



NASA Scientific Data Purchase

JACIE High Spatial Resolution Commercial Imagery Workshop

March 25 – 27, 2002

Reston, Virginia

Bruce Davis, Ph.D.

Acting Lead, Applications Engineering Division

**Earth Science Applications Directorate
National Aeronautics and Space Administration
John C. Stennis Space Center, Mississippi**



SDP Background

Stennis Space Center

- **\$50 Million Appropriation**
 - Acquire science data from commercial sources
- **Demonstration Project**
 - Test new way of doing business
 - Tap new sources of data
 - Support Earth science research
 - Support commercial remote sensing industry
- **Phase I** – Review simulated/prototypical datasets (10 companies)
- **Phase II** – 3-year purchase/distribution of select data (5 companies)
- **FY01 \$20M Appropriation** - Commercial Imagery Office Proposed continuation and new contracts



Earth Satellite Corporation

Stennis Space Center

6011 Executive Blvd, Rockville, MD 20852

GeoCoverTM Products Orthorectified Landsat Imagery

Coverage:

Global Land Areas

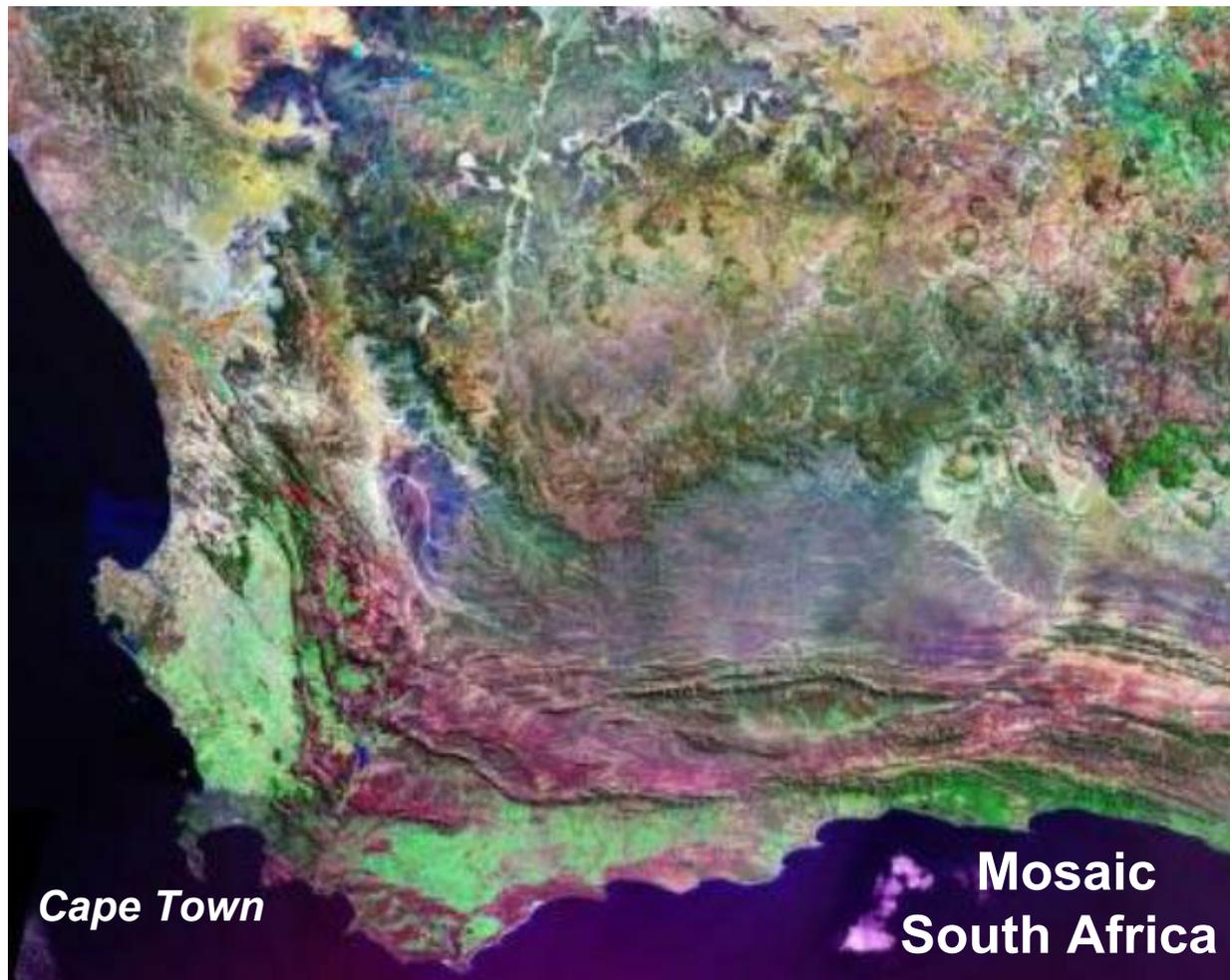
Data Rights:

Unrestricted

Data Description:

- MSS Scenes ~ 1970
Horiz. Accuracy $\pm 100\text{m}$
- TM Scenes ~ 1990
Horiz. Accuracy $\pm 50\text{m}$
- TM Mosaics ~ 1990
bands 7,4,2 ($5^\circ \times 6^\circ$)
 - Uncompressed GeoTIFF
 - Compressed MrSID

Data is being transferred to
EROS Data Center for
Long-Term Archive
and Distribution.



March 25, 2002



EarthWatch/Digital Globe

Stennis Space Center

1900 Pike Road, Longmont, CO 80501-6700

Intermap Technologies Inc. **Global Terrain STAR-3i Airborne Interferometric SAR System**

Data Description:

ORI - Orthorectified Radar Mosaics

7.5' Quad, 8-bit (2.5m resolution, UTM \pm 2.5m)

DEM - Digital Elevation Models

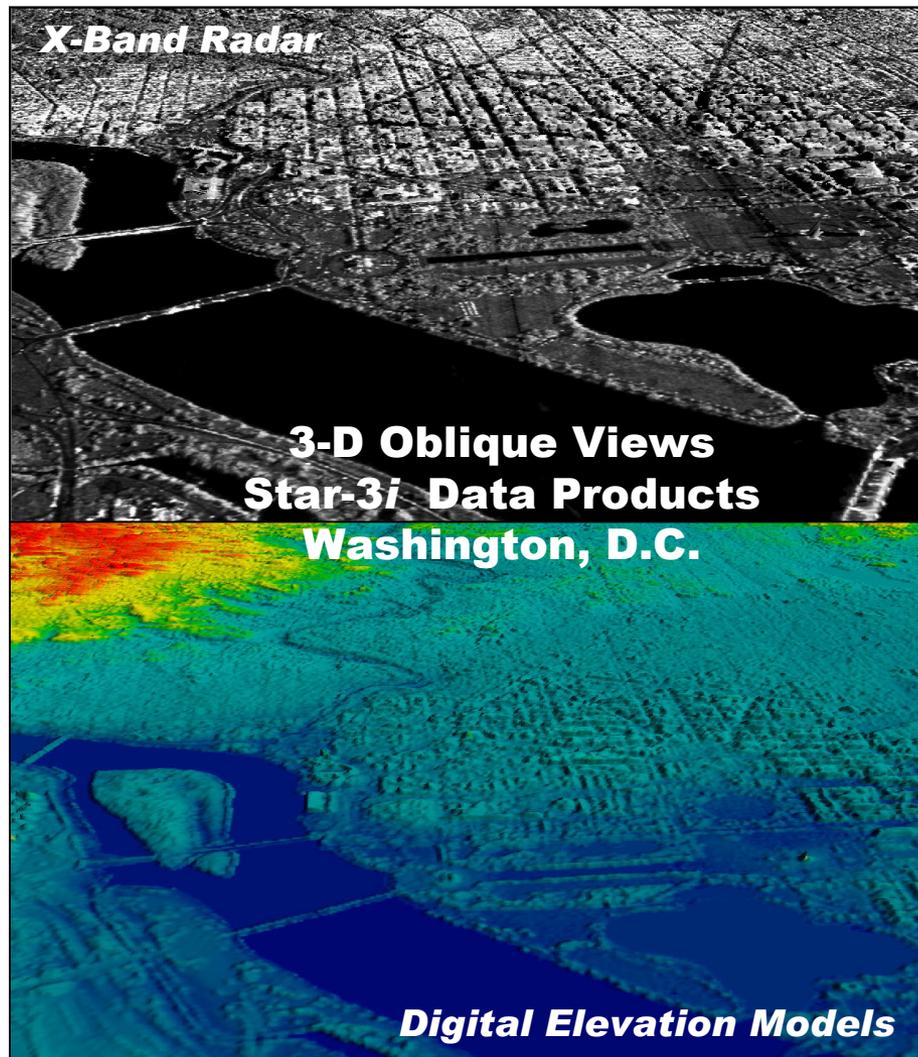
7.5' Quad, 32-bit

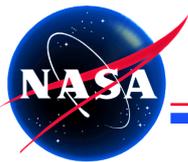
- GT 3 (10m posting, UTM \pm 2.5m, Vertical \pm 3m)
- GT 2 (10m posting, UTM \pm 2.5m, Vertical \pm 2m)
- GT 1 (5m posting, UTM \pm 2.5m, Vertical \pm 1m)

