Creating Career Pathways and Faculty Professional Development for Small UAS Operation Technicians

Preparing the Small UAS Workforce of the Future

Chris Carter, Deputy Director
Virginia Space Grant Consortium
Background in Geospatial

2003, NASA Workforce Development Grant to establish the Virginia Geospatial Extension Agent tenure-track faculty position at Virginia Tech

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
   • Integration of UAS
Mission: prepare the future Small UAS Operations Technician workforce

- Three-year NSF Advanced Technological Education (ATE) Project
- 4th NSF ATE award-preparing geospatial technician and UAS workforce
- Chris Carter (PI), VSGC Deputy Director

David Webb – Mechanical Engineering Technology, John Tyler Community College

Cherie Aukland – IT and Program Head for GIS, Thomas Nelson Community College

Scott Bellows, Ph.D. – Technical Programs Coordinator-CSIIP-GEOTREK12, VSGC

John McGee, Ph.D. – Associate Professor and Virginia Geospatial Extension Specialist, VT

Fred Coeburn – Computer Networking Technology, Mountain Empire Community College

Dan Lewis, Ph.D. - Director of Educational Programs and Policy, Virginia Community College System (VCCS)
FAA Part 107: Small Unmanned Aircraft Systems

(Weighing more than 0.55lbs and less than < 55lbs)

Either Recreational or Part 107

Flying Commercially – Part 107

• FAA Remote Pilot Certificate
• Be at least 16 years old
  • Be able to speak, read, and write English
  • Be in physical and mental condition that would allow the safe operation
• Pass the FAA remote pilot certificate exam
• Pass a Transportation Security Administration (TSA) security check
FAA Part 107: Small Unmanned Aircraft Systems
(Weighing more than 0.55lbs and less than < 55lbs)

- Operate in Class G airspace
- Operations in Class B, C, D and E airspace allowed with ATC permission.
- Visual line-of-sight only
- Daylight or twilight only
- No operations over people, stadiums, etc.
- Must yield right-of-way to manned aircraft
- One UAS per operator
- Max groundspeed of 100 mph
- Max Altitude of 400ft
Business/Industry Partners

- NASA Langley
- NASA Wallops
- Mid-Atlantic Aviation Partnership (MAAP) – FAA Test Site at VT
- Center for Innovative Technology’s Center of Excellence for Unmanned Systems
- Two Virginia Chapters of AUVSI
- GeoTech National Center
- Advanced Aircraft Company
- Drone Express Parts
- Nexutech
- Esri
- Timmons
- Sentinel Robotic Solutions
- Measure Inc.
- Environmental Monitoring Incorporated
- Draper Aden
- U.S. Geological Survey (USGS)
- The Nature Conservancy
### Four Major Project Components

1. Developing a Curriculum (DACUM) Chart for Small UAS Operations Technician

#### DACUM Job Analysis Research Chart for Small Unmanned Aircraft Systems Operator (SUAS) - Four Major Project Components

<table>
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**Notes:**
- * DAU - Define Area of Function
- ** TACTS - Task Analysis Table
- AOP - Area of Practice

* Denotes that the task may be performed within more than one duty.
** e.g. knowledge or skill.
sUAS Operations Technician

- Mission Planning
- Vehicle and Sensor Selection
- Flight Operations
- Data Collection and Management
- Data Post-Processing and Analysis
- Maintenance and Cybersecurity
- Developing and Delivering a Report
New Unmanned Systems Prefix (UMS):

1. UMS 107 - Small Unmanned Aircraft System (sUAS) Remote Pilot Ground School
2. UMS 111 - sUAS I (Introduction—Manual Flights)
3. UMS 177 - sUAS Components and Maintenance
4. UMS 211 - sUAS II (Advanced—Autonomous Flights)
5. UMS 112 - Program and Flight Data Management
6. UMS 290 – Coordinated Internship
7. UMS 296 – Onsite Training

First four foundation courses approved in spring 2017.
Primary Topics of UMS Courses

Encourage interdisciplinary integration across curriculum
All UAS applications in all employment sectors
Micro-Remote Sensing

**UMS 107:** Topics of the FAA remote pilot certificate exam, intro to flight, hands-on flying, sensor selection

**UMS 111:** Intro to manual flight, physics of flights, careers, safety, flight planning, manual flight missions, data analysis.

