

REMOTE SENSING FOR AIRPORT DEVELOPMENT AND TRANSPORTATION PLANNING

Randy Murphy, Founder
Grafton Technologies, Inc.
43 Federal Street
Newburyport, MA 01950
Rmurphy@GraftonTech.com

ABSTRACT

This paper describes the need to share information between airport planners and managers and their counterparts at other agencies as a means to facilitate infrastructure development and urban planning in the vicinity of an airport. How this need can be addressed by packaging remotely sensed data with other information in an intuitive web-based application is the subject on a U.S. DOT Research and Special Programs Administration technical application project. This paper describes this project and the demonstration of the resulting Airport Development and Planning Tool at two demonstration airports, the Portland International Jetport in Maine and the Ted Stevens Anchorage International Airport in Alaska.

IDENTIFYING THE NEED

Currently there is a gap in the knowledge base transportation planners representing different modes of transportation have of each other's requirements. This is particularly the case between airport planners and developers and their counterparts involved with other modes of transportation. This gap is apparent in several airport projects in which Grafton Technologies has been involved. Examples include highway light poles and signage that obstruct airspace surfaces, growth limitations imposed on an airport due to poorly planned access roads and expensive land acquisition programs to accommodate new runways. While this gap has existed since the beginning of aviation, the problem has worsened as urban development and airport expansion have consumed much of the open space around airports.



HOW REMOTE SENSING CAN HELP

Remote sensing offers a unique opportunity to close this knowledge gap by providing a broader coverage of information than airport planners have traditionally surveyed and with more information than wider GIS initiatives usually provide. More specifically, remote sensing offers airport planners and developers a cost effective method of broadening their planning area so that the impact of their infrastructure development and flight operations can be better understood by the regional transportation planners and land developers with whom they interact. Conversely, remote sensing offers a backdrop onto which transportation and municipal planners can post

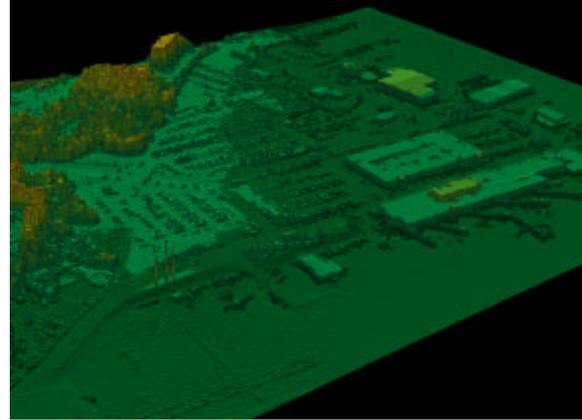


REMOTE SENSING FOR AIRPORT DEVELOPMENT AND TRANSPORTATION PLANNING

Pecora 15/Land Satellite Information IV/ISPRS Commission I/FIEOS 2002 Conference Proceedings

information on projects such as roadway development or zoning bylaws that is of interest to airport planners.

Remote sensing, however, is not just a means to obtain broader coverage. It offers the ability to identify patterns of development and environmental change as well as specific features that are relevant to airport planners. The location of buildings, density of housing, growth behavior of vegetation and the suitability of terrain for development are examples of the type of information that can be derived from remotely sensed data. Two types of remotely sensed data that have shown particular promise for aviation are LIDAR and multispectral imagery. LIDAR has the ability to provide highly accurate elevation data that is critical to aircraft operations. The FAA has been interested in using LIDAR to identify and map obstructions to navigable airspace and has funded research into this application. Multispectral imagery is of use in assessing the natural environment around an airport. Information on trees that can grow to become obstructions, wetlands in potential construction areas or vegetation that can attract birds can be critical to managing an airport.



LIDAR to identify and map obstructions to navigable



Currently, More Questions than Answers

As with any new technology, potential users and more importantly those who will pay the bills currently have more questions than answers. For aviation applications, the two most common questions are accuracy and cost. With regard to accuracy, a concern is whether satellite imagery is as accurate as the traditional aerial photography to which airports have grown accustomed. With the launch of Space Imaging's Ikonos and DigitalGlobe's QuickBird, the resolution and accuracy of satellite images has improved substantially. It is still not at the level produced by aerial photography. This does not however mean that satellite imagery cannot meet the accuracy requirements of many airport applications. This then leads to the second question of cost. Can remotely sensed data provide enough benefit, in relation to its cost, to justify its use? While further cost/benefit analysis is required, recent cost reductions of high-resolution satellite imagery, the lack of mobilization costs for satellite platforms, a growing amount of archived data and advances in digital photogrammetry are all positive indicators. This being said, remotely sensed data should not be seen as a replacement for traditional aerial photography which is still required when extremely high accuracies are needed.

A Project Designed to Provide Answers

This project, being funded by the U.S. DOT Research and Special Programs Administration, is an attempt to provide some answers to the questions aviation users have. Instead of just answering the questions based on research alone, the goal is to demonstrate the effectiveness of remotely sensed data by using it to develop a tool that can be used to address the needs of airport planners and managers and their counterparts.

Application Design Focused On Portland Area Users

First, recently collected remotely sensed data for the Portland International Jetport in Maine was used as the basis for a GIS application to be used by Jetport, City of Portland, Greater Portland Council of Governments and Maine DOT transportation planners and analysts. The application was designed to meet the needs of these organizations as identified through a series of meetings and interviews. In addition, discussions were had with representatives of the FAA and other national agencies who have a stake in airport development.

