The Digital Age of Mapping in Tasmania

GIS Streamlines Cartographic Processes

By Karen Richardson, ESRI Writer

When tourists and locals pull on their hiking boots to trek through Tasmania’s picturesque landscape, they often take a trusty companion along to guide them: a topographic map created by TASMAP, the Tasmanian government agency responsible for supplying accurate, up-to-date maps describing the mountain peaks, caves, and beaches of Australia’s only island state.

More than 40 percent of the state consists of national park and reserve land; with 1,000 mountain peaks, more than 300 islands, and some of the world’s rarest animals, there is much to keep a cartographer busy.

The 1:25,000-scale map series is the most popular of TASMAP’s products, used by government agencies, businesses, and consumers. This series provides large-scale basemaps for all of Tasmania and includes topographic information, such as elevation, water bodies, and government landmarks, along with property information. The series, produced since the 1970s, consists of 415 maps.

Four decades of mapmaking means TASMAP has witnessed significant changes in map production methods—including the introduction of geographic information system (GIS) technology. “Before GIS, map production involved intricate manual processes, with a single map sheet taking many people months to produce,” observes Mark Chilcott, Spatial ArcGIS is used for the entire mapping process, from data extraction to editing and finishing.
GIS Delivers at UN Peacekeeping Mission ONUCI

Highlights
- Maps for planning and operations are delivered within one day.
- Creating maps in-house allows ONUCI to create purpose-driven products.
- Standard maps are available anytime to all staff members over the Internet.

The United Nations (UN) peacekeeping mission in the Ivory Coast, Operation of the United Nations in Ivory Coast (ONUCI), needed to create a road map for the country. Digital data from a local mapping agency was deemed too expensive, and management had the perception that GIS was a system that could provide maps quickly; they didn’t understand the considerable task of creating accurate basemaps to support mapping efforts.

In 2005, GIS staff, hardware, and software were transferred from a UN mission in Sierra Leone to cut down on startup time and training. Two staff members spent four months extracting features from an old paper map, considered to be one of the best data sources to produce a national road map. The paper map was scanned in by WIDEimage software, then digitized in ArcInfo, a component of ESRI's ArcGIS comprehensive GIS software. ArcPad was used for field data collection of x, y, and z data, then a digital elevation model (DEM) was created with ArcGIS 3D Analyst. A third-party imagery program was used to update portions of the data before the design and compilation were completed in ArcGIS. The final product was saved as a PDF to permit rapid background printing and ensure the product could not be changed while in digital format.

The Ivory Coast road map was created using a workflow that included the customer in each step:
- Expression of the user’s needs through online map requests
- Discussions with the user on content detail and product uses
- Determination of required data and sources
- Acquisition of required data including scanning, digitization, field collection, and imagery
- Data processing and analysis
- Feature attribution
- Product design and layout
- Quality control/assurance by both the GIS team and the map user
- Product delivery

Before the establishment of GIS in ONUCI, the organization was purchasing paper maps from external sources, a process that could take two to three months. As these maps were outdated and not purpose designed, staff could not rely on them for planning and operations.

Using ArcGIS in a functional GIS department, more than 100 copies of existing maps can now be delivered in one day by a single staff member. Using fully digitized base data, specific-purpose products are available within three to five days. A number of standard products are also accessible over the intranet at any time by all staff from locations around the country.
Modernizing Nautical Chart Production
Next-Generation Charting System Based on Commercial Off-the-Shelf Solution

The Marine Chart Division (MCD) at the National Oceanic and Atmospheric Administration (NOAA) has gone through system acceptance by making GIS technology core to the management of hydrographic information and the production of digital and hard-copy nautical charts. This system will be used to create the next generation of the Nautical Chart System (NCS II), expanding the use of GIS across the whole organization.

MCD is a division of the Office of Coast Survey (OCS), which is part of the National Ocean Service (NOS), one of five NOAA line offices. NOS works to observe, understand, and manage U.S. coastal and marine resources, including navigation safety. OCS specifically oversees the Marine Transportation System.

NCS II will help MCD meet its critical challenge of providing navigation products that cover approximately 11 million square kilometers of coastal waters including the Great Lakes (areas collectively known as the United States Exclusive Economic Zone). Ninety-five percent of U.S. commerce, by tonnage, travels through these waters alongside 110,000 commercial and recreational fishing vessels.

To produce these complicated products from NCS II, MCD uses source data including hydrographic survey data, hazard updates, and aids to navigation information. From this data, MCD maintains a suite of more than 1,000 paper nautical charts and is in the process of providing complete coverage of their equivalents in Electronic Navigational Chart (ENC) format based on the International Hydrographic Organization S-57 transfer standard. Data is obtained from more than 50 entities, including the Army Corps of Engineers, NOAA survey ships, and the U.S. Coast Guard.

Previously, critical updates for paper and electronic charts were published weekly. NOAA will use GIS to improve cartographic consistency across products.
In 1910, Romanian scientist Henri Coanda built the world’s first jet engine, and the country has been on the forefront of aviation ever since. Today, Romania has a well-developed airport infrastructure including 17 commercial airports, with most open for international traffic. To ensure aviation operations are safe, secure, and efficient, the Romanian Civil Aeronautical Authority (RCAA) was created. RCAA regulates all civil aviation activities in the country including licensing pilots, registering aircraft, and certifying aircraft and engine designs are safe for use. RCAA is coordinated with other aviation authorities around the world by the United Nations International Civil Aviation Organization (ICAO).

Like other aviation authorities, RCAA must do more with less using the limited funds of a public organization. Historically having used computer-aided design and drafting software for creating maps and charts, three years ago RCAA looked for a solution that would allow the organization to efficiently create the products required for it to do its job, as well as share data with ICAO in the best way possible. After looking at many solutions, RCAA chose ESRI’s ArcGIS because the software provides a standards-based platform for the spatial analysis, data management, and mapping that the organization was required to perform. “RCAA now has the ability to efficiently create and edit cartographic products that support our aviation operations,” says Mihai Necula, head of the Air Navigation and Aeronautical Information System (AIS) Department, RCAA.

