American Museum of Natural History
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Ned Horning

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Center for Biodiversity and Conservation
American Museum of Natural History
Central Park West at 79th street
New York, New York, 10024 USA

Writing technical specifications for a remote sensing project

This document provides guidelines for writing and evaluating the technical specifications for a remote sensing project. It is targeted toward individuals and organizations with limited remote sensing expertise and limited funds. We will present some examples that could be used for a project to map land cover using satellite imagery. Not all specification possibilities will be covered but the intent is to provide a reasonable framework from which specifications for a remote sensing project could be developed.

The technical specification portion of a contract details how the project will be conducted. Technical specifications can be written entirely in-house or they can be written in collaboration with a consultant or contractor proposing to conduct the work. In either case it is important that the organization requesting the work be able to evaluate the specification and at the end of the project to verify that the conditions laid out in the specification have been met. At times it may be necessary to solicit help from a third party to write the technical specifications or evaluate the deliverables.

Putting the specification into perspective

Technical specifications can range from extremely detailed to quite flexible and open. The advantage of writing a very detailed and restrictive specification is that there is little leeway with regard to interpretation of the content and quality of the deliverables. The downside is that there is generally a direct relation to how restrictive the specification is and the total cost of the project. Also, the cost to validate the deliverables can be quite high, especially when highly accurate products are requested. Most non-governmental organizations (NGOs) have limited budgets that can be used for remote sensing projects and in order for them to get the most from a small pot of money a balance must be reached between the rigor of the specification, the type and quantity of the deliverables and the money available for validating the delivered products. There is no magic formula that can be used to determine this balance. Experience tends to be the best asset in determining this balance and it usually requires an iterative process of estimating the level of effort for possible scenarios and selecting the one that best meets the project objectives. Another outcome of this process is a reasonable expectation of what can be expected from the project deliverables.

Writing the specification

- Introduction
- Scope of work
- Deliverables
- Data specifications
- Licensing
- Schedule

- Budget
- Appendices

Introduction

An overview of the project and project justification should be presented in this section. Objectives of the project should be included in the overview. The information in this section should provide the overall scope of the project. It provides background information for the remaining sections that delve into more detail. A description of the project area and a map showing the location is useful. The introduction should provide

Scope of work

Information about each of the tasks that will be performed under this contract should be included in this section. Each task should be described sufficiently to give the reader a thorough understanding of what will be done as part of the task. Some example tasks are:

- Preview and order Landsat Enhanced Thematic Mapper (ETM) imagery for the area of interest.

  Using the guidelines in the data specification sections the most suitable Landsat ETM image will be selected and ordered. Level 1 G imagery will be ordered.

- Orthorectify the satellite image.

  Use NED DEM dataset to orthorectify the Landsat ETM image with an RMS error of 50 m or less. GPS derived ground control points collected by the client will be used as tie points.

- Validate the land cover classification

  The land cover validation will use a statistical design to systematically sample points or areas within the study area to determine the per-class accuracy and overall accuracy of the land cover classification.

Deliverables

The deliverables sections should detail exactly what is going to be delivered by the end of the project (hardware, maps, software, original imagery in hardcopy and digital forms, or other documents). The number of copies and the medium on which they will be delivered should also be included. For example:

> 3 copies of 1:200,000 scale land cover classification output using the data specification guidelines. All copies will be printed on color glossy photo paper using an HP DesignJet 5500 printer. All satellite data (original and orthorectified) will be delivered on CD-R in GeoTiff format.

Data specification

In this section the detailed specifications of any data, such as maps and images, are laid out. These details can include the following:

- scale or resolution (1:100,000 scale, 30 m resolution) ,
- suitable dates and image types for original data acquisition (Landsat Enhanced Thematic Mapper satellite imagery must be acquired between June 15 and September 5, 2002),
- acceptable cloud cover in original imagery (average cloud cover over the study area must be less than 20%, however, the area within the capital city must be cloud free),
- projection information (all Satellite imagery used during the project and final maps produced during the project will be delivered with a projection of UTM Zone 18N using the WGS 84 Datum),
- acceptable accuracy limits (land cover maps must have an RMS error of 50m or less and per class accuracy must be 80% or better for all classes),
- file formats (all imagery must be delivered in GeoTiff format and vector data must be in Shapefile format with accompanying projection [.prj] file),
- storage media for delivery (all data will be delivered on DVD-R disks),
- symbolism used on the map (the colors for each land cover class can be left up to the consultant or it can be specified by including the red, green, and blue intensities (i.e., Bright Red = 255, 0, 0) for each color)
- classification system (the National Land Cover Dataset [NLCD] land cover classification definitions will be used to define land cover classes),
- Include anything else that pertains to data that will be used for the project or data that will be created during the project.

Licensing

The licensing section describes who owns the original data and the deliverables with clearly written details on how these data can be used and distributed. This is becoming increasingly important with the varied licensing terms that are used for commercial satellite imagery.

Schedule

The schedule should provide a timeline illustrating when the different tasks will be carried out and how the different tasks are interrelated if that is an issue. This section should also include information about when the different deliverables will be delivered. If there are several tasks involved in the project it is convenient if this information is presented in the form of a timeline so it is easy to visualize when each task will be taking place.

Budget

The budget should clearly show how the money is being partitioned throughout the project. Each major budget item should include a justification explaining why the amount indicated is needed to support a particular task.

Appendices

This is an area for supporting documentation including maps and tables that make the specification easier to understand and documents that go into more detail than what is called for in the previous sections. For example, it could include a glossary, list of acronyms, and technical specifications of satellite imagery that will be used during the project.

Validating the deliverables?

After products are delivered it is important to verify that they meet the specifications. Ideally one would design a validation plan that would likely include significant fieldwork and additional data collections to verify that the delivered products are satisfactory. Unfortunately this is quite costly and is rarely done when working with small budgets. At the very least a third party should review the products and methods to make sure there is a reasonable likelihood that the products meet the specifications.

If sufficient expertise exists in your organization then the validation can take place using in-house staff. If, on the other hand, the necessary expertise does not exist in-house than outside help should be solicited to either carry out or assist with the validation work. Some points on working with consultants are covered in the document How to determine when to hire a consultant and when it is appropriate to do work in-house.

If the products do not meet the specifications then the products must be corrected unless some other process is defined for this situation in the terms of reference. If the consultant disagrees with your decision that the products do not meet the specification then some sort of arbitration must start. The details of this arbitration process should be outlined in the contract.

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