

The Office of Commercial & Economic Analysis

DoD Aerospace Supply Chain Trends



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Supply chain and foreign investment concerns continue to be a focus area for OCEA, and the Air Force more broadly.

- NDAA sUAS supply chain language
- eVTOL initial supply chain development
- Declining private investment transparency



SEC. 848. PROHIBITION ON OPERATION OR PROCUREMENT OF FOREIGN-MADE UNMANNED AIRCRAFT SYSTEMS.

(a) Prohibition on Agency Operation or Procurement.--The Secretary of Defense may not operate or enter into or renew a contract for the procurement of--

(1) a covered unmanned aircraft system that--

(A) is manufactured in a covered foreign country or by an entity domiciled in a covered foreign country;

(B) uses **flight controllers, radios, data transmission devices, cameras, or gimbals** manufactured in a covered foreign country or by an entity domiciled in a covered foreign country;

(C) uses a **ground control system** or **operating software** developed in a covered foreign country or by an entity domiciled in a covered foreign country; or

(D) uses **network connectivity** or **data storage** located in or administered by an entity domiciled in a covered foreign country; or

(2) a system manufactured in a covered foreign country or by an entity domiciled in a covered foreign country for the **detection** or **identification** of covered unmanned aircraft systems.

(b) Exemption.--The Secretary of Defense is exempt from the restriction under subsection (a) if the operation or procurement is for the purposes of--

(1) Counter-UAS surrogate testing and training; or

(2) intelligence, electronic warfare, and information warfare operations, testing, analysis, and training.

(c) Waiver.--The **Secretary of Defense may waive** the restriction under subsection (a) on a case by case basis by certifying in writing to the congressional defense committees that the operation or procurement is required **in the national interest of the United States**.

(d) Definitions.--In this section:

(1) Covered foreign country.--The term "covered foreign country" means the People's Republic of China.

(2) Covered unmanned aircraft system.--The term "covered unmanned aircraft system" means an unmanned aircraft system and any related services and equipment.



■ Each Service would need ready access to the following information:

■ A full accounting of all current and planned UAS Programs of Record and related services and equipment

■ To include a complete systems engineering and design breakdown of each UAS at the system level which steps through each component and sub-component level

- Given the broad language in the definition of covered UAS in both the Senate and House provisions, all related equipment could include subcomponents down to a very minute level (e.g., microelectronics)
- Each building block of the capability must then be mapped to all of the associated prime and sub-tier vendors to assess vendor ownership and the location of the manufacturing or service being provided

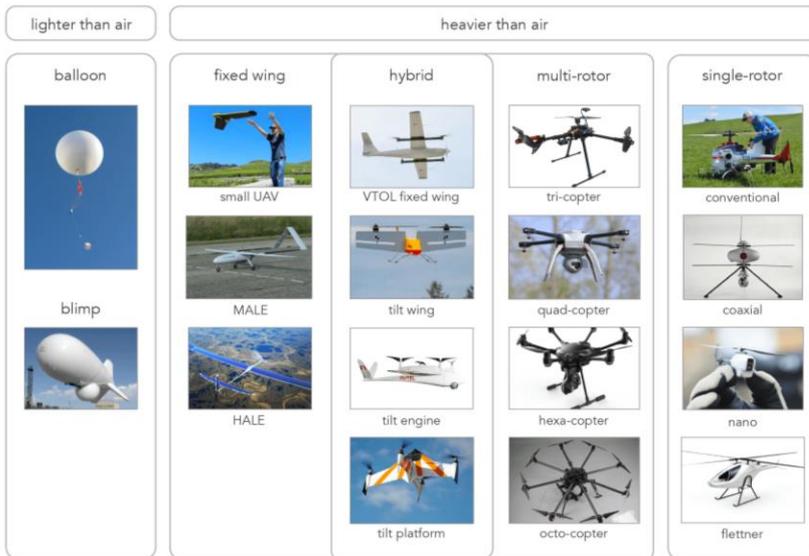
■ To include a complete systems engineering and design breakdown of all the integrated and supporting software, as well as the development and administration of network connectivity and data storage functions

- Each building block of the capability must then be mapped to all of the associated prime and sub-tier vendors to assess vendor ownership and the location of the development and administration functions

■ To include a complete breakdown of all the supporting services provided in association with the system or components and subcomponents

■ The same level of assessment for all current and planned USAF UAS non-Program of Record and related services and equipment