RCAA uses ArcGIS for data management and mapping and viewing spatial data. “We saw the benefits of centrally managing our aeronautical data with GIS once we started using the software,” adds Necula. “Upgrading our implementation means we will be further integrated into our AIS and capable of doing more spatial data viewing and analysis including creating 3D representations, which is very important when managing airspace.”

RCAA upgraded its current ArcGIS solution to include the specialized extensions ArcGIS Data Interoperability, Production Line Tool Set (PLTS) for ArcGIS—Aeronautical Solution, and ArcGIS 3D Analyst. The ArcGIS Data Interoperability software extension makes importing data easier for RCAA by eliminating barriers to data sharing through state-of-the-art direct data access, complex data transformation, and import/export capabilities. The RCAA production lines also utilized ESRI business partner Safe Software Inc.’s FME 2008, which extends the software’s data translation and integration.

Once data is imported, PLTS for ArcGIS—Aeronautical Solution allows RCAA to efficiently manage its aeronautical information and produce high-quality charts. “Using PLTS for ArcGIS—Aeronautical Solution gives us a robust editing environment in a map-based visual editing workspace,” says Iuliana Radu, aeronautical inspector, RCAA. “This gives me precise control of feature parameters, one-touch data maintenance, and the ability to make a change to a feature once in the database that is reflected on all related products automatically. The software is very efficient and allows me to produce data and chart products faster with better quality.”

ArcGIS 3D Analyst allows RCAA to effectively visualize and analyze surface data from many viewpoints, query a surface, and determine what is visible from various locations—all important tasks when working with aviation data. “We are very pleased that RCAA continues to rely on ESRI to assist it in meeting its objectives,” remarks Bogdan Cheversan, project manager, ESRI Romania S.R.L. “It is a forward-thinking organization and a great example for other aviation authorities.”

Aviation administrations like RCAA rely on ESRI to help them maintain digital aeronautical datasets for chart production.
Professional-Quality Maps Made Easy
ArcGIS Topographic Templates Make Mapmakers of Anyone

The ability to make maps doesn’t necessarily make you a mapmaker. Cartography has been around for hundreds of years, and throughout the history of the art, it has developed new kinds of information and new ways of publishing information. GIS is the intersection of this art and technology. Today, about 40 years since the birth of GIS, in many premier universities, GIS and other mapmaking tools are some of the most important ways by which scientists and researchers visualize spatial data. Back to square one: being able to use GIS doesn’t inherently make one an expert in cartography. That may seem incongruous, as GIS uses maps to present ideas, sway opinions, and visualize information. But, in most cases, people using GIS in their jobs are experts in fields like surveying, botany, geology, city planning, and marketing; most never receive education or training to make maps.

There are indeed many organizations around the world that take mapmaking seriously, creating maps that are breathtaking in their beauty and rich in the ideas they bring forth for understanding. Look in any ESRI Map Book for hundreds of examples of beauty combined with well-reasoned intent. For the rest of us who use GIS as a tool in our jobs and don’t have a cartographer on staff, ESRI is creating a solution, map templates, to facilitate the beauty and expertise of great cartography. One of the first sets of map templates will be for an online topographic map service.

“The idea behind the topographic map templates is to create a place to start and guidelines that anyone can use to create professional-quality maps,” says Charlie Frye, chief cartographer and manager of the Mapping Center and cartographic projects at ESRI. “Think about national mapping agencies; each has the directive to create and manage maps, but not everyone has the right software to be able to do this effectively. The topographic map templates give them software methods, such as labeling rules, symbology, and data modeling practices, and the documentation to make it easy to use.”

The topographic map templates provide useful examples that ESRI software users can view and adapt for use as they see fit. The templates differ from traditional software documentation; instead of reading about what something is supposed to do, users will find a map showing what it should look like. “We are using the medium GIS users are familiar with—the map document and layers—to explain what maps should look like,” says Frye.

ESRI’s topographic map templates come with a sample geodatabase containing basemap data from sources like the USGS for terrain, land cover, and hydrography; Tele Atlas for roads, streets, and landmarks; and ESRI for natural features and boundaries. This data is used at scales ranging from 1:147,000,000 to 1:18,000, covering maps of nations all the way down to states, provinces, cities, and neighborhoods.

For larger scales, there are map templates specifically useful for local government including a general-purpose city basemap, local government infrastructure basemap, and parcel and land-planning basemap. The general-purpose map is designed to integrate into the broader fabric of online mapping and will present information at 1:1,000 scale. The latter two maps are designed to be professional basemaps, supporting traditional working scales for planners and infrastructure managers; examples of such scales include 1:200, 1:400, and 1:1,200.

While the templates do come with data that can be put into action immediately, in many instances, they are meant to be a guide. “We expect our users to change the source data of the layers in these templates to use their own, better data and make the best-looking maps,” says Frye. “These are guides to show how ESRI would use ArcGIS for mapmaking so you don’t have to start from scratch.”

Users can also leverage online ESRI basemap services that have been designed to sandwich their own data. “Users can take these basemap services provided by ESRI and insert their own data layers between them, such as demography, crime potential, and emergency response times, in essence, creating a map sandwich,” says Clint Brown, director of software development, ESRI. “While ESRI is providing the base layers and methodology for creating these maps, the users are providing the real ‘meat.’”

For organizations and countries that cannot afford to host online mapping services themselves, the templates offer an opportunity to publish data in a standard way that can be immediately integrated with or improve on ESRI’s ArcGIS Online map services. ESRI plans to host services and integrate cached map tiles into ArcGIS Online offerings for such organizations, making it possible for them to share their maps and content. These users can use map templates to create and register their maps with the ESRI service.

By providing the templates and a hosting service via ArcGIS Online, ESRI hopes to help users publish the most accurate, up-to-date information available at their locations. By publishing maps developed from these map templates, the most accurate, authoritative data can be used on the Internet by those who need it most. Many ArcGIS users are the stewards of much of the most important, authoritative spatial information in the world, and map templates give them a way to publish that information so that it integrates with their neighbor’s information, creating a seamless map composed of the best available information.
ESRI is creating a gallery to showcase the various products that can be created using Production Line Tool Set (PLTS) for ArcGIS. The online gallery is intended to showcase sample charts and maps that can be produced out of the box with PLTS for ArcGIS.

