CURRICULAR REQUEST FORM

Please note: All requests must be approved by the Department Chair, College Curriculum Committee, Dean/Associate Dean, and the External Department Chair(s) (if the proposal impacts or involves another program) before submission to Academic Affairs (Undergraduate Catalog) or the Graduate School (Graduate Catalog) for final review and approval. Be sure to submit requests timely, in accordance with established catalog deadlines.

College/School: College of Arts & Letters	Department/School: Political Science and Geography
Requestor's Name: Tom Allen, Professor of Geography	Requestor's Email: tallen@odu.edu
Program Level: Graduate	Proposed Effective Date (SEM/YR): FALL 2025
Type of Program: Master's Degree	
Name of Degree or Certificate Program (include major or concentration, if applicable): Master of Science in Geographic Information Science and Technology (MS-GIST)	

PROPOSED ACTION

EXIT THIS FORM AND BEGIN WITH THE PROGRAM ACTION INQUIRY (LINK) WHEN PROPOSING….

New Undergraduate Degree Program	New Graduate Degree Program
New Undergraduate Certificate Program	Change Program Purpose/Focus
New Graduate Certificate Program	Add/Reduce Program Credit Hours by 3+ Credits
Add/remove delivery format to online, hybrid, in-person	Discontinue/close a Degree Program
Change name, CIP code, and/or designation of a degree/certificate	Change licensure-qualifying status

OR

CONTINUE COMPLETING THIS FORM WHEN PROPOSING (select applicable proposal) ….

☐ Add/revise/discontinue major (undergrad) or concentration (grad)	☐ Change Continuance Requirements
☐ Change GPA Requirement (GRAD Only)	☐ Change Exit/Graduation Requirements
☐ Change Degree or Curriculum Requirements	☐ Change to Admission Requirements
☑ Other: New Masters program	

APPROVALS: *Information on the following pages must be completed before signatures are obtained*	
Requestor	Thomas R. Allen, Jr. Digitally signed by Thomas R. Allen, Jr. Date: 2024.09.17 13:07:30 -04'00'
Department Chair	Dr. Jonathan Leib Digitally signed by Dr. Jonathan Leib Date: 2024.10.01 15:22:14 -04'00'
External Department Chair(s), if appropriate	
Chair, College Curriculum Committee	Regina Karp Digitally signed by Regina Karp Date: 2024.10.16 12:00:37 -04'00'
College Dean/Associate Dean	Dale E. Miller Digitally signed by Dale E. Miller Date: 2024.10.16 13:20:15 -04'00'
****SEND TO ACADEMIC AFFAIRS (UNDERGRADUATE CATALOG) OR THE GRADUATE SCHOOL (GRADUATE CATALOG) FOR THE ADDITIONAL APPROVALS BELOW****	
Undergraduate or Graduate Catalog Administrator	Shana Pribesh Digitally signed by Shana Pribesh Date: 2024.11.27 16:02:46 -05'00'
Office of Institutional Effectiveness & Assessment	Megan E. Corbett Digitally signed by Megan E. Corbett Date: 2025.01.16 11:48:12 -05'00'
Vice Provost for Academic Affairs/SACSCOC Liaison	Megan E. Corbett as Proxy for VP Digitally signed by Megan E. Corbett as Proxy for VP Date: 2025.01.16 11:48:18 -05'00'

After final approval, the Undergraduate or Graduate Catalog Administrator will provide copies of the form to the SCHEV Liaison, the Office of the University Registrar, the Office of Institutional Research, and the relevant college(s) and departments.
NOTE: DO NOT UPDATE OR REMOVE CATALOG CONTENT UNTIL APPROVAL IS RECEIVED.

1. Description of Proposed Change:

We seek approval for a Master of Science (M.S.) degree program in Geographic Information Science and Technology. This program will be administered by the Department of Political Science and Geography in the College of Arts and Letters. The initiation date is fall 2025. The purpose of the proposed MS in Geographic Information Science and Technology is to provide students foundational knowledge in the core competencies of Geographic Information Systems (GIS) and applications. The program will focus on providing students with skills to acquire, analyze, visualize, and understand insights from geospatial data. Students will learn to acquire and create GIS data, analyze satellite, airborne and drone data, design and implement GIS systems, and conduct spatial, statistical and geovisualization analyses.

2. Rationale for Proposal:

The proposed MS degree in Geographic Information Science and Technology (GIST) will help meet workforce needs by providing students with the advanced skills to work as geospatial scientists, managers, and developers. The MS GIST aligns with the institution's mission and is included in ODU's 2023-2029 Strategic Plan.

3. Program, Major/Concentration, or Certificate Description and Requirements (*to be used for Catalog text*):

If proposal includes new or revised courses, please submit the appropriate information through the online Course Inventory Management (CIM) process in CourseLeaf (nextcatalog.odu.edu/courseadmin). Note: Specific content courses are expected for each *certificate* proposal. **(Attach additional sheets, if necessary.)**

a. Admission Information *(include requirements, standards, and deadlines, if applicable):*

No additional admission requirements.

b. Degree Requirements:

Core Courses: 12 credit hours
GEOG 600 Geospatial Data Analysis (3 credits)
GEOG 601 Spatial Statistics and Modeling (3 credits)
GEOG 563 GIS Programming (3 credits)
GEOG 6XX GIS Professional Practice and Leadership* (3 credits)

Restricted Electives 15 hours
Students consult with their program advisor to choose from a selection of restricted elective courses that develop advanced technical skill proficiency and deeper application domain knowledge. Courses include geospatial techniques and applications, allowing students to tailor their education to their specific interests and career goals.

c. Curriculum *(Include complete Course List and/or Plan of Study – Indicate total number of credit hours:*

Geospatial Techniques Courses
GEOG 504 Digital Techniques for Remote Sensing (3 credits)
GEOG 508 Cartography (3 credits)
GEOG 525 Internet Geographic Information Systems (3 credits)
GEOG 532 Advanced GIS (3 credits)
GEOG 6XX Advanced Earth Observations and Analysis* (3 credits)

Geospatial Applications Courses
GEOG 509 Drone Applications Proseminar (3 credits)
GEOG 517 GIS for Planning and Public Policy (3 credits)
GEOG 519 Spatial Analysis of Coastal Environments (3 credits)
GEOG 520 Marine Geography: GIS for a Blue Planet (3 credits)
GEOG 573 Geographic Information Systems for Emergency Management (3 credits)
GEOG 590 Applied Cartography/GIS (3 credits)
GEOG 6XX Geospatial Internship* (3 credits)

Capstone Course: 3 hours
GEOG 7XX Geospatial Capstone Project* (3 credits)

Total: 30 credit hours

Description of Capstone Project
The capstone project will give all students the opportunity to synthesize knowledge and apply skills to a real-world problem and solution using geospatial analysis. Students enrolled in the program must enroll in the Geospatial Capstone Project course in their last semester. The student must submit an abstract for the project to be approved by the instructor, present it to a committee of faculty who will review it, and submit a project report for program assessment.

The student will be graded on the appropriateness of geospatial data and rigor of analysis techniques used; use of professional standards, completeness of documentation, source data, and references; and quality of presentation and final report (e.g., webmaps, webapps, and cartographic visualizations.) Students will participate in capstone project presentations via video conferencing with the instructor and faculty committee. If a student fails to earn a C grade or above on the capstone project, the student will be given an opportunity to retake the course and work on the same project or complete a new project. Failure a second time will result in dismissal from the degree program.

d. If there is an increase or decrease in the total number of credit hours required for the degree, please specify and explain the change.

N/A (new M.S. degree program)

e. Continuance Requirements, if applicable:

The capstone project requires a minimum C grade. If a student fails to earn a C grade or above on the capstone project, the student will be given an opportunity to retake the course and work on the same project or complete a new project. Failure a second time will result in dismissal from the degree program.

f. Exit or Graduation Requirements, if applicable:

30 credits cumulative, to include 3crs. capstone project

4. Assessment Plan for new or revised programs, majors/concentrations, or certificates: Completed in coordination with the Assistant Director for Assessment. Please provide a summary of the planned assessment action.

Every student who completes the proposed MS GIST will have mastered the skills needed as a GIS analyst, GIS administrator, or professional geospatial scientist. Students will be assessed in each course through various mechanisms and instruments pertinent to the discipline (1) projects, (2) laboratory exercises, (3) term papers, briefs, and critiques, and (4) exams. The capstone course develops deeper, focused learning, applying skills gained in the curriculum, and demonstrating professionalism. Students who also complete an optional internship will be assessed by the internship site professional, faculty advisor, and program internship coordinator. Learning outcomes (detailed in the SCHEV proposal) are measured annually in coordination with the ODU Academic Assessment Office.

5. Target Audience, if new degree, major, concentration, or certificate *(be specific)*:

The degree targets post-bachelors professionals and students intending to develop advanced skills in GIS analysis, database management, spatial analytics, GeoAI, and GIS project and enterprise management. The program's online, asynchronous delivery provides flexible scheduling and dynamic information technology in a robust, consistent, and updated format. Students entering the program may have a GIS background or may not, extending their skills in the field with the progressively developmental coursework (data management, analysis, to programming, and supervisory to leadership level management.)

6. Course Delivery Modes *(please note if a new delivery mode is being added or if the delivery mode is changing)*:

The course will be fully online, asynchronous.

7. Additional funding needed beyond existing resources:

The University has initiated planning to upgrade and expand the necessary IT and software instructure for this program (e.g., Esri and other software licenses, Monarch Virtual Environment/MoVE or other cloud-based computing.)

FOR ADMINISTRATIVE USE ONLY

ADMINISTRATIVE CODING

Effective Term:_____ Major Code: _____

College:_____ Degree Code: _____

Department: _____

Curriculum – Revised November 2024

The proposed Master of Science in Geographic Information Science and Technology will require 30 credit hours.

The foundation courses will provide students with the introductory breadth and depth of GIS data, software, and core analytical techniques. Students will gain a basic understanding of GIS data models and structures, databases and file formats, enterprise data handling for workstations and cloud-based GIS, and fundamental techniques for spatial analysis and GIS map design.
The core curriculum builds on this foundation to expand competencies in GIS data acquisition, spatial analysis, imagery and photogrammetry, and using GIS in distributed or cloud-based computing environments. Students will apply GIS data alongside statistical and desktop productivity software. They will learn how to acquire satellite or drone UAS datasets, conduct image processing, analyze patterns, and create suitability and predictive models. Students will gain experience and expanded competency doing scenario-based exercises and their own applied projects in a range of contexts that reflect the burgeoning GIS sector (urban planning, hazards and resilience, environmental management, and infrastructure and commercial location analytics.) Students will also design geospatial databases, critique GIS implementations, and create sophisticated spatial analysis workflows to produce problem solutions. Students will gain a critical understanding of professional standards, current challenges, potential harms, risks, and ethical considerations in GIScience practice.

The capstone project will provide a culminating opportunity for students to synthesize knowledge and apply skills from their coursework. Students will use their skills to solve a real-world analytical problem and conduct the capstone project from ideation to analysis and creation, communication, and dissemination of capstone project products.

New courses are denoted with an asterisk *.

Program Requirements

Core Courses: 12 credit hours
GEOG 600 Geospatial Data Analysis (3 credits)
GEOG 601 Spatial Statistics and Modeling (3 credits)
GEOG 6XX GIS Professional Practice and Leadership* (3 credits)

Restricted Electives 12 hours (minimum 6crs. at 600-level or above)
Students consult with their program advisor to choose from a selection of restricted elective courses that develop advanced technical skill proficiency and deeper application domain knowledge. Courses include geospatial techniques and applications, allowing students to tailor their education to their specific interests and career goals. A minimum of two 600-level courses are required from among the following:

Geospatial Techniques Courses
GEOG 504 Digital Techniques for Remote Sensing (3 credits)

GEOG 508 Cartography (3 credits)
GEOG 525 Internet Geographic Information Systems (3 credits)
GEOG 532 Advanced GIS (3 credits)
GEOG 562 Advanced Spatial Analysis (3 credits)
GEOG 563 GIS Programming (3 credits)
GEOG 6XX Earth Observation Analytics* (3 credits)
DASC 620 Introduction to Data Science and Analytics (3 credits)

Geospatial Applications Courses
GEOG 509 Drone Applications Proseminar (3 credits)
GEOG 517 GIS for Planning and Public Policy (3 credits)
GEOG 519 Spatial Analysis of Coastal Environments (3 credits)
GEOG 520 Marine Geography: GIS for a Blue Planet (3 credits)
GEOG 573 Geographic Information Systems for Emergency Management (3 credits)
GEOG 590 Applied Cartography/GIS (3 credits)
BIOL 732 GIS in the Life Sciences (3 credits)
OEAS 895 Remote Sensing Technology for Ocean and Earth Sciences (3 credits)
GEOG 6XX Geospatial Internship* (3 credits)

Capstone Course: 3 hours
GEOG 7XX Geospatial Capstone Project* (3 credits)

Total: 30 credit hours

PROPOSAL FOR
MASTER OF SCIENCE IN GEOGRAPHIC INFORMATION SCIENCE AND TECHNOLOGY

TABLE OF CONTENTS

Description of the Proposed Program

Program Background

Old Dominion University (ODU) seeks approval for a Master of Science (M.S.) degree program in Geographic Information Science and Technology. This proposed program will be administered by the Department of Political Science and Geography in the College of Arts and Letters. The initiation date is fall 2025.

The purpose of the proposed MS in Geographic Information Science and Technology is to provide students foundational knowledge in the core competencies of Geographic Information Systems (GIS) and applications. The program will focus on providing students with skills to acquire, analyze, visualize, and understand insights from geospatial data. Students will learn to acquire and create GIS data, analyze satellite, airborne and drone data, design and implement GIS systems, and conduct spatial, statistical and geovisualization analyses. The program will provide students with core competency coursework and project-based learning to discover and apply GIS data to better understand the world and to solve real-world problems. Students will obtain knowledge and skills operating GIS software, Global Positioning Systems (GPS) hardware and data, remote sensing image processing software, and Uncrewed Autonomous System (UAS, aka drone) mapping and data analysis. Students will learn to design, implement, and manage enterprise GIS systems and to create efficient and accurate workflows that analyze GIS data. Graduates of the program will be prepared for advanced positions in public agencies or private sector that require design, advanced analyses, and data-driven geospatial solutions.

Geographic Information Systems (GIS) are defined broadly as technologies that enable the storage, manipulation, analysis, and display of geographic data. David Cowen[1] differentiated GIS from other digital information systems and noted unique geographic data and algorithms and as well as the problems and broader applications that GIS solve (versus banking, medical, transportation or engineering systems.) Geographic Information Science (GIScience) is a scientific discipline at the intersection of geography, social science, computer science and natural sciences. GIScience (or geoinformation science) is rooted in the "spatial analysis tradition" of Geography, has evolved significantly over the last several decades. As emphasized by William Pattison in his keynote address to the 1963 National Council on Geographic Education annual convention, the spatial analysis tradition of Geography remains crucial to spatial decision-making, planning, societal policies, infrastructure, economy, and environment[2]. Scholar of GIScience Michael Goodchild defined GIScience in the 1990s and its core interests in spatial analysis, visualization, and its advancements in geocomputation, geovisualization, and representation of uncertainty[3].

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[1] Cowen, D.J. 1988. GIS versus CAD versus DBMS: what are the differences? *Photogrammetric Engineering and Remote Sensing* 54: 1551-4.

[2] Pattison, W.D. 1963. The Four Traditions of Geography, *Journal of Geography*, 63(5):211-216.

[3] Goodchild, M.F. 2010. Twenty years of progress: GIScience in 2010 | Goodchild | Journal of Spatial Information Science. *Journal of Spatial Information Science*. 1:3–20. doi:10.5311/josis.2010.1.2. Archived from the original on 2020-11-25. Retrieved 2015-09-18.

With the rapid advances in geospatial technology, GIS has achieved widespread adoption across various professions and organizations. Geospatial analysis has not only replaced analog technologies but has also facilitated the integration and advancement of new applications. Today, the realm of geospatial technology includes "Big Data" elements, environmental and sensor networks, location-based and mobile technology, webGIS, spatial statistical analysis, machine learning (ML), augmented and virtual reality, UAS, and public participatory GIS (PPGIS). The National Academies of Sciences, Engineering and Medicine (NASEM) recognized the pivotal role of GIScience and established the Geographical and Geospatial Sciences Committee (GGSC). The committee hosted a webcast in 2023 focusing on the critical need for these skills and problem-solving in the workforce[4].

