

# **A Framework for Geo/Spatial Quality Progress Report**

**CEOS-WGCV-IVOS  
May 2014**

**Dennis Helder  
South Dakota State University  
[Dennis.Helder@sdstate.edu](mailto:Dennis.Helder@sdstate.edu)**

Current Sub-committee members:

Dennis Helder, Chair  
Francoise Viallefont, Co-Chair  
Jack Xiong, NASA  
Derek Griffith, CSIR  
DongHan Lee, KARI



**South Dakota State University**  
Image Processing Lab

# Proposed Framework

- Definition and Importance (short introductory section)
- Measurement (background and basic theory)
- Pre-Flight Estimation (to be developed later)
- On-Orbit Estimation (substantial portion of document)
- Recommendations for Determining Geo/  
Spatial Quality (final effort)

(from IVOS 24)

# Proposed Framework

## On-orbit Estimation (substantial portion of document)

- Field Methods Survey
- Targets
  - Artificial/Man-made
    - Points
    - Lines
    - Edges
    - Pulses
  - Image feature-based
    - Linear ('Rich') features
    - Bridges
    - Moon
  - Matrix of Targets
    - Type vs. GSD
    - Availability/Maintenance
    - Point of Contact
    - Recommended for operational acquisition
  - Database of 'Standard' Imagery for PSF/MTF estimation
- Data Analysis, PSF/MTF Estimation
  - Image data format
  - Models
  - Parametric/Nonparametric Methods
  - Database of 'Standard' estimation methods

(from IVOS 24)

# Proposed Framework

## On-orbit Estimation (substantial portion of document)

- **Field Methods Survey**
- Targets
  - Artificial/Man-made
    - Points
    - Lines
    - Edges
    - Pulses
  - Image feature-based
    - Linear ('Rich') features
    - Bridges
    - Moon
  - Matrix of Targets
    - Type vs. GSD
    - Availability/Maintenance
    - Point of Contact
    - Recommended for operational acquisition
  - **Database of 'Standard' Imagery for PSF/MTF estimation**
- Data Analysis, PSF/MTF Estimation
  - Image data format
  - Models
  - Parametric/Nonparametric Methods
  - **Database of 'Standard' estimation methods**

## Proposed Actions

(from IVOS 24)



# Summary/Actions

- Continue working on proposed framework
- Survey current operational methods
- Develop database of imagery for PSF/MTF/RER estimations
- Develop database of analysis methods
- And?

(from IVOS 24)

# CEOS/IVOS 24 Recommendations

3. CEOS IVOS has recently formed thematic focus group on: Geo/spatial Quality and Geometric Image quality. Agencies are requested to support with experts and a volunteer to lead the geometric Image quality focus group.

5. Encourage pre-flight characterisation and its reporting of sensor PSF/MTF.

13. An agency is requested to establish and maintain a website based data base of MTF cal/val infrastructure/test sites similar to the radiometric gain test site data base created by USGS.

14. To facilitate international harmonisation of best practise in geo/spatial quality cal/val agencies are requested to support the collection of the necessary information in a timely manner.

## Field Methods Survey

Name:

Affiliation:

Email:

Telephone:

Mailing address:

1. Do you maintain a test site?
  - a. What is the location?
  - b. What type of targets?
  - c. Brief description and image (if available), including maintenance and/or deployment overview.
  - d. Who is the point of contact?
  
2. When you estimate image spatial quality which type of target do you use?
  - a. Edge
  - b. Pulse
  - c. Point
  - d. Other
  
3. Please list your major data processing steps. (Note: an example is given on the next page.)
  
4. If you have a detailed presentation or paper on your method that could be posted on the website, please send it with your response to this survey.
  
5. Please provide any recommendations for pre-launch measurements that could be made that would enhance the ability to perform post-launch PSF/MTF estimation.

