ACQUISITION PLAN FOR DIGITAL IMAGERY FOR THE SAN DIEGO REGION

October 2004

Prepared by
The Imagery Subcommittee of
The San Diego Regional GIS Council

ACQUISITION PLAN FOR DIGITAL IMAGERY AND TERRAIN DATA FOR THE SAN DIEGO REGION

Purpose and Goals

Local and regional agencies have an on-going need to acquire up-to-date digital imagery and terrain data to support their on-going work efforts as well as natural disasters or other emergencies that may arise. The acquisition of high- to very-high resolution, region-wide digital imagery is costly. To overcome the high acquisition costs and complexity of image acquisitions, multi-agency acquisition partnerships have been formed to make obtaining these data possible. After considering the lessons learned from past acquisition partnerships, the San Diego Regional GIS Council formed an Imagery Subcommittee to address the need for continued, on-going, regional coordination and to define actions that will facilitate a cooperative approach to future imagery and terrain data acquisitions.

The purpose and goals of the Acquisition Plan for Digital Imagery for the San Diego region are to:

- Provide a framework, schedule, and budget estimates for future coordinated imagery and terrain data acquisition projects,
- Facilitate procurement of digital imagery products which best meet the needs of regional and local agencies,
- Facilitate and promote sharing of digital imagery between multiple agencies in the San Diego region,
- Reduce individual agency acquisition costs for digital imagery and terrain data by sharing workload and costs,
- Reduce data redundancy by promoting local, state, and federal cooperatives and partnerships, and
- Standardize the process for acquiring imagery and for generating terrain data.

The benefits of multi-agency partnerships to procure digital imagery and terrain data are:

- Partnerships and pooling of funds allow for economies of scale to be realized while significantly lowering the cost to individual agencies.
- Partnerships and pooling of resources may allow for digital imagery to be obtained on a more frequent basis and on a known schedule; thereby providing more current, up-to-date imagery to support on-going work, homeland security, natural disasters, and other emergency efforts.

- Image acquisition projects that are cost prohibitive for one agency may be feasible through the use of partnerships.

- Without partnerships and pooling of funds, many image acquisition projects may not occur.

- In general, partnerships and pooling of funds and resources allow for higher resolution data and a broader area of coverage to be obtained, thereby making the data useful to more agencies and a wider variety of applications and increasing the analysis area available for individual agencies.

- Image acquisition tasks, such as research, procurement, evaluation of imagery products, and distribution of final products, can be shared among partnering agencies thereby reducing the burden to any single agency.

- Interagency collaboration and partnerships provide for a broader use and acceptance of the imagery, promotes data sharing between agencies, and provides agencies in the region with a common base for digital imagery.

Proposed Digital Imagery Products and Acquisition Schedule

The actual costs of any digital imagery acquisition project will vary and be dependent on a number of factors. The most significant factors affecting the total cost to acquire digital imagery include the type, resolution, positional accuracy, and required area of coverage. As a general rule, as resolution, accuracy, and area of coverage requirements increase, the costs to acquire these data increase. However, per unit area costs will decrease as the total area covered by the imagery acquisition project increases. In addition, the number of agencies ultimately involved in the acquisition project will also affect the costs to individual agencies.

Table 1 provides information on the proposed acquisition schedule for digital imagery and on the desired and minimal acceptable products for both regional and subregional scale imagery. There are a number of local aerial photography vendors in San Diego and Southern California that prepare off the shelf true color digital imagery for San Diego on an annual basis. These data have a very quick turnaround time between image capture and delivery of final image products. Historically these image products have not had rigorous rectification or color balancing processes, did not cover the entire region, had restrictions on distribution, and were packaged inside of proprietary viewing software packages. However, over time these off the shelf imagery products have improved in spatial resolution, spatial accuracy, and expanded in area of coverage. In addition, imagery from these vendors can usually be obtained at a reasonable cost. Therefore, these products may satisfy the requirements for regional scale imagery and serve the needs of most regional agencies. Some regional agencies need color infra-red imagery to support some of their work programs. These imagery products may be able to be obtained by working cooperatively with the USGS DOQQ program.

Assuming that the off the shelf imagery may satisfy regional scale imagery needs, Table 2 provides cost estimates for various resolution image products that can be used for budgetary purposes for a multi-resolution image acquisition project. Attachment A

describes the assumptions that were used to prepare the budgetary cost estimates. The cost estimates are in 2003 dollars, conservative (most likely on the high side), loosely based on required area of coverage, and are based on past experiences and current knowledge. Conservative estimates are useful for budgetary purposes. It is better to have more than enough money for a project, so as to make the project feasible. The timing for the next imagery acquisition effort is based on the fact that two significant subregional efforts are currently underway. First, a partnership of eight agencies is underway to acquire 2004 imagery Chula Vista, National City, Coronado, Imperial Beach, Escondido and nearby areas. Second, the City of San Diego plans to acquire highly detailed subregional scale imagery for the entire city in 2005. For these reasons, the next subregional effort is planned for 2009/2010; with updates occurring every three to four years thereafter. The Imagery subgroup will work with the City to allow other agencies to participate in their 2005 imagery acquisition project. This will become a pilot project to determine if multiple-resolution, multi-agency partnerships can work in 2009/2010 and into the future and if the budgetary numbers contained in Table 2 are accurate for 2005.

