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THE UNIVERSITY OF GUAM DRONE CORPS PROGRAM: PAVING THE WAY FOR THE FUTURE OF AN ISLAND COMMUNITY'S DRONE INDUSTRY

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The University of Guam (UOG) Drone Corps program aims to meet the growing demand for trained and licensed drone pilots in Guam's heavily regulated airspace. Drones have become essential tools for researchers, addressing projects such as surveying coral reefs and monitoring water supply. The program, launched in April 2021, is a collaborative effort between NASA Guam Space Grant (NGSG) and NASA Guam Established Program to Stimulate Competitive Research (EPSCoR). The Drone Corps aims to build technical capacity by producing informed, responsible, and FAA-licensed drone pilots. The program provides members with FAA Part 107b examination preparatory knowledge courses,

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hands-on flying experience, and stipends. After certification, students fulfill 40 hours of flight time through missions assisting UOG researchers, local government agencies, and nonprofit organizations.

The program's inaugural cohort faced challenges during the COVID-19 pandemic but adapted to provide a structured curriculum and partnered with local UAS companies for resources. By training and certifying drone pilots, the UOG Drone Corps program contributes to the development of Guam's drone industry, prepares students for future careers, strengthens relationships between UOG and local agencies, and promotes responsible drone use and education.

I. INTRODUCTION

On the island of Guam, an unincorporated territory of the United States located in the western Pacific, unmanned aircraft systems (UAS) or unmanned aerial vehicles (UAV) have been critical tools for local researchers in surveying, mapping, gathering data, and visualizing areas of the island that would otherwise be too difficult to reach on land. For many of these projects, researchers use drone technology to address the island's unique challenges and environments from new heights, with past and upcoming projects focused on mapping offshore coral reefs,[5] repairing eroded lands,[6] and surveying the local aquifer's water supply.[7] In recent years, the use of drones has begun to expand outside of the academic sector, extending to recreational areas such as cinematography, photography, and entertainment displays. During the island's 77th Liberation Day, for instance, the local community celebrated the landmark event with the island's first-ever public light

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[5] Andrew Silver, *Drone Takes to the Skies to Image Offshore Reefs*, 570 NATURE 545 (2019). https://www.researchgate.net/publication/334005906_Drone_takes_to_the_skies_to_image_offshore_reefs.

[6] *UOG Repairing Hard to Reach Eroded Lands with Drones*, KUAM NEWS (May 22, 2021), https://www.kuam.com/story/43939297/uog-repairing-hard-to-reach-eroded-lands-with-drones.

[7] *UOG Awarded $715K for Research on Aquifer and Coral Reef Health*, UNIV. OF GUAM, (September 19, 2021), https://www.uog.edu/news-announcements/2021-2022/2021-715k-awarded-for-uog-research-into-aquifer-and-coral-reef-health.php.

drone show.[8] As the need for this service continues to grow in both academic and recreational capacities, so too will the number of certified drone flyers.

Due to the island's status as a territory, much of Guam's drone regulations and restrictions comes from the United States via the Federal Aviation Administration (FAA) and the Department of Defense (DOD) rather than a local governing body (see Appendix A). The FAA requires drone registration for both recreational and commercial uses. In some cases, access to certain airspace requires proof of a registered drone. This accountability measure was established to help prevent flight accidents, privacy violations, and criminal activity in secured areas.

On a local level, there are currently no Guam-issued laws that detail specific restrictions on the use and conduct of drones. Recreational users are not required to obtain any local permit to fly their personal devices. Commercial users must have a permit for their drone equipment as it is part of their services or products.[9] Most recently, Public Law 35-118, which was signed into law on December 11, 2020, helped establish an opportunity for a commercial drone industry to develop on the island.[10] The passing of this law indicates that the industry is still in its developmental stages with opportunity for future growth. Drone flight restrictions from the A.B. Won Pat International Airport and two of the island's military bases, Andersen Air Force Base (AAFB) and Naval Base Guam (NBG), as well as their adjacent federal properties, account for a majority of Guam's airspace.[11] In August 2021, when the U.S. Attorney's Offices for the Districts of Guam and the Northern Mariana Islands hosted a virtual discussion with FAA agents on drone usage, FAA Special Agent Michael Bumberger

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[8] Steve Limtiaco, *Liberation Drone Light Show a First for Guam*, PAC. DAILY NEWS, (Jul. 20, 2021), https://www.guampdn.com/news/liberation-drone-light-show-a-first-for-guam/article_5e0d170c-e8f0-11eb-8e03-bf5fc3ec25b1.html.

[9] *Guam Drone Laws*, UAV SYS. INT'L, https://uavsystemsinternational.com/pages/guam-drone-laws#:~:text=A%20permit%20is%20required%20for,contact%20the%20local%20aviation%20authority (last accessed July 7, 2023).

[10] Act of Dec. 11, 2020, Pub. L. No. 35-118, 35th Guam Leg., Bill Status (2020), https://www.guamlegislature.com/Public_Laws_35th/P.L.%20No.%2035-118.pdf.

[11] *Visualize It: See FAA UAS Data on a Map,* FED. AVIATION ADMIN., https://www.arcgis.com/apps/webappviewer/index.html?id=9c2e4406710048e19806ebf6a06754ad.

stated that more than two-thirds of the island's airspace is either restricted or requires approval before flight.[12] He also noted that many UAS operators are not aware that they need to register their drones prior to flying.[13] The FAA has recorded 869,472 registered drones as of June 13, 2023, with more than half of them being used for recreational purposes.[14] The flight agency has conferred 331,573 Remote Pilot Certificates as of that date.[15]

A heavily regulated airspace presents a unique challenge for Guam's drone community, and further presses the need for trained, licensed drone pilots who are knowledgeable about these federal regulations. To address this demand, the University of Guam (UOG) developed and launched the Drone Corps program.