Data Rights:

**Distribution limited to NASA ESE
community for NASA-related work**

Coverage: As tasked





250 Second Street East, Whitefish, MT 59937

ADAR System 5500 Digital Aerial Imagery

- 1-meter Spatial Resolution
- 8-bit Radiometric Resolution
- Multispectral (VIS/NIR)

Data Description:

IM-R1i-55 Product, Frame Images

(Center Coordinate known to $\pm 100\text{m}$)

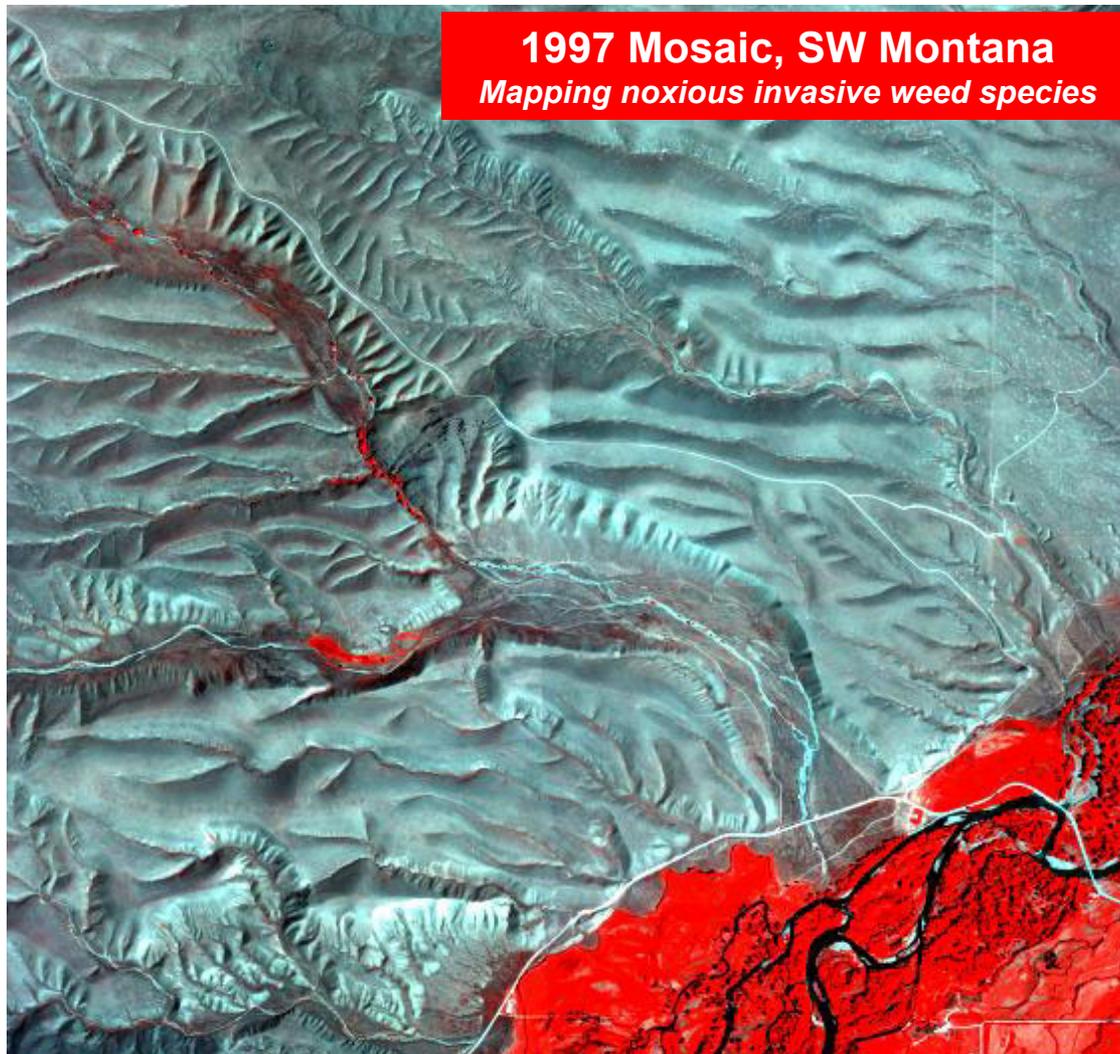
MOS-G1 Product, Mosaics

- Benign Terrain (UTM $\pm 12.2\text{m}$)
- Rugged Terrain (UTM $\pm 33\text{m}$)
- Extreme Terrain (UTM $\pm 50\text{m}$)
- Severe Terrain (no guarantee)

Data Rights:

Distribution limited to NASA
ESE community for NASA-
related work

Coverage: As tasked



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Space Imaging, LLC

Stennis Space Center

9351 Grant Street, Suite 500, Thornton, CO 80229

IKONOS-2 Satellite Imagery

- 1-meter panchromatic (Pan)
- 4-meter multispectral (MSI)
- 11-bit radiometric resolution

Data Description:

Original Product - Georectified

- Standard (UTM, $\pm 250\text{m}$)
- Precision (UTM, $\pm 3\text{m Pan}$, $\pm 5\text{m MSI}$)

Master Product - Orthorectified

- Standard (UTM, $\pm 12.2\text{m}$)
- Precision (UTM, $\pm 2\text{m Pan}$, $\pm 5\text{m MSI}$)

Model Product

- Digital Elevation Models (15m posting)
(UTM, $\pm 25.4\text{m}$, $\pm 7\text{m Vertical}$)
- Pan/MSI Stereo Pairs
(UTM, $\pm 25.4\text{m}$, $\pm 7\text{m Vertical}$)

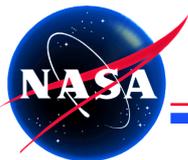
Data Rights:

- Distribution limited to NASA ESE
- Derived products may be distributed within NASA science and research community



Coverage: As Tasked

March 25, 2002



Astrovision, Inc.

Stennis Space Center

PMB 1010, 267 Kentlands Blvd, Gaithersburg, MD 20878

AVStar-1 Geostationary Satellite Imagery

- RGB Color
- Max frame rate at 15 frames per minute

Data Description:

Wide-Field Camera

- 7-kilometer spatial resolution

Narrow-Field Camera

- 600-meter spatial resolution
- Pointable camera
- Interactive event tracking

Coverage:

- Hemispherical disc centered on central U.S.
- 40 point and dwell opportunities
- 5 months of data (tornado season in Midwest/South U.S.)

