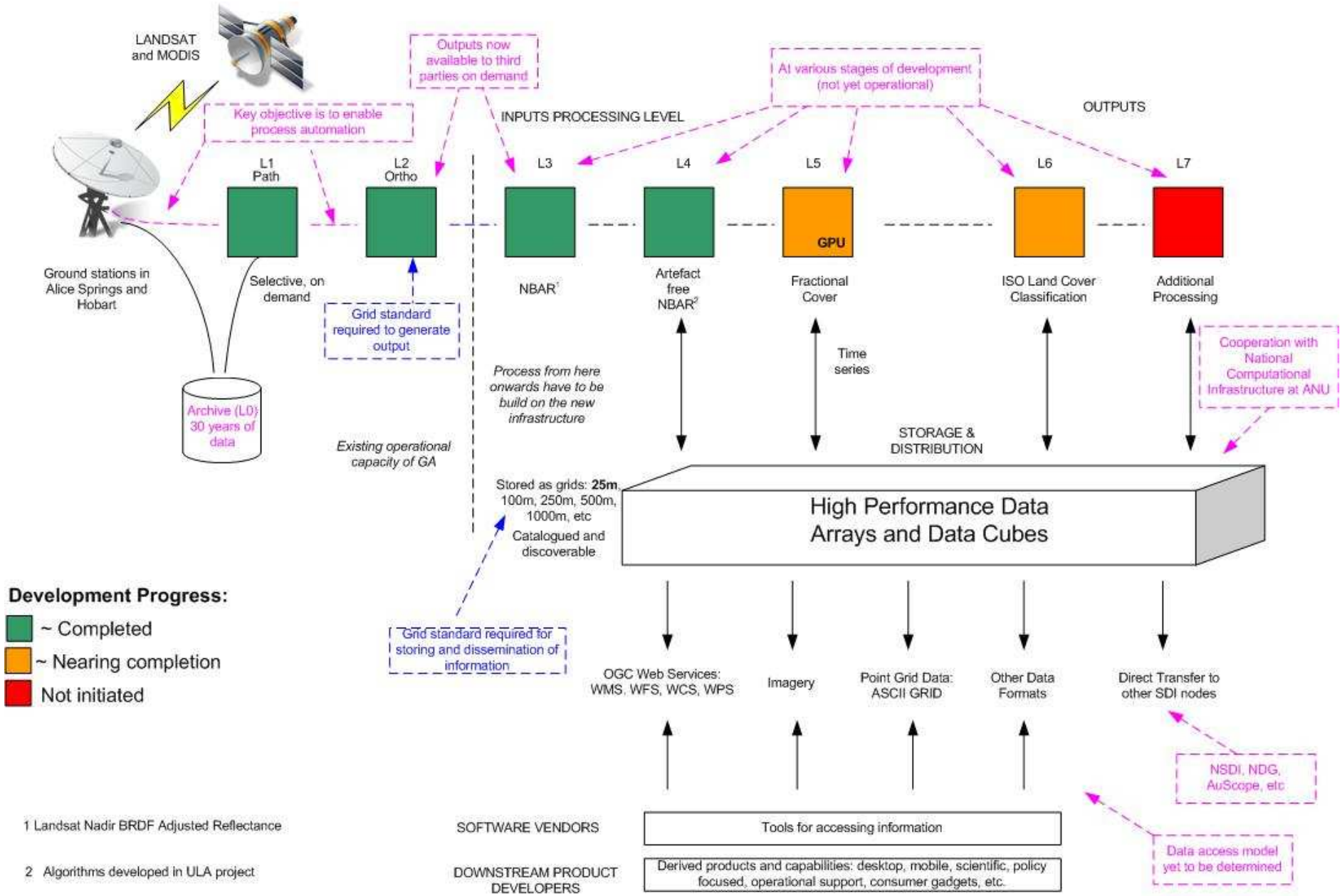
Streamlined mass production of archive backlog

Building processing capability and systems for contemporaneous processing of data received by Geoscience Australia

NBAR implemented as a standard GA Landsat product

Free access to image products:

- Scene-based, plus
- The ability to query imagery time-series in a coherent datacube to inform government policy and decision making



Project progress

- 90TB of telemetry/observation data transferred to NCI
- RCC formatting complete
- LPGS upgrade done based on specification and processing data (2011 and 2010 complete)
- NBAR modifications to enable ULA L1 processing complete and implemented – processing now in pre-production mode
- National Nested Grid consultation complete and recommended changes incorporated into draft. Final approval and publication by ANZLIC in November 2012
- Workflow Management System configured on NCI
- Raster Storage Archive (RSA) data model implemented
- RSA query interface implemented

GA Work Packages

Telemetry transfer to NCI ✓ **- complete**

RCC reformat ✓**- complete**

LPGS testing ✓**- complete**

L1T format specification✓ **- complete**

L1T processing – **in progress**

4.1 Pixel quality development ✓ **- complete**

4.2 NBAR specification **– beta processing**

4.3 Code Hardening – **in progress**

NBAR processing – **in progress**

5.1 Fractional cover science updated ✓ **- fine-tuning required**

5.2 Land cover classification science updated – **in progress**

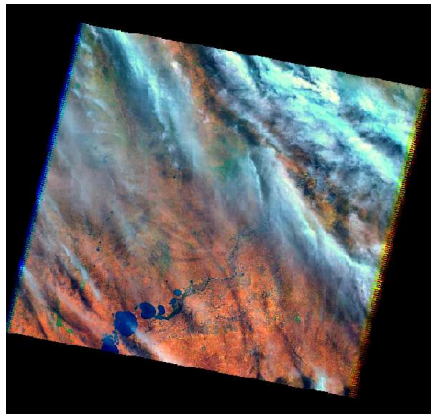
5.3 Code Hardening – Fractional Cover – **in progress**

