

Careers in Cartography and GIS

Cartography and Geographic Information Society
www.cartogis.org

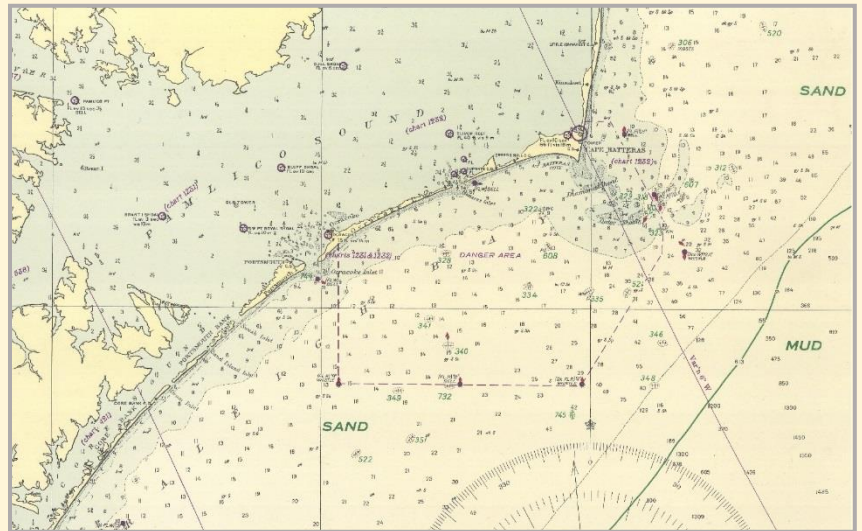


International Cartographic Association
Association Cartographique Internationale

Cartography or Map Making?

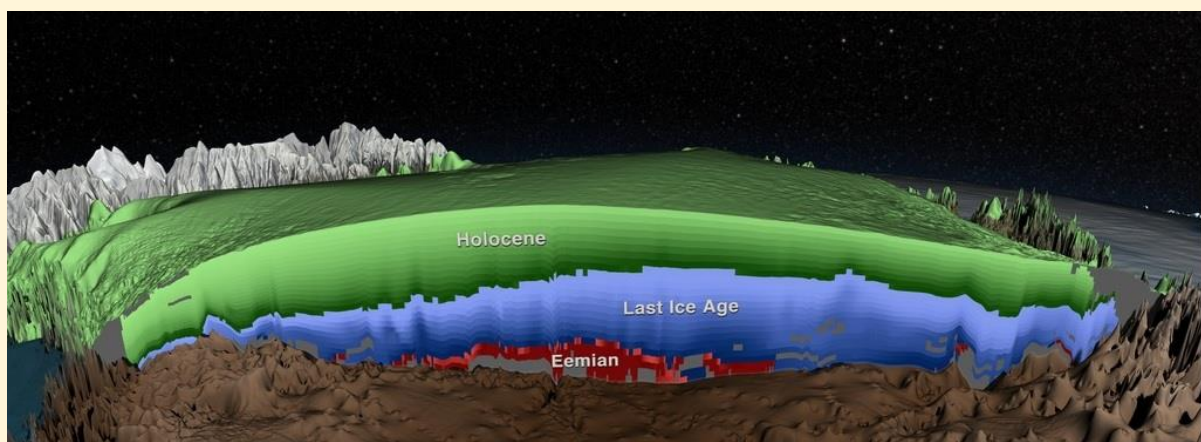
Is there a difference between the two words? Yes. Certainly, both are concerned with making maps. On the one hand, map making is a process that results in a map. On the other hand, cartography is a profession. Map making has been part of the human experience for thousands of years. Cartography is a more recent term dating back to about the late 1850s, referring to the profession specifically trained in “recording on maps the work of cosmographers, hydrographers, geographers, philosophers, chartmakers, and surveyors”— in other words, in the process of map making.

Starting in the 20th C., education and geospatial technology broadened the scientific catalog of cartographic specializations to include computer-assisted drawing (CAD), geographic information systems (GIS), global positioning systems (GPS), and internet- and web-based mapping services enabled by geodatabases and cloud computing. With the numerous technological advances that have made it easy for people to make maps, specialized training in map making and cartography is very necessary for today.



Shipwreck chart showing location of sunken wrecks for use by surface warfare vessels engaged in anti-submarine warfare. cgs05501, NOAA's Historic Coast & Geodetic Survey (C&GS) Collection 1943.

