



sUAS Education and Research at ODU

AUVSI Mid-Atlantic AAM Educator's Conference
May 24, 2023

Dr. Tom Allen
Old Dominion University



Outline



Research



Collaborative Projects



Curriculum & Development Underway

Notable Sponsors



Platforms

- Wingtra
- DJI
- AeroEnvironment
- senseFly
- Seafloor Systems
- FreeFly*
- Custom

Software

- Pix4D
- AgiSoft MetaShape
- OpenDroneMap (WebODM)
- Esri SiteScan
- Global Mapper
- ROCK Cloud*

Sensors

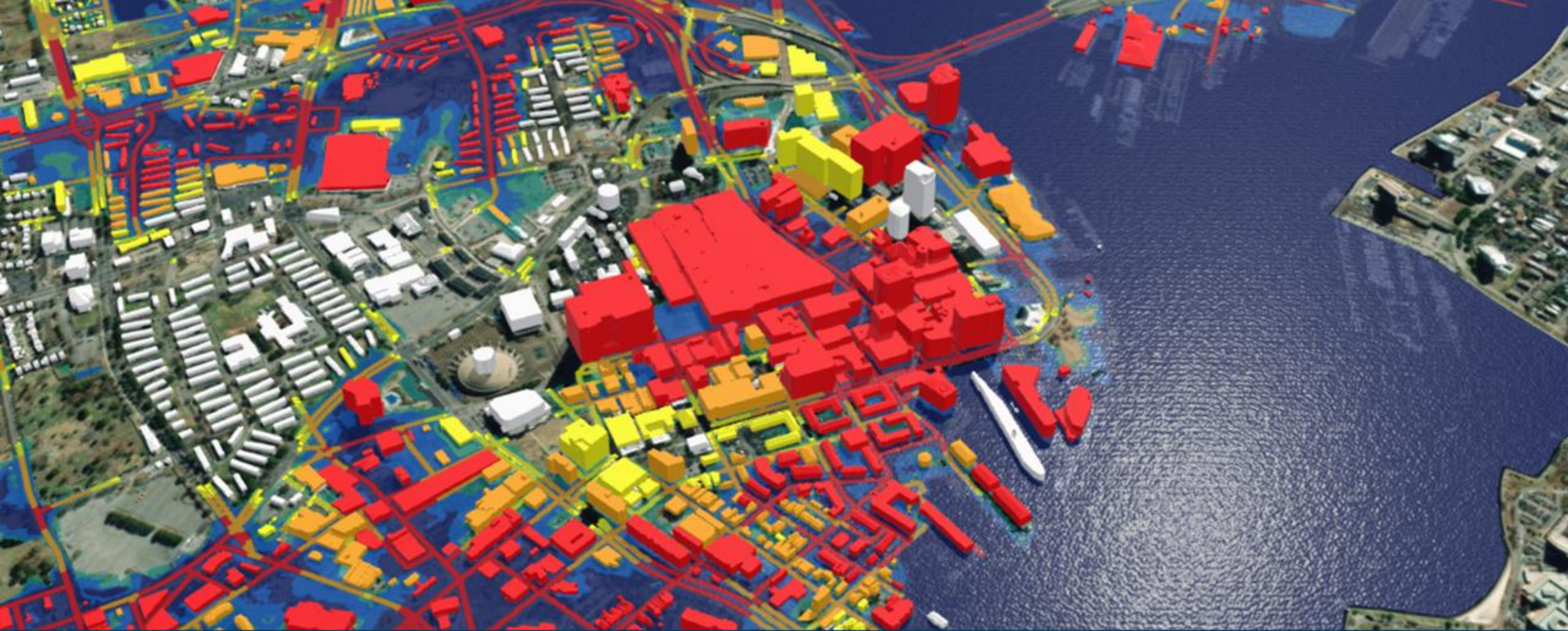
- MicaSense RedXP
- Blue Robotics Ping sounder
- Rock R360 Lidar*



UAVs have been a growing area of coastal research



Allow capture of flood extents as they occur,
useful for building archives and validating models



3-dimensional visualization for enhanced impact

Leveraging Esri's 3d basemap solution with custom
inundation data





Using UAVs and SfM for photorealistic 3D building models (Gmcleod@odu.edu)