Letter Requesting  
information for  
Spatial Quality Test  
Site Database

# Remote Sensing Technologies

understanding the technologies needed to sense our world

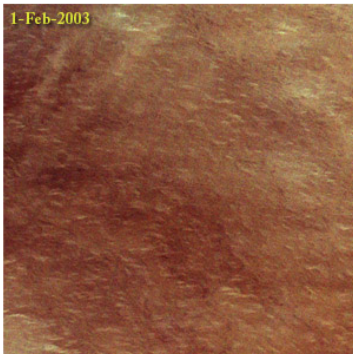
- Home
- Satellite & Sensor Characterization
- JACIE
- USGS Optical Science Lab
- RST Resources
- Past Activities
- About Us
- Sitemap

You are here: [Home](#) » [RST Resources](#) » [Test Sites Catalog](#) » [Radiometric Sites](#) » [Algeria 1](#)

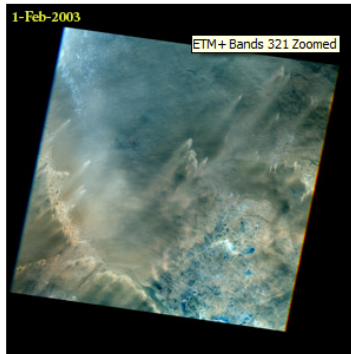
## Test Site Catalog

### Site Location: Algeria 1

#### Radiometric



ETM+ Bands 321 Zoomed



ETM+ Bands 321

#### Test Site Home

##### RADIOMETRIC SITES

- CEOS Reference Sites
- Radiometry Test Site Gallery
- Download Google Earth KMZ

##### GEOMETRIC SITES

##### ADDITIONAL INFORMATION

- Acronyms
- References



Location (City, State, Country):	Algeria, Africa
Altitude above sea level (meters):	1025
Center Latitude,Longitude (Degrees):	+23.80 , -0.40
Landsat WRS-2 Path/Row:	196 / 44
Size of Usable Area (km):	10 x 10
Owner:	TBD
Researcher:	TBD
Purpose:	TBD
Description:	TBD
Support Data:	TBD
Suitability:	TBD
Limitations:	TBD

Current Radiometric Test Site Web Page hosted courtesy of USGS EROS Remote Sensing Technologies (Greg Stensaas, Jon Christopherson)





Remote Sensing Technologies

## Remote Sensing Technologies

understanding the technologies needed to sense our world

Home Satellite & Sensor Characterization JACIE USGS Optical Science Lab R

You are here: Home » RST Resources » Test Sites Catalog » Spatial Sites » Baotou Comprehensive Calibration and Validation Site

### Test Site Catalog

#### Site Location: Baotou Comprehensive Calibration and Validation Site

Spatial



Baotou Ground Level Image

**New Spatial Test Site Web Page**  
hosted courtesy of USGS EROS  
Remote Sensing Technologies  
(Greg Stensaas, Jon Christopherson)

#### Test Site Home

##### RADIOMETRIC SITES

Select Site

- CEOS Reference Sites
- Radiometry Test Site Gallery
- Download Google Earth KMZ

##### GEOMETRIC SITES

Select Site

##### SPATIAL SITES

Select Site

##### ADDITIONAL INFORMATION

- Acronyms
- References



Location (City, State, Country): Baotou City, Inner Mongolia, China

[http://calval.cr.usgs.gov/rst-resources/sites\\_catalog/spatial-sites/](http://calval.cr.usgs.gov/rst-resources/sites_catalog/spatial-sites/)



# Prototype Spatial Quality Test Site Webpages

You are here: [Home](#) » [RST Resources](#) » [Test Sites Catalog](#) » [Spatial Sites](#) » Baotou Comprehensive Calibration and Validation Site