Map making and cartography may take a different path to produce a map, but they both need to follow cartographic principles that make maps clear, readable, and useful. Many of the colors, typefaces, and the map design a map reader views on a map are the result of following cartographic principles. It is the development of these principles that distinguishes cartography from map making. Many cartographers now have job titles such as GIScientists who use geographic information systems to capture, store, analyze, edit, and communicate, via maps, geospatial data. The products they produce are maps made through a variety of modern mapping services and tools have positively impacted, for example, the transport sector, improved global environmental monitoring, and assisted disease tracking and monitoring.



A cross-section of the age of the Greenland Ice Sheet. Age layers determined to be from the Holocene period are shown in Green. Age layers accumulated during the last ice age are shown in blue. Age layers from the Eemian period are shown in red. Regions of unknown age are shown with a flat gray color. NASA's Scientific Visualization Studio. <https://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=4249>

Why Become a Cartographer?

Cartography is a profession that combines exploration with innovation; the people who become cartographers make it possible to explore the natural and human environment around us and make it understandable.

- **DEMAND FOR CARTOGRAPHERS**

Demand for GIScientists, spatial data analysts, geographic data collection specialists, database administrators, and web and mobile mapping services providers, to name just a few, is at an all-time high. According to the Bureau of Labor Statistics, the job outlook for cartographers and photogrammetrists is expected to grow 29% between 2014 and 2024: <http://www.bls.gov/ooh/architecture-and-engineering/cartographers-and-photogrammetrists.htm>

- **SPATIAL THINKING SKILLS**

Cartographers are trained to think spatially—a skill highly valued by employers.

- **PERVASIVE ROLE IN GLOBAL ENVIRONMENTAL MONITORING**

Cartographers help others understand spatial data better. As a result of their better understanding of the world in which they live, individuals, businesses and governments can make better environmental and policy decisions.

- **EARNING POTENTIAL**

Cartographers earn anywhere from \$50,000 to \$100,000 per year, depending on the specialty and job sector chosen

What's Trending in Cartography?

Rich cartographic knowledge has set the foundation for developing new mapping applications and tools for computers and mobile devices such as mapping in the cloud, crowdsourcing of Volunteered Geographic Information, location-based services, big data, and open source mapping software. These technologies have been made possible through the painstaking research and application of cartographic knowledge to everyday problems.

1. OPEN DATA

Designed to be freely available for users to source and republish or distribute, open data is available at the national as well the local level. The Earth Resources Observation and Science (EROS) Center, distributes numerous kinds of geospatial data, while base data and shaded relief can be obtained from Natural Earth Data. Both initiatives are fundamentally changing how geospatial technologies are used.

2. VOLUNTEERED GEOGRAPHIC INFORMATION (VGI)

VGI has been used to map natural disasters and is quite popular among sports enthusiasts. Bicyclists, for instance, collect waypoints with a GPS to track their routes and then upload them to websites such as Garmin Connect or Strava. These websites map the route taken and users can also track their fitness levels and share ride with other bicyclists.

3. BIG DATA AND VISUAL ANALYTICS

Geospatial data collection techniques such as global satellite systems are collecting data at high volumes. They are collecting “big data” that traditional computing power is inadequate to store, process, and analyze. Working with data requires high performance computing (supercomputing), cloud computing and parallel programming/processing—and people who understand how they work.

4. OPEN SOURCE SOFTWARE

Open source software is developed by a community of programmers who write source code in “C” languages, Java, and .NET. A business enterprise or individual develops, markets, and maintains updates to software, while individuals develop, test, and use software which can be freely distributed through the Web. GRASS, OpenJUMP GIS, and QGIS are open source. Community groups around the world have made important contributions to GIScience.

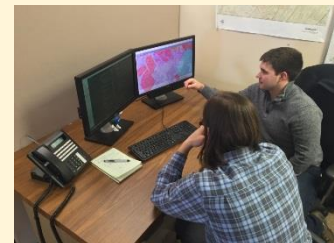
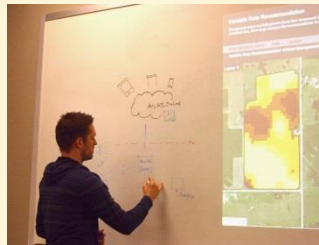
5. LOCATION-BASED SERVICES

Want to find a restaurant, locate a business, avoid traffic delays, or check for severe weather? You need location-based geographic information that is available on your handheld device or the dashboard of your car. Onboard navigation systems have also become standard equipment in new vehicles.

