

**USGS QUALITY ASSURANCE PLAN
FOR DIGITAL AERIAL IMAGERY
IMPLEMENTATION PROPOSAL**

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IMPLEMENTATION PROPOSAL

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Executive Summary

The Remote Sensing Technologies Project (RSTP) has developed and is proposing to implement a U.S. Geological Survey (USGS) Quality Assurance Plan for Digital Aerial Imagery. This plan ensures that common, consistent, quality imagery products are being purchased and made available the USGS and its partners to via The National Map and the National Archives. The plan is referred to as the Digital Imagery Quality Assurance Plan (DIQAP). The four components highlighted in this plan are proposed to become operational in Fiscal Year (FY) 2011 with technology and operational updates and efficiencies being implemented over time. The RSTP at Earth Resources Observation and Science (EROS) Center will continue to support USGS Quality Assurance work with additional support from the National Geospatial Technical Operation Centers (NGTOCs) and other operational field centers. The cost of DIQAP implementation for FY11 and beyond by year and funding organization are:

Table 1: DIQAP Costs

Fiscal Year	Funding Organization	SIR Amount
FY11	LRS	\$175,137
	NGP	\$306,669
Yearly Ongoing Operational	LRS	\$17,871
	NGP	\$66,719

In summary, the costs listed above are required to achieve for full operational status by the end of FY11. However, if Land Remote Sensing Program (LRS) and National Geospatial Program (NGP) budgets remain level from FY10 then the impact will be to defer work until the end of FY12, and moving the operational state of the planned tasks into FY12. Also note that reimbursable funding and technology and science R&D funding is not included in this chart. Reimbursable funding received will be used to offset associated costs for Sensor Type Certifications and Data Provider Evaluations. This work is described in detail further in this document including project task tables listing effort

Background and Overview

In 2000, a panel of experts commissioned by the USGS and the American Society of Photogrammetry and Remote Sensing (ASPRS) concluded that digital sensor calibration and the associated processes were inherently governmental and it was recognized that there is a need for new digital system calibration and characterization processes similar to the calibration processes used by USGS for analog film cameras. The ASPRS panel recommended that the USGS establish a digital camera calibration capability and develop guidelines to satisfy the growing national need for an imagery acquisition process. Based on the panel's recommendations, the USGS began establishing calibration and quality assurance processes for the arriving digital technologies entering the aerial imaging and mapping markets. In the intervening years, the USGS has consolidated digital aerial technology related research tasks and the ongoing film camera calibration responsibilities all within the Remote Sensing Technologies Project (RSTP) at the EROS Center. The RSTP has worked with others from around the USGS, as well as, a specifically formed group of 14 Federal users of aerial imagery called the Inter-Agency Digital Imagery Working Group (IADIWG) to understand the needs of the government including federal, state, local, tribal, and other imagery user requirements. The result of this work is the USGS Digital Imagery QA Plan – DIQAP for brevity.

The DIQAP¹ addresses the full QA process of obtaining digital aerial data, beginning with the initial specification of data requirements through the capture and production of the image products to the final receipt and inspection of the data. The DIQAP addresses this in two domains, each with two parts, as illustrated in Figure 1, and each of the four parts is briefly explained in its respective section of this Implementation Plan. For convenience, tables are provided in Appendix 1 and 2 describing the benefit of each of these USGS DIQAP components and how they relate and support the federal civil imagery community, and an overview summary of DIQAP tasks in table format, respectively

¹ *The USGS Plan for Quality Assurance of Digital Aerial Imagery*,
http://calval.cr.usgs.gov/documents/The_USGS_and_IADIWG_Plan9.pdf

