



FIG WORKING WEEK 2023

28 May - 1 June 2023 Orlando Florida USA

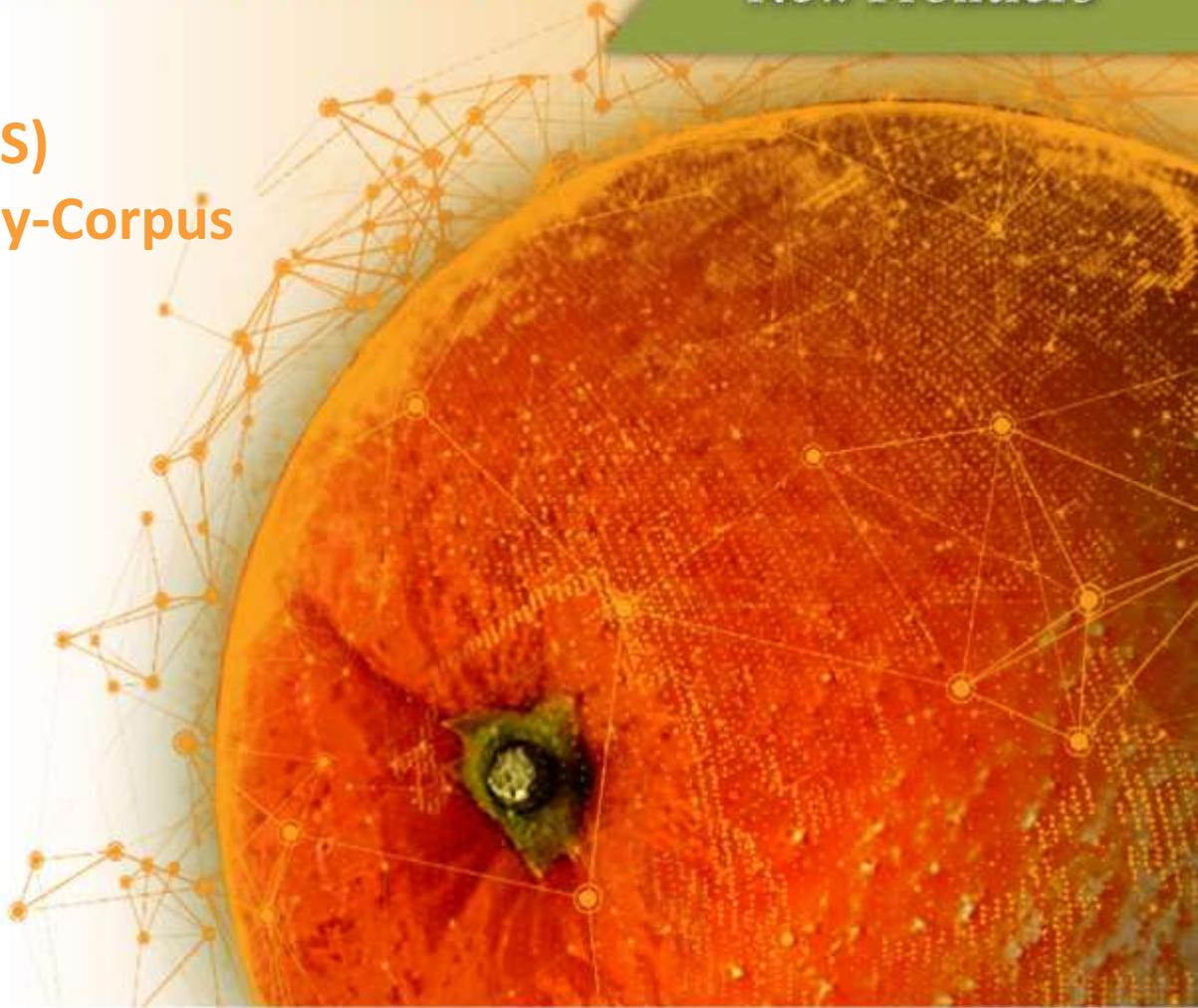
Protecting
Our World,
Conquering
New Frontiers

Presented at the FIG Working Week 2023,
28 May - 1 June 2023 in Orlando, Florida, USA

Overview of the Uncrewed Aircraft System (UAS) Campus Survey Project at Texas A&M University-Corpus Christi

Authors

Pratikshya Regmi, Dr. Michael J. Starek, Jacob Berryhill
Texas A & M University- Corpus Christi, Texas, USA



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Introduction

- Campus survey project is a collaborative effort funded by TAMUCC Operations and executed by MANTIS lab.
- This was started in 2014.
- The purpose of this initiative is to provide geospatial data support for monitoring and expediting campus improvements and maintenance.