Data Rights:

- Distribution limited to NASA ESE community

Data Not Available
Launch Scheduled for Q1 2003

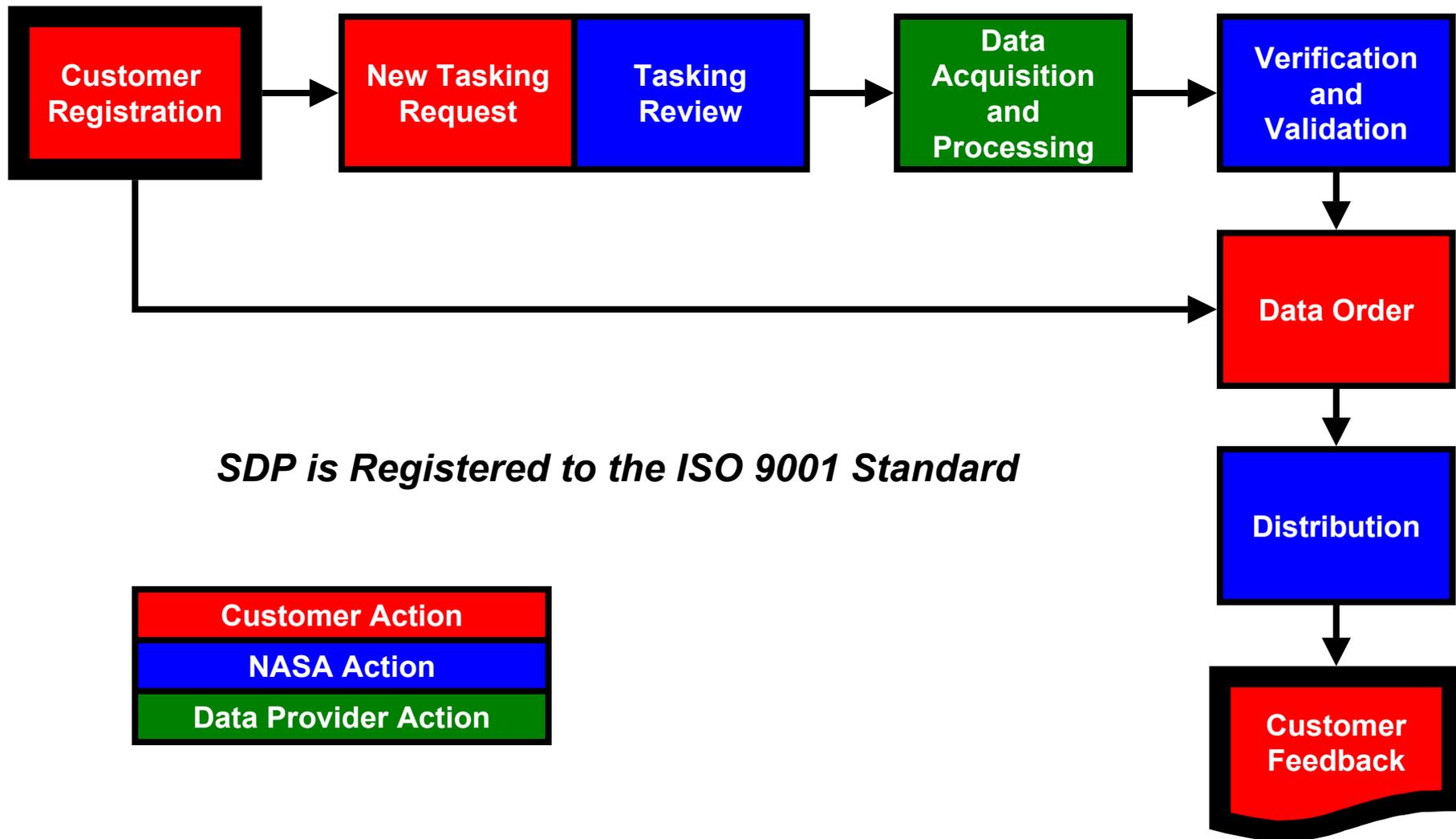


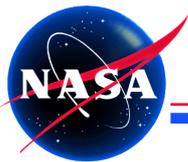
AVStar-1 Satellite Imagery of Hurricane Luis
(simulated using GOES-9 data)



SDP General Process

Stennis Space Center





SDP Customer Registration

Stennis Space Center

<http://www.esad.ssc.nasa.gov/datapurchase>

NASA's New Way of Doing Business



[View SDP Products \(.ppt\)](#)



[View Imagery of the World](#)



[EarthSat Data Transferred](#)



[Login and Register](#)

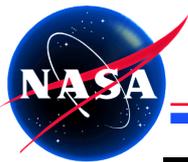


To Register Provide:

Project & Funding Source

Government Contact Person

Synopsis of Research



SDP Public Web Server

Stennis Space Center

View EarthSat TM Mosaics



EARTHSAT – Compressed TM MOSAICS

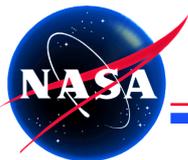
<http://www.esad.ssc.nasa.gov/datapurchase>

- On-Line Viewing
- Download MrSID Files

The screenshot shows the EarthSat TM Mosaics web interface. It features a grid of 15 thumbnail maps, each representing a different geographic region. A large, detailed mosaic of a circular crater is shown in the center, with a red box highlighting a specific area. A zoomed-in view of this area is shown in a larger window on the right. The interface includes a zoom control set to 3 percent and a size control set to 800 x 600 pixels.

The thumbnails are labeled as follows:

- NASA CD# 13 Africa - North West Global Education Series
- NASA CD# 11 Africa - South East Global Education Series
- NASA CD# 10 Africa - South West Global Education Series
- CD-2 Central United States GeoCover Education Series
- CD-8 Australia North GeoCover Education Series
- NASA CD# 14 Africa - West Central Global Education Series
- CD-3 Eastern United States GeoCover Education Series
- CD-6 Australia South East GeoCover Education Series
- CD # 5 Continental Alaska GeoCover Education Series
- NASA CD# 14 Africa - West Central Global Education Series
- CD-1 Western United States GeoCover Education Series
- CD-7 Australia South West GeoCover Education Series
- CD-9 Mexico & Central America GeoCover Education Series
- Islands of the Western Hemisphere GeoCover Education Series
- NASA CD# 12 Africa - Central Global Education Series
- NASA CD# 15 Africa - Eastern Global Education Series



SDP Tasking

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Customer Input: (mini proposal)

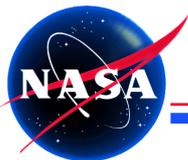
- Application/Science Topic/Research Objective/Use of Data
- Products/Coordinates/Acquisition Window/Special Requirements
- Citizenship/Agree to Data Rights/Customer Input is Reviewed
- Constraints on size, cost, timing, ground control, processing

Tasking and Measurements Committee:

- NASA ESE Program Managers
- Quarterly Review Cycle
- “Early Birds” reviewed as feasible

Basis of Score:

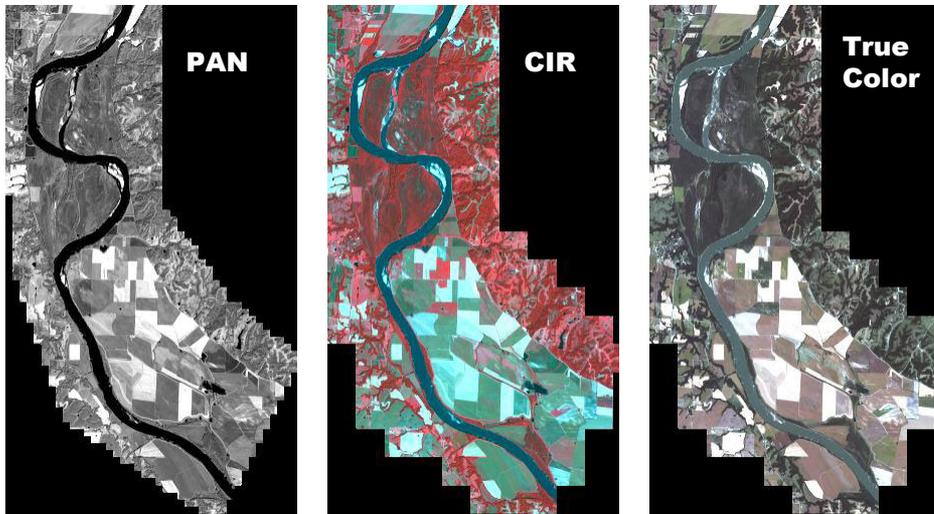
- Value and applicability to ESE program research
- Supports government agencies, industry, and multiple projects



SDP Shipment Verification

Stennis Space Center

Image Thumbnails



Task # 539 - Central Missouri

Automatic Checks

Bands, File Sizes, Metadata Fields

Verify Shipment Content

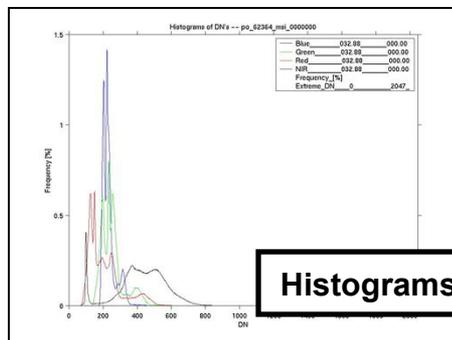
File Count and Deliverables

Visual Quality Inspection

Clouds, Artifacts, Specifications

Verify Task Requirements

Location/Coverage/Date/Product



Tape Library StorageTEK Aegis L700

ACCESS TIME: 7 seconds

CAPACITY: 678 DLT Tapes (24 TB)



