Geographic Information Sciences (GIS) – Drones

*Inland Empire/Desert Region (Riverside and San Bernardino counties)*

# Introduction

The Inland Empire/Desert Region Center of Excellence for Labor Market Research (COE) prepared this report to provide regional labor market supply and demand data related to unmanned aerial vehicles (UAV), more commonly known as drones. Previous COE research showed that online job ads related to drones often require base knowledge in a traditional field, such as software development, photography, and geographic information systems, plus experience with drones as an additional skill or qualification.

While drones were originally developed for military application, the Federal Aviation Administration (FAA) issued its first commercial drone permit in 2006, opening the door for private companies, government agencies, and individuals to use drones for a wide variety of activities. Law enforcement agencies have used drones to chase suspects, assist with crime scene investigation, and conduct search and rescue missions (Ponciano, 2019). Geographic Information Systems (GIS) specialists use drones to provide more detailed and timely aerial images for quicker analysis when compared to satellite imagery (Esri, 2014). Photojournalists have used drones to show the effects of climate change by capturing images of lakes that have dried up to show how Greenland’s ice sheet is melting (Haner, 2018). Furthermore, advancements in mapping software, such as Site Scan for ArcGIS, have made imagery data collection, processing, and analysis more accessible to a wider audience (Esri, 2021).

The Federal Aviation Administration (FAA) began requiring all commercial UAV pilots to have a Part 107 remote pilot license in December 2015. A Part 107 license costs $150, and applicants must pass an aeronautical knowledge exam. Once the license is obtained, it must be renewed every three years (FAA, 2021). All UAVs that weighing between .55 pounds and 55 pounds must be registered with the FAA (FAA, 2020).

Currently, there is no Standard Occupational Classification (SOC) code in the Bureau of Labor Statistics (BLS) coding system for jobs related to drones (i.e., drone pilots, drone technicians, or drone photographers); therefore, traditional occupational demand data for drone technology roles is limited. To better understand the current need for drone knowledge, skills, and abilities (KSAs), this report primarily focuses on an analysis of online job ads in the Inland Empire/Desert region (Riverside and San Bernardino counties) for job titles related to drones.

In addition to analyzing online job ads, this report also provides an overview of drone programs and courses offered at community colleges throughout California. The supply figures in this report were obtained using the Chancellor’s Office Curriculum Inventory (COCI) to identify programs and courses with a drone emphasis. In

this report, supply is defined as the three-year average of awards conferred by community colleges in programs related to drone technology. This data is collected using the California Community Colleges Chancellor’s Office (CCCCO) data tool, the Management Information Systems (MIS) Data Mart. By focusing on these programs, the supply numbers in this report capture the most accurate data available from community colleges. While four-year and other non-community college institutions may offer drone programs and courses, there is not a comprehensive and methodologically sound way to collect detailed course and program data for these institutions. For that reason, this report focuses on data available from community colleges.

# Summary

Based on the available data, there appears to be a need for drone skills in the region; quantifying precise demand, however, is challenging. While demand is typically defined as the number of annual job openings for a set of occupations, drone skills can be applied to a variety of occupations. However, not all positions within those occupations may require drone skills, so traditional demand data will be overstated for drone positions. For this reason, and because drone skills can be applied to numerous occupations, this analysis is primarily based on online job ads. While online job ads are useful for understanding KSAs, education requirements, and other employer hiring preferences, the number of job ads does not provide an accurate count of job openings. For example, employers may list jobs that they do not end up filling or may use a single posting to hire several people. Therefore, the number of online job ads is not comparable to nor indicative of the number of annual openings for any given occupation. Following is an overview of this report’s key findings:

### Key Findings:

* Over the past 12 months, there were 118 online job ads related to drones in the Inland Empire/Desert region. The highest number of job ads were for solar site surveyor, GIS analyst II, and site surveyor.
  + Compared to the same period from 2018 to 2019, there was an increase of 61 online job ads.
  + Within job ads, 55% (65 job ads) included a requested and/or minimum level of education, of which 49% (32) requested a high school diploma, vocational training and 51% (33) requested a bachelor’s degree.
* Overall, online job ad salary information reveals that employers are willing to pay these positions

$56,000 annually, above the $51,452 annual ($24.36 hourly) self-sufficiency standard for the region. Consider the salary information with caution since only 47% of online job ads (55 out of 118) for drone-related positions provided salary information.

