**Palomar College**

**Associate of Science Drone Technology**

**New Program – Career Technical Education (CTE)**

1. **Program Goals and Objectives**

The Drone Technology program provides students with skills to gain employment or launch entrepreneurial endeavors in fields that employ images and videos collected with Unmanned Aircraft Systems (UAS) or Drones. The Drone Technology degree covers the theories and techniques necessary in the responsible gathering, processing, dissemination, and integration of UAS data. Students enrolled in the program will be prepared to take the Federal Aviation Administration (FAA) Small Unmanned Aircraft Regulations (Part 107) aeronautical knowledge test for commercial operation of drones. The program prepares students for entry level positions such as aerial photographer and videographer, mapping technician, and precision agricultural science technician. Since UAS has broad applications in a number of fields, the positions listed above are only a small sample of the career pathways that graduates will qualify for. In particular, the occupations listed are based on the leading industries within California that have applied for commercial UAS exemption with the Federal Aviation Administration according to the Association for Unmanned Vehicle Systems International (<http://www.auvsi.org/advocacy/exemptions70>). The associate’s degree program focuses on:

* 1. Understanding federal, state, and local regulations governing safe and responsible operation, licensing and registration requirements, and privacy concerns.
	2. Describing the functions and limitations of various UAS hardware components (e.g. battery, gimbal, GPS module, flight controller, frame, sensor), and identifying the appropriate components for particular applications.
	3. Designing, implementing, evaluating, revising, and communicating manual and automated flight plans to meet different client requirements.
	4. Demonstrating the ability to apply, communicate, and implement crew resource management principles and risk mitigation strategies.
	5. Analyzing technical problems within the UAS and identifying appropriate solutions.
	6. Processing and disseminating data gathered from UAS using a variety of third party software packages.
	7. Understanding the social, economic, and legal implications of UAS on individuals, organizations, and society.
	8. Evaluating the financial, marketing, legal, human resource, operations, and general management skills that are essential to successfully launch and operate a successful new venture;
	9. Identifying and evaluating approaches of entering an entrepreneurship venture – including but not limited to starting a new venture, buying an existing business, or becoming a franchisee.
	10. Students will have a base of applied knowledge to transfer in to a bachelor degree program in Business.
1. **Catalog Description**

This program will prepare students to become remote pilots or entrepreneurs in fields that currently deploy Unmanned Aircraft Systems (UAS) in their operations. These fields include environmental science and management, real estate, journalism, search and rescue, agriculture, disaster response and management, and cultural resource management among others. This program will provide students with skills in UAS operations as well as the knowledge necessary to plan, create, and develop a UAS based business. Students interested in pursuing a bachelor’s degree in Business Administration or Management can also take advantage of the articulation agreements and transfer pathways jointly developed by Palomar College and National University faculty members.

1. **Program Requirements**

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| **Required Courses** |
| BMGT 153\* | Small Business Entrepreneurship | 3 |
| GEOG 110 | Meteorology: Weather and Climate | 3  |
| GEOG 120 | Digital Earth: An Introduction to Geographic Information Systems | 4  |
| GEOG 140 | Introduction to Remote Sensing | 1 |
| GEOG/GCIP/GEOL 158 | Small Unmanned Aircraft Systems (UAS) Procedures and Regulations | 1 |
| GCIP 168 | Digital Imaging with Drones I | 3  |
| GCIP 268 | Digital Imaging with Drones II | 3  |
| CE 100 | Cooperative Education | 1 - 4 |
|  |  |  |
| **Select two courses:** |
| ENGR 126 | Introduction to Electrical and Computer Engineering | 4 |
| GCMW 165 | Digital Video Design | 3 |
| GCMW 197A | Topics in Internet | 1 – 5 |
| GCMW 205 | Digital Video for Multimedia | 3 |
| GEOG 197 | Geography Topics | 1 - 4 |
| BUS 152 | Social Media for Business | 3 |
|  | **Total Units** | **21 - 31** |

**Course Sequence**

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| --- | --- | --- | --- | --- |
| **Requirements** | **Catalog #** | **Name** | **Units** | **Sequence** |
| **Required Core** | GCIP 168GEOG 110GEOG/GCIP/GEOL 158GCIP 268GEOG 120BMGT 153GEOG 140CE 100 | Digital Imaging with Drones IMeteorology: Weather & ClimateUAS Procedures & Regulations Digital Imaging with Drones IIDigital Earth: Introduction to (GIS)Small Business Entrepreneurship Introduction to Remote SensingCooperative Education | 33134311 – 4 | Yr. 1, FallYr. 1, FallYr. 1, FallYr. 1, SpringYr. 1, SpringYr. 2, FallYr. 2, FallYr. 2, Spring |
| Year 1 Fall – 7 unitsYear 1 Spring – 7 unitsYear 2 Fall – 4 unitsYear 2 Spring – 1 - 4 units | **Major Total** | **19 - 22 units** |