II. ABOUT THE PROGRAM

A. Program Description & Goals

Fig. 1.1. UOG Drone Corps 2021 cohort students – (left to right) Thor H., Queensly D., Ulysses S., Maria Seanna M., Tristan Q., Brian S., Ferenczi C., and Sean G. – visit the

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[12] Nick Delgado, *FAA, Military Speak to Legal Use of Drones*, GUAM DAILY POST, (Aug. 16, 2021), https://www.postguam.com/news/local/faa-military-speak-to-legal-use-of-drones/article_309c296a-fa76-11eb-82eb-9b4c0ecab6c3.html.

[13] *Id.*

[14] *FAA by the Numbers*, FED. AVIATION ADMIN., https://www.faa.gov/node/26 (last visited Aug. 22, 2023).

[15] *Id.*

hangar facility near Tech Center Guam during a Part 107b Preparatory Knowledge Course session. (Photo Courtesy: Maria Seanna M.)

The expected increase of drone technology usage in Guam in both educational and commercial sectors led to the launch of the UOG Drone Corps Program in April 2021. The program is a collaborative effort between NASA Guam Space Grant (NGSG) and NASA Guam Established Program to Stimulate Competitive Research (EPSCoR) to build technical capacity by creating a cadre of informed, responsible, and FAA-licensed pilots to meet current and future demands for the rising industry. Drone Corps is the university's first drone certification and training program for undergraduate and graduate students. In addition to teaching members the regulations and safety protocols of proper flying operations through the FAA Part 107b examination preparatory knowledge course, the program also provides members with stipends and hands-on experience by flying UAVs through Guam's skies both virtually and physically. Drone Corps aims to preemptively avoid drone accidents, minimize potential conflicts, and increase education and awareness of drone technology through responsible use.

After students are recruited, certified, and trained, they must fulfill 40 hours of flight time through missions, providing aid to: UOG researchers with projects that may be augmented with drone-acquired imagery; local government agencies monitoring restoration sites or conducting site inspections; or nonprofit organizations for other uses. These highly sought-after skills will not only enable student pilots to give these agencies valuable contributions in a variety of applications but will also strengthen relationships between UOG and the local agencies. Through various internship opportunities funded by NASA Guam Space Grant, UOG Drone Corps also prepares its members to enter the work force and incorporate drone technology in various sectors of the economy, including areas such as remote sensing, construction, delivery services, environmental mapping, infrastructure inspection, and emergency services.

B. Capacity & Resources

Fig. 1.2. UOG Drone Corps 2022 Cohort students – (left to right) Jin Hee C., Francisco C., and Javier G. – prepare for a flight mission at Gov. Joseph Flores Memorial Park in Tumon.

The UOG Drone Corps program has administered two cohorts so far. Its inaugural cohort was in 2021 and its second cohort was in 2022. The first year of the program met several challenges, leading to some important lessons to keep in mind for future cohorts and funding cycles. Guam's COVID-19 public health guidance and UOG's corresponding protocols required minimum face-to-face instruction, social distancing of six feet, and limited gathering sizes. In addition to the adjustments for a course being conducted during the COVID-19 pandemic, these restrictions made providing direct instruction to a drone pilot particularly challenging. The easing of the pandemic-related restrictions during the 2022 cohort allowed for a more structured program, such as a practicum portion to allow for more hands-on flight time. Furthermore, UOG currently does not have a flight simulator, which is prohibitively expensive to purchase, or enough entry-level drones for each participant. Partnering with two trusted local UAS companies that have these resources, Aviation Concepts LLC

(DBA Tech Center Guam) for its first cohort and Bella Wings Aviation for its second cohort, helped overcome these barriers.

Through funding from NASA Guam Space Grant and NASA Guam EPSCoR, the Drone Corps program accommodated up to 30 students for its first year and 14 students for its second year, including stipends and learning materials. As many as ten entry-level drones were readily available for students to practice with. The program commenced in the spring semester of 2021 and continued through the spring semester of 2022. A third cohort began in the summer semester of 2023.

Fig. 1.3. UOG Drone Corps 2022 cohort students pose for a group photo alongside Bella Wings Aviation instructors during their first day of the Part 107b knowledge course.

The program's workflow is flexible and accommodates students to progress at their own pace. For the 2021 cohort, students participated in the knowledge course in one of three ways: checking into a live stream, watching a recording of the live stream, or attending the class in-person while complying with COVID-19 safety protocols. Students in the 2022 cohort attended an in-person course. Students had access to flight simulator training and access after the knowledge course, for which they had to schedule appointments online. For the 2021 cohort, Tech Center Guam President Art Dawley helped prepare the students for the

FAA examination over a three-week period. Dawley was the sole instructor and had some technical assistance from staff from Tech Center Guam, NASA Guam Space Grant, and NASA Guam EPSCoR. For the 2022 cohort, the course with Bella Wings Aviation was divided into two portions: a ground school session that focused on rules and regulations, and a practicum session that provided hands-on opportunities to operate drones.

> ...[T]here was a high level of enthusiasm for understanding government regulations for commercial drone operations given the fact that a greater level of confidence about operating a drone in complex airspace, as well as a greater understanding of how drones can be affected by weather, operational limitations, aerodynamic effects, and various flight configurations, can contribute to a successful outcome of each flight operation. Our initial knowledge test preparation course for the FAA Part 107b Remote Pilot license that we conducted for UOG Drone Corps was very well attended and … those students that I am aware of that took the test scored very highly. Each now possesses an FAA Remote Pilot license that allows them to legally conduct commercial flights in the National Airspace System and pursue further career opportunities.
>
> —Art Dawley

Further instructional time, especially in the mentorship and practical application of drone flight, depends on the student's aptitude and the partner agency with whom the student will perform missions and obtain the requisite 40-hour drone flight experience.