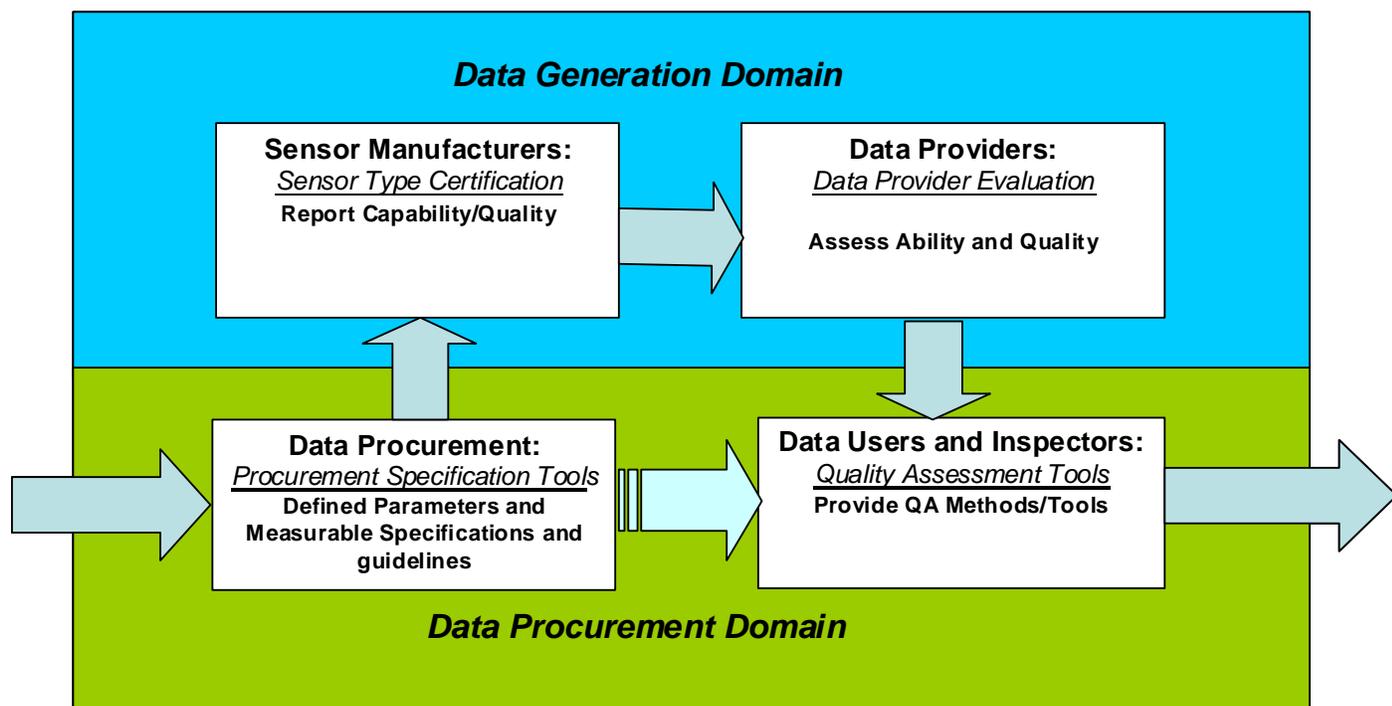


Figure 1: The Four Parts of the USGS Plan for Quality Assurance of Digital Aerial Imagery

The Data Generation Domain

The Data Generation domain describes the processes involved with generating aerial data products. The first part, Sensor Type Certification, ensures that sensors employed in gathering the digital imagery are capable of generating consistent photogrammetric high-quality output. The second part of the Data Generation Domain, Data Provider Evaluation, ensures that those who are using those sensors for data products, namely Data Providers, are capable of operating digital aerial sensors and producing imagery or map-quality products consistent with the sensor’s capabilities.

Sensor Type Certification

Sensor type certification is an attempt to adhere to part of the traditional role USGS has maintained in the United States of giving Government procurers of aerial imagery assurance

that the camera/sensor system used in their project is capable of producing consistent quality metric aerial data products and that those products satisfy their individual requirements.

In general, the digital camera community within the civil government still struggles to understand the nature and performance of digital sensors. From a government viewpoint, commercial vendors are often suspect when it comes to providing objective and unbiased technical information. Civil agencies often seek an objective third-party to confirm or verify information received from vendors. USGS receives and supports, on a regular basis, those questions about a digital imagery system and subsequent data acquisition.

