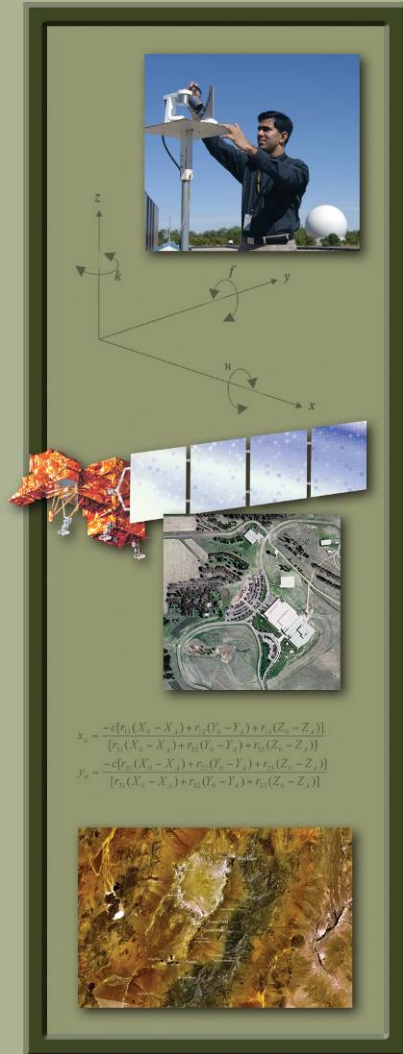


# Overview of the USGS Plan for Quality Assurance of Digital Aerial Imagery

Presented to MAPPS Conference

March 14, 2006



# Outline

---

- Introduction
- Background
- ASPRS Panel recommendations
- IADIWG formation
- USGS Plan for Quality Assurance of Digital Aerial Imagery
- Schedule
- Summary



# Introduction

---

## Why calibration at USGS?

- Photogrammetric methods
- Map production primarily done in-house
- Quality assurance measure for aerial photography from aerial contractors
- Leadership role in standards development
- Unbiased, independent agency with technical expertise
- Quality assurance for *The National Map*

# USGS Camera Calibration History

---

- **USGS responsible for calibration services for film camera in United States since 1973**
- **USGS operates Optical Sciences Lab (OSL) in Reston, VA**
- **ASPRS formed panel of experts from government, industry, and academia in 1999 to address digital aerial sensor calibration issues**
- **Calibration responsibilities centered at EROS in 2003**

# The EROS Data Center

- Located Sioux Falls, SD
- Established in 1972
- National Archive for Land Remote Sensing Data
- Approximately 600 employees

# ASPRS Recommendations

---

1. **Continue calibration of film cameras at OSL using SMAC program**
2. **Develop and implement digital calibration capabilities**
3. **Conduct research in support of transition to digital acquisition systems**
4. **Develop and implement in-situ calibration methods**
5. **Establish a calibration/verification process for satellite imagery**
6. **Develop a standard for camera and sensor calibration**
7. **Develop funding to improve the OSL and ensure continued operation**

# USGS Efforts Since ASPRS Report

---

- **USGS Research began in 2002**
- **Grant to Ohio State University**
  - ◆ *In-Situ* calibration methods & software
- **Contract with Pictometry, Inc.**
  - ◆ Calibration S/W (Australis) & control point cage
- **Laboratory and in-situ testing of digital sensors**
- **IADIWG: Inter-Agency Digital Imagery Working Group**
  - ◆ Formed by USGS in 2005
  - ◆ Represents the 14 leading U.S. government agencies involved in aerial imaging
- **USGS Plan approved and supported by IADIWG**
- **Recommendations implemented from August 2005 Government and Industry Focus Group of Major Manufacturers and Data Providers**