Skills Employers Value

For successful employment, you will need:

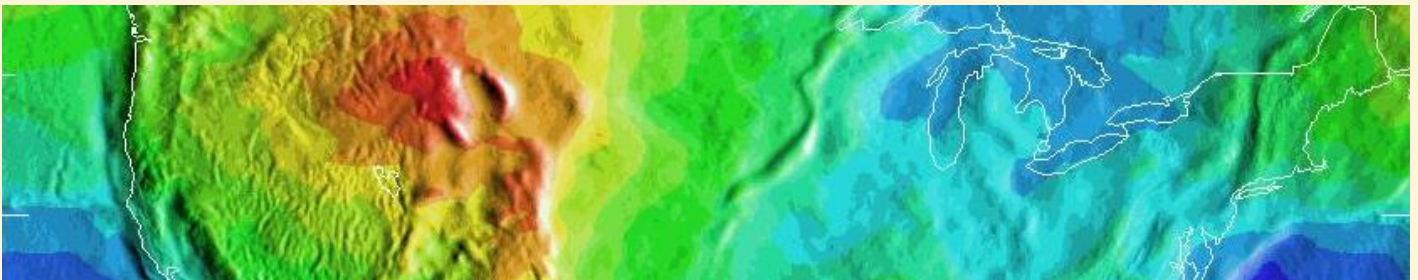
- Knowledge of a **programming language**
- **Spatial** thinking
- Good oral and written **communication** skills
- **Organizational** skills
- Good sense of **design**
- Analytical and **critical thinking** skills
- Ability to meet deadlines and **work independently**



Former undergraduate students now engaged in professional careers in cartography.

And what are the Jobs?

Engineering || **Environmental and Earth Sciences** || **Real Estate** || **Travel** ||
|| **Telecommunication** || **City Planning** || **Transportation** || **Space Exploration** ||
|| **National Security** || **Law Enforcement** || **Health Care** || **Marketing** ||
|| **Rescue Operations** || **Natural Resource Exploration** || **Recreation**



A map showing a portion of geoid heights across the lower United States compiled under GEOID96. National Geodetic Survey. Image from <http://www.ngs.noaa.gov/GEOID/GEOID96/>

Where you can work?

Private Sector: Surveying and GIS companies | Web-based mapping companies (Google Earth, Google Maps) | Telecommunication | Marketing | Environmental Science/Engineering | Relief Agencies | Energy Suppliers/Explorers | Railroads/Airlines/Trucking Companies | Academia

State & Local Government: City Planning | Property Records | Transportation | Utilities | Law Enforcement

Federal Agencies: U.S. Defense Department | Central Intelligence Agency | Environmental Protection Agency | Library of Congress | National Aeronautics and Space Agency | National Geospatial Intelligence Agency | National Oceanic and Atmospheric Administration | National Park Service | National Security Agency | U.S. Census Bureau | U.S. Fish and Wildlife Service | U.S. Forest Service | U.S. Geological Survey | Bureau of Land Management | National Weather Service

Education for Success: So you want to be a cartographer?

Many cartography positions require a bachelor's degree from a four-year college. Because most cartography programs are usually hosted by a Geography Department, students typically earn a degree in Geography while at the same time obtaining specialized training in cartography. Students pursuing a degree in cartography should expect considerable coursework with computers and related technologies. Another cartographic education path leads through Community Colleges that offer two-year programs of selective coursework, which prepares students for entry-level jobs. Graduate degrees offer students greater exposure to cartographic research and technologies. There are an increasing number of online undergraduate and graduate level degree programs.

Coursework for aspiring cartographers may include:

Undergraduate Program

- Map reading and interpretation
- Cartographic design and production
- Mobile and web map design and implementation
- Geographic Information Systems (GIS)
- Remote Sensing
- Global Positioning System (GPS)
- Land surveying

Additional undergraduate coursework provides exposure to related fields includes:

- Computer Science – web design and development, database management, computer programming
- Mathematics — algebra, trigonometry, calculus
- Visual Arts — color theory, typefaces, development of two-dimensional design

Graduate Program

Some benefits of a graduate degree are:

- Increased levels of responsibility (manage projects, develop new technologies, or interface with clients)
- Potential for promotion, especially within Federal Government
- Doctoral degree (Ph.D.) holders may seek a faculty position teaching and conduct research
- Ph.D. holders working for private and government sectors investigate new technologies and how best to apply them to solve cartographic problems

Professional Certification

Two-year professional certificate programs are for those with an undergraduate degree in a related field (e.g., forestry, transportation planning, or environmental engineering). Certificate programs are offered partially or completely online and expand a professional's knowledge on cartography and latest mapping trends.

Educational Resources

Looking for more information? Check out these online education resources.