Fig: Location map of Texas A & M University- Corpus Christi

Background

Ground surveys

- RTK GNSS and Total Stations (TS) for topo, establishing control, line work, etc.

UAS photogrammetric surveys

- 2D and 3D mapping products
- 2014 to Present: biannually and as needed

Surveys done by students and pilot in command

Equipment

eBee Sensefly

Started with



eBee RTK



WingtraOne



WingtraOne GENII

Now using



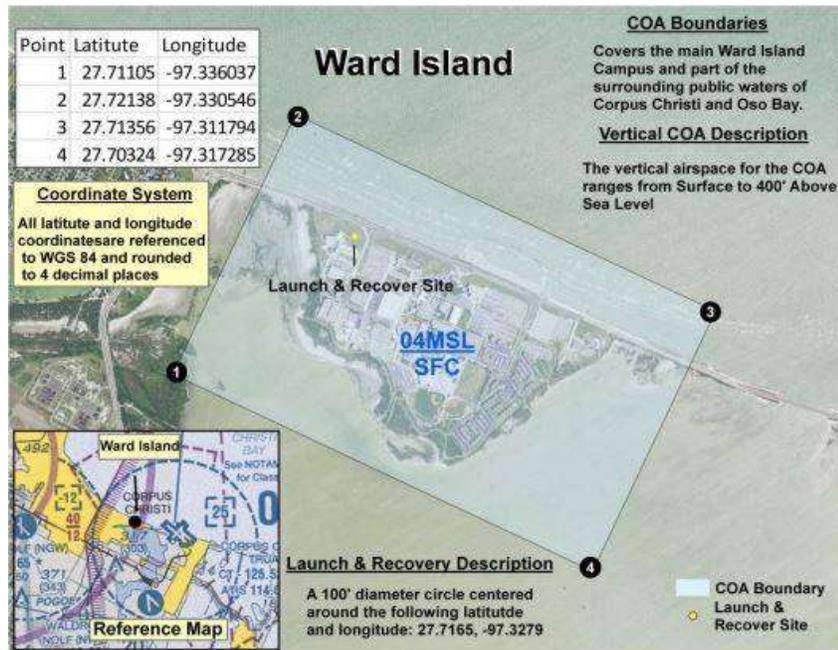
Transitioned from fixed-wing to VTOL platform