* Approximately 71% of all job ads fall into four “Job Families”: Computer and Mathematical, Architecture and Engineering, Arts, Design, Entertainment, Sports, and Media, and Transportation and Material Moving.
  + The skills requested in each job family vary greatly due to the different tasks each job family typically requires.
  + Job ads in the Computer and Mathematics job family do not primarily involve flying or piloting drones. Instead, postings in this area focus on other areas like software development.
* There are 11 community colleges throughout California that have drone-related programs, conferring an average of five awards annually between 2017 and 2020.
  + However, all of these programs were approved in 2017 or later, so several programs were not active during this time period and only recently began to confer awards.
* There are 36 community colleges throughout California that offer drone-related courses listed under 28 different TOP codes ranging from Piloting (TOP 3020.20) to Journalism (TOP 0602.00) and Electro-Mechanical Technology (TOP 0935.00).

# Job Advertisements

A keyword search, including 27 keywords related to drones, was used to conduct a job advertisement search for drone positions in the Inland Empire/Desert Region. The full list of keywords is listed in the Appendix. Over the past 12 months, there were 118 online job ads related to drones in the Inland Empire/Desert Region.

Compared to the same time period from 2019 to 2020, job advertisements increased by 61 job ads or 207%. Because drones can be used across a variety of roles, these postings were spread across numerous industries and occupations. To better understand the skills requested in each area, online job ads were grouped into Job Families. These Job Families are classifications from O\*NET, a U.S. Department of Labor program that provides occupational data and information, which defines a Job Family as a group of “occupations based upon work performed, skills, education, training, and credentials” (O\*NET, 2021a). The top four Job Families account for 71% of all postings and are analyzed in further detail. Exhibit 1 shows the top four Job Families by the number of job ads.

*Exhibit 1: Number of job advertisements by job family*

|  |  |
| --- | --- |
| **Job Family** | **Job Ads** |
| Arts, Design, Entertainment, Sports, and Media | 36 |
| Architecture and Engineering | 22 |
| Computer and Mathematical | 18 |
| Transportation and Material Moving | 8 |

|  |  |
| --- | --- |
| **Job Family** | **Job Ads** |
| *All other job families* | *34* |
| **Total** | **118** |

Source: Burning Glass – Labor Insights, O\*Net

The Arts, Design, Entertainment, Sports, and Media Job Family includes a wide variety of media occupations, ranging from coaches and scouts to floral designers and photographers. This job family also includes directors, video editors, and videographers.

The Architecture and Engineering Job Family covers a wide variety of occupations, including aerospace engineering, electrical and electronics, manufacturing, and product safety occupations. Though most GIS positions are in the Computer and Mathematical Job Family, surveyors and mapping technicians are included in the Architecture and Engineering Job Family.

The Computer and Mathematical Job Family includes occupations primarily related to information technology, computer programming, and software development. This job family also includes geographic information systems (GIS) technicians and other related geospatial occupations.

The Transportation and Material Moving Job Family includes pilots, air traffic controllers, and airfield operations specialists. This job family also includes occupations related to other forms of transportation, such as ship engineers, rain workers, and inspectors for all forms of transportation.

## Advertised Earnings

Community colleges should ensure their training programs lead to employment opportunities that provide self- sustainable income. The University of Washington estimates that a self-sufficient hourly rate for a single adult with one school-age child is $24.36 per hour or $51,452 annually in Riverside County; $23.73 per hour or

$50,119 annually in San Bernardino County (Pearce, 2021). For this study, the higher hourly earnings requirement in Riverside County is adopted as the self-sufficiency standard for the two-county region.

Exhibit 2 displays online job ad salary data for drone-related job families over the last 12 months in the Inland Empire/Desert. Overall, online job ad salary information reveals that employers are willing to pay these positions $56,000 annually, above the $51,452 annual ($24.36 hourly) self-sufficiency standard for the region. Consider the salary information with caution since only 47% of online job ads (55 out of 118) for drone-related positions provided salary information. The salary figures are prorated to reflect full-time, annual earnings status.