PLTS for ArcGIS combines cartographic editing tools, database models, and symbols and styles for specific industries, such as aeronautics, nautical, mapping, and defense, as well as workflow management components, to enable a streamlined map and chart production environment. Because the system is completely database driven, features that exist on multiple charts or products exist as one collection of objects in the database instead of stand-alone graphics, as is the case with most existing systems.

PLTS for ArcGIS comes with various map and chart styles that can be modified to meet any organization’s specific needs, including

This example of a sectional chart for visual flight rules depicts the information needed for visual air navigation. These types of charts are best used for low-speed, short- or medium-range operations at low and intermediate altitudes.

This is an example of an enroute chart made to provide flight crews with information that will facilitate navigation along routes in compliance with air traffic services procedures.
translation to other languages and minor customization needed for specific organizations. The charts and maps included in the online gallery are examples of what these styles look like, giving organizations an idea of how their own finished products would appear once created. Over time, the online gallery may include examples from customers to highlight how the core styles have been modified to meet specification requirements from any given organization.

The first charts published in the gallery are examples using PLTS for ArcGIS—Aeronautical Solution. This solution provides users with tools and styles to create a number of aeronautical products, ranging from small-scale planning charts to large-scale approach and departure plates, that adhere to international specifications such as those from the International Civil Aviation Organization (ICAO). Aeronautical Solution is also configured to load Aeronautical Information Exchange Model (AIXM), the new XML standard for aeronautical data exchange. The AIXM loading capability is part of a subset of tools within Aeronautical Solution, implemented to support creation of U.S. defense and Eurocontrol planning and airspace management charts.

An example of the charts that can be found in the online gallery can be accessed through the main PLTS for ArcGIS page at www.esri.com/plts. All charts and diagrams depicted below were created with ArcGIS 9.3 using the sample data, styles, and tools available in ArcGIS—Aeronautical Solution 9.3.

This airport diagram depicts the airport facility and includes information such as taxiways and vertical obstructions.

Radar minimum altitude charts are supplementary charts to help flight crews monitor and cross-check altitudes while under radar control.
Small Island SDI
Remote Communities Prevail with GIS

GIS for spatial data infrastructure (SDI) is used throughout the world to instill cooperation and collaboration in spatial data to better address social, economic, and environmental issues. It seems logical that large countries like the United States have invested in SDI projects, such as the Geospatial One-Stop, and that unions come together to share data and resources via the Infrastructure for Spatial Information in Europe (INSPIRE). Does SDI make sense for smaller countries and communities? Arguably, even smaller nations benefit from having their landownership carefully mapped, public works and utilities documented, environments and biodiversity protected, resources assessed, and strategic planning completed.

Most islands were using ESRI GIS software products in some form or fashion before SDI was implemented. As Alan Mills, principal with Alan Mills Consulting, Ltd., and one of the driving forces behind using SDI to help manage smaller islands, explains it, “We realized there was synergy in sharing the same add-on applications developed with GIS across the islands. Along with the backup support from other islands performing the same functions, the GIS managers in these remote places would feel a sense of community and have a place to go when they needed help. This is important when you live on a small island in the middle of the ocean, with a three-day boat ride to the nearest airport, and you have to be the expert in GPS, databases, cartography, digitizing, and changing the ink in the plotter.”

Ascension Island Discovers Benefits in Data Sharing
One island that has many unique needs contained in a small space is UKOT Ascension Island, situated in the sea halfway between Africa and Brazil. Only 34 square miles in area (approximately 91 square kilometers), the island is inhabited by about 1,000 people. A relatively recent volcanic emergence close to the Mid-Atlantic Ridge, the island has little natural vegetation except for a few species of ferns and spurge, a plant that exudes a bitter, milky juice. The island became a refuge for a wide variety of marine species and is the second-largest Atlantic nesting site for green turtles.

Humans discovered the island in the 1500s, and since that time, the island's ecology has changed significantly; invasive plant species have run rampant over parts of the island, and rats and cats have decimated the bird populations. Bird and turtle populations have an oceanwide impact on biodiversity, and the conservation department established by the small Ascension Island government is mandated to protect and enhance the crucial nesting sites as well as conserve the local plants and invertebrate species such as crabs.

Since 2005, GIS has been used to synthesize disparate databases and datasets and create new maps and images for environmental management. GIS also assists with other applications including the Environmental Health Department’s mapping of rat control efforts and documentation of the eclectic set of historical sites such as the guns of the sunken HMS Hood, Dampier’s Drip (the original freshwater source), and concrete water catchments in the mountainside that collected scarce cloud water for the population before the building of the desalination plant.

Using ArcView, a component of ArcGIS Desktop, the system works well. “The software is easy enough to be handled by nonexperts. We are able to use a flexible framework that accepts new monitoring data and can integrate datasets from a wide variety of sources and types,” says Dr. Edsel Daniel, professor, Vanderbilt University in Nashville, Tennessee; GIS manager at Ascension Island; and colleague of Mills.

ArcView integrates all the data necessary for the government to make informed planning decisions to balance environmental, amenity, and infrastructure priorities. Clear protocols and procedures have been determined to pass data from the field to the end user. “The key to this system functioning in such a small area so economically with great benefit is the fact that data gathered for one purpose can be shared in many applications,” says Mills.

Saint Helena Finds Cooperation Is the Key
Saint Helena, about 750 miles southeast of Ascension Island, cannot be reached by air. Instead, a visitor must take the RMS St. Helena,
which ploughs between Capetown, Saint Helena, and Ascension each month. Thirty-five hundred hardy settlers live on the island, many above the precipitous cliffs or in a narrow canyon where the well-preserved Georgian capital of Jamestown nestles near landscapes of rocky desert, rolling pastures, and eucalyptus and pine plantations. On the coast, humpback whale mothers and calves shelter themselves, and thousands of seabirds cling to cliff edges and stacks.

