June 1, 2016

MEMORANDUM

TO:         Gregory Ball  
            Dean, College of Behavioral and Social Sciences

            Charles Caramello  
            Associate Provost and Dean, Graduate School

FROM:       Elizabeth Beise  
            Associate Provost for Academic Planning and Programs

SUBJECT:    Proposal to Establish a Master of Professional Studies and Post-Baccalaureate Certificate of Professional Studies in Geospatial Intelligence (PCC log no. 15041)

On May 31, 2016, Chancellor Caret gave final approval to your proposal to offer a new iteration with a focus in Geospatial Intelligence for the Master of Professional Studies and the Post-Baccalaureate Certificate of Professional Studies. A copy of the approved proposal is attached.

These new iterations are effective Fall 2016. Please ensure that the programs are fully described in the Graduate Catalog and in all relevant descriptive materials, and that all advisors are informed.

MDC/  
Enclosure

cc:        Andrew Harris, Chair, Senate PCC Committee  
           Barbara Gill, Office of Enrollment Management  
           Reka Montfort, University Senate  
           Chip Denman, Division of Information Technology  
           Pam Phillips, Institutional Research, Planning & Assessment  
           Anne Turkos, University Archives  
           Linda Yokoi, Office of the Registrar  
           Alex Chen, Graduate School  
           Wayne McIntosh, College of Behavioral and Social Sciences  
           Chris Justice, Department of Geographical Sciences
May 31, 2016

Dr. Wallace D. Loh
President
University of Maryland, College Park
Main Administration Building
College Park, MD 20742

Dear Wallace,

Thank you for forwarding the request of the University of Maryland to offer two new iterations of the Master of Professional Studies and Post-Baccalaureate Professional Studies Certificate with areas of focus in Geospatial Intelligence and in Risk Compliance & Law.

I am pleased to approve this request. Please share my appreciation with the faculty in working to make this a possibility. I have confidence the programs will be successful.

Sincerely yours,

Robert L. Caret
Chancellor

cc: Mary Ann Rankin, Senior Vice President and Provost
Charles Caramello, Associate Provost and Dean, Graduate School
Gregory Ball, Dean, College of Behavioral and Social Sciences
Theresa Hollander, Associate Vice Chancellor for Academic Affairs
THE UNIVERSITY OF MARYLAND, COLLEGE PARK
PROGRAM/CURRICULUM/UNIT PROPOSAL

• Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.
• Please submit the signed form to the Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.

College/School: BSOS-College of Behavioral & Social Sciec
Please also add College/School Unit Code-First 8 digits: 0120
Unit Codes can be found at: https://hyperion.umd.edu/reports

Department/Program: Department of Geographical Sciences
Please also add Department/Program Unit Code-Last 7 digits:

Unit Codes:
(1) 012028001281501
BSOS-Geography (Primary)

(2) 012024001240101 GRAD-Graduate School

Type of Action (choose one):
☐ Curriculum change (including informal specializations) ☐ New academic degree/award program
☐ Curriculum change for an LEP Program ☐ New Professional Studies award iteration
☐ Renaming of program or formal Area of Concentration ☐ New Minor
☐ Addition/deletion of formal Area of Concentration ☐ Request to create an online version of an existing program
☐ Suspend/delete program

Italics indicate that the proposed program action must be presented to the full University Senate for consideration.

Summary of Proposed Action:
The Department of Geographical Sciences proposes to develop and offer a Master of Professional Studies and Graduate Certificate in Professional Studies in Geospatial Intelligence ("MPS GEOINT" and "GCPS GEOINT" respectively) to address the immediate and growing need to train a workforce for the rapidly expanding local geospatial intelligence industry in Maryland and the greater Washington D.C. metropolitan area. The MPS GEOINT program will encompass a 30-credit (10 units of 3-credit courses) course structure comprising six core courses and a selection of four courses among electives. The GCPS GEOINT program will entail 12 credits from four courses (two core and two elective courses). Courses will be scheduled in evenings to accommodate working professionals. In order to attract international students, MPS and GCPS GEOINT will be offered in standard spring/fall/summer/winter terms. MPS and GCPS GEOINT will train students with material far beyond the existing offerings in geospatial information sciences (GIS) at UMD, and they will cater to an entirely new population seeking employment and skills in the intelligence industry.

Departmental/Unit Contact Person for Proposal: Dr. Paul Torrens

APPROVAL SIGNATURES - Please print name, sign, and date. Use additional lines for multi-unit programs.

1. Department Committee Chair Giovanni Bocconi 11/3/15
2. Department Chair Chris Justice 11/5/15
3. College/School PCC Chair Karol Gortan 11/10/15
4. Dean Wayne McIntosh 11/11/15
5. Dean of the Graduate School (if required)
6. Chair, Senate PCC
7. University Senate Chair (if required)
8. Senior Vice President and Provost
Proposal for a new instructional program at the University of Maryland at College Park

Master of Professional Studies and Graduate Certificate in Professional Studies in Geospatial Intelligence (GEOINT)

Proposed initiation date of Fall semester, 2016
Overview and rationale

1. Briefly describe the nature of the proposed program and explain why the institution should offer it

The Department of Geographical Sciences at the University of Maryland, College Park, proposes to develop and offer a Master of Professional Studies and Graduate Certificate in Professional Studies in Geospatial Intelligence (“MPS GEOINT” and “GCPS GEOINT” respectively) to address the immediate and growing need to train a workforce for the rapidly expanding local geospatial intelligence industry in Maryland and the greater Washington D.C. metropolitan area.

The few dedicated graduate programs for geospatial intelligence that exist in the United States are, in essence, programs for Geographic Information Systems (GIS) branded as “geospatial intelligence”, but which have very little (sometimes none) content that deals with intelligence. This has become an issue for the intelligence community, who are having to scramble to train GIS graduates on the job. As a result, there is a move to establish certification programs for geospatial intelligence (see a new initiative by the U.S. Navy at [http://goo.gl/WPEB5H](http://goo.gl/WPEB5H); and the US Geospatial Intelligence Foundation, who have approached us to develop a certified program; [http://usgif.org/education/Prof_Cert](http://usgif.org/education/Prof_Cert)). There is a wide-open gap in the supply of graduate-level instruction in this area, and huge demand for well-trained students.

The growing field of geospatial intelligence is originally associated with national security—the National Geospatial-Intelligence Agency (NGA) is tasked with visualizing, analyzing, and assessing national security through collection and interpretation of geospatial data. These data now come from an ever-growing array of sources, including other intelligence agencies; grounded, airborne, and orbital sensor platforms; evolving silos of big data generated by Internet and Communications Technologies (ICTs); and actively and passively volunteered geographic information that populations and devices cast during their everyday actions and interactions. Geospatial intelligence has, however, begun to grow beyond its original security focus, and the field now encompasses a variety of arenas in which geospatial intelligence plays a role. In machine intelligence, geospatial intelligence is a core component of navigation systems for vehicles and robots, as well as computer vision schemes. In business intelligence, it forms the basis for geodemographics, customer management systems, marketing analytics, location-allocation and site selection support systems, and logistics. In criminology, geospatial intelligence is widely employed in managing public security and investigating crime. In government and public policy, geospatial intelligence is significant in resource allocation and assessment of service delivery. In engineering, it forms an important component of systems engineering, particularly in the emerging area of cyber-physical systems and cyberspace systems. In the earth sciences, geospatial intelligence is used to provide base mapping, geo-referencing, and data fusion for a variety of data products and sensor systems.

