

Unmanned Aircraft Systems (Drone) Operator

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

Introduction

The Inland Empire/Desert Center of Excellence for Labor Market Research prepared this report to provide regional labor market supply and demand data related to unmanned aerial vehicles (UAV), more commonly known as drones. While drones were originally developed for military applications, 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.¹ Geographic Information Systems (GIS) specialists use drones to provide more detailed and timely aerial images for quicker analysis when compared to satellite imagery.²

Notable applications of drone technology within California include drone deployments by police and fire departments. The Chula Vista Police Department (CVPD) has used drones to respond to 911 calls and other emergencies since 2018 under its Drones as a First Responder (DFR) program. CVPD has increased its ability to operate its drones throughout the city, obtaining FAA permission to launch from anywhere in the city and to launch more than one drone from a single launch site.³ Additionally, NASA researchers based in Silicon Valley monitored the use of drones to fight wildfires in Northern California in 2021.⁴

As of December 2015, the FAA began requiring all commercial UAV pilots to have a Remote Pilot Certificate in accordance with the FAA's Small UAS Rule (Part 107), commonly referred to as a "Part 107 license." A Remote Pilot Certificate license requires that applicants pass an aeronautical knowledge exam. Alternatively, pilots that hold a pilot certificate issued under FAA 14 CFR Part 61 and completed a flight review within the last 24 months are eligible to obtain a Remote Pilot Certificate after completing an online training course. Once the Remote Pilot Certificate is obtained, pilots must complete an online recurrent training course every 24 months.⁵ In addition to a Part 107 license, all UAVs, except those that weigh 0.55 pounds or less, must be registered with the FAA.⁶ According to FAA data, 6,609 Part 107 pilots are registered in the Inland Empire/Desert Region.⁷

¹ <https://www.forbes.com/sites/stephenrice1/2019/10/07/10-ways-that-police-use-drones-to-protect-and-serve/?sh=3ae3e8456580>

² <https://www.esri.com/about/newsroom/arcuser/uav-and-gis-an-emerging-dynamic-duo/>

³ <https://www.chulavistaca.gov/departments/police-department/programs/uas-drone-program>

⁴ <https://www.nasa.gov/feature/at-california-blazes-nasa-team-observes-how-drones-fight-wildfire>

⁵ https://www.faa.gov/uas/commercial_operators/become_a_drone_pilot

⁶ https://www.faa.gov/uas/getting_started/register_drone

⁷ https://www.faa.gov/foia/electronic_reading_room/uas#registrants

The United States Bureau of Labor Statistics (BLS) has not identified a drone technology occupation (i.e., drone pilots, drone technicians, or drone photographers) in their Standard Occupational Classification (SOC) system; therefore, traditional occupational demand and earnings data for drone technology jobs do not exist. To better understand the need for drone knowledge, skills, and abilities (KSAs), this report analyzes online job advertisements (ads) in the region for drone-related jobs.

In addition to analyzing online job ads, this report also provides an overview of drone programs offered at community colleges throughout California. While four-year and other non-community college institutions may offer drone programs and courses, there is no 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 of Findings

Based on the available data, there appears to be a need for regional drone operators; however, it is difficult to quantify that need. While demand is typically defined as the number of annual job openings for a set of occupations, drone operators can be classified into various occupations. However, not all positions within those occupations may require drone skills, so traditional demand data would likely overstate the demand for drone operators. 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 accurately count job openings. For example, employers may list jobs they do not end up filling or 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:

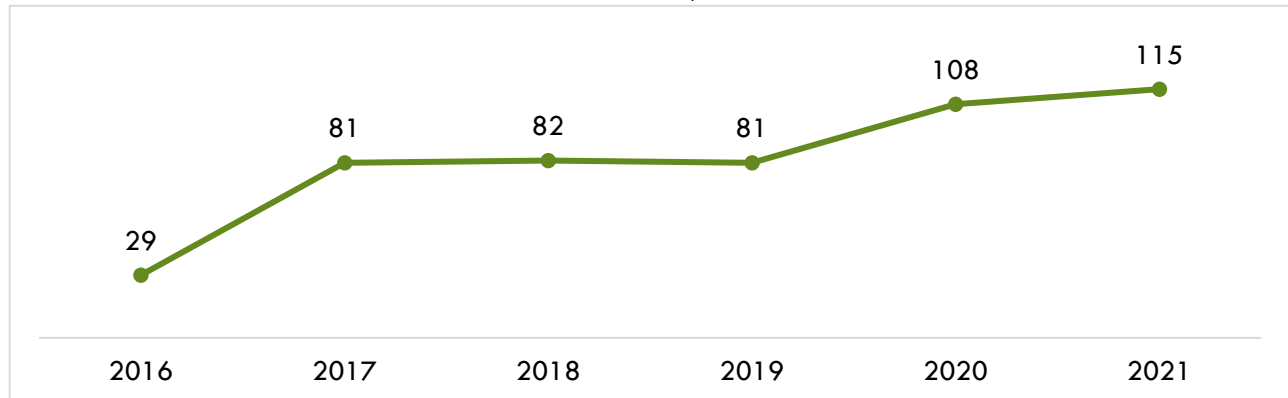
- Over the past 12 months, 78 online job ads for drone operators in the Inland Empire/Desert Region were posted.
 - Overall, online job ad salary information reveals that employers are willing to pay these positions \$60,000 annually, above the \$45,386 annual (\$21.82 hourly) MIT living wage standard for the region.
 - The top five job families accounted for 87% of all job ads posted over the last 12 months in the region (Architecture and Engineering, Arts, Design, Entertainment, Sports, and Media, Management, Transportation and Material Moving, and Computer and Mathematical).
 - Within job ads, 62% (48 ads) included a minimum level of education, of which 48% (23 ads) requested a high school diploma or vocational training, 12% (6 ads) requested an associate degree, and 40% (19 ads) requested a bachelor's degree.
- Over the last 12 months, 4,267 online job ads were posted for drone operators in California.

- Of the drone applications analyzed in this report, most job ads were posted for surveying and construction drone operators, followed by real estate and film drone operators. Job ads show limited demand for agricultural drone operators, geographic information systems drone operators, and protective services drone operators.
- There are 15 community colleges throughout California that have drone-related programs. Mt. San Jacinto College is the only regional community college currently offering a program related to drones.
 - All drone programs were approved in 2017 or later, so program outcome data is limited for statewide drone programs.

Job Advertisements

A job ad search was conducted to determine the regional demand for drone operators. Keyword, job title, occupation, and employer filters were applied to the search to ensure that the information included in this report is specific to drone operator positions. Over the last twelve months, there were 78 job ads posted for drone workers in the region. Exhibit 1 displays the number of job ads posted each year for drone jobs from 2016 through 2021. Between 2016 and 2021, regional job ads for drone operators increased by 297%, indicating that demand for drone operators is rising.

Exhibit 1: Annual job ads for drone operators, Inland Empire/Desert Region, 2016-2021



Source: Burning Glass – Labor Insights

Drone operator job ads were spread across numerous industries and occupations since drones can be used in a variety of roles. To provide insight into the types of positions sought by employers posting job ads for drone operators, the job ad information displayed in Exhibit 2 is separated by job families. Exhibit 2 displays the job families with the most job ads posted for drone operators over the last twelve months in the region.

The top five job families accounted for 87% of all job ads posted over the last 12 months in the region. 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."⁸

Exhibit 2: Job ads by job family for drone operator positions, Inland Empire/Desert Region, September 2021 - August 2022

Job Family (Sample Job Title)	Job Ads
Architecture and Engineering (Site Surveyor)	33
Arts, Design, Entertainment, Sports, and Media (Real Estate Photographer)	14
Management (Land Survey Manager)	9
Transportation and Material Moving (Drone Pilot)	7
Computer and Mathematical (Solutions Engineer – Imagery & Remote Sensing)	5
All other job families	10
Total	78

Source: Burning Glass – Labor Insights

Advertised Salary from Online Job Ads

Exhibit 3 displays online job ad salary data for drone operators over the last 12 months. Online job ad salary information reveals employers are willing to pay drone operators \$60,000 annually, above the \$45,386 annual (\$21.82 hourly) living wage standard. Consider the salary information cautiously since only 49% (38 out of 78) of online job ads provided salary information. The salary figures are prorated to reflect full-time, annual wage status.

