Spatial Data Infrastructure: On the Road to Twenty-First Century Economic Success

An Open GIS Consortium (OGC) White Paper

by Gary R. Bachula[1]

The Washington Post recently reported that a suburban Washington, D.C. bus has been equipped with a GPS locator, transmitting to a transit headquarters electronic map the exact location and movement of the bus along its route. Transit managers plan to equip the fleet of over 250 county buses later this year and expect service, safety, reliability and scheduling to benefit. They imagine the day when the system could notify an individual at a bus stop that "the next bus will arrive in two minutes and twelve seconds" and a computer could switch a traffic light to green to make sure that happens.

During the same week, a network news show highlighted a college campus concerned with personal safety where students with small pocket devices, not unlike car keyless remotes, can signal for help by a single click, with campus police pinpointing the exact location-on the street or inside a campus building-on their computer map, dispatching help within seconds.

The rapid convergence of GIS and GPS, of advanced computing and communications, promises to deliver an array of products and services, public and private, that were imagined only in science fiction a few years ago. Geospatial information will underlie many of these anticipated applications. Electronic commerce will depend on a firm's ability to track shipments in real time. GIS layers describing natural resources and population statistics will enhance emergency management and environmental monitoring. Law enforcement officials will be able to monitor activities in real time while referring to geospatial information about the physical characteristics of crime scenes. Layers pinpointing public facilities will help reengineer government service delivery. Transportation will be more efficient when cars are equipped with navigation systems linked to intelligent transportation networks, and safer when deployment of an airbag notifies police about the exact location of an accident. Tools based on GIS technology will soon be as ubiquitous and commonplace as the stopwatch and the steering wheel, and a geospatial knowledge base will be a vital economic tool.

The Commerce Department's Technology Administration estimates that half of all economic growth in the past fifty years can be traced to the development and deployment of new technologies. Whole new industries, with hundreds of thousands of jobs, have flowed from early work in computing and cellular communications, for example. We believe that those nations that are first to exploit and build a base of geospatial knowledge will establish a critical comparative advantage in the global economy. U.S. industry benefits from our rail, highway and air facilities. The knowledge infrastructure enabled by GIS technology could likewise give a competitive edge to our companies and workers.

GIS industry experts project the world-wide market for GIS-related products to reach $15 billion by the year 2000. According to U.S. GPS Industry Council estimates, GPS-related sales will reach $8 billion by the turn of the century, even though prices for individual receivers drop by an average of 30% per year. This translates into hundreds of thousands of new jobs, and these

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estimates include only the value of the basic tools themselves, not the economic activity, products and services that can be generated using these new tools.

Thus, the National Spatial Data Infrastructure, especially when made "alive" with satellite locators, hand-held communicators, and portable computing, becomes an important enabling factor for a wide range of commercial activity. But no one company or competitor in the free marketplace can afford to build it. As with highways, or airports, investment in infrastructure is the appropriate role for government. Exploitation of that infrastructure is the role for a competitive marketplace. Many of our past investments in infrastructure have facilitated transportation of goods across the country. In 1789, Congress enhanced shipping by authorizing maintenance of lighthouses, still a symbol of today's U.S. Department of Commerce. Government also issued charters and land grants that cleared the way for construction of early rail lines. More recently, the Federal Government has invested in key infrastructures such as interstate highways and air traffic control.

As we move into the twenty-first century knowledge-based economy, the virtual highways of the National Information Infrastructure will outpace physical infrastructure and information will become the commodity that our firms race to transport. Geospatial information describing our nation will be an element of the National Information Infrastructure that makes the bitways worth traversing.

In the past, equipping U.S. industry with necessary infrastructures required new government spending, centralized planning, bureaucratic management, and heavy, one-size-fits-all regulation. Today, that ponderous model is neither necessary nor desirable.

States, counties, cities, universities, firms and even innovative summer jobs programs are using GIS technology to build geospatial descriptions of all corners of the United States. Those efforts could be fused into a digitized picture of the entire nation and, eventually, the whole world. Local pieces could be tied together into a multi-layered GIS basemap, on which value-added layers and services will be built. The mortar required to hold that mosaic together consists of a variety of standards, including those for data exchange and documentation, data content and interoperability. The result could be a rich, vibrant, multi-layered "virtual GIS" with pieces created once in many places, woven together through modern communications networks, and used by millions.

The vision of a National Spatial Data Infrastructure as promoted by the Clinton-Gore Administration calls for a new partnership between federal agencies and state and local governments, as well as the private sector, in creating and maintaining this knowledge base. The Federal Geographic Data Committee, chaired by Interior Secretary Bruce Babbitt, has championed federal efforts to create a national Spatial Data Transfer Standard, a clearinghouse for metadata, and the foundations of the new national partnership.

A report issued in February by the National Research Council, "Promoting the National Spatial Data Infrastructure Through Partnerships" validates the direction of the FGDC and underscores the need to avoid costly duplication of base data layers by different agencies and layers of government. To do so requires data sharing, standards, and a mutuality of effort that will require all of the players to do business differently than they have in the past.

Federal agencies, in particular, will move away from narrow mission- related data production to coordination of efforts and creation of a truly national infrastructure. Federal agencies will have to focus less on their own perceived agency needs and more on the potential end users at the local level, especially with respect to issues of scale and detail of GIS information. Federal agencies will also need to improve access to digital data, and facilitate a standards process with the states that enhances the national infrastructure.

State and local agencies, as well as non-profits and private sector entities, will be more responsible in the future for data collection and stewardship. The national "GIS" will result from tying together all of their remotely-maintained data through the emerging communications

networks, the National Information Infrastructure (NII), or information superhighway. The Department of Commerce -- which provides government-wide leadership in NII activities -- believes that dynamic applications like these will prove to be economically synergistic, building more demand for not only the GIS and GPS tools, but also for the ubiquitous high band-width communications networks that will make seamless movement of the information possible.

While the Federal Government will not play the same role in building a GIS infrastructure that it played in building interstate highways, national leadership will be critical to maintain and expand the vision, communicate the national benefits, facilitate standards, and coordinate the many players at all levels in order to produce a single, transparent, user- friendly infrastructure-- an infrastructure that has the potential to unleash a wave of business and consumer use that will increase productivity, raise standards of living, promote personal safety, and enhance public and private decision-making.

The private sector demand for this infrastructure is just starting to emerge. Whether the pace of government-sponsored GIS activity will keep up with that demand is uncertain. Partnerships, virtual organizations, and electronic data exchange are new concepts, and government often has trouble adapting to the pace of change in the private sector. But the payoff in the form of new jobs and new economic activity will be large if we succeed in raising the visibility, and the urgency, of these efforts.

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REFERENCES

Transit Test Has Satellites Catch the Bus, Keep it Moving." Washington Post. March 16, 1995, C1.National Academy of Sciences. 1995. Promoting the National Spatial Data Infrastructure Through Partnerships." Washington, DC: National Academy