*Exhibit 2: Advertised salary information*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Real-Time Salary Information** | | | | | | |
| Job Family | *Number of job ads* | Less than  $35,000 | $35,000 to  $49,999 | $50,000 to  $74,999 | More than  $75,000 | Average Annual Salary |
| Arts, Design, Entertainment, Sports, and Media | *18* | 28% | 6% | 33% | 33% | $68,000 |
| Architecture and Engineering | *13* | - | 85% | 15% | - | $46,000 |
| Computer and Mathematical | *5* | N/A | N/A | N/A | N/A | N/A |
| Transportation and Material Moving | *5* | N/A | N/A | N/A | N/A | N/A |
| **All Job Advertisements** | ***55*** | **24%** | **34%** | **20%** | **22%** | **$56,000** |

Source: Burning Glass – Labor Insights

## Job Titles

Exhibit 3 displays the job titles most frequently associated with drone positions in the region. The job titles below represent 45% of all job titles associated with drones.

*Exhibit 3: Job titles most frequently included in drone job advertisements*

|  |  |
| --- | --- |
| **Job Titles** | **Job Ads** |
| Real Estate Photographer | 10 |
| Solar Site Surveyor | 8 |
| Site Surveyor | 5 |
| GIS Analyst II | 5 |
| Drone Pilot/Material Runner | 5 |
| Wedding Videographer/Editor | 4 |
| GIS Analyst | 4 |
| Robotics Operator | 3 |
| Drone Operator | 3 |
| Plastics Processing Supervisor II | 2 |
| Mining Engineer | 2 |
| Engineering Technician I – Surveying & Mapping | 2 |
| *All other job titles* | *65* |
| **Total** | **118** |

Source: Burning Glass – Labor Insights

# Employers, Skills, Education, and Work Experience

Exhibit 4 displays the employers that posted the most job ads over the last 12 months in the region. Displaying employer names provides some insight into where students may find employment after completing a program.

Esri posted the most job advertisements related to drone. It should be noted that Esri primarily sought software development positions.

*Exhibit 4: Employers posting the most job ads*

|  |  |
| --- | --- |
| **Top Employers** | **Job Ads** |
| Esri | 14 |
| San Manuel Band of Mission Indians | 7 |
| Sunrun Inc. | 5 |
| EmPower Solar | 5 |
| Sky Country Solar | 3 |
| Servguard | 3 |
| Blue Sky Photography | 3 |
| Amazon | 3 |
| *All other employers* | *76* |
| **Total** | **118** |

Source: Burning Glass – Labor Insights

Exhibit 5 lists a sample of employers' specialized, employability, and software and programming skills employers seek when looking for workers to fill drone-related positions. Specialized skills are occupation- specific skills that employers request for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is often referred to as "soft skills." The skills requested in job advertisements may be utilized to guide curriculum development.

*Exhibit 5: Sample of in-demand skills from employer job ads*

|  |  |  |  |
| --- | --- | --- | --- |
| **Job Families** | **Specialized skills** | **Employability skills** | **Software and**  **Development Skills** |
| Arts, Design, Entertainment, Sports, and Media *(n=26)* | * Photography * Videography * Video Editing * Social Media * Customer Service | * Communication Skills * Writing * Creativity * Teamwork/ Collaboration * Organizational Skills | * Adobe Photoshop * Software Development * Adobe InDesign * Adobe Acrobat |
| Architecture and Engineering *(n=20)* | * Customer Service * Site Surveys * Project Planning and Development Skills * Electrical Systems * Materials Transport | * Written Communication * Teamwork/ Collaboration * Physical Abilities * Organizational Skills * Time Management | * AutoCAD * Civil 3D |