Tape Library

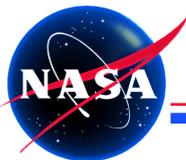
Data Receipt

Automatic Ingest Verification

Visual Inspection

Tasking Requirement

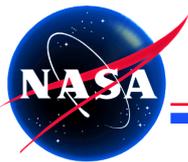
March 25, 2002



SDP IKONOS Validation

Stennis Space Center

Characterization				
Organization	Spatial	Geometric	Radiometric	Application
NASA Stennis	X	X	X	X
University of Arizona	X		X	
South Dakota State University	X	X	X	
USGS EDC		X		
NIMA	X	X	X	
University of Maryland				X
Science Community			X	X

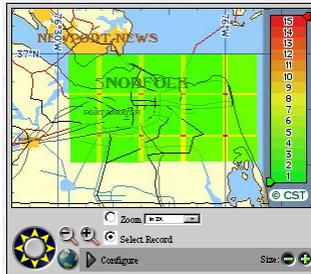


SDP Archive Query And Order

Stennis Space Center

TerraSoar Software

Customer Interface



Log In Prefs **Map** Databases Refine Results Cart ?

Did You Know...

Use the "Zoom" menu and select a point on the map to magnify and/or center a specific feature or landmark. The two icons to the left of this menu point. The Earth icon below this sets the view to its minimum magnification, usually the whole world. The ring of arrow icons on the left shift right make the map image larger or smaller, or the "Configure" twiddle can be opened for numeric size control and to select different map layers to.

Depending on your preference settings, either the boundaries of the current view will define the search area, or an "Input" menu may be present, to begin a search of the specified area.

Location: Map Coordinates Gazetteer

Zoom: 1x2x
Area - First Point
Configure Size: - +

c148a_03_227r.lm1r.jpg

```

numeric day : 164
zilenam : c148a_03_227z.lan.
zilepath : /buffalo
aschlv zilenam : buffalo.3.taz
aschlv zilepath : /h/databuy2/.aschl
original zilectra : 6355138

```

c148a_04_228r.lm1r.jpg

```

numeric day : 165
zilenam : c148a_04_228z.lan.
zilepath : /buffalo
aschlv zilenam : buffalo.3.taz
aschlv zilepath : /h/databuy2/.aschl
original zilectra : 6355138

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c148a_04_229r.lm1r.jpg

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aschlv zilenam : buffalo.3.taz
aschlv zilepath : /h/databuy2/.aschl
original zilectra : 6355138

```



SDP Distribution

Stennis Space Center



DATA REVIEW

- Shipment verification complete
- No discrepancies on this data
- Data validation performed with acceptable results

CUSTOMER REVIEW

- NASA affiliation is valid and current
- Customer is linked to the agreement
- Customer appropriately employed
- Requested data matches project objectives
- Objectives are research oriented, not for profit
- Customer is a U.S. citizen (or processed as export)
- Customer is not *Denied* and there are no *Red Flags*

DISTRIBUTION REVIEW

- Verify transmittal, attachments, and labeling

Distribution Documents:

- Mission Reports and Maps
- Calibration Reports
- Data Rights Agreement
- Data Specifications
- Customer Feedback Form

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SDP Results - Metrics

Stennis Space Center

Registered Users: 608

Data Volume Received: 8.2 TB

Tasks Approved: 563

Data Volume Expected: 10 TB

Tasks Completed: 480

Data Volume Distributed: 10.9 TB

Archive Orders: 553

Data Sets Distributed: 1,618

Archive Completed: 523

Geographic Coverage Received:

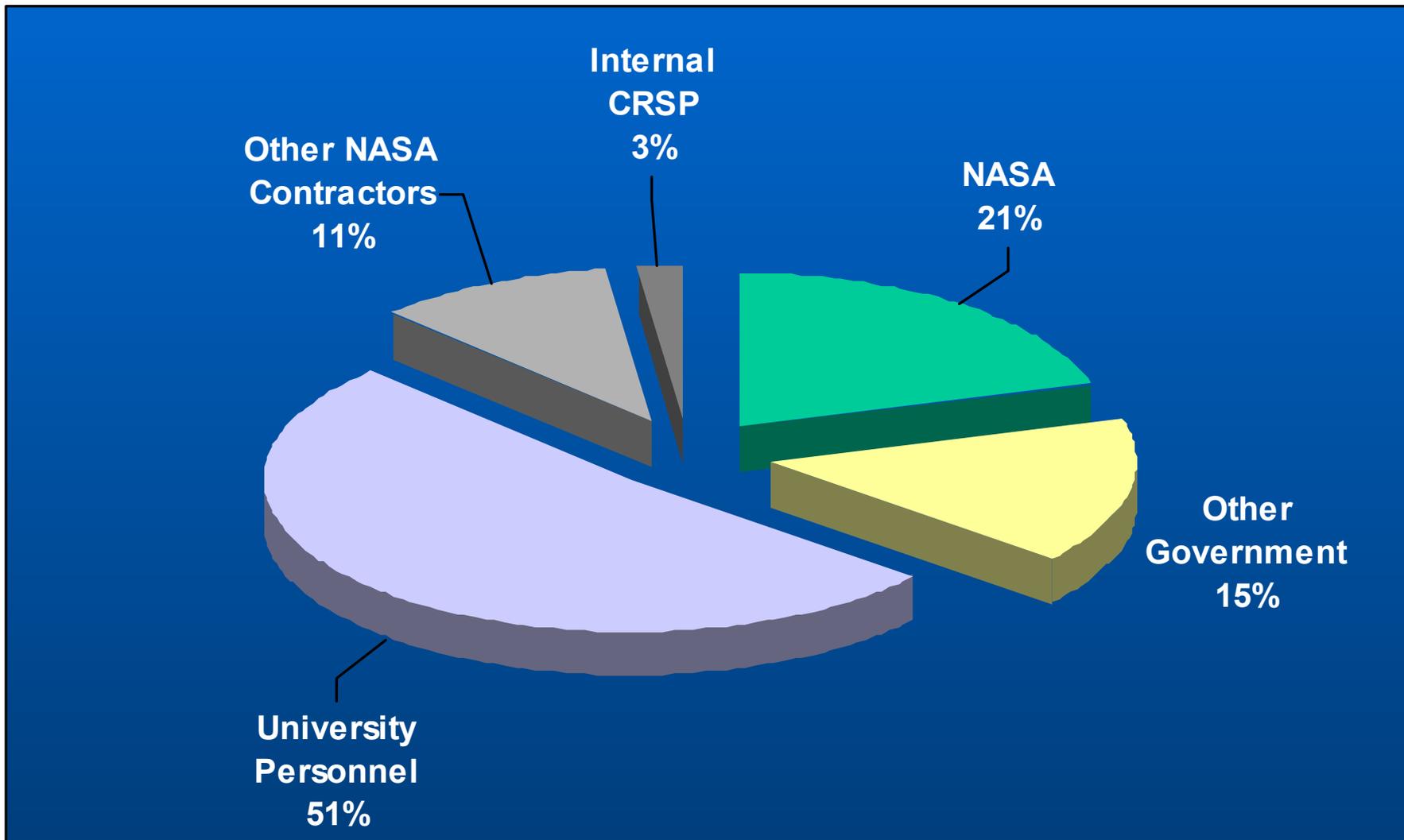
EarthSat TM	7,113 scenes
EarthSat MSS	4,474 scenes
EarthSat Mosaic	374 scenes
EarthWatch	183,962 km ²
Positive Systems Imagery	10,202 km ²
Positive Systems Mosaics	2,965 km ²
Space Imaging	125,641 km ²

<u>Public Web Downloads</u>	
EarthSat MrSID Mosaics	
# Mosaics	22,771
# Afghanistan	392
Volume (Terabytes)	1



SDP Users - Who Are They?

