ASIAN SKY

China GA Report

2021

SPECIAL FEATURES

CHINA AVIATION EMERGENCY RESCUE

AVIATION SAFETY MANAGEMENT SYSTEM

DRONE APPLICATIONS

PRODUCT SPOTLIGHTS AND INTERVIEWS

星雅航空 Astro Air

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EDITOR'S NOTE

The rampant spread of the COVID-19 pandemic at the beginning of 2020 hit the civil and general aviation industry hard. Following the unremitting efforts to combat the pandemic, the general aviation industry has rapidly recovered since April 2020. Flight hours saw a "V" shaped recovery, with GA flight hours in the second half of the year surpassing that of last year's corresponding period. Although overall flight hours slightly dipped compared to 2019, the growth momentum has continued in 2021. The data in the first half of 2021 reached a record high.

2020 was the last year of the 13th Five-Year Plan (the Central Government blueprint for China's social and economic policies from 2016 to 2020). The whole industry has a long way to go to achieve the goal of that Plan - "establishing 5,000 GA aircraft, 500 GA airports and accumulating more than two million flight hours". We think that consumers and market demands play an important role in the development of general aviation. Some progress was achieved during the past five years, but the supply of GA consumer products still has limitations in airspace, infrastructure, etc. 2021 is the initial year of the 14th Five-Year Plan. These policies will guide China's endeavors in the right direction to motivate the effective and high-level development of the industry by strengthening its impetus.

In addition to paying attention to the annual trend of flight hours, the amount of GA aircraft and businesses, as well as other macro-economic data, this year's China GA report also delves into more details on the latest policies and guidelines from the Central and local governments, as well as other related regulatory bodies. We have detailed breakdowns of GA aircraft, including helicopters, turboprops, pistons, and business jets, as well as fleet analysis regarding various aspects. The data we present, alongside our findings, will help readers gain a better understanding of China's GA market.

The manufacturing of general aircraft and construction of infrastructure facilities are the cornerstone of general aviation development, and that is why we have introduced them in separate sections. We believe pilot training is one of the key missions of general aviation, therefore we have also looked into closer detail at the structure and development trends of training schools and pilots.

This year's China GA report also includes several special features:

Astro Air came into the spotlight in recent years with its comprehensive one-stop solutions. Its multi-business sphere and innovative manner won it many new customers. Asian Sky Media interviewed JJ Chen, Founder, President, and CEO of Astro Air who shared his exclusive views and latest industry developments.

Production Safety is a priority in the aviation industry. Safety Management Systems are always evloving, so with this in mind, we have included a special feature on it. We took Sino Jet, the first and only business jet operator in mainland China to not only become accredited to IS-BAO Stage 3, but also to renew it, as an example to study.

Relying on its high speed and mobility, aviation emergency has an edge in emergency aid. A well-structured aviation aid system is fundamentally important for people's wellbeing and the development of the national economy. Asian Sky Group prioritized key development of Chinese aviation aid and interviewed the first national aviation aid team – Chinese Aviation Emergency Rescue.

Possessing high flexibility, low cost, and anti-interference, UAVs can execute risky missions. As such, they have slowly started to emerge in the aviation industry. It is fair to say that drones represent the future development of general aviation. Asian Sky Group presents a special feature on the application of industrial drones and further introduced drone applications in areas like security, environmental monitoring, emergency, agriculture, powerline and oil inspection, as well as cargo and geographical mapping.

Bell Helicopter introduces their light single-engine multi-mission helicopter – the Bell 505, as well as its operational situation globally. Dassault Aviation proudly presents the extraordinary design, technology and innovation of their long-range section – the premier Falcon 6X.

Sincerely,
Casper Zhuang
Commercial Operations Manager, Asian Sky Group

EXECUTIVE SUMMARY

- As of June 2021, the total number of General Aviation aircraft operating in China reached 3,066, an increase of 4% compared to the end of 2020. There were 454 general aviation companies - a deduction of two compared to 2020. Despite seeing a continuous increase in the number of general aviation aircraft, it is the first time general aviation companies have decreased since 2014.

- There were 1,583 turboprops and piston fixed-wing aircraft, accounting for 52% of the total general aviation fleet. 1,049 helicopters and 360 business jets made up 34% and 12% of the total fleet respectively, whilst other types of aircraft accounted for the remaining 2%.

- In 2020, general aviation aircraft flew around 980,000 hours, equivalent to a decline of 8% compared to 2019. In 2021, as the COVID-19 pandemic has been slowly coming under control, and general aviation operators have slowly resumed operations. Flight hours from January to May 2021 saw a dramatic rise from the same period in 2020. It is expected that flight hours for the whole of 2021 will rise by 12% compared to 2020.

- The breakdown of flight hours by category is as follows: pilot training (65%), utility and air tourism (26%) as well as transportation and charter (9%).

- Mainland China has entered the important period of its 14th Five-Year Plan. The State Council of the People's Republic of China and local governments have set new policies to promote the development of the general aviation industry from multiple perspectives such as finance and industry standards. Under the active guidance of policies, mainland China will cultivate low-altitude economic development to realize the quantitative to qualitative changes in the general aviation industry.

- There are a total of 3,936 general aviation engines operating in China. Pratt & Whitney has the highest market share with 20%. Next comes Lycoming, Rolls-Royce, Continental, and Safran. In terms of engine type, pistons (used in helicopters and some fixed-wing aircraft) made up 46% of the market share and ranked the highest. Next were turboshafts (helicopters), turbofans (business jets), and turboprops (fixed-wing aircraft).

- There are currently 33 general aviation aircraft manufacturers in mainland China that have obtained domestic Production Certificate (PC). Amongst these companies, 19 manufacture their own aircraft. China's self-manufactured AG600, GA20, and JH-2 have all made significant progress. Although the Chinese aviation manufacturing industry has developed rapidly in recent years, there is still a gap in technology and sales when compared to GA aircraft manufactured elsewhere compared with American or European countries.

- The end of 2020 saw a total of 339 certified GA airports in mainland China. As of June 2021, there are 346 certified, and 195 uncertified GA airports in China. Most of the certified GA airports have runway lengths between 400 and 800 meters. Heilongjiang Province still has the most certified GA airports, whilst Guangdong and Jiangsu provinces saw the most growth.

- In terms of infrastructure, there are 14 FBOs in mainland China that provide ground support services.

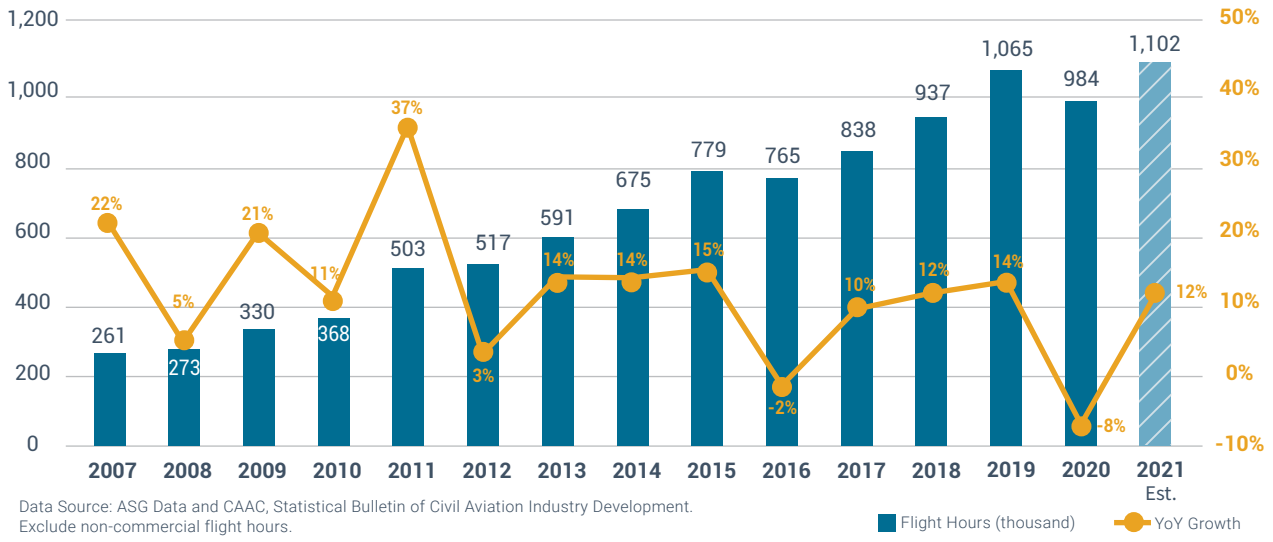
- As of June 2021, there were a total of 43 CCAR-141 aviation schools in China, two more than at the end of 2020. However, compared to 2019, there was an increase of three schools in 2020.

- At the end of 2020, the total number of Chinese civil aviation pilot licenses was 69,817. From 2017 to 2019, the annual growth rate of the number of pilot licenses stayed at around 10%. However, the growth rate dropped to 2% in 2020. Civil aviation companies are still the first choice for a pilot's career, accounting for 91% of the market share. On the other hand, the number of general aviation pilots increased the most in 2020 – by 5%.

GA MARKET OVERVIEW

2021 saw the world still under the shadow of the COVID-19 pandemic. As a result of the excellent control and regulations regarding COVID-19, the economy in mainland China is still dynamic and recovered quickly. As a branch of the aviation industry, general aviation has maintained its continuous development in 2021. However, some factors that deter the development of general aviation still exist. As such, the market potential waits for further discovery.

2007-2021 GENERAL AVIATION TOTAL OPERATION HOURS GROWTH

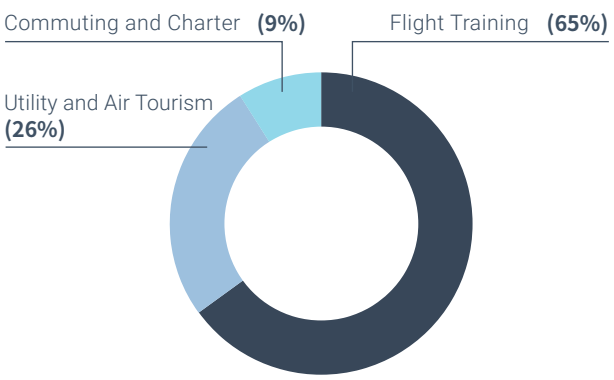


Data Source: ASG Data and CAAC, Statistical Bulletin of Civil Aviation Industry Development.
Exclude non-commercial flight hours.

The forecast of the flight hours in 2021 is based on the statistics published by CAAC for the period between January and June 2021 and with the assumption that the flight hours at second half of 2021 will be identical to the first half of 2021.

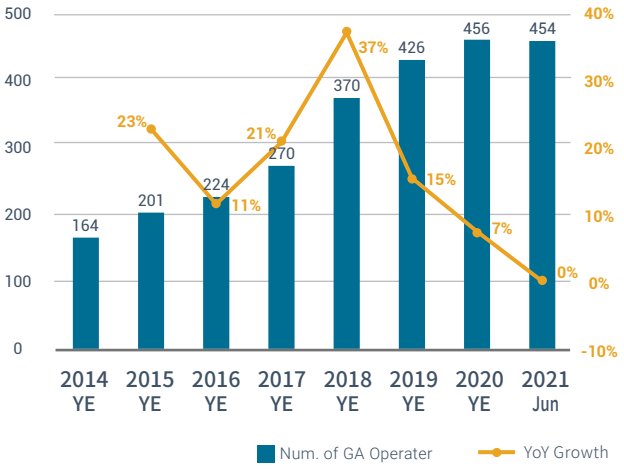
General aviation flight hours decreased by 8% from 2019 to 2020 due to the COVID-19 - the steepest decline since 2016. 2021 saw the operations of general aviation gradually recover to their pre-pandemic state. It is expected that there will be huge growth in flight hours between 2020 and 2021, and could even surpass 2019's flight hour total. General aviation flight hours from January 2021 to May 2021 all showed dramatic growth compared with the same period in 2020. However, from June to July 2021, the Civil Aviation Administration of China (CAAC) restricted flight activities of general aviation aircraft due to the 100th anniversary of the Communist Party of China. In addition, the CAAC published a safety management notice for flight services at the end of June 2021, which deterred light sport aircraft from operating. These two events happening simultaneously caused a huge impact on general aviation operators as well as flight hours.

CATEGORY OF GA AIRCRAFT



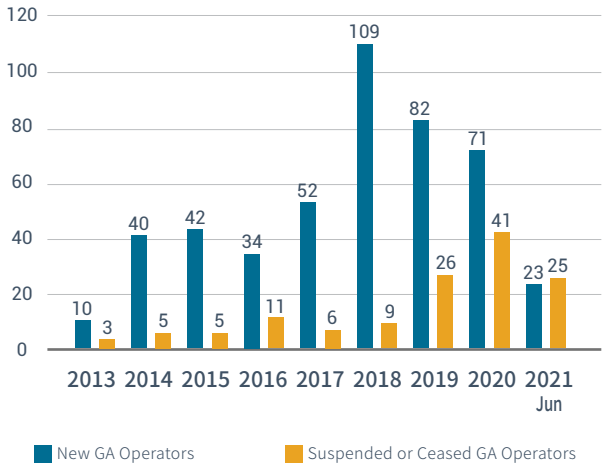
Data Source: CAAC, Overview of General and Small Transport Operations

2014-2021 CHINA GA OPERATORS



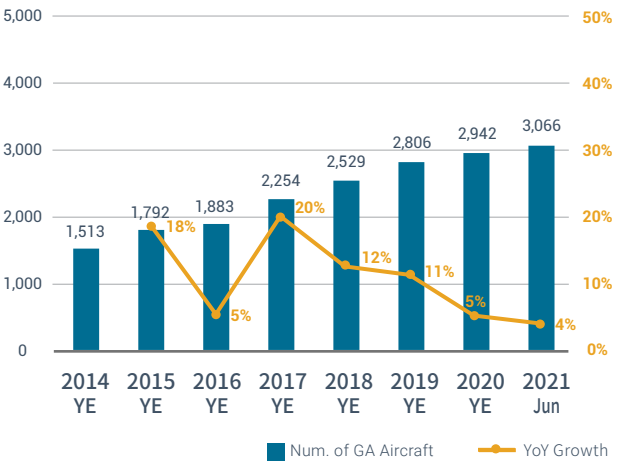
Data Source: ASG Data and CAAC, Overview of General and Small Transport Operations.
The number of GA operators only counts GA operators actually in operation.

GA OPERATOR ALTERATION TREND



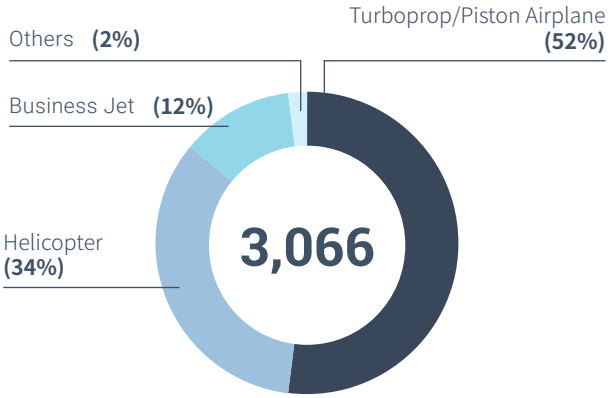
Data Source: ASG Data and CAAC, Overview of General and Small Transport Operations

2014-2021 CHINA GA AIRCRAFT



Data Source: ASG Data and CAAC, Overview of General and Small Transport Operations.
The number of GA aircraft operated in China includes overseas registered and public sector operated aircraft.
The fleet size of B- registered GA aircraft has been counted from official data from the CAAC. The calculation used in the China GA report has slight differences from that used in the Asia-Pacific Civil Helicopter Report.

CATEGORY OF GA AIRCRAFT



Others include balloons, gyroplanes and other electric fixed-wing aircraft

Amongst general aviation flight operations, the flight hours of license training accounted for 65% and ranked the highest in 2020. Next was the utility and air tourism, with a market share of 26%. The remainder includes transportation and charter, which accounts for 9% of the market share.

The number of general aviation operators has shown continuous growth since 2014. However, this trend has gradually slowed. In June 2021, 454 general aviation operators were operating in mainland China - two fewer than at the end of 2020. Additionally, newly added operators experienced continuous growth from 2013, reaching a peak in 2018. There were 109 new operators starting business operations in 2018. After 2018 the number of new enterprises gradually reduced. For the first half of 2021, there were a total of 23 newly added operators.

During the same period a total of 25 operators ceased operations, marking the first time that there were more operators closing operations than beginning. A lot of the operators that suspended operations specialized in license training or sky tours. The rest included business charter flights, forestry, or EMS. The majority of operators are small enterprises.

In June 2021, the number of general aviation aircraft was 3,066, giving a growth rate of 4% compared to the end of 2020. The number of aircraft has seen continuous growth since 2014. The growth reduced in 2016 and then bounced back in 2017. Since then it has been slowly declining.

As of June 2021, fixed-wing turboprops and pistons accounted for 52% of the general aviation market share in mainland China and ranked first amongst various aircraft types. Helicopters and business jets came second and third, each with a market share of 34% and 12%, respectively. The rest of the general aviation aircraft accounted for 2% of the fleet.

When comparing the growth trend amongst flight hours, the number of operators, and aircraft, Asian Sky Group expects that the general aviation market will maintain its positive growth during 2021. Furthermore, the growth stage is over. Now, the market is facing a trend of the biggest operators gradually becoming stronger and larger.

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DASSAULT AVIATION POSITIONS 6X AT TOP OF LONG-RANGE SEGMENT

All-new aircraft designs are relatively rare in the aircraft industry. They must offer a real advancement in the state of the art to justify the investment. The all-new Falcon 6X does not disappoint. It is the largest and most comfortable aircraft in the long-range (more than 5,000 nm-plus/9,260 km) segment, and the most technologically advanced.

A TRUE WIDEBODY CABIN

The 6X introduces a new standard in long range cabins. With a width of eight feet six inches (2.58 meters) and height of six feet six inches (1.98 meters), it has the largest cross section of any business jet flying. It will be eclipsed in cabin size only by the Falcon 10X ultra-long-range jet now in development.

The cabin is divided into three living areas, in part so that passengers on long flights can choose a spot for rest, work or dining. The 6X can carry 16 in comfort, but typical passenger loads will be far smaller, allowing teams or families to really spread out and relax.

Operators can customize each section according to their tastes, and also optimize certain areas for the type of mission they will fly. Those who routinely travel long distances can choose an extended entryway for more galley storage space and equipment. Opposite a longer galley, operators can opt for a crew rest area allowing a resting pilot privacy and the space to lie flat and get some quality off-duty time.

At the other end of the cabin, operators can opt for private lounge or stateroom configurations so that passengers can also rest peacefully and have the privacy to change either into more comfortable flight attire or business clothes to look sharp upon arrival.

A HEALTHIER CABIN EXPERIENCE

Aircraft owners and their passengers are much more focused today on the health aspects of flying. Dassault anticipated these desires in the design of the 6X. Cabin air is refreshed continuously and run through hospital-grade HEPA filters for the healthiest possible experience. Cabin altitude pressurization is maintained at a low 3,900 feet (1,189 m), when cruising at 41,000 feet (12,497 m), greatly reducing fatigue.

Dassault plans a cabin as quiet as the ultra-long-range Falcon 8X, which leads the industry in the sounds of silence. At an average of 49dB, the 8X in flight is as quiet as a living room in the suburbs.

TECHNOLOGY AND SAFETY INNOVATIONS

The 6X benefits from technology transfer from Dassault's advanced Rafale fighter jet, with its finely tuned Digital Flight Control System. DFCS improves handling, safety, and ride in turbulent conditions.

The 6X represents Dassault's latest advance in digital flight control technology, managing primary and, for the first time, secondary flight control surfaces such as flaps and flaperons, as well as nose wheel steering for better tracking in gusty conditions and on wet runways.

AN ADVANCE IN FLIGHT DECK DESIGN

The 6X's spacious, ultra-widebody flight deck offers more headroom than the flight deck in any other business aircraft, and 30 percent more window space than previous models, providing greater situational awareness in the air and on the ground.

The FalconEye Combined Vision System brings a new dimension of technology and safety to the 6X. It is the first Head-up Display (HUD) that combines images from a synthetic vision system (SVS), derived from database-driven terrain mapping, with images from a thermal and low-light enhanced vision system (EVS).

Joined into a single view, FalconEye provides an unprecedented level of situational awareness to flight crews in challenging weather conditions and all phases of flight. FalconEye permits approaches to 100-foot minimums, providing a substantial operational benefit.

DEFINING NEW PERFORMANCE BENCHMARKS

With its high lift slats and flaps and a new and brawny Pratt & Whitney Canada PurePower PW812D engines, the 6X continues the Falcon tradition of strong short field/high and hot runway performance. Approach speeds can be as low as 109 knots, allowing operations at short fields under 4,000 feet (1,220 meters). The new-generation Falcon 6X wing allows for a wide speed envelope bounded by low-speed approaches and a top speed of Mach .90.

The 13,000- to 14,000-pound thrust P&W Canada PurePower PW812D turbofan shares the proven, rigorously tested common core technology used in Pratt & Whitney's PurePower® family of geared turbofan commercial engines.

The new PW812D delivers a double-digit increase in fuel efficiency, with improvements in fuel burn, environmental emissions, engine noise, and operating costs, setting a new "green" standard for emissions with the advanced TALON™ X combustor.

The company estimates a 40 percent reduction in maintenance costs versus other engines in this class. The 6X will also be able to fly with a 50/50 mix of sustainable aviation fuel.

The 6X will have the longest range in its class, flying 5,100 nm (9,445 km) at high-speed cruise of Mach .85, or its 5,500-nm (10,186 km) maximum at Mach .80. It can fly from Paris to Beijing or Shanghai to Melbourne at high-speed cruise. Or Beijing to San Francisco at long-range cruise.

THE CATEGORY LEADER HEADS SKYWARD

Flight testing of the 6X began in March and now three aircraft are flying in the test campaign, which is expected to wrap up next year.