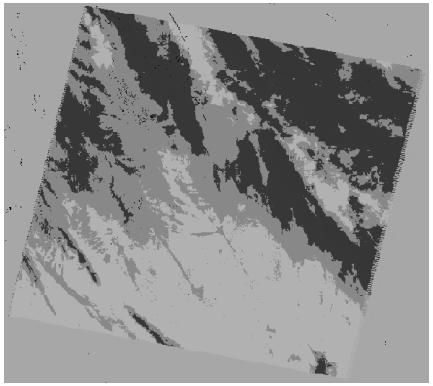
4.1 Pixel Quality

NBAR requires pixel level quality assurance to enable insertion to the NNG and for Fractional Cover processing

Composed of 16 tests with each bit of a 16 bit file representing the result of the pixel level test

- Pixel saturation
- Pixel contiguity
- ACCA cloud mask (Irish 2000)
- FMASK cloud mask (Zhu and Woodcock)
- Cloud shadow
- Land/sea mask
- Topographic shadow





4.2 NBAR Upgrade

Review of NBAR code

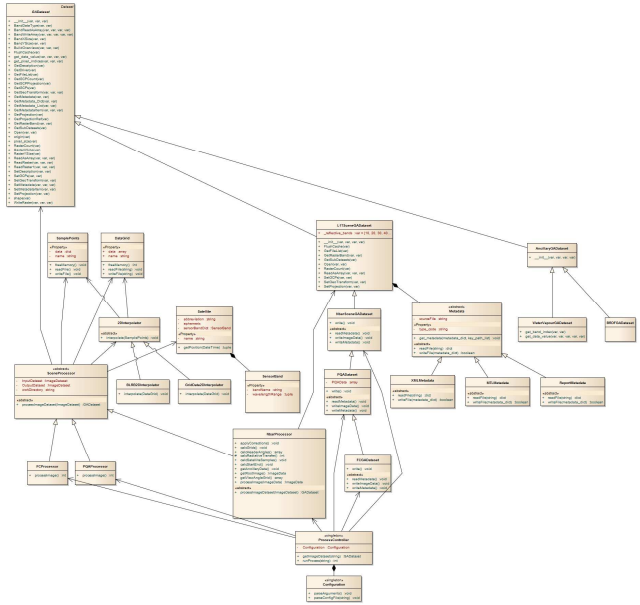
- Modularity, flexibility, maintenance, performance, modifications required to support formats, projections etc. and the cost benefit of this (output = documented and agreed WP)

Commenced testing of Taverna Workflow tool with LMA

NBAR operating in pre-production mode

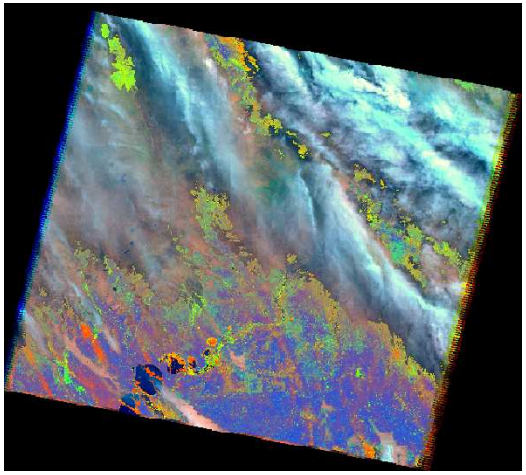
4.3 NBAR Code Hardening

- Production re-architecting of NBAR code
- Simplify new sensor integration
- Implementation of generic data access method
  - Simplifying science code production deployment
- Due for completion October 2012