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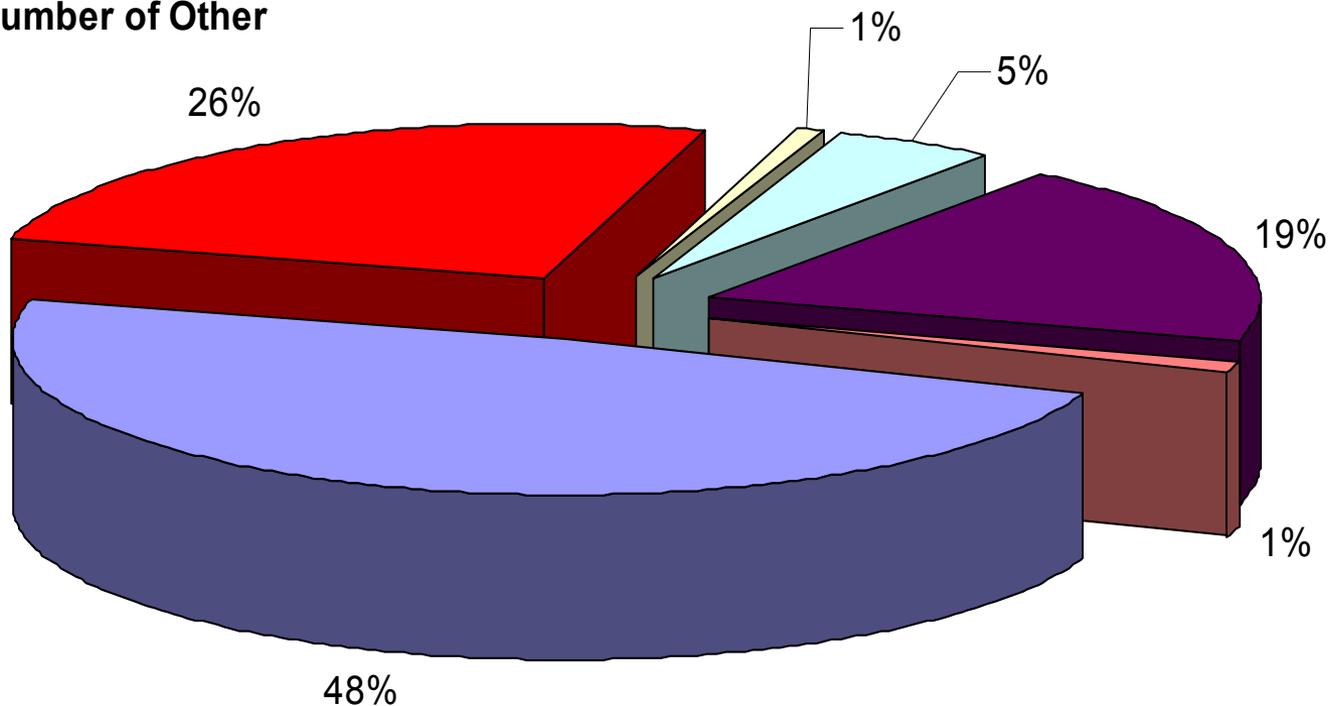


SDP Data Use - Tasking

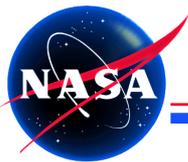
Stennis Space Center

- Total Number of Science Research Tasks
- Total Number of Applications Research Tasks
- Total Number of Commercial Product Tasks
- Total Number of Education Tasks
- Total Number of Verification & Validation Tasks
- Total Number of Other

Data Use
Total Number of Tasked Orders



March 25, 2002

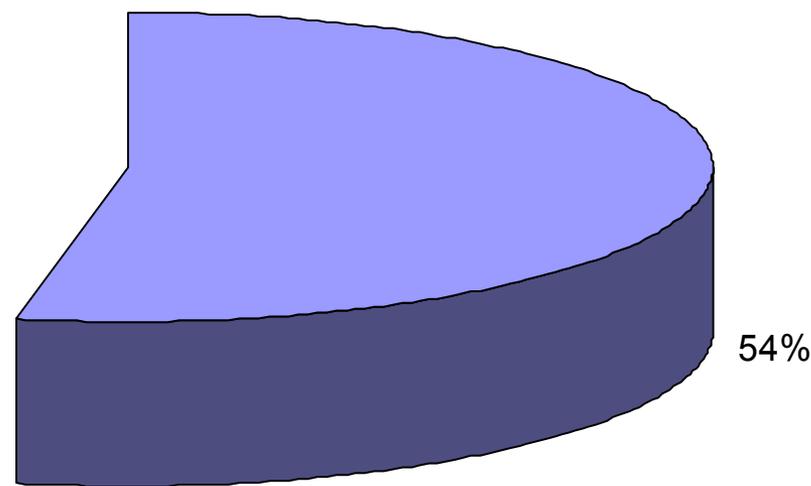
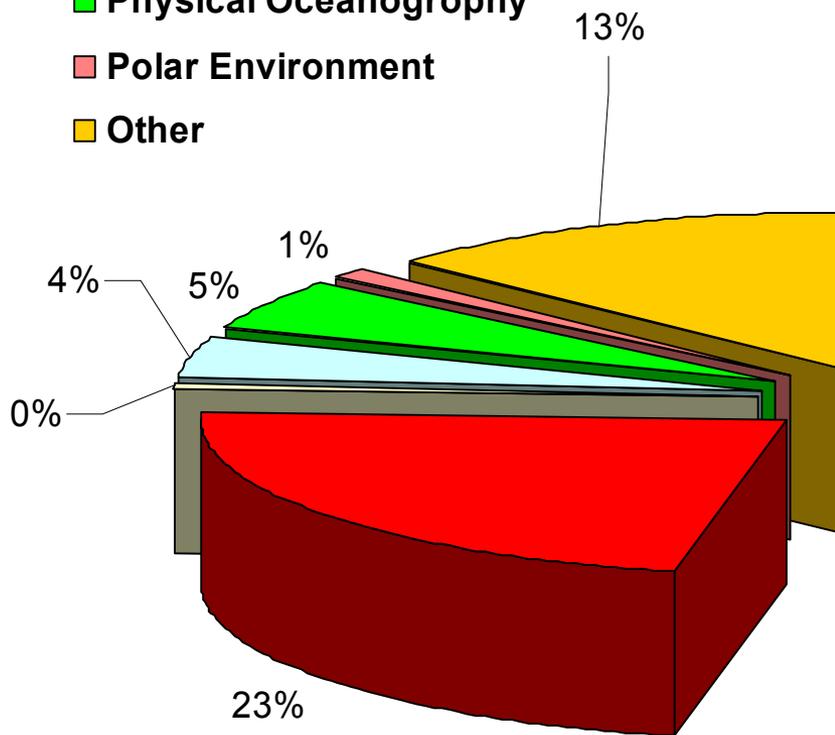


Science Research - Tasking

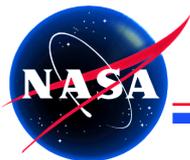
Stennis Space Center

- Land Cover - Land Use
- Terrestrial EcoSystems
- Solid Earth
- Land Surface Hydrology
- Physical Oceanography
- Polar Environment
- Other