Exhibit 3: Advertised salary information for drone operators, Inland Empire/Desert Region, September 2021 - August 2022

Number of job ads	Real-Time Salary Information				Average Annual Salary
	Less than \$35,000	\$35,000 to \$49,999	\$50,000 to \$74,999	More than \$75,000	
38	11%	45%	26%	18%	\$60,000

Source: Burning Glass – Labor Insights

Job Titles, Employers, Skills, Education, and Work Experience

Exhibit 4 displays the job titles most frequently requested for drone operator jobs over the last 12 months in the Inland Empire/Desert Region. Job titles may provide insight into the types of positions held by drone operators. Site surveyor was the most frequently requested job title for regional drone operators, followed by real estate photographer.

⁸ <https://www.onetonline.org/find/family>

Exhibit 4: Job titles most frequently requested for drone operators, Inland Empire/Desert Region, September 2021 - August 2022

Job Titles	Job Ads
Site Surveyor	9
Real Estate Photographer	8
Site Survey Technician	6
Drone Pilot	5
Solar Site Surveyor	4
Land Survey Manager	4
Survey Party Chief	4
Videographer & Photographer	3
Remote Sensing and UAS Advisor (On-Site)	3
Media Production Manager	2
Field Operations Technician	2
Digital Journalist	2
Avionics Technician	2
Tower Technician	2
Solutions Engineer – Imagery & Remote Sensing	2
<i>All other job titles</i>	20
Total	78

Source: Burning Glass – Labor Insights

Exhibit 5 displays the employers that posted the most job ads in the region during the last 12 months. Showing employer names provides insight into where students may find employment after completing a program.

Sunrun, a home solar panel and battery storage company, posted the most job ads for drone operators over the last 12 months, primarily seeking site surveyors.

Exhibit 5: Employers posting the most job ads for drone operator jobs, Inland Empire/Desert Region, September 2021 - August 2022

Top Employers	Jobs Ads
Sunrun	6
VRX Media Group	4
Michael Baker International	4
Kiewit Corporation	4
General Atomics	4
EmPower Solar	4
Edison International	4

Top Employers	Jobs Ads
ADT Solar	4
CDM Smith	3
All other employers	41
Total	78

Source: Burning Glass – Labor Insights

Exhibit 6 lists a sample of specialized, employability, and software and programming skills employers seek when looking for drone operators. 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 ads may be utilized to guide curriculum development.

Exhibit 6: Sample of in-demand skills from employer job ads for drone operators, Inland Empire/Desert Region, September 2021 - August 2022

Specialized Skills (n=76)	Employability Skills	Software and Programming Skills
<ul style="list-style-type: none"> • Photography • Customer Service • Scheduling • Field Surveys • Videography 	<ul style="list-style-type: none"> • Communication Skills • Computer Literacy • Teamwork/Collaboration • Physical Abilities • Writing 	<ul style="list-style-type: none"> • Microsoft Office

Source: Burning Glass – Labor Insights

Exhibit 7 displays the minimum advertised education requirements for drone operators. Approximately 48% of employers sought drone workers with a high school diploma or vocational training.

Exhibit 7: Minimum advertised education requirements for drone operators, Inland Empire/Desert Region, September 2021 - August 2022

Number of Job Ads	Real-Time Minimum Advertised Education Requirement		
	High school or vocational training	Associate degree	Bachelor's degree or higher
48	48%	12%	40%

Source: Burning Glass – Labor Insights

Exhibit 8 displays the real-time work experience requirements from employer job ads. Half of the employers posting job ads for drone operators sought candidates with zero to two years of previous work experience.

Exhibit 8: Real-time work experience requirements, Inland Empire/Desert Region, September 2021 - August 2022

Real-Time Work Experience			
Number of job ads	0 – 2 years	3 – 5 years	6+ years
58	50%	28%	22%

Source: Burning Glass – Labor Insights

Certifications

Exhibit 9 displays the certifications required by employers posting job ads for drone operators in the region. A driver's license was the most frequently requested certification posted for drone operators over the last 12 months. Remote Pilot Licenses, or Part 107 licenses, were included in approximately 6% (5 ads) of drone operator job ads.

