

Vermont's Geographic Information System:  
Development to Implementation

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**Abstract**

This paper will summarize Vermont's efforts to develop an intergovernmental GIS. The paper explores and explains how Vermont went about creating such a system; a description of the planned components and operational characteristics; obstacles to implementation; characteristics of memoranda of understanding between the partners; barriers to implementation; and lessons learned thus far.

**Origins**

Vermont's history with GIS dates back to the late 1970's at the School of Natural Resources at the University of Vermont. Using federal and state money they built a very pragmatic GIS. Their initial orientation was to natural resource management. They had developed an extensive data base for three of Vermont's fourteen counties. As they became convinced of the power of the technology they began to see many planning uses for it. A number of communities came to them seeking help.

They then became major proponent of the technology. They put on demonstrations around the state building broad-based support when they left.

Commission on Vermont's Future

Governor Kunin established a blue ribbon panel to look into how Vermont should be taking charge of its future. The Commission concluded that to help communities and regions plan for the future and meet common goals they would need a GIS to help them in this endeavor.

Governor's Action Plan

Governor Kunin took the Commission's recommendations on growth management and she proposed comprehensive legislation that would integrate state, regional and local planning efforts in a consistent manner. Her visionary proposal included the development of a statewide, intergovernmental GIS.

Legislative Action

The Vermont Legislature considered the proposed legislation and modified it, passed it in May, 1988 and it became Act 200.

Had this legislation not passed a number of senators had ready a separate bill for establishing a GIS. The members of the Senate Natural Resources Committee felt that the

benefits of a GIS would be a major help for many state planning and resource management needs.

**Law to Implementation**

The Governor charged her Secretary of Administration to oversee the implementation of the plan for the development the Vermont GIS.

Oversight Committee

He established a fifteen member Policy Oversight Committee. The Committee was chaired by his Deputy and most of the staff work was accomplished by myself, a policy analyst in the Governor's Office of Policy Research and Coordination.

The Committee then established a Work Group which then established Sub-Committees. The Committee also decided upon pilot projects and the solicitation through an RFP the development of an implementation plan.

Pilot Projects

Five pilot projects were initiated during the time that the planning study was underway. The three of the projects were by selected as part of an RFP solicited from the 12 regional planning commission and 251 towns in Vermont. Two Regional commissions and one city were chosen to participate in the projects in January.

The Oversight Committee felt that the state could learn a lot from the hands on interaction with the technology.

Planning Study

Because of the complexity and cost of the system, the Policy Oversight Committee felt that a long range planning study was needed.

Deciding how a GIS will be used is the fundamental issue in its design. These determinations played a key role in designing the system and in ranking the relative importance of data acquired in order to make these uses possible.

In the fall of 1988, the consultants surveyed and interviewed over 60 Vermonters who have some connection to geographic data. The results of this process resulted in recommendations for GIS use priorities at the state, regional and local level.

The applications are described in Table 1. "Priority 1" refers to uses of the GIS that should be complete or largely complete by June 30, 1991. "Priority 2" refers to GIS uses that, because of financial limitations, probably cannot be begun until 1992; but which should be available by the end of fiscal 1994.

**Priorities**

Needs Study

A needs survey was the first component of the planning

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study. This intensive survey exercise was accomplished over a four week period. The consultant completed the summary of the results by the end of November.

The survey addressed priority application needs and compiled a complete geographic data resources catalogue. In addition the consultant presented some initial organization options as well as data standards issues.

The work group and committee reviewed the material and recommended changes. The general orientation was to address Act 200 local needs as the highest priority.

**Table 1**  
**Application Priorities**

<u>Priority 1</u>	<u>Priority 2</u>
<u>Natural Resources</u> Flood Plain Mapping Inventory/Mapping Wetland Mapping Land Cover Mapping Sensitive Natural Area Mapping Timberstand Management Water Discharge Tracking Hazardous/Solid Waste Site Planning	<u>Natural Resources</u> Water Well Drilling Inventory/Mapping Environmental Impact Analysis Support Groundwater Modeling Air Discharge Tracking Water Discharge Tracking  <u>Land Use Planning/Zoning</u> Support for Comprehensive Planning Permit/Development Tracking Rezoning Evaluations Support for Redistricting Support for Public Land Acquisition
<u>Land Use Planning/Zoning</u> Demographic Analysis Historic/Archeological Site Mapping Land Use Map Production Zoning Map Production	<u>Public Works and Transportation</u> Traffic Volume/Accident Analysis Route Analysis Plat/Site Plan Review Right-of-Way Management Pavement Management
<u>Public Works and Transportation</u> Special Road System Map Production Analysis	<u>Parcel Mapping/Property Appraisal</u> Identifying Parcels in Current Use Tax Mapping Analysis Ownership Searches/Query
<u>Parcel Mapping/Property Appraisal</u> Identifying Parcels in Current Use Tax Mapping Analysis Ownership Searches/Query	<u>Parcel Mapping/Property Appraisal</u> Property Map Update/Production Special Property Map Production Support for Field Appraisal Scheduling and Routing Appraisals
<u>Water/Sewer Utilities</u> Mapping/Tracking Well & Septic Locations	<u>Water/Sewer Utilities</u> Support for Water Supply

