Some GI&S Applications Scenarios

A few applications of Geospatial Information are listed. These focus on electronic or GIS and GIS like systems. The purpose is to give the reader an idea of the range of potential applications without being exhaustive. The emphasis is on military or military like applications. But there are many crossover applications.

I. Classical GIS Applications

1. Urban Planning

The major application of GIS systems in the 1960's and 1970's was for urban planning. Data bases with separate layers for topography, streets, building, sewers, electrical etc. were in the system. When special maps with a few of these were needed they were easily generated. In addition potential changes could be added and evaluated. For example, what are the options for bringing utilities into to a new project, or what are the constraints on new roads in a hilly area due to water runoff.

2. Land Erosion

The GIS system compares data from old measurements and new in areas of runoff or beaches. The data can be in the form of digital data bases, orthorectified photographs, laser altimetry from aircraft etc.

3. Change Analysis in Mine Counter Warfare

In critical areas that an adversary may mine bottom maps are made in peacetime. These can then be compared to maps made later to find new features that are potential naval mines. These can then be more closely investigated. This information is also useful in evaluating potential transit and assault areas. Change analysis is a common application for spatially tagged information in many applications.

4. Rapid Chart / Map Preparation

There are cases where charts need to be rapidly updated to reflect changes. This can easily be done with a GIS system where new items and/or layers can be added to existing data. For example a combat assault chart might be prepared and updated based on the latest intelligence. Information not normally on a map, such as wave conditions etc can be added to the chart or on the chart margins.

II. Mission Execution Applications Scenarios

1. Emergency Vehicle Response Center

In most major cities all the police and fire vehicles have DGPS systems that automatically report the position to the 911 call center as well as to an emergency response command center. The equipment is also tagged with information on it availabilities (an attribute). This is overlaid on a map by a GIS system. First done in a major city by Seattle on special purpose computer/programs, this is now common.

2. Fighting Forest Fires

Each major piece of firefighting equipment has a GPS receiver (DGPS before SA turned off). Fire crews that go into the field also have these. The positions are automatically reported to a command center every few minutes. At the command center they have a GIS system with topographic maps of the area. Into this is fused the equipment and crew locations, aerial photographs, fire locations that arrive by voice radio, and meteorology data (winds). The GIS system used looks specific to this mission, but is really a general purpose GIS program with a special purpose user interface installed. (This is done in visual basic by a third party vendor, not a modification to the main GIS program.)

The data has to be "geo-referenced" together in order to be useful. This is done on the fly by the GIS system. Some data is already spatially tagged and directly used, some is tagged but is on different datums and must be translated to the working system, and some has to be spatially tagged with the assistance of an operator.

The system does spatial analysis and predicts fire motion based on slope, winds and other conditions. The field leader can use this to decide on how to deploy his resources.

3. Military Ground Reconnaissance

A platoon has a GIS and some maps in a portable hand held computer. It can receive updates via radio and respond if not in a radio quite mode. This computer can locally find the best path between to positions. This is found using one of several "cost functions" that involve terrain, risk of detection / enemy contact etc. If the platoon notes that a bridge is out, they can enter this fact and the routes are recomputed. This information may be reported up the line.

Again, this is a GIS system with maps, and other information fussed. The major data fusion process is done in a central site, but the route computation, with local additions to the database, are done locally. The GIS has been customized with a new interface.

4. Multiple Sensor Analysis

Sensor data form two or more ships are exchanged. This allows better estimation of threats. In order to fuse the data, each ship must have position and attitude data on the sensors to add to the data stream. This comes from GPS/INS systems.

5. Ship Data Acquisition

More than one science team that takes data at sea uses a GIS system to follow the progress of the experiments. The planned locations of work are displayed along with the real time ship track. Adjustments are easier to plan in the case of weather or equipment complications. In one case the existing data base of previous samples is also attached to the GIS system and previous data can be called up for analysis. In some cases spatial analysis of current or current and past can be carried out real time.

III. Geospatial Information in GIS Like / Specialized GIS Systems

There are many specialized computer programs that use spatial data as a key component. In the past these may have been written from scratch for that application. Several are transitioning to generic GIS now. In many cases the interface is changed with a GIS scripting language to replace the general controls with specialized ones for the application.

1. Marine Navigation

Electronic charts are now being distributed in GIS formats. The formats have some specialized fields to allow for integrity checking (we don't want a ship using an update garbled in transmission or one sent by an adversary) and other features. The charts approved by international organizations must meet standards that contain these features. The simple systems of displaying GPS positions over a scanned map are approved on an interim basis due to their wide use.

2. Mission Planning

Most aircraft military planning systems are essentially GIS's. Versions based on generic GIS's with tailored interfaces are becoming available. The starting point, the objective, and the topography are standard. The military applications add information on the location of adversary equipment, it capabilities (detection range, missile range etc.) that can be tailored to specific aircraft (threat domes). Different options can be explored and analyzed automatically or in conjunction with an operator.