**UMS 211:** Increase depth on UMS 111 topics; adds autonomous flight planning and operations, reporting, more sensor choice. Lab component for flight. Service learning projects.

**UMS 177:** Maintenance and repair of sUAS, mechanics of electric motors and batteries, 3-D printing components.
Small UAS Pathways in Virginia Community Colleges

**Thomas Nelson Community College – ‘Stackable’ Career Studies Certificates**
Small UAS Flight Technician (9 credit hrs) approved within IT and MET programs; (UMS 107, 111, and 177)
Small UAS Operations Technician (12 credit hrs) (UMS 211, ITE 119, GIS 200, GIS 201) (pending)

**Mountain Empire Community College**
Technical Studies AAS in sUAS Operations program (68 credit hrs)

**Virginia Highlands Community College**
Small UAS Career Studies Certificate (UMS 107, 111, and 177)
10 colleges offering UMS courses as of Fall 2019 catalog listings

Enrollment of 320 students in UMS courses (2017-18 and 2018-19)
  - Unduplicated headcount - 224 students

Enrollment by course (summer 2019)
  - UMS 107 – 160 students
  - UMS 111 – 120
  - UMS 177 – 20
  - UMS 211 – 16
  - UMS 290 – 4
# UMS Courses Offered by College (from online catalog)

<table>
<thead>
<tr>
<th>Community College</th>
<th>UMS 107</th>
<th>UMS 111</th>
<th>UMS 177</th>
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The First 3 Students to Complete sUAS Pathway in Virginia!

Pictured are students at Thomas Nelson Community College learning to repair and maintain drones in the UMS 177 (Small Unmanned Aircraft Systems (sUAS) Components and Maintenance) class. The UMS 177 class is one of three courses that lead to a Career Studies Certificate in sUAS Flight Operations Technician. Thomas Nelson is the first community college in the Commonwealth to have three students complete a pathway in sUAS.
Faculty Professional Development

Three Faculty UAS Institutes

Hosted by Virginia Tech/MAAP (2017 and 2018) and VCU Rice Rivers Center (2019)

- 30 faculty from 12 different colleges and four high schools

Topics: Part 107 prep, sUAS flight operations (manual and autonomous), flight planning, sensor selection, data capture formatting and storage, remote sensing data analysis, maintenance, campus UAS policies, and student service learning

35 educators obtained FAA Part 107 Remote Pilot Certificate
2018 Faculty Cohort at Kegley Farm During Institute
Video Basics

• Shooting into the sun
• Exposure
• Don’t shoot high up just b/c you can.
• Don’t move fast, unless you have the control it looks amateurish.
• Scout your location. And be mindful of the path of the sun.
• Shoot through the start and end of you shot.
Kentland Farm – MAAP at VA Tech
(22 May 2017)
Kentland Farm VA Tech (22 May 2017)
Vegetation Index
Kegley Dairy Farm
Pulaski, Virginia
(23 May 2018)
Kegley Dairy Farm
(23 May 2018)
Kegley Farm (23 May 2018)
Christmas Tree Farm
Montgomery County (23 May 2018)
Christmas Tree Farm
Montgomery County (23 May 2018)
Christmas Tree Farm
Montgomery County (23 May 2018)
VCU Rice Rivers Center Hosting 2019 UAS Faculty Institute

Putting the Environment First

*VCU and The Nature Conservancy celebrate completion of the VCU Rice Center Wetland and Stream Restoration Project*

By Sithya Achei Abraham
University Public Affairs, VCU Across the Spectrum (www.spectrum.vcu.edu)
vunews@vcu.edu

Wednesday, Sept. 28, 2011

After 85 years of being impounded, the Kimages Creek is once again a free-flowing stream, representing completion of a critical stage of a significant wetland and stream restoration along the lower James River in Charles City County.

Earlier today, Virginia Commonwealth University, together with The Nature Conservancy, state government officials, board members and supporters of the center, celebrated the efforts of the Wetland and Stream Restoration Project with a ribbon-cutting ceremony at the VCU Rice Center.