|  |  |  |  |
| --- | --- | --- | --- |
| **Job Families** | **Specialized skills** | **Employability skills** | **Software and Development Skills** |
| Computer and Mathematical *(n=17)* | * Metadata * Global Positioning Systems (GPS) * Geographic Information Systems (GIS) * Data Verification * Data Analysis | * Problem Solving * Planning * Communication Skills * Meeting Deadlines * Time Management | * ArcGIS * Web Application Development * Microsoft Office |
| Transportation and Material Moving *(n=7)* | * Flight Safety * Traffic Laws * Occupational Health and Safety * Appointment Setting * Key Performance Indicators (KPI) | * Physical Abilities * Communication Skills * Troubleshooting * Organizational Skills * Communication Skills | * - |
| **All Job Advertisements *(n=97)*** | * **Photography** * **Customer Service** * **Videography** * **Global Positioning Systems (GPS)** * **Social Media** | * **Communication Skills** * **Written Communication** * **Planning** * **Teamwork/ Collaboration** * **Physical Abilities** | * **ArcGIS** * **Microsoft Office** * **Adobe Photoshop** * **Adobe InDesign** * **Adobe Illustrator** |

Source: Burning Glass – Labor Insights

The advertised educational requirements for drone positions are split between a high school diploma or vocational training and a bachelor’s degree. Exhibit 6 displays the minimum advertised education requirements for drone positions by job family.

*Exhibit 6: Minimum advertised education requirements*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Real-Time Minimum Advertised Education Requirement** | | | |
| **Job Families** | *Number of Job Ads* | High school or vocational training | Associate degree | Bachelor's degree or higher |
| Arts, Design, Entertainment, Sports, and Media | *11* | 55% | - | 45% |
| Architecture and Engineering | *14* | 86% | - | 14% |
| Computer and Mathematical | *14* | - | - | 100% |
| Transportation and Material Moving | *6* | N/A | N/A | N/A |
| **All Job Advertisements** | ***65*** | **49%** | **-** | **51%** |

Source: Burning Glass – Labor Insights

Exhibit 7 displays the real-time work experience requirements from employer job ads for drone-related positions.

*Exhibit 7: Work experience required and real-time work experience requirements*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Job Families** | **Real-Time Work Experience** | | | |
| *Number of job ads* | 0 – 2 years | 3 – 5 years | 6+ years |
| Arts, Design, Entertainment, Sports, and Media | *8* | 63% | 37% | - |
| Architecture and Engineering | *11* | 73% | 27% | - |
| Computer and Mathematical | *15* | 7% | 60% | 33% |
| Transportation and Material Moving | *1* | N/A | N/A | N/A |
| **All Job Advertisements** | ***55*** | **44%** | **42%** | **14%** |

Source: Burning Glass – Labor Insights

# Certifications

Of 45% of job advertisements that included certification information, approximately 28% sought candidates with a drone pilot license. The FAA Part 107 remote pilot license is required for all commercial UAV pilots. For more information regarding FAA certification, please visit the FAA website (FAA, 2021). Exhibit 8 displays the certifications required by employers posting job ads for drone positions in the region.

*Exhibit 8: Certifications typically required in advertisements*

|  |  |
| --- | --- |
| **Certifications** | **Job Ads** *(n=53)* |
| Driver’s License | 41 |
| Drone Pilot Certification | 15 |

Source: Burning Glass – Labor Insights

# Community College Drone Programs in California

According to the Chancellor’s Office Curriculum Inventory (COCI), an inventory of programs provided by the California Community Colleges Chancellor’s Office (CCCCO), there are 11 community colleges that currently offer drone-related programs throughout the state. Cypress, Orange Coast, and Palomar offer the most programs. There are no regional colleges that offer drone-related programs. Exhibit 9 displays each drone-

related program and the award type students earn upon successful completion of the program. TOP code/titles with a leading “\*” symbol are not career education programs.