Over the past three decades, GIS has evolved into a broad field, incorporating spatial analytic methods, grappling with increasing volumes of "Big Data," and finding myriad applications. Described as a "virtual world," GIS abstracts real-world entities into digital form, such as vector points, lines, polygons, raster pixels, or visual representations such as "Digital Twins." Challenges related to geospatial Big Data, including the "four V's" of Variety, Volume, and Velocity, and Veracity are inherent to GIS, requiring specialized solutions for managing spatial Big Data (SBD).

The proposed MS degree in Geographic Information Science and Technology will help meet workforce needs by providing students with the advanced skills to work as geospatial scientists, managers, and developers. ODU is fully committed to offering the proposed degree program to ensure professionals are prepared and trained to meet the industry needs.

Institutional Mission

The mission statement of Old Dominion University is:

> *"Old Dominion University, located in the City of Norfolk in the metropolitan Hampton Roads region of coastal Virginia, is a dynamic public research institution that serves its students and enriches the Commonwealth of Virginia, the nation, and the world through rigorous academic programs, strategic partnerships, and active civic engagement."*

The proposed MS in Geospatial Information Science and Technology program aligns with the institution's mission. The degree program will provide a "rigorous academic" curriculum comprising GIS, spatial statistics and analysis, remote sensing, and applied problem-solving. The program will help to foster "strategic partnerships" with companies and agencies seeking advanced geospatial professionals.

The proposed MS in Geographic Information Science and Technology is included in ODU's 2023-2029 Six-Year Plan.

[4] NASEM. 2023. *The Geospatial Workforce Crisis: a diversity of pathways forward.* Geographical and Geospatial Sciences Committee, National Academies of Sciences, Engineering and Medicine. Nov. 14, 2023. https://www.nationalacademies.org/event/41079_11-2023_the-geospatial-workforce-crisis-a-diversity-of-pathways-forward

Delivery Format

The proposed MS in Geographic Information Science and Technology will be available in a fully online format. All courses will be taught using asynchronous web-based formats. Selected opportunities for optional traditional (face-to-face) and synchronous modes of instruction will be incorporated into individual courses (e.g., seminars, conferences, and field-based geospatial data collection projects.)

ODU utilizes Canvas as the institution's Learning Management System (LMS). Canvas is a web-based course management technology that allows faculty to administrate and manage course content while accommodating the needs of students through a variety of electronic media (e.g. MS Office productivity suite, video and audio recordings.) For online delivery, all assignment submissions and other course management actions take place using Canvas. Faculty-student interactions (including faculty weekly office hours) will be available via email, phone, and Zoom cloud-based web-conferencing. ODU uses Microsoft Office 365 which allows students to work collectively on documents, presentations and spreadsheets. The university provides technology support 24-hour access via ODU Information Technology Services (ITS) Help Desk. ITS includes specialized support staff for GIS software to assist students with software installation, licensing, data management, and training on how to access online GIS content, free software, and Esri and other site-licensed GIS software.

Faculty members who teach online courses are trained in course development and delivery by ODUGlobal and instructional designers in the Center for Learning and Teaching (CLT.) These designers work with faculty to create or convert traditional course content for web-based platforms, develop assignments, tests, and educational materials. Faculty work closely with the designers to ensure web-based content is the same or higher quality as that used for face-to-face instruction. In addition, ODU maintains a site license for Esri ArcGIS Pro, ArcGIS Online, and a variety of other specialized software at reduced prices or free for this program (GlobalMapper, Drone2Map, Geographic Calculator, and Sentinel Applications Toolbox.) ODU ITS also maintains a cloud-based Monarch Virtual Environment (MoVE) with virtual machines specifically configured to support GIS instruction. Specialized assistance installing, licensing, and using software and MoVE are included in courses and supported by technical staff.

Curriculum

The proposed Master of Science in Geographic Information Science and Technology will require 30 credit hours.

The foundation courses will provide students with the introductory breadth and depth of GIS data, software, and core analytical techniques. Students will gain a basic understanding of GIS data models and structures, databases and file formats, enterprise data handling for workstations and cloud-based GIS, and fundamental techniques for spatial analysis and GIS map design.
The core curriculum builds on this foundation to expand competencies in GIS data acquisition, spatial analysis, imagery and photogrammetry, and using GIS in distributed or cloud-based computing environments. Students will apply GIS data alongside statistical and desktop productivity software. They will learn how to acquire satellite or drone UAS datasets, conduct image processing, analyze patterns, and create suitability and predictive models. Students will gain

experience and expanded competency doing scenario-based exercises and their own applied projects in a range of contexts that reflect the burgeoning GIS sector (urban planning, hazards and resilience, environmental management, and infrastructure and commercial location analytics.) Students will also design geospatial databases, critique GIS implementations, and create sophisticated spatial analysis workflows to produce problem solutions. Students will gain a critical understanding of professional standards, current challenges, potential harms, risks, and ethical considerations in GIScience practice.

The capstone project will provide a culminating opportunity for students to synthesize knowledge and apply skills from their coursework. Students will use their skills to solve a real-world analytical problem and conduct the capstone project from ideation to analysis and creation, communication, and dissemination of capstone project products.

New courses are denoted with an asterisk *.

Program Requirements

Core Courses: 12 credit hours
GEOG 600 Geospatial Data Analysis (3 credits)
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Restricted Electives 15 hours (minimum 6crs. at 600-level or above)
Students consult with their program advisor to choose from a selection of restricted elective courses that develop advanced technical skill proficiency and deeper application domain knowledge. Courses include geospatial techniques and applications, allowing students to tailor their education to their specific interests and career goals. A minimum of two 600-level courses are required from among the following:

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OEAS 895 Remote Sensing Technology for Ocean and Earth Sciences (3 credits)
GEOG 6XX Geospatial Internship* (3 credits)

Capstone Course: 3 hours
GEOG 7XX Geospatial Capstone Project* (3 credits)

Total: 30 credit hours

Description of Capstone Project
The capstone project will give all students the opportunity to synthesize knowledge and apply skills to a real-world problem and solution using geospatial analysis. Students enrolled in the program must enroll in the Geospatial Capstone Project course in their last semester. The student must submit an abstract for the project to be approved by the instructor, present it to a committee of faculty who will review it, and submit a project report for program assessment. Student will be graded on the appropriateness of geospatial data and rigor of analysis techniques used; use of professional standards, completeness of documentation, source data, and references; and quality of presentation and final report (e.g., webmaps, webapps, and cartographic visualizations.) Students will participate in capstone project presentations via video conferencing with the instructor and faculty committee. If a student fails to earn a C grade or above on the capstone project, the student will be given an opportunity to retake the course and work on the same project or complete a new project. Failure a second time will result in dismissal from the degree program.

See Appendix A for Sample Plan of Study
Course descriptions are provided in Appendix B
See Appendix C for a list of internship sites

Faculty Resources

The Department of Political Science and Geography has six (6) full-time faculty members who provide essential courses and administrative support for the program. Faculty hold doctoral degrees in geography and geoscience related to the proposed degree program. The faculty have a combined 75 years of teaching experience at the university level. Existing adjunct faculty members who may also teach courses must have earned at least a doctoral degree in geography or closely related discipline.

One (1) new faculty member will be hired who will teach in the proposed degree program. The position will require a Ph.D. degree in geography or a closely related field and expertise in urban geography and planning (key applications of GIS.) The new faculty will be hired at the rank of Assistant Professor or higher.

See Appendix D for faculty CVs.

Advisory Board

To ensure the relevance and alignment of MS in Geographic Information Science and Technology program with emerging GIS and geospatial technology areas as well as industry demands, an advisory board comprising regional GIS industry leaders and employers will be established. This advisory board will play a crucial role in advising faculty and will convene semi-annually to provide valuable insights and guidance.

The advisory board will consist of leaders and professionals from the regional GIS industry, representing diverse sectors relevant to GIScience and technology. These sectors may include government agencies, private enterprises, non-profit organizations, and academia. The program will recruit board members and leverage their expertise. Examples of organizations to solicit members include the Hampton Roads GIS Users Group (HRUG) and the Virginia Association for Mapping and Land Information Systems (VAMLIS.) HRUG, is the regional GIS professional group for Hampton Roads and conducts quarterly to semi-annual meetings or events such as "GIS Day" in November. VAMLIS, the Virginia-wide professional association of GIS practitioners hosts the GIS industry conference, *GeoCon*, and brings together professionals, employers, and academics. HRUG and VAMLIS are valuable resources for students, facilitating opportunities for internships, capstone projects, and instructional alignment with the latest trends in GIS professional practice.

These organizations not only serve as potential pools for internships and capstone projects for students of the program but also contribute selected individuals to serve on the degree program advisory board. This ensures dynamic and diverse perspectives that reflect the current landscape of GIS professional practice.

See Appendix E for a list of prospective Advisory Board members
See Appendix F for support letters

Student Learning Assessment

Every student who completes the proposed MS in Geographic Information Science and Technology will have mastered the skills needed as a GIS analyst, GIS administrator, or professional geospatial scientist. Students will be assessed in each course through various mechanisms and instruments pertinent to the discipline (1) projects, (2) laboratory exercises, (3) term papers, briefs, and critiques, and (4) exams. The capstone course will provide an opportunity for deeper focused learning, applying skills gained in the curriculum, and demonstrating professionalism. For students who also complete an optional internship, the students' learning will be assessed by the internship site professional, faculty advisor, and program internship coordinator.

Learning outcomes of the degree program are specific to the graduate level knowledge, skills, and abilities that students should acquire in the proposed curriculum. Faculty in the program work with ODU Academic Assessment office to ensure that meaningful data are systematically collected and analyzed to assess student achievement and the quality of the educational experience provided. Annual assessment reports are submitted September 30th following data compilation and faculty review.

Learning Outcomes

Students will be able to:

- Comprehensively describe and use geospatial data and analyses including data acquisition sources, spatial reference, storage and data retrieval, analysis and display.
- Effectively analyze geospatial problems and prescribe analyses to produce results and solutions for decision-making and management for organizations.
- Use modern geospatial analysis to a range of problem areas, demonstrating mastery of geospatial raster and vector analysis techniques (e.g., spatial analysis, cartography and geovisualization, and remote sensing.)
- Apply GIS programming and graphical modeling techniques to implement efficient and complex workflows.
- Communicate geospatial management, analysis, and output products using effective written and geovisual products for various audiences.
- Demonstrate understanding of professional standards, ethics, and responsibility in geospatial science and technology.

Curriculum map for MS in Geographic Information Science and Technology

Learning Outcomes	Core and Required Courses	Assessment Measures
Describe and use geospatial data and analyses	GEOG 600. Geospatial Data Analysis GEOG 6XX. Geospatial Professional Practice and Leadership	Formative: Module tests, lab and homework assignments, use of GIS software Summative: Midterm exam, final exam, final project
Effectively analyze geospatial problems and prescribe analysis solutions	GEOG 600. Geospatial Data Analysis GEOG 601. Spatial Statistics and Modeling	Formative: Module tests, lab assignments, article critiques, problem solutions and code scripts or notebooks Summative: Midterm exam, final exam, final project
Use geospatial raster and vector analysis techniques and complex spatial analysis workflows	GEOG 600. Geospatial Data Analysis GEOG 601 Spatial Statistics and Modeling GEOG 563 GIS Programming GEOG 509 Drone Applications Proseminar	Formative: Lab and homework assignments, module tests, interpretation of GIS technique results Summative: Final exam, final project

Communicate geospatial management, analytical and output products	GEOG 601. Spatial Statistics and Modeling GEOG 590 Applied GIS/Cartography GEOG 6XX Geospatial Professional Practice and Leadership GEOG 6XX Geospatial Internship GEOG 7XX Geospatial Capstone Project	Formative: Lab and homework assignments, webmaps, hub and dashboard products Summative: Final project, final exam, webmap portfolio products, internship performance assessment
Demonstrate understanding of professional standards and ethics	GEOG 600. Geospatial Data Analysis GEOG 6XX Geospatial Professional Practice and Leadership GEOG 6XX Geospatial Internship GEOG 7XX Geospatial Capstone Project	Formative: Homework assignments, article critiques Summative: Midterm exam, final project, final exam, capstone project essay, internship performance assessment

Employment Skills

Graduates of the Master of Science in Geospatial Science and Technology will be able to:

- Conceive, design, and implement complex geospatial analysis projects in a wide range of spatial scales, agencies, and application areas.
- Select, acquire, and critically assess the quality of geospatial data sources, create and curate metadata, assess spatial and attribute accuracy, and conduct data management practices.
- Interpret spatial statistical results and write accurate summative reports to inform decision-making.
- Use technical skills to operate GIS software, including desktop, web, and spatial analytical software tools.
- Analyze spatial data in laboratory projects for spatial relationships, quantitative spatial patterns, spatial statistical prediction, and assessment of accuracy, error, and uncertainty.
- Create high quality GIS presentation products able to effectively convey spatial analyses, maps, and geographic methods and patterns via cloud-based GIS interfaces.

- Identify issues and prescribe ethical and professional standards and practices in geospatial professions within the workplace, profession, and wider society.

Relation to Existing ODU Degree Programs

The proposed MS in Geospatial Information Science and Technology is a new graduate degree program and not merely an expansion of an existing concentration, major, minor, or track. The Department of Political Science and Geography offers graduate certificates in Geographic Information Systems (GIS) and Spatial analysis of Coastal Environments (SpACE.) Each certificate is 18 credit hours aimed at students in existing master's programs or professionals who desire to augment their professional skills with geospatial analysis. These certificate programs will continue to be available for students to receive additional education in GIS and coastal applications, respectively. In addition, the Geography Program supports a Geospatial Analytics Concentration in the MS Data Science and Analytics program. That concentration focuses on data science with a secondary Geographic Information Systems analytical skillset, whereas the proposed MS Geographic Information Science and Technology degree program has a wider and deeper focus on GIS, cartography, remote sensing, and applications sectors. The programs share two courses in common, GEOG 600 Geospatial Data Analysis and GEOG 601 Spatial Statistics and Modeling. The proposed program will be attractive to a wider professional audience who have professional applications focus and not a data science emphasis. This wider focus reflects a broader professional practice and will be more attractive to GIS professionals than the data science geospatial analytics concentration.

Effect on Existing Degree Programs

The proposed MS in Geographic Information Science and Technology will not affect existing degree programs at Old Dominion University. The proposed degree has a different scope and targets professional practitioners, attracting students interested in geospatial concepts, skills, GIS management and leadership. The degree will not affect resources of other degree programs in the BS or MS levels. No degree program will be negatively impacted or closed as a result of initiation and operation of the proposed program.

Relation to Existing GMU and VT Degree Programs

The proposed MS in GIST has similarities to the MS degree in Geoinformatics and Geospatial Intelligence offered at George Mason University. However, the GMU program emphasizes computational approaches to geospatial analysis, whereas our proposed degree emphasizes broader techniques and applications of Geographic Information Systems. Computational techniques are available in the proposed ODU program but not emphasized nor required. In addition, GMU offers a MS degree in Geographic and Cartographic Sciences. This program somewhat relates to the ODU proposed MS program but emphasizes the employment market of northern Virginia. The GMU MS curriculum also covers numerous thematic courses (transportation, health, military and sustainable development) that are not offered at ODU. In contrast, the ODU MS proposes a

curriculum that concentrates core GIS classes and restricted electives that all apply geospatial technology in our ODU specializations and Hampton Roads' region (coastal, marine, drones and uncrewed autonomous systems, and urban coastal resilience.) Further, the bulk of the GMU program is delivered synchronously on-campus, whereas ODU's proposed MS will be fully online and asynchronous.

VT offers an MS in Geography that has slight commonality to the ODU MS proposal. However, only one-third of the VT Geography curriculum is geospatial courses, and few of these courses cover applications areas of GIS. ODU's proposed MS has courses in geospatial techniques and their applications (coastal, marine, drones, and urban resilience.) The VT MS is offered by face-to-face modality in Blacksburg, whereas the proposed ODU MS will be fully online and asynchronous.

In summary, the GMU and VT have marginal similarities to the proposed ODU MS in Geographic Information Science and Technology degree program. ODU's proposed MS is less computational and more applied than GMU, more GIS-intensive than VT Geography, and the only program fully online and asynchronous mode of delivery. Graduates of the proposed ODU degree program who might desire in the future to pursue a Ph.D. terminal degree could apply to VT and GMU associated doctoral programs: VT's Ph.D. in Geospatial and Environmental Analysis and GMU's Ph.D. in Earth Systems and Geoinformation Sciences.