Flight tests have also gone "quite smoothly," with the jets showing "a high level of maturity relative to this point in a typical test program," according to company reports. By early summer, more than 200 test hours had been flown.

Dassault, which has invested heavily to expand its global service organization, is training technicians now to care for the new aircraft, in part by assigning senior techs from around the Dassault maintenance network to participate in supporting the test fleet.

In recent years the factory service network has added TAG Maintenance Services and ExecuJet MRO Services to expand service coverage in Europe, the Middle East and Asia. It has strengthened spares support, field service and many other aspects of its vast service organization. As a result, the company now routinely ranks number one in independent industry surveys.

With certification planned in 2022, big things are ahead for 6X customers.

www.dassaultfalcon.com

STEP INTO THE TALLEST AND WIDEST CABIN IN THE INDUSTRY.

The incomparable Falcon 6X cabin. 6-feet, 6-inches (1.98 m) tall, 8-feet, 6-inches (2.58 m) wide. With wide aisles. Bright, extra-large windows and skylight. Whisper-quiet cabin. Cutting-edge technology. Amazing.

Falcon 6X

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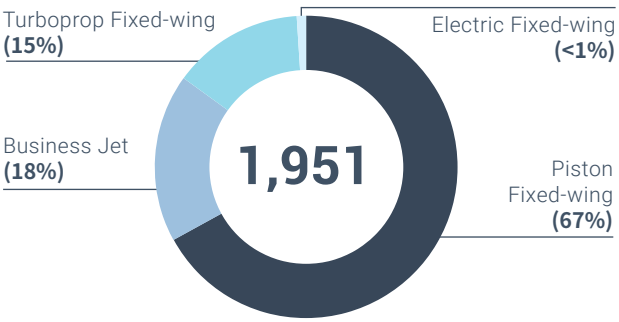
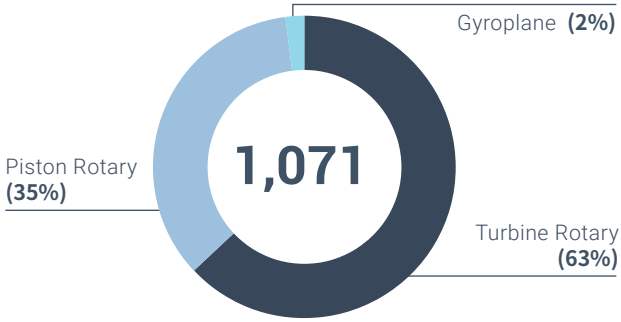
DASSAULT AVIATION

CHINA GA AIRCRAFT MARKET

FIXED-WING FLEET BY CLASS



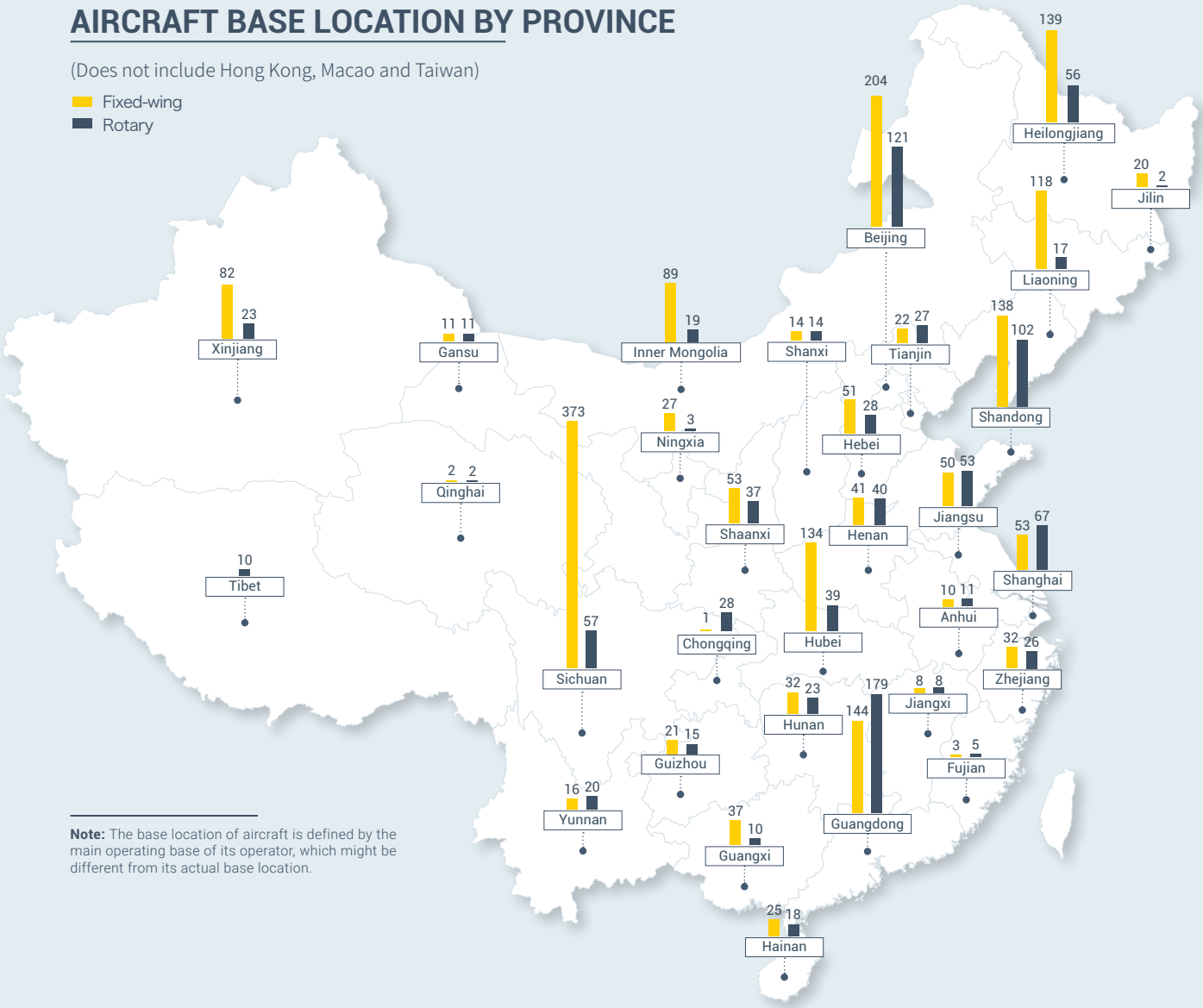
ROTARY-WING FLEET BY CLASS



AIRCRAFT BASE LOCATION BY PROVINCE

(Does not include Hong Kong, Macao and Taiwan)

Fixed-wing
Rotary



Note: The base location of aircraft is defined by the main operating base of its operator, which might be different from its actual base location.

THE BELL 505, A CAPABLE AND FLEXIBLE WORKHORSE

The Bell 505 continues to prove its ability to perform and deliver, with more than 300 aircraft delivered across the globe. Given the aircraft's capability to perform a variety of missions, there is proven demand in the market. From training academies in the UAE and Japan, to private owner operations in North America, the 505 can complete any desired mission.

In the global private ownership segment, Bell 505 owners are using the aircraft to beat traffic, efficiently travel to business sites, and spend quality time with their families. With such efficiency, owners are saving hours in transit time. Conversely, on the weekends, said owners are enjoying the benefits of escaping the constraints of city life and flying off to their proper oasis's with friends and family. With unbeatable views from the sky, a full glass cockpit, and stadium seating, friends and family relish their time in the machine.

The benefits of the aircraft are not limited to business owners or VIP guests. Similarly, utility operators are using the 505 to move crew and cargo, even securing contracts against larger aircraft due to the Bell 505's competitive price point. This versatility doesn't stop with utility operators and ranges all the way to parapublic and law enforcement operations. Law enforcement and government agencies such as Fort Worth Police Department and the Jamaican Defense Force are relying on the Bell 505 for surveillance and patrol missions to keep their cities safe.

In China, the Bell 505 is used for various missions, but the aircraft is primarily used for tourism missions and flight trainings. Reignwood Star GA has expanded its business with the use of the Bell 505. In Sanya, Reignwood Star is operating a Bell 505 to carry out tourism missions and island transport for the Shangri-La Hotel. With such a mission, guests are whisked away with the ultimate VIP treatment. Stepping into the 505 and stepping out towards paradise, the Shangri-La hotel offers an exclusive and comprehensive experience. A guest can experience the freedom of flight, overlooking a breathtaking landscape. The opportunities for the aircraft are endless.

The missions don't stop there. Reignwood also has Bell 505s across the vast country for other missions. For example, they conducted dozens of emergency rescue missions in North China. Captain Zhang Xinyu, pilot of Reignwood Star, once used the Bell 505 in an emergency rescue mission in Panjin, Liaoning province. Previously, he relied on the Bell 206 for these missions. Zhang Xinyu said the Bell 505 has much more power which allows them to perform their flight missions with more ease.

Captain Zhang Xinyu of Reignwood Star General Aviation explained the benefits of the Bell 505 for their operations: "The size of the cockpit of the Bell 505 is leading in its class. Whether you're sitting in the front or in the back, everyone has a great view on board." In the Bell 505, the rear seats are referred to as stadium seating as they are six inches higher than the front seats in order to maximize viewing for every passenger.

Additionally, he stated that the Bell 505's dual channel FADEC is advantageous both for efficiency and economics, and that the Bell 505's power makes it suitable to perform well in multiple different missions. With an immense reduction in pilot workload, Zhang Xinyu can focus his attention on his passengers and their experience, ensuring an unforgettable voyage and raising safety standards to the next level.

Further, he explained the benefits of the Garmin G1000H NXi, which ensures pilots are benefiting from the latest and most comprehensive technology.

> **"The Garmin G1000H NXi avionics system incorporated on the Bell 505 is a highly integrated platform. It provides information to the pilots at a quick glance which further reduces workloads for pilots."**

The 505 is the ultimate short light single workhorse, allowing for a breadth of missions. From business efficiency all the way to lifesaving missions, the 505 is a reliable and powerful aircraft. Pilots are put at ease with advanced technological systems and reliability. Globally, the figures speak for themselves, with the machines performing a variety of operations for entities and private individuals.

www.bellflight.com

BELL 505

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Don't just take our word for it, see what our operators are saying about the Bell 505. From sightseeing to long lining, this aircraft's spacious cabin offers removable rear seats and integrated floor tie downs to quickly convert for carrying crew, customers or cargo.

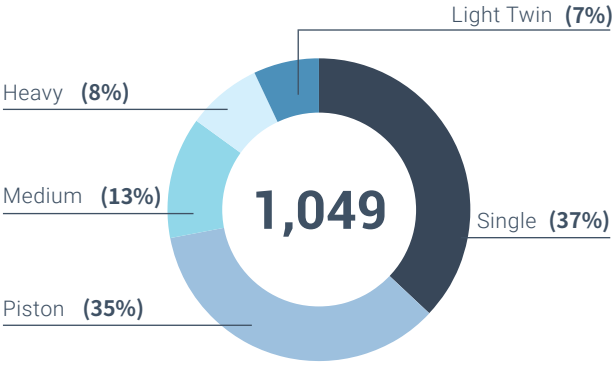
bell.co/testimonials

BELL

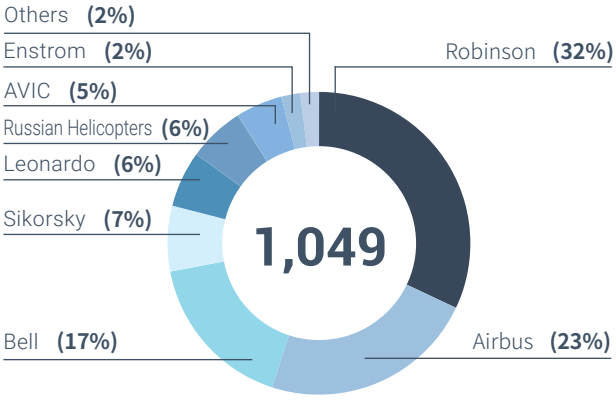
HELICOPTERS

FOR MORE INFORMATION ON THE REGIONAL HELICOPTER FLEETS, PLEASE REFER TO THE ASIA-PAICIFIC CIVIL HELICOPTER REPORT ON ASIANSKYMEDIA.COM

FLEET BY SIZE CATEGORY



FLEET BY OEM



The number of helicopters in mainland China accounts for 34% of its entire general aviation fleet. At the end of June 2021, there were a total of 1,049 helicopters. In terms of engine types, helicopters can be categorized as piston engine helicopters and turboshaft helicopters(turbine). Turbine helicopters can further be divided into single-engine, light-twin engine, medium multi-engine (medium), and heavy multi-engine (heavy) helicopters.

Single-engine helicopters ranked first amongst various helicopter types, with a market share of 37%, which was 3% less than the previous year. The Airbus H125, Bell 407 and 206, as well as Leonardo's AW119 belong to this category and are also the most popular turbine helicopters. The single-engine helicopter is broadly used due to the lower purchase and operation costs as well as its highly flexible performance. It is usually applied in agricultural and forestry operations, air tours, and powerline inspections.

Piston helicopters ranked second, accounting for a market share of 35% of the entire helicopter fleet. The most popular piston helicopters are the Robinson R44 and R22, totaling 86% of the market. Whilst the performance of the piston helicopter is relatively weak, the purchase cost remains the cheapest. Apart from being used in aviation training, it is also used in air tours and aerial photography.

Each of the medium, heavy, and light-twin helicopters accounted for 13%, 8%, and 7% of the entire helicopter fleet, respectively. Thanks to stronger load capacity and larger cabin space, medium and light-twin helicopters are often used to carry out emergency medical services, search and rescue operations, law enforcement, and VIP transportation. Whilst most popular models of medium helicopters include

the Leonardo AW139, Sikorsky S-76, Airbus H155, and Bell 412, most popular models of light-twin are the Airbus H135, Leonardo AW109, and Bell 429.

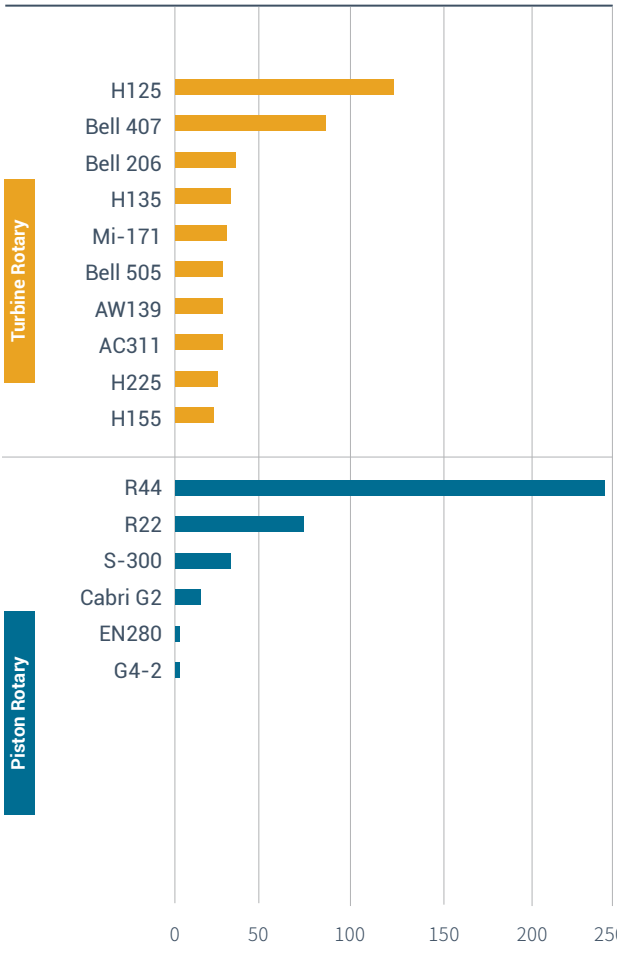
Heavy helicopters accounted for the second to last market share amongst the categories. Nevertheless, due to their strong functions and high reliability, the heavy helicopter is usually utilized in offshore oil services as well as search and rescue missions. The most popular models include the Airbus H225, Russian Helicopters M-171, and Sikorsky S-92.

Amongst various OEMs, Robinson was ranked the highest due to the popularity of its R44 and R22 helicopters, which accounted for a market share of 32%. Airbus, Bell, and Sikorsky each made up 23%, 17%, and 7% of the market share respectively, ranking second to fourth place.

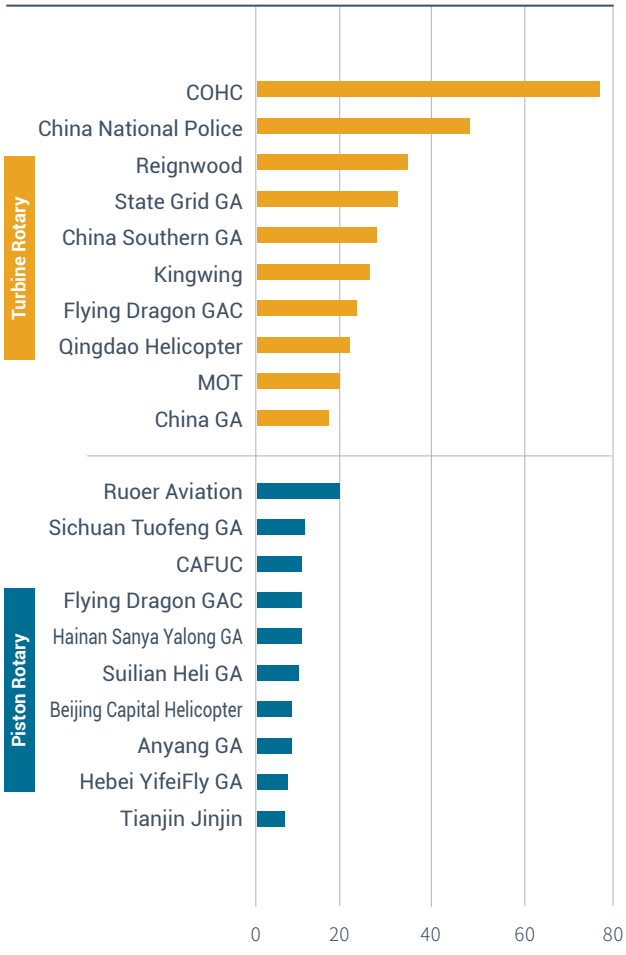
COHC, headquartered in Shenzhen, Guangdong, was the top operator with 78 helicopters in its fleet. Aside from offshore oil services as its core business, COHC has set up branches nationwide to expand its helicopter services. Reignwood mainly operates powerline inspections, navigation, and agricultural missions. State Grid General Aviation is affiliated with the State Grid and headquartered in Beijing. Apart from specializing in powerline inspections, it has expanded its services to include Cargo Lifting, Ariel Prospecting, and Search and Rescue.

Usually, the business scale of companies that operate piston helicopters is smaller than that of turbine helicopters. Piston helicopters are also mainly used for aviation training. Amongst the operators, Rouer Aviation and Sichuan Tuofeng General Aviation ranked first and second respectively, regarding the number of helicopters in their fleet.

TOP TURBINE AND PISTON HELICOPTER MODELS



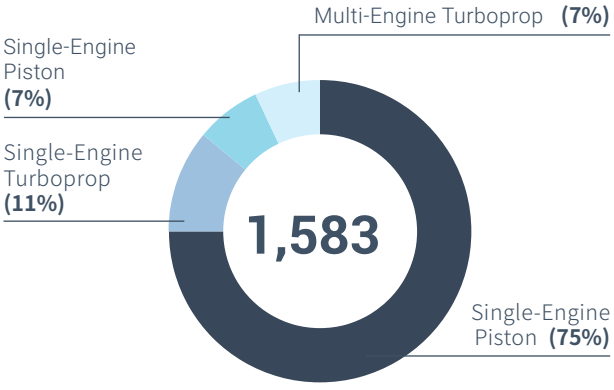
TOP TURBINE AND PISTON HELICOPTER OPERATORS



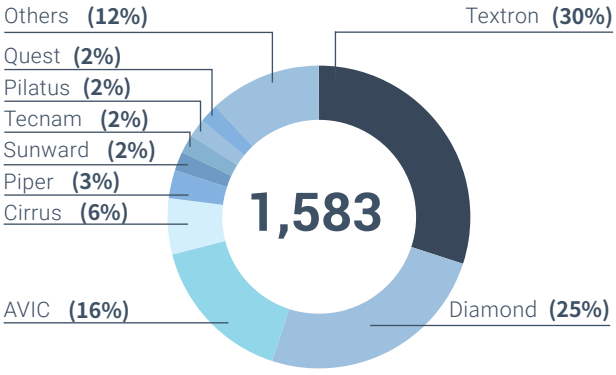
Note: Only includes helicopters operating in mainland China

TURBOPROPS & PISTON FIXED-WING

FLEET BY SIZE CATEGORY



FLEET BY OEM

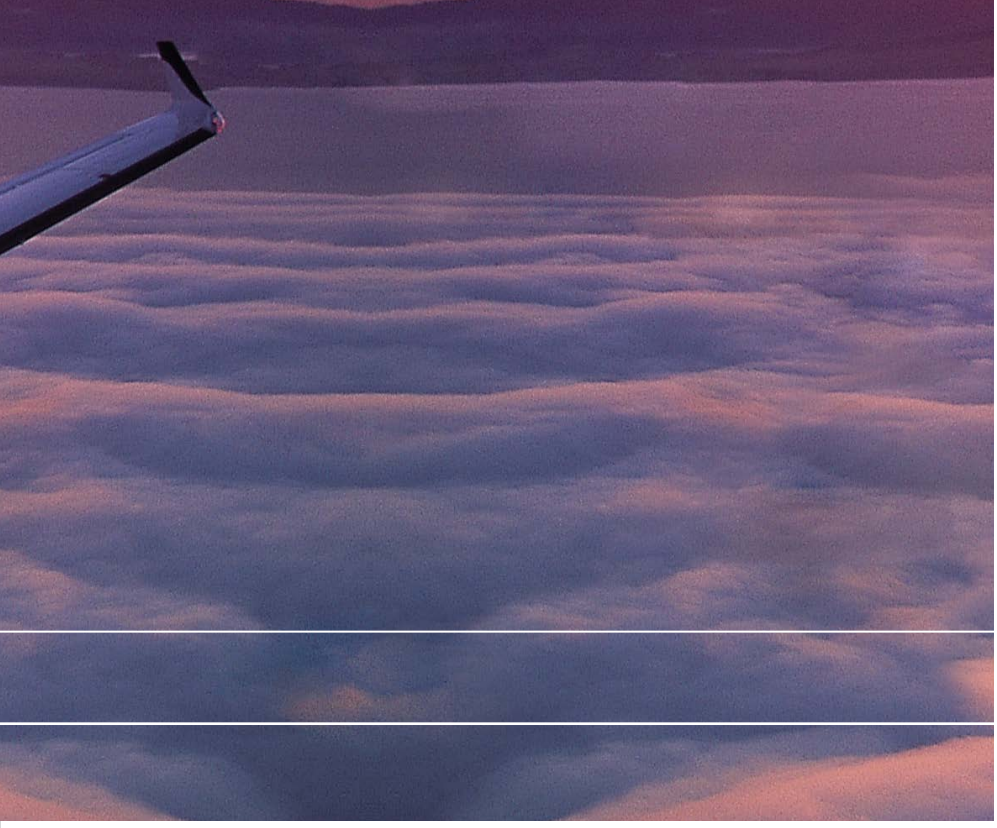


Until June 2021, the total number of turboprop and piston fixed-wing aircraft was 1,583, equal to a market share of 52%, therefore making up over half of the entire general aviation fleet.

