Geospatial Technology Education (GeoTEd) - Unmanned Aircraft Systems (UAS) in Virginia’s Community Colleges

Chris Carter
Deputy Director
Virginia Space Grant Consortium
757-766-5210
cxcarter@odu.edu
Virginia Space Grant Consortium (VSGC)

- NASA National Space Grant College and Fellowship Program (1989)
- STEM Education, Workforce Development, Research, and Outreach
- Recruit and train U.S. Citizens, especially women, underrepresented minorities and persons with disabilities, for careers in STEM
- Mary Sandy, Director (msandy@odu.edu)
- ODU is host institution. Office in Peninsula Workforce Development Center, Hampton
<table>
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<th>VSGC Member Institutions</th>
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<td>College of William and Mary</td>
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<td>Hampton University</td>
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<td>Old Dominion University</td>
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<td>University of Virginia</td>
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<td>Virginia Tech</td>
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<td>NASA Langley Research Center</td>
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<td>NASA Goddard Space Flight Center’s Wallops Flight Facility</td>
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<td>State Council of Higher Education for Virginia</td>
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<td>MathScience Innovation Center</td>
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<td>Science Museum of Virginia</td>
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<td>Virginia Air and Space Center</td>
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<td>Center for Innovative Technology</td>
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Geospatial Technology Initiatives

3 NSF-Advanced Technological Education (ATE) Awards

Goal: Increase Number of Trained GIS Technicians

1. NSF Planning Project (2007)
   - Statewide Workforce Needs survey; DACUM to define GIS Technician

2. Statewide Project Grant (2009-12)

3. GeoTEd (2012-16) – Regional Project
   - GIS Courses and Pathways; Faculty and Teacher Professional Development; Mentoring; GIS Webportal; Mobile App
   - Integration of UAS
Geospatial Technology Resources

VCCS Geospatial Institute - Summer 2015

June 22 - June 24, 2015
Cheatham Hall
Dept. of Forest Resources and Environmental Conservation, Virginia Tech
Blacksburg, Virginia

Hosted by the Virginia Geospatial Extension Program at Virginia Tech, Thomas Nelson Community College, Southwest Virginia Community Consortium.

Provide us with comments, suggestions, testimonials, and more via the Virtual Suggestion Box (link is external).

Instructional Resources from the 2015 GeoTEd Institute:
- Handouts (pdf's) (link is external)
- Data for exercises
- PowerPoint Presentations

Map & Compass Resources
- US Orienteering
- NCAA Magnetic Declination

Data Sources
- National Map Viewer: View and download Geographic data (elevation, topo, many others) for any area of the US
- National Map Program: Information and metadata for National Map products
- VDEEP: Virginia Economic Development Program GIS Data Resources pace

Collector & Geospatial Apps
- Collector Resources: tutorials and videos
- GPS Kit
- Trimble Outdoors

GeoTEd.org
Geospatial Technician Education
Unmanned Aircraft Systems
(GeoTEd-UAS)

- Three-year NSF ATE project proposal. In final negotiation for award (still pending).

“In Virginia….Looking Down is Looking Up!”
Other Partners

- Mid-Atlantic Aviation Partnership (MAAP)
- NASA Langley
- NASA Wallops
- Hampton Roads Chapter of AUVSI
- GeoTech National Center
- SpaceTec
- Flirtey
- Timmons
- Sentinel Robotic Solutions
- AirSight Global
- Nexutech
- Esri
- Jack Kennedy
- Northland Technical College
- Environmental Monitoring Incorporated
- University of Virginia
Focus on ‘UAS Operations Technician’

- Mission Planning
- Flight Operations
- Data Collection
- Data Post-Processing
- Data Analysis Using GIS
- CyberSecurity Awareness

Not Just a Pilot or a Maintenance Technician

(GeoTEd-UAS)
Focus on small UAS (<55lbs) and micro UAS (<4.4lbs)
1. Workforce Demand and Defining Competencies of a UAS Operations Technician

- Developing a Curriculum (DACUM) Panel
- Alignment with ASPRS Certification – UAS Technologist (in development)
## A UAS Operations Technician