Response to Current Needs
(Specific Demand)

Geographic Information System technologies provide a diverse set of data, tools, and techniques that contribute to society. These include vital mapping and data infrastructure for cities, industry, commerce, and environmental management. GIS professionals work in planning, public works, engineering, non-profits, scientific agencies, and consulting companies. Geospatial professionals create and maintain GIS databases, provide cartographic products and tools for other professions, and serve a critical role asset management. Indeed, a committee of the National Academies of Sciences, Engineering and Medicine (NASEM) was convened and addressed the critical need to fill workforce demand and overcome gaps in diversity and advanced geospatial education. This committee studied the workforce demand and existing degree programs and curricula nationally. It recommended improving the pipelines for professionals and adjustments to curricula to include advanced geographic information systems and applications sectors.

These recommendations are especially pertinent in Virginia, which has grown a strong geospatial industry that supports national defense, economic development, and management of hazards arising from climate change and sea level rise. This recent strategic gap follows similar assessments, such as the National Research Council's identification of a gap in Geospatial Intelligence (GeoINT), which has been helpfully filled with George Mason University's focused masters. The coastal adaptation and resilience sector in Hampton Roads addresses sea level rise, designing architecture and engineering sector, using geospatial data to assess flood risks and

inform the planning and design of resilient communities. With 8.6 million residents and 3,300 miles of coastline, Virginia is renowned for its coastal heritage, resources, estuaries, and beaches, and managing these resources and supporting these communities requires GIS professionals with the skills to create and analyze data and provide spatial decision support. The region is a critical gateway for commerce, national security, and regional tourism that has been identified as vital to the Commonwealth's Coastal Resilience Master Plan and the national defense and security (REF sentinel landscape cooperative.)

Industry Demand

Virgina is renowned for its high technology and marine-oriented economy comprising $6.2B wages, 123,000 employees, and $9.0B in GDP[5], yet the state is also very exposed to sea level rise and coastal hazards. This situation underscores the need for applied GIS professionals, who play critical roles in coastal and urban risk assessment, mapping, planning, and analysis. Municipal governments and planning agencies rely upon GIS to plan and adapt communities, using GIS skills to manage infrastructure, delivery city services, provide citizen data and service access, plan for sustainable development, and provision tax, parcel, and property data. National defense agencies and civilian contractors require advanced GIS to plan and protect facilities, coordinate defense and surveillance, and perform critical intelligence analyses. The National Geospatial-Intelligence Agency (NGA), for instance, is headquartered in northern Virginia and employs hundreds of military personnel and civilians who analyze satellite imagery and create maps and geospatial intelligence. Public utilities, private energy and power companies, ports and logistics services companies, and retail distributors rely on GIS for market analysis and operations.

Professionals having a Masters in Geographic Information Science and Technology are necessary to these industries, government agencies and non-profit organizations that tackle such problems. In addition to the core knowledge of designing, implementing and operating a GIS, a MS degree program must emphasize applied domain knowledge to support coastal, environmental and resilience applications. In the example of telecom and other infrastructure intensive domains, GIS analysts require a combination of the advanced technical skills *and* broad domain area knowledge (e.g., tax and parcel property and real estate data, easements, zoning, and planning regulations and ordinances, and communications and governmental services processes.) These areas stress the applied and interdisciplinary knowledge of using GIS to solve real-world problems, which meets demands in growing job outlook fields including: security/defense intelligence, coastal engineering and planning, physical science and satellite Earth Observations, uncrewed autonomous systems mapping (drones), and business and services location analytics (trade areas, routing, and marketing.) These are also thematic topics that are applicable to the region and unique industry and agency requirements of employers such as FUGRO, Dewberry, NASA LaRC, and Navy Facilities Command (NAVFAC.) To achieve this combination of core analytical and applied competencies, our program contains a hybrid foundation and core curriculum inclusive of application courses that support industry demand.

[5] 2023 Marine Economy Report: Virginia. NOAA Office for Coastal Management. https://coast.noaa.gov/data/digitalcoast/pdf/marine-economy-virginia.pdf

Filling Gaps in Geographic Information Systems Applications

Unique regional needs and sectoral skills differentiate Hampton Roads and Old Dominion University capacity from marginally related masters degrees in the Commonwealth. The professional demand for a core of advanced GIS, photogrammetry, and geospatial analysis techniques is very high yet also exhibits topical specific areas[6]. To explicitly consider these factors, the proposed degree program incorporates coursework that covers spatial data, advanced methods, and geodata management of special interest to municipal and state government employers and agencies and commercial businesses that support them.

Coastal GIS Applications

Owing to its historic and globally significant deep-water port at the mouth of the Chesapeake Bay, ODU is eminently poised to support growing coastal and marine spatial planning and management challenges that require GIS. The Port of Virginia (PoV), for instance, recently followed up a research study by ODU and is implementing a dedicated enterprise GIS. The PoV is among the top three largest ports on the Eastern Seaboard, operating four major cargo container terminals. The area also requires complex near-real time data management and spatial planning for port operations, regulated by the Captain of the Port of the US Coast Guard Fifth District, the Navy, and numerous other port commercial operators. Another distinctive feature of the region is the burgeoning potential for offshore wind energy resource development. The Commonwealth of Virginia has received approval for the first-ever commercial scale windfarms to be developed in federal waters offshore Virginia.

Strategic and emerging industry needs also reflect specific demands for graduate GIS degrees. Immediate needs for offshore wind include GIS support for marine spatial planning as well as future operational support for the service and maintenance of offshore wind energy, its infrastructure, and its shore-based assets and manufacturing. Dominion Energy will also be the first utility in the United States to operate offshore wind turbines in federal waters. Already strongly developing land-based renewables, Dominion Energy is itself an active and growing employer of GIS professionals. These early investments will develop a new industry to service and sustain the offshore wind energy production, all of which includes spatial planning and logistics maintained by GIS. Concomitant with the port of offshore wind sectors, the coastal region encompasses complex environmental and regulatory policies that are often managed spatially. With the startup of the Masters degree, these courses will play an integral role developing hybrid skills and student depth of coastal-marine critical knowledge and problem-solving. Given scientific forecasts for sea level rise and recurrent flooding, the Commonwealth and regional government are expected to see continued strong demand for these fields of study within GIScience. The availability of these courses also extends a natural postgraduate professional pathway for graduates who may have specialized in oceanography, marine science, or civil and

[6] Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, Cartographers and Photogrammetrists*, https://www.bls.gov/ooh/architecture-and-engineering/cartographers-and-photogrammetrists.htm (last accessed 1 July 2023.)

environmental engineering but who want to pursue a masters with an integrated, applied, and scientific skills emphasis.

Urban GIS Applications

Urban applications of GIS are a major sector needing advanced GIS education owing to the mass volumes of "Big Data"[7] and the complexity of urban infrastructure. As the second largest metropolitan area of Virginia, Hampton Roads comprises seven distinct cities, a regional Planning District Commission, regional and state agency offices of several federal agencies, and of course, extensive military installations and facility support commands. This extensive urban metro is served by critical geospatial data infrastructure, providing everything from transportation, water supply and wastewater, electric grid, and innumerable government and commercial services. Each municipality hosts dedicated GIS staff as well as secondary GIS analysts and technicians across multiple departments. Indeed, some cities have multiple GIS offices and managers, reflecting a mature and embedded reliance on GIS. The Hampton Roads GIS User Group (HRUG) is among the largest in the state (with quarterly to annual meetings drawing 100-150 attendees), and the region often hosts the VAMLIS statewide GIS professional association annual meeting. The state agencies including VDOT and VIMS have regional offices that heavily use GIS. Complex infrastructure networks managed by Dominion Energy and Hampton Roads Sanitation District (HRSD) also rely upon enterprise GIS support staff. Several professional affinity groups are also present and "power users" of GIS in the area, including the American Planning Association (APA) and its urban and regional planning professionals, found in each city and numerous environmental consulting-engineering firms. In sum, resilience has featured geospatial analysis as an integral approach and is an emerging, high-demand field for advanced GIS education[8].

Uncrewed Autonomous Systems Applications

In order to build the GIS workforce with advanced technical talent, the proposed program aims to expand graduate offerings in the Commonwealth. While a bachelor's degree in a related field is required for almost all GIS positions from entry-level and higher, many GIS positions require advanced education and experience, greater technical skills than achievable in a 4-yr undergraduate degree and/or greater management, professional, or leadership skills. The proposed graduate program gives students a professional "extension ladder" for their careers, additional technical, theoretical, leadership, managerial and business skills required in high-level GIS positions. The skills reflected in job advertisements and employer contacts with university faculty include specific technical competencies, including design and tuning of GIS databases, scripting and advanced workflows, creating and managing cloud-based GIS tools, analysis of advanced remote sensing and drone sensors, and interoperability of GIS with other scientific sensors, mobile field collectors, Internet-of-Things (IoT) (e.g., flood sensors, webcams, utility sensors and

[7] Yaragal, S. 2018. Big data in GIS environment. *Geospatial World,* https://www.geospatialworld.net/blogs/big-data-in-gis-environment/ (Last accessed 20 May 2019.)

[8] Esri. 2023. *Digital Twins: GIS creates digital twins of the natural and built environments.* https://www.esri.com/en-us/digital-twin/overview (last accessed 1 September 2023.)

controls, or traffic sensors), and uncrewed and remote operated systems (e.g., drones or vessel automated identification systems.) The same advanced skills and technologies attractive to employers also attract students and professionals, who see that obtaining a master's degree in GIS is an opportunity for career advancement.[9,10]

Employment Demand

The proposed MS in GIST program is designed to build advanced proficiency in Geographic Information Systems and its applications. Graduates will be prepared to serve as advanced geospatial analysts, GIS managers, physical scientists focusing on GIS, remote sensing, and spatial analysis. Graduates will be able to work in industry sectors such as government/public sector, military, private and non-profits to meet the Commonwealth's and nation's demand for growing geospatial infrastructure. The US Department of Labor's 2020 outlook for Cartographers and Photogrammetrists cites a median annual wage of $64,430 and a 19% growth through 2026, much faster than the average across all occupations (Bureau of Labor Statistics, 2020.) Projected growth for Cartographers and Photogrammetrists within Virginia is estimated from a base of 460 to 550, reflecting a change of 19.6% in ten years in the Commonwealth. Projections broken into short- vs. long-term estimate that most of this growth will be in the long-term (6.4% 2016-20 vs. 13.2% 2020-26.) In addition, several of the associated occupations (urban and regional planners, environmental scientists, emergency managers, geoscientists) also are expected to see double-digit increases in positions (ranging 11-17%; PMP 2020.)

Labor Market Information: Bureau of Labor Statistics, current decade 2020-2030 (10-Yr)

Occupation	Base Year Employment	Projected Employment	Total % Change and #s	Typical Entry Level Education
Cartographers and photogrammetrists	13,200	13,900	5%, 700	Bachelor's degree
Surveying and mapping technicians	54,800	56,900	4%, 2000	High school diploma or equivalent
Surveyor	46,000	46,700	2%, 700	Bachelor's degree

Virginia and Regional Context

[9] GIS Salary Expectations: Climb the GIS Career Ladder. *GIS Geography*, https://gisgeography.com/gis-salary-expectations-gis-career/ (last accessed 28 February 2024.)

[10] Top 50 Highest Paying States for GIS Manager Jobs in the U.S. https://www.ziprecruiter.com/Salaries/What-Is-the-Average-GIS-Manager-Salary-by-State (last accessed 26 February 2024.

Starting salaries for masters GIS professionals varies widely, depending upon the subfields, yet informal appraisals from graduates among peer institutions and our preliminary survey place a range from $60,000 to $70,000 and median of $63,000 in 2018. As compared to starting salaries from bachelors degrees in GIS or Geography, these higher salaries provide an attractive incentive for professionals or current bachelors students alike to obtain a postgraduate degree. A LinkedIn workforce report (2022) recently noted the strong gap in demand and supply for data scientists, broadly, but highlighted that the gap is largest in those with the computing skills as well as oral communications, a skill that is targeted to develop in our curriculum[11]. In the subset field of GeoInt, a current jobs clearinghouse currently reports 844 job openings requiring security clearances[12], several of which are located regionally such as Langley Air Force Base, Springfield, Chantilly, Fort Belvoir. In fact, more than half of the job vacancies are within Virginia (471 of 844.)

Labor Market Information: Virginia Employment Commission, 2018 -2028 (10-Yr)

Occupation	Base Year Employment	Projected Employment	Total % Change and #s	Annual Change #	Education
Cartographers and Photogrammetrists	512	606	18.3594%, 94	9	Bachelor's degree
Surveying and Mapping Technicians	2132	2260	6.0038%,128	13	High school diploma or equivalent
Surveyors	1636	1696	3.6675%, 60	6	Bachelor's degree
Architects, Surveyors, and Cartographers	6495	6920	6.5435%, 425	42	Not applicable

Approximately 480 cartographers and photogrammetrists (occupation code 17-102) were employed in Virginia, having a median income of $81,750[13]. Projected Virginia job growth is extremely strong, among the top 5 occupations in the broader categories of Computer and Information Systems Managers (+2,882) and software or applications developers (+8,019)[14]

Hampton Roads Focus

[11] LinkedIn Workforce Report, August 2018. https://www.linkedin.com/jobs/blog/linkedin-workforce-report-august-2018-san-francisco-ca?src=li-other&veh=news.linkedin.com

[12] GeoInt Jobs, https://www.clearancejobs.com/q-geoint

[13] US Dept. of Labor, Bureau of Labor Statistics, Occupational Employment Statistics May 2018. https://www.bls.gov/oes/current/oes_va.htm#19-0000

[14] Projected Virginia Job Outlook, Virginia Employment Commmission. https://www.vec.virginia.gov/sites/default/files/documents/2024-Jobs-Outlook.pdf

The Hampton Roads area includes organizations that are keenly interested in this program. Letters of support from several of these employers may be found in Appendix F.

A survey was conducted among employers and prospective students with results of the survey are found in Appendix G.

Appendix H contains current job descriptions and position announcements demonstrating a need for prospective employees with the knowledge that this degree program would provide.

Duplication

Few master's degree programs are offered in the Commonwealth of Virginia that are similar to the proposed ODU program. Summary information below support and affirm the non-duplication of the program in four fundamental aspects:

1) The program only topically relates to two university programs at GMU and VT. GMU's programs are based in Northern Virginia. VT's program is a broader, geography masters and does not focus on GIS. MWU's program, an evening program focused on part-time, commuting students, is in the process teach-out and closing.
2) ODU's proposed program is for online, asynchronous delivery, meeting a larger pool of demand and professional accessibility that leverages ODUGlobal digital instruction capabilities.
3) The proposed program is responsive to a wide range of coastal, urban, and resilience applied GIS skills that are in high demand and within ODU faculty expertise.
4) The proposed program as a professional masters, can serve as a conduit to doctoral programs at other institutions (e.g., VT Geospatial and Environmental Analysis PhD program and GMU Earth Systems and Geoinformation Sciences PhD)

Institution	**Program degree designation, name, and CIP code**	**Degrees granted (most recent 5-yr average)**
George Mason University	M.S. Geographic and Cartographic Science, 45.0701	11
George Mason University	M.S. Geoinformatics and Geospatial Intelligence, 45.0702	6.8
Virginia Tech	M.S. Geography, 45.0701	9.6
Mary Washington	M.S. Geospatial Analysis, 45.0702	2 (closing)

Similarities

GMU's programs emphasize a wide range of geospatial data and analysis techniques, spanning remote sensing, GIS, spatial analysis, and small UAS systems. Both programs include cartographic communications and analysis and digital, webGIS skills courses. The programs also have similar credit hour requirements.

Differences

The GMU programs focus on delivery of instruction via primarily synchronous, on-campus face-

to-face instruction modes, whereas ODU's proposed MS-GIST will be online, asynchronous with periodic optional events and seminar options. GMU's programs emphasize computational approaches to GIS, and while ODU includes such courses, it is not computationally focused. ODU's program also incorporates significant professional development, management, leadership and ethics content. ODU's curriculum also includes a liberal array of applied GIS and applications courses (e.g., coastal, marine, and urban resilience), more applied as compared to GMU.

Location and Delivery

GMU's program is primarily offered at its northern Virginia Fairfax campus, with a fraction of its classes available online asynchronously. In contrast, ODU's proposed MS is designed for online, asynchronous instruction, providing access to full-time professionals and those unable to commute to on-campus courses. The MS degree programs that are offered similarly to ODU's proposed MS are out of state: Johns Hopkins University (Maryland), Penn State Online (Pennsylvania), NC State University (North Carolina), University of Denver (Colorado), and University of Redlands and University of Southern California (California.)