Single-engine piston aircraft, mainly used for license training, accounted for around three-quarters of the turboprop and piston fixed-wing fleet. Multi-engine pistons, also used for flight training, made up 7% of the market. Moreover, single-engine and multi-engine turboprops that were mainly used for agriculture, transportation, and aerial photography, accounted for 11% and 7% of the market share, respectively.

Textron was still the highest-ranked OEM with a market share of 30%. Among Textron's aircraft, the Cessna 172 and Cessna 208 are the most popular piston and turboprop models, respectively. The Cessna 172 is also the most successful aircraft model with the longest longevity and is usually used as a training aircraft in aviation schools. The second most popular OEM was Diamond, with a market share of 25%. Its single-piston DA-40 and multi-piston DA42 are also popular models used in aviation training. State-owned aviation conglomerate, the Aviation Industry Corporation of China (AVIC) ranked third with a market share of 16%. Its single-engine piston model, Y5, a licenced version of the An-2 and self-developed twin-engine piston model, Y12, also have considerable market share.

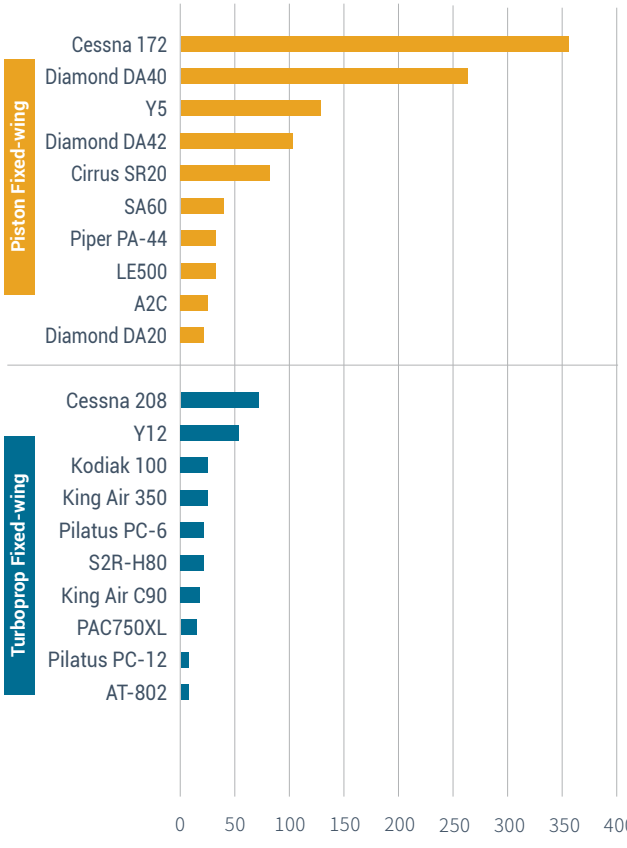
Not surprisingly, the top piston fixed-wing operators are flight training schools. Amongst various flight training schools, the Chinese Civil Aviation Flight Academy – a university under the Civil Aviation Administration of China, was the largest and operated a fleet of 286 piston aircraft. Their fleet size is 6.5 times larger than that of Jiutian Flight Academy. The



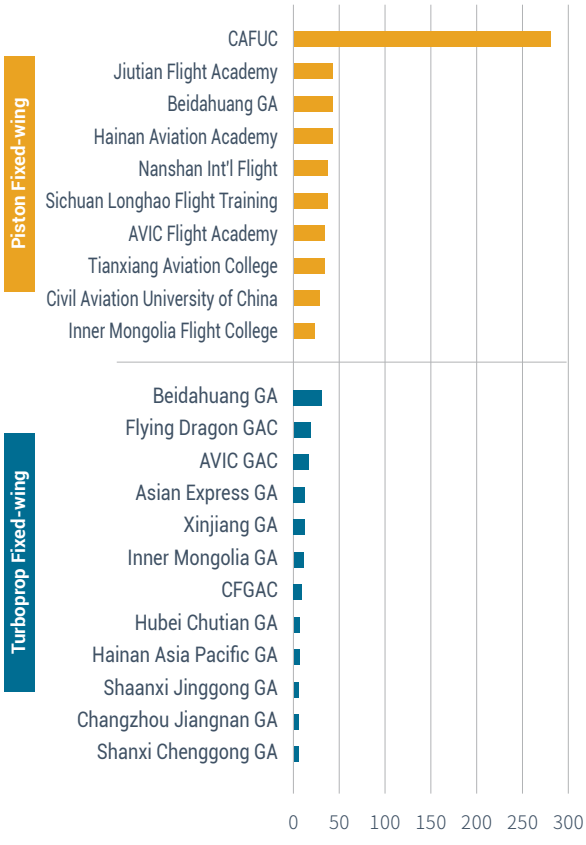
Chinese Civil Aviation Flight Academy is not only the largest Chinese training school but also the largest training institution in the world.

Beidahuang General Aviation, listed under Beidahuang Group Co, has a total number of 35 aircraft in its fleet and is ranked the highest amongst turboprop fixed-wing operators. Its main business focuses on agriculture and forestry as well as aviation training. Flying Dragon GAC and AVIC GAC ranked second and third with a total of 21 and 19 aircraft in their fleets, respectively. Flying Dragon GAC specializes in license training and land oil services, while AVIC GAC focuses more on flight training, forestry, and agriculture. Both Flying Dragon GAC and AVIC GAC have a close relationship with the Aviation Industry Corporation of China.

TOP TURBOPROP AND PISTON FIXED-WING MODELS



TOP TURBOPROP AND PISTON FIXED-WING OPERATORS

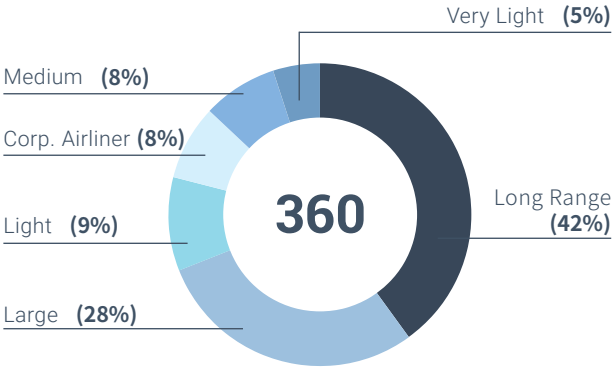


Note: Only includes piston and turborprop fixed-wing aircraft operating in mainland China

BUSINESS JETS

FOR MORE INFORMATION ON BUSINESS JET FLEET, PLEASE REFER TO ASIA-PACIFIC BUSINESS JET FLEET REPORT ON ASIANSKYMEDIA.COM

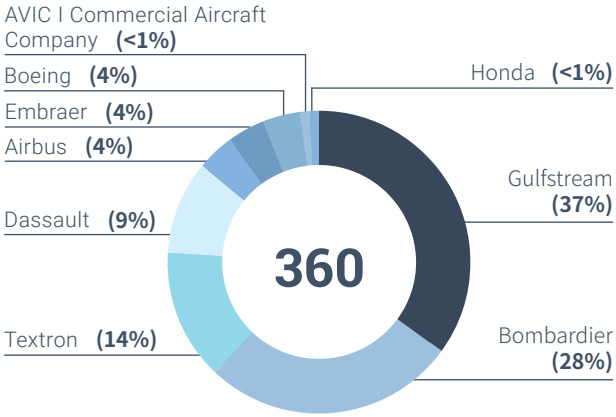
FLEET BY SIZE CATEGORY



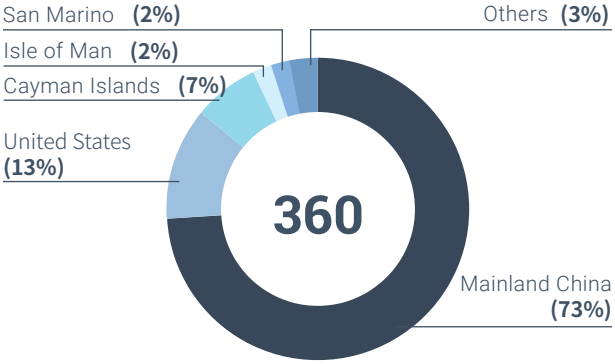
At the end of June 2021, there were 360 business jets operating in mainland China, totaling a 12% market share of the entire general aviation fleet. Although business jets do not account for a high market share, their higher purchasing and operation costs, as well as being a symbol of luxury makes them stand out. Regarding enterprises that purchase business jets and clients that utilize them for transportation, business jets are viewed as time-saving, highly efficient, and highly private. Moreover, as a high-end transportation tool, a business jet can showcase the client's prestige. With regards to flight range and cabin space, business jets can be categorized as commercial airliners, long-range, large, medium, light, and super light jets.

Long-range business jets accounted for 42% of the market share and ranked the highest in the business jet market. Without a doubt, it is aimed at long-range distance travel across continents,

FLEET BY OEM



FLEET BY REGISTRATION



usually over 5,000 miles. At the same time, long-range jets usually have more cabin space and can carry more fuel. The most popular long-range models include the Gulfstream G550, G650 and G650ER, the Bombardier Global 6000, 7500, and Global Express, as well as the Dassault Falcon 7X and 8X. In addition to models that have already entered the market, OEMs are also dedicated to developing new models that will fly further and better satisfy customer's needs. For example, compared to the Dassault Falcon 8X that has a maximum range of 6,450 miles, the Falcon 10X with a maximum range of 7,500 miles can travel to even further.

Large business jets ranked second, making up 28% of the market. Although large business jets and long-range jets both have large cabins, the flight range of a large jet is less than a long-range jet. Large jets are usually used for continent-wide or nationwide travel. The most popular large jet models are the Bombardier Challenger 600 and 800 series, the Dassault Falcon 2000, as well as the Embraer Legacy 600 and 650.

Light jets ranked third, accounting for 9% of the business jet market. Due to the smaller size and short length required for take-off, a light jet can land and take off from smaller airports. Therefore, it provides more flexibility and freedom for clients. Compared to the popularity of light jets in Europe and American markets, it has a smaller group of customers in mainland China. The frequency of traveling on a light jet is much lower than a long-range or large jet. Commercial airliners, medium, and super-light jets each accounted for 8%, 8%, and 5% of the market share, respectively.

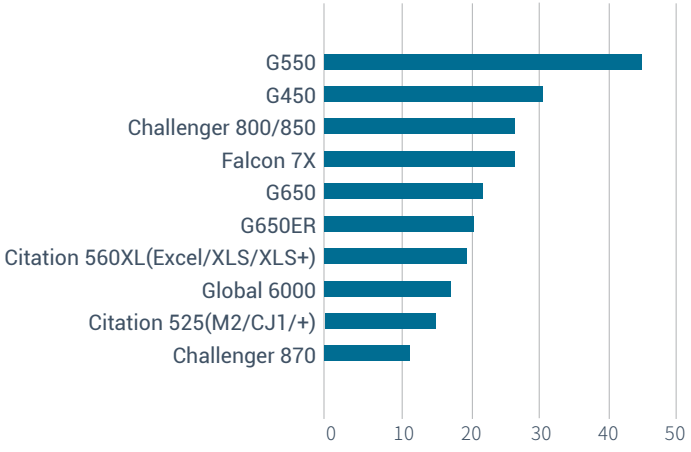
Amongst various OEMs, Gulfstream without a doubt ranked highest with a market share of 37%. The Gulfstream G550 and G450 ranked first and second as the most popular business jet models, each with 45 and 31 jets operating in mainland China. Bombardier accounted for 28% of the market share and ranked second after Gulfstream. The Bombardier Challenger 800/850 series was the third most popular business jet model. Textron came next with a market share of 14%. Textron has a variety of

models and most of them are medium to super light business jets. The Cessna Citation 560XL series was ranked the seventh most popular business jet. Dassault ranked fourth with a market share of 9% and its Falcon 7X was also the fourth most popular business jet model.

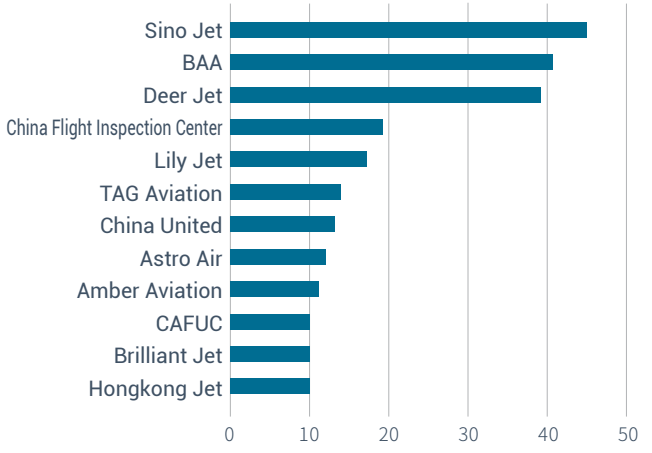
In addition, B- registered business jets accounted for almost three-quarters of the market share. American N registered business jets have a market share of 13%. As for the offshore registry, Cayman Islands acquired the highest market share – by 7%. For those operators that chose the USA or offshore registry, they prefer the higher flexibility, and easier procedures.

The services that business jet operators provide include charter and aircraft management services. As one of the biggest business jet operators, Sino Jet ranked the highest by operating 45 business jets in mainland China. For daily business, Sino Jet provides its clients the most luxurious services with a combination of "internal + external" operation patterns. BAA was 2021's dark horse with 41 business jets in its fleet. Compared to the previous year, it saw the biggest increase of 13 business jets amongst the most popular operators. Well-known operators Deer Jet and Hongkong Jet are both owned by HNA Group, and operate 39 and 10 business jets, respectively.

TOP BUSINESS JET MODELS



TOP BUSINESS JET OPERATORS



Note: Only includes business jets operating in mainland China

ASTRO AIR

Interview with **JJ Chen**, Founder, President, and CEO

Astro Air won "2021's most innovative enterprise" award at the 10th China Finance Summit. As a high-profile general aviation (GA) company in mainland China, Astro Air's main business includes aircraft management, business charter services, aircraft sales, infrastructure construction and operation, medical transportation, and aviation training. To better understand Astro Air's success in general aviation and low-altitude flights, Asian Sky Media interviewed JJ Chen, Founder, President and CEO of Astro Air. The interview helped us understand more about Astro Air's operational strategies and the advantages as well as related businesses in the low-altitude sector.

What is Astro Air's development history and operational philosophy?

Astro Air started preparations in 2011 and was established in 2012. The headquarters are located in Shenzhen Qianhai Free Trade Zone and the main operations are based in Shenzhen Baoan International Airport. Astro Air also set up branches in Beijing Capital International Airport, Shanghai Hongqiao International Airport, Shanghai Pudong International Airport, Guangzhou Baiyun International Airport, and Hong Kong International Airport. With complementary advantages of "domestic + overseas" dual platforms, Astro Air can provide one-stop solutions for charter clients and business jet clients with aircraft registered domestically and overseas.

What maintenance qualifications has Astro Air acquired in mainland China?

Astro Air's maintenance and engineering department obtained a maintenance and maintenance engineering management qualification from the Civil Aviation Administration of China (CAAC), Federal Aviation Administration (FAA), Civil Aviation Authority of the Cayman Islands (VPC), Civil Aviation Authority of San Marino (T7) and Civil Aviation Authority of Isle of Man (M). These qualifications lay a secure foundation of operations for aircraft inside and outside China. After years of development, Astro Air has established a powerful maintenance technical team. The team members are all experienced and used to work in a variety of famous aviation companies. They hold maintenance licenses from the CAAC as well as FAA A&P licenses. They also have abundant experience in technical management, base maintenance, airline, and emergency external aid, aircraft delivery as well as troubleshooting.

In addition, Astro Air can provide assurances regarding operation and maintenance for mainstream models of various business jet OEMs such as Gulfstream, Dassault, Bombardier, and Hawker. The company's maintenance network expands from Shenzhen to the whole country, establishing a 7*24-hour global AOG emergency support capability to manage possible aircraft failures at any time.

How many aircraft has Astro Air added this year? What qualifications does Astro Air have as a general aviation company that operates both business jets and helicopters?

Astro Air had a net increase of three business jet management aircraft during the first half of 2021, namely one Bombardier

Global 5000, one Bombardier Global 6000, and one Dassault Falcon 900LX. At the same time, Astro Air also increased one leased Bell 429 helicopter. As such, the fleet size has grown steadily. As a general aviation company that operates fixed-wing aircraft, business jets, and helicopters, Astro Air qualifies for the CCAR-91, CCAR-145, CCAR-135, FAR-91 (N-REG), OTAR-91 (VP-C REG) IS-BAO Stage II, CAR OPS2A (T7-REG), and Civil Aviation (Rules of the Air) Order 2021 (M-REG). Astro Air adheres to the operation philosophy of security and high efficiency and has a complete range of professional staff.

10th CFS"2021's Most Innovative Enterprise"

Congratulation to Astro Air for winning the "2021's most innovative enterprise" from China Finance Summit. As the winner of the "2021 Influencer award", how do you understand the term "innovation"?

First of all, I would like to thank the Finance Summit for giving the honor of "2021's Most Innovative Enterprise" to Astro Air. Enterprise innovation ability refers to enhancing the internal quality and motivating businesses to acquire more differences between themselves and competitors. The strength of innovation can also influence the development and competitiveness of a company. Whilst leading the development of Astro Air, we initiated a "Sparking Talented Project" partner plan to inspire the managers and employees to form a community within the company and grow together thus achieving a win-win situation. In terms of the product model, through much consideration, we have followed the demands of the general aviation market to improve our products. We changed the old product model in fields such as PSP, and bank factoring to solve the need of the industry.

As an excellent manager and decision-maker, what new strategies and plans does Astro Air have in the face of the COVID-19 pandemic and fluctuations in the market?

Astro Air plans to finish an A-share IPO listing around 2023. We plan to expand core businesses such as aircraft property rights transactions, management, and business jet charter services while maintaining a steady development of subsidiaries. Activating the driving force of productivity through co-founders makes Astro Air a versatile aviation holding group. In the low-altitude field, Astro Air plans to speed up the development of PSP, low-altitude express, and Internet operating. We are dedicated to improving the cross-border and member system to become an international comprehensive aviation company that can represent China's image.

Could you elaborate on relevant strategies and results that Astro Air has done to open up the low-altitude field?

Strategies include accumulating low-altitude sectors, matching high and low altitudes, as well as providing customized high-end charter services for high-value clients in the Greater Bay Area. Astro Air's low-altitude services include helicopter charter services, air tourism, infrastructure construction and operation, aviation finance as well as fractional ownership program.

Currently, the successful cases are as follows.

- One Shenzhen Bay's helipad (One Shenzhen Bay T7 Helipad was the first office space elevated helipad that was certified by the CAAC. Since 2014, Astro Air has provided professional consulting and acquisition services of operation certificates.) In terms of travel efficiency, starting from One Shenzhen Bay, it takes 30 minutes to fly to Guangzhou, 20 minutes to Zhuhai, 15 minutes to Hong Kong and other areas in Shenzhen.

- Jointly created by Astro Air and the Overseas Chinese Town Group (OCT), the project "Air Tourism of Eastern Overseas Chinese Town" provided the first air tourism services in 5A thematic scenic areas. This project was listed as a great example of general aviation tourism by the National Development and Reform Commission.

- The helicopter shuttle project between Shenzhen Airport and Futian CBD: which is the leader of rapid transportation in the Greater Bay Area: In 2015, the western, middle, and eastern airways in Shenzhen were opened. From Shenzhen Airport to Futian CBD to Eastern Overseas Chinese Town, Astro Air connected them by rapid helicopters.

- Fixed-point airline "Guangzhou Yuexiu Fortune Center – Shenzhen Excellence Group – Zhuhai Hengqin Port": The first line connecting three cities in the Pearl River Delta. "Guangzhou Yuexiu – Shenzhen Excellent – Zhuhai Hengqin" first flew on December 31st, 2015.

What are included in Astro Air's low-altitude businesses?

The low-altitude business mainly provides Pearl River Delta city shuttle flight services. The helicopter's low-altitude flight network

mainly covers major cities in the Pearl River Delta such as Hong Kong, Macao, Guangzhou, Shenzhen, Zhuhai, Chaoshan. It is aiming to satisfy the need for fast and efficient travel. Astro Air is dedicated to building a strategic helicopter platform to achieve a 30-minute lifecycle for intra-city flights. The services are mainly concentrated on the following aspects.