*Exhibit 9: Drone-related programs in California*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TOP Code/Title** | **Local Program Name** | **College** | **California Region** | **Award Type** | **CCCCO**  **Approval**  **Date** |
| \*0302.00 –  Environmental Studies | Drone Technology and Applications | Southwestern | San Diego/Imperial | Noncredit | 2/19/2021 |
| 0602.00 - Journalism | Drone Journalism | Fullerton | Los Angeles/ Orange County | Certificate | 7/23/2021 |
| 0612.20 – Film  Production | Drone Videography | Orange Coast | Los Angeles/ Orange County | Certificate | 2/17/2021 |
| Drone Operator I | Palomar | San  Diego/Imperial | Certificate | 7/14/2021 |
| 0614.00 – Digital Media | Basic Drone  Imaging Skills | Orange Coast | Los Angeles/  Orange County | Certificate | 4/7/2021 |
| Drone Applications and Technologies | Palomar | San Diego/Imperial | Associate Degree | 6/20/2018 |
| 0702.00 – Computer Information Systems | Drone Media | Merced | Central Valley/Mother Lode | Certificate | 6/10/2021 |
| 0799.00 – Other Information  Technology | Drone Technology | Santa Ana | Los Angeles/ Orange County | Certificate | 1/27/2021 |
| 0950.00 –  Aeronautical and Aviation Technology | Drone/Unmanned Aircraft Systems (UAS) Technology | Gavilan | Bay Area | Certificate | 7/19/2018 |
| Drone/Unmanned Aircraft Systems (UAS) Technology | Gavilan | Bay Area | Associate Degree | 8/6/2018 |
| Unmanned Aircraft  System Technology | West Valley | Bay Area | Certificate | 2/6/2017 |
| 1012.00 – Applied Photography | UAV/UAS Drone Photography and Video | Cypress | Los Angeles/ Orange County | Certificate | 1/17/2017 |
| Drone Camera Operator | Mt. San Antonio | Los Angeles/ Orange County | Associate Degree | 8/31/2018 |
| Drone Photography | Orange Coast | Los Angeles/ Orange County | Certificate | 2/17/2021 |
| 2206.10 –  Geographic Information Systems | Drone Technology | Diablo Valley | Bay Area | Certificate | 6/29/2020 |
| Drone Operations | Palomar | San Diego/Imperial | Certificate | 1/26/2018 |
| Getting Started with Drone Careers and  Safety | Palomar | San Diego/Imperial | Noncredit | 5/24/2021 |
| 3020.00 – Aviation and Airport Management and  Services | Unmanned Aircraft Systems | Orange Coast | Los Angeles/ Orange County | Certificate | 6/21/2019 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TOP Code/Title** | **Local Program Name** | **College** | **California Region** | **Award Type** | **CCCCO**  **Approval Date** |
| 3020.20 – Piloting | UAS Drone Basic | Cypress | Los Angeles/  Orange County | Certificate | 1/17/2017 |
| UAS Drone Advanced | Cypress | Los Angeles/ Orange County | Certificate | 1/17/2017 |
| UAS Drone | Cypress | Los Angeles/ Orange County | Associate Degree | 1/29/2017 |
| Unmanned Aircraft System | Mt. San Antonio | Los Angeles/ Orange County | Associate Degree | 3/10/2020 |
| Unmanned Aircraft  Systems | Mt. San  Antonio | Los Angeles/  Orange County | Certificate | 4/20/2020 |
| Drone Technology  and Applications | Southwestern | San  Diego/Imperial | Certificate | 4/12/2019 |
| \*4930.13 Academic Guidance | Drone Technology | Merced | Central Valley/Mother Lode | Certificate | 1/9/2020 |

Source: COCI

In addition to the programs listed in Exhibit 9, one college has a program that is currently listed as CCCCO “approved” in COCI but is not yet active. This program is Unmanned Aircraft Technology at West Valley College.

## Community College Supply

Exhibit 10 shows the three-year average number of awards conferred by community colleges in drone- related programs, which constitute the “supply.” Because awards data is collected and organized by TOP code and colleges can list multiple programs under the same TOP code, awards conferred under these TOP codes may be specifically related to drones.

However, by utilizing CCCCO tools to compare MIS Data Mart and COCI data, awards listed under the same TOP Code can be disaggregated based on the number of units the certificate requires. For example, Cypress College has five programs listed under the Applied Photography Top Code (1012.00). Only one of these programs, UAV/UAS Drone Photography and Video, requires “8 to less than 16-semester units”, so all awards conferred under this designation and TOP code are related to drones. Though this method is more accurate than listing the number of awards for all programs in a given TOP code, there are still limitations. For example, Cypress offers two AS Degree programs, UAV/UAS and Commercial Pilot, under the 3020.20 TOP code. Since these programs have the same award type, it is not possible to disaggregate the number of awards conferred in each program with Data Mart data.