The USGS accomplishes Sensor Type Certification for the purpose of providing an unbiased assessment of the commercial aerial camera systems. In the certification process of, the USGS works with the camera manufacturer to certify a type of sensor (as opposed to certifying sensor systems on a serial number basis as was and is being done for film cameras) to understand the sensor (camera) design, specifications, and the quality regimen under which their sensor types are manufactured, tested, calibrated, sold, and supported. During the certification process, USGS visits the manufacturer's facilities to observe and verify the processes that are used. Once the USGS is satisfied the sensor systems are designed, manufactured, calibrated, and supported such that they will produce consistent metric imagery, certification documents for that sensor type are issued.

USGS Type Certification of Sensor Systems² has been ongoing in a research environment for three years beginning in FY07 and is well documented. At the present time, these certifications are performed with the vendors in a cost share arrangement via a USGS Technical Assistance Agreement (TAA) and now the Project is proposing to implement a reimbursable cost model to perform the evaluation and analysis, verification, and certification reporting. It is anticipated that sensor type certifications will continue to be done within the research environment in

²*USGS Type Certification of Sensor Systems,*

http://calval.cr.usgs.gov/documents/Sensor_Type_Certification_07.doc

support of the LRS Program requirement to keep abreast of the latest technology in all areas of remote sensing and provide support for the aerial operational environment that is the responsibility of the NGP.

Sensor Type Certifications are carried out by a technical team assembled by the RSTP consisting of at least one representative from USGS RSTP management and appropriate technical expertise as required. Resources required for certifications are dependent on the system and level of inspection required. The resources and expertise needed to perform these certifications are drawn from the same experts used by the RSTP to perform system characterizations and camera calibrations and are funded for these efforts by the LRS program. A typical new system certification involves the full certification team of four experts with the following types of skill areas: Photogrammetry, Calibration, System Engineering, Manufacturing, Optics/Sensors, and Quality Assurance.

In FY10, RSTP is proposing to change the TAA certification fee from a USGS cost share to fully reimbursable. The current reimbursable fees for Sensor Type Certification are detailed below. This cost will be evaluated and documented by the USGS project every three years and updates will be incorporated after management approval. Notification on the project web page will be displayed 90 days prior to the effective date of change. Any changes to the reimbursable costs are expected to be minor (overhead, travel, and cost of living adjustments) in the near future.

Table 2: Cost of Sensor Type Certification

2010 Sensor Type Certification Costs	New System	Similar System Update	New System Type w/ Minor design differences & similar manufacturing process	New System Type w/ Major design process difference, some previous documentation
OCONUS	\$39,998	\$14,327	\$24,146	\$38,797
CONUS	\$28,444	\$10,830	\$16,779	\$27,243

Sensor Type Certification Development Costs and Responsibilities:

The Sensor Type Certification process has been underway since 2007 and as a result much of the development work has been completed. The remaining work to be done to make this portion of the DIQAP operational is to finalize current documentation and costs, publish them, and present them publicly. These documents are now in a well-developed draft state and the actual development work will conclude within FY10 under existing funding.

Task No. *	Description	Action	Completion Date	Fiscal Year Cost
1	Update Sensor Certification Plan to 1.0 and release	RSTP	Summer 2010	\$15,520
2	Document reimbursable fees and update process for Sensor Type Certification	RSTP	Summer 2010	\$9,531

(*) - It should be also noted that project task reference numbers (Task No.) in this and following tables not be consecutive due to other project efforts not directly to this plan.

Sensor Type Certification Operational Costs and Responsibilities:

Once fully operational, the costs associated with each individual Sensor Type Certification are covered within the reimbursable fee paid by the sensor manufacturer. The costs of maintaining the capability to do these certifications is contained in the RSTP operating budget using appropriated SIR funding via its system characterization and camera calibration tasks. The current authority and responsibility for on-going Sensor Type Certifications is delegated to USGS via the Analog Camera Calibration requirement and provided by LRS Program guidance. The National Geospatial Program (NGP) has operational responsibility for Orthoimagery and The National Map Theme Lead has been participating in the Sensor Type Certification process, therefore it is assumed that at this point any operational expense for this activity in the future will be the responsibility of the NGP.