At first, GIS was used to determine the best locations to place freshwater boreholes. In 2004, other projects began, the largest being the building of the island’s cadastre. The Agriculture and Natural Resources Department (ANRD), along with the St. Helena National Trust (SHNT) implemented ArcView and a Microsoft Access database to monitor clearance of invasive flax and other plants and manage the growth of endemic cabbage trees and tree ferns. “The emergence of a map showing the recolonization of endemics over a 10-year period gave other departments the idea to link their monitoring data with the mapping being accomplished,” says Len Coleman, GIS manager, Saint Helena.
GIS Keeps People and Mountain Chickens Safe on Montserrat

In the Eastern Caribbean Sea, Montserrat is another UK overseas territory, 20 kilometers west of Antigua. After a volcanic eruption in 1997, the population dwindled from 11,000 to 3,500 and is now settled on only one-third of the island. These few people on the island are in need of GIS to assist them in mapping safe zones and planning for permanent homes and services away from the dangerous area around the volcano. GIS is also used to map endangered species in the Center Hills area, including the curiously named mountain chicken, a frog that is a local delicacy and has been unfortunately decimated by a fungal disease.

GIS Maps Resources on Rodrigues Island to Sustain Human Activity

Rodrigues Island is a partly autonomous island 650 kilometers east of Mauritius. One of the more populated islands in this grouping, it is home to 40,000 people who live off reef and subsistence farming and has few support services and only a fledgling tourism industry.

SHOALS, a nongovernmental organization (NGO) working closely with the island’s government—the Regional Assembly—conducts training and marine research of and education about the extensive reef area, which extends over twice the size of the land itself. One major activity is assessing the extent and health of the marine resources, including the corals, seagrasses, and mangroves. With the support of the Universities of Newcastle and Bangor in the United Kingdom and using ArcView, SHOALS created a map of the basic reef structure using supervised classification of Landsat Enhanced Thematic Mapper (ETM) data, with an eye toward using QuickBird satellite imagery in the near future for the more detailed map of the resources as well as educational work and governmental planning.

Led by GIS manager Lavern Rogers-Ryan, who works in the Physical Planning Department, the GIS team uses ArcGIS to cover the requests of clients on the island, including updating the land cadastre and mapping for natural disasters and environmental protection. “Assisting the Department of the Environment in mapping its data opened our eyes to the spatial comparisons across the island,” says Rogers-Ryan.

Mills assisted in developing a database and training field staff in how to make simple maps. “This assistance helped me better structure my data to provide wider services to several government departments without being overwhelmed by the work,” Rogers-Ryan says.
GIS Is Used to Evaluate Land Resources for St. Kitts in a Post-Sugar Era

St. Kitts (also called St. Christopher) is part of an independent twin island federal state with the island of Nevis. Both islands achieved their independence in 1983 from the British, making them the smallest independent state in the western hemisphere. St. Kitts has a land area of 168 square kilometers, with extremely fertile soils used primarily for sugar production for the past 350 years.

Fluctuating commodity prices and reduced European Union trade preferences have made the island’s reliance on single-crop agriculture an economic vulnerability. To address such vulnerabilities, in 2005 the Government of St. Kitts and Nevis (GoSKN) made the decision to close the sugar industry and vigorously pursue its economic diversification by placing emphasis on more viable alternatives, such as tourism and nonsugar agriculture including field crops and livestock. One of the major challenges of this effort is adopting careful planning, which ensures that the island’s land resources previously utilized by the sugarcane crops are optimized for the long-term economic, social, and environmental sustainability of the country.

After the closure of the sugar industry, the Physical Planning Department (PPD) and Department of Agriculture (DoA) spearheaded planning for the agricultural transition. A land resource analysis study was conducted using ArcView to identify the most suitable lands for six nonsugar agriculture crops. “While specific areas have been quantified based on suitability, an added benefit of this study was the ability to identify, compare, and quantify areas for uses beyond agriculture,” says Daniel. “We were able to evaluate future land use, such as housing for tourism and industrial and residential needs, along with suitable lands for tree crops. Using GIS, we were able to see the bigger picture of how to develop areas for the benefit of the community.”

For more information, contact Alan Mills at +44-1622-813214 or e-mail alanmillsuk@yahoo.co.uk.
A Geospatial Foundation
Public, Private, and Military Applications Flow from SDI

The marine spatial data infrastructure (SDI) developed by the Portuguese Instituto Hidrografico (IHPT) provides information to decision makers and information products for environmental protection activities, research and development, private industry, military activities, and public information.

IHPT is the naval organization responsible for producing official nautical paper and electronic charts as well as conducting studies and research in marine-related disciplines such as physical oceanography, hydrography, marine geology, chemical oceanography, and navigation safety.

For the last several years, IHPT has been developing an SDI called IDAMAR (an acronym in Portuguese for spatial data infrastructure for the marine environment) to support the production of technical and scientific data and information product management.

To conform with military communications security rules, the IDAMAR SDI is actually composed of two similar systems: one connected to the Internet and one connected to a private military network. Three communication networks support data transfer and online access to the SDI: an Internet connection, a private unclassified military network, and a private classified military network. The Internet connection supports data acquisition from several environmental sensors (e.g., wave buoys, radar stations) and the public dissemination of information products through www.hidrografico.pt. The private military networks provide access to the full system and support specific data and information requests.

Several databases were developed using either DBMS- or file-based systems. The choice of system was based on the type of data stored and how that data could be most efficiently used. Internally developed data models (when applicable) follow the S-57 standard for hydrographic data transfer. The most relevant developed data model supports the hydrographic data warehouse (HDW). This database stores bathymetric soundings acquired by the IHPT and represents a major improvement in the cartographic production process because it reduces production time, eliminates procedures susceptible to human error, and improves the quality of the final product.

Data stored includes data about the sea state (e.g., wave height, wave period, wave direction, and sea temperature) from ocean buoys; tide predictions and observations; horizontal control points; nautical chart and cell coverage; chemical analysis of seawater and sea bottom sediments; bathymetric navigation warnings; and medium-resolution satellite imagery. Not all data was supplied by IHPT—some data is related to activities of the Portuguese Navy.