Six years ago, VCU and The Nature Conservancy partnered to remove a dam on Kimages Creek and
Plan Name
Copy of South P4 RGB Low Tide 5.21

Nearby items found, want to make them a project? Review Items

9:41  43  121  1
Minutes  Acres  Images  Battery

Flight Altitude
Resolution: 1.7 in / px
330ft

Enhanced 3D

Live Map HD
Generates an instant 2D map as the drone flies, in addition to normal image capture. High definition imagery will be used where available.
Student Service Learning Projects

Faculty-led Student Service Learning Projects in Partnership with The Nature Conservancy, NASA, US Forest Service, Virginia Tech and others

- Base Mapping/Land Monitoring and Change
- Phragmites (invasive species) Mapping
- Shoreline Monitoring
- Habitat mapping of Golden-winged Warbler and other species
- Inspections and 3D Models
- Sensitive Species Mapping
- Fire Effects Monitoring
- Media Products
On June 21, 2018 a small unmanned aircraft went whizzing over Virginia Tech Lane Stadium. Daniel Kuhr, a student at Blacksburg High School and member of the BHS Drone Club stood on the field, eyes fixed on the small craft as it zipped overhead, fingers twitching slight adjustments to its path on the remote controls.

Veronica Spradlin stood close by, monitoring the drone’s progress on a phone.
8 Missions
More than 2600 images

Lane Stadium, Blacksburg, VA (21 June 2018)
Lane Stadium, Blacksburg, VA (21 June 2018)
• Support TNC’s need to collect data and make decisions
• Aerial mapping of TNC properties on the Eastern Shore of Virginia
• Faculty Professional Development
• Statewide model for students in service learning
• Expand the Virginia model to a National model
TNC, Oyster Shoreline (9 May 2018)
TNC, Oyster Shoreline (9 May 2018), Near Infrared
November 17-18
Student Service Learning

Brownsville NIR

Brownsville NDVI

GeoTEd-UAS
Future Service Learning

- Gantry Inspection at NASA Langley
- Survey and mapping the CERTAIN UAS Range
4. UAS Outreach

- Introduction to drones and demos
- Teachers and students
- Various topics
  - Applications
  - Sensors
  - FAA Regulations
- Assembling a drone kit
- Learning to fly a drone
- Drone obstacle course competition
UAS Outreach...
Virginia Tech coordinating introductory-level workshops open to anyone!

1. **Mapping With Drones** (Hampton, Sept 10-12)

   - **What**: 3-day workshop. Mapping with Drones
   - **Who**: Natural resource professionals, planning professionals, public safety professionals, agricultural operators, educators, etc.
   - **Topic**: Mapping with Small Unmanned Aircraft Systems (sUAS)
   - **Online Registration**: [http://tinyurl.com/dronemapping](http://tinyurl.com/dronemapping)

2. **Remote Sensing with ArcGIS Pro** (Williamsburg, Aug 5-6)

   - **What**: 2-day workshop. Remote Sensing with ArcGIS Pro
   - **Who**: Natural resource professionals, planning professionals, public safety professionals, agricultural operators, educators, etc.
   - **Topic**: This is a comprehensive workshop that provides a 'start to finish' process with remote sensing using ArcGIS Pro. While we will utilize commercial data, the focus is on the software and techniques used in industry.
Community colleges teach students unmanned aircraft skills

In May 2018, the GeoTEd-UAS taught 18 faculty members...

The National Science Foundation-funded program GeoTEd-UAS, managed by the Virginia Space Consortium and partners, is training educators to teach community college students important skills for the growing unmanned aircraft systems market from laws and regulations to repairs and maintenance.

Credit: National Science Foundation

Who We Are and What We Do

- The mission of the National Science Foundation (NSF) is to promote the progress of science; to advance the national health, prosperity, and welfare; and to provide for the general welfare of the United States.

Research and Education Highlights

Training students for the growing unmanned aircraft systems market. Through the NSF-funded Geospatial Technician Education-Unmanned Aircraft Systems Faculty Institute, high school teachers and faculty members are learning how to plan and fly manual and autonomous unmanned aircraft system (UAS) missions. The week-long training enables the educators to establish coursework for Virginia’s community colleges. Thus far, the project helped five colleges in the Virginia Community College System to offer UAS courses for credit, and three additional colleges to offer non-credit courses. NSF’s Advanced Technological Education Program funds the UAS training activity, with the goal of promoting the education of technicians to meet STEM workforce demands through faculty professional development, curriculum development and pre-college activities at 2-year colleges. More than 200 students completed courses at one school, Mountain Empire Community College. The project seeks to meet the emerging demand for trained UAS technicians. In 2013, the Association for Unmanned Vehicle Systems International released a report that projected more than 100,000 new jobs in UAS by 2025.