Transition from autonomous GNSS to direct georeferencing with PPK onboard

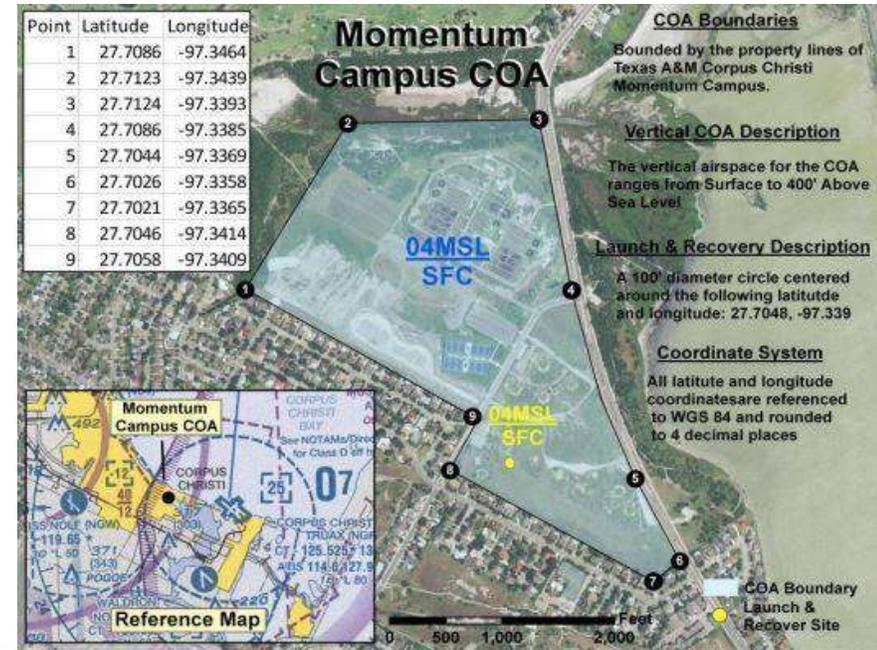


Authorization process for UAS

To legally operate the UAS, the university had to undergo a lengthy authorization process with the US Federal Aviation Authority (FAA) due to its proximity to the US Naval Air Station; the Certificate of Authorization (COA) was first procured in 2014 and recently renewed in 2022.



Left: Ward Island (Main Island Campus)



Right: Momentum (Small developing campus)

Ground Control Point Network

- TxDOT GNSS Real Time Network
 - Horizontal accuracy up to 2 cm
 - Vertical accuracy up to 4 cm
- Series of GCPs used to check and validate accuracy



Fig: Ground control survey (Left) and Ground control distribution map (Right).

Methodology

Flight Design and Data Collection *Sensefly Ebee*

- 60% sidelap and 75% endlap
- GSD: 3cm/pix
- Flight height: 107 meters (AGL)

WingtraOne GenII

- 80% sidelap and 75% endlap.
- GSD: 0.7cm/pix
- Flight height= 120 meters (AGL)

Note: All flights are conducted quarterly to biannually by remote pilot in command/UAS Pilot (Jacob Berryhill).