The field of geospatial intelligence has recently and suddenly ballooned and major technology companies (Google, Apple, Facebook, Uber, for example) have been scrambling to put together teams to get up to speed (see an article on this exact topic in the New York Times this weekend at [http://goo.gl/px8Nu2](http://goo.gl/px8Nu2)). These new technology companies join already well-established geospatial intelligence divisions in major government contract companies in and around the Beltway, such as BAE Systems ([http://goo.gl/9viLPI](http://goo.gl/9viLPI)), Lockheed Martin ([http://goo.gl/FEgEjl](http://goo.gl/FEgEjl)), Harris ([http://goo.gl/Ww4UQJ](http://goo.gl/Ww4UQJ)), Northrup-Grumman ([http://goo.gl/3MQz47](http://goo.gl/3MQz47)), IDS ([http://goo.gl/b2lWzs](http://goo.gl/b2lWzs)), and Leidos ([https://goo.gl/8ekubo](https://goo.gl/8ekubo)), as well as most banks and insurance companies.
companies, all of which have geospatial intelligence divisions. Huge and entirely new companies are beginning to form around the topic of geospatial intelligence (see Palantir, which has offices locally in Tyson’s Corner, VA; https://goo.gl/Wi1JQE). In early August, 2015, Audi, BMW, and Daimler purchased the geospatial intelligence division of Nokia (known as “Here”) for $3.1 billion.

Our local surroundings play host to the center of influence for the geospatial intelligence industry in the United States. The National Geospatial-Intelligence Agency employs 8,500 people at the third largest federal building in the D.C. region at nearby Springfield, VA. The NASA Goddard Space Flight Center in nearby Greenbelt, and the United State Geological Survey in nearby Reston, VA serve as the nexus for the nation’s earth science geospatial intelligence. The U.S. Census Bureau in nearby Suitland, MD is tasked with a decennial nationwide data collection exercise that mobilizes a huge workforce to perform geospatial intelligence gathering year-round.

The need for well-trained and nimbly-moving workforce in geospatial intelligence is growing, markedly. The Bureau of Labor Statistics “Job outlook” statistics place graduates in geospatial intelligence in the “Much faster than average” category for employment prospects across each classification of relevance to the field (20% to 29% change in employment over the next ten years; see http://goo.gl/j8f1F1 and http://goo.gl/cnBXnT). Again, Maryland is enjoying some of the most dramatic rises in future job prospects for geospatial intelligence. We rank as the number one state for highest employment level in the occupation, as well as the top state for highest concentration of jobs. The D.C. metropolitan area ranks highest (by a factor of between four and seven!) in urban areas with the highest employment level in this category, job concentration, and mean wage. Maryland is ranked second (behind Virginia) for top paying states for the occupation. (Details are at http://goo.gl/Jw9M9G.)

Yet, despite the huge employment potential in our backyard, the State of Maryland currently lacks any graduate-level degrees to train students in this field. (Students wishing to earn a degree in geospatial intelligence in the area must instead enroll in programs at the Pennsylvania State University or George Mason University.)

To respond to this gap in instructional offerings, the Department of Geographical Sciences is responding in three ways. First, we are undergoing accreditation of our existing Major in Geographical Sciences with concentration in Geographic Information Science (the “GIS major”) with the United States Geospatial Intelligence Foundation (USGIF) (see http://goo.gl/vPcqZ2). Second, we have established a Center for Geospatial Information Science (CGIS) (http://geospatial.umd.edu) with colleagues from the College of Behavioral and Social Sciences, the College of Information Studies, the R.H. Smith School of Business, and the College of Computer, Mathematical, and Natural Sciences. The CGIS will provide a central hub for research in geospatial information science and will be instrumental in revitalizing instruction in our GIS major with the most advanced research. Third, we are seeking to establish a dedicated MPS GEOINT and GCPS GEOINT to provide workforce-focused training at graduate level in ways that can nimbly respond to developments in what is often a rapidly shifting landscape of applied problem-sets, analysis schemes, big and growing data-sets, and software platforms that characterize today’s geospatial intelligence.

The MPS GEOINT program will encompass a 30-credit (10 units of 3-credit courses) course structure comprising five core courses and a selection of five courses among electives. The GCPS GEOINT program will entail 12 credits from four courses (two core and two elective courses).
The GCPS GEOINT is considered a subset of the MPS GEOINT: the credits earned from a GCPS GEOINT can be transferred towards the MPS GEOINT.

Courses offered in MPS and GCPS GEOINT will expose students to material far beyond the existing offerings in geospatial information sciences (GIS) at UMD, and they will cater to an entirely new population seeking employment and skills in the intelligence industry. The Department of Geographical Sciences already offers a MPS in geospatial information sciences (MPS GIS) and we see MPS and GCPS GEOINT working in synergy with that MPS degree. Indeed, MPS and GCPS GEOINT provide us some “cover” at the higher end of the geospatial intelligence job market and will specifically help UMD to distinguish itself from a growing cohort of university programs that are offering basic software-oriented GIS courses at the lower-end of the market.

The MPS and GCPS GEOINT will require that students enter with a basic GIS or remote sensing background. (For students that are missing that background, we offer a series of intensive weekend/evening workshops through the UMD Office of Extended Studies, via the Center for Geospatial Information Science, that can provide the skill-set; see http://goo.gl/9bjYDV for our offerings this past summer). From this foundation, the MPS and GCPS GEOINT will explore (1) intelligence gathering; (2) knowledge discovery in security, business, and engineering domains; and (3) workflows and decision support systems for applied geospatial intelligence.

Courses will be delivered in a hybrid format: instructors will present lectures and lead discussions tangibly in a classroom setting, while also streaming the lectures Online. Students that can attend in person may do so, while those that require access remotely can also participate (via Adobe Connect). Similarly, laboratory sessions may be attended tangibly, or students may access instruction remotely using video conferencing and virtual machine access to our software and data at UMD. International students, however, are limited in the way of taking classes. According to F-1 Visa regulations by United States Citizenship and Immigration Services (UCSIS), only one "online" or "distance education" course per semester can be counted toward the student’s full course of study per academic period, and all other course work must be delivered in a "contact" classroom.