Student Demand

Student demand for a masters degree in GIS or related geospatial technology at Old Dominion has lingered for literally decades. Absent the availability of advanced studies beyond our GIS certificates, students have found options outside the state (e.g., Penn State, NC State, Maryland or elsewhere.) Indeed, some of our courses are in such demand that students in those programs have enrolled as non-degree-seeking students in ODU to take our courses and then transfer them to these other universities toward their degrees.

A survey was administered concurrent to prior VAMLIS *GeoCon* conferences and annual Hampton Roads GIS User Group "GIS Day" events, including 2021 and 2023 in-person polling. *GeoCon* is the leading statewide professional GIS conference. From the survey of cumulative 100 responses, 39 prospective students expressed interest in pursuing the MS-GIST program in its proposed form via online delivery.

Interest is extremely high owing to the growing demand for advanced technical and managerial skills in the GIS profession. Prospective students note especially strong interest in GIS programming, cloud-/web-based GIS, and Enterprise GIS (spanning GIS database design and administration, scripting, and management.) Emergent subfields such as UAS/Drones and machine learning/Artificial Intelligence are also notable. Few undergraduate programs provide the depth desired, and availability of such curricula in Virginia is an apparent gap, especially for full-time working professionals. A smaller subgroup of existing students also express interest in pursuing a masters degree as a possible extension of prior GIS study.

STATE COUNCIL OF HIGHER EDUCATION FOR VIRGINIA
Summary of Projected Enrollments in Proposed Program

Projected enrollment:

Year 1		Year 2		Year 3		Year 4 **Target Year (2-year institutions)**			Year 5 **Target Year (4-year institutions)**		
2025 - 2026		2026 - 2027		2027 - 2028		2028 - 2029			2029 – 2030		
HDCT 8	FTES 10	HDCT 25	FTES 15	HDCT 34	FTES 28	HDCT 45	FTES 34	GRAD 12	HDCT 50	FTES 35	GRAD 12

Assumptions:
Retention: 90%
Part-time students: 60% / Full-time students: 40%
Full-time students credit hours per semester: 12
Part-time students credit hours per semester: 6
Full-time students graduate in 1.5 years
Part-time students graduate in 2.5 years

Projected Resource Needs for the Proposed Program

Resource Needs

Old Dominion University and the Department of Political Science and Geography have the resources necessary to initiate and sustain the proposed MS degree program in Geospatial Information Science and Technology. The department will have the faculty, staff, equipment, and space needed. Six full-time faculty with four focused in GIST specializations will be tenured or in tenure-track positions. The proposed program will allocate 1.0 FTE of instructional effort for every 7.0 of enrollment. The proposed program will thus require 1.20 FTE of instructional effort in 2025, rising to 6.2 FTE by the target year 2028-29.

Full-time Faculty
Six (6) faculty teach geospatial courses in the department and will regularly offer courses for the program. Three faculty will dedicate 100% of their teaching load (3 FTE.) One faculty member will serve as the program director and dedicate 50% (0.5 FTE) of the teaching load to the proposed program. Based on teaching load, 3 of 4 faculty will be full-time to the proposed degree program.

The Dean of the College of Arts and Letters has committed resources for another faculty member, who will teach part-time in the proposed program at launch in 2025-26 pending hiring. The new faculty will be hired at the rank of Assistant Professor and dedicate 50% of their

teaching load (0.5 FTE) to the proposed degree program. In sum, the proposed program will require 1.00 FTE in 2025-26, rising to 3.5 FTE in the target year.

Part-time Faculty
Faculty from the Department of Political Science and Geography will teach required courses in the degree program. It is anticipated that 5-6 faculty will rotate teaching the courses. The program will require 0.20 FTE of part-time faculty to initiate and rise to 1FTE of part-time faculty in the target year.

Adjunct Faculty
Three adjunct faculty may assist in teaching required courses in the proposed degree program. No adjunct faculty will be necessary in the initial year. The proposed degree will require 0.5 FTE of adjunct effort by the target year 2028-29. All adjunct faculty will be paid at the same applicable rate per credit hour at that time (and not paid fringe benefits.)

Graduate Assistant
The Dean of the College of Arts and Letters has provided one Graduate Teaching Assistant (GTA) for the proposed program serving in the capacity of the GIS lab assistant. This GTA will continue to receive an academic year stipend and no fringe benefits.

Classified Positions
An administrative assistant currently employed by the Department will support the proposed degree program. The program will require 0.50 FTE of classified employee support to initiate and remain constant. Salary for the administrative assistant will remain unchanged subject to future adjustments.

Equipment (including computers and software)
In the initial year equipment will be purchased for the new faculty hire and to update laboratory and server computing equipment. Working with ODUGlobal and ITS, the Department will acquire software licenses to support courses and provision technical support and network or cloud computing resources for online course development. No new resources will be required after this infrastructure is implemented. The Department will continue to maintain the on-campus GIS laboratory and its parallel Monarch Virtual Environment (MoVE) virtual machines. ODUGlobal will provide funds for online course development. ODU will also scale its MoVE and networking capacity to meet or exceed equivalent capabilities and performance of on-campus instruction. Software licenses for Esri will be sustained with the addition of packages for new courses (e.g., Drone2Map Advanced 3D package and/or Pix4D photogrammetry and remote sensing software. Minor ancillary software licenses will also be supported from Department funds and laboratory fees as new courses are implemented or enrollment growth demands. The curriculum will also leverage low cost or free and open-access software and educational materials.

Library
No additional library resources are necessary to launch or sustain the proposed degree program. The library collection and journals are adequate, and faculty will utilize open-source and Virtual Library of Virginia (VIVA) on-line access. The Department will utilize funding from the library to recommend or purchase any ad hoc additional new resources.

Communications and Marketing
The Department, College of Arts and Letters, and University will provide funds to advertise the program and recruit students in pertinent events (e.g., VAMLIS GeoCon, HR GIS User Group, or Esri User Conference events.) This is anticipated to be $2,000/year for the first three years for a total of $6,000.

Funds to Initiate and Operate the Degree Program

Part A: Answer the following questions about general budget information.

- Has or will the institution submit an addendum budget request to cover one-time costs? Yes _____ No X
- Has or will the institution submit an addendum budget request to cover operating costs? Yes _____ No X
- Will there be any operating budget requests for this program that would exceed normal operating budget guidelines (for example, unusual faculty mix, faculty salaries, or resources)? Yes _____ No X
- Will each type of space for the proposed program be within projected guidelines? Yes X No _____
- Will a capital outlay request in support of this program be forthcoming? Yes _____ No X

Part D: Certification Statement(s)

The institution will require additional state funding to initiate and sustain this program.

_____ Yes _____
Signature of Chief Academic Officer

X No _____
Signature of Chief Academic Officer

If "no," please complete Items 1, 2, and 3 below.

1. Estimated $$ and funding source to initiate and operate the program.

Funding Source	Program initiation year 2025 – 2026	Target enrollment year 2027 - 2029
Reallocation within the department *(Note below the impact this will have within the department.)*	$75,000	$75,000
Reallocation within the school or college *(Note below the impact this*		

will have within the school or college.)		
Reallocation within the institution *(Note below the impact this will have within the institution.)*	$75,000	$75,000
Other funding sources *(Specify and note if these are currently available or anticipated.)*		

2. Statement of Impact/Other Funding Sources.

Reallocation within the Department:
The Department of Political Science and Geography, in collaboration with the Graduate School, will administer the proposed program. The Graduate Program Director of the MS-GIST will oversee the program and teach a minimum of one course in the program. Funds from the department and College of Arts & Letters will be available at the program's launch and through the target year. In addition, two graduate assistants will assist with this program. The faculty and administration anticipate no negative impact from the implementation of this program.

Reallocation within the Institution:
All courses in this program will be taught by faculty within Political Science & Geography. No negative impact is anticipated for any of the colleges or from any other areas of the University.

3. Secondary Certification.

If resources are reallocated from another unit to support this proposal, the institution will **not** subsequently request additional state funding to restore those resources for their original purpose.

__X__ Agree _____
Signature of Chief Academic Officer

_____ Disagree _____
Signature of Chief Academic Officer

Appendix A
Sample Plan of Study

Sample Schedule for Full-Time Students:

Course	Credits	Category
Fall I		
GEOG 600 Geospatial Foundations	3	Core
Restricted Elective (techniques)	3	Elective
Restricted Elective (applied)	3	Elective
GEOG 6XX GIS Professional Practice and Leadership	3	Core
TOTAL 12 credits		
Spring I		
GEOG 601 Spatial Statistics and Modeling	3	Core
Restricted Elective (techniques)	3	Elective
Restricted Elective (techniques)	3	Elective
Restricted Elective (applied)	3	Elective
TOTAL 12 credits		
Fall II (or summer)		
GEOG 7XX Geospatial Capstone Project	3	Capstone
Restricted Elective or Internship	3	Elective
TOTAL 6 credits		

Total Required for Degree—30 credits

Sample Schedule for Part-Time Students:

Course	Credits	Category
Fall I		
GEOG 600 Geospatial Foundations	3	Core
GEOG 6XX Geospatial Profession and Leadership	3	Core
TOTAL 6 credits		
Spring I		
GEOG 601 Spatial Statistics and Modeling	3	Core
Restricted Elective (techniques)	3	Elective
TOTAL 6 credits		
Fall II		
Restricted Elective (techniques)	3	Core
Restricted Elective (applied)	3	Elective
TOTAL 6 credits		
Spring II		
Restricted Elective (techniques)	3	Elective
Restricted Elective (applied) or Internship	3	Elective
TOTAL 6 credits		
Fall III		
GEOG 7XX Geospatial Capstone Project	3	Capstone
Restricted Elective (techniques or applied)	3	Elective
TOTAL 6 credits		

Total Required for Degree—30 credits

Appendix B
Course Descriptions

Core Courses

GEOG 600 Geospatial Data Analysis (3 Credit Hours)
Course focuses on the fundamentals of geospatial data science. Students learn the key data models, structures, sources, and application of spatial analysis using GIS software, R, programming, and Earth observations.

GEOG 601 Spatial Statistics and Modeling (3 Credit Hours)
This course covers the foundations of spatial statistics and modeling. Emphasis is placed on point, linear and areal patterns, geostatistics, and model development for a variety of problems using multiple software packages.

***GEOG 6XX GIS Professional Practice and Leadership (3 Credit Hours)**
Course focuses on administrative leadership, management, ethics, and organizational practices of professional GIS management. Problems and solutions addresses state-of-the-art developments in geospatial technology using outside speakers, case studies, and critical reviews.

***GEOG 7XX Geospatial Capstone Project (3 Credit Hours)**
Culminating course in the MS GIST degree program designs and develops a project to solve a geospatial analysis problem. Faculty and external representatives serve as mentors for the students (an external mentor is not mandatory but encouraged.)

Electives

GEOG 502 Geographic Information Systems (3 Credit Hours)
A study of the conceptual basis of GIS as a tool for manipulating spatial information. The course focuses on how geographic information can be input and organized within the framework of a GIS. Students will work on a computer-based GIS to gain a greater understanding of spatial database structures and analytical operations.

GEOG 508 Cartography (3 Credit Hours)
Computer-assisted methods and techniques employed in the design, construction, and use of maps and other graphics as tools for data analysis and communication.

GEOG 517 GIS for Planning and Public Policy (3 Credit Hours)
Geographic Information Systems (GIS) and science are an essential tool for urban planners and policy makers who have special interests in places and who need this kind of knowledge for decision making. The purpose of this course is to teach students the foundations of GIS and how it is applied in urban planning and other related disciplines. The course combines lectures, discussion of readings, and hands-on exercises in the computer lab.

GEOG 519 Spatial Analysis of Coastal Environments (3 Credit Hours)
The course integrates remotely sensed and field techniques for scientific investigation and practical management of coastal environmental systems. Spatial modeling of coastal processes and management tools using Geographic Information System (GIS).

GEOG 520 Marine Geography and GIS (3 Credit Hours)
An analysis of the environmental geography and resources of the ocean, with particular emphasis on geospatial analysis of the seafloor, hydrography, climate change, fisheries, ocean pollution, maritime activity spaces and management.

GEOG 525 Internet Geographic Information Systems (3 Credit Hours)
Theoretical and practical exploration of methods, standards, and policies related to the development and utilization of geographic information systems on the Internet. Students will create and utilize distributed geospatial data and analytical systems using the WWW and the Internet to address geographical problems.

GEOG 532 Advanced GIS (3 Credit Hours)
The study of a series of advanced topics in the field of geographic information systems/science. Focus is placed on the development of projects/models and a survey of several advanced techniques. Students will work on a computer-based GIS to implement topics from lectures.

GEOG 560 Medical Geography (3 Credit Hours)
The course covers a range of topics in medical and health geography, including spatial behaviors of infectious disease and health care access. The focus of the course is on the geographical patterns of health and disease from the population rather than individual scale. In addition to seminar style lectures and discussions, the course enables students to further investigate by learning how to conduct medical/health geography research.

GEOG 562 Advanced Spatial Analysis (3 Credit Hours)
This course introduces the essential theoretical concepts and analytical tools for analyzing spatial process, spatial autocorrelation, spatial patterns, techniques for spatial interpolation, network connectivity, big data, and landscape patterns. The course culminates with students carrying out their own spatial analysis projects. This course assumes that students understand the basic concepts in GIS with some experience in software operation of ArcGIS.

GEOG 563 GIS Programming (3 Credit Hours)
This course develops students' GIS programming skills. Focus is placed on Python programming in ArcGIS and JavaScript in Web GIS development.

GEOG 573 GIS for Emergency Management (3 Credit Hours)
Students will demonstrate advanced skills and techniques using spatial data to prevent, mitigate, respond to, and recover from intentional, natural, and accidental homeland security threats and emergencies. This course demonstrates the importance of rapidly disseminating spatial information towards the prevention and response of various organizations to homeland security events. This course will provide students with the tools and experience required to collect,

prepare and manage spatial data and enable students to be prepared to map and analyze the data to quickly and effectively create a coordinated response to real homeland security events.

GEOG 590 Applied Cartography/GIS (1-3 Credit Hours)
Practical experience in applying the principles of cartography and geographical information systems to the design and construction of maps and other graphics.

GEOG 597 Independent Study (1-3 Credit Hours)
Independent reading and study on a topic to be selected under the direction of an instructor. Conferences and papers as appropriate.

BIOL 732 GIS in the Life Sciences (3 Credit Hours)
This course is designed to introduce students to geographic information systems through examples and applications in the life sciences.

DASC 620 Introduction to Data Science and Analytics (3 Credit Hours)
This course will explore data science as a burgeoning field. Students will learn fundamental principles and techniques that data scientists employ to mine data. They will investigate real life examples where data is used to guide assessments and draw conclusions. This course will introduce software and computing resources available to a data scientist to process, visualize, and model different types of data including big data. Cross-listed with CS 620.

Appendix C
List of Internship Sites

City of Norfolk
City of Portsmouth
City of Suffolk
City of Virginia Beach
GeoSEA Center (ODU ITS)
Dewberry Corp.
Elizabeth River Project
Environmental Protection Agency
Environmental Systems Research Institute (Esri)
Hampton Roads Planning District Commission (HRPDC)
Hampton Roads Transit (HRT)
Hampton Roads Transportation Planning Organization
Michael Baker Company
ODU Institute for Coastal Adaptation and Resilience
NASA Langley Research Center
NASA DEVELOP
Naval Air Station Oceana
Newport News Shipbuilding
NOAA Center for Coastal Oceanographic Products
NOAA National Geodetic Survey
Northrop-Grumman
Port of Virginia
The Nature Conservancy
Timmons Group
US Army Corps of Engineers (Norfolk District)
US Fish and Wildlife Service
US National Park Service (Cape Hatteras and Assateague I. National Seashores)
US National Weather Service (Wakefield Forecast Office)
Virginia Modeling and Simulation Center (VMASC)
Virgina Sea Grant
Wetlands Watch
Woolpert Company
WorldView Solutions

Appendix D
Faculty Curriculum Vita (abbreviated)

Department of Political Science and Geography

Allen, Thomas, Ph.D. Geography, University of North Carolina at Chapel Hill, 1995, Professor, Specialization: GIS, remote sensing, spatial analysis, coastal and marine applications.

Liu, Hua, Ph.D., Geography, Wuhan Technical University, China, 2006. Specialization: GIS, remote sensing, environmental GIS.

Whytlaw, Jennifer, Ph.D., Geography, Rutgers University, 2018, Specialization: GIS in emergency management, cartography, hazards and resilience applications.