Permit Review  
Water/Sewer Map  
Update/Production

Mining  
Mapping Sand/Gravel  
Pits/Rock Quarries

Priority data layers

A data "layer" is a set of geographically referenced data that has a common theme and that can be overlaid on other layers. For the Large Area and Small Area Databases, the following layers will be created:

**Table 2 Priority Data Layers**

<u>Large Area Data Layers:</u>	<u>Small Area Data Layers:</u>
<u>Priority 1 (by 7/1/91):</u> Digital Line Graph Base Map Transportation Centerlines Surface Water Political and Administrative Boundaries Census Areas Land Cover Wetlands	<u>Priority 1: (by 7/1/91)</u> Orthophoto Base Map Property Parcels Transportation Centerlines Land Use/Cover Zoning Flood Zones
<u>Priority 2: (by 7/1/94)</u> Soil Associations Groundwater Features Historical/Archaeological Sites Sensitive Natural Areas	<u>Priority 2: (by 7/1/94)</u> Soils Sanitary Sewer Facilities Water Facilities Septic Systems
<u>Priority 3: (after 7/1/94)</u> Topographic Contours Watersheds Geology Recreational Facilities Infrastructure Facilities Solid/Hazardous Waste Sites Utility Transmission Lines	<u>Priority 3: (after 7/1/94)</u> Topographic Contours (2' Interval) Political/Administrative Boundaries Stormwater Facilities Dams, Bridges, Culverts, Etc.

### GIS Home as a HUB

An Office of Geographic Information Services will serve as the central hub/clearinghouse for the Vermont GIS. This office will be responsible for the development of the system, data management and distribution, standards and operational procedures.

### The Spokes

Three state agencies--Development and Community Affairs, Natural Resources, and Transportation along with the twelve regional planning commissions are the supporting network to make the Vermont GIS a viable effort. Each spoke will have responsibilities for data management and development and application development for each of their own needs. Regional Planning Commissions will be responsible for supporting and providing for local needs. Community spokes will be added as needed.

### Structure/Data Management

Along with the hub and spoke approach, the wheel will roll in an environment of mutual support and responsibility. The entity most closely aligned with the actual data collection will be the primary manager/storekeeper of the data. The details for this arrangement will be contained in Memoranda of Understanding and Cooperative Agreements.

OGIS will orchestrate all the component data layers and determine priority for development/financing.

### Executive Order

In early June, 1989, Governor Kunin signed an executive order which created an Office of Geographic Information Services (OGIS) and a formal Geographic Information System Advisory Board. The Office of the Secretary of Administration houses OGIS. The choice follows the consultant's and the Oversight Committee's recommendation. The key factor in this location is the access to governor and role as the key person in the state's budgeting process.

The creation of a 15 member GIS Advisory Board will provide the continual guidance to the Director of OGIS on work plan, policies, and standards.

### Operations

In July, 1989, an Interim Director was appointed. Since he had been providing the operational staff support to the effort over the last year and half, it was a natural. Using ad hoc administrative help and living in temporary quarters, he has managed to keep the effort moving forward until an office is found and personnel hired.

### Wheels of Government

Creating an operational Office of Geographic Information Services from scratch has taken considerable effort.

Legislative authorization of three positions starting July 1, 1989 really meant starting October 1. The procedural gears of government only turn as fast as the components. Personnel, outfitting and finding an office have consumed half a person-year. Procurement of computers, software, peripheral equipment and furnishings for the office took considerable effort and requires a minimum of three months lead time.

Appointing the GIS Advisory Board members required delicate recruitment and balancing skills. Efforts to fill all the "allocated slots" with talented people representing the geographic corners of the state again took three months. The Deputy Secretary and Interim Director interviewed/screened candidates and sought recommendations from the major interested segments designated in the Executive Order. The Governor reviewed the names and gave her approval in late August. The Advisory Board met for their first meeting in mid-September.

### Work Plan

The Executive Order requires that there be a one- and five-year work plan revised annually. This effort expanded upon the planning study recommendations and details the tasks and time line and associated budget. A finely tuned spreadsheet is essential in balancing the proportion of effort dedicated to each element--operations and staffing, education and training, data conversion, equipment, and special programs.