Task No.	Description	Action	Completion Date	Fiscal Year Cost
3	Ongoing Sensor Type Certification	RSTP	Ongoing	Reimb.
4	Maintaining Operational Sensor Certification Capabilities	RSTP	Ongoing	SIR Other*

- * - LRS Program funding for satellite and sensor research and assessment.
- NGP will be expected to provide operational support to sustain the required aerial certification procurement and partnership process.

Benefit of Sensor Type Certification

The major benefit from this effort is an independent system capability and performance assessment is accomplished for both the government and private digital aerial community. It is very important to government contracting teams, or purchaser of an acquisition system, that an independent team of experts provides an assessment of a system/sensor’s intended applications and associated accuracy/performance. The current sensor type certification process has moved forward to where Government contracts have incorporated the requirement for a “*USGS Sensor Type Certification Report, or USGS Certificate of Calibration*”. The USGS and other contract vehicles are using this statement in current request for proposals (RFPs), “**Calibration:** Aerial Sensors/Camera(s) used to collect project imagery shall have current USGS certification, or in the case of digital sensors, a current USGS digital aerial sensor type certification.”, and manufacturers are receiving system purchase requests contingent on the sensor/system passing the USGS Type Certification.

Data Provider Evaluation

The remaining activities within the Data Generation Domain are addressed by a process called Data Provider Evaluation. After considerable discussion within the USGS, the IADIWG, and after consultation with industry, it is recommended that the Data Provider Evaluation consist of providers using digital aerial cameras to fly a USGS-approved test range and provide defined orthomosaic products over one of the USGS approved ranges for evaluation. The orthoimagery

will be assessed for positional accuracy and quality. This accuracy, along with basic details about the company and their staff, will be made available in a public report that will provide evidence that the data provider can correctly operate their system(s) to produce data products that meet USGS standards.

The Data Provider Evaluation requires the largest amount of support of the four-part Digital QA Plan in order to become operational. The work needed to perform data provider evaluations; such as, developing the Data Provider Evaluation processes, USGS National Aerial Test Ranges, and associated software tools, and other imagery definition, is described below, along with a current (as of July 2010) status of the progress made to date.

Development of USGS National Aerial Test Ranges

In an attempt to maximize convenience of location for flyers to be able to use the USGS ranges, the USGS is in the middle of locating and developing National Ranges well-distributed across the contiguous 48 states. Five ranges are considered the minimum to go operational with Data Provider Evaluation but as indicated by the image map in Figure1 additional ranges are preferable. In FY09, the Sioux Falls Range was completed, surveyed and evaluated with three-inch imagery. In FY10, two more ranges (Rolla, Mo and Pueblo, CO) were established, MOU's for signature are in-work and on-site points have been surveyed and put into a database by the EROS and USGS NGTOC engineering staff. These two ranges have been completed and ready for operations by the end of August 2010. Subsequent range locations are being considered. Initial discussions are happening with the State of North Carolina as a potential site and USGS is discussing future potential test ranges areas with National Geospatial-Intelligence Agency (NGA).



Figure 1: Existing and Planned USGS Ranges

To create an evaluation test range, USGS with partners obtain high-resolution aerial imagery (3-inch and 6-inch resolution) over the entire extent of each range. The range is then precisely surveyed and the imagery is then used as known ground control for assessing Data Provider imagery using automated Image-to-Image (I-2-I) autocorrelation tools. Using imagery as control and associated mensuration tools will improve the repeatability, reliability, consistency and efficiency of assessments used in the Data Provider evaluation reports. New methods of collecting small, inexpensive image “chips” and rectifying them with needed control points across a range area is under review and could provide efficiency for the range process in the future

Potential Collaboration

It should be noted that some of the ranges, based on their geographic extent, can also serve as test ranges for medium and high-resolution satellites. The EROS RSTP is also investigating several possibilities for establishing cooperators in the development of

USGS-approved test ranges. One possibility is to cooperate with the National Geospatial-Intelligence Agency (NGA) in their current effort to establish a ground control range for national assets. Identifying the congruency of the two missions' requirements and cooperative roles and contributions is a current high priority. In addition, LRS has the need for test ranges that can be used to validate satellite sensors and may be a source of collaboration.