- American Association of Geographers' *Guide to Geography Programs in the Americas*:
<http://www.aag.org/cs/publications/guide>
- American Association of Geographers' Directory of Online Geography Courses:
http://www.aag.org/cs/education/online_geography_programs_and_resources/aag_directory_of_online_geography_courses_and_programs
- URISA's List of Colleges and Universities: <http://www.urisa.org/careers/colleges-and-universities/>
- University Consortium of Geographic Information Science: <http://ucgis.org/basic-page/organization-members>

Wait, Hasn't the World Been Mapped Already?

The short answer is yes and no. While the art and science of making maps has been part of the human experience for thousands of years, at no time has map making been the same. That is because the physical world, the Earth, the people who inhabit it, their needs for geographic information, and the technology used to visualize it are constantly changing. Something else is changing — the knowledge and skills map makers need to make geographic information easily accessible and — useful. Today, because of research into mapping techniques and more powerful data collection, computer analysis, and the interconnectedness the Web provides, even the most complex geographic information can be visualized and communicated to users in a format most useful to them. It is cartographers (and map makers) with highly specialized training who have made the use of geographic information ubiquitous. Cartography is a profession that combines exploration with innovation; the people who become cartographers make it possible to explore the natural and human environment around us and make it understandable.

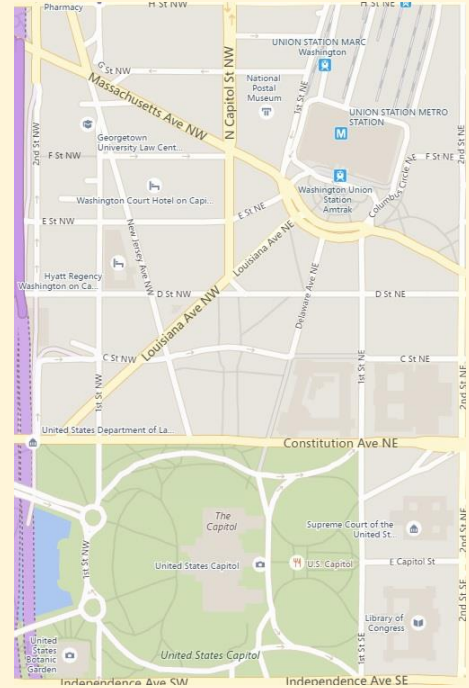


Image from Bing Maps www.bing.com/mapspreview

Discover your Cartography Career with Education and Professional Engagement

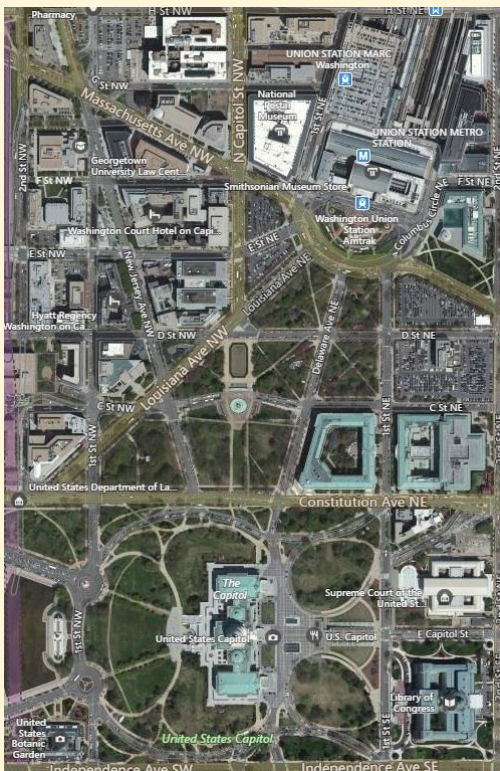


Image from Bing Maps
www.bing.com/mapspreview

Start Building your Professional Network: Join CaGIS!

Cartography and Geographic Information Society (CaGIS) is one of several professional organizations that focus on the many facets of cartography. The society is a learned society with a mission to improve the understanding, creation, analysis and use of maps and geographic information in order to improve the quality of life through improved decision making.

Among CaGIS members are distinguished cartographers, researchers, scientists, and educators. Members hold exciting and prestigious positions in the private sector, at educational institutions, non-governmental organization, and in local, state, and federal government. Collectively, they represent a wealth of information to guide you toward rewarding careers in cartography. For more information on CaGIS check out their website: www.cartogis.org

This brochure is published by the Cartography and Geographic Information Society (www.cartogis.org) whose mission is to improve the understanding, creation, analysis and use of maps and geographic information in order to support effective decision-making and improve the quality of life.

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