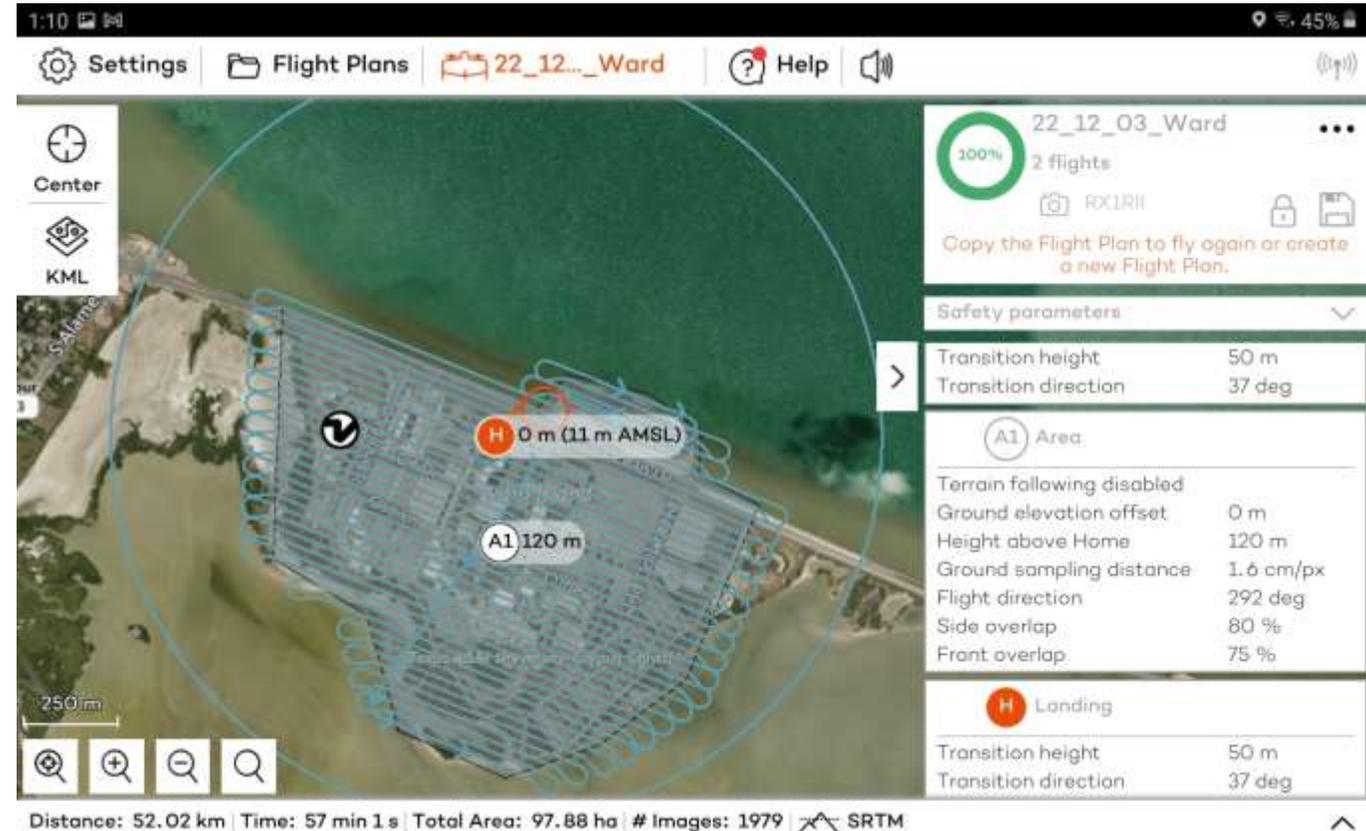


Fig: Flight plan in WingtraPilot software

UAS - SfM Post-Processing