Exhibit 9: Certification requirements in job ads, Inland Empire/Desert Region, September 2021 - August 2022

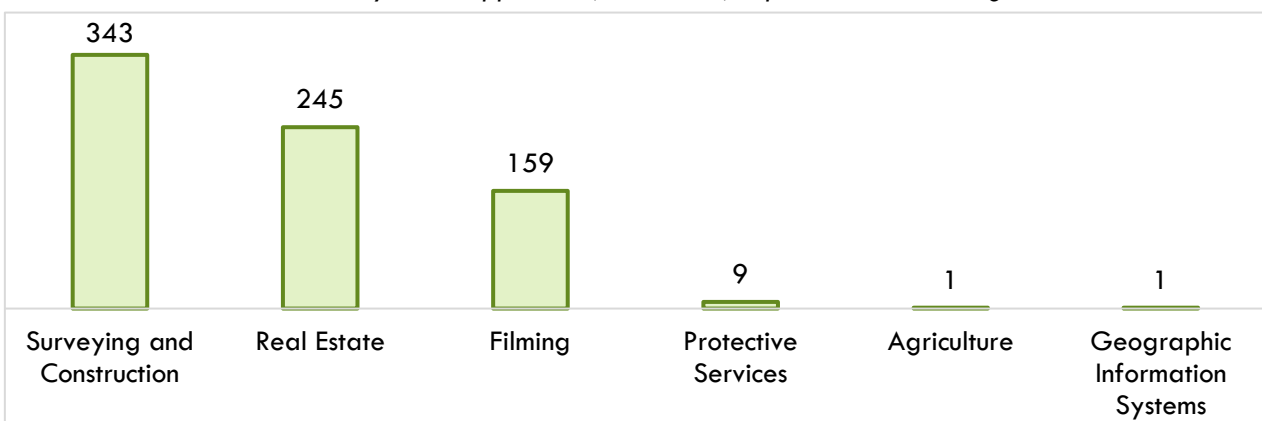
Certifications (n=43)	Jobs Ads
Driver's License	30
Remote Pilot License	5

Source: Burning Glass – Labor Insights

Drone Applications

This section of the report details online job ad demand for applications of drone technology, such as agriculture, filming, geographic information systems, protective services, and surveying and construction. To ensure the job ad information in this report is reliable and generalizable, the job ad search for drone applications was expanded to include all drone operator job ads posted in California over the last 12 months. Over this period, 4,267 drone operator job ads were posted in the state. Exhibit 10 displays the number of job ads posted by application over the last 12 months in California.

Exhibit 10: Job advertisements by drone application, California, September 2021 - August 2022



Source: Burning Glass – Labor Insights

Job ads reveal that demand for drone operators is geographically concentrated in the state's coastal metropolitan statistical areas (MSAs), with approximately 82% of statewide drone operator job ads posted in San Diego-Carlsbad MSA (1,336 ads), Los Angeles-Long Beach-Anaheim MSA (1,039 ads), San Francisco-Oakland-Hayward MSA (646 ads), and San Jose-Sunnyvale-Santa Clara (463 ads).

Agriculture

Drones can be used in agriculture to gather data for precision agriculture as well as to spray seeds and fertilize crops.⁹ Through the utilization of an industry filter, the search for agricultural drone operators was limited to ads posted in the agriculture, forestry, fishing, and hunting industry over the last 12 months in California. Over this period, only one job ad was posted for drone operators in the agriculture industry. Central Coast Agriculture, a farm focused on utilizing science and sustainability to grow crops, posted an ad for a cultivation engineering coordinator with drone operation experience. This position requires the use of drone technology to scan properties and track crop development. Central Coast Agriculture sought a cultivation engineering coordinator with a bachelor's degree and three to five years of previous work experience. There were too few job ads for drone operators in the agriculture industry to provide generalizable skills information.

Filming (Photography/Videography)

Drones are popular in the film industry because they provide a reduced cost for aerial footage compared to helicopters, and they can film in confined spaces.¹⁰ To limit the job ads to positions that utilize drone technology for photography and videography, an arts, design, and entertainment occupation filter was applied to this search. Over the last 12 months, there were 159 job ads posted for film drone operators. The job titles most frequently included in job ads for film drone operators were wedding photographer/videographer, photographer, and videographer. The employers posting the most job ads for film drone operators were Kapturly, Nexstar Media Group, and Fotofetch.

Approximately 50% of employers sought film drone operators with a bachelor's degree, 38% sought candidates with a high school diploma or vocational training, and 12% sought candidates with an associate degree. Two-thirds (66%) of employers sought film drone operators with zero to two years of previous work experience. The average annual salary for film drone operators was \$99,000 annually, above the \$45,386 annual (\$21.82 hourly) living wage standard. The skills in greatest demand for film drone operators were editing, photography, videography, creativity, and video production.