Courses will be scheduled in evenings to accommodate working professionals. In order to attract international students, MPS and GCPS GEOINT will be offered in standard spring/fall/summer/winter terms. It is recommended that students take at least two courses in a regular Spring and Fall semester sequence: MPS GEOINT will require at least five semesters to complete, and GCPS GEOINT will require at least two semesters. F-1 students pursuing academic degrees in other programs may apply and enroll in the GCPS GEOINT program, as long as they continue to make academic progress in the degree programs.

1.2 How big is the program expected to be? From what other programs serving current students, or from what new populations of potential students, onsite or offsite, are you expecting to draw?

The MPS and GCPS GEOINT programs are designed for new-graduates to pursue a degree/certificate in GEOINT, or working professionals seeking to refresh or expand their existing skill-set and training.

We anticipate attracting students from the ranks of military personnel and employees already
employed locally in the geospatial intelligence industry, who are looking to retrain in what is a highly dynamic field, or who are looking to bolster their skills relative to the current state of the art technologies, practices, and problem-sets. Again, Maryland has one of the largest populations of potential students in this catchment category.

Our more immediate pool of students for recruitment will be from GIS undergraduate students in the area. The Department of Geographical Sciences has a current cohort of 183 GIS majors, 86 GIS minors, and 8 remote sensing minors. There are similar undergraduate GIS programs in Maryland from which we expect to draw undergraduate students: UM Baltimore County (http://goo.gl/Z9JvB9), Salisbury (http://goo.gl/kP21ro), Washington College (https://goo.gl/2dVI7J), Towson (http://goo.gl/IUzlKj), Bowie State (http://goo.gl/v8t74Y), Coppin State (http://goo.gl/mhGwEk), Frostburg State (http://goo.gl/NghF3J), UM Eastern Shore (https://goo.gl/bbD7Ip), and the Naval Academy.

We also see significant potential in drawing students from additional academic fields—particularly from computer science, criminology, business, and engineering. Indeed, the addition of a program in geospatial intelligence would be particularly useful in drawing graduate students to UMD that might not traditionally consider pursuing a generic GIS field of study. Put simply, there is simply no other option in Maryland available to GIS, geography (or any) students that wish to pursue graduate education in geospatial intelligence. Given the huge availability of jobs in Maryland and the metropolitan D.C. area, we see significant potential for enrollment and growth.

We anticipate hosting a cohort of 30 students per year once the MPS and GCPS GEOINT programs gather steam. A combined enrollment (MPS and GCPS in GEOINT) of at least 10 students is anticipated in the first year, and an annual incremental growth of 5-10 students is expected in the following years. We expect to be at full steam in year 3 or 4 of the program. Given our discussions with local employers, federal agencies, UMD students, and our visits to the ESRI User Conference, we feel that these enrollment goals are realistic in the near- to short-term. The plethora of local employers and the uptick in employment for geospatial intelligence, as well as the rapid and ever-shifting nature of the field should provide sustainable growth to year 3 or 4.

2 Curriculum

2.1 Provide a full catalog description of the proposed program, including educational objectives and any areas of concentration

The MPS and GCPS in GEOINT programs will deliver fundamental and advanced courses in three main areas (labs and hands-on exercises in problem-solving will be integrated throughout the sequence):

1. Fundamentals of intelligence gathering;
2. Knowledge discovery processes;
2.2 List the courses (number, title, semester credit hours) that would constitute the requirements and other components of the proposed program. Provide a catalog description for any courses that will be newly developed or substantially modified for the program.

The program will consist of the following courses:

<table>
<thead>
<tr>
<th>Type</th>
<th>Course #</th>
<th>Course Title</th>
<th>Credit</th>
<th>Newly Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>GEOG6**</td>
<td>Fundamentals of geospatial intelligence</td>
<td>3</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>GEOG6**</td>
<td>Advances in geographic information science and remote sensing</td>
<td>3</td>
<td>Y</td>
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<td></td>
<td>GEOG6**</td>
<td>Big data analytics</td>
<td>3</td>
<td>Y</td>
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<td></td>
<td>GEOG6**</td>
<td>Ethical intelligence and analysis</td>
<td>3</td>
<td>Y</td>
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<tr>
<td></td>
<td>GEOG6**</td>
<td>Algorithms for geospatial intelligence analysis</td>
<td>3</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>GEOG6**</td>
<td>Capstone project: problem-solving in geospatial intelligence</td>
<td>3</td>
<td>Y</td>
</tr>
<tr>
<td>Elective</td>
<td>GEOG6**</td>
<td>Human and activity-based intelligence</td>
<td>3</td>
<td>Y</td>
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<tr>
<td></td>
<td>GEOG6**</td>
<td>Geospatial intelligence in business</td>
<td>3</td>
<td>Y</td>
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<td>GEOG6**</td>
<td>Geospatial intelligence for security</td>
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<td></td>
<td>GEOG6**</td>
<td>Engineering geospatial intelligence</td>
<td>3</td>
<td>Y</td>
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<td></td>
<td>GEOG6**</td>
<td>Geovisualization and the user experience</td>
<td>3</td>
<td>Y</td>
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<td></td>
<td>GEOG6**</td>
<td>Mobile and social geocomputing</td>
<td>3</td>
<td>Y</td>
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<td>GEOG6**</td>
<td>Image processing and computer vision</td>
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<td></td>
<td>GEOG6**</td>
<td>Decision support systems for geospatial intelligence</td>
<td>3</td>
<td>Y</td>
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<td></td>
<td>GEOG6**</td>
<td>Being entrepreneurial and innovative</td>
<td>3</td>
<td>Y</td>
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</tbody>
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2.2.1 Course descriptions

GEOG6** Fundamentals of Geospatial Intelligence

This course introduces the foundation knowledge of geospatial intelligence. It will cover the history of the field; the day-to-day practice of geospatial intelligence; the intelligence and geospatial intelligence frameworks in the United States and abroad; and introductions to intelligence gathering schemes, knowledge discovery and analysis, and decision support systems. It will also introduce substantive topics of intelligence problem-solving in the social and behavioral science, security, business, and engineering.

GEOG6** Advances in Geographic Information Science and remote sensing

Assuming a basic understanding of geographic information systems and services, and remote
sensing techniques, this course focuses on state-of-the-art advances in geographic information science and remote sensing data acquisition as they support geospatial intelligence. The course will focus on synergies between GI science and remote sensing in informatics, computer science, and spatial engineering, and their application to problem domains in human systems, physical systems, and cyberspace. Current topics include the shift toward open source geospatial data, temporal data, place-based data, cyberinfrastructure, unmanned vehicles, machine vision, high-performance and distributed computing for data fusion, and geocomputing.

GEOG6**  Big data analytics
This course explores data fusion, statistical analysis, and data-mining for geospatial and non-geospatial data in structured and unstructured form, with an emphasis on large silos of data across diverse sources and assumptions. Topics will include open sourcing, metadata schemes, data standards and models, data-access, data-mining, clustering methods, classifiers, data reduction, machine learning, filtering schemes, real-time and streaming data, archiving and preservation, and handling uncertainty.