The administrative side primarily consisted of four members: the Associate Director (Dr. Romina King) and Communications Coordinator (Keanno Fausto) of NGSG; and the Executive Director (Dr. Leslie Aquino) and Communications Coordinator (John I. Borja) of NASA Guam EPSCoR.

C. NASA Guam EPSCoR

While NASA is widely known for its research and achievements related to outer space, the national agency also studies Earth and ocean sciences in an effort to better understand the planet's natural systems and the human-induced impacts that affect the global environment.

EPSCoR creates partnerships with local governments, institutes of higher education, and industries that are designed to affect lasting improvements in a state or region's infrastructure, research, and development capacity. NASA EPSCoR supports the NASA Earth and Ocean Science Mission at a local level, with research addressing critical challenges such as coral reef conservation, terrestrial land change, water security, and biodiversity in the Pacific Islands. The NASA EPSCoR program focuses on jurisdictions that have not participated equitably in competitive aerospace and aerospace-related research activities.

NASA Guam EPSCoR's mission is to increase Guam's research capacity and competitiveness in areas relevant to NASA missions and to the Marianas region. The program's objectives are to conduct research that is both relevant to the region and aligned with NASA mission directorates: promote education and workforce development with a focus on geographic information systems and remote sensing applications, promote research and capacity building efforts by UOG faculty through seed grant funding, and foster collaboration between Guam and NASA researchers. NASA Guam EPSCoR is housed within the University of Guam and is currently led by Executive Director Dr. Leslie Camacho Aquino.

> Drone Corps will be a fantastic supplement to the NASA Guam EPSCoR Program. We see Drone Corps as directly building research capacity at UOG by allowing researchers to incorporate drone-acquired imagery into their projects, when they might not have done so otherwise due to lack of expertise or an experienced drone operator.
>
> —Dr. Leslie Camacho Aquino

D. NASA Guam Space Grant

The UOG Drone Corps program is partially funded by NGSG, an affiliate of the University of Hawai'i Space Grant Consortium (HSGC). In 2019, NASA allocated funds to specifically benefit the United States territories as part of the National Space Grant College and Fellowship Program. UOG was awarded the full amount of $750,000, at $150,000 per year, via a subaward from HSGC in

April 2020.[16] It is through this subaward that NGSG financially supports the UOG Drone Corps project's various components, including the costs of the knowledge course and the three monetary stipends that serve as incentives for members as they complete their flight hours.

Through UOG Drone Corps, NGSG aims to support its goal of training future generations of professionals in STEM fields concerned with the understanding, utilization, exploration, and investigation of both Earth and space – including the local island environments of Guam and Micronesia. Among its primary programs, NGSG manages the NGSG University Research Internship and Fellowship, which awards undergraduate and graduate students at UOG with Space Grant funding to allow them to pursue research projects relevant to NASA's goals.[17] One particular internship, the NASA Guam Space Grant Professional Internship program, pairs students with industry mentors from local agencies and companies to gain workplace experience. UOG Drone Corps is aligned with NASA Guam Space Grant's role in spearheading interdisciplinary careers in STEM, inspiring students to pursue careers in fields that will continue to heavily rely on the incorporation of drone technology as the respective industries advance into the future.

III. PROGRAM TIMELINE

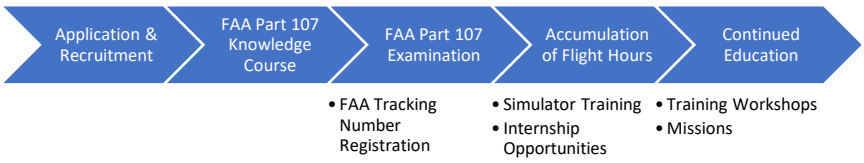

Fig. 2.1 Workflow timeline of the UOG Drone Corps program.

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[16] *NASA Guam Space Grant Program*, UNIV. OF GUAM, https://www.uog.edu/nasa-guam-space-grant/information.php (last visited June 23, 2023).

[17] *Undergraduate Students: Become a NASA Guam Space Grant Intern!*, UNIV. OF GUAM, (Oct. 19, 2021), https://www.uog.edu/news-announcements/2021-2022/2021-undergraduate-students-become-a-nasa-guam-space-grant-intern.php.

The UOG Drone Corps program was designed to be completed within one full academic year, granting students a flexible period in which they can meet the demands of the program while maintaining their schoolwork and other extracurricular activities. Students can opt to remain in the program past their initial year to serve as mentors to new cohorts, continue to fly, and organize future missions. Beyond the application process, the program spans three primary sections: the completion of the FAA Part 107b examination knowledge course, the FAA Part 107b certification, and the accumulation of flight hours. The program is augmented by workshops that are specific to equipment that would be used. For example, Drones Optics, a local private firm, organized a workshop entitled "Best practices for the maintenance and operation of the Phantom Pro 4, RTK," allowing students to learn about the device and its payload. At the end of each milestone, a student is entitled to receive three monetary stipends. The stipends totaled $675 for the first cohort and $2000 for the second cohort.