The IDAMAR SDI relies on Microsoft for its operating system, Oracle for DBMS, and ESRI’s ArcGIS for its GIS software. Specifically, the IDAMAR SDI makes use of ArcSDE, ArcIMS, and ArcGIS Server applications as well as single use and floating licenses for ArcView; ArcEditor; and the ArcGIS Spatial Analyst, ArcGIS 3D Analyst, ArcGIS Publisher, and ArcGIS Geostatistical Analyst extensions. The SDI is supported by four servers—two internal and two external. A variety of IHPT devices (PDAs, laptops, PCs, workstations, printers, plotters, and high-resolution scanners) are used for some SDI functions.

Information products are publicly disseminated and are available from the public Web site at www.hidrografico.pt.
Generated in response to ad hoc requests for information, offline products are normally distributed as CDs or DVDs. Online products and services provide broad access to the SDI. They are the most visible part of the public system that includes data catalogs, information products, and data services. Two Web portals (one internal and one external) allow users to obtain information products and services and provide the front end for data catalogs, data visualization applications, the metadata search engine, download services, and data services.

One example of the many information products produced, the ENC World Catalog, is one of the most relevant catalogs available. Although not entirely related to IHPT (because its geographic extent is the world), this catalog helps sea navigators identify the available cells relevant to their route. The coverage data, collected by the International Centre for ENCs (IC-ENC), is available at websig.hidrografico.pt/website/icenc and is updated monthly.

Information on the coastline as it appears from the sea is very useful for sea navigation. A compilation of visual aids to the navigation of the Portuguese coastline is available from a customized ArcGIS Server Web site. This site provides links to photographs of coastline landmarks that help inexperienced sailors recognize coast features.

The IDAMAR SDI is a valuable asset that supports its main mission objectives: ensuring safe sea navigation, supporting the navy’s activities, protecting the environment, and contributing to knowledge of the ocean.

Ongoing data acquisition activities include converting historical analog data and products to digital format and registering this data in the system. A geospatial portal for better visualization is also being developed. Future enhancements include the implementation of GeoRSS feeds for the dissemination of technical and scientific data and the development of multi-criteria geospatial analysis for mission-impact diagrams that will improve environmental tactical decisions.

To read more, visit www.esri.com/news/arcuser/0309/marinesdi.html.

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Visit www.esri.com/training to learn more about the instructor-led course ArcGIS Server Geospatial Extension.
The International Steering Committee for Global Mapping (ISCGM) examines how international, national, and regional organizations can work together to facilitate the creation and sharing of global geographic datasets. The committee’s hope is that sharing geographic data worldwide will help mitigate natural disasters and encourage economic growth within the context of sustainable development.

Global Map, a repository of digital geographic information covering the earth’s surface at 1:1,000,000 scale, is the primary focus of ISCGM. Map information at this scale is best used for global, hemispheric, continental, and regional issues and is available for noncommercial purposes.

Global Map consists of eight layers: boundaries, drainage, transportation, population centers, elevation, land cover, land use, and vegetation.

Global Map version 1.0 was formally released in June 2008. The first version of Global Map was displayed at the 2008 ESRI International User Conference in the MAPS Showcase area of Exhibition Hall in a 7-by-3.5 meter display. To date, 143 organizations—mostly national mapping organizations—are involved in the Global Map project, and 20 have released fully verified, complete data. More than 30 other nations, including Canada and China, have submitted their data to Global Map for verification, as has the Scientific Committee for Antarctic Research (SCAR) for the Antarctic continent.

Since October 2008, Global Map v.1.0 has been available in SHAPE format for vector data and in TIFF with a world file (.tfw), which has positional information for raster data. These formats can be easily used with many GIS programs, and in particular, TIFF data can be seen with an image viewer for those who do not have GIS. Releasing the data in these user-friendly formats, as well as the officially formatted Global Map data, will extend the use and application of that data. This data is made available for 70 countries and 4 regions as of October 2008. Visit www.iscgm.org/login.html to register and download the data.

Global Map was first proposed by the Ministry of Construction of Japan (presently the Ministry of Land, Infrastructure, and Transport) in response to Agenda 21, a comprehensive plan of action to be taken worldwide by the UN, country governments, and major groups in every area where humans impact the environment. Agenda 21 was adopted by 178 governments at the Earth Summit in 1992.

Produced under the ISCGM International Corporation, data is created mainly by national mapping organizations (NMOs) participating in the Global Mapping project. NMOs can be involved at one of three levels, designated A, B, and C. Level A involvement requires an NMO to provide and process data for its own country and assist one or more Level C countries. Level B involvement requires the provision and processing of data only for the country concerned, and NMOs in Level C countries receive capacity-building support from Level A NMOs. Infrastructure and capacity building has been further encouraged by the provision of grants such as ESRI’s US$5 million Global Map/GSDI grant program, established in 2002 to help organizations participate in Global Map.
The grant provides both software and training with the condition that the recipient nations place their 1:1,000,000-scale datasets that meet Global Map specifications on the Geography Network in addition to providing them to the Global Map Secretariat. To date, 100 countries have participated in the grant program.

The level of commitment from the NMOs and available grants have allowed many developing nations to fully release their data in a timely fashion. Regional cooperation is also very much a feature of the philosophy and organization of the Global Map structure. Although several European countries are members of ISCGM in their own right, the relatively recent creation of EuroGeographics, established to represent all European national mapping agencies, means that it took the lead in creating a seamless Europewide contribution to the Global Map project, called EuroGlobalMap. This effort is currently being coordinated by the National Survey of Finland. EuroGlobalMap, covering 30 countries, was first released in September 2004 and is available through EuroGeographics. Participation in Global Map has also been explicitly endorsed and supported by the regional groupings of national mapping organizations from Asia (PCGIAP), Africa (CODI), and the Americas (PCIDEA) and supported by the various United Nations Regional Cartographic Conferences since 1996.

A number of organizations are represented in ISCGM in an advisory capacity including the United Nations Geographic Information Working Group (UNGIWG), United Nations University, and the International Cartographic Association. The International Organization for Standardization (ISO) and the Committee for Earth Observation Satellites (CEOS) also have liaison status with ISCGM.