GEOG6**  Ethical intelligence and analysis
This course addresses ethical issues in data-gathering, analysis, representation, display, and communication for geospatial intelligence. Students will undergo certification through the Collaborative Institutional Training Initiative (conflicts of interest, export guidelines, human subjects research, information privacy and security, and responsible conduct of research). The course will then explore topics in ethics related to the legal frameworks for geospatial intelligence, intelligence bias, data privacy, information security, inference and function creep, tracking and location-aware technologies, geodemographic profiling, transactional privacy and inference, handling error and uncertainty, data-sharing and provenance, open-source and open-access information, and public participation in geospatial intelligence.

GEOG6**  Algorithms for geospatial intelligence analysis
The purpose of this course is to expose students to fundamental algorithms in geospatial intelligence and their application in methodological and substantive domains, and their implementation in computer programs and software systems. Current topics include spatial and space-time analysis, cartographic transformations, data compression and reduction, MapReduce and distributed data access, genetic algorithms, clustering and indexing algorithms, filtering algorithms, geometry and tessellation algorithms, routing algorithms, localization algorithms, and complexity and scaling. Implementation of algorithms will be explored through pseudo-code and a variety of scripting, data access, and programming languages.

GEOG6**  Capstone project: problem-solving in geospatial intelligence
The capstone course provides students with opportunities to build on the knowledge that they have gained in the core coursework by applying their knowledge and interests to particular geospatial intelligence problems of a methodological and/or substantive nature. An emphasis is placed on
applying fundamental techniques of geospatial information-gathering, analysis, knowledge creation, or methodological development, and treatment of future-looking problems is encouraged. The first third of the course will focus on instruction-based review of problem formulation, project development, project scheduling, evaluation criteria and schemes, team-building and collaboration, communication, and outreach. The remaining two-thirds of the course will be student-driven, and will task students with developing their own project independently. Students will prepare either a written report or a documented piece of software or analysis for presentation in a program-wide research symposium involving student, faculty, and industry participants.

GEOG6** Human and activity-based intelligence
This course focuses on the applied human domain of geospatial intelligence and its relationship to social and behavioral science. It begins with a review of human geography, behavioral geography, political geography, and cultural geography and their relationships to human intelligence gathering. It then focuses on fundamental and emerging techniques for activity-based intelligence. Current topics include migration and flow, movement analytics, transportation analytics, time geography and event conceptualization, transactions and interactions, and social and cyber-physical networks.

GEOG6** Geospatial intelligence in business
This course focuses on geospatial intelligence for business applications, including industrial location theory, spatial dynamics of preference, supply chain management and logistics, site selection, market and trade area delineation and segmentation, geodemographic profiles, location-based advertising, location-allocation and service delivery, geographies of hazard and risk assessment in actuarial science, network geography for utilities, cyberspace and e-commerce, location-aware technologies and micro-marketing.

GEOG6** Geospatial intelligence for security
This course focuses on security problem-sets, opportunities, methods, and applications of geospatial intelligence in security four main domains. First, in defense and homeland security, the course will examine how geospatial intelligence supports military operations (including operations other than war) and national security initiatives. Second, in the domain of crime, the course will explore how geospatial intelligence is used in law enforcement, crime prevention, and forensic analysis. Third, the course examines the role of geospatial intelligence in cyber-security, including topics such as cyber-crime, location spoofing, and space-time dynamics of computer virus and service attacks, fraud, and SPAM. Fourth, the course treats geospatial intelligence as it relates to the identification, analysis, evaluation, management, and response to hazards, crises, and critical scenarios. Here, we focus on both natural and on man-made phenomena and systems, as well as interactions between them.

GEOG6** Engineering geospatial intelligence
This course focuses on the engineered substrate for geospatial intelligence data-gathering and
analysis, as well as application of geospatial intelligence in cyber-physical systems, cyber-technical systems, and human-centered computing. The course will cover topics including fundamentals of Internet and communications technologies, the GeoWeb, autonomous vehicles, location-aware technologies and devices, sensors, sensor webs and networks, smart infrastructure, spatial thinking and spatial abilities for robotics, and intelligent machines.

GEOG*** Geovisualization and the user experience
This course focuses on graphical interfaces to spatial data, models, and analysis. It will cover computer cartography, scientific visualization, handling high-dimensional data, and animation. It will also explore the user experience atop spatial data, including design of graphical user interfaces for ordinary and special users and scenarios, human factors in geovisualization, narrative and story-telling, linking and brushing, gamification, immersion, augmented reality, virtual reality, and virtual worlds.

GEOG*** Mobile and social geocomputing
This course will follow the movement of geospatial intelligence and analysis to mobile (particularly location-enabled and location-aware) platforms and to social media. The course will review the implementation of GIS on mobile and social media, software platforms, and devices, with particular emphasis on the development of “apps” for geospatial intelligence and analysis, or that make use of their capabilities. The course will also focus on next-generation technologies: current topics include human-centered computing, volunteered geographic information, ambient geographic information, crowd-sourcing of intelligence gathering and analysis, wearable computing, and augmented reality.

GEOG*** Image processing and computer vision
This course will explore image processing routines atop remotely-sensed data from a variety of multispectral, hyperspectral, radar, and microwave platforms, including data preparation and enhancement, feature transformation, classification, pattern detection, and feature extraction. The course will also cover LIDAR-based data and the construction of point cloud geometries. We will also explore next-generation platforms for machine vision, including commercial sensors in location-aware devices and gaming devices, car sensor systems, and security cameras, and methods for object detection and tracking, structure from motion, and gait and expression analysis.

GEOG6** Decision support systems for geospatial intelligence
This course will focus on the interface between geospatial data, modeling and simulation, and the day-to-day workflow of the geospatial analyst in ordinary and extraordinary scenarios. The course will cover decision and planning support systems generally, including fundamentals of modeling and simulation; data and model interoperability and standards; issues of error, accuracy, and uncertainty; calibration, validation, and verification; and data support. We will also spend considerable time in exploring a range of widely-used decision support systems in key substantive areas, including natural hazards (HAZUS), transport and evacuation (TRANSIMS and MATSIM),
epidemiology (EpiSimS), hurricanes (GFS), climate change (GCMs), cybersecurity, and municipal systems (including Maryland’s own StatNet system).

GEOG6** Being entrepreneurial and innovative

Geospatial intelligence requires a skill-set that spans academic, public, and commercial settings, with vistas that can vary or often must connect in harmony. This course will focus on training students to be entrepreneurial across these dimensions of the industry. We will focus on the practice of geospatial intelligence gathering and analysis in some public and private enterprise settings, including a review of the formation and operation of major companies and public-private partnerships in the industry (e.g., GeoEye, Palantir, TeleNav, Leidos, Booz Allen Hamilton, Lockheed Martin). We will also cover start-up companies, particularly those focused on early-stage product and service development in geospatial intelligence. The course will then turn to issues of business development in the geospatial intelligence industry: developing business models, patents and intellectual property, licensing, business formation, venture capital, product development, management, contracts and agreements.