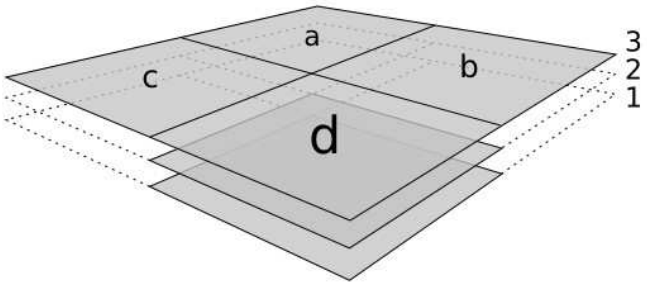
5.1 Fractional Cover Development

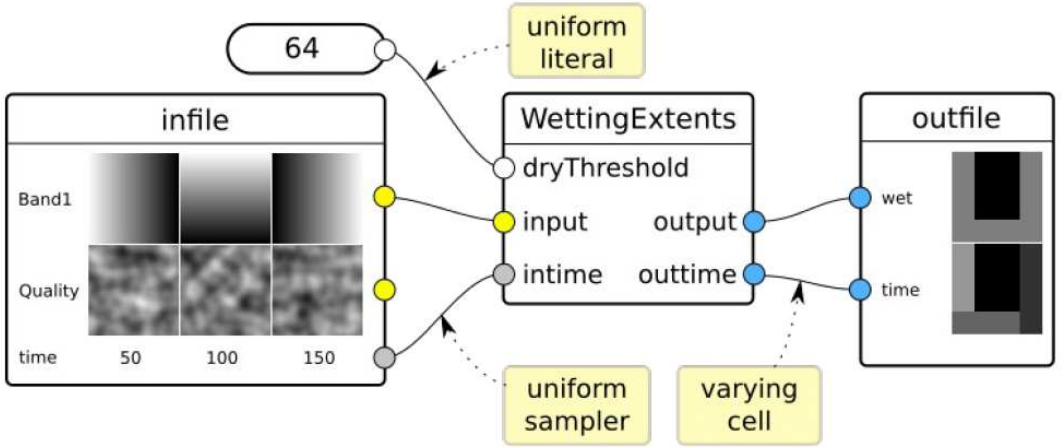
- GA's Fractional Cover code now operating on ULA NBAR outputs.
- GPU move to core processing cluster required for routine production
- Refinement of end member spectra required to tune outputs through access to a database of end-member spectra



5.2 Land Cover Classification

- Raster Storage Archive (RSA) query to prove the utility of this method for deriving Land Cover classes
- VPAC RSA Query interface currently being tested on real data





Example RSA queries

WATER (Query returns 0 or 1) - For a period between date A and date B, display pixels with a value of NBAR Landsat band 5 value of less than 1000 (reflectance scaled by 10000) - true = 1 false = 0. The pixel level metadata for positive results should provide capture date information.

ACTIVE FIRE (Query returns temperature, metadata enables identification of date of fire per pixel) – For a period between date A and date B, display the greatest pixel temperature for Top of Atmosphere temperature with a value > 360K. The pixel level metadata for the result should provide capture date information.

THE MOST RECENT CLOUD FREE PIXELS BEFORE A GIVEN DATE (Query returns an RGB colour image for a selection of bands) – Display the latest quality assured pixels.

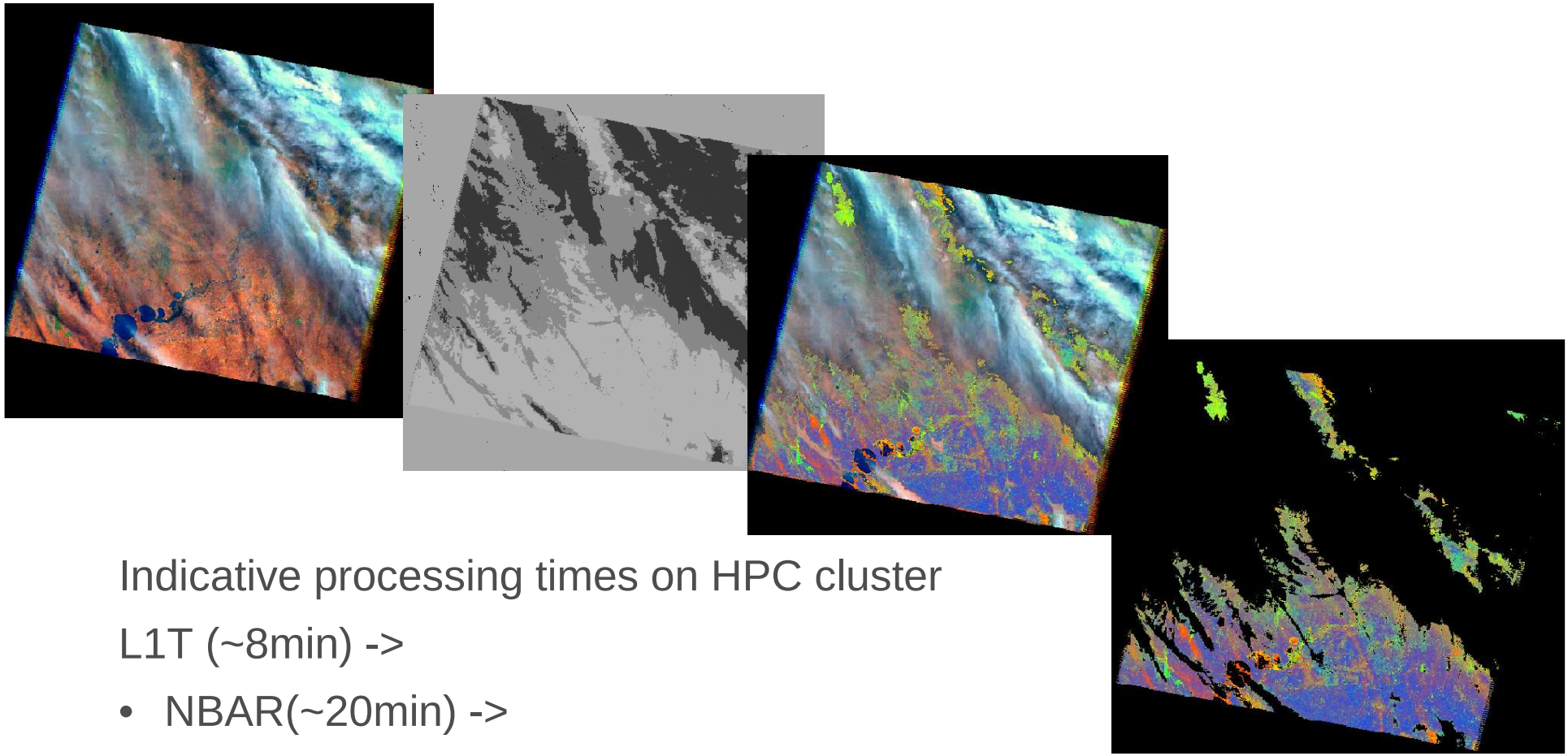
ANALYSIS OF PIXEL VALUES: for a period between data A and date B for pixels, which pixels meet some statistical measure (i.e. max, mean, min, stdv, mode etc.)