It is also important to consider that all of these programs were approved in 2017 or later. Some programs, such as Drone Technology at Diablo Valley College, were approved in 2020. Based on the approval dates, no awards for these programs could have been awarded during the three years used to calculate supply.

Since awards were not conferred for this program, those colleges and programs are not included in Exhibit 10.

*Exhibit 10: Drone-related community college awards, 2017-2020*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TOP Code/Title** | **Local Program Name** | **College** | **Certificate 16 < 30**  **semester**  **units** | **Certificate 8 < 16**  **semester**  **units** | **3-Year Award Average** |
| 0950.00 – Aeronautical and Aviation Technology | Drone/Unmanned Aircraft Systems (UAS) Technology | Gavilan | 4 | - | 4 |
| 1012.00 – Applied Photography | UAV/UAS Drone Photography and Video | Cypress | - | 1 | 1 |
| **Total** | | | **4** | **1** | **5** |

Source: COCI, Data Mart

## Community College Drone Courses in California

While there are 11 community colleges that offer drone programs, there are 36 community colleges that offer 104 drone-related courses in California, according to COCI. These courses are listed under 28 different TOP codes, ranging from Piloting (3020.20) to Journalism (0602.00). While the number of students and enrollments in these courses are not considered part of traditional supply data, they demonstrate drones’ diverse applications across a number of areas. Because drone job ads typically require or request knowledge in a traditional field, a student with a background in another area, such as photography, programming, or surveying, could complete a drone course to add drone skills and become eligible for those jobs. While these students may not complete a drone program, they could be considered part of the supply of qualified workers. However, individual course data is not available in Data Mart, so the COE cannot quantify the number of students enrolled in these courses. Additionally, these courses may be reflective of interdisciplinary partnerships across departments and highlight the importance of base knowledge in a traditional field to complement drone skills. Exhibit 11 lists all the drone-related courses throughout the state. It is important to note that these courses include only those that are listed in COCI. TOP code/titles with a leading “\*” symbol are not career education courses.

*Exhibit 11: Drone-related community college courses*

|  |  |  |  |
| --- | --- | --- | --- |
| **TOP Code/Title** | **College** | **Local Program Title** | **Region** |
| 0602.00 – Journalism | Fullerton | Federal Aviation Administration Drone Pilot  Test Preparation | Los Angeles/  Orange County |
| 0604.20 – Television (including combined TV/Film/Video) | Santa Ana | Drone Cinematography & Editing | Los Angeles/ Orange County |
| Drone Pilot License Test Prep |
| Drone Pilot Training |
| 0612.20 – Film  Production | West L.A. | Camera Operation for Unmanned Aircraft Systems | Los Angeles/ Orange County |
| 0614.00 – Digital Media | Coastline | Drone Imaging 1 | Los Angeles/ Orange County |
| Drone Imaging 2 |