Greater Bay Area VIP shuttle among Guangzhou, Hong Kong, and Macao:
Astro Air established an industry alliance with other operators such as China Southern Zhuhai Helicopter and COHC. Astro Air took the idea of light assets by using existing fleets and a large support team to operate a low-altitude express business.

Short distance transportation:
After continuous improvement and the setting up of operation networks as well as landing and take-off sites and airport infrastructure, Astro Air combines the government's short-distance transportation policies with the trend of constructing medium and small airports to lower ticket prices and save time for passengers.

Air Tourism:
Astro Air operates helicopter air tourism services in every scenic and downtown area of the Pearl River Delta. It not only satisfies flight enthusiasts' wish to fly to the sky but also gives passengers the chance to appreciate the beautiful sceneries nationwide.

Low-altitude aircraft charter services:
Astro Air tries to enhance the willingness of business jet consumers to purchase and use helicopters in the form of fractional ownerships. Astro Air provides diversified support and service systems including aircraft management, customized air routes, complete facilities, and flexible charter services.

Specific digital marketing strategy:
Through the development of "Astro Air APP 2.0", Astro Air created a helicopter digital operating platform containing general aviation business development, general aviation ecosystem establishment, and general aviation technological innovation. Astro Air plans accurately to manage helicopters, pilots, cabin crew, helipads, airlines, climate, and regulatory information.

What are the core competitive advantages of Astro Air in the low-altitude field?

1 **Professional advantages:**
In terms of fleet, Astro Air passed the professional qualification and certification from the CAAC and Civil Aviation Administration of other countries. In terms of human resources, Astro Air has highly educated, senior titled, and high-quality professional management and maintenance talents.

2 **Product advantages:**
Astro Air owns the first-class business jet fleet and low-altitude aircraft. Astro Air carried out high and low-altitude shuttles and is the only operator that flies business jets and helicopters in the general aviation industry.

3 **Resource advantages:**
Astro Air has a complete Greater Bay Area aviation network and huge resource integration advantage. Astro Air is competitive in government support and commercial aviation rights.

4 **Operation advantages:**
Astro Air utilizes online + offline operation models to gather high-end customers. Astro Air created a high-end circle platform to enhance client experiences and complete efficient conversions.

Astro Air Hotline: 40006-99977 Website: www.astroairgroup.com

星雅航空
Astro Air

星雅航空筹建于2011年，2012年正式成立，总部注册在深圳市前海自贸区，主运营基地设在深圳市宝安国际机场，在北京首都机场、上海虹桥机场、上海浦东机场、广州白云机场、香港赤鱲角国际机场等全国主要城市空港设有分公司或运行保障基地。公司主要开展航空器托管、商务包机、航空器销售、航空基础设施建设及运营、医疗转运、航空培训等业务，也是国内中央商务区直升机FBO开创者。星雅航空致力于为客户提供极致的低密度出行体验。

Astro Air was prepared in 2011 and formally established in 2012. Its headquarter is registered in Shenzhen Qianhai Free Trade Zone. The main operating base is located at Shenzhen Bao'an International Airport, and at Beijing Capital Airport, Shanghai Hongqiao Airport, Shanghai Pudong Airport, Guangzhou Baiyun Airports, Hong Kong Chek Lap Kok International Airport and other major cities across the country have branch offices or operation support bases. The company mainly engages in aircraft custody, business charter, aircraft sales, aviation infrastructure construction and operation, medical transport, aviation training, etc., and is the pioneer of helicopter FBO in the domestic central business district.

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星雅航空小程序　　星雅航空公众号

REGULATIONS AND POLICIES

China's general aviation (GA) development is supported by related policies. The country's 14th Five-Year Plan (2021 to 2025) will help light a path regarding the industry's development. According to the guidance of 14th Five-Year Plan, the industry's future goal is to develop and pinpoint consumer groups, stimulate growth and internal need, showcase the benefits of convenient air travel, nurture internal economic circulation, develop potential of Low Altitude Airspace Economy, and change the industry to focus more on quality instead of quantity. Local governments and other departments in various provinces have also successively released policies and guidelines to promote the growth of GA from every angle.

With regards to Finance, it is worth noting the "Hainan Free Trade Port "Zero-Tariff" Raw and Auxiliary Materials List" and the "Notice on the Measures for the Administration of Tax Policies for Supporting the Import of Aviation Equipment Used for Civil Aviation Maintenance from 2021 to 2030". The policies mention that listed components which are used to repair planes operated by aviation companies based in Hainan or those that have entered China from abroad for maintenance and later leave will be exempted from import duties, value-added tax (VAT), and consumption tax. At the same time, the notice also states civil aircraft design and manufacturing companies, domestic airlines, maintenance organizations, and aviation equipment distributors which import aviation maintenance equipment that cannot be produced in China or whose quality is not up to par, are to be exempted from import tariffs. The policy implementation marks another breakthrough regarding China's tax support for civil aviation.

According to industry standards, the "Notice on Strengthening the Management of Experienced Flight Safety Operations" issued by the Flight Standards Department of the Civil Aviation Administration has drummed up extensive discussion. The focus was on the 'Notice' that "Only aircraft that hold a standard Airworthiness certificate can provide flight experience services." As Light-Sport Aircraft (LSA) are restricted, the planes cannot be allowed to provide flight experience services. As such, this

policy will impact the development of hundreds of aircraft design, manufacturing and operations businesses.

All local governments have proactively responded to the country's 14th Five Year Plan; Anhui, Henan, Fujian, Shenzhen, and the Hong Kong SAR have also issued corresponding policies that are already showing results. Worth noting is that Hunan has already become China's leading low-altitude pilot province, with the opening of airspace to 3,000 meters. We believe Hunan province will accumulate experience in fields like aviation communication monitoring, low-altitude supervision, and management which will further prove the feasibility of opening up whole low-altitude airspace nationwide.

Summary of GA Policy 2020

Issue Date	Policy	Main Contents
Jan 21	Release of 2019's GA Administrative License Information	Published 5 summary tables, namely, general aviation operating permit summary and cancellation summary, non-operating general aviation registration summary and cancellation registration summary, as well as a drone business registration summary.
Feb 13	GA Plays an Important Role in COVID-19's Epidemic Prevention & Control	Outlining the capabilities of GA in relation to COVID-19, as well as providing an overview of enhanced safety and protection measures.
Feb 14	GA Fuel Quality Control and Technical Specifications for Aircraft Refueling	Promote the reconstruction of the general aviation regulations and standards system, improve the policy support system, and promote the construction of the service guarantee system.
Feb 17	Notice on the Launch of the GA Standby and Duty Information Platform	In response to the needs of emergency transportation and air operations during the Covid-19 epidemic, the corresponding organizational support capabilities have been effectively strengthened.
Mar 20	Notice on strengthening Flight Operation Management of GA Chartered Airplanes	Requiring GA companies and associations to improve the flight operations of chartered aircraft during the epidemic prevention and control period.
Aug 19	Release of the Interim Regulations on Short-Distance GA Transportation Management	Management of GA short distance transportation.
Aug 26	Release of Regulations on General Aviation Operation License Administration CCAR-290-R3	Reclassifies item categories; the original A-B-C-D classification by scale of registered capital is replaced with three categories: the 'Passenger'; 'Manned'; 'Others' which are divided by the nature of flight activities. The new category classifications aim to reduce access threshold, as well as supplement the integrity of GA operational evaluation construction terms. Additionally, it requires an annual audit to be conducted by the CAAC, as well as simplifies and reduces the number of registered items from 10 to 6 in GA Operation License. Furthermore, it replaces the 3-year validity limitation with a long-term order, optimizes recording methods of GA operation activities to implement on-line recording, specifies the demand of real production data delivery, implements the approval mechanism for most GA operation activities, specifies the regulation of business flight activity permits of civil unmanned aerial vehicle, and improves the related contents of market surveillance.
Aug 31	Listing of Hebei Pilot Free Trade Zone in Daxing International Airport	Daxing International Airport is supported by the modern logistics industry. By importing international supply chain comprehensive logistics business, it expands the development of service trade and mainly develops aircraft maintenance and aviation training services. At the same time, it selectively developes aviation supplies, technological information and scientific research testing facilities.
Sep 15	Release of The Public Announcement of GA Adiministrative License Information from January 2020 to August 2020	3 summary tales were published, namely, the general aviation operating permit summary, non-operating general aviation registration summary and civil UAV operating permit summary.
Oct 14	The Management Regulation of the General Aviation Development Special Foundation	The plan shows that it is expected to have a total of 220 aviation operators acquiring subsidies with a sum of 503,750,000 RMB in 2021.

Summary of GA Policy 2020

Issue Date	Policy	Main Contents
Oct 16	CAAC's Announcement on canceling the "Non-operating GA Aircraft Registration Authorization"	By establishing a complete non-operating GA record system, enhancing the management standard of informationization, categorizing, precisely monitoring and strengthening coordination, it is able to strengthen in-the-middle and afterhand monitoring of close-circle management.
Nov 3	GA Chartered Flight Management Interrim Regulations	Main executions include regulating the management of GA charter services, protecting legitimate interests, and maintaining the GA market order. Measures will start on January 1st, 2021.
Nov 11	Hainan Free Trade Port "Zero Tax" Raw Materials List	The list has been jointly printed and issues with approval from the State Council of the People's Republic of China, the Department of Treasury, the General Administration of Customs, and the State Taxation Administration. It includes planes and other aircraft.
Nov 25	Hong Kong SAR Policy Address	Carrie Lam: The CAAC agrees that Macao and Hong Kong can start to prepare for cross-border commercial helicopter services, strengthening the international business environment of the Guangdong-Hong Kong-Macau Greater Bay Area.
Nov 27	Fujian Province Aviation Sports Industry Development Plan (2020-2030)	The plan thoroughly analyzes the current foundations of Fujian Province's sport aviation industry development. It proposed five important missions incluing guiding the layout of sport aviation infrastructure construction. It envisions the long-term goal of sport aviation industry wil begin to take shape by 2023, which means initiating a 200 kilometers sport aviation flight circle to create a complete sport aviation industry system.
Dec 12	Central Air Traffic Management Committee holds Meeting to promote a Low-altitude Airspace Management Revolution Test Point Expansion	The meeting explicitly opened the first low-altitude test point province-Henan. It is expected that more provinces will open up to low-altitude.
Dec 17	GA Airport Group Standard System	Incudes guiding industrial technical development, promoting transformation of innovative results; cultivating and optimizing the industry, forming core compentitiveness, serving national strategies; as well as promoting high quality and versatile development of GA airport construction and operation.
Dec 31	The General Requirement for the construction of the GA Airport Airspace Surveillance System	Requiring a refined standard airspace surveillance system of domestic GA airport and temporary airports for general aviation. It is aimed at targeting different aircraft features, comprehensively utilizing multiple surveillance methods and integrating management skills to create a complete airport airspace surveillance system.

Summary of GA Policy 2021

Issue Date	Policy	Main Contents
Mar 12	National Development and Reform Commission Publishes "The 14th Five-Year Plan and the Outline of 2035 Long-term Goal"	The plan points out it is necessary to steadily construct regional airports, general airports, and commercial airports as well as to proactively develop general aviation.
Mar 16	The 14th Five-Year Plan and the Outline of 2035 Long-term Goal of National Economy and Social Development in Shaanxi Province	Promote the research, development, and production of a series of large cargo aircraft as well as the capacity enhancement of the Y-8 and Y-9 series. Accelerate the development of MA700 aircraft's research and certification to enter the market. Development multi-mission planes. Vigorously develop the UAV industry.
Mar 29	CAAC Notification of "General Aviation Airspace Surveillance Operation Regulations"	Regarding the general aviation airspace surveillance operation rules targeting air transportation services, emergency rescue, and operation assessment. It also enhances the operation security level and usage of airspace.
Mar 29	CAAC Notification of "GA Airports Airspace Surveillance Operation Management Approach"	Revise the original operation management approach. The new one measures will start on April 1st, 2021. The original "GA Airports Airspace Surveillance Operation Security Management Approach" will be abolished on the same day.
Mar 31	Notice of the General Administration of Customs of the Ministry of Finance on the Tax Policy on Support for the Import of Aviation Equipment for Civil Aviation Maintenance, 2021-2030	Implement import duty exemption policies for specific import units and aviation equipment.
Apr 13	The 14th Five-Year Plan for Shenzhen's Comprehensive Transportation	Promote the implementation of general aviation classified management reforms, and carry out classified management of ground facilities, to facilitate infrastructures for helicopter take-off and landing with standardized operations and management. Also, promote construction of low-altitude flight service stations in Shenzhen and enhance capabilities for flight services, ground navigation and surveillance, and flight safety control. Seek support from military and civil aviation departments, promote the reform of low-altitude airspace management, and establish low-altitude air routes. Improve the cross-border clearance for helicopter and cross-border flying services, in order to optimize the general aviation operating environment in the Greater Bay Area.
Apr 20	The 14th Five-Year Plan for National Fitness Facilities Implementation Plan	Formally includes aviation flying camps as public outdoor sports facilities, and each camp is entitled to the Central Budgetary Investment Subsidy for up to $10 million.
Apr 21	The 14th Five-Year Plan Outline of 2035's Long-term Goal of National Economic and Social Development in Anhui Province	Facilitate the construction of general airports to gradually form a group of general airports in the central, north, west and south of Anhui. Also, strive to implement low-altitude airspace management reform. By 2025, expected at least seven general aviation airports with A2 and above grading to be built.
Apr 23	The Helicopter Aviation Medical Ambulance Service Guide and the Fixed-wing Aircraft Medical Ambulance Service Code issued by the Civil Aviation Authority	According to the implementation of the Joint Air Medical Ambulance Scheme released in March 2019, the pilot experience will be summarized and refined to further improve capacities in public health service, and to speed up the construction of a fully functional general aviation system through the issue of service guidelines and service specifications.

Summary of GA Policy 2021

Issue Date	Policy	Main Contents
May 6	The 14th Five-Year Plan Outline of 2035's Long-term Goal of National Economic and Social Development in Henan Province	Strengthen the development and manufacturing of general aircrafts and drones, improve the low-altitude flight service guarantee system, promote innovation in general aviation operations and consumption models, and aim to become a role model of the national general aviation industry for other provinces.
May 10	Guidance on Promoting the Deep Integration and Innovation development of Civil Aviation and Red Tourism	Strengthen airport construction in areas with red tourism, improve airport layout and support qualified airport projects to be included as key items of the 14th Five-Year Plan for civil aviation development. Facilitate construction and preliminary work of key projects in Ruijin, Xiangxi and Jiaxing, as well as instruct local governments on the construction of general airports.
May 12	Technical Specifications for Low-Altitude Flight Service Systems (Parts 1to3) (Draft for Comments)	In order to standardize and provide guidance on design and production layout of low-altitude flight service system, promote the unified national low-altitude flight service network, and meet the rapid demands in general aviation development, the Division of Airworthiness in Civil Aviation Administration drafted this criteria to meet the rapid development needs of general aviation.
May 14	Opinions on consolidating and expanding the Achievements of Poverty Eradication and comprehensively promoting the Implementation of Rural Revitalization	To comprehensively promote rural revitalization, seven key tasks are highlighted, including improving the layout of airports, speeding up construction of air transportation, and accelerating the development of general aviation. More specifically, the fifth task, is to "accelerate the development of general aviation and promote the transformation of local economic momentum." To instruct the construction of general airports, encourage non-hub airports to build navigation facilities, coordinate with the use of low-altitude airspace, support the development of leisure agriculture and rural tourism in poverty-relief areas with general aviation, carry out emergency and medical rescue, flight training and other services according to local conditions, and give prioritised support to UAV logistics and distribution."
Jun 22	"Strengthen the experience of Flight Safety Operation Management Notice." issued by the Flying Standards Division of Civil Aviation Authority	Operators of experiential flight have to meet the requirements of advisory circular AC-91-33, plus, four additional requirements such as "qualification requirements", "aircraft", "operational area and meteorological standards" and "flight implementation", which emphasizes that only these aircraft who obtain standard airworthiness permits can be used for experienced flying.
Jul 17	Hunan became the First Province of Low-altitude Trial Flight in China.	Hunan will accumulate experience in aircraft surveillance communication coverage, low-altitude airspace supervision and operation management in low-altitude airspace below 3000 meters, providing a theoretical basis for the opening of low-altitude flying throughout the country.

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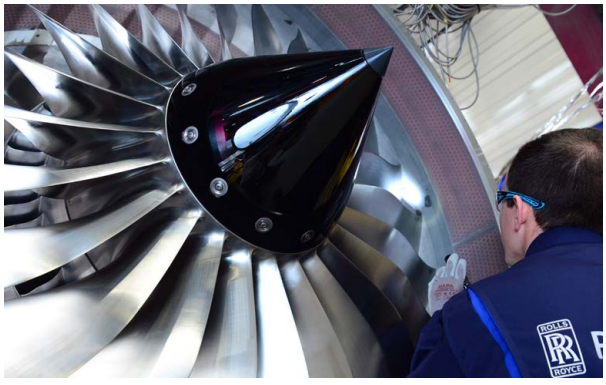
GA ENGINE OVERVIEW

As of June 2021, there were 3,936 general aviation engines in operation in mainland China. Amongst various engine types, piston engines accounted for the largest market share, reaching 46%. The turboshaft engine type came next, accounting for 25%. Turbofan and turboprop engine types accounted for 19% and 10% of the market share, respectively.

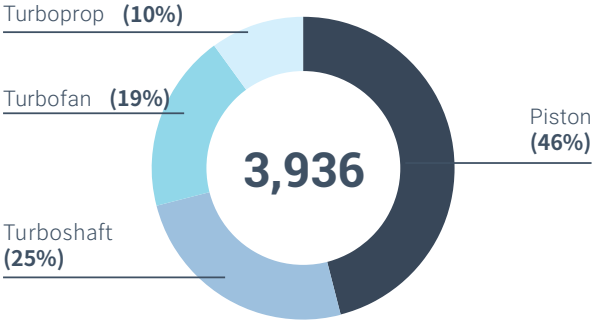
Pratt & Whitney has a big market share in turboshaft, turbofan, and turboprops. As a result, it ranked the highest amongst engine OEMs, with a market share of 20%. Lycoming and Continental engines dedicated to piston engine market expansion ranked second and third due to the large piston engine market share. Rolls-Royce and Safran ranked third and fourth due to their excellent performance on the turboshaft and turbofan markets, respectively.

Due to its lower power, the piston engine is widely used in various light and super light helicopters and fixed-wing aircraft. Amongst piston engine OEMs, Lycoming ranked first with a market share of 30%. There are currently 543 Lycoming engines in the market, with 245 O-540 engines equipped on the Robinson R44. Continental,

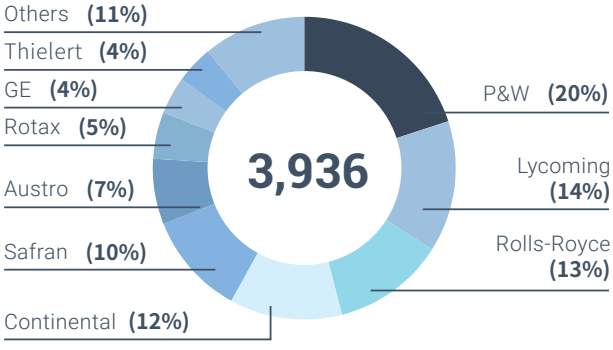


acquired by AVIC in 2016, accounted for 27% of the market share due to being installed on the most popular aircraft model – the Cessna 172. Amongst 480 Continental engines, 361 were equipped on the Cessna 172. Both Austro and Thielert engines are equipped on Diamond's aircraft, each ranking third and fifth with a market share of 15% and 9%, respectively. Although Rotax only accounted for 11% of the piston engine market share, its engines have been installed on a greater variety of aircraft models

AIRCRAFT ENGINE BY CATEGORY



ENGINE OEM MARKET SHARE



compared to other engine OEMs. The Rotax 912 engine family is installed on 21 piston aircraft models operating in mainland China.

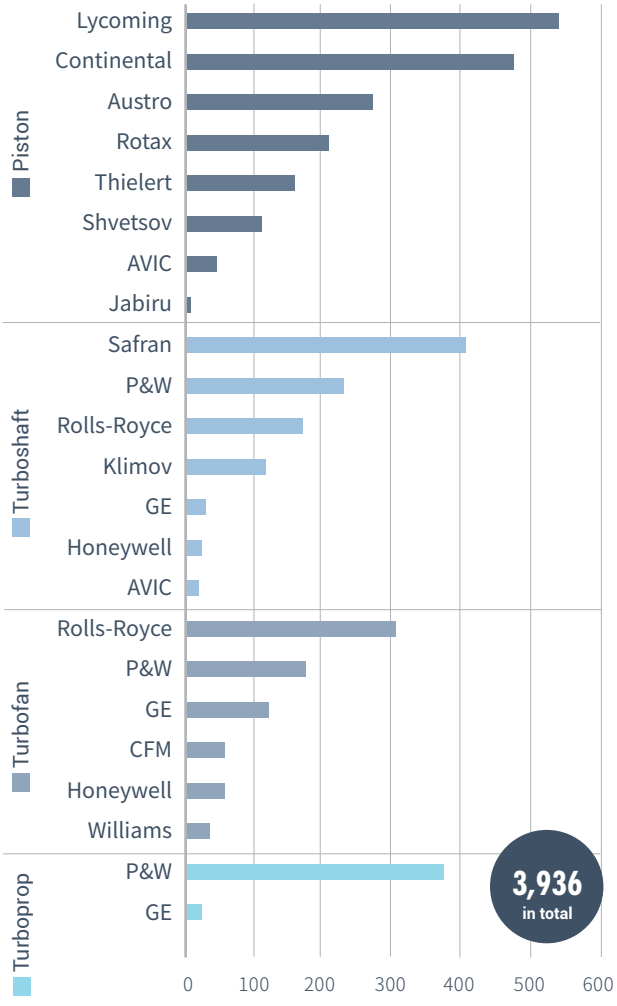
Turboshaft engines are applied to helicopters. Safran ranked the highest due to the success of its Arriel engine family, giving a market share of 41%. Popular helicopter models include the H125 and the H155. Pratt & Whitney accounted for 23% of the market share. In addition, the PW200 is the most popular engine series of Pratt & Whitney on the turboshaft market with a total of 124. It is mainly equipped on H135, AW139, and Bell 429. Although Rolls-Royce only accounted for 17% of the market, its engines are used in seven helicopter models. Amongst Rolls-Royce turboshaft engine types, there were 90 Allison 250 equipped on the Bell 407.