A. Applications & Eligibility

The UOG Drone Corps program was officially announced in April 2021 through various communication outlets, including the university website,[18] internal newsletters, mass emails, local newspaper publications,[19] social media channels, and news broadcasts. To be eligible, an applicant was required to be a U.S. citizen, a UOG student, and at least eighteen years of age. The eligibility criteria were expanded for the 2022 cohort to include students attending Guam Community College. Applicants were also required to be in good academic standing, maintaining a cumulative grade point average of 2.5 or higher. No prior experience with drone flying or operational knowledge was required. Among 38 applicants, 27 students were formally accepted into the program's inaugural cohort. The program's second cohort accepted 14 students.

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[18] *UOG Launches Drone Corps Program*, UNIV. OF GUAM, (Apr. 15, 2021), https://www.uog.edu/news-announcements/2020-2021/uog-launches-drone-corps-program.php.

[19] *UOG Offers Drone Training Program*, GUAM DAILY POST, (Apr. 16, 2021), https://www.postguam.com/business/local/uog-offers-drone-training-program/article_5622513a-9d9e-11eb-9830-9b2b2e03ab93.html.

B. Knowledge Course

Fig. 2.2 UOG Drone Corps students Jeremy D. and Alexis E. hold their study materials during the Part 107b Preparatory Knowledge Course.

Upon acceptance into the UOG Drone Corps program, students participated in a three-week knowledge course that focused on preparing them to pass the FAA Part 107b Remote Pilot written examination.[20] To provide training and resources, UOG Drone Corps built partnerships with two privately-owned drone companies. The first cohort's knowledge course was administered by Tech Center Guam while the second cohort's course was instructed by Bella Wings Aviation. Both organizations are local privately-owned UAS training facilities that offer instructor-led teaching, practice test guides and a virtual flight simulator.[21] The course centered around the ASA Remote Pilot Test Guide, with the curriculum itself spanning various drone-related topics, including regulations, weather systems, loading, performance, and operations. Topics on drone flight regulations included acceptable flight

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[20] *Students Takes the First Steps to Become Certified Drone Pilots*, UNIV. OF GUAM, (Aug. 6, 2021), https://www.uog.edu/news-announcements/2020-2021/2021-Students-take-first-steps-to-become.php.

[21] *UAS Organizational Training*, TECH CENTER GUAM, https://www.techcenterguam.com/ (last visited Aug. 22, 2023).

times and locations, qualifications for drone operators, and local airspace boundaries.

The first cohort's knowledge course was held onsite at Tech Center Guam's classroom and hangar facility located at the A.B. Won Pat International Airport. To accommodate those who were unable to attend physically, members were given the option to either attend online via Zoom or view the recorded sessions during a more convenient time. Some students chose to attend the classes through a hybrid model, which consisted of onsite and live stream attendance. Due to the easing of COVID-19 related restrictions in 2022, the second cohort's knowledge course was only held onsite at Bella Wings Aviation's facility located at Tumon Sands Plaza. Students from this cohort were also able to participate in a practicum portion that gave them hands-on time with drones to practice basic maneuvers and operations. Members who completed the knowledge course could claim their first monetary stipend, worth $175 for the 2021 cohort and $500 for the 2022 cohort. Most students used this stipend to pay for the cost of the FAA examination.

C. FAA Part 107b Examination

Fig. 2.3 UOG Drone Corps members Jonelle S., Maria Seanna M., and Ulysses S. hold up their Part 107 licenses during a Drone Flight Safety PSA video.

At the end of the three-week preparatory course, students registered for their FAA tracking number (FTN), a career-long

identification code needed prior to taking the remote pilot examination. The registration process was completed via the Integrated Airman Certification and Rating Application (IACRA), a web-based rating program that guides applicants through the certification process and ensures that they meet regulatory and policy requirements.[22] Once students had their FTN codes registered, they had a flexible period during which they could schedule their FAA Part 107b written test. Examinations were proctored and held at Trend Vector Aviation, an aviation and certification facility in Guam.[23] As of November 2022, twenty-four total UOG Drone Corps members from both cohorts successfully passed their FAA Part 107b exam and received their Part 107b licenses. This remote pilot certification is valid for two years. Students must score 70% at minimum to pass the Part 107b examination.[24] Members who received their certification were able to claim their second monetary stipend, worth $200 for the 2021 cohort and $500 for the 2022 cohort.

D. Flight Hours

As part of the UOG Drone Corps program, both certified and non-certified members had access to opportunities in order to accumulate the required target goal of 40 flight hours. The three primary ways for UOG Drone Corps members to gain flight hours are through simulator training, internships, and missions.[25] Flight hours are recorded in a flight logbook (see Appendix B), which is based on the Standard UAS Log and has been updated to comply with the new sUAS regulation 14 CFR Part 107b as stipulated by remote pilot certificate requirements.

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[22] *Integrated Airman Certification and Rating Application (IACRA)*, FED. AVIATION ADMIN., https://iacra.faa.gov/IACRA/Default.aspx (last visited June 23, 2023).

[23] *About TVA*, TREND VECTOR AVIATION INT'L, http://www.trendvector.com/tvaie/office_e.htm (last visited June 23, 2023).

[24] *What Drone Pilots Need to Know About the Part 107 Exam*, DRONESENSE: DRONESENSE BLOG (Aug. 11, 2016), https://blog.dronesense.com/what-drone-pilots-need-to-know-about-the-part-107-exam.

[25] NASA Guam Space Grant financed additional hours of flight simulator time so students could practice based on their availability.

Fig. 2.4. Tech Center Guam President and Instructor Art Dawley guides UOG Drone Corps students, Thor H., Ulysses S., and Queensly D., through a drone simulator training.

The simulator training offered members who had not yet received their remote pilot certification the chance to practice enterprise flight scenarios and sharpen their skills in a virtual environment. Each practice session, which used either the DJI Enterprise Simulator or the NIST Simulator, focused on granting students the ability to learn basic and advanced flight maneuvers using camera and video systems.