Sea Level 2080 with Chrysler Museum in 3D





Blue Line Project

NINE TIDE
OCTOBER 29, 2022

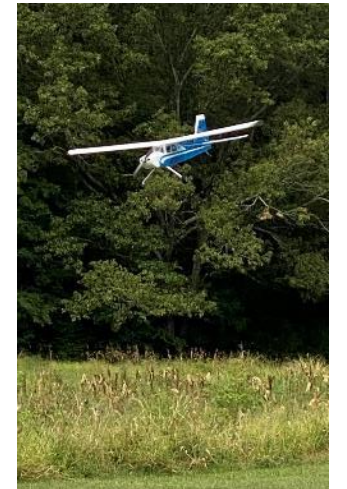
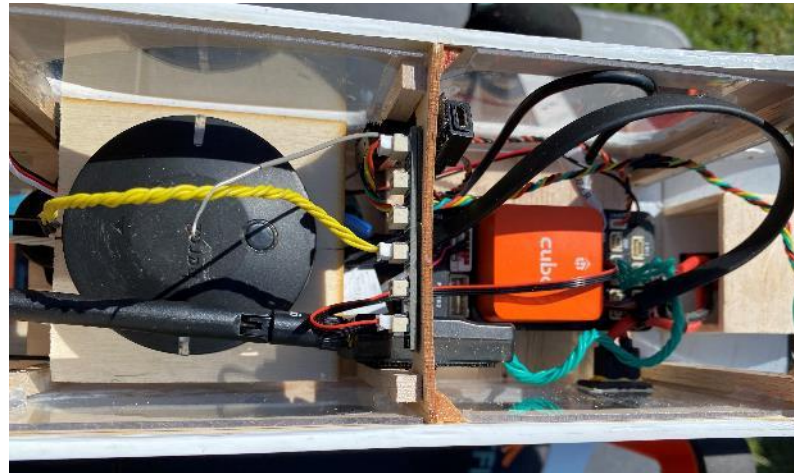
sUAS for Mech Engineering Capstone Education at ODU

- 2014-2019 ODU participated in the SAE aircraft aero design series
 - Significant experience gained with designing small RC fixed-wing aircraft
 - For many students it is was their first chance to design something new
 - Aerospace concentration students learn theory: aerodynamics, propulsion, flight mechanics
 - Starting in 2015, MAE developed a dedicated UAV Laboratory
 - Laser cutters, 3D printers, hot-wire foam cutters, woodworking machines
 - Soldering stations
 - And most importantly – room for students to brainstorm and build projects



sUAS for Mech Engineering Capstone Education at ODU

- Following the pandemic, it was decided to move in a new direction and leverage experiences with SAE Aero for practical drone design
- Funding from AeroVironment and a match from VISA was secured to develop an autonomous fixed wing drone for the capstone project
 - The first task was to successfully demonstrate automated takeoff, navigation and landing using a COTS trainer aircraft with Ardupilot based autopilot
 - The new design would have to cruise at 30 m/s for a range of 20 Km



sUAS for Mech Engineering Capstone Education at ODU

- Students designed and built a catapult launcher and molded composite electric powered flying wing
- Molds were cut from insulation foam and the upper and lower skins vacuum bagged in a wet layup



sUAS for Mech Engineering Capstone Education at ODU

- Two prototypes were built – one from fiberglass and one from carbon fiber
- The wing first flew May 15, 2023
- Further development is underway this summer
- Contact: Drew Landman, Dlandman@odu.edu