- Generation of 3D point cloud, DSM, and orthomosaic.

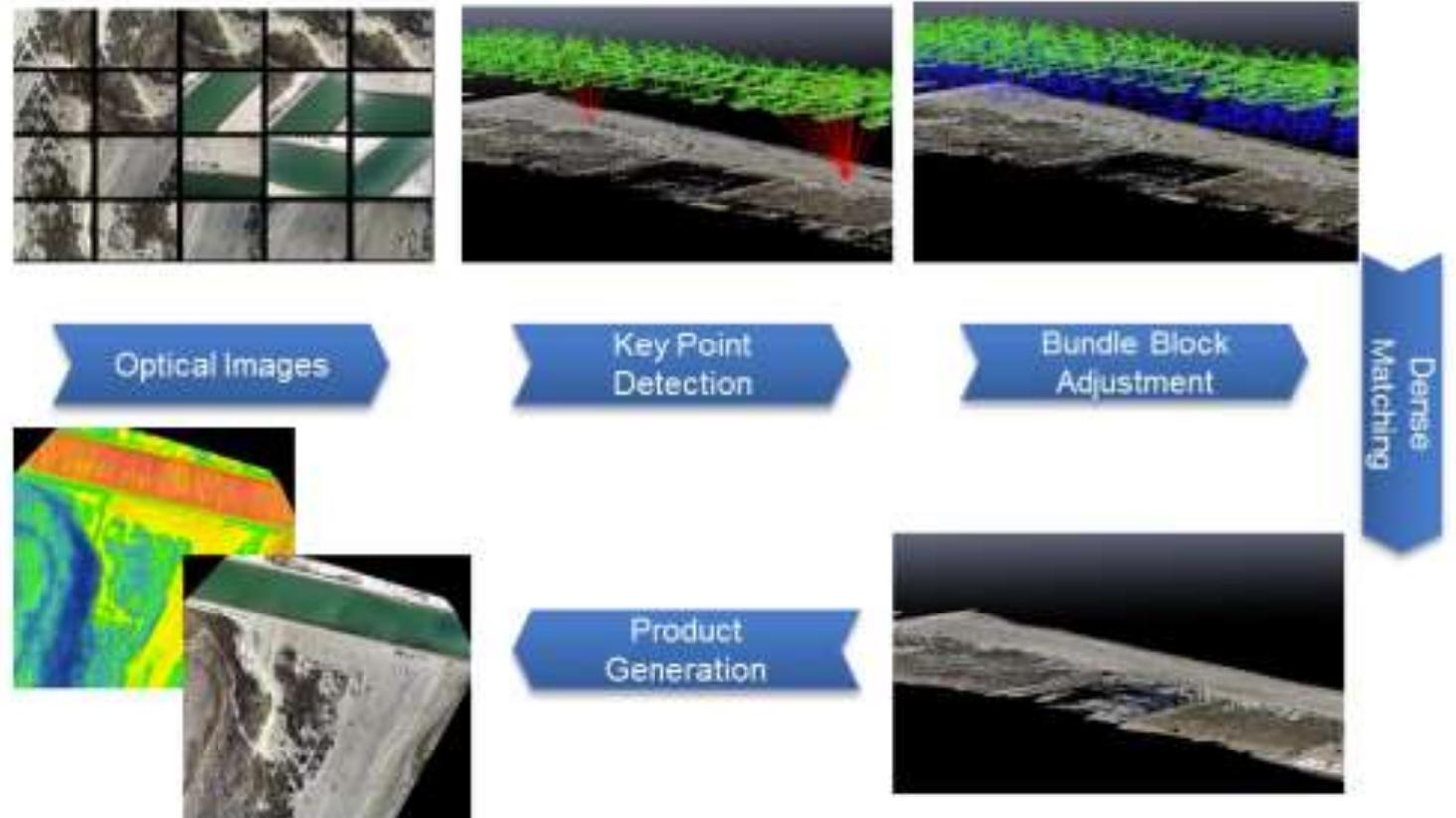
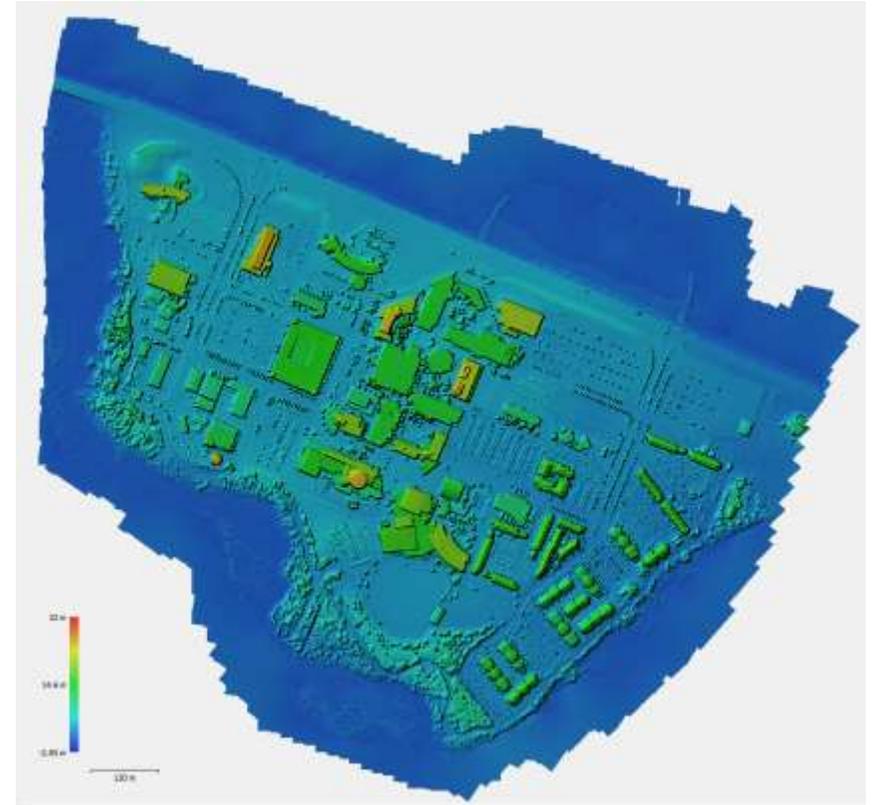