For members who received their certification, the program offered internships and mission opportunities that required the physical operation of drones. Through the NASA Guam Space Grant Professional Internship program, for example, Drone Corps students were paired with industry mentors from private drone companies to offer their remote pilot skills. These hands-on opportunities allowed students to gain flying experience and specialized skills by assisting select local agencies, including the university's own research units, in capturing drone footage and data for their research projects. One opportunity offered to members was an internship with Tech Center Guam, where interns not only practiced operating drones, but also developed drone-training curricu-

lums for agencies, such as the Guam Fire Department.[26] Other mission opportunities offered to students included a partnership with the Guam Department of Agriculture, where students would operate their drones to survey erosion-prone areas and identify ideal spaces for reforestation. Upon completion of their 40 flight hours, members were able to claim their final monetary stipend, worth $300 for the 2021 cohort and $1000 for the 2022 cohort.

E. Continued Education

Newly licensed students with 40 hours of flight time can receive more training through workshops. These workshops focus on best practices of mission planning, flight preparation, flight operation, education of various sensors, contingency planning, data acquisition, data processing, and equipment maintenance. NASA Guam Space Grant and NASA Guam EPSCoR are jointly operating a geographic information system and remote sensing (GIS/RS) laboratory named the Micronesian Area Geospatial Information Center (MAGIC). The MAGIC lab will provide a base of operations for Drone Corps. Pilots will be able to view and sign up for mission requests from UOG units, Government of Guam agencies, and nonprofit agencies.

F. Outreach

In its mission to not only create more licensed remote pilots for the region, but to create responsible ones, the UOG Drone Corps has also conducted various outreaches. Members have participated in various expos and fairs in order to educate diverse sectors of the community about proper drone usage on the island. During an expo catered toward contractors and homeowners in September 2022, for example, members ran a booth where they explained to attendees how drones can be used to make construction projects more efficient through aerial mapping and LiDAR scanning. In an additional outreach that focused on STEM opportunities for the island's youth, Drone Corps members hosted a

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[26] Steve Limtiaco, *Money for Drones: GEDA Announces Latest Winners of QC Grants*, PAC. DAILY NEWS (May 20, 2021), https://www.guampdn.com/news/local/money-for-drones-geda-announces-latest-winners-of-qc-grants/article_59d07b33-ccaa-5c37-8282-1d0ba817fcc2.html.

drone simulator station for visitors to try out. Members addressed common misconceptions about drones, emphasizing that drones are tools and not toys. A common goal of these outreaches was to educate the public that there are numerous opportunities for individuals of all backgrounds to get engaged with the drone industry.

IV. TESTIMONIALS

The following testimonials are written by the president of Tech Center Guam and two UOG Drone Corps members from the 2021 cohort who interned with Tech Center Guam. These testimonials detail these individuals' background and experience with the program and internship, as well as their beliefs on the future of the drone industry in Guam.

A. Art Dawley

Tech Center Guam was established three years ago with the focus of creating commercial opportunity and career paths for students interested in the unmanned aircraft and robotics sector. Our paid internship program with UOG Drone Corps has created exactly this opportunity. We currently utilize Drone Corps students as trainers and assessors in our public safety agency training and assessment program, which is sponsored by the U.S. Department of Commerce. Drone Corps students will also be utilized as program manager trainees for a recently awarded Guam government drone program, which focuses on operational implementation of drone programs for various public agencies here on the island.

I think there is a lot of perfectly legitimate concern in local communities that drones are not necessarily used for commercial good and infringe on privacy rights of citizens. Additionally, there is also the perception that drones can be quite easily purchased by unskilled, untrained, and unknowledgeable operators with little regard to local or federal regulations, which is also understandable. It is important for the local community to understand that drones can have a significant positive impact on our everyday lives by providing, among other things, rapid response assistance in natural or local disasters, assistance to public safety agencies in search and rescue, fire or law enforcement operations, critical supply delivery, monitoring of our environment, and many other

activities that benefit the community. Because drones are classified as "aircraft" by the FAA and they share the National Airspace System with crewed aircraft (commercial airliners and private aircraft), they also need to share in the same responsibilities for safe operating practices that minimize risk and adhere to local and federal regulations regarding privacy. This is achieved by requiring drone pilots operating for commercial purposes to have an FAA Remote Pilot license and also register their drones in a federal database. It should be noted that the vast number of complaints regarding unsafe operation or invasion of privacy result from non-licensed operators not engaged in commercial activity. For now, the FAA does not require a Remote Pilot license for non-commercial operators. However, they are required to adhere to similar guidelines and regulations as commercial operators.

B. Maria Seanna Minas

My name is Maria Seanna Minas, and I graduated from the University of Guam (UOG) in Spring 2020 with a major in Mathematics. I was born in Guam and currently reside in the village of Dededo with my parents. Since I have lived on Guam my whole life, I have been exposed to this "paradise" many visitors desire to experience. Although many people admire Guam for its beaches, foods, and other tourist attractions, I have admired the gradual development of technology on the island, whether it would be in schools, public facilities, or workplaces. This has inspired me to pursue a degree in STEM. STEM focuses on the disciplinary principles of science, technology, engineering, and mathematics. With these principles, students are provided the skills and experiences to promote STEM in the community – to contribute to a technological society. Hence, my degree in Mathematics serves a purpose to educate younger generations about STEM and inspire them to discover ways to advance the community in all aspects of technology.