### Standards Development

A dedicated GIS Standards Committee has been developing standards in several areas--digital data, parcel mapping guidelines, and a land use coding scheme. These efforts have borrowed from other state and county efforts. Because the Interim Director has focused on so many operational efforts, the schedule for standards adoption has also taken slightly longer than expected.

### Data Conversion

Efforts are well underway to convert the priority data layers into ARC/INFO. The University of Vermont is converting all existing mapped soils data and all surface waters. The Agency of Natural Resources is converting its Natural Heritage Data Base, Hazardous Waste Sites, and Wetland data. Shortly, OGIS will issue two RFP's to digitize existing town parcel maps and road centerlines from the state's 1:5000 orthophoto base map.

### Data Interchange

By the end of the 1989, OGIS will have procedures in place for interchanging data. This very important effort will most likely go through several iterations before settling down. The issue of formats and access will provide many lively debates throughout the state.

### Training

The state's first effort at training ARC/INFO users was

successful. The state contracted with the School of Natural Resources at UVM for two weeks of training for each pilot site and a number of other local users. In total, 14 individuals from nine different organizations received training. One lesson learned from this experience is that five days of intensive training is too much. Three, three-day sessions would be better. Software should be installed and all computers should be fully functional prior to training. The group of trained users are now meeting monthly to discuss common issues and progress. These monthly sessions have proven to be excellent learning exercises.

#### **Spawning Success**

The five pilot projects are doing wonders at developing local and state agency interest. The idea that the technology can aid so many planning and related needs has sparked sufficient positive interest that concern is rising over delivery of services.

#### **Act 200 Special Planning Funds**

During the first year of Act 200 a number of communities applied for special project money. Several communities used the money to develop local resource/base maps in GIS format. Local consultants provided the services. The result has been very productive.

This winter a special round of competitive applications will be sought targeting GIS use. Money will be matched three ways. OGIS will match the Act 200 Special planning funds which in turn will need a local match. This competitive approach also provides built in investment into the statewide GIS effort. Building local support for GIS is important. Demonstrated success using the technology is critical for continued legislative and executive support.

#### **Obstacles Overcome**

In any mammoth government undertaking, the human obstacles are larger than the technology issues. In Vermont this is also the case. The implementation process has proceeded rather remarkably. A few bumps in the road have caused some rethinking, but in general the establishment of a statewide system is on its way. The first encounter with difficulty has been in keeping all the players part of the team.

#### Agency Domains

As with any large organization, Vermont is no different. Historic self-protection and patterns did not change just because Act 200 said there would be an intergovernmental GIS.

#### Act 200 Focus

Act 200 is unique in that all state agency planning must conform with regional and local planning. State agencies are to participate as a co-equal partner in these plans. They will all have to meet the 32 goals expressed in the Act. However, since state agencies have not historically planned for the impact on land use against such a sweeping

set of goals, the challenge is great. Some departments have done remarkably well at stepping up to the call. An entirely new mood exists. A single unifying theme found.

#### Standards

Vermont is a very fortunate to have complete statewide orthophoto base maps. This was chosen as the standard early on by the Oversight Committee for our large scale GIS for local planning. Developing digital data standards has taken somewhat longer than expected, but the effort has been aided by the long term expertise of the staff at the School of Natural Resources.

Reworking the state's Parcel Mapping Guidelines for towns has proved a larger task than anticipated. Manual methods are the basis of the earlier versions of the guidelines. The document required significant reworking. Debates of the recommended numbering system continue.

#### **Obstacles Yet to be Overcome**

##### Local Needs versus State Orientation

A strong undercurrent of who is the Vermont GIS going to serve has provided constant tension through the planning stage. The Oversight Committee heard numerous pleas to make the system one which local government has a major say. This healthy tension will surely continue until there delivery of the services.

##### Agency of Transportation

The Vermont GIS has been embraced by nearly all state agencies. The most difficult case is with the Agency of Transportation which has a fully developed CAD system. Over the last five years, the agency has developed a town and county map series with thousands of coded attributes. The road lines themselves however are not on any known coordinate system. The agency has not yet integrated the concepts of GIS into its operation or its many data bases. The Oversight Committee and the Agency tried to reach compromise over the agency's approach to conducting their own GIS planning study. The study or significant resolution never materialized.

Efforts to bring the Agency into the project as an integral partner are still going on. A newly appointed secretary is currently reviewing the question. Efforts to utilize the attribute data are scheduled for this fall.

##### Delivery

Can the a system that meets the demands of Act 200' tight time schedule be met? This question will play heavily on the perception and reality of achieving the VGIS goal. The goal of development of system and delivery of services has inherent conflicts in the first two years of implementation. On one hand you don't want to offer what can't be delivered in a timely fashion, and on the other hand you need to build constituent support to prove the state's investment is worth every cent appropriated.