Ologunorisa, Omolola, Ph.D. Geosciences, 2019, University of Missouri, Specialization: GIS,
McLeod, George, Ph.D. Oceanography, Old Dominion University, 2022, Specialization: GIS, forests, and environmental health.

New Hire: Ph.D. in Geography, Assistant Professor, Specialization: Urban planning and GIS.

New Hire: Ph.D. in Geography, Assistant Professor, Specialization: Natural hazards, environmental policy, human dimensions of climate change, AI.

Appendix E
Prospective Advisory Board

- Ryan Hippensteel (NOAA National Geodetic Survey)
- Derek Barnhill (Woolpert)
- Dr. A. Scott Bellows (Virginia Space Grant Consortium)
- Brian Kingery (Timmons Group)
- Nathaniel Davis (Dominion Energy)
- Shonia Holloway (City of Norfolk)
- Dr. Heather Richter (Hampton Roads Biomedical Research Consortium)
- Laura Rogers (NASA Langley Research Center)
- Kyle Spencer (City of Norfolk)
- Keith Vangraafeiland (Esri)
- Tracy Wamsley (US Navy NAVFAC Facilities Engineering Command)

Appendix F
Letters of Support

October 1, 2024

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

Dr. Leib,

My name is Brian Kingery. You may remember me as you were my initial advisor back in 2013 when I transitioned from Active Duty Army to civilian life and enrolled at Old Dominion University in the Geography program. I am writing this letter in support of ODU establishing a Master of Science (MS) degree program in Geographic Information Science and Technology. I think ODU is well-placed to offer top-notch education and unique insights in fields like social injustice studies, climate resiliency and planning, and more.

Writing from personal experience as someone who successfully completed the undergraduate BS program in Geography at ODU as well as taking the courses necessary to earn the Certificate in GIS, I was primed to take that next step in my higher education and would have continued to use my Post-9/11 GI Bill with this MS GIST degree program at ODU if it had existed a decade ago. In fact, I did go on to earn a MS in GIS from Elmhurst University in their online program.

Over the last decade, I have strived to take on a significant role in the field of GIS in the Commonwealth of Virginia attempting to participate in every sector of GIS possible building on the foundation that ODU helped to establish. After my time at ODU where I studied and worked as a GIS student intern with George McLeod, I went to work in local government with the City of Newport News as a GIS developer. Then, I went to work in state government at the Virginia Department of Transportation as a GIS administrator. I have now left the government and work as a GIS consultant with Timmons Group while also serving on the executive board of Virginia Association for Mapping and Land Information Systems (VAMLIS).

In my present position, I frequently take part in interviewing candidates for GIS technician and analyst roles. A graduate degree can significantly distinguish a candidate from others. If that advanced degree is from ODU with a focus on GIS technology, the candidate is almost certain to secure the job.

If there is anything I can do to serve in an advisory role or to help lend my knowledge or expertise in the field of GIS, let me know. Thank you for taking the time to consider my letter and please don't hesitate to reach out.

Brian Kingery, GISP, PMP
GIS Solutions Architect & Project Manager, VAMLIS Treasurer
Timmons Group | www.timmonsgis.com
1001 Boulders Parkway, Suite 300, Richmond, VA 23225
Mobile: (804) 944-1042 | brian.kingery@timmons.com

CITY OF SUFFOLK

Department of Information Technology - 1st Floor Suffolk City Hall, 442 W Washington ST

Professional Letter of Support for
MS in Geographic Information Science and Technology
Old Dominion University

10/15/2024

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

Dear Dr. Leib:

I am the GIS Manager for the City of Suffolk, Virgina and a 2012 Alumni of Old Dominion University. As a GIS professional I was asked by Associate Professor of Geography Hua Lui if I would be willing to provide a letter of support for the proposed Master of Science in Geographic Information Science and Technology to be offered at ODU. As a GIS professional working in the field for over a decade and an ODU GIS program alumni, I am honored to provide my support for this program. GIS has become an information technology staple within government and private industry, providing access to complex information and spatial analysis to enhance decision making and increase proficiently within an organization. As the use of GIS technologies has increased the need for more qualified GIS professionals has as well.

During my career I and my colleagues have been tasked with more and more complicated requests and duties. Many of these requests require skills in advanced spatial and data analysis, higher level GIS programming abilities, GIS database maintenance and integration, the development of WebGIS applications and tools, and a strong understating of an Enterprise Level GIS environment. As GIS technology use has grown GIS professionals have had to develop and maintain a variety of skills that an undergraduate education in GIS does not always offer. As a GIS Manager finding skilled GIS staff who can meet these demands has required recruiting GIS professionals who hold advanced degrees in GIS. Many of my current staff hold master's degrees in GIS and possessing the advanced GIS skills offered in those programs has been essential to maintaining our organization's GIS program and providing data resources to city staff and the public.

As an ODU alumni I can state that the GIS Certificate program currently offered at ODU provided a powerful framework in GIS technologies, methodologies, and skills, but through my professional experience I can also report that a more advanced graduate GIS program would provide future ODU students with the enhanced skills required in today's GIS field and make graduates more desirable to organizations and recruiters. Currently I am unaware of any other local universities that offer advanced studies in GIS, so adding a program to ODU would provide local students and professionals with an opportunity they would normally have to go elsewhere for. It would also be a great addition to the already well-respected GIS program offered at ODU.

Therefore, I will reiterate my support for a Graduate Program in GIS to be offered at ODU as organizations like Suffolk will continue to need more and more GIS skilled staff as we expand and modernize. In speaking with other professional GIS colleagues, I can confirm other industries would benefit as well. Personally, I would like to offer my services to help shape and guide this program in any way I can. I believe creating a partnership with the program and industries that utilize GIS would be beneficial to ensuring students develop the skills needed in tomorrow's GIS driven world.

Sincerely,

Robert L Bradley
GIS Manager
City of Suffolk, Viginia
rbradley@suffolkva.us
(757) 514-7699

HAMPTON ROADS TPO

October 24, 2024

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, VA 23529-0088

RE: Support for ODU's Proposed MS-GIST Program

Dear Dr. Leib:

On behalf of the Hampton Roads Transportation Planning Organization (HRTPO) staff, we are pleased to offer our strong support for the proposed Master of Science in Geographic Information Science and Technology (MS-GIST) program at Old Dominion University (ODU). This program is essential to meeting the growing demand for geospatial professionals in the transportation sector.

The link between transportation and geography makes advanced geospatial skills critical to our work. At the HRTPO, GIS is indispensable for transportation modeling, corridor analysis, land use assessment, and scenario planning. The proposed MS-GIST program's emphasis on acquiring, analyzing, and visualizing geospatial data aligns directly with the evolving demands of transportation planning. As big data and machine learning become more integrated into transportation systems, the ability to design and implement sophisticated geospatial databases and workflows will be crucial. The program's focus on evaluating GIS implementations and refining spatial analysis techniques will further enhance our capacity to address complex, data-driven challenges and explore emerging technologies such as autonomous systems and real-time analytics.

At the HRTPO, we have long recognized the value of cultivating a workforce with advanced geospatial expertise. Several of our staff members, along with many of the stakeholders we work with, are proud ODU alumni – an indication of the long-standing excellence and wide reach of ODU's Geography program. The creation of an MS-GIST program at ODU will strengthen these connections and expand the pool of highly qualified professionals available to us and other regional agencies.

We are fully committed to supporting the development of this program and would be honored for staff to serve on an advisory panel to help provide insights to ensure that the program remains responsive to the practical needs of transportation planning and other regional priorities. The HRTPO looks forward to contributing our expertise and collaborating with ODU to foster the next generation of GIS professionals.

Should you have any questions or need additional information in support of this program, please do not hesitate to contact us.

Sincerely,

Robert A. Crum, Jr.
Executive Director

K. P. Parthasarathi

Pavithra Parthasarathi
Deputy Executive Director

The Regional Building | 723 Woodlake Drive | Chesapeake, Virginia 23320 | 757-420-8300

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

October 17, 2024

Dear Dr. Leib:

I am writing to express our support for the establishment of the newly proposed masters program in *Geographic Information Science and Technology* at Old Dominion University.

Many of the challenges society faces in this century will be influenced by increasingly complex global issues. Experience shows we will require an understanding of international perspectives, earth systems, emerging technologies, and the geographic relationships between humans and their planet. At Esri we strive to foster science-based policy and solutions and the integration of cutting-edge technologies to aid in the understanding of the geographic impact of these perspectives.

Success will require understanding how to acquire, organize, and analyze staggering amounts of data – and how to efficiently retrieve the data we need from the massive resource available from public, government and corporate domains and how the spatial distribution of the data impacts decisions. At Esri, we pioneer methods for just this task and strive to make data comprehensible through innovative analytics and graphic representation to see what others cannot.

I believe your proposed degree program will be relevant of significant benefit to the broad and diverse local Virginia community and national and international reach of Old Dominion University. Your reach will aid in the training of professionals with the ever-evolving skills required for this important work.

Your program's emphasis on geographic information systems and technology is timely. It recognizes the relationship of geography and technology. At Esri, through interaction with our tens of thousands of clients around the world, we see firsthand, the daily interplay between corporate goals, government policy, public health, environmental stewardship, science, and education and advancements in technology. And much more. Naturally, we understand the need to develop the necessary workforce for this industry through cutting edge academic preparation. This is what you propose.

For all these reasons, we at Esri support the establishment of the Master of Geographic Information Science and Technology program at Old Dominion University and look forward to observing the positive impact of your graduates.

Sincerely,

Geri Miller
Education Sector Director
Global Business Development
Esri

October 24, 2024

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

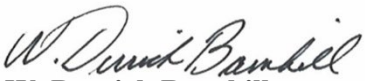
Dear Dr. Leib:
I would like to thank Mr. Tom Allen for keeping Woolpert informed on Old Dominion University's plans to implement a Master of Science on Geographic Information Science and Technology. As a graduate of Old Dominion University combined with my 30 years of experience in the Architecture, Engineering and Geospatial Industry (AEG) allows me to be very passionate about the future of the Geospatial Industry.

I along with the Geospatial community within Woolpert, are excited what the future holds within the Commonwealth. We utilize our GIS analysts everyday to comb through data sets to mine information out of big data to create client focused deliverables. As a Licensed Professional Land Surveyor in the Commonwealth, I understand the importance the geospatial community has in collecting, analyzing, and visualizing spatial data. This is essential for making informed decisions for engineering, urban planning, environmental management, and public health and safety. A program to provide a master's degree in GIS will be a great contribution to the Commonwealth and enhance the future needs of the GIS community.
The Masters Degree program would allow the GIS professional the ability to focus on a specific area within the wide range of skills to become an industry expert. This opportunity would allow students to have the ability for career advancement as well as the skills to advance industry's needs for these highly educated employees. Woolpert prides itself on internal growth, but I would be remised if I did not say a plug and play employee is a unicorn these days. Old Dominion University's MS-GIST program could create that unicorn for industry,
Woolpert currently has a staff of approximately 50 certified GIS Professionals (GISP's). The demand over the past 5-10 years has more than doubled for this professional certification. The only way to keep up with this demand is to provide an opportunity and the education required to gain the GISP certification. Currently the Commonwealth does not provide a four-year program in Land Surveying, which has really slowed the growth and the advancement in Land Surveying. I along with members of the Virginia Association of Surveyors (VAS) are currently working with the Virginia community colleges and the Department of Education to collaborate on an approach to provide an in-state survey program.

I give this background as the basis to promote the MS-GIST program at Old Dominion University. This program will provide the education to promote the advanced skills that will be required to perform GIS programming and spatial analysis. The advancement in autonomous vehicles along with autonomous air mobility are very much driven by big data that will require the skill set provided in this program to advance the technology. It is imperative that an

education be provided to fill the growth expectations in the GIS community. Old Dominion University has and will help fill that role now and into the future.

It would be an honor to help Old Dominion build, implement, and promote this MS-GIST program. Woolpert would support these efforts with career opportunities, technical white paper collaborations, industry knowledge and local support in the Hampton Roads community. Thanks for your time and I look forward to what the future holds.
Sincerely,



W. Derrick Barnhill, LS
Geospatial Project Manager | Senior Associate
D: 757.549.3548 | M: 757.348.8987
derrick.barnhill@woolpert.com

Woolpert
4433 Corporation Lane, Suite 125 | Virginia Beach, VA 23462
woolpert.com
Twitter Facebook LinkedIn

11/04/2024

Dr. Jonathan Leib, Chair
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

Dear Dr. Leib,

I was recently made aware of the proposal for ODU to move forward with a Master of Science in Geographic Information Science and Technology (MS-GIST). When invited to submit a letter in support of the program, I immediately agreed and appreciated the opportunity to provide my endorsement.

I am an alumna of ODU, graduating with a Bachelor of Science in Geography in May of 2000. I continued my education in GIS at ODU, completing both the Program for Remote Analysis of Coastal Environments and Geographic Information Science certificates in 2001 and 2003, respectively. The only opportunity missing has been a master's program for GIS. I have remained in the local GIS community with ties to ODU, TCC, the Hampton Roads User Group for GIS, GIS Day activities, Woman in GIS initiatives, and a network of GIS professionals. Within that community, there is shared interest in the successful deployment of the ODU MS-GIST.

Our world is evolving daily with significant advancements in areas such as data science, big data, artificial intelligence, data analytics, remote data, and cloud based computing. Our industry requirements are growing to expand location intelligence through digital twin models, real-time spatial data, unmanned aircraft systems (UAS), web-based interactive applications, and more, placing increased demand on skilled professionals, and continued learning. This area needs more opportunities in higher education for GIS, specifically a local master's program, to meet these demands and to be more competitive.

It goes without saying that professionals with master's degrees, particularly in technical fields like GIS, are generally paid at a higher rate and get preferential treatment in the hiring process. However, with the increased demand for more advanced skillsets, positions are starting to require master's degrees, specifically if applicants do not have significant professional experience.

In addition to the educational benefit of a MS-GIST at ODU, providing a master's program in GIS shows the Institution's commitment and investment in the profession. Local careers in GIS will likely gain visibility and become more sought after. Undergraduate students will be more likely to seek careers in GIS, expanding local talent and elevating the baseline skills for GIS professionals.

I am an advocate for the Master of Science in Geographic Information Science and Technology and am willing to support the program now and in the future. I have professional experience in the private sector, local government and federal government and would be happy to serve on an industry advisory panel should the opportunity arise.

Thank you for your consideration of this important addition to our higher education opportunities.

Sincerely,

Tracy Wamsley, GISP, PMP

GIS Project Manager, NAVFAC
Naval facilities Engineering Systems Command
Naval Station Norfolk

Appendix G
Employer and Prospective Student Survey

A survey was sent via email to 200 employers and prospective students to ascertain interest in hiring individuals who earn the Master of Science in GIST. The results of the survey are summarized as follows:

- A total of 31 unique potential employers responded to the survey about their interest and demand for graduates of the MS-GIST.
- All employers reported being somewhat interested (25%) or very interested (75%) in hiring an applicant with the MS in GIS.

	Great demand % (n)	**Some demand % (n)**	**Not sure % (n)**	**Not much demand % (n)**
What is the current industry demand for a MS degree in GIS in Virginia?	32% (33)	34% (35)	10% (10)	25% (24)

- A majority (66%) of employers said demand was great or somewhat for GIS masters degree graduates.