Senior Design Project: Autonomous Drones with Swarming Capabilities



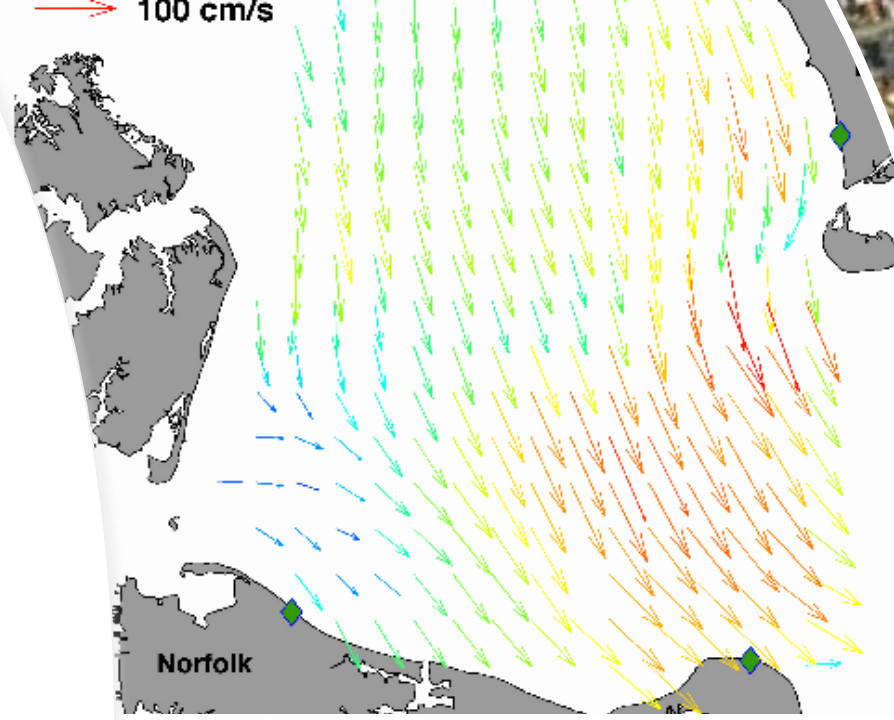
Advisors: Krishna Kaipa, Drew Landman, Thomas Alberts
Assisted by: Rob Stuart, ODU Drone Club
Sponsors: Aerovironment, BCET Project Committee Funds

Features:

- Two drones using Ardupilot, designed and built for swarming capabilities.
- Scanning Lidar and optical flow sensors
- The project is ongoing



Calibration of HF radar antennas using drones



Teresa Updyke

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CCPO

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Drones for Coastal Erosion

- ODU ICAR and Sea Grant RAFT assisted the Town of Colonial Beach
 - Multidate UAV, topobathy LiDAR, and ASV bathy survey
 - Shoreline change analysis
 - Volumetric change (onshore, offshore, & alongshore)



Hydrone Supports OES Marine Science Technology Course

- Small, modular ASV platform
- Teaching in Geography, Oceanography, Civil Engineering, Mechatronics, Control Systems, Data Science, and Computer Vision
- Planktoscope
- Flourimeter
- Water temperature
- Salinity
- CDOM