Science Research Total Number of Tasked Orders



March 25, 2002

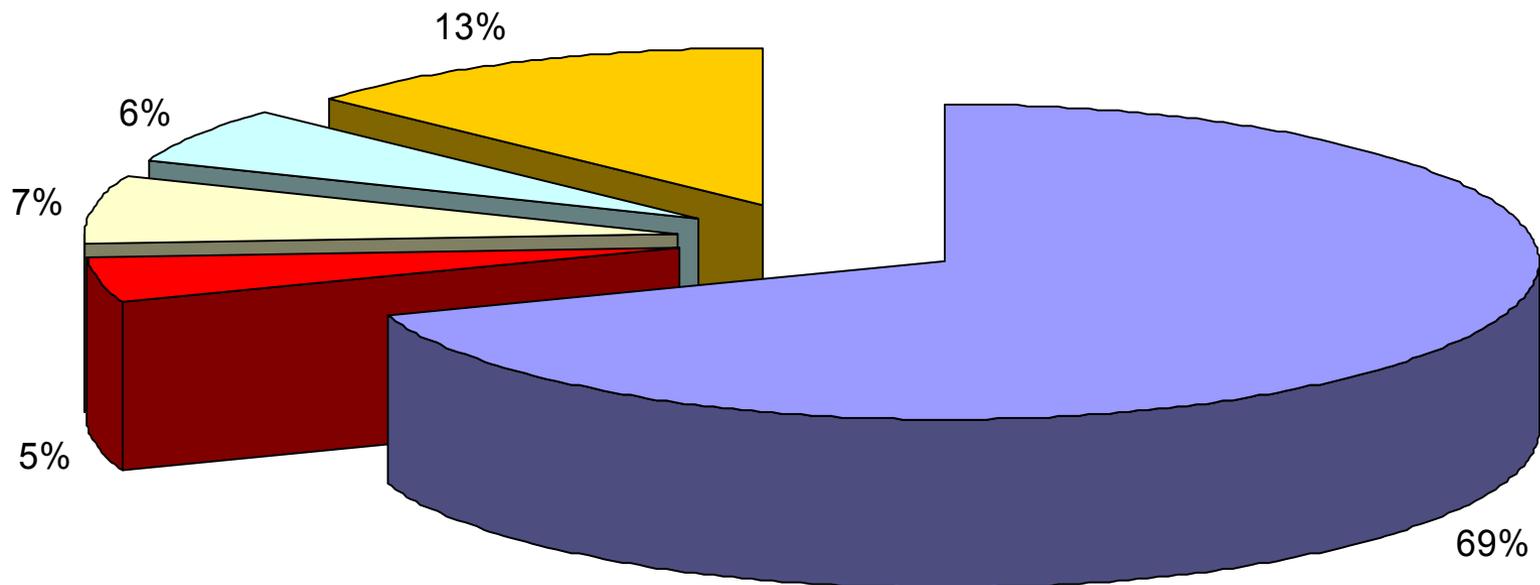


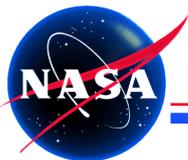
Applications Research - Tasking

Stennis Space Center

- Resource Management
- Community Growth
- Disaster Management
- Environmental Quality
- Other

Applications Research
Total Number of Tasked Orders



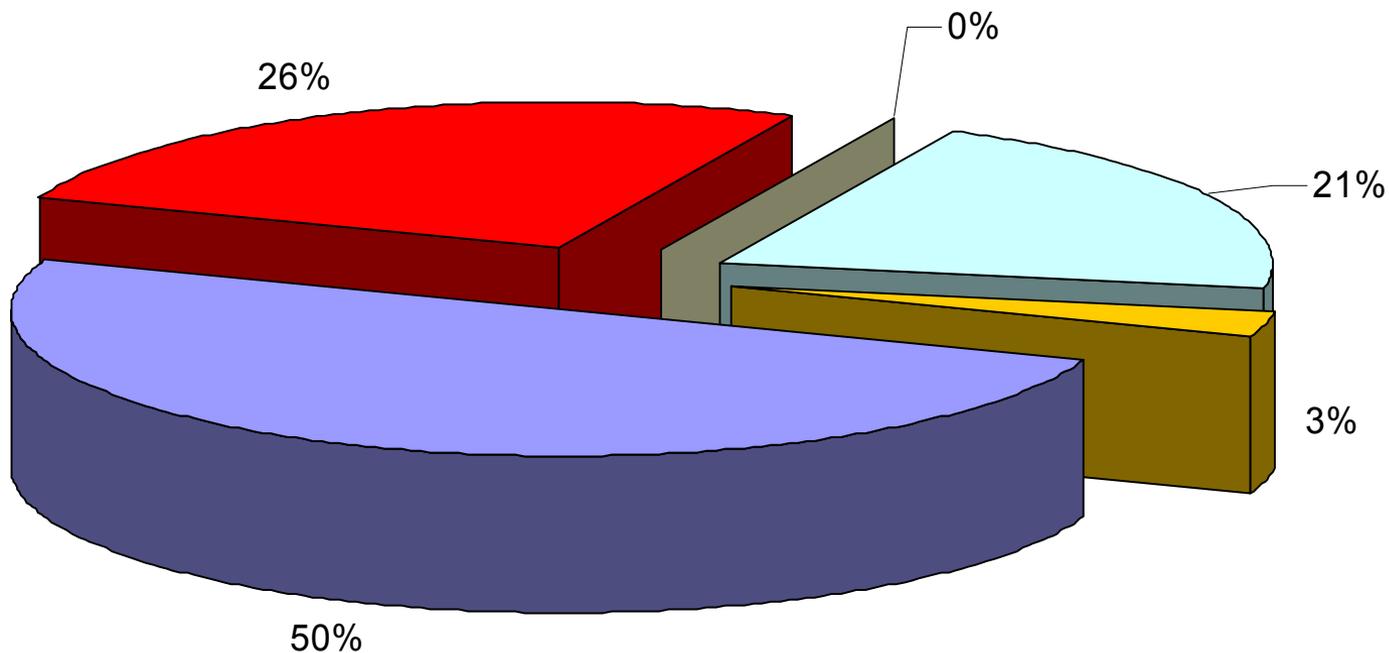


SDP Data Use - Archive

Stennis Space Center

- Total Number of Science Research Tasks
- Total Number of Applications Research Tasks
- Total Number of Commercial Product Tasks
- Total Number of Education Tasks
- Total Number of Other

Data Use
Total Number of Archive Scenes



March 25, 2002

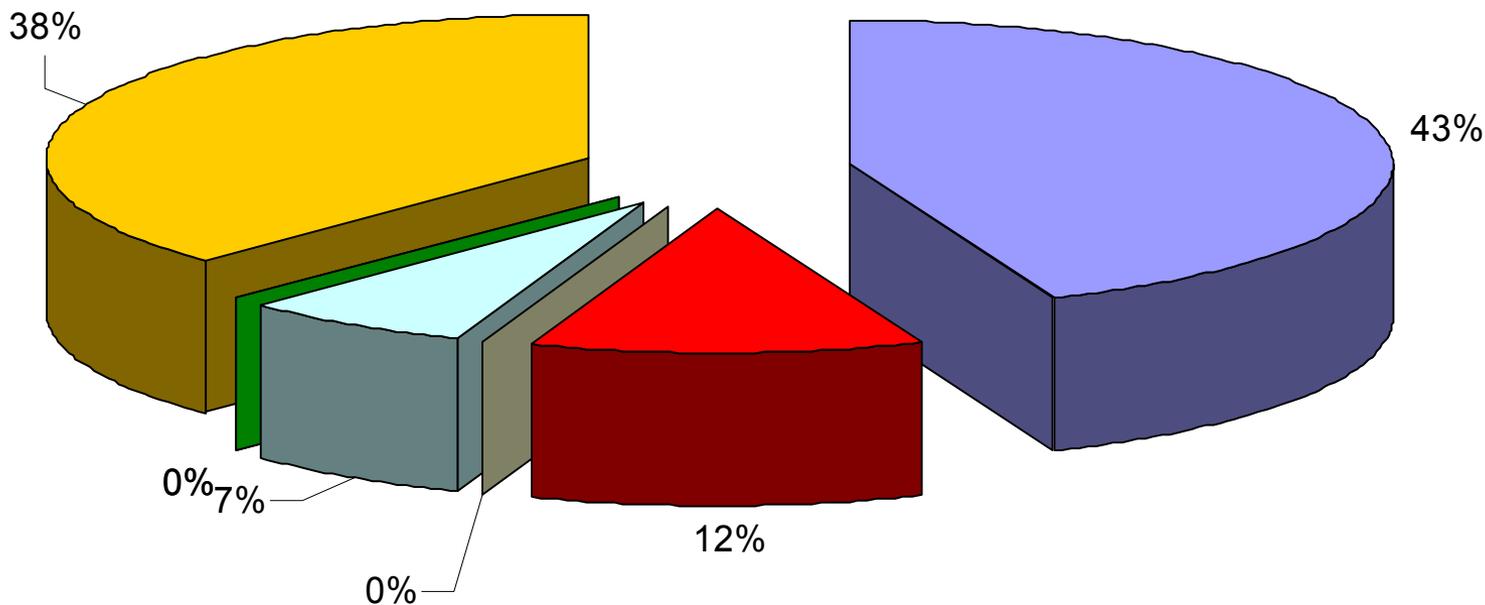


Science Research - Archive

Stennis Space Center

- Land Cover - Land Use
- Terrestrial EcoSystems
- Solid Earth
- Land Surface Hydrology
- Physical Oceanography
- Polar Environment
- Other