A very interesting related activity, but not currently funded under this activity plan, is the effort underway at the U.S. Department of Agriculture (USDA) and through the IADIWG to establish a National Control Point Library that can be used to assess the geometric accuracy of data acquired under a broad range of programs; such as, National Agriculture Inventory Program (NAIP), National Resources Conservation Service (NRCS), Imagery for the Nation (IFTN), etc. These efforts are being monitored closely by the USGS and looked upon as another significant opportunity to benefit the Government's future QA efforts as well.

Software Tools and Processes for Data Provider Evaluation

The software and tools currently being used in the Data Provider Evaluation development process are manual and required human resources to pick and compare points for analysis. The software needed to perform assessments of the imagery submitted by the Data Providers exists, and is suitable for assisting the range development and evaluation effort. The software needs to be assembled into an easy-to-use, automated package for operational use in Data Provider assessments. Enhancements to the software and tools will provide the ability to support an efficient operations effort and allow efficiency cost saving processes in the future. These enhancements include development and utilization of controlled image chip processes, automated target (control point) recognition, and automated assessment tools; such as enhanced versions of the Accuracy Analyst and the I-2-I tool.

Data Provider Evaluation and Range Development Costs & Responsibilities:

The development of the first three ranges was covered in the RSTP FY09 and FY10 budgets. The subsequent two ranges are proposed to be built in FY11. Software development estimates are planned for USGS in-house development. If commercial software companies can and will develop needed enhancements in time for operations the USGS cost could be lower; however, the cost for testing, revision, etc... will still be required. All the documentation of the Data Provider processes must be developed and completed by March 31, 2011 in order to be publically available at the beginning of the Spring/Summer 2011 flying season. The public release of this capability will be done via articles in community journals, mapping community conferences and meetings; such as, the Management Association for Private Photogrammetric Surveyors (MAPPS) Winter meeting in late January 2011, the ASPRS Spring meeting in May 2011, and future training workshops via the USGS and partner liaisons. The tasks, responsible parties, completion dates, and estimated costs are:

Task No.	Description	Action	Completion Date	Cost	Fund Source
8	Range #4 development	RSTP	31-Mar-11	\$57,426	NGP
9	Range #5 development	RSTP	31-Mar-11	\$62,192	NGP
10	Operational DP Assessment Software development	RSTP	31-Mar-11	\$133,438	(Proposed) LRS
11	Establish reimbursable fee process for Data Provider Evaluation	RSTP	31-Mar-11	\$13,106	NGP
12	Finalize DP Operational Processes and Documentation	RSTP/NGTOC	31-Mar-11	\$28,594	NGP
13	Communicate Data Provider Evaluation plans and processes to Industry	RSTP/USGS Liaisons	FY11/FY12	\$55,996	NGP

Data Provider Evaluation and Range Operational Costs and Responsibilities:

Beginning in the Spring/Summer of 2011, the proposed operational concept for Data Provider Evaluation is planned to begin. The process recommends data providers fly over one of the approved USGS ranges and then sends data to the USGS for analyses and reporting. The operations concept is that every sensor utilized by the data provider would fly over a USGS range at a minimum of once in a three year period. The cost for the data provider evaluation will be produced with final analysis and documentation by March 31, 2011. The rough estimated cost to support the flight and do the evaluation and report is assumed to be around \$5000 with a potential for a \$3000-4000 cost with automated tools. These Level 0 engineering estimates (+/- 50%) are burdened costs without including in-house software and management costs. It is proposed that staff at the USGS Optical Science Laboratory (OSL), perform the operational scheduling, data assessments, and reporting of results. This growing task of Data Provider Evaluation will augment the film camera calibration work currently being performed by this staff which is anticipated to dwindle in the coming 5 – 10 years. Additional USGS staff will provide technical and management support to this effort with the RSTP issuing the evaluation acceptance letters, managing funding processes, and issuing evaluation letters and associated reports.