**A. Describe any selective admissions policy or special criteria for students selecting this field of study.**

The Graduate School of the University of Maryland admits applicants that have earned a four-year baccalaureate degree with a cumulative 3.0 GPA (on a 4.0 scale). Official transcripts of a post-secondary degree and a résumé are required along with the application. International applications must meet all requirements for international admissions, which have specific standards for academic credentials, language proficiency, financial support, visa requirements, etc. Refer to http://www.gradschool.umd.edu/admissions/international-admissions for process and requirements for international applications.

In addition to the requirements from the Graduate School, the Department of Geographical Sciences also requires that applicants will have completed a sequence of course work equivalent to the Department of Geographical Sciences’ 300-level offerings in statistics, remote sensing, GIS, and computer cartography as well as one year of calculus. Students without this academic background may substitute with relevant professional experience. Applicants without academic or professional backgrounds may be accepted with a conditional offer, given that applicants will take required workshops or short courses to address these core competencies.
I. STUDENT LEARNING OUTCOMES AND ASSESSMENT

The purpose of this plan is to set clear guidelines, identify articulated outcomes, and ensure avenues for continuous improvement. It is the mission of the Office of Professional Studies to provide programs that meet UMD’s institutional goals and objectives for educational activities.

Graduating students from both of MPS and GCPS GEOINT programs are expected to complete the course with the following outcomes:

1. A well-rounded understanding of the fundamental nature of geospatial intelligence and analysis, including the core theory, methods, and protocols for gathering of geospatial intelligence data, analyses of those data, use of the resulting products in operational settings for applied geospatial intelligence, and the ethical treatment of data and analysis throughout those procedures.

2. Advanced expertise in either or both of the challenges and opportunities for geospatial intelligence in human, security, business, and engineering domains; and technologies for future geospatial intelligence and analysis in computing, machinery, and software.

3. Practical, hands-on project and lab-style training with data collection procedures, data analysis, algorithm development, in the central and newly-forming modeling and analysis software and platforms.

4. Train students for future success in the workforce.

5. Design and implement strategies to solve real-world intelligence problems as they present across a variety of domains, including human dynamics, business activities, security and defense, hazards and emergency management, and engineering.

To ensure that these outcomes are met, the MPS and GCPS GEOINT program will focus on coursework and course modules that emphasize:

1. Well-rounded understanding—Impose a core set of coursework to ensure that students develop a well-rounded education in the fundamentals of geospatial intelligence and analysis, with courses that cover basics of the profession and science, technical offerings, and ethics.

2. Advanced expertise—Offer a series of balanced electives that build on that core with advanced coverage of topics of a substantive nature and/or a technical nature.

3. Practical training—A capstone project will be required of all students, affording them the opportunity to develop hands-on problem-solving skills on operational intelligence tasks.

4. Lab skills—In each course, a set of projects or lab exercises will ensure that students apply their theoretical knowledge to actionable topics in geospatial intelligence and analysis.

5. Workforce success—A dedicated course will be offered to train students in the art and practice of thinking and acting entrepreneurially, so that they are well-prepared for success in the workplace.

Our success in guiding students through the outcomes will be evaluated using a set of varied metrics and instruments:
1. **In-class observation**—Assessments will be carried out throughout the program to gauge (1) student involvement, (2) student interest and engagement, (3) student performance, (4) faculty performance, and (5) the nature of the learning environment. This assessment will be carried out by informal observation by other faculty in the MPS and GCPS GEOINT program, as well as by faculty in the Department of Geographical Sciences. Unstructured (quick chats and check-ins) and structured (survey questions) data will be collected to support these observations.

2. **Student participation**—Will be gauged through checks on attendance and progression through course milestones (submitting assignments and projects in a timely manner). Where content is provided digitally (through Adobe Connect or via ELMS, for example), empirical metrics for students’ access of course resources can also be evaluated.

3. **Student feedback**—Will be collected through open sessions (office hours or question-and-answer sessions) and formal evaluation events (end-of-course evaluation). Upon graduating from the course, we will also hold student exit interviews to gather feedback on their success in the course and in meeting our learning outcomes objectives.

4. **Capstone project**—The capstone project is one of the main culminating course experiences for the MPS and GCPS GEOINT program. Each capstone project will be evaluated in a dedicated review session and evidence of learning outcomes as they present in the projects will be assessed.

**II. FACULTY AND ORGANIZATION**

**A. Who will provide academic direction and oversight for the program**

Faculty:

The MPS and GCPS in GEOINT will be taught by:

- Dr. Ruibo Han, Lecturer, Department of Geographical Sciences and Director of Programs, Center for Geospatial Information Science
- Lecturer, to be hired full-time to teach specifically in the MPS and GCPS in GEOINT program.

The MPS and GCPS in GEOINT will be housed in the Graduate School. The “Program Oversight Committee” is responsible for directing both programs in GEOINT, while the programs will be administrated and managed by the University of Maryland Center for Geospatial Information Science (CGIS). The program will also form a “MPS and GCPS GEOINT Advisory Committee”.

Members of the Program Oversight Committee include:

- CGIS Director—Paul Torrens, Professor, Department of Geographical Science, College of Behavioral and Social Sciences; and University of Maryland Institute for Advanced Computer Studies, College of Computer, Mathematical, and Natural Sciences (Joint appointment)
- Graduate Director—Laixiang Sun, Professor, Department of Geographical Sciences, College of Behavioral and Social Sciences
- Graduate School Representative—Charles Caramello, Dean, Graduate School
The “MPS and GCPS GEOINT Advisory Committee” will be formed internally from faculty in the MPS and GCPS GEOINT program, with two elected student representatives (one from MPS and one from GCPS). The role of the Advisory Committee will be to provide semester-to-semester guidance on the running of the program, as well as strategic advice regarding future opportunities for the program.

B. If the program is not to be housed and administered within a single academic unit, provide details of its administrative structure.

The MPS and GCPS in GEOINT will be housed in the Graduate School and managed by the CGIS. Faculty members from the Department of Geographical Sciences in the College of Behavioral and Social Sciences will perform the academic leadership for the program oversight team.

III. OFF-CAMPUS PROGRAMS (if necessary)

A. If at Shady Grove – indicate how students will access student services

Not applicable

B. If on-line – describe the concerns in “Principles and Guidelines for Online Programs” are to be addressed.

Not applicable

IV. OTHER ISSUES

A. Describe any cooperative arrangements with other institutions or organizations that will be important for the success of this program.

Not applicable

B. Will the program require or seek accreditation? Is it intended to provide certification or licensure for its graduates? Are there academic or administrative constraints as a consequence?