Global Map is providing a framework for cooperation and mapping among nations, exemplified by EuroGeographics, as national efforts to provide digital geographic information for each individual nation can be useful for regional efforts as well. For many regions, having both a national and regional approach to spatial data infrastructure such as this is required to address challenges including environmental action. While action within national borders is necessary, it is not sufficient to address encroaching global environmental concerns. With the support of participating nations and the framework of Global Map, visualizing geographic information without borders for the good of the earth is more than a possibility; it is happening today.
Training Opportunities

Upcoming ESRI Instructor-Led Learning Center Courses
Additional Offerings and Course Schedules Online at training.esri.com

<table>
<thead>
<tr>
<th>Course Title</th>
<th>ESRI Instructional Series Podcasts</th>
</tr>
</thead>
</table>
| compass-points.com/industries/map-chart-dataproduction/user-community/compass_points.html.html

<table>
<thead>
<tr>
<th>Course Title</th>
<th>ESRI Instructional Series Podcasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartography with ArcGIS</td>
<td>QA/QC for GIS Data: Creating a Quality Assurance Plan</td>
</tr>
<tr>
<td>Working with Cartographic Representations</td>
<td>QA/QC for GIS Data: Initial Quality Control Checks</td>
</tr>
<tr>
<td>Managing Editing Workflows in a Multiuser Geodatabase</td>
<td>QA/QC for GIS Data: Recording and Tracking Errors</td>
</tr>
<tr>
<td>QA/QC for GIS Data</td>
<td>QA/QC for GIS Data: Starting a Quality Assurance Program</td>
</tr>
<tr>
<td>ArcGIS Server Geoportal Extension</td>
<td>QA/QC for GIS Data: Visual Inspection and Quality Control</td>
</tr>
<tr>
<td>Data Production and Editing Techniques</td>
<td>Best Practices: Working with Cartographic Representations</td>
</tr>
<tr>
<td></td>
<td>Using Geoprocessing Tools for Cartographic Representations</td>
</tr>
<tr>
<td>ArcGIS Desktop</td>
<td>Best Practices: Loading Raster Data into an Enterprise Geodatabase</td>
</tr>
<tr>
<td>Cartography</td>
<td>Five Best Practices for Maintaining an Enterprise Geodatabase</td>
</tr>
<tr>
<td>Geodatabase</td>
<td>Three Tips for Managing Raster Data in an Enterprise Geodatabase</td>
</tr>
</tbody>
</table>

Stay Connected

Stay connected to the MAPS Community by subscribing to Compass Points e-newsletter at www.esri.com/industries/map-chart-dataproduction/user-community/compass_points.html.

To submit articles for publication in the 2010 ESRI User Conference (ESRI UC) Compass Points edition, please contact Karen Richardson at krichardson@esri.com.

To get informed on GIS perspectives for government agencies, see Federal GIS Connections, a free quarterly printed newsletter, at www.esri.com/federalgisconnections.

Also, check out Surveying-Special Interest Group (S-SIG), a free e-newsletter focusing on GIS and the surveying and engineering user community, at www.esri.com/ssig.
ESRI announces that Interactive Visualization Systems 3D (IVS 3D) has joined its business partner program. IVS 3D is a leading vendor of interactive 3D visualization and analysis software for marine information. This partnership will benefit organizations with workflows that visualize and analyze bathymetric data for use in the maritime community including the defense, petroleum, environment, and hydrographic sectors.

“A tightly integrated solution between IVS 3D Fledermaus and ESRI ArcGIS is something our users have been requesting,” says Timothy Kearns, deputy marine manager, ESRI. “This partnership gives our companies the opportunity to work together, improving customer workflows and ensuring not only a seamless dataflow but a more efficient use of both technologies.”

The two companies are working toward the ability to read and write from IVS 3D’s Fledermaus suite of software directly into ESRI’s geodatabase, the common data storage and management framework for ArcGIS. Storing data in a geodatabase ensures that it is in a centralized location, maintaining integrity and consistency in the most efficient way in a multiuser environment. Fledermaus will be able to embrace a service-oriented architecture, one of the most powerful characteristics of ESRI enterprise GIS technology. Added benefits for ArcGIS users include the ability to perform sounding selection, model surfaces to international standards, and support a wide variety of hydrographic formats within ArcGIS.

“Partnering with ESRI gives our clients access to the most comprehensive suite of GIS software available,” says Lindsay Gee, CEO, IVS 3D. “Our work together ensures that the mapping and charting needs of geoscientists, oceanographers, and hydrographers are met with an integrated solution that meets their needs from ship to shore.”

For more information on ESRI and how its GIS software is used in the nautical industry, contact Timothy Kearns at 909-793-2853, extension 1210; e-mail tkearns@esri.com; or visit www.esri.com/maritime.

Founded in 1995, Interactive Visualization Systems is the developer of the Fledermaus suite of 3D visualization and analysis software, used internationally by government, commercial, and academic clients in all areas of ocean mapping.

Fledermaus software stands apart in providing scientists and engineers with interactive and intuitive tools for processing, quality control, and analysis of multibeam sonar and related data. It provides significantly improved efficiency in nautical charting, geologic interpretation and assessment of seabed habitats, and identification of geohazards during engineering development.

The company has offices in Canada, the USA, and the UK, as well as a worldwide distribution network. For more information on IVS 3D and how its visualization and analysis software is used in the nautical industry, contact info@ivs3d.com or visit www.ivs3d.com.
ESRI attended the American Society for Photogrammetry and Remote Sensing (ASPRS) Conference in early spring in Baltimore, Maryland. ArcGIS Server was showcased, focusing on the software’s ability to collect, manage, produce, and exploit imagery along with vector data in a transactional workflow. ArcGIS is able to consume imagery from a variety of sources, including satellites; aerial photographs; scanned hard-copy maps; and input information such as elevation data, lidar, and radar. “Imagery is integral to GIS adding another dimension to geospatial analysis,” says Mark Cygan, MAPS industry solutions manager, ESRI. “Whether as a background image, a source for interpretation, or a feature extraction, to show temporal changes or perform raster analysis, imagery enhances GIS data.”