The result of these requirements gathering activities was the following objectives for the Portland GIS application as well as the project as a whole:

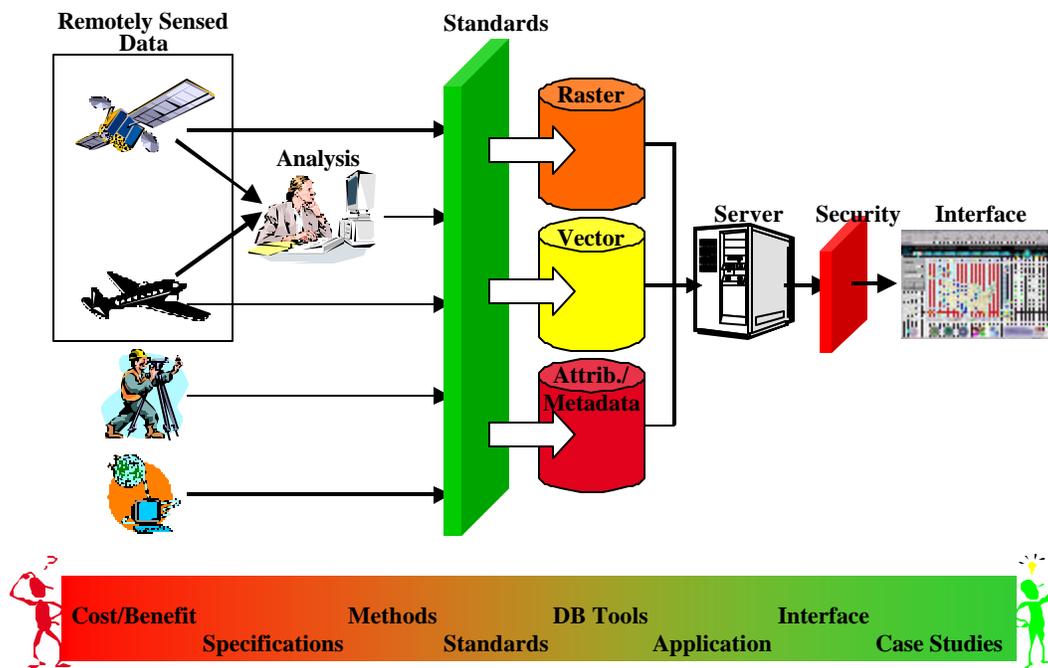
- Identifying urban growth patterns that can constrain future airport development.

- Evaluating the effect airport configuration changes can have on surrounding transportation corridors and land areas.
- Illustrating areas of where road construction and land development can come into conflict with airport operations.
- Showing that remotely sensed data is a cost effective means to support regional planning around an airport.

Technical Design

Next, the technical design of the application had to satisfy these objectives for a variety of users from a variety of agencies. To accomplish this, web-based technology was used to develop a secure application to be deployed over the Internet. Using ESRI's ArcIMS and Macromedia's ColdFusion, maps and tabular data alike could be deployed to anyone with an authorized username and password. The graphical user interface was also designed to be as intuitive as possible since the ability of users to attend training could not be counted upon.

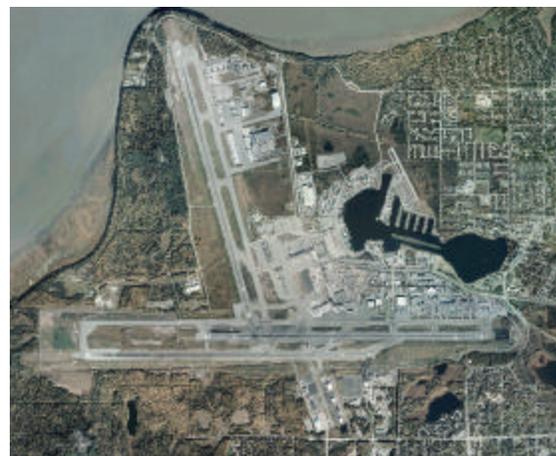
Application Conceptual Design



The final deliverable of this initiative is not only a web-based GIS application, but a knowledge base of factors and issues that need to be considered by each of the thousands of airports in the U.S. which are expanding within urban environments that are also growing. This information includes a clearly documented methodology and specifications that other airports can apply to develop similar solutions for themselves, a sort of recipe for applying this solution elsewhere.

Anchorage Implementation

To verify that this recipe can work for a wide variety of airports, the methodologies, application functionality and documentation developed for the Portland International Jetport was applied at the Ted Stevens Anchorage Interna-



tional Airport. Although very different in terms of location, climate and air traffic, Anchorage users were found to have many of the same needs as Portland users. The hypothesis, which is being proven by loading Anchorage data into the application developed for Portland, is that these similar needs will lead to a similar benefit in using the application and the remotely sensed data it contains.

Related Projects

Important to the success of this project is its correlation with other research initiatives currently being conducted, some with which Grafton Technologies is involved. Most notably is the Satellite GIS Mapping Project that has produced the data sets that are available for this project. Other related initiatives include a project being proposed to the FAA to store electronic basemaps for airports and an expert system to automate the conversion of remotely sensed data to useful vector information within the controlled environment of an airport.

Project Team

The project team for this initiative includes Grafton Technologies, researchers in the Geological Sciences Department of Brown University and personnel from the Portland International Jetport and the Ted Stevens Anchorage International Airport. Randy Murphy, the proposed Principal Investigator, has over 13 years of experience developing information systems for the transportation industry. He is a founding member of both the American Association of Airport Executive's GIS Subcommittee and the FAA's National Airspace System Information Architecture Committee's GIS Working Group. Through these venues he has identified the need for this project and hopes to promote acceptance of the solution it delivers.



By establishing the value remotely sensed data can offer to airport planners and their non-airport counterparts, this project hopes to alleviate many of the infrastructure expansion problems facing airports throughout the country and in doing so encourage more proactive and compatible land use and transportation planning around airports.