The turbofan engine is installed on business jets. Rolls-Royce ranked the highest with a market share of 43%. Its BR700 family is equipped on long-range jets such as Gulfstream's G550, G650 and G650ER, as well as the Bombardier Global Express family. Pratt & Whitney came next, with a market share of 23%. The most representative series would be the PW300, which is equipped on the Dassault Falcon 7X.

The turboprop engine is also applied to turboprop fixed-wing aircraft. Between the only two turboprop OEMs, Pratt & Whitney has achieved a landslide victory, with a market share of 94%. Its PT6A engine series is equipped with popular fixed-wing aircraft models such as the Y12, Cessna 208, and King Air series.

Currently, the general aviation engine market is still dominated by foreign manufacturers. However, as Chinese OEMs such as AVIC receive increased attention from the state, it is developing aircraft and engines independently. In the future, it is expected that Chinese engine manufacturers will shine in the general aviation field.

ENGINE OEM MARKET SHARE IN DIFFERENT CATEGORIES



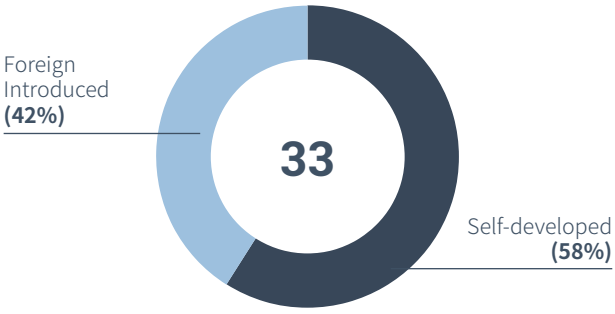
MOST POPULAR ENGINE SERIES AND APPLIED AIRCRAFT MODEL

Engine Type	Engine OEM	Engine Family	Model Group
Piston	Continental	O-300	Cessna 172
	Lycoming	O-540	R44
	Austro	AE 300	Diamond DA42
Turboshaft	Safran	Arriel	H125
	Rolls-Royce	Allison 250	Bell 407
	P&W	PW200	H135
Turbofan	Rolls-Royce	BR700	G550
	P&W	PW300	Falcon 7X
	GE	CF34	Challenger 800/850
Turboprop	P&W	PT6A	Y12
	GE	H80	S2R-H80

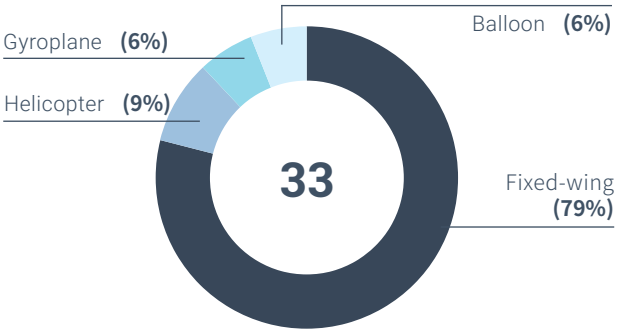
CHINA GA MANUFACTURERS

How far China's GA industry can go ultimately depends on the development of its manufacturers. As China started relatively late in GA manufacturing, imports of foreign aircraft models in the early days became an important way for businesses to improve their services. After decades of development, several GA manufacturers have sprung up in Liaoning, Jiangsu, Hubei, and other regions. Furthermore, local GA manufacturers have opened up a development path according to current industry situations in mainland China.

MANUFACTURERS SELF-DEV. VS. FOREIGN INTRODUCED



MANUFACTURERS BY AIRCRAFT CATEGORY



As of June 2021, 33 GA manufacturers in mainland China have managed to obtain a production certificate (PC), one more than previous year. Among them, manufacturers that independently developed models made up 58%, whereas manufacturers that have imported or purchased models made up 42%.

Between 2020 and 2021, China's self-developed GA aircraft industry has made some progress. Regarding fixed-wing aircraft, the amphibious "Kunlong" AG600, which was solely developed by China, achieved its first sea flight in July 2020. This was its third flight, following its first land flight in 2017 and water flight in 2018. The AG600 is the first large-scale special-purpose aircraft developed according to China's civil aviation regulations, regarding forest firefighting and water rescue. It is a piece of major aviation equipment that is urgently needed for building China's emergency rescue system. At present, the AG600 has already entered the overall prototyping and testing stage. Guanyi Aviation's GA20, which is a single propeller-driven, four-seat, general-purpose aircraft, has made further progress. As of July 2021, four GA20s have entered the final stages of certification. The market is extremely confident in these aircraft. As of writing, the GA20 has won around 200 orders, focusing on the domestic pilot training market. After certification is complete, it will become the first CCAR-23 aircraft with China's independent intellectual property rights to enter the aviation training market. Among rotorcraft, it is worth noting that the JH-2 developed by Beijing General Aviation Jiangxi Helicopter Co. (BGAC), has obtained a light helicopter certificate, thus filling a gap in the industry as well as promoting the development of domestic general aviation. Urban air traffic has always been a popular topic, with China being at the forefront in this field. More specifically, EHang 216 has already obtained special flight permits and airworthiness certificates from many international regions. Furthermore, China's Civil Aviation Administration has started an airworthiness supervision of EHang 216 in April this year, and hopefully, it will also obtain the first autopilot certificate in China.

MANUFACTURERS BY PROVINCE

CAAC, List of Approved Civil Aviation Products and Components, as of 30 Sep 2019.
CAAC Central and Southern, Production Certificate (PC) for Civil Aircraft (Engine, propeller), as of 31 Dec 2020.

America's Federal Aviation Administration (FAA) also issued the world's first flying car certificate at the beginning of this year. It is the Transition (TF-1) developed by the Zhejiang Geely Holding Group that has obtained the certification. July this year saw China's joint largest general aviation unmanned aerial vehicle (UAV), the "Y5U", making its first flight in Inner Mongolia. November 2020 saw the AR500B make its first flight in Poyang test base. Overall, China's domestic general aviation aircraft shows a state of competitation among hundreds of manufacturers.

China's aviation industry has rapidly developed these past few years but there is still a large gap compared with Europe and America, as GA in China is still in its infancy. In terms of market size, aircraft produced by domestic GA manufacturers tend to be mid-to-low-range piston aircraft, whilst most high-performance GA jets are monopolized by foreign manufacturers. The competitiveness of China's self-developed high-end aircraft is insufficient. As a result, the supply of high-end aircraft highly relies on imports. However, recent international relationships are becoming more complicated. An example is how high tariffs on imported aircraft have increased operating costs for domestic general aviation companies. Moreover, it will also limit positive development for these businesses in China.

China's GA manufacturing industry took off relatively late, but the market potential for GA aircraft is huge. Additionally, these domestic aircraft manufacturers are exploring new developmental paths based on national policies. Firstly, domestically developed aircraft are gradually developing in the direction of multi-purpose aircraft. Compared with single-purpose aircraft with short operating and long idle periods, China's amphibious aircraft like the A2C, can take off and land on simple cement and asphalt runways. The aircraft can also fly from reservoirs, rivers, oceans, and other bodies of water and adapt to different terrain. In addition, through some simple modifications, amphibious aircraft can also be used in tourism and sightseeing, aviation training, agriculture, aerial surveying, and other fields. China is a big country of agriculture, but still has some natural features like challenging terrain and regular farming seasons. Amphibious aircraft can perfectly fit those features by providing multiple applications and extending use even during the slack season compared to the traditional one.

Secondly, military and civilian integration is also a new path for the development of China's GA aircraft. This development is also a great opportunity for GA to strengthen the internal impetus for economic development. Military and civil aviation technology not only come from the same place but the commonality of their key technologies and manufacturing process is around 70%. The technological standard and manufacturing philosophy of GA aircraft can be promoted together with the development of military aircraft. The Nanchang CJ6 is a high-performance primary trainer aircraft solely developed by China. Moreover, flight traning schools in the mainland use them for pilot selection and training. This aircraft, which was the country's first military-to-civil aircraft model, was granted a type certificate/production license (TC/PC) in February 2019 marking its official entry into the domestic aviation market. This also has great significance regarding the development of military-civil aviation.

In the future, China's GA tourism market will quickly expand. At the same time, the country is rapidly taking an interest in the aerial emergency rescue sector. Aside from agricultural production, private travel, and aviation training, the need for GA aircraft will also increase swiftly. China's local GA manufacturers should seize opportunities, follow trends, and find a breakthrough in local aircraft manufacturing.

CHINA GA AIRCRAFT MANUFACTURERS WITH PRODUCTION CERTIFICATE (PC)

Provience	City	OEM	Group	Self/Foreign	Type	Model
Liaoning	Shenyang	Liaoning United Aviation, Shenyan Aircraft		Foreign Introduced	Fixed-wing	Tecnam P2006T
Liaoning	Shenyang	Liaoning Ruixiang General Aircraft Manufacturing		Self-developed	Fixed-wing	Ruixiang RX1E
Liaoning	Shenyang	Shenyang Zhongqing Light Aircraft	GAOS	Self-developed	Fixed-wing	HY650B/C
Liaoning	Shenyang	AVIC Shenyang Aircraft Industry	AVIC	Foreign Introduced	Fixed-wing	Cessna 162
Liaoning	Dalian	Cub Crafters Aircraft Manufacturing		Foreign Introduced	Fixed-wing	CubCrafters CC18-180
Jiangsu	Changzhou	Changzhou Pan Pacific Aviation Technology	BAIC Group	Foreign Introduced	Fixed-wing	PAC 750XL
Jiangsu	Yancheng	Sino-Australia Aviation Technology		Foreign Introduced	Fixed-wing	Jabiru J230-D
Jiangsu	Nanjing	Nanjing Hongguang General Aviation Equipment Technology	AVIC	Self-developed	Balloon	HG2 Balloon
Hubei	Jingmen	Hubei Hangte Equipment Manufacturing	AVIC	Self-developed	Fixed-wing	A2C
Hubei	Xiangyang	Xiangfan Hongwei Aircraft	AVIC	Self-developed	Balloon	RQ Balloon
Hubei	Wuhan	Zall Aviation Industry		Foreign Introduced	Fixed-wing	Skyleader 600
Heilongjiang	Harbin	Harbin General Aircraft Industry	AVIC	Self-developed	Fixed-wing	Y12 Series
Heilongjiang	Harbin	AVIC Harbin Aircraft Industry	AVIC	Self-developed	Helicopter	Z-9 (H410, H425)
Beijing	Beijing	Beijing University of Aeronautics and Astronautics		Self-developed	Fixed-wing	M3C, M4
Beijing	Beijing	Beijing Keyuan Light Aircraft Industry		Self-developed	Fixed-wing	AD-200
Fujian	Xiamen	Xiamen Aidi Light Aircraft		Self-developed	Fixed-wing	AD-100
Fujian	Xiamen	AeroJones Aviation Technology (Xiamen)		Foreign Introduced	Fixed-wing	Flight Design CT-LS-LSA
Jiangxi	Nanchang	Jiangxi Hongdu Aviation Industry	AVIC	Self-developed	Fixed-wing	N5A, CJ6
Jiangxi	Jingdezhen	Jiangxi Changhe Aviation Industry	AVIC	Self-developed	Helicopter	Z-11(AC311), Z-8 (AC313)
Guangdong	Zhuhai	Zhuhai Yanzhou Light Aircraft Manufacturing		Foreign Introduced	Fixed-wing	TRITON SPORT
Guangdong	Zhuhai	Zhuhai AVIC General Aircraft	AVIC	Foreign Introduced	Fixed-wing	Cirrus SR20/22 Series
Shaanxi	Xi'an	Shaanxi Aircraft Industry	AVIC	Self-developed	Fixed-wing	Y8 Series
Shaanxi	Xi'an	AVIC Xifei Civil Aircraft	AVIC	Self-developed	Fixed-wing	Y7 Series
Henan	Zhengzhou	Henan Sanhe Aviation Industry		Self-developed	Gyroplane	SH-ZX-480-A/-AT
Henan	Luoyang	Luoyang Rotaplane Technology		Self-developed	Gyroplane	Rotaplane DS-100/115
Hunan	Zhuzhou	Hunan Sunward Technology		Self-developed	Fixed-wing	Sunward Aurora SA60L
Hunan	Chenzhou	Xiang Long General Aviation		Self-developed	Fixed-wing	XL100
Anhui	Wuhu	CETC Wuhu Diamond Aircraft Manufacturing	CETC	Foreign Introduced	Fixed-wing	Diamond DA42 Series
Chongqing	Chongqing	Chongqing General Aircraft Industry	CGAG	Foreign Introduced	Helicopter	Enstrom EN480B
Zhejiang	Shaoxing	Wanfeng Aviation Industry		Foreign Introduced	Fixed-wing	ALTO 912 TG, Diamond DA40 Series
Shandong	Heze	Progressive Aerodyne General Avia-tion Industry		Foreign Introduced	Fixed-wing	Searey LSA
Hebei	Shijia-zhuang	AVIC Shijiazhuang Aircraft Industry	AVIC	Self-developed/ Foreign Introduced	Fixed-wing	W5, Y5 Series (licenced version of An-2), LE500
Shanxi	Datong	Datong Light Aircraft Manufacturing	Sino-German	Foreign Introduced	Fixed-wing	Comco Ikarus C42E

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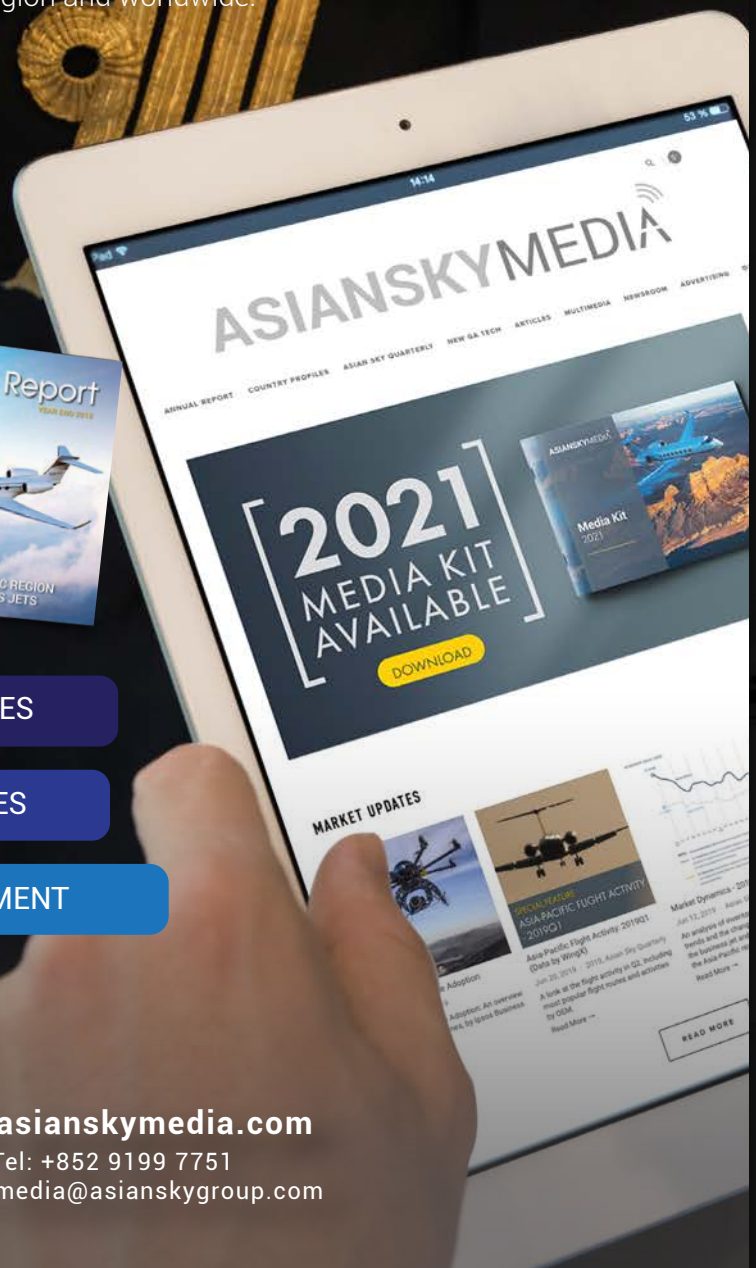

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CHINA AVIATION EMERGENCY RESCUE

CONTENT CONTRIBUTED BY CARE

中航材航空救援
China Aviation Rescue & Emergency

Mainland China has a vast area with a variety of climates and complicated terrains, as such it is one of the countries that has the most serious natural disasters. The sudden natural disasters and production safety accidents have brought huge losses and dangers to peoples lives and fortunes, which has created a huge demand for emergency rescue services. The transportation system is well developed with highways spread across the whole country. However, large-scale personnel flow leads to large car flow, with frequent traffic accidents and deaths. As the level of urbanization continuously increases, the aging population rises day by day. With the growth of the civil income level and health awareness, the demand for advanced medical resource transfers will also increase. In addition, due to the predictions for accidents that may occur during traveling, participating in cultural activities, and assembly, medical rescue displays a multi-point, multi-issue, widespread normalized increasing demand.

The role that aviation emergency rescue plays in emergency management

In the process of managing and handling a variety of accidents and disasters, aircraft such as helicopters, fixed-wing aircraft, and drones have the advantages of high mobility, fast movement, large scope of activities, and rare restrictions by terrain. Developed countries around the world usually use these aircraft as emergency rescue tools. Hence, the modern aviation rescue system is composed of helicopters, fixed-wing, and drones as the main force of the whole emergency rescue system.

General Secretary Xi attaches great importance to emergency rescue and has issued a series of important talks and discussions. General Secretary Xi emphasized on the 19th conference about the Chinese emergency management system and ability establishment held by the Political Bureau of the Central Committee of the Party: "Emergency management is the important part of the governance of the country's system and competence. It is responsible for preventing serious safety risks and instantly responding to a variety of disasters and accidents as well as protecting the safety of peoples' lives and properties to maintain a stable society. We need to give full play to the specialties and advantages of the national emergency management system, learn from the successful models of international emergency management systems, and proactively promote the modernization of the national emergency management system." As a significant part of the emergency rescue system, General Secretary Xi highlighted "We need to strengthen the construction of aviation emergency rescue capabilities and optimize the mechanisms of emergency rescue." General Secretary Xi's important instructions provide consolidated guidance for us to construct an aviation emergency system.

The advantages and challenges of aviation emergency rescue

Aviation rescue has the advantages of fast speed and high mobility, especially when executing missions such as short-distance transportation, urban emergency, medical rescue, forestry fire fighting, offshore search and rescue, etc. Establishing a complete aviation rescue system is quite meaningful to national economic development and the public. It is also an important way to improve the public's sense of happiness and security.

Aviation rescue also confronts some specific challenges, mainly including the following four points:

- The performance of rescue aircraft might limit operation areas. For example, plateau regions need professional plateau aircraft with a heavier load, which requires high aircraft function and pilot professionalism. However, there are not enough aircraft able to operate in a plateau region, resulting in a shortage.
- Relevant support resources and capabilities such as take-off and landing facilities, aviation fuels and supplies will influence the efficiency and costs of aviation emergency rescue.
- Airspace management mode restricts aviation emergency rescue response speed to a certain extent.
- General Aviation aircraft have complex models, various configurations, and complicated professional equipment. Moreover, not every aircraft is installed with aviation positioning equipment. As a result, it is hard to know the

complete dynamic distribution information, making it difficult to coordinate.

The current development of aviation emergency rescue in mainland China

Compared to Western developed countries, the aviation emergency rescue industry in mainland China is still in the beginning stage. There are huge differences between mainland China and developed countries in the number of rescue aircraft, rescue response time, rescue service quality evaluation, and service categories. The government pays great attention to aviation rescue development. By setting up supportive policies, establishing managing departments, and regulating industry management, the aviation rescue system has started to take shape.

The aviation rescue force in mainland China can be divided into two categories. One is the centralized management government force and the other is social power used in aviation rescue. For example, the aviation rescue team in the film "The Rescue" (2020) belongs to the ministry of transport as the professional aviation rescue force. On the other hand, general aviation companies with rescue capabilities are part of the social power of aviation rescue.

There still exists some shortages in China's aviation emergency system that needs to be addressed as follows:

- Professional rescue forces need to be strengthened
- Social general aviation forces are scattered and uneven
- Aviation emergency rescue support facilities are not sufficient
- Airspace management mode restricts aviation rescue development
- Lack of efficient coordination and response mechanism
- Lack of professional aviation resource information management platform

The policies and future development of aviation emergency rescue

In recent years, the aviation rescue business and system in mainland China is developing due to central and local governments' promotions. The government published a series of policies such as the General Office of the State Council of the People's Republic of China "Opinions on Promoting the Emergency Industry Development" (2012), the State Council of the People's Republic of China "Opinions on Promoting the Development of Civil Aviation" (2014), General Office of the State Council of the People's Republic of China "Guidance toward Promoting the Development of General Aviation" (2016), General Office of the State Council of the People's Republic of China "The 13th Five-Year Plan on National Accidents Emergency System Construction" (2017), the State Council of the People's Republic of China "Opinions on Carrying through" Government Operation Report" Department Coordination" (2018), CAAC, the National Health Commission "Execution Plan on Aviation Medical Rescue Coordination Experimental Work" (2019). These documents provide specific guidance toward policies, strategic planning, and solid implementation.