## Test Site Catalog

**Site Location: Baotou Comprehensive Calibration and Validation Site**

Spatial



Baotou Ground Level Image

<b>Location (City, State, Country):</b>	Baotou City, Inner Mongolia, China
<b>Altitude above sea level Min/Max/Mean (meters):</b>	TBD
<b>Center Latitude,Longitude (Degrees):</b>	40.8517N, 109.6289E
<b>UTM Zone:</b>	49 N
<b>Owner:</b>	Academy of Opto-Electronics, Chinese Academy of Sciences
<b>Points of Contact and Affiliation:</b>	<u><a href="#">LingLing Ma</a></u>
<b>Purpose:</b>	The target used for evaluating MTF performance of optical sensors in this test site is a permanent knife-edge target.
<b>Range Layout:</b>	The knife-edge target has a size of 48m*48m for a single panel, painted target on concrete; a contrast (white/black) of larger than 5:1 and an angle between the "knife-edge" and the "True North" of 5 degrees.
<b>Description:</b>	<ol style="list-style-type: none"> <li>1. Target is imaged by satellite</li> <li>2. Extract edge target from the image data</li> <li>3. Check the quality of the edge target image data</li>   <li>4. Select and Determine ROI of edge from the edge image</li> <li>5. Extract edge profile from each row/column across the edge</li>   <li>6. Align and plot Edge Spread Function (ESF) with Pixel data</li> <li>7. Determine the extent of the bright and dark area on either side of edge</li> <li>8. Calculate and plot ESF by fitting from the trimmed ESF pixel data</li>   <li>9. Calculate Relative Edge Response (RER)</li> <li>10. Calculate and plot Line Spread Function (LSF)</li> <li>11. Calculate Full Width at Half Maximum (FWHM)</li>   <li>12. Calculate and Plot MTF (Modulation Transfer Function)</li> </ol>

# Prototype Spatial Quality Test Site Webpages

You are here: [Home](#) » [RST Resources](#) » [Test Sites Catalog](#) » [Spatial Sites](#) » Site Location: Stennis, Mississippi, USA

## Test Site Catalog

**Site Location: Site Location: Stennis, Mississippi, USA**

Site Location: Stennis, Mississippi, USA

Spatial



Stennis Spatial Targets, February 2004

30.386151° -89.628116°



Stennis Spatial Targets, March 2014

<b>Location (City, State, Country):</b>	Stennis, Mississippi, USA
<b>Altitude above sea level Min/Max/Mean (meters):</b>	TBD
<b>Center Latitude,Longitude (Degrees):</b>	30.386151° -89.628116°
<b>UTM Zone:</b>	13 N
<b>Landsat WRS-2 Path / Row:</b>	022039
<b>Owner:</b>	NASA Stennis Space Center
<b>Points of Contact and Affiliation:</b>	<u><b>Dr. Robert Ryan</b></u> , Mary Pagnutti
<b>Purpose:</b>	Spatial assessment of high resolution satellites
<b>Range Layout:</b>	Painted concrete targets on the property of NASA Stennis Space Center.
<b>Description:</b>	From ~1998 to ~2009 two targets, one an edge target, the other a quarter Siemens Star, were maintained to some degree. From 2010-2013 targets fell into disrepair and covered. As of 2014 new edge target has been made in location of Siemens Star.
<b>Suitability:</b>	Higher resolution satellites (2m or finer {??} resolution)
<b>Limitations:</b>	Due to proximity to Gulf of Mexico, atmosphere tends to be humid and may often have clouds, particularly in afternoons. Best months for use tend to be: {XXXXX}



# Current Status

- In Progress
  - Solicitation for test site information sent May 2, 2014
  - Solicitation included request for best practices on PSF/MTF estimation
  - Webpages for test site database being developed at USGS EROS
- To be Initiated this Summer
  - 2<sup>nd</sup> solicitation letter for test site information
  - Population of test site database web pages
  - Development of test data
- Feedback wanted:
  - Additions/deletions/correction to solicitation letter
  - Updates or recommendations for the Spatial Quality Framework