This integration is synergistic; imagery makes GIS timely, provides visual integration of data, and enhances spatial analysis. GIS brings contextually rich information and an authoritative source to enhance imagery. Perhaps the biggest gain GIS users have from using imagery data is temporal: whether it’s being used for immediate data streaming to inform decision makers about fleeting issues, sent within minutes of its capture to give a warning regarding an anticipated baseline condition, analyzed to monitor enduring issues, or simply archived, imagery enhances operational decision making.

Lawrie Jordan, director of imagery enterprise solutions, ESRI, presented the company’s information-centric approach to imagery workflows through ArcGIS. “ArcGIS serves as the interoperable organizing system to enable workflows in any enterprise,” says Jordan. “ESRI streamlines this process by reducing time between image collection and use, helping users efficiently manage and serve large catalogs of imagery, produce multiple products and services using the same data, and exploit the rich information content that imagery brings.”

Jordan announced a new Imagery Team Center of Excellence and invited ESRI customers and users to participate as advisers.

Along with hosting a booth for demonstrations in the ASPRS exhibition hall, ESRI held a user group meeting where Peter Becker, imagery product manager, ESRI, gave an overview of ArcGIS and demonstrated how an integrated data approach can be used to solve challenges that municipalities across the world face each day. Using an extensive dataset from the Portland, Oregon, Metropolitan GIS, ESRI’s Lindsay McGreevy, technical marketing specialist, assisted in explaining how to use different types of imagery for many scenarios.

Join ESRI at future ASPRS events, including the ASPRS/MAPPS 2009 Specialty Conference being held November 16–19, 2009, in San Antonio, Texas.

For more information on using imagery in GIS, visit www.esri.com/remotesensing.
Improving Field Data Collection Productivity
New Tools and Better Integration with ArcGIS Server

ArcPad 8 supplies significant usability and productivity improvements that make field mapping and data collection faster and easier for users. In addition, ArcPad Application Builder, the development framework for customizing ArcPad, will be included with every ArcPad license.

The ArcGIS Server ArcPad extension, new with this release, allows users to publish an ArcPad project to ArcGIS Server. This project can then be used in ArcPad 8. Any device that can connect to the Internet by cradle, USB, Wi-Fi, or phone connection can synchronize ArcPad edits directly with the enterprise geodatabase via ArcGIS Server.

Users have more options when preparing data for ArcPad using the ArcPad Data Manager extension. New options allow users to configure an ArcPad project for repeated use with geoprocessing tools or author an ArcPad project for publication to ArcGIS Server and subsequent use in ArcPad.

The new lookup index in the ArcPad 8 StreetMap extension provides an easier method for finding addresses and locations. In addition to the Tele Atlas Premium North American dataset, ArcPad 8 is now bundled with Tele Atlas Premium Western Europe StreetMap data at no additional cost.

A sleeker and customizable interface makes it easier to access needed tools and data. New icons and toolbars take up less screen space. Customize the interface with toolbars that can be docked, minimized, and maximized. With ArcPad Toolbar Manager, a new out-of-the-box tool, existing toolbars can be modified or new ones created. The new Open Map dialog box allows browsing for maps by list or thumbnail.

The new translucent GPS status bar, which replaces the GPS position dialog box, appears at the bottom of the map screen. It shows much of the same detail displayed in the GPS position dialog box but indicates the quality of the GPS fix using color cues. More detailed GPS position information can be displayed on the full-screen, multitab GPS dialog box. For more information about ArcPad, visit www.esri.com/arcpad.
The 1:25,000-scale map series consists of 415 large-scale basemaps for Tasmania including information like elevation, water bodies, government landmarks, and property information.

Operations, Geodata Services, Department of Primary Industry and Water. “Today, maps can be produced quickly and efficiently in about two weeks by automating many of the mundane tasks. This allows our cartographers to focus on cartography and reduces production time significantly.”

Using ESRI’s ArcGIS suite of GIS software, TASMAP now manages, creates, and edits all necessary map layers digitally. The organization uses ArcInfo 9.3 for inputting and editing data; ArcGIS Server 9.3 Spatial Database Engine (SDE) technology for managing the spatial data; and FME Server from ESRI business partner Safe Software Inc. to extract, transform, and load data. When maps are complete, they are sent via PDF file for offset printing, or are available for download (some at no cost).

**GIS Lets Cartographers Focus on Cartography**

When computerizing daily mapmaking activities, TASMAP focused on building on past experiences to create solutions that would help guide the agency toward the future. “It was important we didn’t reinvent the wheel,” says Chilcott. “While the specifications for creating maps are the same, the methods are obviously quite different. Cartography is not a dead art; it is very much a required skill.”

The heart of TASMAP’s newfound efficiency: its ability to apply database-driven mapping with a geodatabase, a common data storage and management framework for ArcGIS. Since data is stored in one location, it can be updated and edited with little error. Using the geodatabase also means mapping attributes, such as north arrows, map name and number, grid references, and climate graphs, can be created by using intelligent information directly from the data itself. TASMAP now stores these attributes with the map features themselves.

All changes to these attributes are managed with an easy-to-use template TASMAP created using ArcGIS to simplify editing and reduce the potential for mistakes. The template contains the map frame and all marginal information required for each sheet. For example, grid references are created from a sample point that is unique to each map and stored in the geodatabase. Staff members can edit data for new points and precalculate the universal grid reference. Climate graphs are created directly from climate data obtained from the Australian government’s Bureau of Meteorology (BOM). Map names, numbers, editions, and dates, as well as the cover and location box, are now objects generated from code. While the initial setup took some effort, the end result is that each map margin and template takes less than one minute to generate. Mistakes and errors are greatly reduced and a considerable amount of work saved. “Now, our cartographers can focus on cartography,” notes Chilcott.

Taming the marginal data meant TASMAP could focus on streamlining the extraction and geoprocessing of the map data itself. These tasks are now performed on each editor’s

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ArcGIS helped TASMAP create maps with the same specifications and high-quality cartography in two weeks instead of six months and with fewer people.
desktop using a personal geodatabase with ArcGIS and FME software. Using FME to build graphic geoprocessing models automates data manipulation from a variety of sources. Using GIS to create new information by applying geoprocessing operations to existing data, such as clipping to boundary; making single layers into multiple layers; joining lookup tables; and rotating objects like waterfalls to rivers, gates to roads, and buildings to roads, again saves TASMAP time and effort. “ArcGIS and FME have many powerful tools,” says Chilcott. “The software is easy to adjust to meet our needs, and most importantly, users can retain ownership of their data.”