TIMESERIES PLOT FOR A GIVEN INDEX – graphical plot of NDVI over a time period

The following would be considered a complex query

WITHIN A WINDOW OF PIXELS, VARIANCE IS MINIMISED (Query returns an RGB colour image for a selection of bands) – for a 3x3 kernel which iterates through the combination of pixels for that kernel in the stack within the time period - output pixels for a date range which minimise the variance within the search window for a given band i.e. reduce noise.

ULA Production Pipeline



Indicative processing times on HPC cluster

L1T (~8min) ->

- NBAR(~20min) ->
- PQ(~7-8min) ->
- FC(~7-8min)

Unlocking the Landsat Archive - Next steps

- Enable NBAR for pre 2000 imagery - MODIS dependency
- Bring the ULA data home – Earth Observation Data Store
- Bring the ULA software and processes home
- Implement in the Processing Management Application (PMA)
- Stand up contemporaneous processing using ULA derived methods and standards

Processing Management Application (PMA)

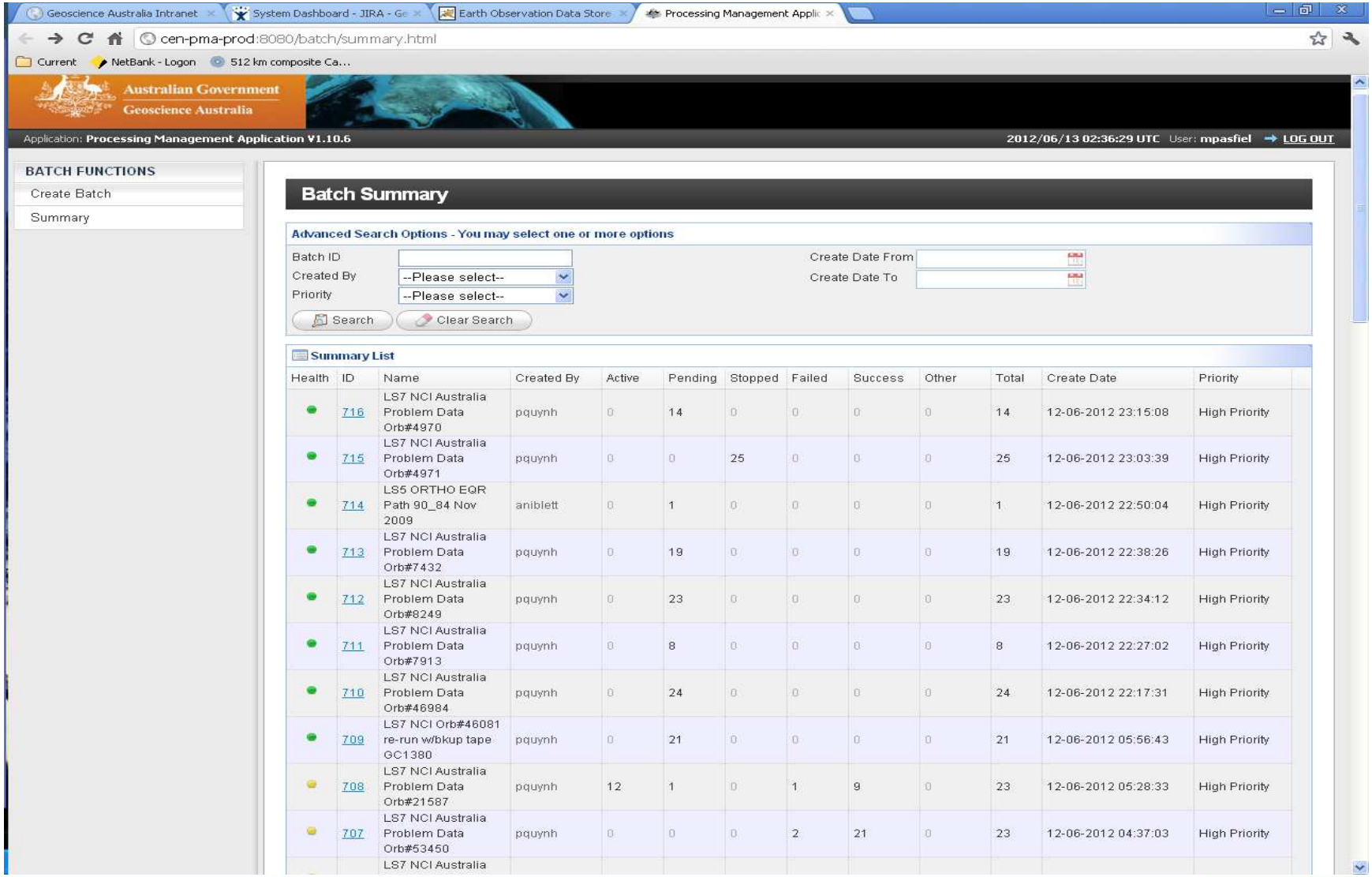
Processing Management Application

A tool used by GA staff to orchestrate and stage production of image products

Enables:

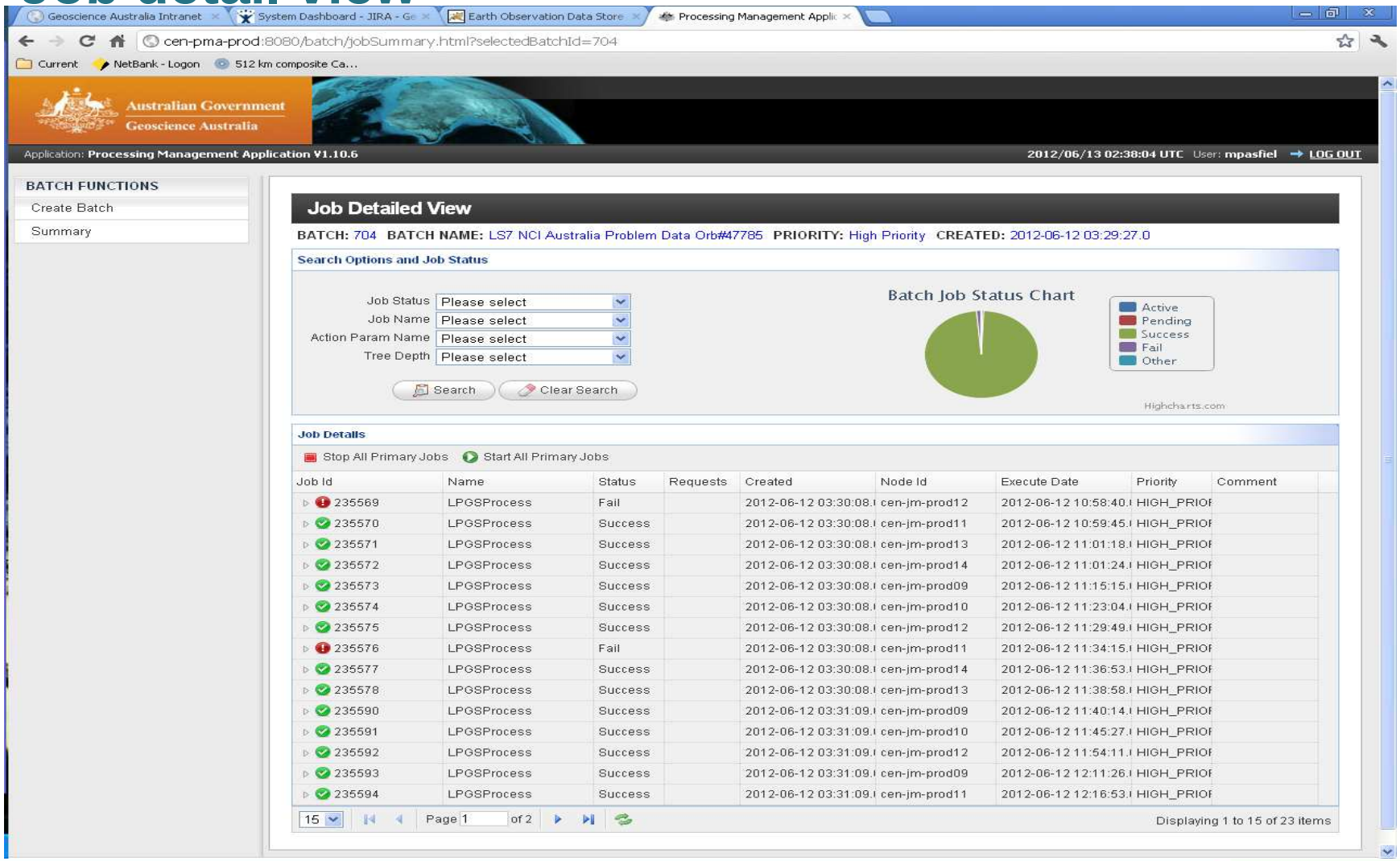
- Bulk processing and mass throughput
- Virtualised scalable production
- Contemporaneous processing
- Job progress monitoring
- Production chain oriented rather than single product – dependencies included
- Feeds data to the Earth Observation Data Store for storage and user access

Processing Management Application (PMA)