In 2018, the Ministry of Emergency Management of the People's Republic of China was established, which managed a variety of positions and departments about security production, natural disasters, and serious accidents. At the same time, it is the main department responsible for abnormal rescue dispatch and mission execution and also united the aviation rescue force together. The Ministry of Emergency Management of the People's Republic of China pays great attention to the establishment of the aviation emergency rescue system. On September 6th, 2019, it published the "Emergency Rescue Aviation System Establishment Plan" (Emergency [2019] No.89) and proposed specific requests and implementation plans such as "Constructing Emergency Rescue Aviation Command Platform", "Establishing Aviation Key Force of Emergency Rescue", and "Optimizing Emergency Rescue Aviation Security Terms".

As the industry management department, the Civil Aviation Administration of China (CAAC) manages the operation specifications of general aviation companies and general airports. In terms of financial subsidies, the CAAC encourages and supports the development of the general aviation industry to assist with construction of an aviation emergency rescue system. On the other hand, the National Health Commission has explored new high-efficiency rescue methods in the medical field.

The first aviation rescue national team – China Aviation Rescue & Emergency.

The establishment of an aviation emergency rescue system is a vast and complex engineering feat involving aspects of the national economy, social development, and national defense construction. It is necessary to be strongly promoted, from the top design to overall planning, with factors such as system construction, regulations and mechanisms, scale development, and industrial operation. Exploiting factors such as centralized management, unified deployment, rapid reaction, focus and concentration, professional development, appropriate size, support improvement, the aviation emergency rescue system can play to the strengths of central and local governments, enterprises, and institutions to promote it step by step.

As the "First National Aviation Rescue Team", China Aviation Rescue & Emergency Holding Company (China Aviation Rescue & Emergency) is dedicated to creating an aviation rescue service system covering the country, serving the public, in line with international standards, secure, and highly efficient. Using province and region as its unit, China Aviation Rescue & Emergency can provide safe and high-efficient all-day aviation medical rescue services to main regions nationwide and aviation emergency rescue services when accidents happen.

Since its establishment, China Aviation Rescue & Emergency has been committed to emergency aviation rescue following important instructions from president Xi Jinping and the document requirement form□2019□#89. This platform serves as a bridge between the demand and providers as an informative platform and service. Taking advantage of current resources and integrated viable forces, this platform can meet the demands of administrative departments and users by providing a one-stop service.

China Aviation Rescue & Emergency has planned to promote work by drawing upon experiences gained in key areas, formulating a pilot scheme at the provincial level, and then spreading this to other provinces/regions. That is why China Aviation Rescue & Emergency has established a rescue base in Zhejiang province which has gradually spread to the Yangtze River Delta Area. China Aviation Rescue & Emergency proactively attended the aviation aid safeguard for major national projects and communicated with related corporations from all over the world. Combining other resources, China Aviation Rescue & Emergency can improve the functions of the aviation aid system.

On July 16th, 2021, Henan Province suffered from floods due to heavy rainfalls. China Aviation Rescue & Emergency reacted quickly and took responsibility to execute rescue missions. On July 22nd, against all odds, China Aviation Supplies assembled one utility (equipped with professional onboard medical facilities) light-twin Bell 429 helicopter which was dispatched overnight to disaster areas with consolidated operational capabilities. As a result, China Aviation Supplies became the "first and only" case of a central enterprise combining with social forces to fight floods. In the continuous three-day rescue process, China Aviation Supplies easily executed missions such as Xinhua's aerial photography for news reports, supplies delivery for nursing homes, schools, trapped communities as well as medical hospital transfers. It has departed 17 times, patrolled cities with more serious disasters such as Xinxiang Weihui, Hebi Junxian, Zhengzhou Baisha, brought around ten thousand pieces of supplies and saved thousands of people. When China Aviation Supplies fought against the disasters in Henan Province, it simultaneously responded to the need from the emergency department in Hebei Province beforehand. China Aviation Supplies rescue team went to Shijiazhuang for disaster prevention surveillance, which provided decisive support for disaster prevention and reduction. This action demonstrated what central corporations should do: they should come forward, regardless of gains or losses, and move forward courageously with positive energy. Thus, it can influence more social forces to follow, allowing central and local forces to work together.

China Aviation Rescue & Emergency sufficiently fulfills the social duties as a central corporation whilst promoting industry development. By creating a platform-based company, China Aviation Supplies and Aviation Rescue can work together to play an important role in aviation rescue. This is reflected in the following three aspects:

- China Aviation Rescue & Emergency supports the government to fulfill its duties. The main missions include establishing an aviation emergency rescue service third-party platform to bridge demand and supply, assisting government institutions to efficiently finish construction and layout, as well as executing other missions assigned by government departments.

- China Aviation Rescue & Emergency promotes the coordination of emergency capabilities and the general aviation industry. By implementing government emergency rescue missions, the platform can gather core resources of general aviation operation, attract related upstream and downstream general aviation corporations to participate, facilitate the exchange of various elements, continuously motivate high-quality development of general aviation as a national strategic emerging industry, and promote the optimization of the national emergency rescue standard.

- China Aviation Rescue & Emergency improves safety and security as well as the public happiness index. It fully utilizes the platform's resource connections and the support from local governments to provide normal aviation medical rescue services such as road traffic rescue and aviation hospital transfer etc. As a result, it can improve the level of livelihood rescue and people's sense of happiness and security.

Connecting supply and demand as well as up and down has been set as the goal for China Aviation Rescue & Emergency. It is dedicated to becoming an important starting point of the government's emergency decision-making and a powerful way to enhance the rescue ability and standard of corporations.

中航材航空救援
China Aviation Rescue & Emergency

Your Aviation Rescue Butler

China Aviation Rescue & Emergency Co., Ltd (hereinafter referred as the Company) is a professional company offering comprehensive aviation rescue and emergency services, established by China Aviation Supplies Holding Company as an essential action to fulfill the responsibilities of a State Owned Enterprise, and implement the national development strategy that general aviation should keep pace with commercial aviation, the Company is the first "National Team" to develop aviation rescue and emergency system within China.

The Company is dedicated to building a safe, efficient and sustainable aviation rescue and emergency system that serves the whole nation of China complying with international standards. It provides safe and efficient aviation medical rescue service in all weather conditions and aviation emergency rescue services in the time of disaster.

中航材航空救援
China Aviation Rescue & Emergency

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E-mail: jiuyuan_media@cas-care.com.cn

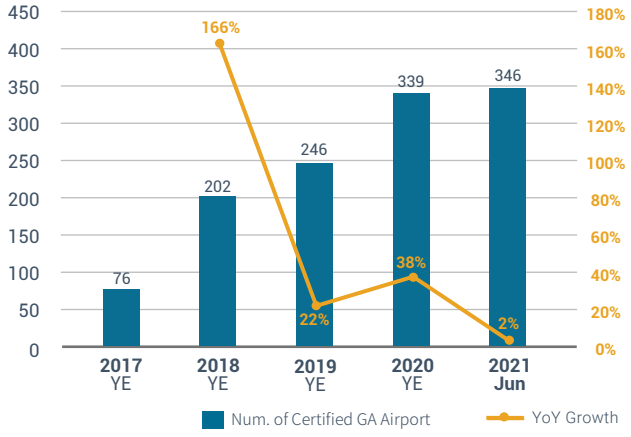
INFRASTRUCTURE OVERVIEW

GA AIRPORTS

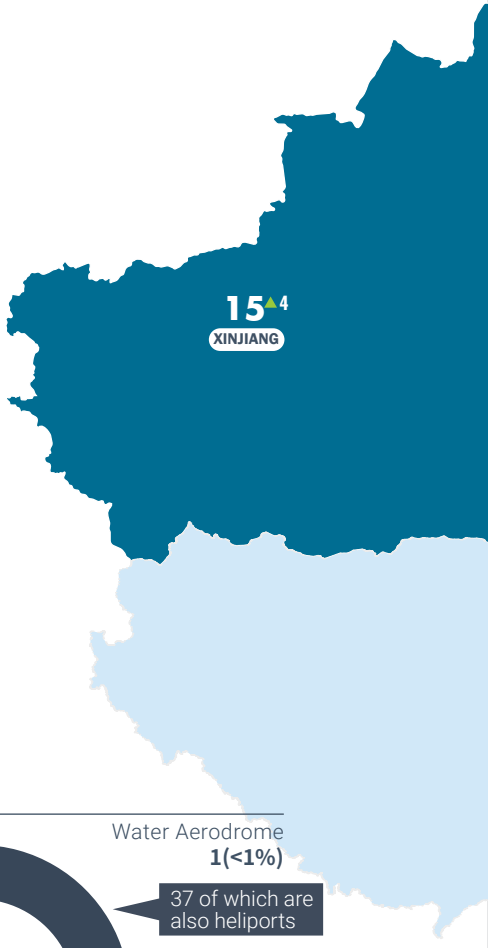
The rapid growth of general aviation airports in 2019 and 2020 slowed down in 2021. As of June 2021, mainland China has a total of 346 certified GA airports. Compared to the previous year, this was an increase of seven airports, equivalent to a growth rate of 2% - the first time grow has been a single digit.

2017-2021 CHINA GA AIRPORT GROWTH

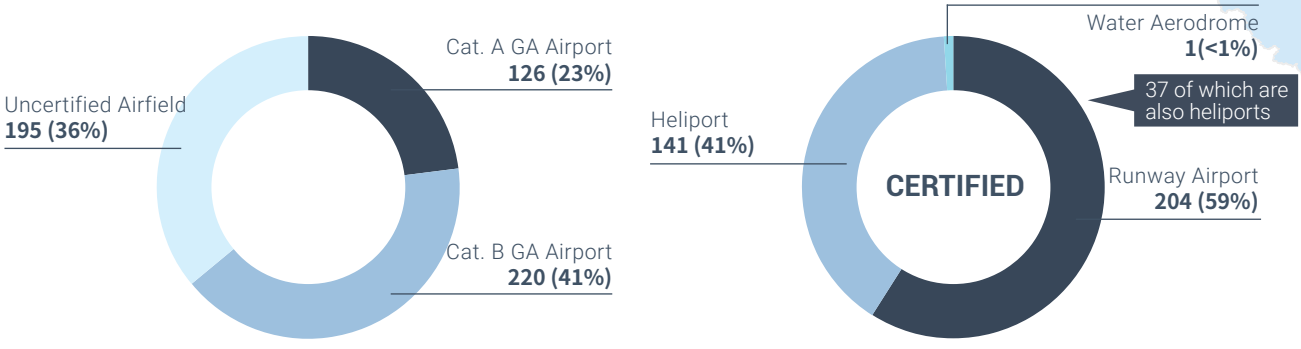
(excluding Hong Kong, Macao and Taiwan)



Data Source: CAAC, Statistical Bulletin of Civil Aviation Industry Development and AOPA GA Airport Information Platform



CHINA GA AIRPORTS BY CATEGORY



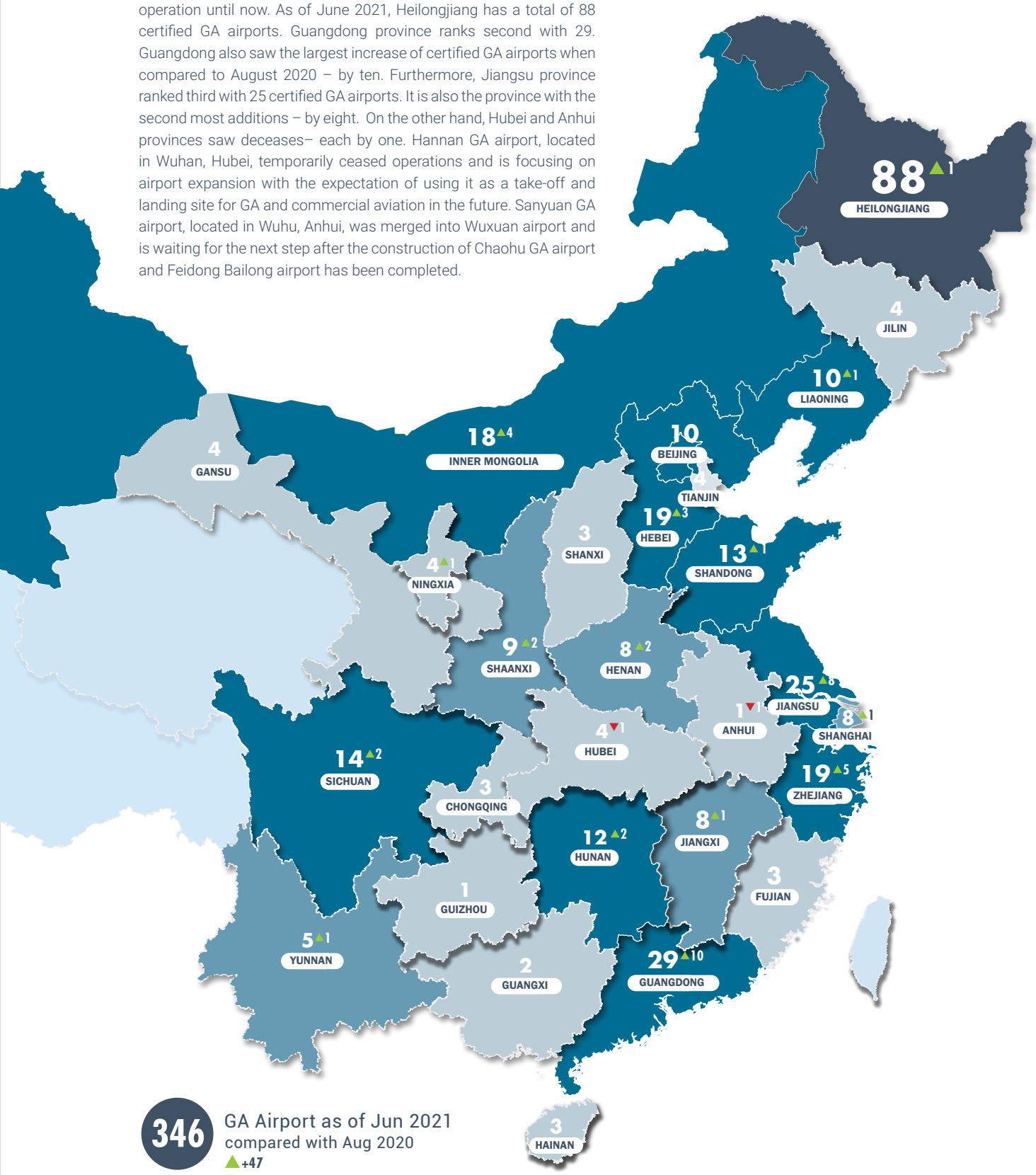
Data Source: AOPA GA Airport Information Platform, as of Jun 2021.

Apart from certified GA airports, there are 195 uncertified runway airports, heliports, medical-usage helipads, and elevated heliports. Amongst these GA airports, some will be certified in the near future. As of the time of publication, there are 91 GA airports under construction. Additionally, a lot of GA airport construction has been scheduled by local governments since the introduction of the 14th Five-Year Plan.

CHINA GA AIRPORT BY PROVINCE

(Not including Hong Kong, Macao and Taiwan)

Heilongjiang province, the largest grain production region in China, is still ranked the highest thanks to historic agriculture airports in operation until now. As of June 2021, Heilongjiang has a total of 88 certified GA airports. Guangdong province ranks second with 29. Guangdong also saw the largest increase of certified GA airports when compared to August 2020 – by ten. Furthermore, Jiangsu province ranked third with 25 certified GA airports. It is also the province with the second most additions – by eight. On the other hand, Hubei and Anhui provinces saw deceases– each by one. Hannan GA airport, located in Wuhan, Hubei, temporarily ceased operations and is focusing on airport expansion with the expectation of using it as a take-off and landing site for GA and commercial aviation in the future. Sanyuan GA airport, located in Wuhu, Anhui, was merged into Wuxuan airport and is waiting for the next step after the construction of Chaohu GA airport and Feidong Bailong airport has been completed.



346 GA Airport as of Jun 2021
compared with Aug 2020
▲+47

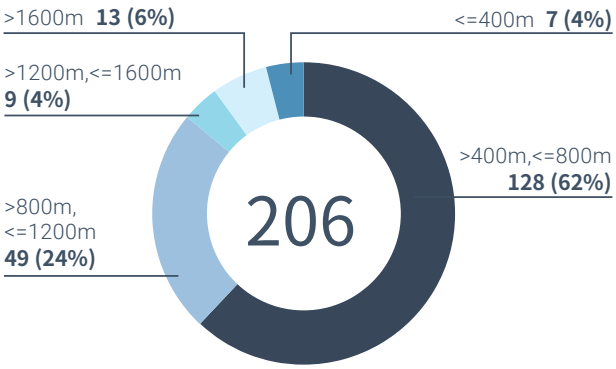
Amongst certified GA airports, there are 126 Type-A and 220 Type B airports as of June 2021. There are some differences between the two; Type A airports are allowed to be open to the public and run commercial flight activities, whilst Type B airports are not allowed to, and can only be used for general aviation activities.

Moreover, certified GA airports can be categorized into runway airports (constituting 59%), heliports (41%), and water aerodrome (less than 1%). Amongst the runway airports, 37 of them can be used as heliports. Aside from the Shanghai Jinshan Water Aerodrome which was certified in 2019, there are three other GA airports with the facilities to provide water aerodrome services.

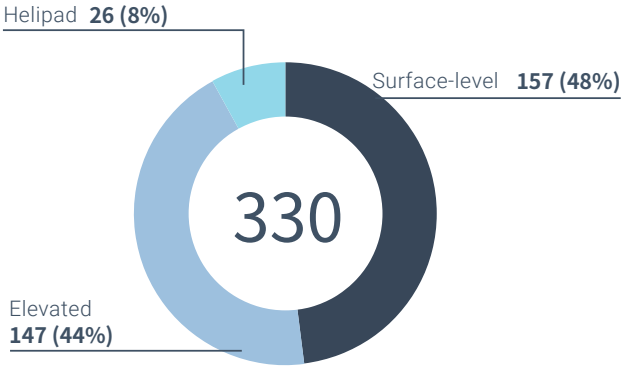
Runway airports can be divided by the length of the runway. The airports with runway lengths between 400 and 800 meters account for 62% of the market share. As small-sized fixed-wing aircraft usually need a runway length between 600 and 800 meters, this means that a runway with a length of 800 meters is enough for the majority of the general aviation aircraft. On the other hand, business jets need longer runways than other aircraft types, with most needing a runway length from 1600 to 2000 meters for take-off and landing. Overall, there are only 13 GA airports with a runway length above 1600 meters.

Amongst the 157 surface-level heliports, 115 are certified. There are 26 certified elevated heliports and 147 uncertified helipads. Compared with a helipad, a heliport is usually equipped with more secure operational facilities.

RUNWAY AIRPORT BY RUNWAY LENGTH



HELIPORTS AND HELIPADS BY CATEGORY



Data Source: AOPA GA Airport Information Platform. As of Jun 2021.

金石航空

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EMERGENCY RESPONSE: EMS, Urban Operation, Rescue Hoist, etc.

DISASTER RELIEF: Mountain Flying, External Load Operation, Precision External Load, Aerial Delivery, Short Haul, etc.

AERIAL FIREFIGHTING: External Load Operation, Vertical Reference, Mountain Flying, Aerial Firefighting, etc.

AIR TRANSPORT: Aerial Delivery, External Load Operation, Vertical Reference, Mountain Flying, Short Haul, etc.

Falcon Special Mission provides the following equipment and can help clients source other special mission equipment based on the clients' needs:

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- Professional Air Crew Gear
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FBO AND MRO FACILITIES

FBO

A Fixed-base Operator (FBO) is a facility that provides ground services for business aircraft. An FBO usually has an independent terminal with facilities such as VIP lounges, cabin crew lounges, security checks, and a customs corridor. It also provides hangar parking, refueling, maintenance, and cleaning services.

As of June 2021, there were 14 FBOs in mainland China, all in major civil transport airports. In addition, under current government rules, only one FBO is allowed per airport. Beijing, Shanghai, Guangzhou, and Shenzhen, which are first-tier cities, all have FBOs. Tianjin Binhai International Airport began operating in 2015 to serve the needs of clients looking for business jet charter services in the metropolitan area. Deer Jet has the biggest cluster of FBOs. Its FBOs cover seven coastal and inland cities, including Hangzhou, Xian, Changsha, Guilin, Nanning, Haikou, and Sanya.

Beijing Daxing International Airport started operations in September 2019. The FBO inside Daxing Airport was planned to open before the end of 2021, and it is expected there will be another FBO operating in mainland China. Apart from that, Chengdu Shuangliu International Airport, Wuhan Hannan General Airport, and Kunming Airport also have plans to construct an FBO.

MRO

Maintenance, repair, and overhaul (MRO) facilities provide overhaul, maintenance, and repair services for business jets, helicopters, turboprops, and piston fixed-wing aircraft. The daily airline maintenance is usually done by the operator itself.

MROs can be divided into three categories. The first one is the MROs that OEMs directly or jointly establish. Another is MROs authorized or designated by the manufacturer. Finally, third-party MROs are operating under CAAR- 145 regulations.

Some MROs authorized by OEMs also operate large fleets manufactured by OEMs, or are agents or distributors of that OEM in the region. For example, the two Airbus Helicopter authorized MRO maintenance centers COHC and State Grid GA, are each the largest operators of H155/H225 and H125 models. The Bell authorized MRO center, Reignwood, is the only authorized distributor of the Bell 505 model and operates the largest Bell fleet in mainland China.