Yes, both of the programs will seek accreditation from United States Geospatial
Intelligence Foundation (USGIF). USGIF is the “only organization of its kind aimed at bringing together the many disciplines involved in the geospatial intelligence sector to exchange ideas, share best practices, and promote the education and importance of a national geospatial intelligence agenda”. The accreditation is only awarded to selected institutions with geospatial intelligence programs and will bring merit to our graduates in the job market. MPS degree and graduate certificates are expected to be accredited from the first round of graduation, and no academic and administrative constraints are to be expected.

V. COMMITMENT TO DIVERSITY

The University of Maryland is an equal opportunity institution with respect to both education and employment. The University does not discriminate on the basis of race, color, national origin, sex, age, or handicap in admission or access to, or treatment or employment in, its programs and activities as required by federal (Title VI, Title IX, Section 504) and state laws and regulations.

Through its actions and statements of policy the University of Maryland has demonstrated a commitment to diversity by creating programs of study which explore the experiences, perspectives, and contributions of a wide variety of cultures, groups, and individuals; and has sought to create a campus environment which encourages tolerance and respect for individuals regardless of differences in age, race, ethnicity, sex, religion, disability, sexual orientation, class, political affiliation, and national origin.

MPS and GCPS GEOINT programs will adopt the model established by the University of Maryland to contribute the diversity by marketing and attracting applicants from various professional backgrounds in various regions of the world. Course content and delivery methods will be tailored to respect students regardless of differences in race, color, age, sex, religion, disability, etc.

VI. REQUIRED PHYSICAL RESOURCES

A. Additional library and other information resources required to support the proposed program. You must include a formal evaluation by Library staff.

Both the MPS and GCPS GEOINT use existing resources and no additional library resources or support are required.

B. Additional facilities, facility modifications, and equipment that will be required. This is to include faculty and staff office space, laboratories, special classrooms, computers, etc.
New classroom facilities are being provided as part of the development of the Center for Geospatial Information Science. A dedicated set of server and high-performance computing clusters are also being provided from CGIS.

The CGIS has two dedicated lines for Lecturers, who will provide instruction in the MPS and GCPS GEOINT programs. As the program grows (year 2 to 3), we will consider hiring one additional lecturer, a dedicated Program Coordinator, and a dedicated IT technician using funds from the program itself.

To kick-start the programs, Lecturers will teach both lecture and lab sections for the course. However, Teaching Assistant lines will eventually be required for the courses as enrollment grows. These will initially be provided through revenue from the program.

C. Impact, if any, on the use of existing facilities and equipment. Examples are laboratories, computer labs, specially equipped classrooms, and access to computer servers.

Not required.

VII. RESOURCE NEEDS AND SOURCES

A. List new courses to be taught and needed additional sections of existing courses. Describe the anticipated advising and administrative loads. Indicate the personnel resources (faculty, staff, and teaching assistants) that will be needed to cover all these responsibilities.

The following courses will be proposed to the Department of Geographical Sciences for approval:

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamentals of geospatial intelligence</td>
</tr>
<tr>
<td>Advances in geographic information science and remote sensing</td>
</tr>
<tr>
<td>Big data analytics</td>
</tr>
<tr>
<td>Ethical intelligence and analysis</td>
</tr>
<tr>
<td>Algorithms for geospatial intelligence analysis</td>
</tr>
<tr>
<td>Capstone project: problem-solving in geospatial intelligence</td>
</tr>
<tr>
<td>Human and activity-based intelligence</td>
</tr>
</tbody>
</table>
CGIS will hire Lecturers and Graduate Teaching Assistants to support the programs, and tuition revenue will be used for salaries and benefits of the teaching and managing team.

B. List new faculty, staff, and teaching assistants needed for the responsibilities in A, and indicate the source of the resources for hiring them

No new staff will be required in years 1 to 2.

In following years, we anticipate hiring one new lecturer and requesting three to four TA lines. In each case, resources for these hires will come from Program revenues directly unless other sources can be identified.

C. Some of these teaching, advising, and administrative duties may be covered by existing faculty and staff. Describe your expectations for this, and indicate how the current duties of these individuals will be covered, and the source of any needed resources.

The CGIS has two dedicated lines for Lecturers. One of the lecturer roles is for a hybrid instruction/Center and program management staff. This lecturer will provide management for the program initially. The two lecturers will serve as instructors for the program. Initially, the lecturers will also provide lab instruction, but these responsibilities will shift to Teaching Assistants once the program grows and revenue to support them can be obtained internally within the program.

D. Identify the source to pay for the required physical resources identified in Section VIII. above.

Tuition revenue will be used to cover all program expenses.

E. List any other required resources and the anticipated source for them
Not applicable

F. Complete the additional proposal and financial tables as required by MHEC.

Not applicable for MPS/GCPS programs.

**Additional Approvals** *(see PCC coversheet for other required signatures)*
## MPS GEOINT Budget

<table>
<thead>
<tr>
<th>Resources</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition Revenue</td>
<td>$225,000</td>
<td>$540,000</td>
<td>$855,000</td>
<td>$945,000</td>
<td>$945,000</td>
</tr>
<tr>
<td>Tuition per Credit Hour</td>
<td>$750</td>
<td>$750</td>
<td>$750</td>
<td>$750</td>
<td>$750</td>
</tr>
<tr>
<td>Number Fulltime students 1st year:</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>30</td>
<td>30</td>
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<tr>
<td>Full time load 10 credits semester *</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Number Fulltime students second year</td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Full time load 10 credits semester *</td>
<td>0</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
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<tr>
<td>Annual Full time tuition revenue</td>
<td>$135,000</td>
<td>$360,000</td>
<td>$585,000</td>
<td>$675,000</td>
<td>$675,000</td>
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<tr>
<td>Number Parttime students</td>
<td>10</td>
<td>20</td>
<td>30</td>
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</tr>
<tr>
<td>Part time load 6 credits semester</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
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<tr>
<td>Annual Part time tuition revenue</td>
<td>$90,000</td>
<td>$180,000</td>
<td>$270,000</td>
<td>$270,000</td>
<td>$270,000</td>
</tr>
</tbody>
</table>

Fulltime = 3 semesters  
Parttime = 5 semesters  
* Fulltime Cohort graduate in 3 semesters so calculated at half load their second year

## Expenses

| Number of Courses | 6 | 9 | 9 | 9 | 9 |
| Lecturers (teaching) | 1 | 1.5 | 1.5 | 2.0 | 2.0 |
| Program Director (review applicants, recruit) | 1 | 1 | 1 | 1 | 1 |

| Total Lecturers inc Program Director | 2.0 | 2.5 | 2.5 | 2.5 | 2.5 |
| Total Salary (Lecturers/Dir @85K) | $170,000 | $212,500 | $212,500 | $212,500 | $212,500 |