Task No.	Description	Action	Completion Date	Cost	Fund Source
14	Ongoing Data Provider Evaluation	RSTP	Ongoing	(Reimb.)	NGP
15	Gen. Range Infrastructure and Tools Maintenance	RSTP	Ongoing	\$29,785	NGP
16	Aerial Range Maintenance & Operations (Rolla, Sioux Falls, Pueblo, NC, TBD)	RSTP	Ongoing	\$17,871	NGP
17	Satellite Range Maintenance & Operations Augmentation to existing ranges to accommodate satellite sensors	RSTP	Ongoing	\$17,871	LRS

Benefit of Data Provider Evaluation

The USGS DIQAP data provider evaluation process is the only independent assessment of the system performance and validation of the ability of the data provider to use the system and create products that meet manufacturer and stated data provider specifications. This process can also be used to validate that data products from vendors can meet USGS and Government partners specifications.

This evaluation is the most important part of the QA process. A provider must prove that they can use the system and create the product. This is the only way to weed out the incapable providers in the system. The Data Provider Evaluation process provides the contracting officers and their technical staff a realistic evaluation of a data provider's capability; especially with the rapid change and growth in the digital camera market.

The Data Procurement Domain

Data procurement covers the longest period of time in the process of obtaining digital aerial imagery. Its two parts, properly specifying the data desired at the beginning of the procurement, followed by assessing whether the final delivered product meets those specifications, are the two "bookends" to the entire procurement/production chain and are often separated by a year or more between specifying and receiving/checking the data. Both parts are intimately related to the initial purpose and specification of the data and these very important DIQAP parts are represented by the Procurement Specification Tools and Quality Assessment Tools and their associated contracting guidelines.

The RSTP proposes to address both of these parts in one effort by building a digital aerial imagery specification and quality assessment tool. This tool will help users of the tool properly specify the digital aerial data that they need and, upon receipt of that data, provide them with the recommended methods for checking that those data met the original specifications. This

tool, known informally as the “Spec & Check Tool”, will be a web-based tool available initially to USGS procurement and QA staff and the State Liaisons across the country. In the future, this tool will be made accessible to the community; however, for the purposes of this implementation plan, the tool is only considered to be a USGS and partners tool until it has been fully developed, tested and verified.

The need for common contracting tools became apparent at the first IADIWG meeting in August 2005 and a common contracting guideline document was started; however, the need for common specification definition and associated QA tools remained. Development of the Spec & Check tool began in earnest in FY09 with concept development, concept presentation, and feedback gathering. Favorable results from virtually all who attended these presentations and their feedback were incorporated in to the operations concept for this tool and design was started. In FY10 funding for the Spec & Check Tool was reduced, leaving insufficient resources to complete the tool. With a small amount of funding remaining, the RSTP is completed Phase I of the tool in order to have a visual, limited-functionality version of the tool before “putting it on the shelf” for potential future funding. The “Spec and Check” tool is currently available for internal review on an internal web server. Current FY11 funding only allows for minimal tool support and does not allow major development work to continue; however with USGS and/or partner funding and resources the spec and check tool development could be completed.

In addition to the components in the “Spec and Check” Tool (common digital imagery definitions and recommendations, multiple user specification examples and database, and contract specification methods and associated measurable quality parameters), there are additional QA recommendations provided by the DIQAP. These recommended QA processes in the DIQAP include 1) the completion and use of common contract performance measurement metrics (via spec and check tool) for satisfying the Federal Acquisition Regulation (FAR) for past performance documentation and 2) standardizing these metrics for comparison across Government contracts by using a standard tool. The DIQAP suggests, and the project recommends, that enhanced common metrics for Government contracts be added via a tool similar to the National Oceanographic and Atmospheric Administration (NOAA) THOMIS tool

and at a minimum that tool be utilized to provide standardized performance metrics across the Government. The current tool is in use at NOAA and has been tested and used for evaluation by USGS and USDA.