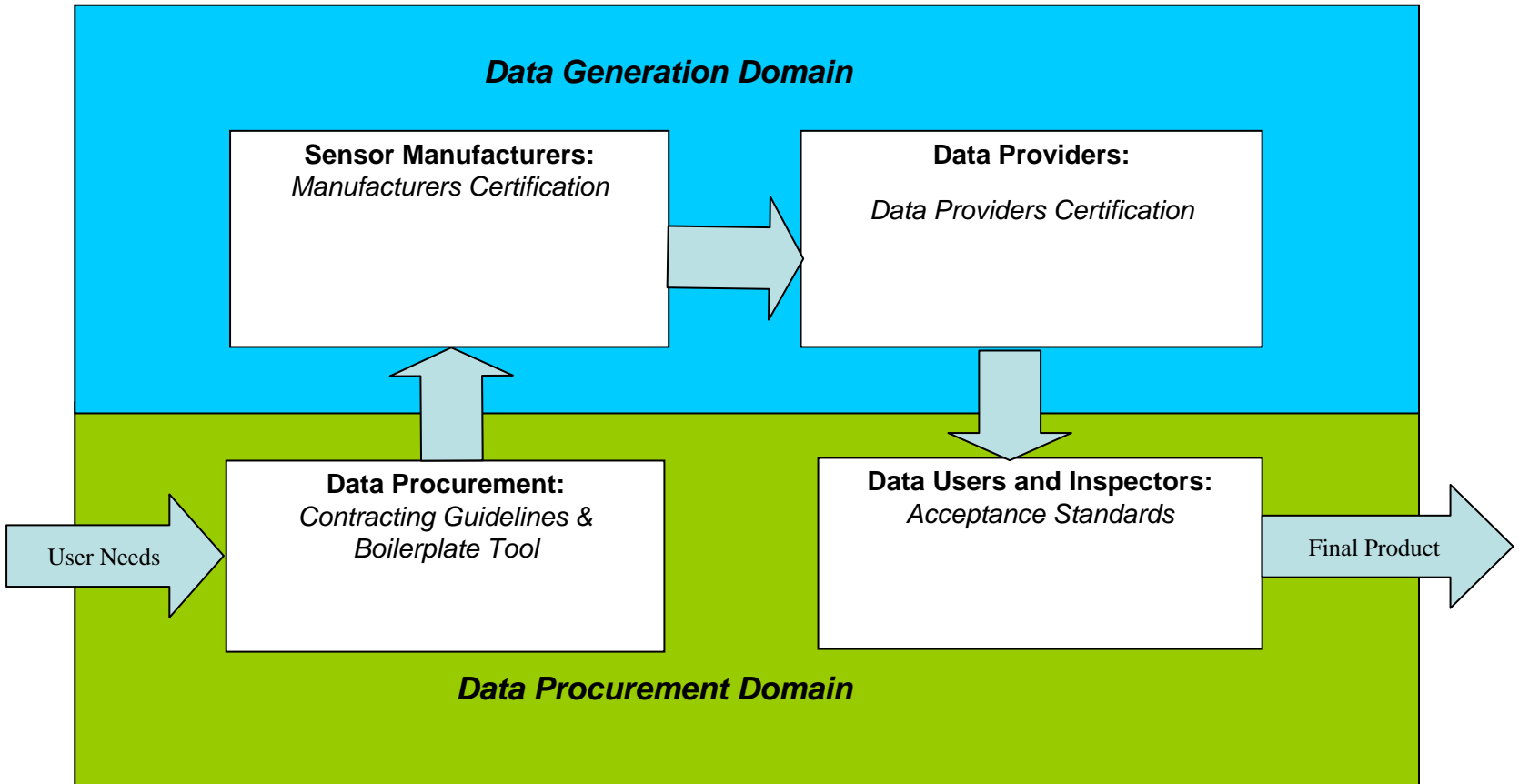
# USGS Plan for Quality Assurance

---

- **Four major parts covering two major processes:**
  - ◆ **Data Production:**
    - Manufacturers Certification
    - Data Providers (flyers) Certification
  - ◆ **Data Purchasing & Acceptance**
    - Contracting Guidelines
    - Data Acceptance Standards
- **Education and training also a major component**