Program Coordinator Assistant **  
Existing Coordinator for GEOG MPS programs will be used. Additional may need to be hired as cohorts increase (60K)  
| Total Salary Coordinators | $60,000 | $60,000 | $60,000 |

** TAs  
<p>| Number | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Total Cost ($20,603 step II) | $61,809 | $82,412 | $82,412 | $82,412 | $82,412 |
| Total Salary | $231,809 | $294,912 | $354,912 | $354,912 | $354,912 |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Benefits</td>
<td>$69,543</td>
<td>$88,474</td>
<td>$106,474</td>
<td>$106,474</td>
<td>$106,474</td>
</tr>
<tr>
<td>Campus 15% of Tuition for on campus programs</td>
<td>$33,750</td>
<td>$81,000</td>
<td>$128,250</td>
<td>$141,750</td>
<td>$141,750</td>
</tr>
<tr>
<td>Advertising inc travel to conferences</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Supplies</td>
<td>$50,000</td>
<td>$50,000</td>
<td>$50,000</td>
<td>$50,000</td>
<td>$50,000</td>
</tr>
<tr>
<td><strong>Total Expense</strong></td>
<td><strong>$400,102</strong></td>
<td><strong>$529,386</strong></td>
<td><strong>$654,636</strong></td>
<td><strong>$668,136</strong></td>
<td><strong>$668,136</strong></td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td><strong>($175,102)</strong></td>
<td><strong>$10,614</strong></td>
<td><strong>$200,364</strong></td>
<td><strong>$276,864</strong></td>
<td><strong>$276,864</strong></td>
</tr>
</tbody>
</table>
DATE: March 11, 2016

TO: Dr. Paul Torrens
Professor, Geographical Sciences; Director, Center for Geospatial Information Science
Dr. Ruibo Han
Director of Programs, Center for Geospatial Information Science

FROM: On behalf of the University of Maryland Libraries:
Dr. Kelley O’Neal, Geospatial Information Specialist, Geographical Sciences Librarian
Maggie Saponaro, Interim Head of Collection Development
Daniel Mack, Associate Dean, Collection Strategies & Services

RE: Library Collection Assessment

We are providing this assessment in response to a proposal by the Department of Geographical Sciences in the college of Behavioral and Social Sciences to create a Master of Professional Studies and Graduate Certificate in Professional Studies in Geospatial Intelligence (MPS GEOINT and GCPS GEOINT respectively). The MPS/GCPS GEOINT program requested a collections resources assessment from the University of Maryland Libraries to determine how well the Libraries support the curriculum of this proposed program.

Serial Publications

The University of Maryland Libraries currently subscribe to a large number of scholarly journals, almost all in online format, that focus on Geospatial Intelligence.

The Libraries subscribe to several journals on topics related to Geospatial Intelligence such as Business Intelligence, Cyber Intelligence, and Strategic Analysis. These journals include the following:

- Computing for Geospatial Research and Application
- Geospatial Today
- Applied Computational Intelligence and Soft Computing
- Advances in Distributed Computing and Artificial Intelligence Journal
- Advances in Artificial Intelligence
- Computational Intelligence
- Big Data and Society
- Journal of Information Privacy and Security
- Journal of Selected Topics in Applied Earth Observations and Remote Sensing
- Justice Quarterly
- Journal of Global Optimization
- Computer Law and Security Review
- International Journal of Intelligence and CounterIntelligence
- The Journal of Strategic Information Systems
- Governance
- Philosophy and Public Affairs
- Decision Analysis
- Transportation Science
- Information Systems Research (ISR)
In cases in which the Libraries do not subscribe to articles in journals that we do not own, they likely will be available through Interlibrary Loan/Document Delivery

**Databases**

The Libraries’ Database Finder (http://www.lib.umd.edu/dbfinder) resource offers online access to databases that provide indexing and access to scholarly journal articles and other information sources. Many of these databases cover subject areas that would be relevant to the Master of Professional Studies/Graduate Certificate in Professional Studies in Geospatial Intelligence programs are:

1. **LexisNexis Academic** - Full-text database that offers a wide range of news, political, legal, business, and reference information in full-text format. Primary source of newspaper articles, including those from the Washington Post and the New York Times. Federal code, regulations, and case law, plus state codes and case law are also included.

2. **EIU ViewsWire** - Full-text country news daily that provides analysis and forecast information on worldwide politics, economics, business strategies & conditions and market trends in almost 200 countries.

3. **Passport** – Provides global statistics for 205 countries on economic indicators, health, foreign trade, environment, lifestyle, industrial and agriculture output, communications and more. It also includes market size data for over 300 consumer products and services, including reports covering analysis of drivers of the industry, industry risk, market data and segments, competitors and industry performance. It provides demographic trends, economic indicators, finance, foreign trade, health, labor force, industrial and agricultural production, environmental data, consumer expenditure patterns, retail sales, advertising and media patterns, consumer prices, household patterns, literacy rates, telecommunications, automotive and transport figures, travel and tourism, income and earnings potential.

4. **IEEE Xplore** - Provides full-text access to IEEE transactions, journals, magazines and conference proceedings published since 1988 and all current IEEE Standards. Includes access to Bell Labs Technical journal Archive (BLTJA) 1922-2015.

5. **Communication & Mass Media** - Complete originated with the acquisition and subsequent merging of two popular databases in the fields of communication and mass media studies -- CommSearch (formerly produced by the National Communication Association (NCA)), and Mass Media Articles Index (formerly produced by Pennsylvania State University). This database is currently offered on a trial basis.

6. **Encyclopedia of Statistical Sciences (Wiley)** - Covers topics in statistics, biostatistics, quality control, economics, sociology, engineering, probability theory, computer science, biomedicine, psychology, survey methodology, and many other areas. Includes the full text of the first and second print editions, plus the supplemental volumes. The entries are self-contained and easily understood by readers with a limited statistical background.

7. **Global Terrorism Database** - Developed by the National Consortium for the Study of Terrorism and Responses to Terrorism and START: A Center of Excellence of the U.S. Department of Homeland Security, University of Maryland. "The Global Terrorism Database is an open-source database including information on terrorist events around the world from 1970 through 2008 (with annual updates planned for the future). Unlike many other event databases, the GTD includes systematic data on domestic as well as international terrorist incidents that have occurred during this time period and now includes more than 87,000 cases."
8. **Military & Government Collection** - Designed to offer current news pertaining to all branches of the military, this database offers full text for nearly 300 journals, periodicals, and U.S. government documents. The database also includes full text for 245 pamphlets and offers indexing and abstracts for nearly 400 titles. Many full text titles are available in native (searchable) PDF, or scanned-in-color.

9. **Academic Search Complete** - Multi-disciplinary database providing information for nearly every area of academic study. Includes an enormous collection of the most valuable peer-reviewed full text journals, as well as additional journals, magazines, newspapers and books.

Also three general/multidisciplinary databases, **Science Direct**, **MasterFILE Premier**, and **Web of Science**, are good sources of articles relevant to this topic.