Development Costs & Responsibilities of Specification and Quality Tools and Guidelines:

Task No.	Description	Action	Completion Date	Cost	Fund Source
20	Development of Phases II and III of Spec & Check Tool	RSTP	TBD	\$131,055	NGP

Operational Costs and Responsibilities of Specification and Quality Tools and Guidelines:

Task No.	Description	Action	Completion Date	Cost	Fund Source
21	Operational use, feedback, and communication of the Spec & Check Tool	NGTOC	Ongoing	**	NGP
22	Hosting & Technical Maintenance of the Spec & Check Tool	RSTP	Ongoing	\$19,603	NGP

** This work will be accomplished during normal operations without additional cost.

Benefit of Specification and Quality Tools and Guidelines:

The USGS has the opportunity to lead and guide the community into a standard methodology of ordering and verifying digital imagery products, to house and become the global resource as an aerial digital imagery knowledge base, and to unify the larger remote sensing community in the area of digital aerial imagery. The proposed tools will allow USGS and partners to acquire and archive common quality products and achieve the capability to use interoperable products in order to support of future science change and impact assessment requirements. The procurement domain’s processes and tools defined in the DIQAP will provide a solid quality baseline for all Federal, IFTN, and Government partners’ image products and will establish a common, consistent past

performance methodology. These processes will allow consistent metrics for contractors to work toward and result in better quality data and products for the Government. Government groups have said the following in support of the Spec and Check tool in FY09: “This could be the most important thing we contribute” – IADIWG Members, and “Where is the tool you promised? We could use it!” – USGS Contracting.

Sustaining Operational Enhancements and Future Work Requirements

In addition to the work needed to provide the initial operational capability for the four individual portions of the Digital Aerial QA Plan, there are several overarching and supporting tasks that must be undertaken to put this Plan in place and communicate its use to the community and to provide future operational needs and enhancements.

These tasks include:

- Development of a “Federal Digital Imaging Guidelines” that explain the QA plan and how people should use it to benefit their procurement of digital aerial data.
- Publications in trade and scientific journals describing the Digital QA Plan and its components as well as pertinent USGS work related to this to help maintain the USGS reputation for technical expertise in the aerial imaging arena.
- Enhancement of automated assessment tools.
- Enhancing digital imagery definitions and measurable processes for QA.
- Development of additional National Ranges.
- Upgrading cal/val range and target specification documents for imagery, LiDAR, and SAR as needed.
- Range, target, enhancement and associated tool research and enhancement.
- Laboratory and research work to restore and maintain the reputation earned by the USGS in decades past on the fields of aerial as well as space-borne remote sensing technologies.
- Working towards a common National Control & Check-point Library.

In summary to the description above, a **QA Plan Summary Table** is attached in Appendix 2 to provide a high level summary of tasks for FY10, FY11, and FY12 and beyond. This table is at an overview level and covers project level tasks. The table does not cover all detailed subtask requirements and efforts.

Appendix 1: QA Plan Benefit Summary Table

	Contracting Agents/Officers (COs)	Digital Aerial Sensor Manufacturers (MFRs)	Digital Aerial Data Providers (DPs)	Digital Aerial Data Product Consumers
Contracting Guidelines	<ul style="list-style-type: none"> Standardized terms and descriptions make contracting easier and clearer Guidelines help acceptance of digital aerial data and its benefits Standardized terms and guidelines help COs more accurately describe their users needs 	<ul style="list-style-type: none"> Clearer, easier contracting build greater demand, for digital aerial products, thus greater demand for sensors/systems. Better understanding and expectations of digital aerial products by purchasers drives greater satisfaction. 	<ul style="list-style-type: none"> Clearer, more precise contracting language and expectations mean fewer misunderstandings and problems with customer. Common specifications are more directly communicated Improves ability to meet customer expectations. 	<ul style="list-style-type: none"> Clearer contracting standards mean greater likelihood of receiving data products that meet consumer’s needs Clearer language helps COs more precisely and consistently buy the data consumers need
Manufacturers Certification	<ul style="list-style-type: none"> CO knows if D.P. is using high-quality systems to generate data. COs better able to determine if system can produce desired data 	<ul style="list-style-type: none"> Independent certification helps promote sensor system. Substandard systems are less likely to enter marketplace; data quality remains high Increased acceptance of digital systems leads to greater demand. 	<ul style="list-style-type: none"> DPs are assured that sensor systems can meet MFR claims DPs have operation and maintenance requirements clearly laid out Calibration is designed and done by those who designed systems 	<ul style="list-style-type: none"> Data consumers know that data products originated from high-quality systems High-quality data encourages continuing demand
Data Providers Evaluation	<ul style="list-style-type: none"> CO can see that a D.P. has met minimum standards for quality processes. Helps COs build trust of certified DPs 	<ul style="list-style-type: none"> DPs are expected to operate MFR’s systems in accordance within specifications Holds DPs to maintenance standards of MFR systems 	<ul style="list-style-type: none"> Independent certification helps promote DPs and their capabilities. One certification for DP; not for each camera DP no longer taking cameras out of service, expense of shipping, etc. 	<ul style="list-style-type: none"> Data consumers know that data products originated from high-quality systems High-quality data encourages continuing demand
Acceptance Standards	<ul style="list-style-type: none"> COs understand how the products they are ordering will be judged COs know that the products can be fairly measured. 	<ul style="list-style-type: none"> Clearer understanding of digital sensors capabilities encourages use; grows end-customer base & demand 	<ul style="list-style-type: none"> DPs know the standards to which their products will be judged; customer expectations clearer 	<ul style="list-style-type: none"> Data consumers have common standards by which to judge data products Clearer standards develop clearer expectations