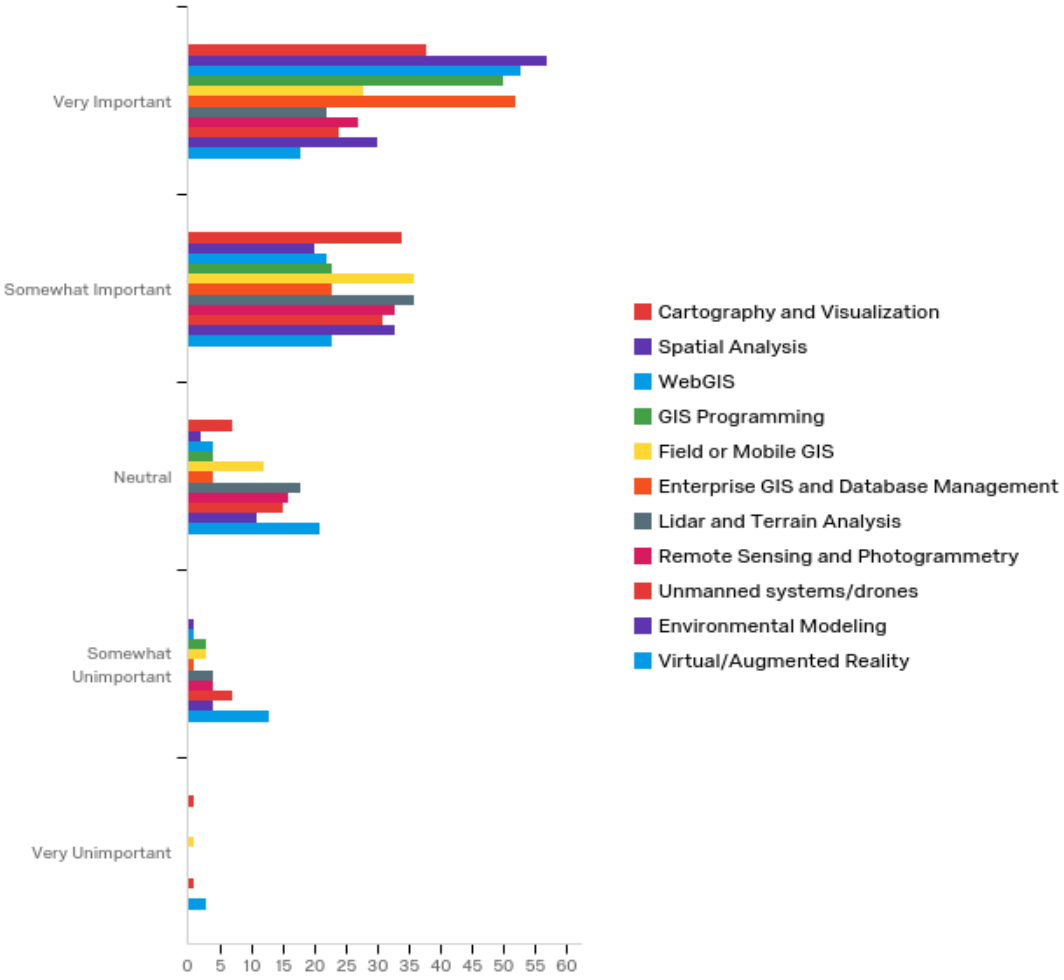
	Business and Private Sector % (n)	**Public Sector/Govt. % (n)**	**Military % (n)**	**Academia, NGOs, Other % (n)**
In what industry do you foresee the most demand for a MS GIS degree?	22% (21)	48% (48)	6% (5)	25% (26)

- Government agencies were rated by far as the strongest sector for GIS masters degree careers.
- Since the sample did not capture operational active duty or deployed military or their senior command, demand for military and geospatial intelligence specialties is likely underrepresented in the survey.
- All employers were from organizations located in Virginia. A majority of them (90%) are based in Hampton Roads.

	Business and Private Sector % (n)	Public Sector/Govt. % (n)	Military % (n)	Academia, NGOs, Other % (n)
What geospatial skills are of most value to develop in GIS masters students? Rate the listing.	22% (21)	48% (48)	6% (5)	25% (26)

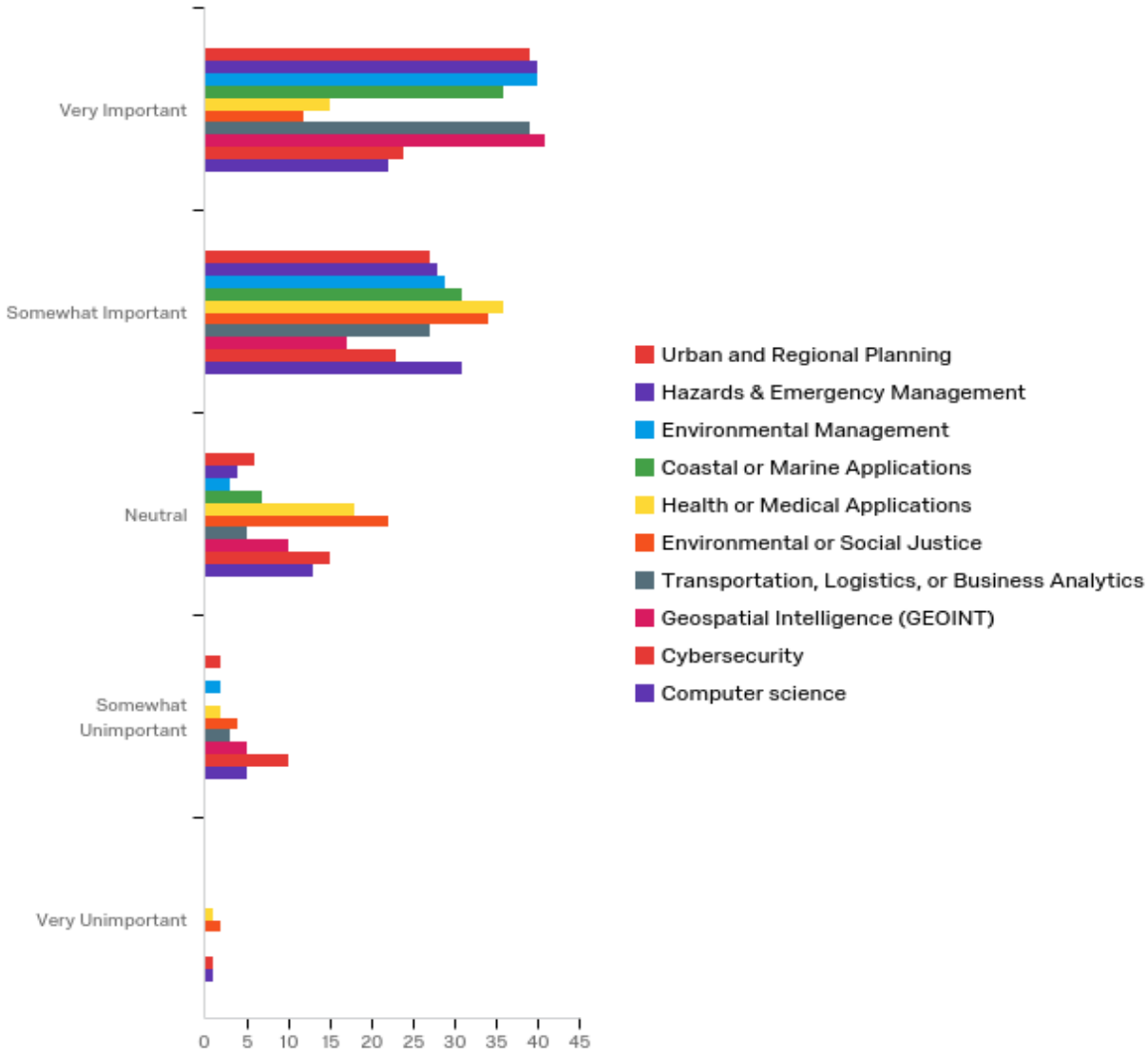
#	Skillset	Very Important		Somewhat Important		Neutral		Somewhat Unimportant		Very Unimportant		Total
1	Cartography and Visualization	47.50%	38	42.50%	34	8.75%	7	0.00%	0	1.25%	1	80
2	Spatial Analysis	71.25%	57	25.00%	20	2.50%	2	1.25%	1	0.00%	0	80
3	WebGIS	66.25%	53	27.50%	22	5.00%	4	1.25%	1	0.00%	0	80
4	GIS Programming	62.50%	50	28.75%	23	5.00%	4	3.75%	3	0.00%	0	80
5	Field or Mobile GIS	35.00%	28	45.00%	36	15.00%	12	3.75%	3	1.25%	1	80
6	Enterprise GIS and Database Management	65.00%	52	28.75%	23	5.00%	4	1.25%	1	0.00%	0	80
7	Lidar and Terrain Analysis	27.50%	22	45.00%	36	22.50%	18	5.00%	4	0.00%	0	80
8	Remote Sensing and Photogrammetry	33.75%	27	41.25%	33	20.00%	16	5.00%	4	0.00%	0	80
9	Unmanned systems/drones	30.77%	24	39.74%	31	19.23%	15	8.97%	7	1.28%	1	78
10	Environmental Modeling	38.46%	30	42.31%	33	14.10%	11	5.13%	4	0.00%	0	78
11	Virtual/Augmented Reality	23.08%	18	29.49%	23	26.92%	21	16.67%	13	3.85%	3	78

Please rate the importance of various geospatial skills to develop in MS GIS students.



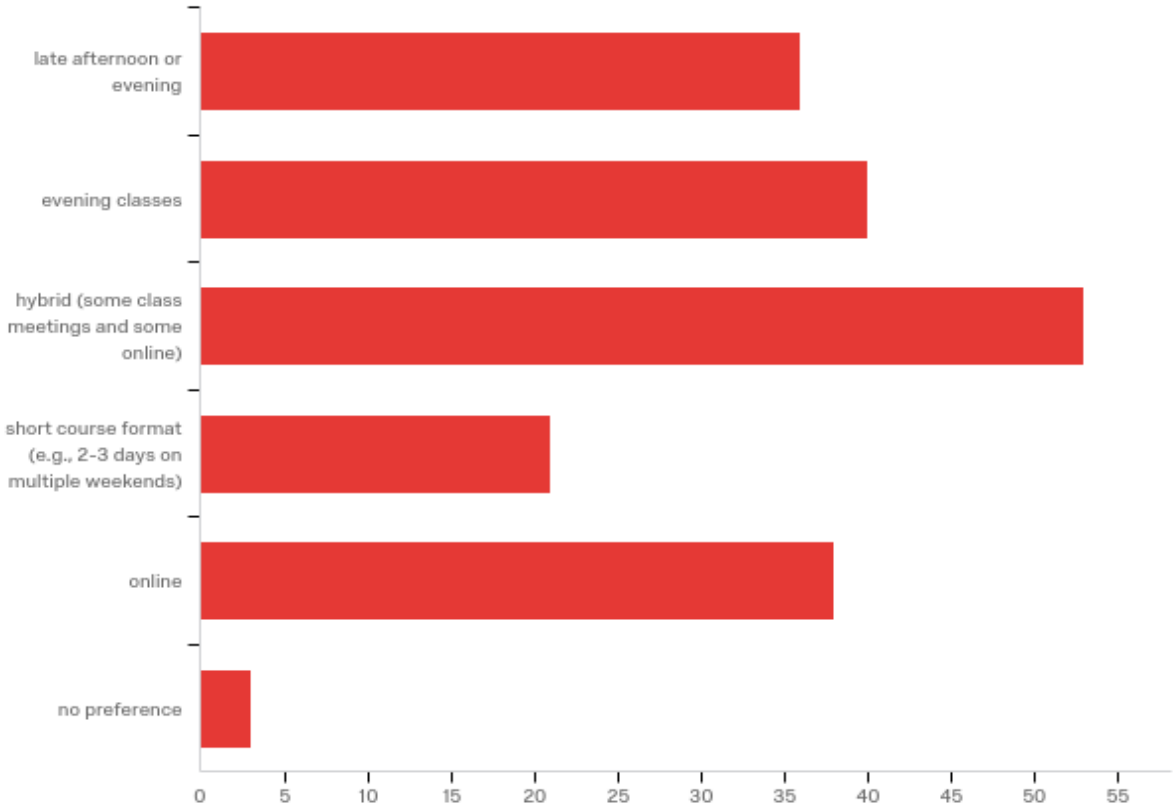
- Skillsets across geospatial technology are clearly differentiated by respondents, with somewhat or very important skills for a prospective GIS masters program emphasizing the need for spatial analysis, database management, cartography, and webGIS.
- Secondary skills emerged prominently to include LiDAR and terrain analysis, field/mobile GIS, and photogrammetry.

Please rate the importance of application courses and subdisciplinary specialities to the professional MS GIST degree.



- Two clusters of very important rated application areas emerged in the survey. First, respondents highly rated urban and regional planning, hazards/emergency management, and environmental management. This likely reflects the strong industry in environmental consulting and urban/regional planning adoption of GIS in the region (reflective of the nation.) Secondly, transportation, logistics, and geospatial intelligence were also very highly rated, reflective of the heavy commerce, port, and military demand.
- Secondary but noteworthy application areas rated somewhat important included health/medical applications, environmental and social justice, and computer/data science fields.

Which instructional delivery mode do you recommend for the MS GIS degree?



- Allowed to select more than one option, this question revealed a strong preference for at least hybrid courses with mix of face-to-face classroom delivery and online content. Late afternoon/evening classes and online classes were also significantly preferred (~70% of respondents.)

Qualitative expressed responses. Asked by open-ended question to recommend curriculum topics for the MS GIS degree, a representative sample of the highlighted recommendations follows below:

- Encourage leadership in private and public sector organizations ... and increased focus on data driven decision making. Electives in the areas of data governance / enterprise data management and business analyst-oriented topics will provide a versatile foundation for the future.
- Put emphasis on Python scripting and application development (both web and desktop) .. these are in short supply
- I need staff that can edit when they start out. Esri analysis tools are a need-to-know.
- As a consultant in the GIS world, the environmental applications of a masters in GIS would be most applicable to me. I would also be interested in remote sensing (including LiDAR) areas of study. Use of real-world scenarios would also benefit a large audience as it would be more realistic the challenges folks would face in their careers; whether more of a research scientist, government official, or consultant.
- Familiarity with web GIS and programming skills - Python, JavaScript, R
- I am a GIS manager for a company that employs engineering geologists, geotechnical engineers, marine geoscientists, marine surveyors and oceanographers and the key competencies for a MS degree in our field of work are statistics (understanding uncertainty/confidence levels and ability to perform probabilistic assessments), geomatics, understanding earth/oceanographic processes, and programming/web services.

- The future of GIS is enterprise management. This include web development, automation, programming, database development, etc.
- Coursework in UAV, Photogrammetry (its own class rather than one module/lesson), and courses related to GEOINT would be a fantastic accompaniment to the program.
- I think offering a statistics course would be beneficial and complement a spatial modeling class. Also a course focusing on ArcGIS online where students develop their own web application through Web App builder could be useful. I would also recommend considering a client-based class for younger students with limited professional experience (i.e. partnering with local or state government agencies and non-profits).
- The curriculum topics like GeoINT, UAS, and AR/VR seem to be the areas of most interest and perhaps most appealing right now. Specifically on how these technologies can assist with helping collect and maintain data. As far as a Master's Program, as a graduate of Penn State's online MGIS program, I found the online option very flexible and was achievable for full-time career students specifically. Individuals interested in a Master's Program in GIS may need that flexibility in order to complete the requirements.
- Web / App Development Drone Lidar. Use of Field Work devices.
- GeoINT, Emergency Management, Understanding "Human Terrain" and Demographics

Appendix H
Job Announcements

Department: Economic and Community Development
Reports to: Economic and Community Development Director

General Statement of Duties
Performs geospatial analysis; assists with the development, maintenance and support of data in the GIS system and develops GIS-based solutions to respond to COG and local government needs and requests.

Distinguishing Features of the Class
An employee in this class performs a variety of specialized and technical tasks to develop, plan and implement GIS applications to support a variety of COG programs and services including transportation, land use, zoning, economic development, broadband, housing, stormwater, watershed planning and hazard mitigation; the employee also collaborates with local governments in the region with support for GIS training, data acquisition and data management, technical services and support. Work involves management and quality assurance of data and working on a variety of projects to present information and concepts for programmatic use. The employee analyzes spatial datasets and works to ensure the integrity and applicability of information; researches and interprets source records and documents; checks spatial layers for consistency, errors and adherence to standards; creates specialized data sets, reports, graphics and maps; fills requests for GIS data, products and services; creates spatial datasets/layers from databases obtained from various sources; confers with end users to determine procedures necessary to facilitate completion of projects, and provides support to local government agencies in the development and application of GIS technologies. The employee must exercise considerable accuracy and attention to detail in ensuring proper recording of various data, and must also exercise considerable tact and courtesy in frequent contact with COG, county and municipal officials, and the general public. The employee also leads or chairs committees for various planning-related project groups. Work is performed under the supervision of Director of Economic and Community Development and is evaluated through conferences, feedback from users and the analysis of program achievements.

Duties and Responsibilities
Essential Duties and Tasks
• Manages data acquisition, organization and access; gathers data from many sources including local, state and federal agencies: transportation networks, demographics, employment, environmental assessment, parcels, land use, water resources, etc.; digitizes data layers using sources such as aerial photography; collects infrastructure locations using GPS systems.
• Performs geospatial analysis and modeling.

• Designs maps and graphics from geospatial data and analysis for COG staff and local governments using cartographic principles; provides technical assistance, support and explanation of geospatial information.
• Serves on committees and teams to support planning processes and projects.
• Attends training to upgrade skills and maintain awareness of technological advances.
• Manages GIS licensing and software access for COG staff.