Science Research
Total Number of Archive Scenes



March 25, 2002

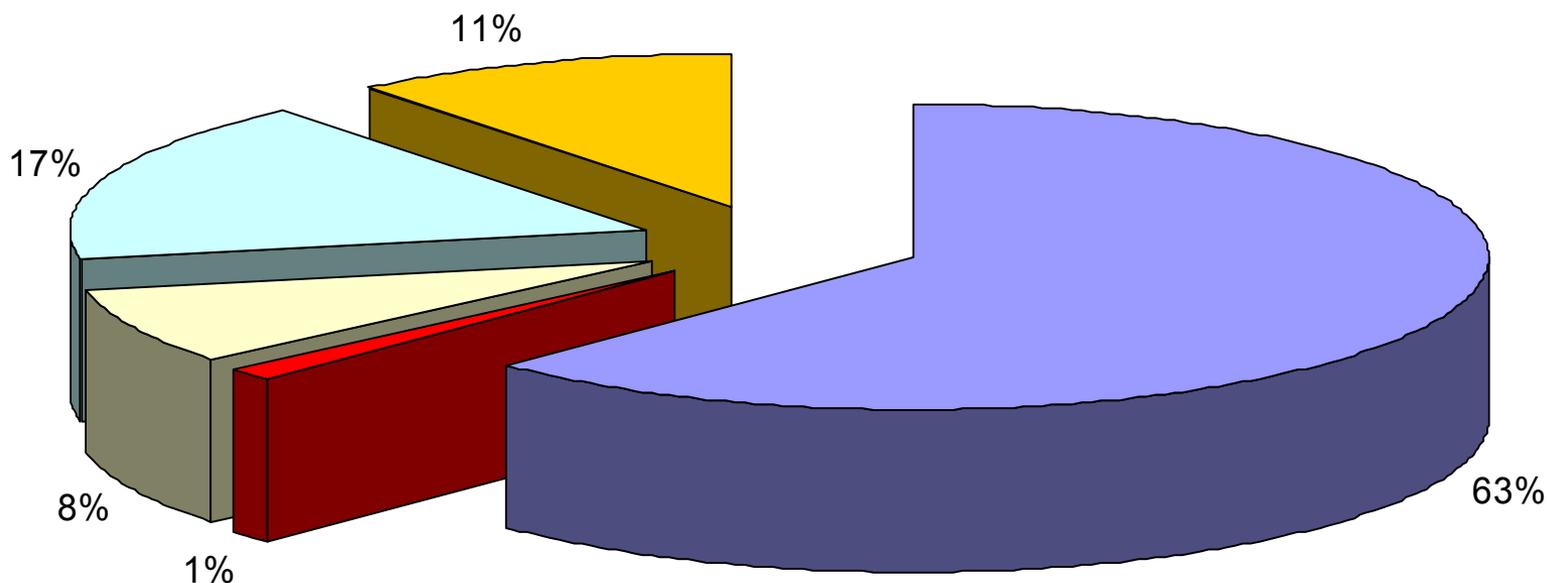


Applications Research - Archive

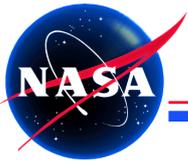
Stennis Space Center

- Resource Management
- Community Growth
- Disaster Management
- Environmental Quality
- Other

Applications Research
Total Number of Archive Scenes



March 25, 2002

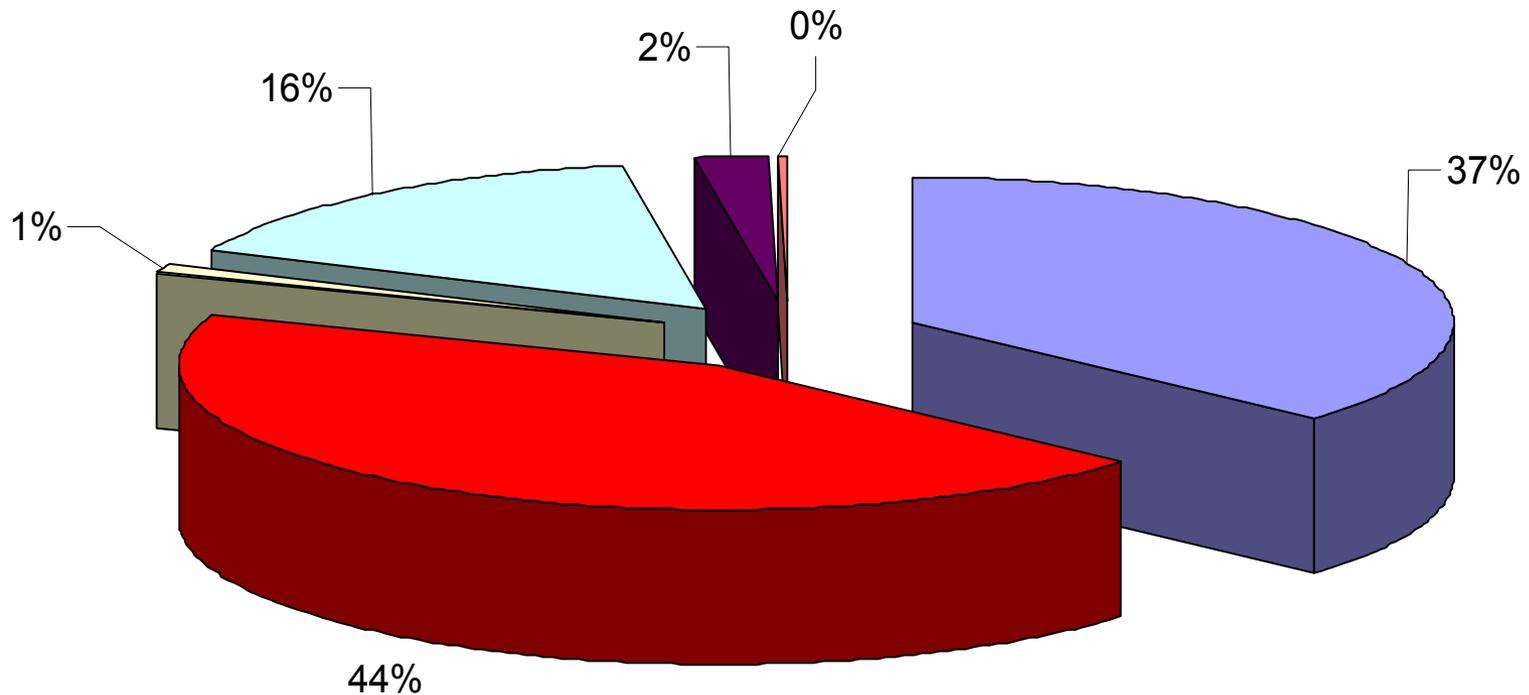


SDP Data Use – Tasking Costs

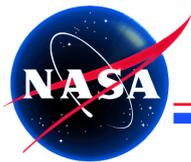
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- Total Price of Science Research
- Total Price of Applications Research
- Total Price of Commercial Product
- Total Price of Education
- Total Price of Verification & Validation
- Total Price of Other