To spearhead my career in STEM, I decided to apply for the UOG Drone Corps Program. I first heard about this program through a STEM professor at UOG. She informed me that as the use of drones continues to rise in both education and commercial sectors, UOG's first-ever certification and training program will expose students to unique research opportunities involving cap-

turing drone footage and data for local agencies. My motivation for applying for the UOG Drone Corps was to discover new personal interests in the drone industry and to build up my background experience in conducting research. From watching aerial footage on commercials and on social media, I have gained an interest in becoming a drone pilot. This program indeed has offered me the opportunity to safely fly unmanned aerial vehicles while capturing footage and data for academic missions. Given this opportunity, I became more eager to learn about drones, such as understanding the integration of technology and programming in several research projects. While in this program, I can acquire more knowledge about drones, gain more research experience, establish and improve relationships, and lastly, develop a background in flight projects and experiences.

Fig. 3.1. UOG Drone Corps member, Maria Seanna Minas, earns flight hours flying drones during her internship with Tech Center Guam.

However, my experience with the Drone Corps did not end after the three-week course. Through UOG Drone Corps, I was able to extend my drone experience under Tech Center Guam, a subsidiary of Aviation Concepts, as one of their project interns, along with Thor Hauerbach. After acquiring a Temporary Airman Certificate, we were able to apply our knowledge of the Federal Aviation Administration's (FAA) Part 107b materials and regulations to our virtual and in-field training. Under the mentorship of Mr. Art Dawley, a former Certified Flight Instructor (CFI) and private

pilot, we have completed the following certifications in preparation for our current project of public safety: National Fire Protection Association (NFPA) and National Institute of Standards and Technology (NIST) for Measuring Capabilities and Remote Pilot Proficiency (Course Number ALC-716). Tech Center Guam was contracted to train and guide the Guam Fire Department in attaining an FAA Part 107b Remote Pilot License through our designed curriculum using the NIST training guidelines.

Throughout my experience with both UOG Drone Corps and my internship at Tech Center Guam, I can continue to immerse myself in various flight conditions and environments to best assess my proficiency as a new drone pilot. Prior to these programs and projects, I had no general drone experience with small unmanned aircraft systems (sUAS). I often saw people fly drones in public parks, but I did not think flying one required a remote pilot license, waivers, or authorizations (if applicable) and mobile applications. With the help of Tech Center Guam, I have been granted access to fly both the simulator and the actual drones: Phantom 4 Pro V2 and Mavic Pro. I have only flown a drone under the supervision of Mr. Art Dawley during our in-field training. One obstacle I faced during the process was having to overcome my nervousness in flying a drone alone. Flying a company drone comes with great responsibility. Although I have passed several certifications that qualify me to fly, I need more practice and in-field guidance when it comes to unlocking airspace under temporary flight restrictions.

As Guam continues to integrate technology in many workplaces, the country's current efforts in using drone flights and displays for entertainment has sparked this year. Guam hosted its first drone light show at Ypao Beach in celebration of Liberation Day. Although this display has attracted many locals, I believe the involvement of drones in many workplaces and schools will contribute to the advancements in technologies on the island. As schools continue to improve their curriculum, we can encourage the Department of Education to implement a drone simulation course in which students can learn to program drones before flying one (quite similar to the robotics courses offered now). In workplaces, many drones have been used to survey lands, as well as capture drone footage and data for local agencies. With our cur-

rent project involving public safety, the use of drone technology will be an asset to search and rescue by improving situational awareness, helping locate missing people or suspects, combating fires and inspecting damage or accidents. The future of drones may depend on the future students' interest in aviation and in the STEM field. Introducing them to aviation concepts at early ages will spark a great interest in developing improvements in our community through the use of advanced technology.

C. Thor Hauerbach

My name is Thor Hauerbach. I am a student at the University of Guam (UOG) majoring in Business Administration. Currently, I reside in the village of Sinajana with my family, where I have lived for the past year and a half. Prior to moving to Guam, I attended community college in Los Angeles, California, where I was born and raised. The decision to move to Guam was greatly influenced by the opportunity to explore a new environment while also being able to progress academically and experience the so-called "island life," a lifestyle that seems only to get better with the time I spend here. Following graduation, I intend to move back home to California and go to law school.

I first heard about the UOG Drone Corps Program through an email sent to students in April of 2021. The email invited interested students to apply for this great opportunity. Without hesitation, I applied for the program. I knew I would stop at nothing in order to become a part of it. For as long as I can remember, I have had a passion for airplanes and the realm of aviation. This alone is my major reason for applying and having interest in the program. Following the submission of my application, I anxiously awaited the outcome. Eventually, I received an email in June of the same year, notifying me that I had been accepted into the program. I was ecstatic and could not wait to learn and dive headfirst into the experiences and opportunities that lay ahead. One month later, we began the Knowledge Course segment of the UOG Drone Corps Program. For three weeks, a cohort of students and I learned the ins and outs of the Federal Aviation Administration's Part 107b materials and regulations, taught by Mr. Art Dawley (my current supervisor), a former Certified Flight Instructor (CFI) and private pilot. At the end of the knowledge portion of the pro-

gram, we were encouraged to take the FAA Part 107b exam. I did so immediately and passed with a score of 94%.

Fig. 3.2. UOG Drone Corps member, Thor Hauerbach, earns flight hours flying drones during his internship with Tech Center Guam.

Following the conclusion of the knowledge portion of the program and passing the FAA Part 107b exam, the UOG Drone Corps students were invited to apply for an internship at Tech Center Guam, a subsidiary of Aviation Concepts. Mr. Dawley is also the president of Aviation Concepts/Tech Center Guam, and directly supervises me and one other intern, Maria Seanna Minas. Maria and I came onboard as interns for Tech Center Guam in September. In the time that we have worked for Mr. Dawley, we have completed certifications for the National Fire Protection Association (NFPA), as well as for the National Institute of Standards and Technology (NIST) for Measuring Capabilities and Remote Pilot Proficiency (Course Number ALC-716). Additionally, I have been tasked with the development of a curriculum to implement using NIST guidelines in order to facilitate training for the Guam Fire Department (GFD), with whom Tech Center Guam was awarded a contract to train and guide in attaining the FAA Part 107b Remote Pilot License.