FOR MORE INFORMATION ON INFRASTRUCTURE MARKET, PLEASE REFER TO ASIA-PACIFIC INFRASTRUCTURE REPORT ON ASIANSKYMEDIA.COM

FBO AND MRO BY CITY

(Not including Hong Kong, Macao and Taiwan)

FBO MRO ● CITY

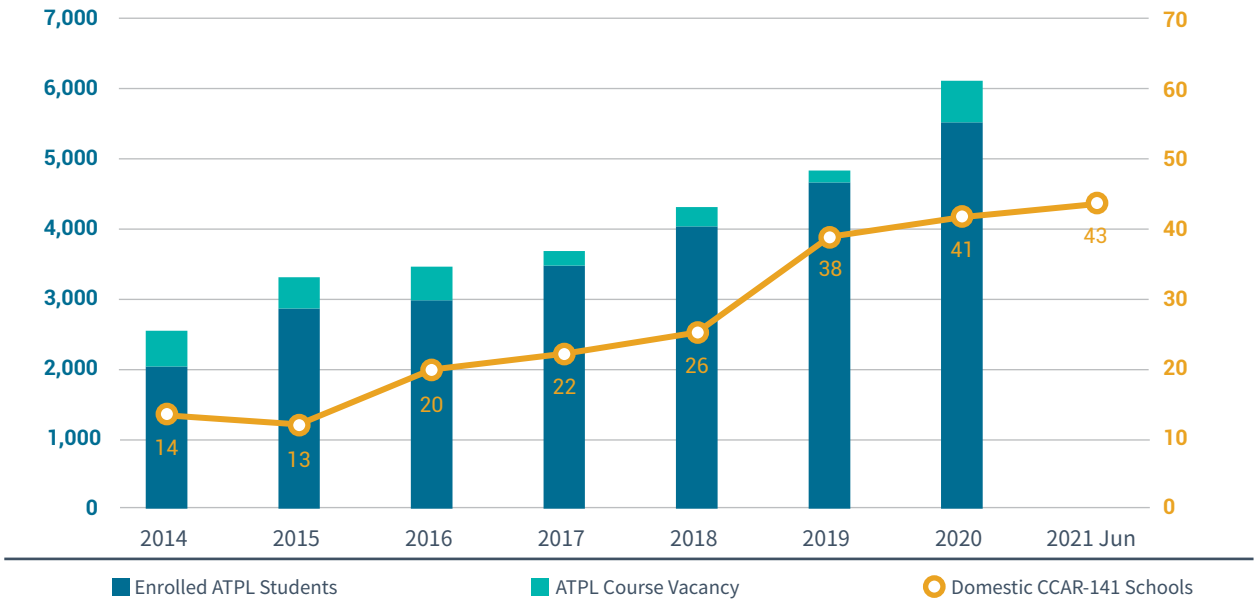
TRAINING AND PILOTS

TRAINING SCHOOLS

In mainland China, training institutions are composed of the CCAR – 141 aviation schools and the CCAR – 61 training institutions. Usually, CCAR -141 aviation schools are more rigorously regulated, have larger fleet sizes, younger aircraft, and better aircraft functions. Also, these schools are usually equipped with professional teachers who are allowed to provide Airline Transport Pilot License (ATPL) courses. On the other hand, CCAR – 61 training institutions are usually general aviation operators under CCAR – 91 and mainly aim to train their own pilots. Although the CCAR – 61 schools are not allowed to provide ATPL courses, their flexible academic process, and low expenses are advantages when compared to CCAR – 141 training schools. As a result, students graduating from CCAR – 141 schools usually pursue a career with commercial airline companies, whilst those from CCAR – 61 training institutions usually gravitate towards general and private aviation for their careers.

At the end of 2020, there were 41 CCAR – 141 training schools, compared to the previous 38 schools in 2019. The slow growth in the number of facilities continued from 2020 to 2021. As of June

2014-2020 CCAR-141 SCHOOL AND ATPL COURSE CAPACITY

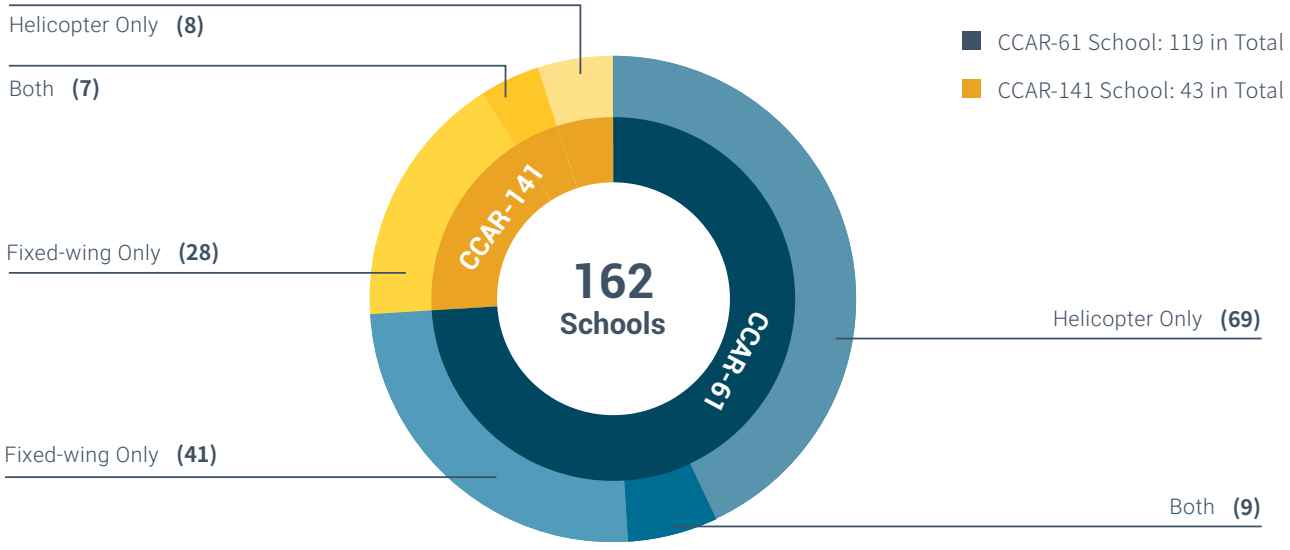


Data Source: CAAC, China Civil Aviation Pilot Development Annual Report

ATPL course capacity of 2021 has not been released yet.

CCAR-61 AND CCAR-141 SCHOOLS AND COURSES PROVIDED

Data as of June 2021



2018-2020 CCAR-61 AND CCAR-141 FLIGHT TRAINING HOURS YOY TREND

Data Source: CAAC, Overview of General and Small Transport Operations

2021, there were only two new CCAR - 141 facilities, giving a total of 43 schools.

Due to the outbreak of the COVID-19 pandemic, many training pilots were not able to travel abroad, and could only stay in China. As a result, the number of registered CCAR – 141 training pilots increased 18.4% from 4,650 in 2019 to 5,506 in 2020.

As of June 2021, there were 43 CCAR – 141 and 119 CCAR – 61 training institutions. Amongst the CCAR – 141 facilities, 28 of them only provided fixed-wing training courses. Furthermore, eight schools only provided helicopter training and seven schools provided both fixed-wing and helicopter lessons.

On the flip side, CCAR – 61 training schools are quite different. The majority of facilities only provide helicopter training courses – 69 of them. There are also only 41 training institutions providing fixed-wing courses. Finally, nine institutions provided both helicopter and fixed-wing curriculums.

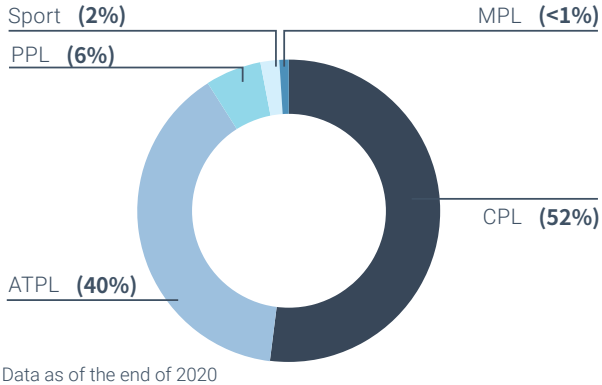
Regarding the flight training hours in 2020, CCAR – 141 schools accounted for over 90%. The rest belonged to CCAR – 61 institutions, roughly staying the same as previous years. On the other hand, the training hours of CCAR – 141 and CCAR -61 schools showed a different trend, in 2019, both CCAR – 141 and CCAR – 61 grew compared to 2018 – each by 14% and 54%, respectively. 2019 to 2020 saw CCAR – 141 training hours increased by 25%, whilst CCAR – 61 training hours dropped by 4%.

PILOT OVERVIEW

From 2014 to 2020, the number of registered Chinese civil aviation pilot licenses experienced a continuous increase. According to data from the "China Civil Aviation Pilot Development Annual Report", there were a total of 69,817 Chinese civil aviation pilot licenses at the end of 2020. Whilst the annual growth rate remained around 10% from 2017 to 2019, the growth rate in 2020 drastically decreased to 2% due to the COVID-19 pandemic.

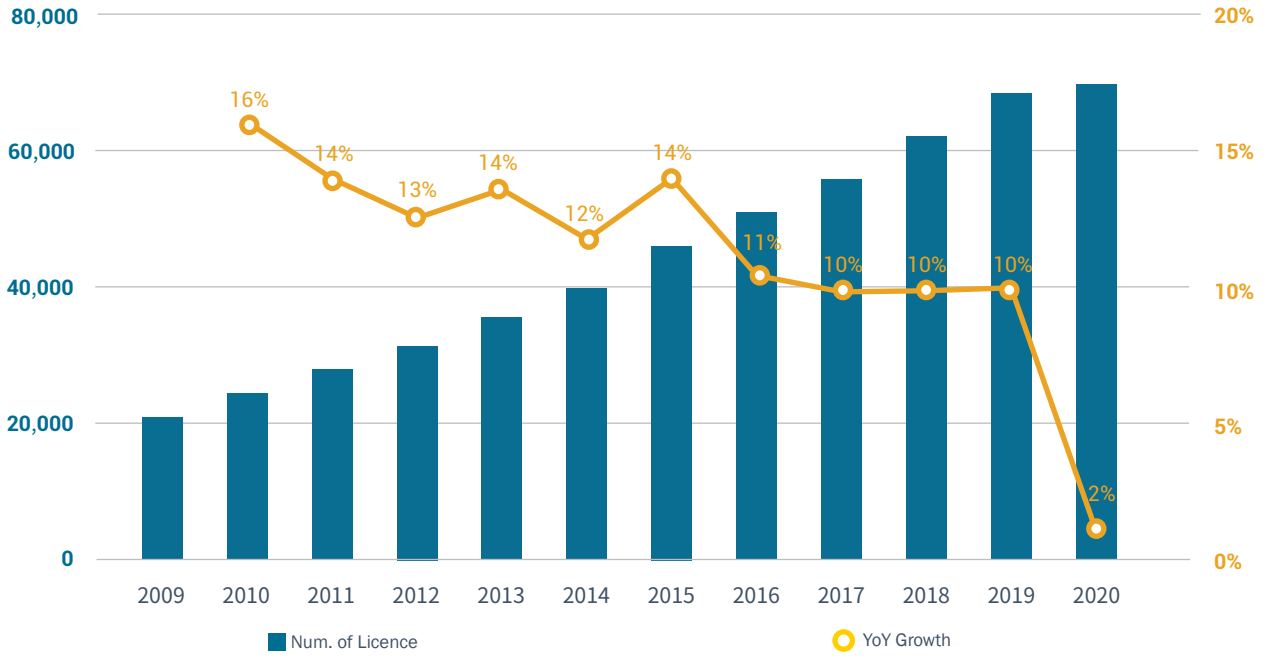
By the end of 2020, amongst the various civil aviation pilot license categories, the number of Commercial Pilot License (CPL) accounted for 52%. Additionally, the Airline Transport Pilot License (ATPL) accounted for 40%. The rest of the makeup is composed of Private Pilot License (PPL) at 6%, Sport Pilot License (SPL) at 2%, and Multi-crew Pilot License, with less than 1%.

CIVIL PILOT LICENSES BY TYPE

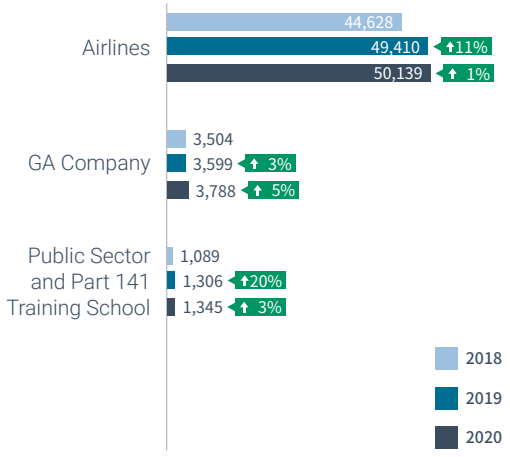


Data as of the end of 2020

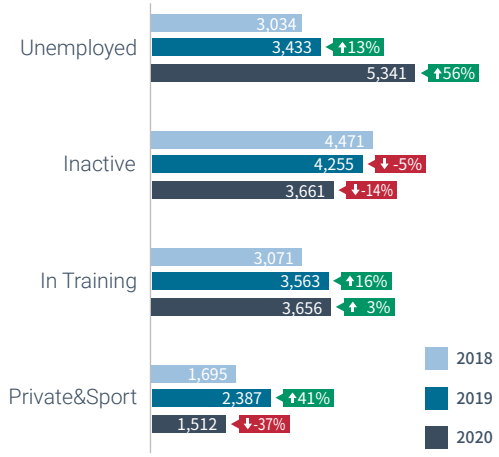
2009-2020 CHINA CIVIL PILOT LICENSE GROWTH



IN-SERVICE PILOT BY EMPLOYER TYPE (80%)



NOT-IN-SERVICE PILOT BY TYPE (20%)



Around 80% of registered pilots were employed in 2020, making the situation similar to previous years. More specifically, 91% of licensed pilots still chose to work for commercial airline companies. Although pilots that chose general aviation businesses remained fewer in comparison, the number of general aviation pilots increased by 5% from 2019 to 2020. With regards to the number of public service pilots and CCAR – 141 instructors, there was only 3% growth from 2019 to 2020.

Unemployed and inactive pilots (mainly resigned non-local pilots, retired pilots, and deceased pilots) as well as private and sport pilots saw a drop from 2019 to 2020. On the flip side, the number of trainee and unemployed pilots experienced an increase. Due to the outbreak of coronavirus, the number of unemployed pilots increased dramatically – by 56%.

AVIATION SAFETY MANAGEMENT SYSTEM

CONTENT CONTRIBUTED BY SINO JET

華龍航空 SINO JET

What is Aviation Safety Management?

According to the International Civil Aviation Organization (ICAO), safety management is a consistent approach to hazard identification and safety risk management, reducing and controlling risks to, or below, an acceptable level.

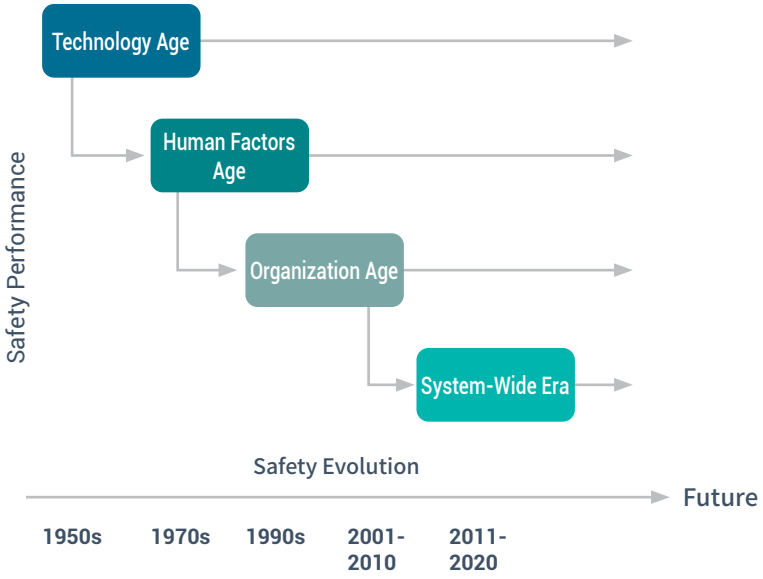
Civil Aviation Safety Management refers to activities including decision-making, planning, organization, and regulation, to attain the objectives of aviation operational safety, which includes necessary organizational structure, responsibilities, policies, and procedures. By applying modern safety management principles, as well as analyzing a multitude of unsafe factors, risks can be mitigated and solved from technical, organizational, and management aspects.

The Current Development of China's Aviation Safety Management

China's aviation safety management has gone through several notable periods: the age of technology, human factors, organizations, and the system-wide era that we are currently in.

The age of technology refers to the early 20th century to the late 1970s, when aviation emerged as a form of mass transportation, and its identified safety deficiencies were associated with technical failures or errors. Therefore, technical investigations and improvements were the main focus at the time. Until the 1950s, as technology improved and accident rates declined, the developing objectives gradually shifted to regulations and compliance.

The age of human factors refers to the period from the early 1970s to the mid-1990s. In the early 1970s, the accident rate was greatly reduced due to continuous improvement in technology and safety regulation framework. Aviation has become a safer mode of transportation, and the developing safety objectives



further extended to the human-machine interface. Despite the resources invested in reducing human errors, they are still a major cause of accidents.

The age of organization refers to the time from 2001 to 2010 when people began to review safety from a systematic perspective. Apart from technical and human factors, organizational factors were also included. Considering the impact of organizational culture and policies on safety risk management, the concept of structural organization was adopted. In addition, the traditional method of data research and analysis was limited to the data collected in the investigation of incidents and serious accidents. To tackle the problem, a new and proactive approach to safety was introduced.

During the time, civil aviation safety management began to move towards standardization and systematization: building a structured framework, constructing a system, establishing procedures, and setting standards.

With the increasing modernization of civil aviation, and the growing scale of operations, the division of labor has become more detailed, and the production cooperation with different industries and different posts in the aviation industry has become more extensive. China's civil aviation has made great leaps in safety management, with the construction of five systems - Supervision System, Legal and Regulatory System, Safety Information Reporting System, Internal Regulation System, and the Aviation Safety Management System (SMS).

In 2010, China officially entered the system-wide era. The entire aviation industry was viewed as a system, all service providers and their safety management systems were regarded as sub-systems, which allows a country to consider the relationships between different service providers, as well as how they work together.

Safety Management System

Achieving safety is an essential foundation to any country or company; without it, no country can grow successfully. This doesn't only apply to business and general aviation industry, but also in commercial aviation as well. ICAO defines Safety Management Systems (SMS) as "a systematic approach to managing safety, including the necessary organizational structures, responsibilities, policies, and procedures." This provides a blueprint for civil aviation safety policies, which aims to improve the quality of aviation safety management in mainland China, and to provide a scientific safety management model for managing authorities, safety concepts, tools, and methods, to achieve a standardized safety management system.

Unlike traditional safety management, SMS is about emphasizing the organizational factors of unsafe behaviors and the potential factors of incidents. With the improvements in organization and pre-incident management, the core aspects of SMS are risk management, prevention, and proactive approach. It is significant that everyone participates and takes responsibility for the SMS, as well as forming self-managed, self-supervised, and self-improving practices. These have greatly contributed to safety management in civil aviation.

Moreover, ICAO member countries have developed and implemented 'Safety Management Systems' for civil aviation to achieve the industry requirement of aviation safety.

Top-level Safety Management Design

A good example is Sino Jet. In 2018, the company became the first business jet operator in mainland China to achieve IS-BAO Stage 3 certification - the highest level of achievement to be awarded by the International Business Aviation Council (IBAC).

Sino Jet believes that safety management can be divided into four aspects: Corporate Culture, Talent, Management Policy, and Advanced Technology.

First up is Corporate Culture. Sino Jet values Honesty, Integrity and Detail-mindedness. The company is aware that it is worth keeping an eye on hidden risks, as these can be the root cause of incidents.

Secondly, Talent. Sino Jet has implemented an effective talent acquisition program. The team members at Sino Jet are experienced in their fields and have professional skills and knowledge in operational safety. Sino Jet also conducts various safety training courses for employees once they are on board, which includes workplace safety procedures, internal assessment in safety management, course participation of civil aviation management institutions, and inviting experts to share insights on international safety management.

Thirdly, Policy Management. All employees in Sino Jet share operational safety as a common goal. Based on the regulation manual of the Civil Aviation Authority, Sino Jet has refined specific standard operation procedures and formulated corresponding incentives. By enjoying a safer workplace with established policies, the company aims to enhance operational safety .

Sino Jet Flight Crew Preflight Check

Fourth, Advanced Technology. Apart from applying professional and technical skills to daily work, information technology has been adopted in daily operations as well. Sino Jet has developed its own safety management system, maintenance, and operating program, and introduced an advanced Flight Operational Quality Assurance & Data Monitoring System, Global Satellite Positioning System, and Weather Monitoring System.

Overall, Sino Jet accomplished the goal of operational safety by creating an atmosphere for safe operations, electing talents, and constantly providing employees opportunities to improve, with provisions of advanced technology to support their work. With concerted efforts, Sino Jet became the first company in mainland China to achieve IS-BAO Stage 3 and successfully renewed it this year.

Information Technology in Safety Management

Throughout the aviation industry, the Standard Operating Procedure (SOP) runs through every part of operations, and all employees strictly follow the regulations and operating manuals. However, human error is inevitable, so technical applications are required in this case. Sino Jet, as an industry leader that has consecutively passed the International Business Jet Operating Standard IS-BAO Stage 3 Certification twice, has applied key information technologies, including but not limited to modern communications, the Internet, and data analysis in daily operation. The overall implementation of safety operations in each procedure strengthens the risk control of high-complexity production.

According to business operations, Sino Jet has developed a Safety Management System (SMS), Flight Operations System (FOS), Maintenance Management System (MMS), and also introduced a Quick Access Recorder (QAR) and other flight quality monitoring systems, such as a Global Satellite Positioning Systems and Weather Monitoring Systems, etc. These provide scientific statistics to support decision-making in safety production. The information is processed promptly, which facilitates simpler, more standardized, and systematic operation, which is the safety management goal.

Sino Jet Operation and Control Team

The Future Plan of Sino Jet Safety Management

Sino Jet believes that safety management has a long way to go. Safety operations must be delivered to each employee layer by layer, to avoid human errors in the workplace and to correct and execute any deviations in the system.