This fine line will remain a constant over the next two years.

#### Data Updates

The development of a current database requires a continuing commitment to maintaining the data. Systems are not yet developed. Ideas abound to make this happen. This one area will also play a major role in the long-term integrity of the system.

#### **Characteristics of MOU's**

Each partner in the VGIS is expected to perform a number of mutually supported roles. Cooperative agreements with regions and towns and memoranda of understanding with state agencies and departments will become the charter of the system.

At this time, the only agreements that exist are with the pilot projects. We now have a good idea of what characteristics should be in these agreements. They include:

- Details of datalayers of responsibility
- Procedures for updating
- Commitment of staffing and adequate space for the equipment
- Adherence to standards and procedures.
- Identification of roles
- Means for data exchange.
- Provisions for use of developed data.
- Identification of clients served
- Procedures for developing cooperative agreements with local governments
- Commitment to service constituency(ies)
- Commitment to training
- Commitment of support, both financial and

leadership

#### **Hurdles Yet To Come**

Over the next two years many unexpected things will happen. Good planning can minimize these "events." Will a vested community of users develop. Can the hub and spoke concept work? Can data be maintained. Will there be sufficient resources? Will the legislature and executive continue their commitment?

These are just a few of the questions and issues yet to be faced.

#### **Political & Technical Dynamic For Success**

Can the creation of a system composed of partners who have had historic mistrust for each other become a reality. Act 200 seems to be making this part of the effort real. There is genuine interest in planning together at all levels. The enthusiasm shown at the executive level is reason to believe that it will happen. There are enthusiastic citizens and business people. Community leaders are sowing seeds now that will blossom several years from now.

#### **Lesson's Learned**

##### Good Planning

There is no substitute for thorough planning. The more preparation the better the system will work. Hiring a good consultant for this phase has helped. Developing in-house plans are a good way to go if you have lots of time, Vermont's timing for implementation was too short for anything but a consultant effort.

System implementation requires a road map. A needs analysis and conceptual plan come first. Turning that guide into action requires a detailed one- and five-year work plan are critical elements at managing the effort.

##### Planting Seeds

Spreading the seeds for early harvest has reaped many benefits. Besides the lessons learned, the interest generated by the pilot projects is paying off in the building of local support. Making an early decision to continue data conversion with the University was another important decision. Any delay in data conversion would cause delays in helping towns and regions meet their Act 200 planning deadlines.

##### Staffing

Staffing should have begun right at the completion of the planning study. As a result of not having additional staff delayed six months has hampered implementation at a critical time. Temporary help should have been recruited until positions were authorized by the legislature and personnel could classify previously unclassified positions--a entire new class had to be developed.

##### Demonstrate Success

Demonstrating that the technology can deliver early on is critical. The pilot projects are an excellent method for accomplishing this.

##### University Resources

Without the knowledge and skill base housed at the University of Vermont, the state effort would have had a definite time lag. These resources translated into training and technical support that would be impossible to replicate. The existing data layers that they have developed over the last six years are critical to the "demonstration of success."

##### Money

Without the five year appropriation, it is doubtful that Vermont's ambitious effort could have any hope of succeeding.

##### Intergovernmental Approach

Vermont has made the correct decision to develop an intergovernmental approach to GIS. Keeping data layers up

to date is a critical component. Spreading this "obligation" to the appropriate level and jurisdiction will help keep the system successful.

## THE USE OF A GIS BASED DECISION SUPPORT SYSTEM IN PHYSICAL PLANNING

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### ABSTRACT

In their work on developing spatial policies, physical planners have to do a lot of decision making, a process which requires them to have access to adequate information. Yet, in present day situations, the information supply to the planner often is not optimal or may even be inadequate, resulting in planning decisions that may not be the best ones available. One possible source of assistance to physical planners is the use of Decision Support Systems (DSS). Such systems are designed to rapidly and clearly provide the decision maker with the appropriate information to support his or her work.

A special aspect of a DSS for physical planning, which makes it different from "regular" DSS's, is the need to perform spatial data storage, display and analysis. This need suggests the use of GIS within the DSS. But using GIS within an integrated software environment means that GIS must not be perceived, as it often is, as a software package or a "toolbox". Instead, it must be seen as a technique or group of techniques of spatial data manipulation. These techniques can then be incorporated in the appropriate modules of the actual DSS. In this paper, this concept of GIS use in a DSS for physical planning is illustrated with the description of a possible Dutch planning DSS. This DSS will have to support planners in developing spatial policies based on the accessibility profiles of locations.