⁹ <https://enterprise-insights.dji.com/blog/drones-in-agriculture>

¹⁰ <https://www.nfi.edu/drone-filming/>

Geographic Information Systems

The geographic information systems (GIS) industry significantly benefits from drone technology because UAVs make geospatial data collection less expensive and more accessible.¹¹ Over the last 12 months, only one job ad was posted for a drone operator geographic information systems technologist and technician in California. Helix Environment Planning, an environmental consulting firm, posted one job ad for a GIS Specialist I, to use drone imagery to develop maps and assist in environmental planning. This position requires individuals to have a bachelor's degree and one year of experience working with Esri software. There were too few job ads for GIS drone operators to provide generalizable skills information.

Protective Services

As previously stated, there is evidence that police and fire departments utilize drone technology to assist in the provision of protective services. A job ad search for drone operators in protective services occupations was conducted to reveal the demand for these workers in the state. Over the last 12 months, there were nine job ads posted for protective services drone operators. U.S. Customs and Border Protection posted seven job ads, and two job ads were posted by municipal police departments. U.S. Customs and Border Protection sought air interdiction agent drone operators, while the municipal police departments sought police officer drone operators.

The police officer job ads sought individuals with a high school diploma, while air interdiction agents did not include minimum education requirement information. Employers sought candidates with zero to two years of previous work experience. Average advertised salary information is not available for protective services drone operators. The skills in greatest demand for protective service drone operators were surveillance, record keeping, law enforcement, aviation law, and information systems.

Real Estate

Drone technology is frequently used in real estate marketing because agents can show the property from many unique angles, allowing the prospective buyer to view not only the house, the roof and yard, but also the surrounding neighborhood and views.¹² Through the utilization of a keyword filter, the search for drone operators was limited to real estate positions. Over the last 12 months, there were 245 job ads for real estate drone operators. The job titles most frequently included in job ads were real estate photographer, freelance videographer, and real estate videographer. The employers posting the most job ads for real estate drone operators were Blue Sky Photography, VRX Media Group, Ignite Now Media, Homesell Photography, and Aerial Canvas.

¹¹ <https://ellipsis-drive.com/blog/drones-and-their-impact-on-gis-mapping/>

¹² <https://www.nar.realtor/drones>

Approximately 73% of employers sought real estate drone operators with a high school diploma or equivalent. More than half (55%) of employers sought real estate drone operators with zero to two years of previous work experience. The average annual salary for real estate drone operators was \$64,000 annually, above the \$45,386 annual (\$21.82 hourly) living wage standard. The skills in greatest demand were photography, real estate experience, videography, organizational skills, and creativity.

Surveying and Construction

Drones are used in surveying and construction because they can generate high-resolution images and high-accuracy data, much faster and less expensive than other methods.¹³ Through the utilization of an occupation filter, the search for drone operators was limited to positions using drones for surveying and construction. Over the last 12 months, there were 343 job ads for drone operators working in surveying and construction. The job titles most frequently included in job ads were site survey technician, land survey manager, site surveyor, and solar site surveyor. The employers posting the most job ads for surveying and construction drone operators were Sunrun, Kiewit Corporation, and Michael Baker International.

Approximately 50% of employers sought surveying drone operators with a high school diploma or equivalent, 43% sought candidates with a bachelor's degree or higher, and 7% sought candidates with an associate degree. More than half (54%) of employers sought surveying drone operators with zero to two years of previous work experience. The average advertised annual salary for survey drone operators was \$65,000, above the \$45,386 annual (\$21.82 hourly) living wage standard. The skills in greatest demand were land surveys, field surveys, calculation, customer service, and project management.

Training Programs

Mt. San Jacinto College is the only regional community college to offer a program related to drones. Mt. San Jacinto College's Drone Applications in Geospatial Information Science was approved in August 2022 and utilizes the geographic information systems program code (TOP 2206.10). Due to the recent approval of this program, program completions and outcome data are unavailable for Mt. San Jacinto's drone applications in geographic information systems program. Mt. San Jacinto is one of three community colleges in the state that utilizes the geographic information systems program code (2206.10).

Three regional community colleges currently offer geographic information systems programs. Over the last three academic years (2018-2021), two regional community colleges issued five awards annually in geographic information systems programs. Over this period, regional geographic information systems programs did not include instruction related to drone operation.