Prior to joining the UOG Drone Corps Program, I had no experience or familiarity with small unmanned aircraft systems (sUAS), although I did have some past experience with remote

controlled aircraft. In the past months, I have spent numerous hours on the DJI Enterprise simulator, both doing skill training exercises and free flight, and have also had the privilege to fly real drones like the DJI Mavic Pro and Phantom 4 in the field. After some time flying in the field with Mr. Dawley, he entrusted me to bring home the company Mavic Pro for a weekend. Before flying by myself, I was always with Mr. Dawley. I felt as if he was a licensed driver and I was a beginner driver. I drove around Guam that weekend and flew at a handful of places. I got over my initial anxiety and had a great, joy-filled experience.

Guam does not celebrate the 4th of July with nearly as much energy and enthusiasm as it celebrates Liberation Day on July 21st. Liberation Day commemorates the United States' second invasion of Guam, which ended the Japanese occupation in 1944. Each year, families, friends, and strangers gather at popular areas to witness displays of fireworks, performers, and parades. This most recent year, although there was no parade, there was a drone show conducted over Tumon Bay, followed by fireworks from two beaches. The drone show used over 100 drones, all modified with lighting accessories, synchronized via computer software to project images in the star-filled sky. The crowd was in awe of the various images and messages presented. The drone show of 2021 Liberation Day was a hallmark event in terms of drone performances. I am certain that there will be more to come soon.

In the near future, I hope to see more integration of sUAS by various Government of Guam agencies, especially by agencies directly involved in public safety. While the training facilitated by Tech Center Guam is a remarkable start, it is clear that many other agencies have a use for drones in regard to doing their respective jobs. For example, the Department of Agriculture can use similar training to inspect potential farmland and wildlife habitats.

V. LIMITATIONS

Despite the UOG Drone Corps program seeing several successes during its first year, including the certification of 12 members as remote pilots, several limitations of the program can be identified and improved upon in future cohorts. The first limitation of the study was that the program was launched during the

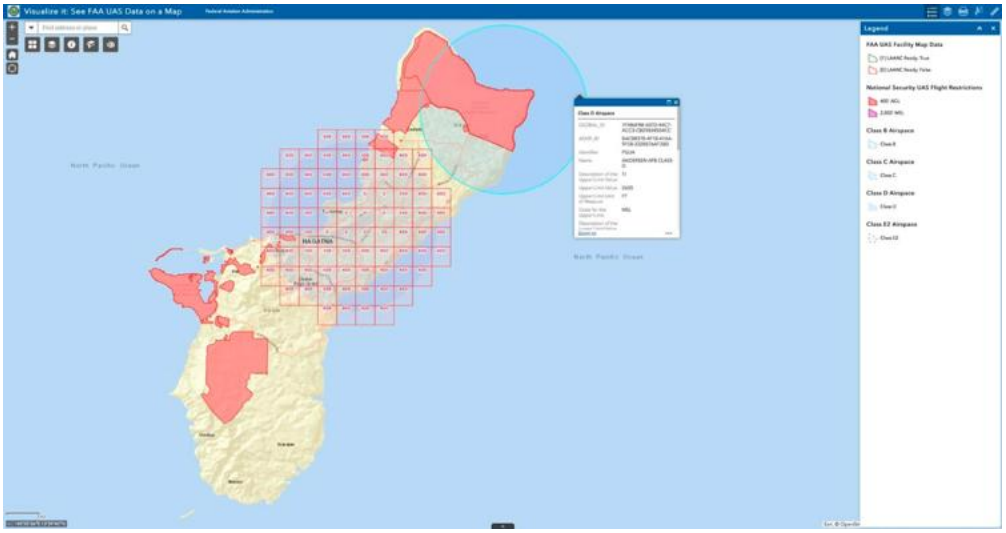
ongoing COVID-19 pandemic, resulting in ever-shifting schedules and facility closures. While many of the issues brought on by the pandemic are beyond the control of the program, planning for future cohorts should include continuity measures that would mitigate disrupted program operations. A related limitation was that several accommodations were made to account for pandemic-related circumstances, including a reliance on the virtual environment and the option for students to participate in the program asynchronously (e.g., flexible deadlines and hybrid participation). Since drone training is a rigorous and immersive practice heavily dependent on hands-on guidance, future cohorts should consider ways to ensure that students are guided and kept engaged with the material throughout the course. These pandemic-related restrictions proved to be less of an obstacle during the program's 2022 cohort. Finally, as stipulated by NGSG funds, the program was only made available to UOG and GCC students who are U.S. citizens. To provide a more diverse and inclusive experience for all, future iterations of the program should consider finding ways to offer the UOG Drone Corps program to Guam residents of all backgrounds.

VI. CONCLUSION

As drones become increasingly accessible and inexpensive to purchase both globally and locally, it is expected that the adoption of drones by students, private individuals, businesses, and public authorities on Guam will increase tremendously in the coming years. To meet this demand, the UOG Drone Corps program plans to expand its program in several ways for future cohorts. This includes broadening the range of partnerships with whom students are able to work when accumulating their flight hours, including local organizations that will inevitably emerge because of accelerated drone use. Specific industries that the program aims to collaborate with include those who deal with areas such as crop monitoring, cargo transport, safety and surveillance, and storm tracking. Given the expectation that drones will continue to extend to a diverse range of areas beyond the academic field, the UOG Drone Corps program also aims to integrate lessons into its curriculum that specifically focus on the recreational uses of drones, such as aerial cinematography and photography. As drone technology con-

tinues to advance and becomes safer as a result, the curriculum should also consider any changes made to the currently restrictive FAA regulations.