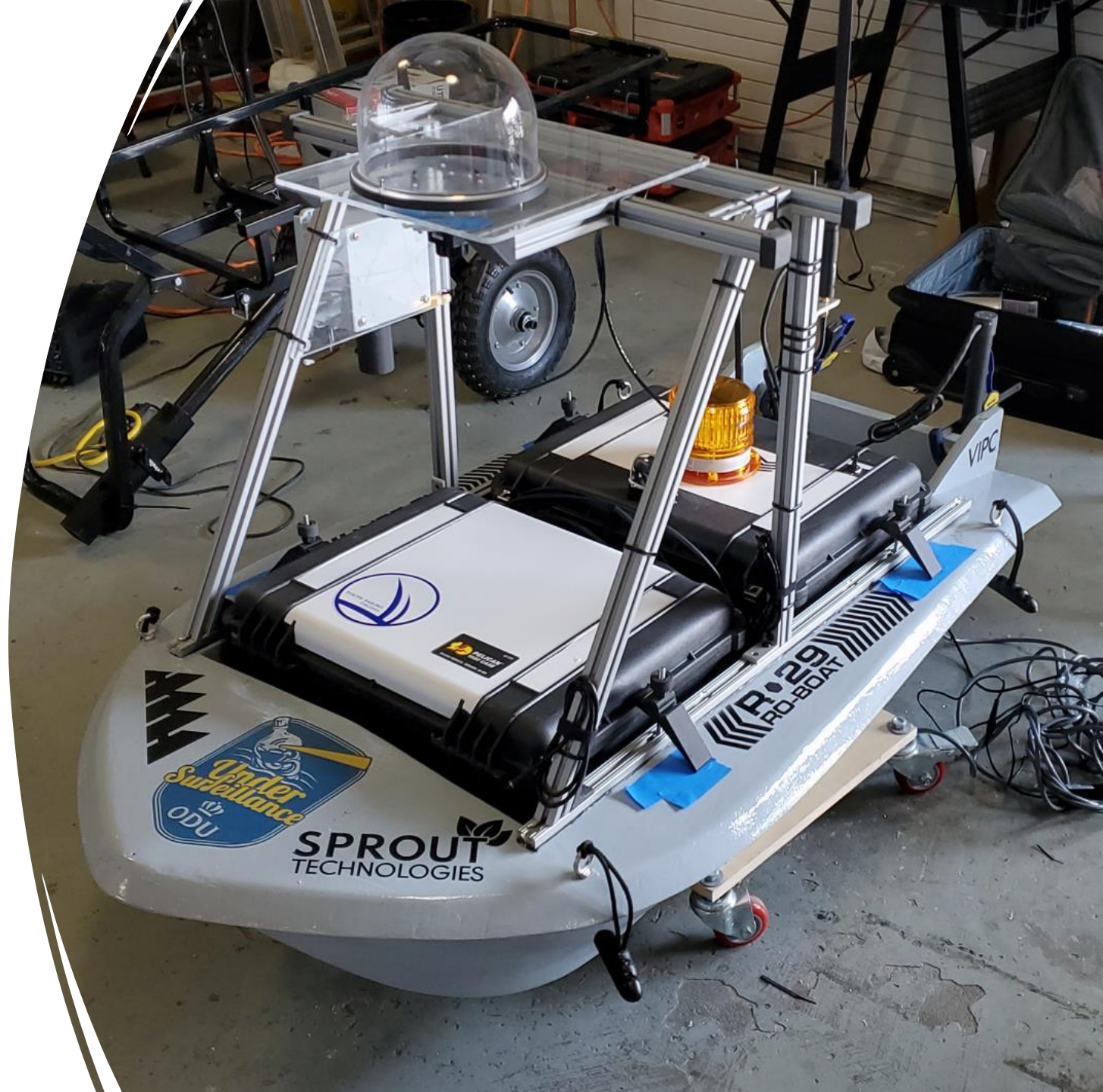
Hydrone Demo Day @ Hoffler Creek Preserve 2022

VMASC STEM-Education Program
Portsmouth Public Schools



VIPC Port Security Demo
5/22/23

Analytical Mechanics
Associates (AMA) and
ODU's Rob Stuart





Wave-Adaptive Modular Vessel (WAM-V)

Dr. Yiannis Papelis



Learning by Doing

- Burned out ECS
- Seized prop (salt?)
- Lost skeg
- Burned-out echosounder
- Peregrine falcon encounter:
Falcon: 1 vs ODU UAV: 0
- Faulty firmware updates
- Possible RF Interference

WILDLIFE & NATURE

Wildlife photos: Norfolk man gets peregrine falcon visitor on his balcony

By [Mary Reid Barrow](#)
PilotOnline.com • Apr 25, 2019 at 8:00 am





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Curriculum Developments Underway

- Certificate/s and Courses*
 - Autonomous Systems Design and Engr.
 - Part 107 short course
 - sUAS applications modules/courses/certificate
- Established student Drone Club
- NASA, NOAA, Sea Grant projects
- University centers (ICAR, VMASC, Maritime)
- VISA hosts ODU's AUVSI associate membership
- OCEANS 2023 Tutorial Workshop
- Master of Science GISci and Technology*

* In development

dronelabs*

GIS
GEOG
MAE UAV Lab
VMASC
OES



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Questions and Feedback Welcome!

Dr. Tom Allen

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Special Thanks:

Drs. Drew Landman, Ryley Harris, George McLeod, Rob Stuart, Dave Bowles and John Costulis (VISA), Teresa Updyke, Chris Davis, Blake Steiner, Yiannis Papelis, Dick Zimmerman, Wie Yusuf and the RAFT Team

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