|  |  |  |  |
| --- | --- | --- | --- |
| **TOP Code/Title** | **College** | **Local Program Title** | **Region** |
| 0614.10 – Multimedia | Ohlone | Commercial Drone Imaging | Bay Area |
| Orange Coast | Drone Imaging for Immersive Media | Los Angeles/ Orange County |
| Butte | Introduction to Drone Management and Operations | Far North |
| Drone Video and Photography |
| 0614.60 – Computer Graphics and Digital Imagery | Santa Rosa | Drone Piloting and Imaging | Bay Area |
| Applied Drone Projects |
| 0699.00 – Other Media and  Communications | Palomar | Digital Imaging with Drones | San Diego/Imperial |
| 0701.00 – Information Technology, General | Mission | Introduction to Drones and Unmanned Aerial Vehicles | Los Angeles/ Orange County |
| 0702.00 – Computer Information Systems | Santiago Canyon | Introduction to UAS History and Operations | Los Angeles/ Orange County |
| Siskiyous | The Drone Academy | Far North |
| Merced | Introduction to Drones | Central Valley/Mother Lode |
| Federal Aviation Administration Drone Pilot Test Preparation |
| Drone Media I |
| Drone Media II |
| 0707.10 – Computer Programming | Merced | Drone Technology I | Central Valley/Mother Lode |
| Drone Technology II |
| Orange Coast | Introduction to UAS Automation | Los Angeles/ Orange County |
| 0799.00 – Other Information Technology | Santa Ana | Introduction to Drones | Los Angeles/ Orange County |
| \*0901.00 Engineering, General (requires  Calculus) (Transfer) | San Mateo | Introduction to Drone-Based Science and Engineering | Bay Area |
| 0924.00 – Engineering Technology, General (requires Trigonometry) | Moorpark | Introduction to Unmanned Aerial Vehicle Technology | South Central |
| 0934.00 – Electronics and Electric Technology | Fullerton | Basic Drone Piloting | Los Angeles/ Orange County |
| 0935.00 – Electro- Mechanical Technology | Santa Ana | Introduction to Autonomous Control and  Drones | Los Angeles/ Orange County |
| Payload and Sensors for The Manufacturing of Autonomous Drones |
| Repair and Troubleshooting of Autonomous Drones |
| 0950.00 – Aeronautical and Aviation Technology | Glendale | Introduction to Unmanned Aerial Vehicles | Los Angeles/ Orange County |
| Introduction to Unmanned Aerial Systems |
| Palomar | Digital Imaging with Drones II | San Diego/Imperial |
| West Valley | Introduction to Unmanned Aircraft Systems | Bay Area |
| UAS Image Analysis and Visualization |
| UAS Flight Operations and Flight Planning |

|  |  |  |  |
| --- | --- | --- | --- |
| **TOP Code/Title** | **College** | **Local Program Title** | **Region** |
|  |  | Drone Videography and Photography |  |
| Gavilan | Introduction to Drones | Bay Area |
| Drone Flight Operations and Pilot  Certification |
| Drone Aerial Photography and Videography |
| Drone Maintenance Technician |
| Advanced Drone Aerial Photography and Cinematography |
| Data Acquisition, Mapping, And Surveys with Drones |
| Drones in Business and Industry |
| Drones in Agriculture |
| West L.A. | Introduction to Unmanned Aircraft Systems | Los Angeles/ Orange County |
| Introduction to Unmanned Aircraft Systems Lab |
| Fullerton | Counter Drone Operations | Los Angeles/ Orange County |
| 0953.30 – Electrical, Electronic, and Electro- Mechanical Drafting | Cerritos | Introduction to Drone Technology | Los Angeles/ Orange County |
| 0956.00 –  Manufacturing and  Industrial Technology | San Diego City | Stem Drone Building | San Diego/Imperial |
| 0999.00 – Other Engineering and Related Industrial Technologies | Fullerton | Applied Drone Piloting | Los Angeles/ Orange County |
| Applied Drone Lab |
| Solano | Basics of Drone Operations | Bay Area |
| Introduction to Drones |
| Drone Photography and Video |
| 1012.00 – Applied Photography | Cypress | Drone Photography and Video | Los Angeles/ Orange County |
| UAV Flight Lab - Photography |
| San Francisco City | Beginning Drone Piloting and Imaging | Bay Area |
| Mt. San Antonio | Drone Basic Still and Motion Camera Operator | Los Angeles/ Orange County |
| Drone Photogrammetry and Mapping |
| Drone Inspection and Thermal Imaging |
| Drone Advanced Still and Motion Camera Operator |
| Glendale | Drone Photography and Video | Los Angeles/ Orange County |
| Southwestern | Drone Aerial Photography & Cinematography | San Diego/Imperial |
| Santa Ana | Drones for Mapping | Los Angeles/  Orange County |
| \*1509.00 Philosophy | Cabrillo | Clones, Drones, The 99% And Other Moral Conundrums For The 21st Century | Bay Area |