Fig: SfM Processing workflow [3].

Outputs



Fig: Colorized 3D point cloud.



Flight Date: December 03, 2022

Fig: DSM

Outputs



Fig: Orthomosaic.

Flight Date: December 03, 2022

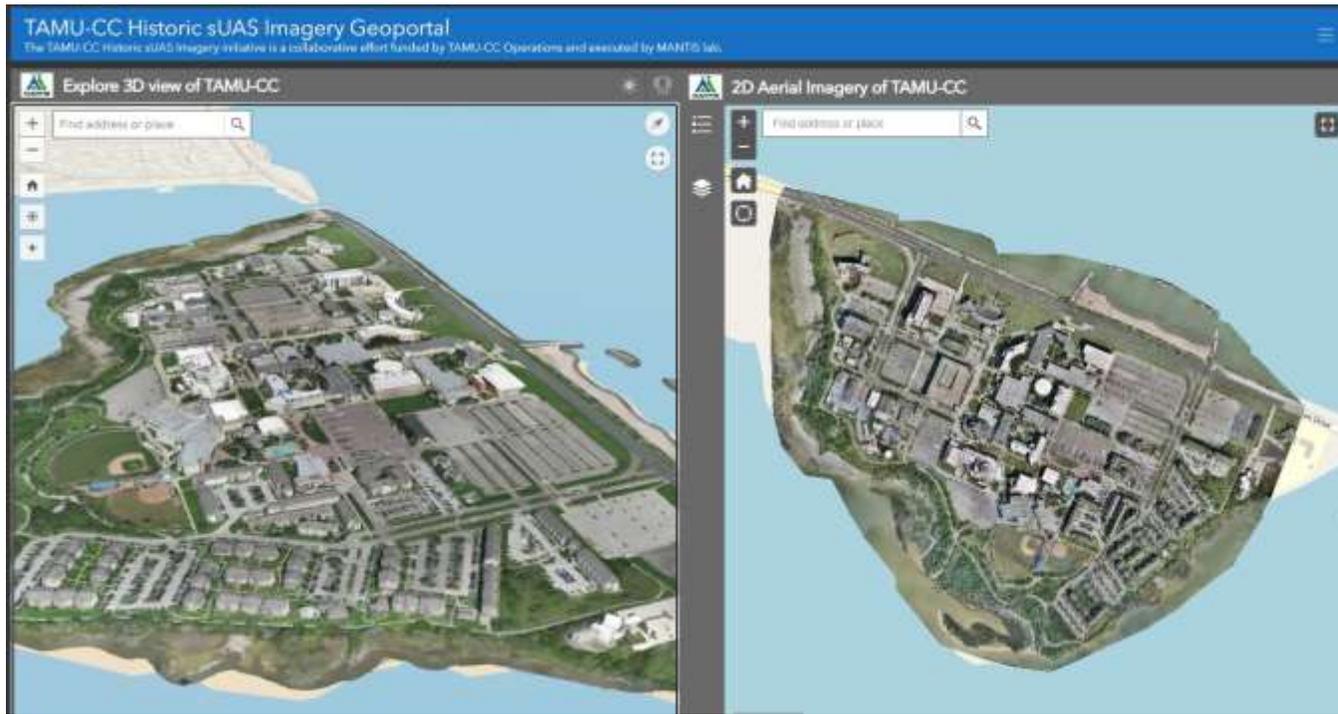
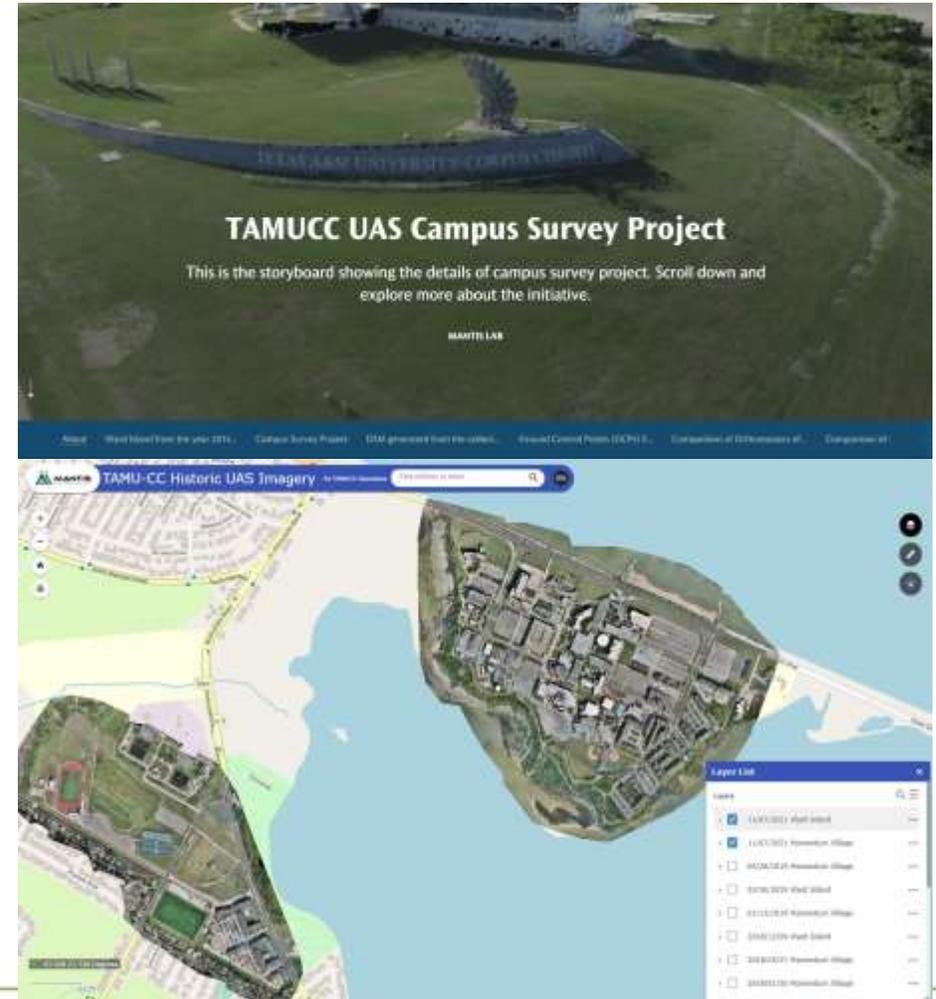