Additional Job Duties
• Performs related duties as required.

GIS Coordinator

Recruitment and Selection Guidelines
Knowledge, Skills, and Abilities
• Considerable knowledge of GIS and associated programming languages.
• Considerable knowledge of the principles of cartography.
• Considerable skill in the collection, analysis, and presentation of technical data and planning recommendations.
• Working knowledge of governmental laws, programs, and services pertinent to transportation and community and economic development and planning processes.
• Time management and prioritization skills.
• Ability to establish and maintain effective working relationships with associates, government officials and the general public; ability to effectively communicate ideas both orally and in writing.
• Software: ESRI products including ArcGIS Pro, ArcGIS Online, Network Analyst, Spatial Analyst, Business/Community Analyst, StoryMaps, Open Data Portal, ArcGIS Dashboards; as well as Lightcast, Trimble Pathfinder and Terrasync
• Optional: 3D and 4D visualization

Organization Conformance Standards for all positions:
• Perform quality work within deadlines with or without direct supervision.
• Interact professionally and courteously with other employees, clients and partners.
• Work effectively as a team contributor on all assignments.
• Understand the necessity to efficiently and effectively interact, communicate and coordinate work efforts with other employees and organizations to accomplish common tasks.
• Function in stressful circumstances.
• Maintain a high level of professionalism and to conduct business in an ethical manner at all times.
• Maintain regular and punctual attendance.

Physical Requirements
• Must be able to perform the basic life operational support functions of walking, pushing, pulling, lifting, fingering, grasping, talking, hearing, and repetitive motions.
• Must be able to perform sedentary work exerting up to 10 pounds of force occasionally and/or a negligible amount of force constantly to move objects.

• Must possess the visual acuity to prepare and analyze figures, operate a computer, perform mechanical tasks in the computer environment, perform extensive reading, and do visual inspections of data, maps and field data.

Desirable Education and Experience
• MS in Geographic Information Systems and GISP preferred, with 3-5 years of professional experience

Land of Sky Regional Council – 2024

Spatial Software Engineer
Spatial Integrated Systems, Inc. Virginia Beach, VA

Spatial Integrated Systems, Inc. a leader in autonomous software development, is seeking C++ software engineers who thrive working in a fast-paced development environment developing cutting edge autonomous software. As a software engineer you will be part of a team developing behaviors supporting USV, UGV and UAV platforms. Additionally, you will work in an UNIX environment integrating hardware and software consisting of perception systems, weather, world model information, C2 and vehicle controllers. Duties include: implement, test, and maintain software solutions written in C++. Working in a team environment or on occasion individually, participate in the analysis and composition of requirements, design of architectural and component software features, design and implementation of instrumentation, design and implementation of test plans, and documentation of final product.
Basic Qualifications:
- MS in GIS or related discipline
- 1 - 3 years of experience in a professional environment working with C++ and UNIX
- Experience development and architecting, applications, user interface and data layers
- Experience with multiple languages (e.g. C++, C, Python, Java, JavaScript, HTML)
- Solid networking knowledge (OSI network layers, TCP/IP, Cisco systems, UDP)
- Experience with Application Lifecycle Management and Source Code Control
- Transmission Control Protocol/Internet Protocol (TCP/IP), User Datagram
- Excellent communication skills both oral and written

Additional Qualifications (a plus):
- Geographic Information System (GIS) / Digital Terrain Elevation Data (DTED) access,

Job Type: Full-time

Natural Resource GIS Analyst / Programmer
The Sanborn Map Company, Inc.
Location: McClellan, CA
Posted: 2019-05-23

The Sanborn Map Company is looking to fill a Natural Resource GIS Analyst / Programmer position. Join Sanborn's award-winning team! Sanborn is looking for a Natural Resource GIS Analyst / Programmer to provide technical and analytical support for developing and streamlining workflows to prepare and process spatially-explicit datasets for National Forest plan revisions. This requires programming in multiple languages including Python, MATLAB, R and Javascript. This also requires advanced knowledge of the following software packages applications: ArcGIS 10.x, ENVI, and Fusion.

REQUIRED EXPERIENCE
•Master's degree is highly desired.
•Bachelor's degree in Forestry, Ecology, Wildlife Biology, Soils, Geology, Hydrology, Geography or related degree.
•Fifteen years of intensive and progressive experience requiring extensive use of GIS and related tools.

TECHNICAL REQUIREMENTS
•Background in Remote Sensing
•Advanced relational database management skills
•Proficiency with R, PL/SQL programming languages
•Development experience with scripting languages including JavaScript and Python.
•Experience with GIS analysis and technology including ESRI software.
•Ability to understand and implement logic within Entity Relationship Diagrams (ERDs)
•Experience automating workflows
•Advanced knowledge of ArcGIS 10.x, ENVI, and Fusion
•Coursework and work-related experience pertaining to natural resource management, as well as analytical techniques for modeling and assessing dynamic ecological communities.
•Knowledge of USFS GIS data structures, National Application structures, and other agency structures a plus
•Excellent communication skills
•Attention to detail
•Well organized

TASKS
•Quality Control of National Applications GIS Data and other Corporate Data:
•Gathering spatial and tabular data from a large variety of complex National databases;
•Use of ArcGIS, ArcSDE, Oracle and PL/SQL developer software to create/update/improve data quality scripts;
•Following agency policies and procedures for national corporate data, to understand and follow Entity Relationship Diagrams (ERDs) to maintain forest data layers such as wildlife, Botany, Aquatics, Geology, Forest Activities, Transportation and others, into national corporate format.
•Analytical Support:
•Python and R programming to spatially and quantitatively analyze forest structural characteristics from remotely sensed data products.
•Automation of multi-scale (i.e. ecoregion subsection, Forest and bioregional scale) analysis of bioclimatic, vegetation, wildlife and other natural resource data.
•Assist in the development of statistical models for data analysis or for data product development.
•Run the Ecosystem Disturbance and Recovery Tracker algorithm for key project areas and assess the quality of the resultant data products.
•Develop cartographic products and perform live on-screen presentations to show FS personnel and the public how data sets were created, how to interpret the resultant outputs, and present preliminary summary statistics.
•Write code, in Javascript, to process Landsat and Sentinel data in Google Earth Engine.
•Provide oral and written communication staff regarding how datasets were generated and what underlying assumptions are implicit in statistical hypothesis testing.
•Additional project work may be assigned due to changing regional priorities.

Job Detail
Organization: West Virginia University
Title: (Hybrid) GIS Programmer
Location: Morgantown, WV / Hybrid
Posted: 2024-01-04
Application Deadline:
Position Description:

The WV GIS Technical Center, housed in the Department of Geology and Geography in the Eberly College of Arts and Sciences, is seeking a full-time GIS Programmer who will provide GIS programming expertise and assist with system administration within the Center to support geospatial mapping and research projects, web map and application development, and maintaining and expanding the geospatial infrastructure in the state of West Virginia.
The Technical Center (http://wvgis.wvu.edu) is an educational and research institution which provides direction and leadership to users of geographic information systems, digital mapping, and remote sensing within the State of West Virginia. The Center collaborates with the WV Office of GIS Coordination and other organizations to develop and distribute geographic data and information. It provides outreach, educational, and mapping services to the citizens, government agencies, non-profit organizations, and businesses of West Virginia in the area of GIS and related spatial data technologies.
The employee will:

- Perform GIS, spatial analytical, and digital cartography tasks to support projects.
- Develop, maintain, update, and document outward facing/client-side web resources and associated code and documentation.
- Assist with managing, maintaining, troubleshooting, updating, backing up, and documenting geospatial data servers/databases, ArcGIS
- Enterprise environments, portals, web services, and server-side code to support the WVGISTC Data Clearinghouse, Map WV, the state's
- geospatial data infrastructure, and funded projects.
- Work with WVU IT/Eberly College IT to ensure stability, compliance, and security of all WVGISTC systems.
- Along with other West Virginia GIS Technical Center staff, seek external grant funding; write grant proposals; administer grants; submit
- grant reports; document workflows; communicate finding in written, oral, and graphical format; and work with funders, clients, and other
- WVGISTC staff to fulfill funding requirements in a timely manner and ensure quality of all deliverables and products.
- Along with other West Virginia GIS Technical Center staff, manage graduate research assistants and student workers to ensure quality of
- deliverables and products within project timelines.

WVU is a R1 research land grant university located within 90 minutes of Pittsburgh and 3.5 hours from the Washington/Baltimore area. Morgantown has been recognized as one of the most livable small cities in the U.S. There are extensive recreational opportunities, excellent public schools, and a supportive University environment in which to develop a visible and productive career.

Qualifications

A master's degree is required in Geographic Information Systems/Science, Geography, Geology, Environmental Science, Computer Science, Computer Engineering, Data Science, or other cognate subject. In addition, applicants must have at least six (6) months of concurrent work experience in GIS programming, system administration, or web map application development.

Candidates should be knowledgeable of geographic information systems and how these systems are utilized for data management, analysis, and presenting all types of spatial or geographic data. Applicants should be proficient in the following areas: ESRI ArcGIS desktop software; ESRI ArcGIS Online; web mapping and application JavaScript APIs; web programming in HTML/CSS and web frameworks; cartographic design principles including experience in graphic design and user interfaces; and Python scripting. Experience with ESRI ArcGIS Enterprise/Portal and Microsoft SQL Server databases within a GIS framework is desired but not required. If hired, the employee must be willing to learn and further develop skills associated with ESRI ArcGIS Enterprise/Portal and Microsoft SQL Server databases.
To apply, please visit jobs.wvu.edu and navigate to the position title listed above. Upload (1) a cover letter describing experience and qualifications, (2) a resume, (3) the names and contact information of at least three referees, and (4) web links or screen shots of Web map applications you have developed. Salary will be commensurate with education and experience. For additional information, please contact Kurt Donaldson at kdonalds@mail.wvu.edu.
At West Virginia University, we leverage our talents and resources to create a better future for our state and the world. As West Virginia's land-grant university, WVU has three campuses that touch each corner of the state. The WVU System includes 518 buildings on 15,880 acres, Extension Service offices in all 55 counties, ten experimental farms and four forests.

From the groundbreaking R1 research of our flagship campus in Morgantown to the career-oriented programs of WVU Potomac State in Keyser to the technology-intensive programs at WVU Tech in Beckley — the contributions of WVU employees directly impact the 1.8 million people of West Virginia every day, no matter their role or position. Service, curiosity, respect, accountability, and appreciation are the core values that unite Mountaineers, inspiring one another to work tirelessly and support others as they seek to reach new heights. After all, when you're a Mountaineer, impossible is just another mountain to climb.

To learn more about West Virginia University, visit go.wvu.edu. View current career opportunities at careers.wvu.edu.

West Virginia University is proud to be an Equal Opportunity employer and is the recipient of an NSF ADVANCE award for gender equity.

The University values diversity among its faculty, staff, and students, and invites applications from all qualified applicants regardless of race, ethnicity, color, religion, gender identity, sexual orientation, age, nationality, genetics, disability, or Veteran status.

Organization: geocgi
Title: Senior GIS Architect - Hampton, VA
Location: Hampton, VA
Posted: 2024-02-15

Position Description:
At geocgi we pride ourselves on not losing our focus. We started out and remain GIS experts (or geeks. . . depending on your perspective). Since 2006, we've evolved into a world-class and worldwide service provider of multiple disciplines. We are a talented, hardworking group that shares values and characteristics that drive client, professional, and personal success. geocgi is looking for a Senior GIS Architect to design, develop, and deploy enterprise geospatial systems and capabilities for a large U.S. Federal agency GIS program. The Senior GIS Architect is responsible for the design, development, and implementation of GIS data infrastructure, systems architecture, systems integration, and GIS applications. The ideal candidate will have had previous experience as a development lead on geospatial application projects. The candidate will execute the responsibilities of a Senior GIS Architect, which include:
•Provide guidance and structure for designing, implementing, and maintaining geospatial system infrastructure.
•Evaluate existing architecture framework and document current state.
•Develop recommendations for optimization and enhancements to increase efficiency.
•Design and implement future state architectures.
•Bring best practice architecture design for GIS IT frameworks.
•Develop system hardware specifications and documentation.
•Coordinate system plans and efforts with systems Lead.
•Serve as a technical expert on GIS projects.
•Use industry best practices for continuous integration and continuous development/deployment of applications.
•Have excellent written and oral communication skills including the ability to interface with various subject matter experts.

Qualities:
•Dedicated GIS architect professional.
•Highly developed analytical, technical, and problem-solving skills.
•High proficiency in the ArcGIS suite.
•Exceptional Programming skills.
•Eager to learn new technology and integrate existing skills within a new industry.
•An above-average communicator, comfortable with technical writing, as well as public speaking.
•An active and collaborative team member.
•Highly organized and able to support several projects at one time.
•Possess a desire to immerse yourself in location-based problem-solving to support our client's missions.

As an employee of geocgi, the candidate will have access to a generous benefits package, in addition to a corporate culture and community of GIS geeks. Our benefits include but are not limited to:

•Competitive salaries, commensurate with experience and leading Federal Contractors in the geospatial industry.
•Opportunities for upward mobility in a dynamic fast-paced environment within a small company.
•Merit-based spot and end-of-year bonuses
•Safe Harbor 401(k) plan with immediate vesting
•Flexible work hours and PTO
•Complete Medical, Dental, and Vision coverage for individuals
•Company-paid training, certifications, and professional growth and development.

The following are requirements of the potential candidate:
•Master's Degree in GIS, information technology, computer science, engineering, or similar discipline.
•12 years experience designing complex architectures and IT applications.
•10 years' experience working with geospatial data.
•Demonstrated proficiency with ArcGIS Enterprise, Portal for ArcGIS/ArcGIS Online
•Proficient in Service-oriented architecture (SOA), Oracle RDBMS, GitHub, and leveraging past and present versions of geospatial
software programs including Esri's full ArcGIS suite.

The following are desired capabilities and experience of the potential candidate:
•Experience working within a large, U.S. Federal agency enterprise GIS program
•Certifications (GISP, Security+, Esri, AWS, Azure, etc.)
•ArcGIS Server, ArcGIS Online, and Portal for ArcGIS Administration experience
•Experience with enterprise geodatabase management

•Knowledge of Cloud services and concepts
•Experience with software development projects using the Agile methodology
•Ability to work independently and proactively to take initiative to solve complex problems
•Excellent writing and communication skills
•Active U.S. security clearance of Secret or above.

Please visit our website and careers page at: www.geocgi.com to apply to Req 1183. Geocgi provides equal employment opportunities to all employees and applicants for employment and prohibits discrimination and harassment of any type without regard to race, color, religion, age, sex, national origin, disability status, genetics, protected veteran status, sexual orientation, gender identity or expression, or any other characteristic protected by federal, state, or local laws. As a U.S. Federal Contractor, geocgi complies with COVID-19 vaccine mandates for all personnel as outlined by Executive Order 14042.

Sr. GIS Analyst
Antero Resources Company
Denver, Colorado, United States

The Senior Geographic Information System (GIS) Analyst uses spatial analysis techniques to manipulate, extract, locate, and analyze geographic and tabular data to answer complex questions and fulfill customer requests. Results of the analysis are conveyed in the form of maps, reports, and charts, where the output information is used in the decision-making process throughout Antero Resources Corporation (the "Company"). Senior GIS Analysts are also responsible for creating innovative, sustainable solutions, that satisfy customer requirements and comply with GIS and IT standards and policies.

Essential Duties and Responsibilities
Create map products and data outputs on a daily basis that is easy to understand, and meet customer and business expectations for data accuracy, content, currency, and overall intent. Gather external and internal customer requirements and apply one's own understanding and knowledge of the various business processes, to design, create, and maintain enterprise databases, custom workflows, and tools. Design logical, multi-step processes that require spatial analysis, data integration, and reporting. Then interpret the information, maintain the data, and communicate with the customers to help generate ongoing solutions that meet their needs. Support and maintain the map services and mapping applications used by the growing customer base within the organization. GIS web browser mapping applications that contain map services and maps which are maintained by the Sr. GIS Analysts. Review and provide feedback regarding GIS Analyst's deliverables to ensure that the highest quality control standards are being met by the GIS Department, and exceed management expectations.