This document currently focuses only on a plan for the coordinated acquisition of digital imagery, and does not include costs to acquire new terrain data. The National Oceanographic and Atmospheric Association (NOAA) is preparing a terrain model for the San Diego region that is assumed to support the rectification of both the desired regional and, in most cases, the subregional scale digital imagery specified in Table 1. The NOAA terrain model uses the IfSAR technology to produce a first return elevation surface (not bald earth). This terrain model will have elevation values every 3-meters with a +/- 1-meter vertical accuracy. Agencies with existing, locally developed, accurate terrain data should continue to use these data in the production of subregional scale imagery. In areas where there has been significant grading or other alteration of the land, agencies may wish to update the terrain data for these areas.

The San Diego Regional GIS Council strongly encourages local agencies to adopt the plans, schedule, and recommendations contained in this document and to use the cost figures in Table 2 to budget for desired image products. Adoption of this document will assist in the planning and budgeting for future image acquisitions and lead to more coordinated, systematic approaches to obtaining up-to-date imagery. Adoption of this document and participation in this cooperative acquisition effort will require a formal letter of intent to be signed by each participating agency. The more agencies that adopt this plan and participate in on-going digital image acquisition projects, the lower the costs will be to individual agencies.

In addition, each digital imagery and/or terrain acquisition project will require a formal letter of commitment or memorandum of understanding (MOU) to ensure adequate participation and funds will be available to complete the project. If there is not enough agency interest, participation, and commitment at the start of an acquisition project, the acquisition may not occur or a less desirable imagery product may be obtained with the committed funds.

A companion document entitled Acquisition Guidelines for Digital Imagery and Terrain Data for the San Diego Region describes in more detail the benefits of coordinated, multi-agency acquisition projects; documents typical issues that need to be considered when acquiring

digital imagery or terrain data; outlines the major tasks associated with successful imagery acquisition projects; and provides a history of regional and subregional imagery acquisitions to date. Both the Image Acquisition Plan and the Image Acquisition Guidelines are dynamic documents and will be updated periodically as technologies and the region's need for digital imagery change.

Table 1.

Imagery Characteristics	**Regional Scale Imagery**		**Subregional Scale Imagery**	
	(A) Preferred/Desired Image Products	(B) Minimum Acceptable Image Products	(A) Preferred/Desired Image Products	(B) Minimum Acceptable Image Products
Spectral Resolution	True Color or CIR	True Color or CIR	True Color	True Color
Spatial Resolution	2-foot	3-foot	6-inch	1-foot
Anticipated Frequency of Updates	approx. every 3 years	approx every 5 years	approx. every 3 years	approx every 5 years
Temporal Specificity	Spring, hours with least shadows	Fall, hours with least shadows	Spring, hours with least shadows	Fall, hours with least shadows
Positional Accuracy	+/- 15 feet	+/- 33 feet	+/- 5-foot	+/- 10-foot
Area of Coverage	San Diego County, Approx. 4260 sq. mi.	San Diego County, Approx. 4260 sq. mi.	Western Urbanized, Approx. 1500 sq. mi.	Western Urbanized, Approx. 1500 sq. mi.
Proposed Acquistion Schedule	As Needed or in conjunction with subgregional imagery acquistions		Every 4 years, beginning in FY 2009	
Radiometric Balance *	Uniform tonal balance across project area			
Coordinate System/Units *	CA State Plane NAD 83, US Survey Feet			
Metadata *	Complete Documentation			
Image Compression *	Yes, compatible with ESRI GIS software			
Ground Control *	Sufficient to meet Positional Accuracy			

* *Requirements for these imagery characteristics are the same for all image products*

October 2004

Table 2.

Per Agency Budgetary Cost Estimates for Digital Imagery

Required Area of Coverage (square miles)	2-foot resolution *	1-foot resolution	6-inch resolution
<10 sq mi	$ 2,000.00	$ 3,500.00	$ 5,000.00
11-25 sq mi	$ 3,500.00	$ 6,000.00	$ 12,000.00
26-50 sq mi	$ 4,500.00	$ 8,000.00	$ 17,000.00
51-70 sq mi	$ 5,000.00	$ 10,000.00	$ 22,500.00
71-200 sq mi	$ 6,000.00	$ 20,000.00	$ 40,000.00
200 - 500 sq mi	$ 8,000.00	$ 35,000.00	$ 75,000.00 **
500+ sq mi	$ 10,000.00	$ 50,000.00	$ 100,000.00

* Agencies generally requiring 2-foot resolution imagery for their area of interest can specify areas they would like to have imagery at higher resolutions. The costs incurred for these areas of higher resolution would be based on the number of square miles needed and the resolution as shown in the Table above.

** Assumes that the City of San Diego participates in the multi-agency partnership, is the cornerstone of the project, and pays for the full cost of their desired final image products.

Attachment A.
Assumptions behind the budgetary cost estimates

1. Costs to prepare the desired image products were obtained from vendor responses to a formal request for cost estimates to prepare the products specified in Table 1.

2. Costs are for obtaining digital imagery only and do not include the costs for new or updated terrain models/data or image compression.

3. Costs assume that the NOAA IfSAR 3-meter DEM will be available and useable for all image products described in Table 1.

4. Costs are based on image acquisitions using conventional aerial cameras (other capture methods will cost more).
    a. Image capture with digital cameras will cost an additional 80% for 2-foot resolution imagery, and would be more than double the cost for 6-inch resolution
    b. Image capture with Satellites would cost an additional 60% for 2-foot resolution imagery (6-inch resolution is not commercially available from satellites)

5. Budgetary cost figures include the costs of image acquisition, project management, project administration, QA/QC of final image products, delivery of final products, and a 10% contingency to accommodate changes in the project.

6. Budgetary cost figures are to prepare the digital image products only, and do not include creating a DEM or contours.

7. Budgetary cost figures are based on the number of agencies that have historically participated in past digital imagery acquisition partnerships (about 30 agencies total, of which about 25%-30% have been regional agencies).