### Specific employment tasks

<table>
<thead>
<tr>
<th>Manage GIS Data</th>
<th>Create GIS Data</th>
<th>Create Static Maps</th>
<th>Create Dynamic Maps/applications</th>
<th>Analyze GIS Data</th>
<th>Support Internal/External Customers</th>
<th>Maintain Hardware/software Systems</th>
<th>Perform Administrative Tasks</th>
<th>Maintain Professional Knowledge</th>
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</thead>
<tbody>
<tr>
<td>A-1 Obtain data sets *</td>
<td>B-1 Create data schema</td>
<td>C-1 Collaborate with stakeholders *</td>
<td>D-1 Determine purpose of application</td>
<td>E-1 Define reason for analysis</td>
<td>F-1 Process customer requests</td>
<td>G-1 Initiate IT tickets</td>
<td>H-1 Maintain supply inventory</td>
<td>I-1 Develop personal training plan</td>
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<tr>
<td>A-2 Update versioned data</td>
<td>B-2 Collect field data</td>
<td>C-2 Determine Purpose of map</td>
<td>D-2 Identify data sets for application</td>
<td>E-2 Determine feasibility of analysis</td>
<td>F-2 Deliver product to customer</td>
<td>G-2 Install software</td>
<td>H-2 Submit timesheet</td>
<td>I-2 Participate in training activities (e.g. online course, in person sessions)</td>
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<tr>
<td>A-3 Update non versioned data</td>
<td>B-3 Digitize spatial features</td>
<td>C-3 Identify specific data sets for map</td>
<td>D-3 Prepare cartographic data sets for application</td>
<td>E-3 Outline analysis process</td>
<td>F-3 Deliver map sources (e.g. symbols sets, legends, logos)</td>
<td>G-3 Update firmware</td>
<td>H-3 Submit travel requests</td>
<td>I-3 Attend professional conferences</td>
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<td>A-4 Perform QA/QC on GIS data</td>
<td>B-4 Georeference spatial data</td>
<td>C-4 Prepare cartographic data sets</td>
<td>D-4 Determine type of layout for map</td>
<td>E-4 Identify analysis tools</td>
<td>F-4 Compile training materials</td>
<td>G-4 Apply software patches</td>
<td>H-4 Submit expense reports (e.g. travel, procurement)</td>
<td>I-4 Present at GIS events</td>
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<tr>
<td>A-5 Update metadata</td>
<td>B-5 Geocode spatial data</td>
<td>C-5 Determine type of layout for map</td>
<td>D-5 Design custom application layout</td>
<td>E-5 Identify analysis tools</td>
<td>F-5 Provide GIS training</td>
<td></td>
<td>H-5 Archive projects</td>
<td>I-5 Represent organization at community events</td>
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<tr>
<td>A-6 Perform backup of GIS data</td>
<td>B-6 Process raster data</td>
<td>C-6 Design GIS layout</td>
<td>D-6 Modify existing application</td>
<td>E-6 Determine analysis parameters (e.g. extent, cell size, filters, relationship)</td>
<td>F-6 Provide equipment training (e.g. GIS, plotters, scanner)</td>
<td></td>
<td>H-6 Facilitate meetings (e.g. webinar, phone confr., in-person)</td>
<td>I-6 Review trade publications</td>
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<tr>
<td>A-7 Update data inventory</td>
<td>B-7 Deliver survey data (e.g. GO)</td>
<td>C-7 Design map template</td>
<td>D-7 Follow required design specs for application</td>
<td>E-7 Create project workspace</td>
<td>F-7 Troubleshoot data issues</td>
<td></td>
<td>H-7 Create purchase requests</td>
<td>I-7 Maintain professional memberships</td>
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<tr>
<td>A-8 Report GIS data changes</td>
<td>B-8 Convert data across formats (e.g. CAD, KML, CSV, Excel, PDF)</td>
<td>C-8 Modify existing map document</td>
<td>D-8 Determine application scales</td>
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*Task is performed across more than one duty

Coming Soon
2. Academic Course and Pathway Development

• Career Studies Certificate – UAS Operations Technician (18+credit hour) (Model for the VCCS) (Flexible)

Potential Courses

UAS I and II

GIS 200 and 201

Introduction to Remote Sensing

Pilot Ground School

Interdisciplinary; Service Learning; Communication
3. Faculty Professional Development

• Train the Trainer (Summer 2016)
• GeoTEd-UAS Train AND Mentor Community College Faculty
4. Student Pipeline into UAS Careers
   • Regional High School UAS Expos and Competitions
   • Dual-Enrollment, Transfer, and Articulation Agreements
Thomas Nelson Community College (Hampton/Williamsburg)

- Integration of UAS into GIS Courses
- Rules and Regulations, Sensors, Image Processing, GIS Analysis
- Partnerships with NASA Langley and Others
- Faculty Experience

(GeoTEd-UAS)
Mountain Empire Community College (Big Stone Gap)

- Avionic and Aviation Mechanics 195-Topics in UAS
- Hands-on introduction to UAS with a specific focus on quadcopters
- Offering Online Ground School
- Faculty Experience
GIS 295 – Topics in Service Learning GIS Course

Fieldwork at NASA Wallops Island

SERVICE LEARNING COURSE OPPORTUNITY AT NASA WALLOPS ISLAND

HELP NASA INVESTIGATE SEA LEVEL RISE AND INVASIVE SPECIES

Thomas Nelson Community College is offering a three-credit Sea Level Rise Service Learning course. All expenses paid for course tuition and four days of fieldwork including travel, lodging, and food! Open to Virginia community college. Competitive application process; students from all disciplines are encouraged to apply. Sponsored by Virginia Space Grant Consortium (VSGC) and offered through the STEM Takes Flight Program in partnership with NASA Wallops Flight Facility and Thomas Nelson Community College.

GIS 295 - Topics in Service Learning in GIS.
This online course contains four days of outdoor fieldwork at NASA Wallops on Virginia’s Eastern Shore. Fieldwork will likely be completed over a weekend (Thursday-Sunday) in April 2016.