1. **Master Planning**

The Drone Technology Associates is an interdisciplinary program consisting of courses from Business, Graphic Communications and Geography. This program emphasizes the applications of Unmanned Aircraft Systems (UAS) or Drones in photography, videography, mapping, remote sensing and photogrammetry. This degree program aligns with the college’s mission statement by providing a degree that focuses on an emerging technology that is in high demand for the county of San Diego. Occupations related to the operations of UAS are projected to experience tremendous growth in the San Diego-Carlsbad Metropolitan area between 2014 and 2024, these occupations include aerial photographer [18.2% growth] and videographer [17.7% growth], mapping technician [14% growth], cartographer and photogrammetrists [46.7% growth], and precision agricultural science technician [6.7%]. Median incomes of these occupations range between $16.38 per hour and $30.17 per hour. With additional experience and education, a student can advance to positions in project management, image analyst, and various senior positions in fields related to UAS. Furthermore, the Drone Technology Associates examines the broader impacts as well as wide-ranging social, economic, and ethical issues associated with the use of UAS in commercial applications.

The Drone Technology associates degree aligns with the recommendations identified by the California Community College’s Strong Workforce Task Force. In particular, it enhances career exploration and planning, and creates pathways that prepare students for a variety of occupations with tremendous growth potential in the San Diego region. Moreover, specific courses within the Drone Technology associates degree (BUS 152, BMGT 153) have been articulated with National University (NU) in order to develop transfer pathways into NU’s bachelor’s degree in Business Administration and bachelor’s degree in Management programs.

1. **Enrollment and Completer Projections**

 Required CoursesYear 1: 2018-2019 Year 2: 2019-2020

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| --- | --- | --- | --- | --- | --- |
| Course Number | Course Title | Annual # Sections | Annual Enrollment Total | Annual # Sections | Annual Enrollment Total |
| BMGT 153 | Small Business Entrepreneurship | 2 | 84 | 2 | 84 |
| GEOG 110 | Meteorology: Weather and Climate | 2 | 64 | 2 | 64 |
| GEOG 120 | Digital Earth: An Introduction to Geographic Information Systems | 6 | 180 | 6 | 180 |
| GEOG 140 | Introduction to Remote Sensing  | 1 | 30 | 1 | 30 |
| GEOG/GCIP/GEOL 158 | Small Unmanned Aircraft Systems Procedures and Regulations(new course under development) | 2 | 84 | 2 | 84 |
| GCIP 168 | Digital Imaging with Drones I  | 6 | 120 | 6 | 120 |
| GCIP 268 | Digital Imaging with Drones II  | 2 | 48 | 2 | 48 |
| CE 100 | Cooperative Education | 1 | 30 | 1 | 30 |

 Projected Students/Annual CompletersYear 1: 2020-2021 Year 2: 2021-2022

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| --- | --- | --- | --- | --- | --- |
| Course Number | Course Title | Annual # Sections | Annual Enrollment Total | Annual # Sections | Annual Enrollment Total |
| BMGT 153 | Small Business Entrepreneurship | 2 | 84 | 2 | 84 |
| GEOG 110 | Meteorology: Weather and Climate | 2 | 64 | 2 | 64 |
| GEOG 120 | Digital Earth: An Introduction to Geographic Information Systems | 6 | 180 | 6 | 180 |
| GEOG 140 | Introduction to Remote Sensing | 1 | 30 | 1 | 30 |
| GEOG/GCIP/GEOL 158 | Small Unmanned Aircraft Systems Procedures and Regulations | 2 | 84 | 2 | 84 |
| GCIP 168 | Digital Imaging with Drones I | 6 | 120 | 6 | 120 |
| GCIP 268 | Digital Imaging with Drones II | 2 | 48 | 2 | 48 |
| CE 100 | Cooperative Education | 2 | 60 | 2 | 60 |

Enrollment Justification is based on historical completion rates by academic year according to the Palomar College Institutional Research and Planning Office. Given that the occupations associated with UAS are expected to experience growth in the range of 6.7% to 46.7% for the San Diego region (see previous section), we believe that this is a strong program with plenty of room for growth.

1. **Place of Program in Curriculum/Similar Programs**

This interdisciplinary program uses many of the courses currently found in the Geography (GEOG),Graphic Communications (GCIP), and Business (BMGT) disciplines. It does not replace any programs in the curriculum. However, it organizes existing courses into a new degree that may be awarded for entry-level employment.