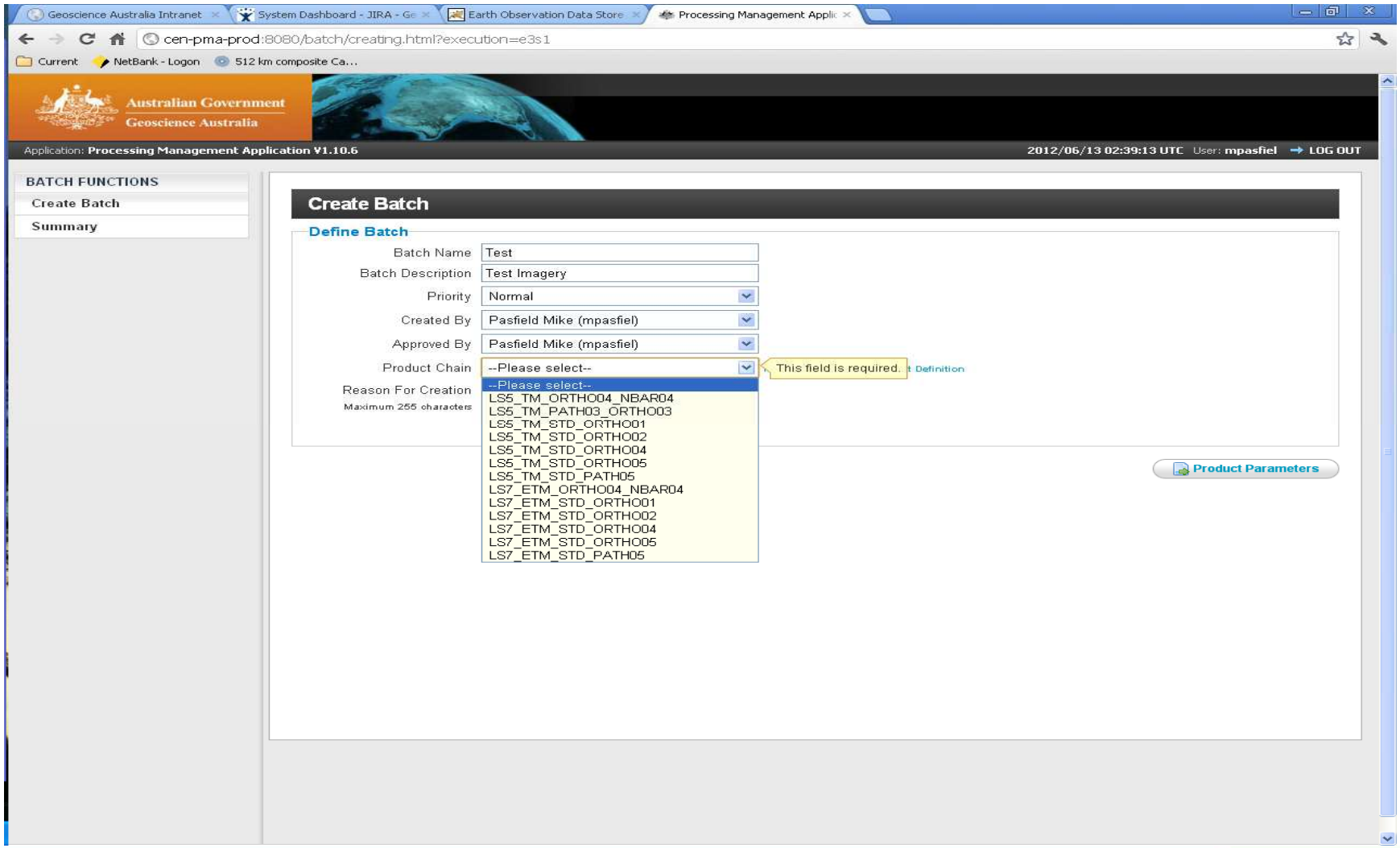


Health	ID	Name	Created By	Active	Pending	Stopped	Failed	Success	Other	Total	Create Date	Priority
	716	LS7 NCI Australia Problem Data Orb#4970	pquynh	0	14	0	0	0	0	14	12-06-2012 23:15:08	High Priority
	715	LS7 NCI Australia Problem Data Orb#4971	pquynh	0	0	25	0	0	0	25	12-06-2012 23:03:39	High Priority
	714	LS5 ORTHO EQR Path 90_84 Nov 2009	aniblett	0	1	0	0	0	0	1	12-06-2012 22:50:04	High Priority
	713	LS7 NCI Australia Problem Data Orb#7432	pquynh	0	19	0	0	0	0	19	12-06-2012 22:38:26	High Priority
	712	LS7 NCI Australia Problem Data Orb#8249	pquynh	0	23	0	0	0	0	23	12-06-2012 22:34:12	High Priority
	711	LS7 NCI Australia Problem Data Orb#7913	pquynh	0	8	0	0	0	0	8	12-06-2012 22:27:02	High Priority
	710	LS7 NCI Australia Problem Data Orb#46984	pquynh	0	24	0	0	0	0	24	12-06-2012 22:17:31	High Priority
	709	LS7 NCI Orb#46081 re-run w/bkup tape GC1380	pquynh	0	21	0	0	0	0	21	12-06-2012 05:56:43	High Priority
	708	LS7 NCI Australia Problem Data Orb#21587	pquynh	12	1	0	1	9	0	23	12-06-2012 05:28:33	High Priority
	707	LS7 NCI Australia Problem Data Orb#53450	pquynh	0	0	0	2	21	0	23	12-06-2012 04:37:03	High Priority
		LS7 NCI Australia										