Digitally Managing Production with ArcGIS

Another area of improvement TASMAP found through automating cartographic production with ArcGIS was the placement of annotation on the map sheets. By digitally managing annotation, TASMAP has significantly reduced the time necessary to create each map. “Traditionally, lettering the map—the process of selecting the type, preparing the names, and placing them in position—was considered among the more complex and time-consuming parts of the cartographic process,” explains Chilcott. “While this is still one of the most time-consuming processes, it is now significantly less time-consuming and considerably easier than in the past.”

Using ESRI’s Maplex extension to ArcGIS, annotation can now be created directly from the geodatabase. Maplex manages symbolization and annotation placement through user-defined rules based on map complexity. Annotation placement is prioritized according to sophisticated cartographic rules, and filters are set up to handle densely packed annotation in urban areas differently than filters for annotation in rural areas.

The last challenge TASMAP faced in its cartographic production workflow was printing. TASMAP produces maps using offset printing, sending maps in PDF files to the printers. The maps are created using standard cyan, magenta, yellow and key black (CMYK) color. “In the recent past, we would export the almost-completed map to Adobe Illustrator for finishing to ensure that CMYK color separation for offset printing could be achieved. Now, we use ArcGIS for the entire mapping process—from data extraction, editing, finishing, and the final export to PDF for printing. No other application needs to be used in the entire process,” Chilcott says.
Even with these efficiencies, producing 415 maps is a large task requiring many resources. So TASMAP also uses GIS technology to more effectively determine when to produce maps for use and resale. “The question is always, Which map sheet do I work on?” adds Chilcott. ArcGIS is useful in answering this question. Using ArcGIS, TASMAP has developed tools to assist in managing map production. A feature class of the map extent is linked to the stock database to produce reports of real-time stock levels. ArcGIS ModelBuilder is used to create a weighted matrix to identify which maps should be worked on over the next 12 months. Stock levels for the coming year and the highest-selling area are also predicted.

In the past, it took up to four cartographers six months to produce a map. Today, one cartographer takes two weeks to produce the same map to the same specifications with the same high-quality cartography. “Granted, in the past, the map production process also included the data capture process, which in itself was time consuming,” says Chilcott. “With today’s technology, the datasets come from our corporate and state spatial data infrastructure.”

While the technology has changed, the results are the same: the maps retain high quality, as in the past. The offset printing process is similar to how map production was originally done—but maps are produced with significantly fewer resources and in much less time.

Technology, however, does not trump the art of cartography. “We have simply created tools to allow cartographers to focus on cartography,” declares Chilcott, who concluded with a quote from the preface to *Elements of Cartography*, Fifth Edition (Arthur Robinson et al.): “Rapid changes in technology demand that practitioners learn not only ways of doing new things but additional ways of doing old things with new equipment.”

For more information, contact Mark Chilcott at Mark.Chilcott@pdlw.tas.gov.au.

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**Modernizing Nautical Chart Production**

However, the noncritical update cycle for paper charts ranged from every 6 months for areas of high commercial traffic to every 12 years for remote areas. The average revision interval per nautical chart was about 2 years. Data had to be applied multiple times, stored in many applications, and processed through several production lines to either an ENC or a paper chart, which was a major factor in the amount of time, effort, and quality control needed for updates.

MCD has used GIS for many years to improve workflows and data management but wanted a commercial off-the-shelf (COTS)-based enterprise-wide system for NCS II to gain efficiencies and streamline data management and product generation. In 2006, MCD contracted with Fairfax, Virginia-based ManTech International Corporation, a leading provider of U.S. government technology and solutions for mission-critical national security programs. After a rigorous selection process, ManTech selected ESRI as a subcontractor on the project due to ESRI’s expertise and experience working on GIS projects. In particular, the team wanted to leverage Production Line Tool Set (PLTS) for ArcGIS—Nautical Solution, which provides production-oriented applications and end-to-end workflows tailored specifically to the needs of hydrographic offices. In February 2009, NOAA reached a milestone by accepting the new system.

“The needs of the global navigation community are constantly changing, and our charts must adapt to those needs,” said Captain Steven Barnum, Office of Coast Survey director. “The system we developed with ManTech and ESRI allows NOAA to continue being the provider of choice for accurate and timely navigation data.”

Currently, NOAA is licensing 39 seats of Nautical Solution to create and maintain nautical charts. PLTS allows NOAA to create charts from a product-neutral, centralized database, giving the organization the ability to fuse existing legacy systems, databases, and workflows into one comprehensive system. With the implementation of NCS II, ManTech is creating a system that compiles source data from the myriad of providers, stores the information in a single database, and is able to extract information to produce various paper and electronic charts. NOAA intends to expand its use to more than 80 seats of Nautical Solution by the end of the year.

MCD expects NCS II to decrease production time for charts significantly, allowing more frequent updates. The streamlined workflows and improved data management will increase the agency’s ability to respond to coast-altering events as well as improve the accuracy of charts and ensure greater navigational safety and better coastal management. Because MCD will manage data centrally, integration with ancillary legacy systems will be centralized and optimized. MCD will also have the capability to offer new products and Web services within NOAA and to end users of the data.

With system acceptance complete, MCD expects to realize significant gains in productivity, data management capability, and flexibility. With this move to a next-generation GIS-based system, NOAA MCD will continue to be the world leader in hydrographic information management.

**More Information**

For more information, contact Julia Powell, Marine Chart Division, NOAA (e-mail: Julia.Powell@noaa.gov), or Tim Kearns (e-mail: tkearns@esri.com) phone: 909-793-2853, ext. 1-1210). International copyright, 2009, NOAA, U.S. government.
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To contact the ESRI Desktop Order Center, call 1-800-447-9778 within the United States or 909-793-2853, ext. 1-1235, outside the United States.


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