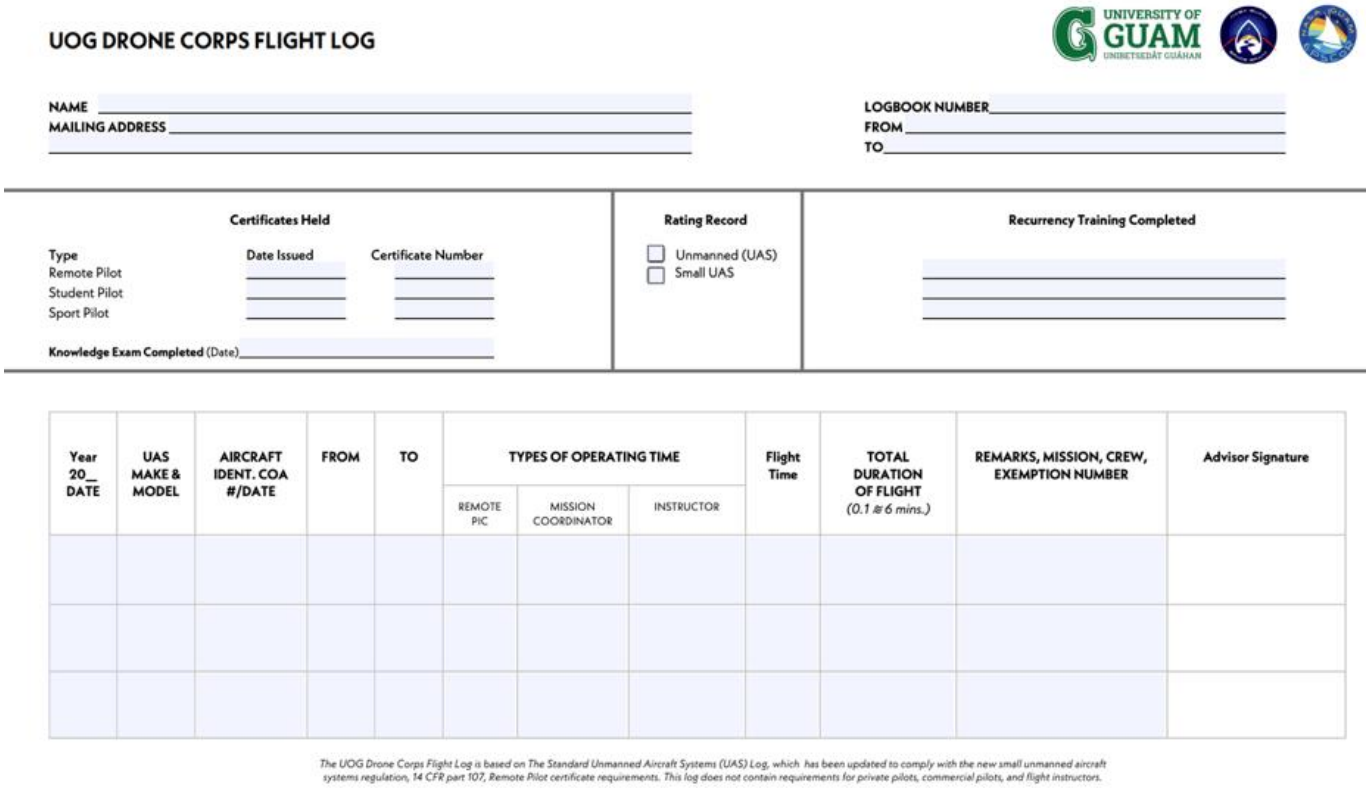
APPENDIX A



Appendix A. This map highlights the current airspace restrictions on Guam as regulated by the Federal Aviation Administration.[27]

[27] *Airspace Restrictions*, FED. AVIATION ADMIN., https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/airspace_restrictions/ (last updated June 14, 2022).

APPENDIX B



UOG DRONE CORPS FLIGHT LOG

UNIVERSITY OF GUAM
UNIBETSEDÅT GUÅHAN

NAME _____
MAILING ADDRESS _____
_____

LOGBOOK NUMBER _____
FROM _____
TO _____

Certificates Held

Type	Date Issued	Certificate Number
Remote Pilot		
Student Pilot		
Sport Pilot		

Knowledge Exam Completed (Date) _____

Rating Record

☐ Unmanned (UAS)
☐ Small UAS

Recurrency Training Completed

_____
_____
_____

Year 20__ DATE	UAS MAKE & MODEL	AIRCRAFT IDENT. COA #/DATE	FROM	TO	TYPES OF OPERATING TIME			Flight Time	TOTAL DURATION OF FLIGHT (0.1 = 6 mins.)	REMARKS, MISSION, CREW, EXEMPTION NUMBER	Advisor Signature
					REMOTE PIC	MISSION COORDINATOR	INSTRUCTOR				

The UOG Drone Corps Flight Log is based on The Standard Unmanned Aircraft Systems (UAS) Log, which has been updated to comply with the new small unmanned aircraft systems regulation, 14 CFR part 107, Remote Pilot certificate requirements. This log does not contain requirements for private pilots, commercial pilots, and flight instructors.

Appendix B. A copy of the UOG Drone Corps Flight Log used by members to log their flight hours.