|  |  |  |  |
| --- | --- | --- | --- |
| **TOP Code/Title** | **College** | **Local Program Title** | **Region** |
| \*1902.00 Physics, General | Napa Valley | Theory and Experimentation with Drones and Rockets | Bay Area |
| Rio Hondo | Unmanned Rocket Science | Los Angeles/ Orange County |
| Chabot | Introduction to Unmanned Flight & Rocket Science | Bay Area |
| San Mateo | Introduction to Drone-Based Science and  Engineering | Bay Area |
| 2105.00 –  Administration of Justice | Santa Ana | Introduction to Drone Laws | Los Angeles/ Orange County |
| Canyons | Small Unmanned Aircraft Systems (SUAS) In Public Safety | Los Angeles/ Orange County |
| 2105.50 – Police Academy | Santa Ana | Building A Public Safety Drone Program | Los Angeles/ Orange County |
| Drones for First Responders |
| 2206.10 – Geographic Information Systems | Palomar | Introduction to Drone Safety and Applications | San Diego/Imperial |
| Small Unmanned Aircraft Systems Procedures and Regulations |
| Careers in The Drone Industry |
| Southwestern | Introduction to Drone Safety and Applications | San Diego/Imperial |
| Palomar | Introduction to Remote Sensing and Drone Data Processing | San Diego/Imperial |
| Diablo Valley | Drone Remote Sensing and Mapping | Bay Area |
| Drone Operations and Piloting |
| Rio Hondo | Small Unmanned Aircraft Systems Procedures and Regulations | Los Angeles/ Orange County |
| 3020.00 – Aviation and Airport Management and  Services | Sacramento City | Remote Pilot - Small Unmanned Aircraft Systems | Greater Sacramento |
| Orange Coast | Introduction to Unmanned Aircraft Systems | Los Angeles/  Orange County |
| 3020.20 – Piloting | Cypress | UAS Drone Basic | Los Angeles/ Orange County |
| UAS Drone Basic Flight |
| UAS Drone Advanced |
| UAS Drone Advanced Flight |
| UAS Drone Basic Simulator |
| UAS Drone Advanced Simulator |
| Reedley | Remote Pilot Ground School for Small Unmanned Aircraft Systems (SUAS) | Central Valley/Mother Lode |
| Orange Coast | Unmanned Aircraft Systems Lab | Los Angeles/ Orange County |
| Mt. San Antonio | Unmanned Aircraft Systems Advanced | Los Angeles/ Orange County |
| Unmanned Aircraft Systems Basic |
| Fullerton | Advanced Drone Piloting Skills | Los Angeles/ Orange County |
| Southwestern | Introduction to Drone Technology and Applications | San Diego/Imperial |

|  |  |  |  |
| --- | --- | --- | --- |
| **TOP Code/Title** | **College** | **Local Program Title** | **Region** |
|  |  | Introduction to Drone Technology and Applications |  |
| Orange Coast | Unmanned Aircraft Systems Advanced Lab | Los Angeles/ Orange County |
| Introduction to UAS Automation |
| West Hills Coalinga | Survey of Unmanned Aerial Systems | Central Valley/Mother Lode |
| 3099.00 – Other Commercial Services | Citrus | Drone Pilot License | Los Angeles/ Orange County |
| Drone Mapping |
| Commercial Drone Applications & Flight Training |

Source: COCI

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# Appendix: Methodology

Job advertisement data is limited to the information provided by employers and the ability of artificial intelligence search engines to identify this information. Additionally, preliminary calculations by Georgetown Center on Education and the Workforce found that "just 30 to 40 percent of openings for candidates with some college or an associate degree, and only 40 to 60 percent of openings for high school diploma holders appear online" (Carnevale et al., 2014). Online job advertisements often do not reveal employers' hiring intentions; it is unknown if employers plan to hire one or multiple workers from a single online job ad or collect resumes for future hiring needs. A closed job ad may not be the result of a hired worker.

### Keywords used in the Burning Glass search:

* UAV operator
* UAS Operator
* UAV pilot
* UAS pilot
* unmanned aircraft system operator
* unmanned aircraft system pilot
* unmanned aerial vehicle operator
* unmanned aerial vehicle pilot
* drone operator
* drone pilot
* unmanned aerial system operator
* unmanned aerial system pilot
* unmanned aircraft vehicle operator
* unmanned aircraft vehicle pilot
* autonomous pilot
* drone technician
* drone operations
* drone photography
* aerial cinematography
* UAS technician
* sUAS
* part 107 pilot
* UAV technician
* UAV mechanic
* UAS mechanic
* drone
* drone videographer
* GIS drone