Appendix 2: QA Plan Summary Table

QA PLAN Support	IADIWG/ASPRS/MAPPS agreement	US and International Collaboration	International Coordination	US and International Collaboration
Timeline	Current (FY10)	Expected (FY11)	Future (FY12 and beyond)	Additional (FY12 and beyond)
Data Generation Domain				
Sensor Type Certification				N/A
Resources	R&D base/partial reimbursable	R&D base/fully reimbursable	R&D base/fully reimbursable	
Baseline	4 per year	5 per year	5 per year	
Timeline	3 months per certification	3 months per certification	3 months per certification	
Funding Type	SIR/REI	SIR/REI	SIR/REI	
Report Funding Source	REI	REI	REI	
Process Incorporation	NGP	NGP	NGP	
Sensor R&D and base team Funding	LRS	LRS	LRS	
Data Provider Evaluation	plan/manual process	assess over range	assess over range	
National Ranges	3	5	6	6-8 ranges and control point library
Image to Image Evaluation Geometry	draft evaluation process and documentation / and Range and Target Specs	Completed evaluation process and documentation/ Support for an automated tool	common data base	Support for an enhanced automated tool and support to incorporation tool into checkpoint library
Image to Image Evaluation Spatial	R&D	Develop targets and tools	operational	Enhanced MTF tools
Radiometric Evaluation	Manual satellite process	Aerial research	Need to establish satellite and aerial methods and processes	Funding to research and establish satellite and aerial methods and process
LiDAR cal/val interoperability Process	Discussion/White papers	R&D	operational - establish satellite and aerial methods and targets	Research Targets and Process and write process
Control Point Database	population	enhancement	common OGC use	Funding to incorporate, develop tools, and test process and tools
DP Cert Timeline	4 weeks	4 weeks	3 weeks	2 weeks
Funding Type	R&D	operational/reimbursable	operational/reimbursable	Enhanced Automated Process - R&D
Funding Source	LRS satellite /NGP Aerial	LRS satellite (2) /NGP Aerial (3)	LRS satellite (3) /NGP Aerial (3)	LRS satellite (3) /NGP Aerial (3) and support for control point library started at USDA
Data Procurement Domain				
Contracting Guidelines	Consolidated Federal Contract Documentation		Tied to spec and check knowledge base (USGS and IADIWG support)	Refined and tied to spec and check knowledge base (USGS and IADIWG support)
Spec and Check tool	Spec and web modular baseline tool	Common Specification/Definitions/QC process	Knowledge base/WIKI	Enhanced and enhanced definitions toolset
Quality Tracking and Performance DB and Tools	FAR requirements	NOAA THOMIS	IADIWG Enhanced Contract Performance Tool	IADIWG Enhanced Contract Performance Tool