# The USGS Plan



# Contracting Guidelines

---

- **User community is not sure how to contract for digital imagery**
  - ◆ New terms, capabilities, standards, lexicon
  - ◆ Inhibits digital contracting
  - ◆ Addresses boilerplate requiring “USGS Certificate”
  - ◆ Goal is to remove barriers to digital aerial contracts
  - ◆ **Encourage digital imaging!**
- Created Federal Digital Imagery General Contract Guideline

# Benefits of Contracting Guidelines

---

- **Standardized terms and descriptions make the contracting process easier and more uniform among agencies**
- **Guidelines help acceptance of digital sensors and educate end-users on benefits of digital technology**
- **Standardized terms and guidelines help contracting officers describe their users needs**
- **Standardized performance measures**
- **USGS certifications provide a priori acceptance of systems and Data Provider's "best practices"**
- **Manufacturer and DP Certification documents support a large reduction in proposal documentation**

# Status

---

- **Federal Digital Imagery General Contract Guidelines are being updated to include certification, QA/QC, and other process upgrades**
  - ◆ A Web-based tool to help generate contracting language is being developed
  - ◆ Draft presentation tool should be available for ASPRS conference in May 06

# Manufacturers Certification

- **Aerial Digital Imaging is in its “Wild West” phase**
  - ◆ Anything & everything being tried
  - ◆ Some metric-quality systems
  - ◆ Many “other” systems
- **How does the customer know which can produce mapping-quality data?**
- **USGS to offer “type certification” of mapping-quality digital aerial sensors**
  - ◆ Must be stable, well-quantified, repeatable
  - ◆ Able to routinely generate mapping-quality data
    - When operated properly!

# Benefits of Manufacturers Certification

---

- **Communicates specifications**
- **Provides evidence of system performance**
- **Independent certification helps to promote sensor systems**
- **Support data provider system requirement verification**
- **Type certification eliminates burden of calibration for each sensor sold in the United States (1 time vs. n times)**
- **Eliminates need for USGS to have custom-built calibration instrument for calibration purposes**

# USGS Review Team

- **Review Team Lead - Gregory L. Stensaas**  
Remote Sensing Technologies Project Manager  
USGS Earth Resources Observation and Science Center, Sioux Falls, SD  
[stensaas@usgs.gov](mailto:stensaas@usgs.gov)
- **Systems Engineering Team Member - Jon Christopherson**  
Science Applications International Corporation (SAIC)  
Contractor to the USGS EROS, Sioux Falls, SD  
[jonchris@usgs.gov](mailto:jonchris@usgs.gov)
- **Photogrammetric Engineering Team Member - Dr. George Y. G. Lee**  
U.S. Geological Survey, Menlo Park, CA  
[gylee@usgs.gov](mailto:gylee@usgs.gov)
- **Geo-Spatial and Software Engineering Team Member - Donald Moe**  
Science Applications International Corporation (SAIC)  
Contractor to the USGS EROS, Sioux Falls, SD  
[dmoe@usgs.gov](mailto:dmoe@usgs.gov)
- **Radiometric and Physics Team Member - Dr. Robert Ryan**  
Science Systems and Applications, Inc.  
Contractor to NASA Stennis Space Center, MS  
[Robert.Ryan@ssc.nasa.gov](mailto:Robert.Ryan@ssc.nasa.gov)

# Status

---

- **Manufacturers Certification Guidelines in work now**
- **Applanix factory visit completed, report pending**
- **Z/I Imaging factory visit scheduled for April 3-7**
- **Leica and Vexcel visits pending further discussions**



# Data Providers Certification

---

- **Second half of data generation is the flyer/Data Providers' data processing**
- **USGS to provide Data Providers Certification**
- **Focused on processes and process control**
  - ◆ Ensures that Data Providers are operating sensors in accordance with manufacturer's instructions and limitations
  - ◆ Ensures that Data Providers follow quality procedures
- **Desire to ensure reliability, repeatability, and trust**