Other Duties and Responsibilities
Attend the various department meetings such as Land, Midstream, Operations, etc. to gain insight into the Company's initiatives and prioritize workload accordingly.
Advise on best practices and standards to promote and apply them within the department and organization.
Serve as a GIS technical lead and point of contact for questions related to GIS related matters, supporting specific business groups in the Company.
Utilize Python scripting or Model Builder to automate routine tasks by analyzing the weekly data from the vendor, and write scripts to prepare the data that gets sent to the different distribution lists.
Troubleshoot and resolve problems with GIS solutions, software, and processes in an appropriate fashion.
Assist in the training of GIS software and procedures to the customers as needed.
Actively seek out and identify areas for process improvement, like documenting and performing data clean up. To ensure a more accurate and reliable data, and improve and streamline processes so the results are consistent and able to be repeated.

Qualifications
Required Education and/or Experience, Licensure

MS degree in Geography, GIS, Computer Science or Natural Resources discipline with a concentration in Geographic Information Systems.
Five (5) or more years of experience utilizing GIS.
Prior Oil and Gas Industry related experience.

Preferred Education and/or Experience, Licensure
Experience working in a multi-tiered GIS environment.
Experience using Global Positioning System (GPS) field collection devices.

Required Core Competencies – Knowledge, Skills, and Abilities
High proficiency with ESRI's ArcGIS for Desktop application.
Working knowledge of ArcGIS for Server, ArcGIS Mobile Applications, Python, Petra, and relational databases.
Strong attention to detail and ability to identify incorrect results and reconcile accordingly.
Ability to extend or alter the standard analysis by leveraging on past experiences and subject matter knowledge.
Good verbal and written communication skills with the ability to present detailed subject matter material to a wide variety of audiences, including upper management.
High level of organizational skills and the ability to correctly archive and maintain structured data stores.
Ability to recognize and understand the different processes across multiple disciplines within the Company, as daily requests can originate from any department.
Ability to independently research information needed to complete a task with little to no direction.
Provide great customer service to build and maintain a good relationship with internal and external customers.
Strong documentation and technical writing skills to document developed codes.
Knowledge of land information is preferred.
Ability to safely operate vehicles, equipment, and tools.
Able to recognize and apply safety processes and procedures.

Sr. GIS Engineer

Professional Technology Integration, Inc.
Herndon, VA 20170

Salary: $55.00/hr.
Duration: 1 Years 6 Months 13 Days - Contract
Openings: 1

Description:
We are seeking a Senior GIS Engineer to provide an array of technical geospatial and / or database development and business analytics solutions. This position will provide technical expertise in the management, manipulation, and analysis of GIS and other database information. We utilize Azteca Systems Cityworks and has recently embarked on implementation of Tyler Technology EnerGov application that will utilize ArcGIS online.

GIS engineer will interact with EnerGov Product Managers and other members of the development team to make recommendations on use of current GIS technologies in future product releases. This role is responsible for assessments and recommendations, system administration and configuration, application deployment, documentation, end user support and training data analysis, data modeling, web service creation, application testing and troubleshooting. Resource will assist in user training and demonstrations on use of GIS tools and GIS applications, and assists with the development and implementation of department/division GIS initiatives and programs.

Essential Functions:
• Lead needs assessments/requirements meetings and document solutions for GIS enterprise use
• Provide/write GIS system technical recommendations, standard operating procedures, administrative and help documents for clients and technical teams.
• Apply industry-recognized best practices to support the design and development of spatial and non-spatial databases, web mapping applications, and enterprise system integrations in support of the strategic objectives.
• Create and maintain GIS environments for the EnerGov application that will be used by town's permitting, code enforcement, public works, zoning and community development departments.
• Develop and maintain GIS documentation as it relates to configuration, best practices, as well as test scripts for the EnerGov product
• Advise project implementation teams and clients on incorporating GIS capabilities into their EnerGov environment.
• Interact with Support staff for technical support in troubleshooting client problems
• Create and maintain database schema using prescribed best practices.
• Conduct versioned editing workflow management, database design, management and maintenance.
• Support and maintain simple data visualizations in spatial, tabular and graphical formats within various software systems.
• Pursue innovation and mentor the work of team members.
• Create new and innovative solutions for GIS data integration, administration, and management.
• Assess Town's existing GIS environments and recommend areas for improvements in application technology, system performance, and disaster mitigation plans
• Communicate with departments to successfully deploy GIS solutions
• Present system design information to technical and non-technical audiences
• Create mapping, imagery and data services
• Works with town departments and IT staff to identify available GIS data, evaluate for accuracy, and consolidate into centralized data source for the town.
• Work with IT department to secure GIS and make the application accessible internally and externally.
• Publish departmental maps and integrate GIS services with SeeClickFix mobile application and Cityworks.
• Train users on the use and adoption of Cityworks technologies
• Works with town departments to define and meet mapping and GIS data needs, implement GIS best practices and ensure compliance with relevant data standards, policies and regulations.

• Creates moderately complex cartographic products, dynamic web maps, static maps, charts, reports and graphs as needed by departments and assists in the management of department/division GIS layers and related data.
• Assists in the development of automated data management routines and various projects to improve department or program efficiency.
• Reviews, creates and maintains metadata to specifications for datasets and services.
• Assists and trains other users with GIS software and workflow processes.
• Resolves technical issues in cooperation with IT staff.
• Serves as liaison to Fairfax County GIS for updates.
• Utilizes GIS tools and data to improve the development of business processes within the department/division.
• Designs, develops and implements GIS enhancements using various ESRI programming tools and methodologies.
• Identifies and resolves complex GIS issues that affect the town's ability to meet objectives.
• Assists in the design and implementation of integrating GIS with other enterprise systems.
• Assists in maintaining and administering ArcGIS Server including security, publishing map services and content management.
• Assist in preparing disaster recovery plans.
• Troubleshoot solution errors and support end users
• Lead the development of simple data visualizations.
• Translate business process workflows into technical requirement documentation.
• Demonstrate advanced qualitative, quantitative (statistical) analytical skills.
• Lead, guide, coach, and mentor others and work with teams on the technical component of GIS system configuration workflows, GIS application development initiatives, and database management and design protocols.
• Performs other duties as assigned or required.
• Competencies and Skills:
• Admin experience with Esri's GIS platform (ArcGIS Server, ArcGIS Online, enterprise geodatabase) support of mobile application and ArcGIS integration.
• Experience installing and configuring ArcGIS and Microsoft SQL server 2016.
• professional experience using GIS-related technology in a professional setting
• Proficiency with the Esri product line, including ArcGIS Desktop, ArcGIS Enterprise, ArcGIS Online, and related desktop extensions
• Experience with automated cartography, computer science, programming, and spatial analysis
• Knowledge of Geospatial and mapping concepts such as spatial analysis, map projections, etc.
• Knowledge in the following software programs: MS SQL Server, AutoCAD, MS Word, MS Excel, MS Access, MS PowerPoint, Adobe Photoshop, Adobe Illustrator.
• Tyler Technology EnerGov, SeeClickFix mobile application, and Azteca Systems Citywork

Required / Desired Skills
- Expert Esri ArcGIS (ArcGIS Online, ArcGIS 10.x ArcGIS Server, enterprise geodatabase) server platform software Required - 4 Years
- ArcGIS Online and Tyler Technologies EnerGov software integration required - 3 Years
- Knowledge of Data Management as it relates to Asset Management and Geospatial applications Required - 3 Years

- Experience providing ArcGIS knowledge transfer and training to administrators and end users Required - 3 Years
- Create mapping, imagery and data services Required - 4 Years
- Publish departmental maps and integrate GIS services with SeeClickFix mobile application and Cityworks Required - 3 Years
- Merging data between multiple sources and verifying data integrity Required - 3 Years
- Python Programming Language and ArcGIS Python Toolbox scripting Required - 3 Years
- Configuring Cityworks and ArcGIS systems to align with asset or work management business requirements Required - 3 Years
- SQL 2016 admin experience Required - 3 Years
- Creates moderately complex cartographic products, dynamic web maps, static maps, charts, reports and graphs as needed by departments Required - 3 Years
- Masters or equivalent experience

Job Number: R0035267
GEOINT Throughput Analyst

Key Role:
Analyze a variety of information and intelligence relevant to the threats facing the systems, assets, and resources critical to the nation and develop relevant research studies and recommendations. Lead or participate in approved studies, as needed. Provides additional analysis in response to specific threats and incident reports, as needed. Manage program and project implementation and make significant contributions to department goals and planning efforts.

Basic Qualifications:
-Experience with **GEOINT** collection requirements, operations, or tasking, collection, processing, exploitation and dissemination (TCPED) processes as a source throughput analyst (STA), source strategies analyst (SSA), or collection manager
-Experience with **GEOINT** Information Management Services (GIMS), FishTools, and PRISM
-Knowledge of NGA enterprise services dissemination processes and supporting architectures
-Knowledge of national, commercial, and airborne **GEOINT** sensors and capabilities
-Ability to work independently or as part of a team to enable **GEOINT** throughput
-Ability to liaise with partners across the intelligence community (IC) and DoD to innovate and enable intelligence integration
-Ability to discover, collaborate on, and integrate new technologies into **GEOINT** TCPED
-TS/SCI clearance

Additional Qualifications:
-Experience as an imagery or geospatial analyst
-Experience with GIS tools and capabilities
-Experience with GIMS Advanced Search and Net-centric **GEOINT** Discovery Services (NGDS)
-Ability to facilitate interagency collaboration
-MA or MS degree a plus

Clearance:
Applicants selected will be subject to a security investigation and may need to meet eligibility requirements for access to classified information; TS/SCI clearance is required.

Geospatial Resource Lead with Lidar Production
Dewberry is currently seeking a Geospatial Resource Lead with Lidar Production experience for our Fairfax, VA office that will work full time to support Dewberry's Geospatial and Technology Services team by providing geospatial production management support, data processing and analysis, problem solving, task and personnel management as well as project oversight.

This position requires daily production oversight and reporting for all geospatial related projects. The successful candidate will have expertise in GIS, geodatabase design, ArcGIS, datum and projections, complex geospatial analysis, LIDAR and photogrammetry. Must have in-depth expertise in one or more of these areas and must be proficient with all of these subject areas. The Resource Lead will report directly to the Department Manager located in the Tampa, FL office. Masters degree in GIS or equivalent geoscience degree and GIS skills required.

APPENDIX I

STUDENT DEMAND SURVEY

To be completed semester before starting
Add student related questions from the first survey

Results of Student Survey

Appendix I
Prospective Student Letters of Interest

October 23, 2024

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

Dear Dr. Leib,
I am writing to voice my support for Old Dominion University's MS in Geographic Information Science and Technology. Currently, I am GIS Analyst working at Old Dominion University under Dr. George McLeod in the Center for Geospatial Science, Education & Analytics (GeoSEA). I have been employed at Old Dominion University since January 2020. During my interview for this position, I was told that the creation of a MS in GIS was imminent, and after my first year of employment, I had planned to enroll in the program by using Old Dominion University's Tuition Assistance policy. This incentive was one of the reasons I decided to move from Georgia to take the position in Dr. McLeod's group. Unfortunately, due to emergence of the COVID-19 Pandemic in March of 2020, the creation of the MS in GIS was put on hold. I remain as eager as I was nearly five years ago to enroll in the program and remain hopeful that the MS in Geographic Information Science and Technology is soon approved as a graduate school degree offering at Old Dominion University.

Sincerely,
Christoper Davis
GIS Analyst, Old Dominion University's Center for Geospatial Science, Education & Analytics (GeoSEA)
c3davis@odu.edu
(706) 248-0575

October 22, 2024

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

Dear Dr. Leib,
I wanted to write to express my support and interest in ODU's MS Geographic Information Science and Technology Program. I graduated from ODU in 2017 with a BS in Ocean and Earth Science while also acquiring certificates in GIS and Spatial Analysis of Coastal Environments. I currently work as a Civil Engineer with the U.S. Army Corp of Engineers here in Norfolk, and my education, including my GIS education and experience, is the reason I have come so far in so little time.
Compared to when I first started my studies, GIS has expanded and is more widely used than ever. That is why a continuing education program such as an MS GIST from ODU is necessary for those of us that would like to stay current and expand our knowledge, as well as giving a competitive edge in the job market. After I interviewed for my current position, to give me an edge over the other applicants, I emailed some of my GIS work from my previous employer, where I was an Engineer for the City of Chesapeake, because GIS is not just about making maps, it involves incorporating various data and presenting it in a concise, logical way that everyone can understand. My work has been used in environmental studies, technical papers and various media for the City of Chesapeake. I owe so much to the GIS staff, such as Dr. Allen and Dr. Liu, for their time, expertise and knowledge, but especially to Dr. McLeod, as I worked with him closely while I was a GIS Technician at what is now the Center for Geospatial Science, Education and Analytics (GeoSEA).
I have and continue to consider pursuing an MS GIST from ODU as it would only further my career with the Corps of Engineers, or any field I choose to pursue. It is a rapidly expanding science and technology that is used in everything from spatial analysis to webGIS apps that my husband and parents unknowingly take advantage of. It is the future and it is something I continue to want to be a part of.

Sincerely,
Jennifer E. Peterman
Civil Engineer, Design Section, Operations Branch, Water Resources Division, U.S. Army Corps of Engineers, Norfolk District
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10/17/2024
Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

I am writing to express my support for ODU's MS in Geographic Information Science and Technology. I'm currently an ODU undergraduate student studying Geography with an emphasis in GIS and a minor in Computer Science. I am also pursuing the GIS certificate. In my time with ODU's GIS program, I have acquired a broad range of spatial analysis, mapping, data science, and visualization skills. These skills have helped me jumpstart my career in GIS, as I have applied them at internships at NASA and here at ODU. I can say with certainty that the coursework in the GIS undergraduate program has helped me secure these internships and succeed in them.

That said, the broad and ever-advancing nature of GIS as a science makes it impossible to gain a complete skillset in just four years. Some of the most pertinent and marketable geospatial skills, such as big data applications, GIS programming, and geospatial statistics are too advanced to fit in the timeline of an undergraduate program. The master's in GIS and Technology could fill the gaps that remain after my completion of my degree.

Possessing an advanced degree in GIS would qualify me to pursue jobs with a more advanced and broad range of responsibilities. The GIS job market is growing, and the demand for skilled GIS professionals has never been greater. It is for these reasons that the Masters of GIS and Technology would be beneficial to my career, and the careers of many others.

Sincerely,
Sean Asbrand
GIS Intern, ODU Center for Geospatial Science, Education, and Analysis
B.S. Geography, Expected Graduation: Spring 2025
sasbr001@odu.edu
(540) 577 6408

10/21/2024

Dr. Jonathan Leib, Chair
Department of Political Science and Geography
College of Arts and Letters
Old Dominion University
Norfolk, Virginia 23529-0088

Dear Dr. Leib:

I write you in hopes of communicating my utmost support for MS in Geographic Information Science and Technology at Old Dominion University. My personal experience with the staff responsible for ODU's Geographic Information Science/Technology program during my undergraduate studies was nothing short of commendable in the way I was prepared for my now 4-year career in the environmental consulting industry. The variety of subject matter interwoven with the instruction on technical matters were invaluable then, as I predict would be invaluable applied to a master's program.

Between 2018-2020, I was a student at ODU aiming to complete my bachelor's degree and GIS certification. During this time, all my GIS certification core classes, advanced classes and electives were instructed by ODU staff. From Spatial Analysis of Coastal Environments to Marine Geography and Geospatial Field Techniques, many of my courses were not only engaging but pragmatic and helpful for me in my future career. These classes introduced novel geographic subject matter such as the function of coastal wetland environments in reducing coastal erosion, as well as tangible data collection and management skills such as operating UAS devices and processing their data. Working closely with professors such as Dr. Tom Allen, Dr. Jennifer Whytlaw, and George McLeod allowed me to get quality first-hand instruction and help when needed, and their expertise and knowledge was very impactful to me as a student still finding his way.

As a GIS professional in the environmental consulting industry, the skills and knowledge acquired from my time at ODU under these professors has given me a confident leg up in the ever-evolving world of the industry. Working with military, government, and commercial clients over many different types of projects and workflows has only solidified my opinion on the importance of Geographic Data Science in the professional world. The skills of spatial analysis, UAS data collection/processing, and the knowledge of coastal/marine geographic environments are immediately applicable to the development of the regional economy and industry. These skills and knowledge are needed by clients and are sought after by professionals looking to push the envelope. Having a well-developed local GIS MS program would allow many professionals such as myself a to propel ourselves forward in a professional and technical manner.

My support for this program is genuine and unwavering. To have a pillar of higher GIS education in the Hampton Roads region is incalculably important, and I see no better faculty to erect such a pillar than that of ODU. If you have any questions or would like to discuss any of the things I have mentioned here, please feel free to reach out.

Sincerely,
Manuel A. Solano
GIS Analyst, Tetra Tech Inc.
Undergrad ODU Program, 2020

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