Data Use
Total Price of Tasked Orders



March 25, 2002

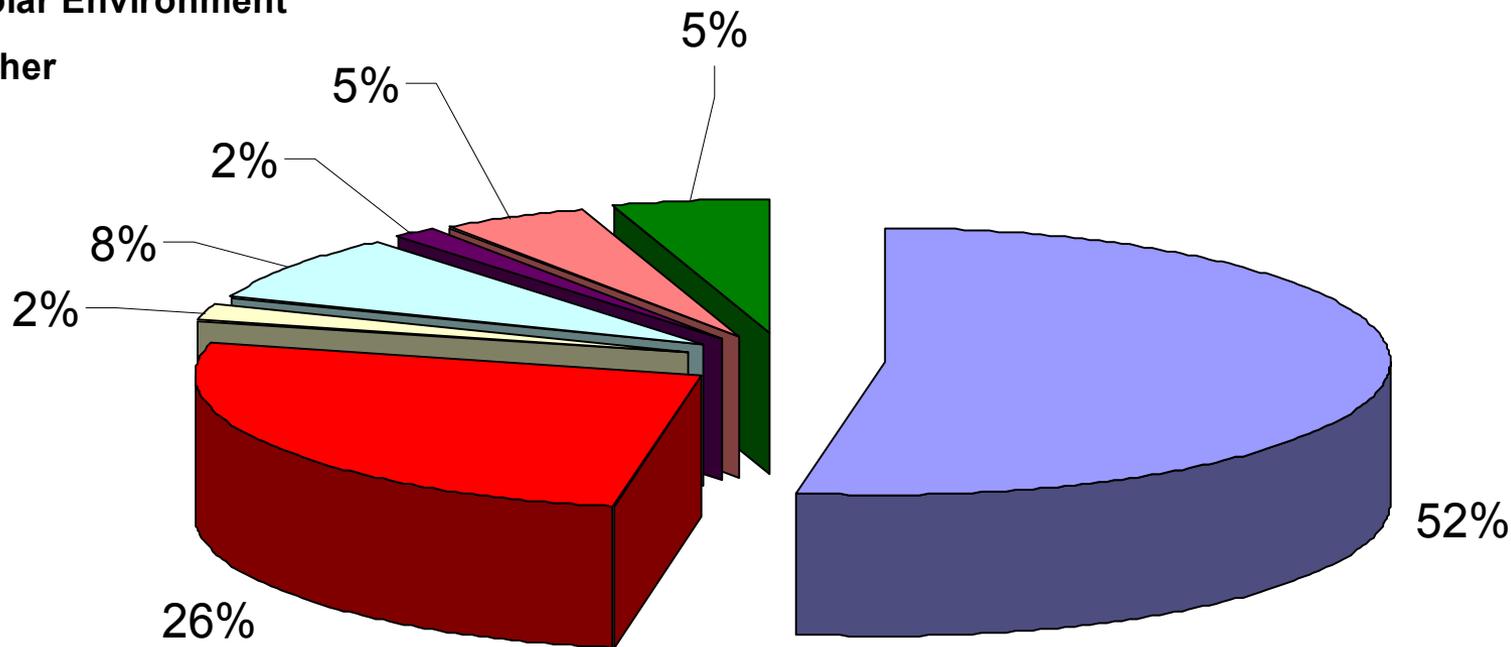


Science Research – Tasking Costs

Stennis Space Center

- Land Cover - Land Use
- Terrestrial EcoSystems
- Solid Earth
- Land Surface Hydrology
- Physical Oceanography
- Polar Environment
- Other

Spending on New Acquisitions Science Research Categories



March 25, 2002

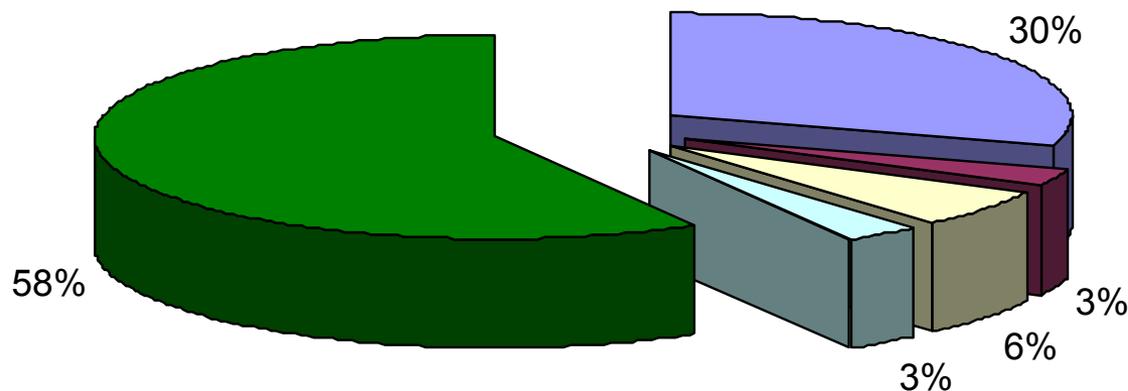


Applications Research – Tasking Costs

Stennis Space Center

- Resource Management
- Community Growth
- Disaster Management
- Environmental Quality
- Other

Spending on New Acquisitions Applications Research





Customer Satisfaction Index

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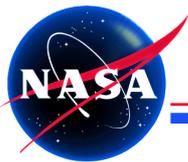
- **Quality of the data received:**
 - 8.65 (Very Good Quality)
- **Usefulness of the data in your research/application:**
 - 8.60 (Very Useful)
- **Your experience with the Scientific Data Purchase process from data request through data delivery:**
 - 8.66 (Very Good Experience)
- **Limitations that the Data Rights agreement had on the utility of the data, or your ability to accomplish research objectives:**
 - 8.10 (Not Very Limiting)
- **12% Customer Response**
 - * **185 Feedback Responses/1602 Distributed Data- 1/25/02**
 - * **Mass Emails submitted to increase feedback response**
 - * **SDP Project Assessment and Review Prospectus**



Additional NASA Data Purchase Activities

Stennis Space Center

- **FY01 \$20 Million Congressional earmark for additional data purchases**
 - Most funding obligated to selected NASA science and applications programs
 - Landsat 7 orthorectified global dataset
 - Airborne hyperspectral
 - Spaceborne multispectral (IKONOS, QuickBird)
 - LIDAR (TBD)
 - Some funding available for open tasking by NASA affiliated researchers
 - IKONOS and QuickBird



Earth Satellite Corporation

Stennis Space Center

6011 Executive Blvd, Rockville, MD 20852

GeoCover™ Products Orthorectified Landsat-7 Imagery

Coverage:

Global Land Areas

Data Description:

- ETM+ Level 1-G Scenes
 - Best Available Year 2000 (approx.)
 - Contributed by the USGS
- ETM+ Orthorectified Scenes
 - All 8 Bands
 - Absolute positional accuracy: +/-25 – 75m RMSE (depending on type of ground control available)
- ETM+ Pan-Sharpended Ortho Scenes
 - Bands 7,4,2
 - Absolute positional accuracy: +/-25 – 75m RMSE (depending on type of ground control available)
- ETM+ Pan-Sharpended Mosaics
 - Uncompressed (size is 3°x 3°)
 - Bands 7,4,2
 - Absolute positional accuracy: +/-25 – 75m RMSE (depending on type of ground control available)
- ETM+ Pan-Sharpended Mosaics
 - Compressed (size is 5°x 6°)
 - Bands 7,4,2
 - Absolute positional accuracy: +/-25 – 75m RMSE (depending on type of ground control available)



Data Rights:

Unrestricted

March 25, 2002



Quick Bird Satellite Imagery

- 0.61 meter (at nadir) panchromatic (Pan)
- 2.44 meter (at nadir) multispectral (MS)
- 11-bit radiometric resolution
- Cloud Cover $\leq 20\%$

Data Description:

Basic Image – Radiometric Correction

- Minimum Order 16.5 km x 16.5 km scene
- Info supporting Lat/Long Ephemeris registration

Standard Image – Radiometric & Geometric

- Minimum Order for New Acquisition is 64 sq km
- Minimum Order for Digital Globe Archive is 25 sq km
- Ephemeris Correction (UTM, $\pm 23m$, 90% CI)
- Available Internationally (no GCP required)

Orthorectified Image – Radiometric Correction

- Minimum Order same as for Standard Image
- Positional Accuracy Ranges 8.3m – 23m (90% CI)
- International 1:50000 (no ground control requirement)
- International other scales require GCP & DEM

Image Sharpening

Stereo and DEM (Future) $\pm 17m$, 90% CI

Data Rights:

- Distribution limited to NASA ESE



Small Island off
Long Island, New
York

2.4 Meter
Spatial Resolution

False color (NIR)
Bands 4,3,2

*NOTE: No corrections
have been applied –
Continued improvements
Expected.*



Additional NASA Data Purchase Activities

Stennis Space Center

- **Landsat Data Continuity Mission**
 - Commercial data purchase for Landsat-compatible data sets
 - Land Remote Sensing Policy Act of 1992 and Commercial Space Act of 1998 requires commercial data be acquired whenever cost effective and meets government scientific and educational requirements
 - Formulation Phase:
 - Formulation phase will focus on the following:
 - Developing initial concepts
 - Conducting a system level Preliminary Design Review
 - Conducting a business concept review
 - Two commercial firms were selected for formulation study contracts
 - Resource21
 - DigitalGlobe
 - Contracts pending
 - Implementation phase RFP will down-select to one vendor
 - Anticipated release Early CY '03



Questions?