At the same time, safety awareness should be strengthened. To ensure all employees work consistently under safety regulations, instant measurements of safety performances should be adopted to spot errors. Also, the safety operation guidelines should be adjusted in different conditions and kept updated over time, which is essential to prevent the system from becoming outdated.

Finally, to promote safety operations comprehensively in multiple dimensions, an incentive plan should be used to motivate employees, which will encourage them to pursue work safety proactively, and tackle problems positively.

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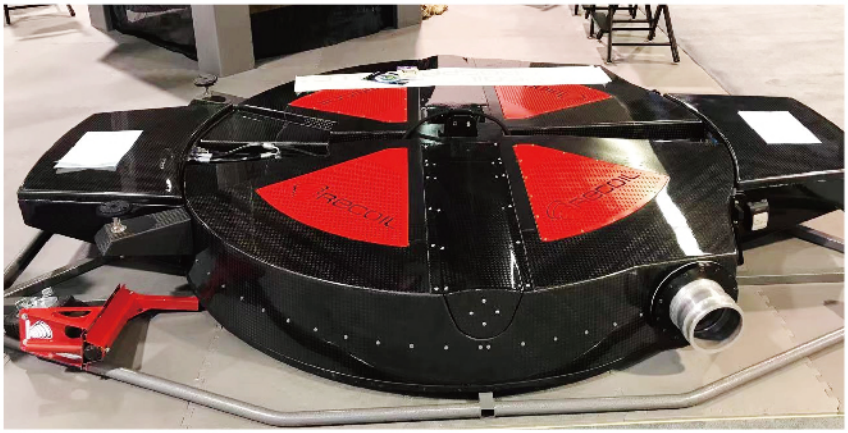

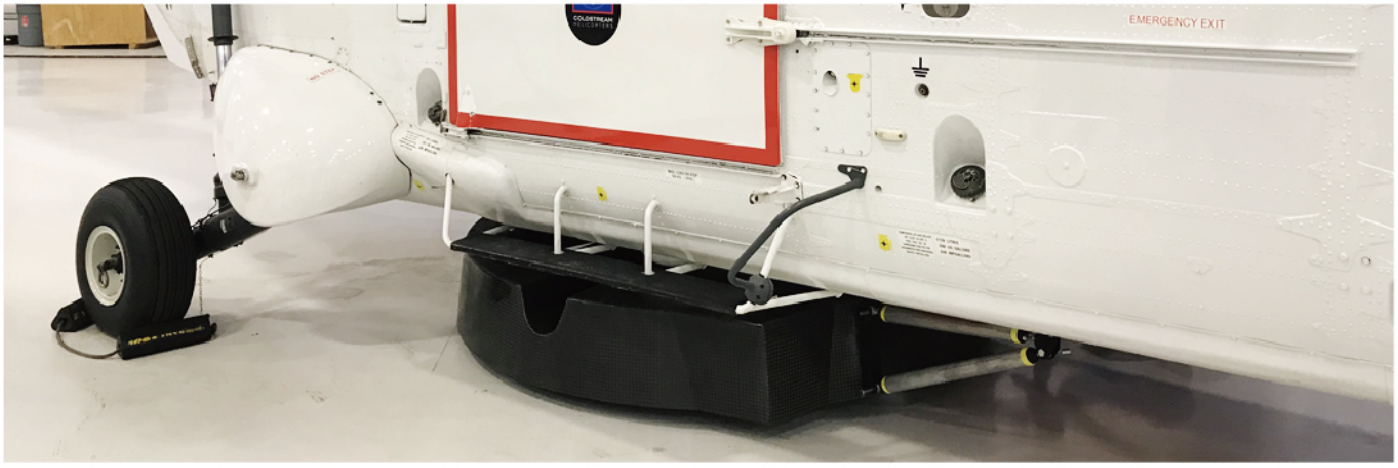

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取水时间：40秒

洒水时间：4-8秒

水箱系统自重：250公斤

电源：机载交流电源系统供电

自动保护：故障安全保护系统设计

改装简单：最少的加改装程序

R60-E 选装内容

水炮

泡沫喷射器

飞行员培训

任务员培训

R60-E 适配机型

- Bell 212 / 412
- SK92 / SK76
- Mi-17 / Mi-26
- EC225/AS332/EC215
- S70i
- Sk61
- Aw139
- Ka-32

Avion
亚飞太平洋有限公司

一站式通用航空服务商
Total General Aviation Solutions

AVION PACIFIC LTD

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DRONE APPLICATIONS

Interviewees:

北大荒通用航空有限公司 BEIDAHUANG GENERAL AVIATION CO.,LTD

star loop AVIATION

国家电网 STATE GRID

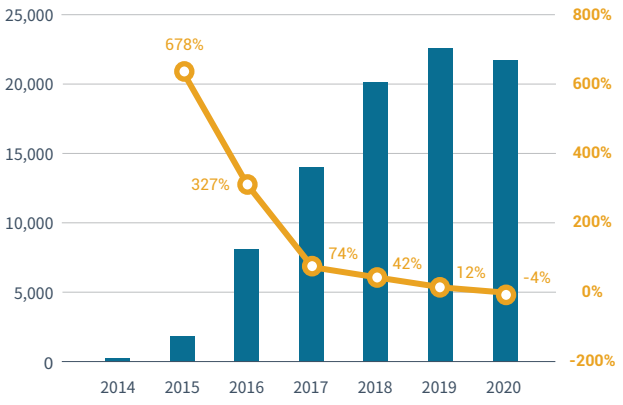
国网通用航空有限公司 STATE GRID GENERAL AVIATION COMPANY LIMITED

中国南方电网 CHINA SOUTHERN POWER GRID

DEVELOPMENT STAGE

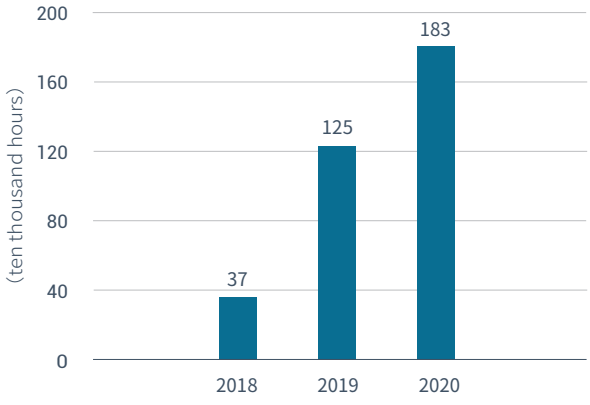
The technology for drone manufacturing has become more and more mature. The latest drones are highly flexible, have strong anti-interference measures and security for risky missions. Drones are mainly used in aerial photography, agriculture, forestry, powerline inspections, logistics and supply chains, as well as firefighting. It has also led to a surge in drone purchases. Moreover, drone manufacturers have had great success in exporting their drones worldwide.

DRONE PILOT LICENSE YOY TREND



Data Source: CAAC, Annual Report of Chinese Civil Aviation Pilot Development

2018-2020 DRONE FLIGHT HOURS



Data Source: CAAC, Statistical Bulletin of Civil Aviation Industry Development

According to the data acquired from the "Chinese Civil Aviation Pilot Development Annual Report" and "Civil Aviation Industry Development Statistical Report", the number of drone pilot licenses has experienced continuous growth even in 2020 with the COVID-19 pandemic. Drone flight hours also saw an increase from 2018 when drone development began to scale up.

The unmanned aerial vehicle (UAV) industry in mainland China has experienced three stages of development, including the introduction, slow development, and boom phase. The first stage began in 1980 and continued until 2006. The most important change in the UAV industry is from military to civil usage. At the time, technology and industry were in their infancy. As a result,

soft and hard devices equipped on drones had higher costs. The second stage lasted from 2007 to 2015. The demand for drones from the downstream industry began to increase. The civil UAV market was small and many newly established companies competed against one another. At the same time, technological research and development, as well as product functionality, had substantially improved. The third stage began in 2016. Individual consumers have rapidly increased, bringing huge profits to the UAV industry. On the other hand, industrial drones are in the process of differentiating their application fields. Fields such as agriculture and forestry, powerline inspections, as well as logistics and distribution all show promise and have attracted more investors to the market.

Current Situation and Policies

So far, the UAV industry in mainland China is mainly centralized in the eastern and south-central areas. South China has also become a core area due to its advantageous industrial cluster, mature manufacturing, logistics, and components industry. As a result, enterprises in southern China take the lead. Especially Shenzhen, which is the leading region of UAV technology and services.

Whilst the market is growing, the government has also introduced policies to manage drones more efficiently and systemically in the aviation sector. In November 2016, the State Council of the People's Republic of China released the 13th Five-Year Plan which aimed to develop drones for industrial usage. In December 2017, the Ministry of Industry and Information Technology published the "Guidance toward How to Improve and Regulate the Development of Civil UAV Manufacturing Industry", this policy was aimed at strengthening the safety management of drones such as promoting the establishment of management platforms and advocating technological innovation to expand services and application areas.

Furthermore, although the overall UAV market has become more mature, the industrial drone is still in its fast-growing period and its market share has experienced a continuous increase, from 34.88% in 2019 to 45.61% in 2021. This was thanks to the continuous development in drone technology, strong support from government policies, and large-scale investments into the market. As such, the industrial drone industry has a promising future.

APPLICATION FIELDS

In mainland China, UAVs are usually used in law enforcement, environmental surveillance, emergency management, agriculture and forestry, powerline, oil and gas inspections, logistics and distribution, geographical mapping, and training businesses.

Law Enforcement

The drone is specialized in monitoring airspace with a wide-angle lens, has clear low-altitude images, high flight flexibility and maneuverability, as well as convenient low-altitude communications. Therefore, it can rapidly reach crime scenes and follow targets, as well as aerially monitor to assist public agencies to judge and make proper decisions. Drone missions typically include criminal investigation, traffic management, and daily patrol inspections.

Regarding criminal investigations, a drone can take photos of target areas, collect ground information, as well as use thermal imaging and infrared devices to track and lock suspects, which can increase the efficiency and success rate. In addition, for traffic accidents, a drone can bypass traffic jams and quickly arrive at the scene to take photos. Also, drones can be equipped with loudspeakers for large-scale commands. Moreover, drones can implement daily patrol inspections in specific areas to save expenses on human resources and equipment.

Environmental Surveillance

Drones can perform real-time monitoring and real-time sampling, due to their high performance and reliability in environmental surveillance. Missions include atmosphere monitoring, water conservancy surveillance, and collecting evidence of environmental damage. Water conservation can be divided into water sampling and sewage surveillance, which are used to provide early warnings of natural disasters such as typhoons or floods.

For atmospheric monitoring, a drone can be equipped with devices to conduct three-dimensional monitoring on high-altitude air pollution. Additionally, environmental law enforcement officials can utilize drones to carry out Precise Point Positioning (PPP), and high-altitude aerial photography. As a result, drones can easily identify damage and collect evidence at a scene.

In terms of water sampling, UAVs can be equipped with water withdrawing features combined with ground station systems to execute missions such as sample collection in areas that humans cannot access or approach. As such, it is highly efficient as well as low in risk and costs.

In addition, drones can be equipped with an infrared thermal imaging system to supervise the sewage disposal situation across a wide area. Not only can it oversee from the air but it can also conduct close observations in places that environmental personnel cannot reach.

Emergency Situations

Climate change has led to more frequent extreme weather in recent years. It poses a strong threat to the economy, environment, and social security of mainland China. To manage these sudden situations, the government has put more emphasis on disaster prevention. Yan Jie Sun, the Administration Director of Aero-Starloop, told Asian Sky Media that drones are low-cost, have high security and intelligence. Compared with manpower and helicopters, a drone can provide better disaster relief in emergencies.

UAVs are low cost, easily maintained, have a comprehensive view, and are easy to use in conditions such as urban firefighting and rescue, forest fires and disaster prevention, as well as natural disaster rescue.

As for urban firefighting and rescue, a drone equipped with a visible light and a thermographic camera can completely display the scene as well as penetrate smoke and buildings to acquire temperature distribution. Aside from assisting firefighters to determine the ignition point and areas of high temperature, it also allows rear commanders and logistic forces to handle real-time information and take corresponding measures through a wireless network.

In terms of forest firefighting, a drone can automatically patrol large forest areas and reach places that humans cannot easily go to, enhancing patrol efficiency. When a fire disaster happens, a drone can turn the process from passive detection to active tracking. The thermographic camera on a drone can quickly detect and assist firefighters to extinguish a fire. Afterward, a drone can patrol the area to prevent disasters from happening again.

When natural disasters occur, transportation in affected areas will be seriously damaged. A drone can break through ground limitations to quickly arrive and execute search and rescue operations. Moreover, a drone can bring an emergency communication base station, hover above the disaster area, and provide a wireless communication system to those affected. Regarding post-disaster reconstruction, drones can spray disinfecting pesticides. It can also evaluate and decide on resolution policies for fuel, coal mines, and mud leaks.

From 20th to 21st July 2021, "Wing Loong" -2H, manufactured by AVIC, conducted reconnaissance and relay missions over Henan province to provide China Mobile Communications Corporation (CMCC) public network communications to those disaster victims affected by heavy rainfall. According to statistical data from AVIC, "Wing Loong" aerial communications platform can respond to 50 square kilometers of mobile public network communications as well as establishing an audio and video internet network covering 15,000 square kilometers.

Agriculture & Forestry

Agriculture has a long history in China. As village labor gradually shifts to cities, agriculture operations are also facing the need to change. At the same time, cases of poisoning resulting from pesticides are countless. Each year there are over 100,000 people poisoned by pesticides, with a death rate of around 20%. Under such circumstances, UAVs have boomed in popularity. Hui Sun, assistant of the General Manager of Beidahuang General Aviation, said in an interview with Asian Sky Media that: "Drones have indeed changed the way traditional pesticide and fertilizers are used. Compared to using traditional machinery and manual labor, drones can save on manpower and time, thereby increasing efficiency."

Furthermore, according to Sen Mei, Co-Founder of Woozoom, compared to traditional helicopters that need pilots, the number of parts a drone needs is 60% less. Also, the parts a directional system needs have decreased by 90%. Reducing these parts can help lower the failure rate and increase the effectiveness of UAV applications in agriculture.

UAVs are mainly used in agriculture spraying and crop monitoring. According to Hui Sun, so far Beidahuang General Aviation owns more than ten drones which are mainly used in agricultural spraying. Regarding spraying, workers need to plan the route according to the topography of the terrain and pesticide spraying requirements. For crop monitoring, drones equipped with high-resolution digital cameras, spectrometers, and thermal-infrared sensors can take high-definition photos to examine the state of the crops.

Although theoretically a drone has stronger flexibility and lower labor costs compared to a manned helicopter, there still are some limitations. Hui Sun said: "Due to the limitations on electricity and load, a single drone cannot spray a large area by itself." To do the same things as a traditional helicopter, there needs to be more than one drone and drone pilot. Also, the UAMs need to change batteries and add pesticides frequently.

Therefore, according to the current situation, Hui Sun suggests that drones in agriculture should be used in small croplands in villages and small areas in cities to solve the insufficient labor force in a village and very high labor costs in cities. Although drone applications still face some current limitations, Hui Sun still holds a positive attitude toward the future development of UAVs. As he said in an interview: "With the increase in UAVs commercial capacity, large scale agricultural and forestry operations are possible."

Powerline and Oil/Gas Inspections

Asian Sky Media also interviewed Yi Wu, the Deputy General Manager of the Drone Business Department in State Grid GA. State Grid GA mainly uses medium and large fixed-wing UAVs to implement power transmission line surveillance, disaster monitoring inspections, and laser scanning. Yi Wu told us: "The drones of State Grid GA are expected to fly 180,000 km annually. In areas with complex terrain, drones play an important role to increase electrical grid inspection efficiency as well as elevate power grid construction, operation, and management standard."

Moreover, Hua Wei Meng, Drone Operation Manager of China Southern Power Grid mentioned in an interview with Asian Sky Media: "UAVs and other intelligent equipment are now the main tools for daily powerline inspections. So far, we have completed drone inspections of around 80,000 km of overhead lines and 500,000 towers, as well as automatic surveillance route planning for pipeline monitoring in the no-fly-zone." UAV's automatic inspection technology is applied in the production practice, which greatly enhances equipment inspection efficiency and results in a change in production.

Hua Wei Meng believes that drones can reduce the workload of operation and maintenance employees. It can also effectively improve the working environment and intensity of inspectors as well as increase employees' happiness index. Simultaneously, utilizing drones can enhance the lifecycle management standard and improve the health of equipment.

Yi Wu also mentioned that compared with manned helicopters, drones are more flexible, convenient, low cost, widespread, and easy to use. On the other hand, there are still some limitations to using drones. UAVs are influenced by factors like endurance, payload, and communication, and have limited operational capabilities. Drones cannot be equipped with heavy loads, nor can they adapt to extreme situations such as extreme temperature, high altitudes, and places with no signal. Compared to helicopters, drones overall operate with lower efficiency.

Regarding future developments, Yi Wu still holds a positive attitude. In an interview, he said: "In the future, UAVs will gradually replace manual labor ground inspections in powerline inspections. In particular, the multi-rotor drone will be a tool for power grid inspections, whilst the medium and large drones will take the lead in power grid emergency response and pipeline inspections."

Compared with power transmission pipelines, which are constructed above ground, oil and gas pipelines are located underground. Similar to the power grid layout, oil and gas pipelines span a large area and extend for thousands of miles. In areas with complex terrain and adverse environments, drones can prevent dangerous cases such as leakage or the theft of oil and gas. Operations include checking the damage and deterioration of facilities, detecting oil and gas leakage, identification of flammable and explosive substances, as well as investigating landforms along the pipeline.

Logistics and Supply Chain

Logistics is a management system using calculations and strategic planning to control raw material, intermediary goods, terminal products, and information amongst different warehouses. Through independent networks or joint ventures, express delivery is a new way that logistics companies send documents or packages authorized by their clients to the receivers rapidly and safely.

Drones for logistics have fast running speed, low operating costs, are not limited by terrain, and are suitable for small batches and high-frequency distribution. Compared to the high cost of constructing traditional logistics networks covering villages

and remote regions, the distribution network created by drones can dramatically reduce logistic costs. In metropolitan areas, express services are more mature. In addition, regulations toward low-altitude flying equipment are stricter in the city. Therefore, drones are more suitable to provide express deliveries in remote areas.

Geographical Mapping

Topographical surveying refers to the means of providing geographical information for national economic and social development, as well as to governmental departments and mapping institutions. Surveying has affected land planning, urban construction, engineering construction, and navigation applications. As the technology for aerial photography has become more mature, drones have achieved great recognition in geographical surveying. They are mainly used in engineering construction, land approvals, and real estate registrations, etc.

Engineering uses include volume measurement, tunnel pipeline inspections, highway and bridge inspections. Drones are equipped with high-resolution cameras and LIDAR to collect data for creating a 3D model. Through aerial photography, drones can acquire three-dimensional data and combine them with side view images to rapidly construct models for assisting with issues such as land approvals in villages. In addition, utilizing high-precision photographic mapping of drones can be used to obtain the height of a building. As a result, it can realize the digitization, precision, and real-time implementation of real estate registration and management.

Training

Due to the rapid development of the civil UAV industry, the demand for drone pilots is growing day by day. However, insufficient drone pilots are a key factor restricting the growth of the UAV industry. The government and drone businesses have discovered the possibility of developing specialized training. As a result, UAV training has gradually scaled up.

In terms of drone OEMs, DJI, headquartered in Shenzhen, accounts for 80% of the global drone industry market. It established Huifei Unmanned Aerial Systems Training Center in June 2016. It also took the UTC training system provided by China Air Transport Association General Aviation and China Adult Education Association. The training center offers courses on agriculture, geographical surveying and emergency security, and other fields. Additionally, aviation universities in mainland China have offered UAV courses to develop senior talents for the civil UAV industry.

FUTURE DEVELOPMENTS AND FORECAST

The development of UAVs in mainland China has brought substantial change and innovation to the aviation system. Yan Jie Sun, the Chief Administrative Officer (CAO) of Aero-Starloop mentioned in an interview with Asian Sky Media: "Using UAVs indeed makes it more convenient in fields such as environmental monitoring and intelligent firefighting which previously used manpower or traditional helicopters to execute missions." Even so, there are still some barriers that need to be broken for UAVs future development.

On the one hand, the UAV industry still has some gaps in supervision policies and relative regulations such as in the standard system, airworthiness regulations, and UAV flight management. The lack of legislation has led to uneven conditions of UAV applications in the market. Moreover, the endurance deficiency also places a hurdle on the development of the UAV market. Yan Jie Sun told Asian Sky Media: "Compared to a traditional helicopter, drones have lower load capacities, poorer wind resistance, and shorter flight duration." So far, the endurance time of a drone is between 20 to 30 minutes. Factors that influence endurance include wind strength, weight, airplane mode, and hardware consumption. Compared with consumer drones, industrial UAVs require greater endurance as they need to be equipped with exterior equipment to execute missions.

Although drone applications have some existing limitations at the moment, complete automatic flying might happen in the future due to the increase of ground control stations and continuous innovations of drone hardware and software technology, which drastically reduces production costs, manpower, and time costs required by UAV pilots. Apart from that, the establishment of upstream, midstream and downstream industrial chains of the UAV industry is relatively complete. Supplemented by resources of supporting industries and the government's vigorous promotion of UAV, will ensure the UAV industry will further grow in the future.

Yan Jie Sun mentioned in an interview: "With the development of UAV flight control and power technology, wind resistance, payload capability, and hang time will increase dramatically. In the future, it will gradually replace manned aircraft in environmental monitoring and intelligent firefighting." Although there are still some technological and policy obstacles regarding the industrial UAV market, the demand for industrial UAVs will increase drastically once the endurance technology has a major breakthrough. Overall, the future development of the UAV market will be even more prosperous.

CONTRIBUTION

ASG would like to acknowledge the gracious contributions made by numerous organization, including aircraft operators, aviation authorities and OEMs in providing data for this report.

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DISCLAIMER

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