1. **Similar Programs at Other Colleges in Service Area**

Although there is discussion about starting UAS programs within San Diego County, we are not aware of any active UAS programs in the San Diego region at the moment. The proposed associates degree program is unique in that in addition to its focus on career technical education, it also contains transfer pathways for students wishing to pursue a bachelor’s degree in Business Administration or a bachelor’s degree in Management from National University. Furthermore, the proposed drone technology degree is unlike other UAS programs that have been discussed in that it not only focuses on the applications of UAS in photography, videography, mapping, remote sensing and photogrammetry, but also entrepreneurship in fields that deploy UAS. Other drone-related programs in the country (e.g. Northland Community College, MN; Sinclair Community College, OH) usually specialize in engineering and designing UAS, rather than UAS entrepreneurship and operation..

**Additional Supporting Documentation - CTE**

* 1. **Labor Market Information (LMI & Analysis)**

UAV/UAS (Unmanned Aircraft Vehicles/Unmanned Aircraft Systems), often referred to as drones, is the fastest growing sector of both civilian and military aviation. ATRE, the Federal Aviation Administration, the National Oceanic and Atmospheric Administration, Boeing, Raytheon, General Atomics and other organizations identify that in California, the U.S., and globally the UAV/UAS drone hobby, commercial, and military markets will expand significantly by 2020. It is forecasted that the UAS economic direct, indirect, and induced impact of UAV/UAS manufacturing and sales on California’s economy for 2015 to 2017 to be $2.4 billion creating 12,292 jobs. AUVSI estimates that by 2025 there will be the creation of over 100,000 new jobs nationally. [http://www.atreeducation.org/wp- content/uploads/2015/10/The-ATRE-Drone-Report.pdf](http://www.atreeducation.org/wp-%20content/uploads/2015/10/The-ATRE-Drone-Report.pdf)

According to the report, prepared for Peter Davis, Statewide Director, on this emerging UAS Industry, 12,292 California jobs were expected to be created from 2015 to 2017. By 2025, 18,161 (17.5%) of the 103,776 US UAS jobs created are expected to be in California. Southern California is projected to receive the majority of those jobs based on the proportion of national aerospace manufacturing. Palomar College is perfectly situated in San Diego’s North County to supply trained graduates for careers in local aerospace companies or entrepreneurial endeavors as UAS operators.

San Diego is home to two of the largest military unmanned aerial vehicle (UAV) manufacturers, Northrop Grumman and General Atomics, and is a hub for UAV technologies for both military and civilian users. Covering air, land, and water, the unmanned systems platforms manufactured in the region serve a variety of sophisticated military and commercial missions.

With the rise in commercial and consumer uses, this industry is well positioned to carry aerospace innovation forward and to continue to attract top aerospace and software engineering talent to San Diego. While the Department of Defense (DoD) has been driving these technologies, significant moves by companies like Qualcomm, Amazon, and Google reflect the emerging opportunities for unmanned systems in commercial markets. San Diego’s talent base has the right blend of technical skills from communications, software, cybersecurity, aviation, robotics, and data analytics to capitalize on the maturation of these commercial markets.

The occupations associated with this proposed Drone Technology degree are growing at tremendous rates, ranging between 6.7% and 46.7%. Moreover, we expect new occupations to be created as industry recognizes the potential of this emerging technology, and we also expect the median pay for UAS operators in various fields to increase as they will be in high demand. The Association for Unmanned Vehicle Systems International’s Economic Report (<http://www.auvsi.org/auvsiresources/economicreport>) projected that the integration of UAS in the US airspace will create more than 100,000 jobs and has an economic impact of $82 billion by 2025.

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| **Position Title** | **2017 Median Pay** |
| [Cartographers and Photogrammetrists](https://www.bls.gov/ooh/architecture-and-engineering/cartographers-and-photogrammetrists.htm) | $30.76 per hour  |
| [Photographers](https://www.bls.gov/ooh/media-and-communication/photographers.htm) | $15.62 per hour  |
| [Agricultural and Food Science Technicians](https://www.bls.gov/ooh/life-physical-and-social-science/agricultural-and-food-science-technicians.htm) | $19.19 per hour |
| [Drafter, Engineering, and Mapping Technicians](https://www.onetonline.org/link/summary/17-3031.02) | $20.41 per hour |
| [Media and Communication Workers](https://www.bls.gov/oes/current/oes273099.htm) | $23.03 per hour |

* 1. **Advisory Committee Recommendation**

Minutes were taken at the 7/17/2017 meeting. Majority of our committee members noted that the drone labor market will experience tremendous growth in the next five years. Many representing local government and private sectors are interested in providing students with internships or employment opportunities.

* 1. **Regional Consortia Approval Meeting Minutes**

The region’s workforce council will vote on the development of the Drone Technology degree at an upcoming meeting.