Faculty-led student teams will engage with NASA scientists to tackle the issue of sea level rise, invasive species, and their impact on coastal communities and ecosystems including NASA Wallops. Using GIS, global positioning system (GPS), unmanned aircraft systems, and other technologies, students will model various sea level rise scenarios and gauge their impacts to NASA infrastructure and habitats. Students will compare data with existing datasets and develop a report to be presented to NASA staff.

Application: https://www.surveymonkey.com/r/9HXDL88
Application Due Date: December 1, 2015
Notification of acceptance by December 5

http://www.vsgc.edu/STEMtakesFlight/sealevelrise.html

During the course you will
- Learn about service learning.
- How to use and operate an Unmanned Aircraft Systems (UAS) to collect data.
- Develop or acquire geographic information system (GIS) skills in analyzing data collected with a UAS. (Prior GIS knowledge is not a pre-requisite for this cross-discipline course)
- Learn about remote sensing and how to use regular imagery, near-infrared imagery, and Lidar to answer questions using a GIS.
- Gain real world experience collecting and analyzing data.
- Tour the facilities and observe the research being completed at the site.
• 3-Credit Online Course Developed and Offered by Thomas Nelson Community College
• Co-Developed with David Webb, GeoTEd Consultant
• Funded by VSGC Through the STEM Takes Flight Program
• Offered to 14 Students Attending 6 Different Community Colleges

Content: GIS; Remote Sensing; UAS

Support WFF’s Coastal Resilience Initiative

Fieldwork: Sea Level Rise and Phragmites
WIN-WIN!

• Benefits for Students
  • Real-world experience with UAS, instruments, GIS, LiDAR and near-IR data

• Benefits for NASA
  • Updated LiDAR data (digital elevation model) and shoreline data
  • Baseline data for future UAV LiDAR
  • Improved mapping of invasive (Phragmites) marsh vegetation
Phragmites
Fly Phantom 2 and Phantom 3 Missions

- True color, near infrared (NIR), and Lidar data
- Students analyze data for invasive species locations and shoreline determination
- Students complete ground truthing of the data
- Final products: georeferenced map layers, DEM, true color, lidar and NIR data. Written report to NASA.
- Fly Missions on April 6-8, 2016
Phantom 2 and 3
Equipped With:

- **Computer**: Raspberry Pi Model B 512MB
- **NIR camera**: Raspberry Pi NoIR Camera Board - Infrared-sensitive Camera
- **Regular RGB camera**: Raspberry Pi Camera Board
- **Near IR Camera Two**: Infragram DIY Plant Analysis Webcam
- **Lidar**: LIDAR-Lite v2

**Software**: DroneDeploy
GeoTED-UAS Team

• Dr. John McGee, Virginia Geospatial Extension Specialist, Virginia Tech, jmcg@vt.edu, 540.231.2428
• David Webb, GeoTEd Consultant (Former Community College Faculty), davidewebb@outlook.com
• Cherie Aukland, Associate Professor of IST and Program Head for GIS, Thomas Nelson Community College, auklandc@tncc.edu, 757.258.6592
• Fred Coeburn, Instructor, Mountain Empire Community College, fcoeburn@mecc.edu, 276.523.2400 ext. 285
Developing multi-skilled technicians in advanced manufacturing for the New Virginia Economy

Collaborating in active community partnerships with industry, K-12, economic development and government

Solving the shortage of highly skilled workers for high-tech manufacturing operations

Enhancing the region’s technical and economic competitive advantage

Promoting manufacturing as great careers with high wages and ongoing growth in new technologies

Incorporating new products and processes emerging from new advanced technologies – composites, additive manufacturing, robotics, mechatronics

Establishing a model for an innovative educational program focused on project-based learning, problem solving and critical thinking skills, expertise of industry’s subject matter experts, and co-op experience

Providing a new associate degree and accelerated career studies certificates beginning Fall 2015
Advanced Integrated Manufacturing (AIM) Multi-Skilled Technicians

Goal: Build a dynamic partnership with business and industry to develop multi-skilled technicians in advanced integrated manufacturing

- Teamwork skills developed by working in teams of engineers, researchers, scientists and technologists
- Broad skill base developed through academic program (50%) and rotation of co-op experience (50%)
- Emphasis on new technologies for jobs of the future: composites, additive manufacturing, sensors, robotics, mfg systems....
- Critical thinking and problem solving skills enhanced by developing real manufacturing projects using integrated technology areas
- Technicians/technologists that embrace change, capable of incorporating and utilizing new technologies as they are developed
AIM Programs

A.A.S. in Advanced Integrated Manufacturing
  • First cohorts of 16 students Jan 2016 and Aug 2016
  • Application and interview with industry partner participation
  • Labs in Hastings Hall updated with $500K in additional equipment
  • Electronics, mechanical, instrumentation, composites, additive manufacturing

Advanced Integrated Manufacturing Career Studies Certificate
  • Prerequisite courses for application to AIM degree (16 credits)
  • Precalculus, Electronics, CADD, Mechanical Technology, College English