In most cases, these indexes offer full text copies of the relevant journal articles. In those instances in which the journal articles are available only in print format, the Libraries can make copies available to graduate students through either the Libraries’ Article Express Program (http://www.lib.umd.edu/access/article-express) or via Interlibrary Loan.

**Monographs**

The Libraries acquire scholarly monographs regularly in geographical sciences and geospatial information systems/science along with allied subject disciplines. Monographs not already part of the collection can usually be added upon request.

Even though most library research for this course/program likely will rely upon online journal articles, students may wish to supplement this research with monographs. Fortunately, more and more monographs are available as e-books. Even in instances when the books are only available in print, graduate students will be able to request specific chapters for online delivery through the Libraries’ Article Express program (Note: see below).

A search of the University of Maryland Libraries’ WorldCat UMD catalog was conducted, using a variety of relevant subject terms. This investigation yielded sizable lists of citations of books that we own. I provide here some example subjects within the field of Geospatial Intelligence, title counts for those subjects, and some example monographs available within our holdings.

Subject: Business Intelligence = 2,616
- Business analysis for business intelligence (e-book) 2012
- Fundamentals of business intelligence (e-book) 2015
- Business intelligence making decisions through data analytics (e-book) 2011
- Open source data warehousing and business intelligence (e-book) 2013
- Big data, big innovation: enabling competitive differentiation through business analytics (2014)
- Business intelligence and analytics: systems for decision support (2015)

Subject: Geospatial Intelligence = 91
- Future U.S. workforce for geospatial intelligence (e-book) 2013
- Geospatial intelligence support in joint operations. (e-book) 2012
- U.S. national intelligence an overview. (e-book) 2011
- Geospatial abduction principles and practice (e-book) 2012
- Geospatial semantics and the semantic web foundations, algorithms, and applications (e-book) 2011

Subject: Strategic Analysis =3,899
Social network analysis in telecommunications (e-book) 2011
Strategic conflict (print) 2012
Providing for national security: a comparative analysis (e-book) 2014
Beyond data protection strategic case studies and practical guidance (e-book) 2013
Beyond data protection strategic case studies and practical guidance (e-book) 2011

Subject: Cybersecurity = 378

Homeland security: policy and politics (print) 2015
DoD program manager's guidebook for integrating the Cybersecurity Risk Management Framework (RMF) into the system acquisition lifecycle. (e-book) 2015
The Department of Defense cyber strategy. (e-book) 2015
Guidebook on best practices for airport cybersecurity (e-book) 2015
Homeland security intelligence (print) 2015
Cybersecurity : protecting critical infrastructures from cyber attack and cyber warfare (print) 2015
Privacy in a cyber-age: policy and practice (print) 2015
Managing online risk: apps, mobile, and social media security (e-book) 2015
At the nexus of cybersecurity and public policy : some basic concepts and issues (e-book) 2014

Subject: Computer Security = 4,117

Wireless and mobile device security (print) 2016
You: for sale: protecting your personal data and privacy online (e-book) 2016
Google hacking for penetration testers (e-book) 2016
Risk analysis and security countermeasure selection (print) 2016
How to defeat advanced malware : new tools for protection and forensics (e-book) 2015

Subject: Cyberspace = 382

The new cyberwar: technology and the redefinition of warfare (print) 2015
Cyber war versus cyber realities : cyber conflict in the international system (e-book) 2015
Cyber warfare: a multidisciplinary analysis (print) 2015
Cyber security and the politics of time (e-book) 2015
The evolution of cyber war : international norms for emerging-technology weapons (e-book) 2015

Subject: Cyberterrorism = 339

The protection of critical energy infrastructure against emerging security challenges (e-book) 2015
Choices for America in a turbulent world (print) 2015
Cyber war versus cyber realities : cyber conflict in the international system (e-book) 2015
Terrorism in cyberspace : the next generation (print) 2015
A further similar search revealed that the Libraries’ membership in the Committee on Institutional Cooperation (CIC) dramatically increases these holdings and citations. As with our own materials, graduate students can request that chapters be copied from these CIC books if the books are not available electronically.

Geospatial Intelligence = 2,123

Business Intelligence = 14,437

Cybersecurity = 9,341

**Article Express and Interlibrary Loan**

These services offer online delivery of bibliographic materials that otherwise would not be available online. As a result, remote users who take online courses may find these services to be helpful. Article Express and Interlibrary Loan are available free of charge.

A special amenity for graduate students and faculty, the Article Express service scans and delivers journal articles and book chapters within three business days of the request—provided that the items are available in print on the UM Libraries' shelves or in microform. In the event that the requested article or chapter is not available on campus, Article Express will automatically refer the request to Interlibrary Loan (ILL). Interlibrary Loan is a service that enables borrowers to obtain online articles and book chapters from materials not held in the University System of Maryland.

Please note that one limitation of these services that might create some challenges for the online student is that the Libraries are not allowed to make online copies of entire books. The only way that a student can get access to a print copy of an entire book is to physically come to the Libraries and check out that book.

**Additional Materials and Resources**

In addition to serials, monographs and databases available through the University Libraries, students in the Master of Professional Studies/Graduate Certificate in Professional Studies in Geospatial Intelligence will have access to a wide range of media, datasets, software, and technology. Library Media Services (http://www.lib.umd.edu/lms) houses media in a variety of formats that can be utilized both on-site and via ELMS course media. GIS datasets are available through the GIS and Geospatial Services Center website (http://www.lib.umd.edu/gis) and the future CIC Geoportal planned for launch in 2017. Statistical consulting and additional research support is available through the Research Commons (http://www.lib.umd.edu/rc) while technology support and services are available through the Terrapin Learning Commons (http://www.lib.umd.edu/tlc).

The subject specialist librarian for geospatial information systems, Dr. Kelley O’Neal (kelleyo@umd.edu), also serves as an important resource to Geographical Sciences and the upcoming Master of Professional Studies/Graduate Certificate in Professional Studies in Geospatial Intelligence program.

**Other Research Collections**

Because of the University’s unique physical location near Washington D.C., Baltimore and Annapolis, University of Maryland students and faculty have access to some of the finest libraries, archives and research centers in the country vitally important for researchers in geospatial intelligence. These include the Library of Congress, the National Archives, National Agricultural Library, and the Smithsonian, to name just few.
Conclusion

With our substantial journals holdings and index databases, as well as additional support services and resources, the University of Maryland Libraries have resources to support teaching and learning in Geospatial Intelligence. These materials are supplemented by a strong monograph collection. Additionally, the Libraries Article Express and Interlibrary Loan services make materials that otherwise would not be available online, accessible to remote users in online courses. As a result, our assessment is that the University of Maryland Libraries are able to meet the curricular and research needs of the proposed Master of Professional Studies/Graduate Certificate in Professional Studies in Geospatial Intelligence program.