Fig: Point cloud flythrough.

Geoportal

To visualize the obtained data

- Campus Story map
- Dashboard for 2D and 3D tile layers
- Web mapping application for multitemporal tile layers



Applications

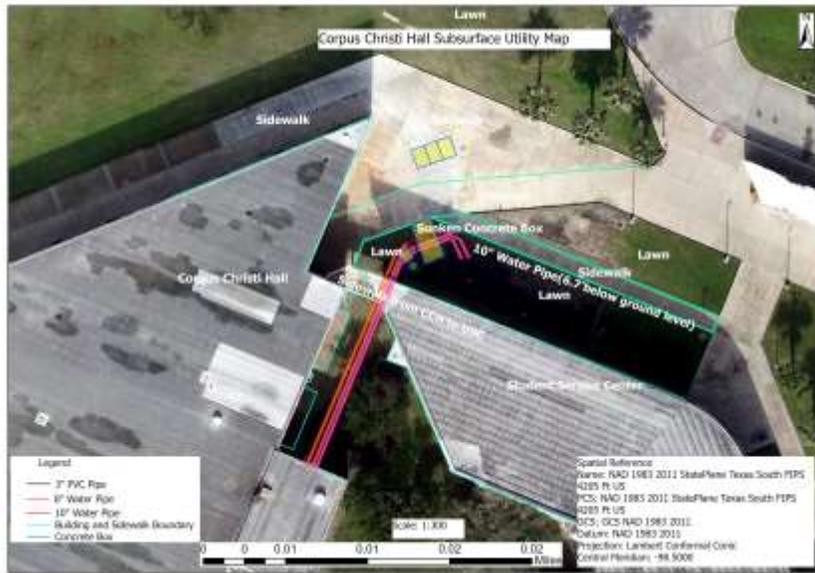


Fig: Subsurface utilities overlaid on UAS orthomosaic.



Fig: Image showing building change through time.



Fig: Using deep learning models to detect and count palm trees.

References

1. Davis, T., Starek, M.J., 2014. UAS Campus Survey Project. eBee, 2023. senseFly eBee X Fixed-Wing Drone - AerialMediaPros [WWW Document]. URL <https://www.aerialmediapros.com/sensefly-ebex-fixed-wing-drone.html>
2. Starek, M.J., Davis, T., Prouty, D., Berryhill, J., 2015. Small-scale UAS for geoinformatics applications on an island campus. 2014 Ubiquitous Position. Indoor Navig. Locat. Based Serv. UPINLBS 2014 - Conf. Proc. 120–127. <https://doi.org/10.1109/UPINLBS.2014.7033718>
3. Starek, M. J., Gingras, M., & Jeffress, G. (2019). Application of Unmanned Aircraft Systems for Coastal Mapping and Resiliency. In A. Rajabifard (Ed.). CRC Press. Retrieved from <https://library.oapen.org/handle/20.500.12657/24929>
4. Wingtra.com, 2022. Technical specifications WingtraOne. Wingtra, 2023. WingtraOne - Mapping drone for high-accuracy aerial surveys | Wingtra [WWW Document]. URL <https://wingtra.com/mapping-drone-wingtraone/technicalspecifications/>

Thank you !!!

Contact Info:

Pratikshya Regmi

pregmi@islander.tamucc.edu



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