# Benefits of Data Providers Certification

---

- Provides evidence of performance of products
- Independent certification helps to promote product specifications and Data Provider's capabilities
- Documents Data Provider's quality assurance plan and "best practices"
- One certification for Data Provider and not for each camera
- Data Providers no longer have to send cameras to OSL for calibration, reducing down-time and shipping expenses

# Status

---

- **Development of Data Providers Certification documentation in work**



# Digital Data Acceptance Standards

---

- **End-users unsure of how to judge digital aerial data quality**
  - ◆ New terms & capabilities (resolution, spectral, etc.)
  - ◆ Each customer understands things differently
- **There is a need for common, uniform definitions and methods for evaluating quality of image data**
- **USGS to work with IADIWG and technical experts to develop these**
- **Goal is a Web-based tool illustrating quality problems, measurement techniques, and standards**

# Benefits of Acceptance Standards

---

- Data consumers have common standards to evaluate data products
- More consistent acceptance/rejection criteria among contracting agencies
- Clearer standards and guidelines helps to eliminate false expectations
- Ensures high quality products
- Increases customer satisfaction

# Status

---

- **Development of Acceptance Standards in work**





# Funding Strategy

---

- **Manufacturers Certification (Cost-shared by USGS and manufacturers)**
- **Data Providers Certification (100% by Data Providers)**
- **Contracting Guidelines (100% USGS and IADIWG funded)**
- **Acceptance standards (100% USGS and IADIWG funded)**

# Schedule

---

- **USGS Plan for Quality Assurance of Digital Aerial Imagery briefed during ASPRS panel session May 5<sup>th</sup>**
  - ◆ Panel Session - 1:00 pm to 3:00 pm  
Characterization/Calibration/Certification, Standards Digital Camera Systems – The Quality Assurance of Digital Imagery
- Complete and announce certification of Applanix and Intergraph at ASPRS - May 06
- Complete certification of Leica and Vexcel - September 06
- Overall USGS plan – Finalize, complete, and obtain ASPRS approval of the plan - June 06



# Schedule (cont)

---

- Begin Data Provider Certification with 3 initial data providers - June 06
  - ◆ **Aerometric, NW Geomatics/Horizons, Sanborn**
- Manufacturer and Data Provider Certification Process available for others - September 06
- Review digital imagery delivery and acceptance QA/QC process recommendations - July 06
- Training to Federal, State, and Local Government agencies to begin- October 06

# MAPPS USGS Discussions

---

- **MAPPS meeting discussion between MAPPS/USGS Liaisons, Intergraph, Leica, Vexcel – 1/28/06**
  - ◆ Issues concerning USGS plan
- **MAPPS/USGS Liaisons, Intergraph, USGS Project Telecon - 2/10/06**
  - ◆ Certification at the manufacturer's facility
  - ◆ Process certification of the data providers
- **MAPPS Liaison and USGS Project Telecon – 2/15/06**
  - ◆ Reviewed and defined data providers certification key elements
- **MAPPS/USGS Liaisons, Intergraph, USGS Project Telecon - 3/6/06**
  - ◆ Manufacturer Certification Process documentation was acceptable
  - ◆ Agreement that Data Provider Certification Process was understood and feasible
  - ◆ Associated costs were determined to be reasonable
  - ◆ Good understanding that system/process certification **is not** personnel certification, and the two **are not related**

# Summary

---

- To implement a comprehensive, meaningful process that ensures the quality of data products and services
- To cooperatively develop the plan with all elements of the geospatial community
- Good for one is good for all
- To establish a model to support new technologies

# For more information

---

- IADIWG Web site at: <http://calval.cr.usgs.gov/>





# For issues or comments

---

## Contact:

- **Gregory L. Stensaas**  
**Remote Sensing Systems Characterization Manager**  
**USGS EROS Data Center**  
**47914 252nd Street**  
**Sioux Falls, SD 57198**  
**605-594-2569**  
**[stensaas@usgs.gov](mailto:stensaas@usgs.gov)**

# The USGS Plan

---

Questions or comments?