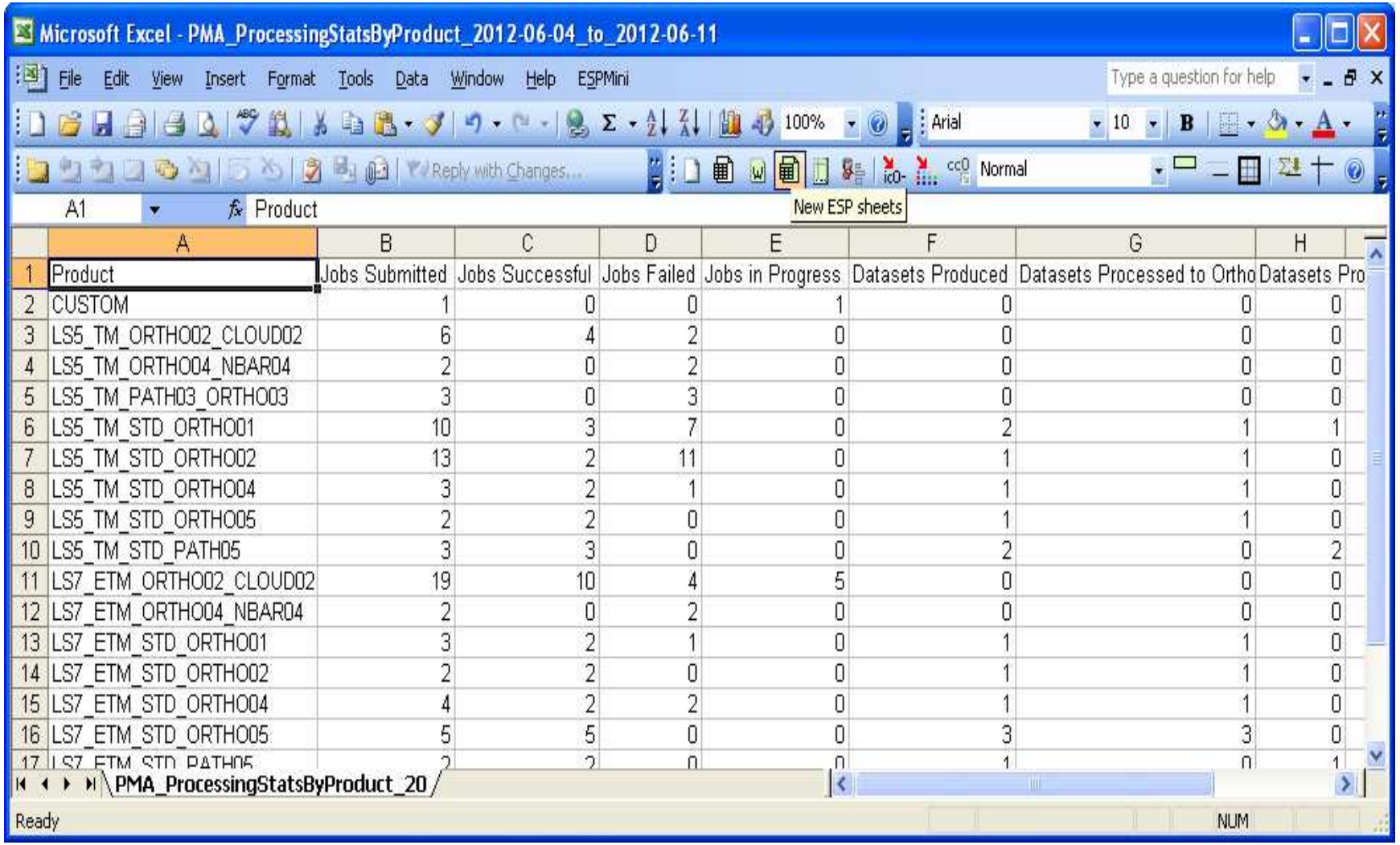
Processing Management Application (PMA)
Job detail view