¹³ <https://wingtra.com/drone-mapping-applications/surveying-gis/>
Drone Operators in the Inland Empire/Desert Region, September 2022

According to the Chancellor's Office Curriculum Inventory (COCI), an inventory provided by the CCCCCO, there are 15 community colleges that currently offer drone-related programs throughout the state. The majority of programs are located in the Los Angeles/Orange County Region, with eight colleges offering drone programs; four colleges in the San Francisco Bay Area Region offer drone programs, and one college in the Central Valley/Mother Lode Region, Inland Empire/Desert Region, San Diego/Imperial Region currently offer programs related to drones. Exhibit 10 lists each drone program and the award type students earn upon successful completion of the program. All drone programs were approved in 2017 or later, so program outcome data is limited for statewide drone programs.

Exhibit 11: Drone-related programs, California, 2022

Region	College	Top Code	Local Program Title	Award	Approved Date	
Central Valley/ Mother Lode	Merced	Computer Information Systems (0702.00)	Drone Media	Certificate	6/10/2021	
		Academic Guidance (4930.13)	Drone Technology	Certificate	1/9/2020	
Inland Empire/ Desert Region	Mt. San Jacinto	Geographic Information Systems (2206.10)	Drone Applications in Geospatial Information Science	Certificate	8/26/2022	
Los Angeles/ Orange County	Citrus	Other Commercial Services (3099.00)	Drone Technology	Noncredit program	5/12/2022	
	Cypress	Applied Photography (1012.00)	UAV/UAS Drone Photography and Video	Certificate	1/17/2017	
		UAS Drone	A.S. Degree	1/29/2017		
		Piloting (3020.20)	UAS Drone Advanced	Certificate	1/17/2017	
		UAS Drone Basic	Certificate	1/17/2017		
	Fullerton	Journalism (0602.00)	Drone Journalism	Certificate	7/23/2021	
	Glendale	Applied Photography (1012.00)	Drone Photography	Certificate	3/28/2022	
Los Angeles/ Orange County	Mt. San Antonio	Applied Photography (1012.00)	Drone Camera Operator	A.S. Degree	8/31/2018	
		Piloting (3020.20)	Unmanned Aircraft System	A.S. Degree	3/10/2020	
	Orange Coast		Film Production (0612.20)	Drone Videography	Certificate	2/17/2021
			Digital Media (0614.00)	Basic Drone Imaging Skills	Certificate	4/7/2021
			Applied Photography (1012.00)	Drone Photography	Certificate	2/17/2021
			Aviation and Airport Management and Services (3020.00)	Unmanned Aircraft Systems	Certificate	6/21/2019

Region	College	Top Code	Local Program Title	Award	Approved Date
	Santa Ana	Television (including combined TV/Film/Video) (0604.20)	Drone Cinematography	Certificate	2/24/2022
		Other Information Technology (0799.00)	Drone Technology	Certificate	1/27/2021
	Southwestern	Environmental Studies (0302.00)	Drone Technology and Applications	Noncredit program	2/19/2021
		Piloting (3020.20)	Drone Technology and Applications	Certificate	4/12/2019
San Diego/Imperial	Palomar	Film Production (0612.20)	Drone Operator I	Certificate	7/14/2021
		Digital Media (0614.00)	Drone Applications and Technologies	A.S. Degree	6/20/2018
		Geographic Information Systems (2206.10)	Drone Operations	Certificate	1/26/2018
		Geographic Information Systems (2206.10)	Getting Started with Drone Careers and Safety	Noncredit program	5/24/2021
San Francisco Bay Area	Diablo Valley	Geographic Information Systems (2206.10)	Drone Technology	Certificate	6/29/2020
	Las Positas	Applied Photography (1012.00)	Drone Photography, Mapping, and Piloting	Noncredit program	4/20/2022
	Los Medanos	Aeronautical and Aviation Technology (0950.00)	Basic Drone Piloting	Noncredit program	3/3/2021
	West Valley	Aeronautical and Aviation Technology (0950.00)	Unmanned Aircraft System Technology	Certificate	2/6/2017
Unmanned Aircraft Technology		Unmanned Aircraft Technology	A.S. Degree	9/3/2021	

Source: COCI

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Appendix: Methodology

Job ad 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 ads 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 collecting resumes for future hiring needs

Keywords used in job advertisement search:

- Drone
- UAV
- UAS
- Unmanned Aircraft System
- Unmanned Aerial Vehicle
- Drone Operator
- Drone Pilot
- Unmanned Aerial System
- Unmanned Aircraft Vehicle
- Autonomous Pilot
- Aerial Cinematography
- Part 107 Pilot