Processing Management Application (PMA) Chains

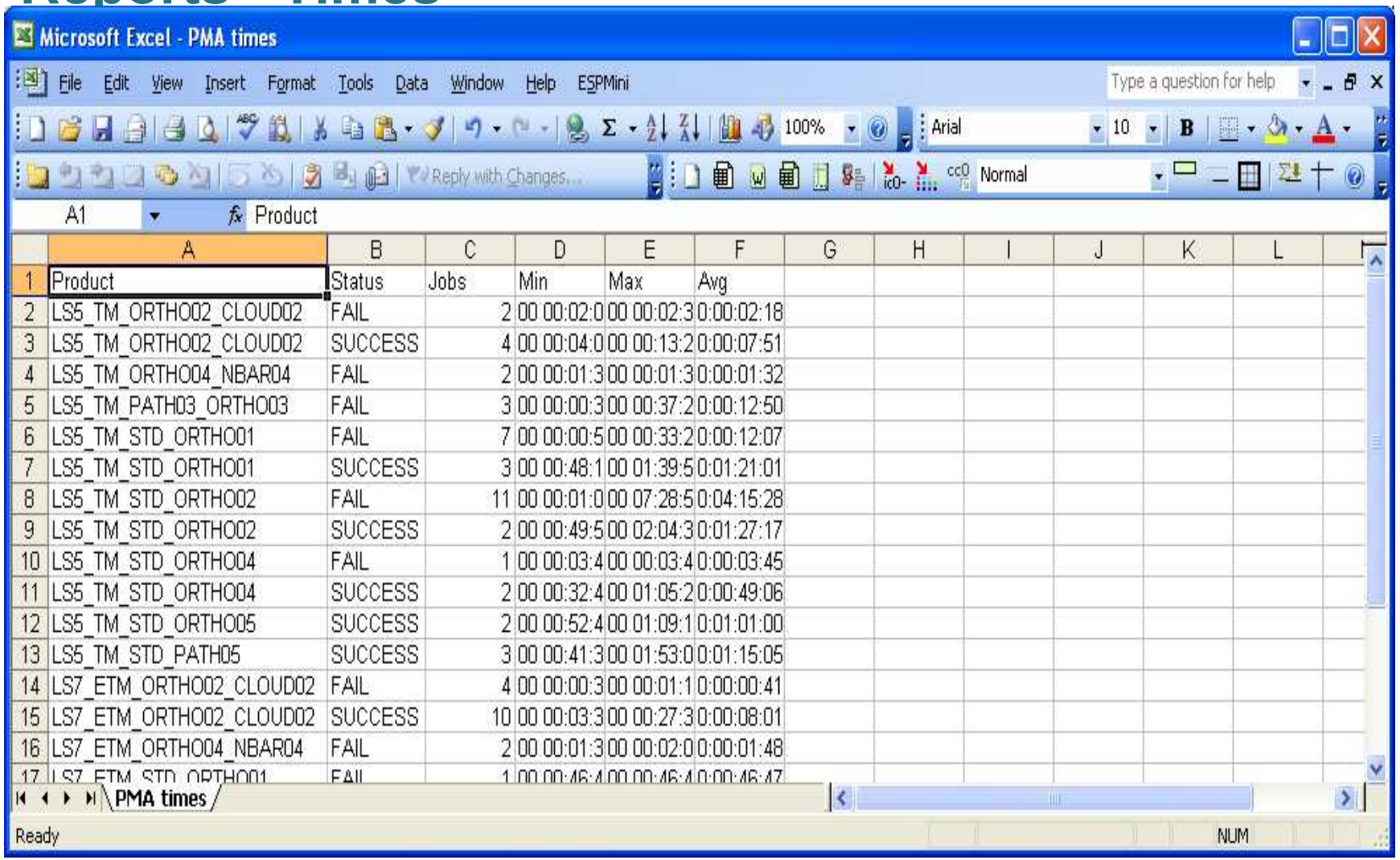


Processing Management Application (PMA) Reports – Processing Stats



	A	B	C	D	E	F	G	H
1	Product	Jobs Submitted	Jobs Successful	Jobs Failed	Jobs in Progress	Datasets Produced	Datasets Processed to Ortho	Datasets Pro
2	CUSTOM	1	0	0	1	0	0	0
3	LS5_TM_ORTHO02_CLOUD02	6	4	2	0	0	0	0
4	LS5_TM_ORTHO04_NBAR04	2	0	2	0	0	0	0
5	LS5_TM_PATH03_ORTHO03	3	0	3	0	0	0	0
6	LS5_TM_STD_ORTHO01	10	3	7	0	2	1	1
7	LS5_TM_STD_ORTHO02	13	2	11	0	1	1	0
8	LS5_TM_STD_ORTHO04	3	2	1	0	1	1	0
9	LS5_TM_STD_ORTHO05	2	2	0	0	1	1	0
10	LS5_TM_STD_PATH05	3	3	0	0	2	0	2
11	LS7_ETM_ORTHO02_CLOUD02	19	10	4	5	0	0	0
12	LS7_ETM_ORTHO04_NBAR04	2	0	2	0	0	0	0
13	LS7_ETM_STD_ORTHO01	3	2	1	0	1	1	0
14	LS7_ETM_STD_ORTHO02	2	2	0	0	1	1	0
15	LS7_ETM_STD_ORTHO04	4	2	2	0	1	1	0
16	LS7_ETM_STD_ORTHO05	5	5	0	0	3	3	0
17	LS7_ETM_STD_PATH05	2	2	0	0	1	0	1

Processing Management Application (PMA) Reports - Times



	A	B	C	D	E	F
1	Product	Status	Jobs	Min	Max	Avg
2	LS5_TM_ORTHO02_CLOUD02	FAIL	2	00 00:02:0	00 00:02:3	0:00:02:18
3	LS5_TM_ORTHO02_CLOUD02	SUCCESS	4	00 00:04:0	00 00:13:2	0:00:07:51
4	LS5_TM_ORTHO04_NBAR04	FAIL	2	00 00:01:3	00 00:01:3	0:00:01:32
5	LS5_TM_PATH03_ORTHO03	FAIL	3	00 00:00:3	00 00:37:2	0:00:12:50
6	LS5_TM_STD_ORTHO01	FAIL	7	00 00:00:5	00 00:33:2	0:00:12:07
7	LS5_TM_STD_ORTHO01	SUCCESS	3	00 00:48:1	00 01:39:5	0:01:21:01
8	LS5_TM_STD_ORTHO02	FAIL	11	00 00:01:0	00 07:28:5	0:04:15:28
9	LS5_TM_STD_ORTHO02	SUCCESS	2	00 00:49:5	00 02:04:3	0:01:27:17
10	LS5_TM_STD_ORTHO04	FAIL	1	00 00:03:4	00 00:03:4	0:00:03:45
11	LS5_TM_STD_ORTHO04	SUCCESS	2	00 00:32:4	00 01:05:2	0:00:49:06
12	LS5_TM_STD_ORTHO05	SUCCESS	2	00 00:52:4	00 01:09:1	0:01:01:00
13	LS5_TM_STD_PATH05	SUCCESS	3	00 00:41:3	00 01:53:0	0:01:15:05
14	LS7_ETM_ORTHO02_CLOUD02	FAIL	4	00 00:00:3	00 00:01:1	0:00:00:41
15	LS7_ETM_ORTHO02_CLOUD02	SUCCESS	10	00 00:03:3	00 00:27:3	0:00:08:01
16	LS7_ETM_ORTHO04_NBAR04	FAIL	2	00 00:01:3	00 00:02:0	0:00:01:48
17	LS7_ETM_STD_ORTHO01	FAIL	1	00 00:46:4	00 00:46:4	0:00:46:47

Processing Management Application

- Funded through International Forest Carbon Initiative – Department of Climate Change and Energy Efficiency
- Required to enable controlled bulk processing
- Currently supporting:
  - Landsat Product Generation System
  - NBAR Equirectangular
- Future
  - MODIS
  - RADAR through NEST (Next ESA SAR Toolbox)

Australian Government
Geoscience Australia

Afternoon Tea

Australian Government
Geoscience Australia

National Earth Observations from Space Infrastructure Plan (NEOS-IP)

David Hudson

Australian Government
Geoscience Australia

Round table discussion

Australian Government
Geoscience Australia

Conclusion

Adam Lewis

National Earth Observation

Group Leader