UAV Configuration Types



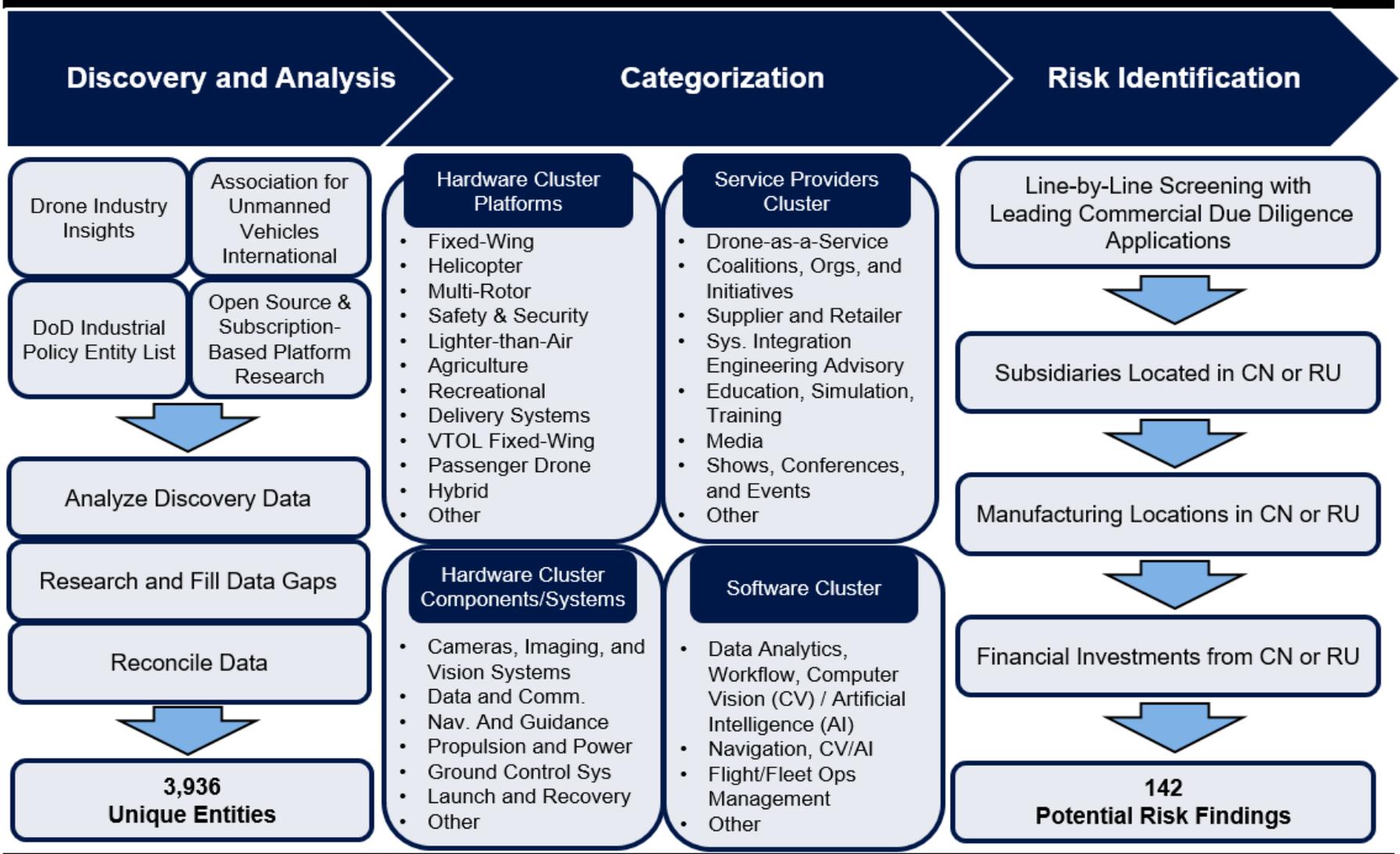
MALE: medium altitude long endurance (15,000 – 45,000 ft.), HALE: high altitude long endurance (>45,000 ft.)

Source: Droneil.com June 2016





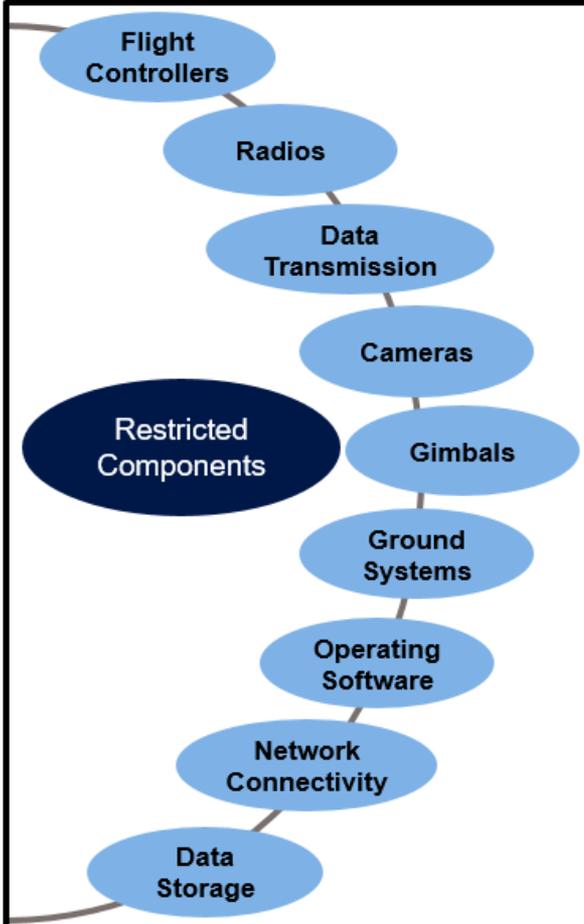
Congressional Interest in sUAS





Congressional Interest in sUAS

FY2020 NDAA Section 848 Summary¹: The Secretary of Defense may not operate or enter into or renew a contract for the procurement of an unmanned aircraft system and any related services and equipment manufactured in China or by an entity domiciled in China.



- UAS system components include FY2020 NDAA restricted items (see left).¹ These items are comprised of various micro-electronic components, including
 - **Printed Circuit Boards** – may be used in flight controllers, radios, cameras, gimbals, and ground systems
 - **Integrated Hardware** – may be used in network connectivity, operating software, data storage, data transmission, and ground systems
 - **Magnets** – may be used in cameras and gimbals
 - **Capacitors** – may be used in flight controller, ground systems, and cameras*

- The above micro-electronic components have a high likelihood of being sourced and/or manufactured in China, expanding the scope of the supply chain ecosystem and increasing the potential for supply chain risks within the UAS market
 - **Printed Circuit Boards** – in 2017, ~53% of global printed circuit board (PCB) production took place in China^{2, 3, 4}
 - **Integrated Hardware** – the APJ region’s (Asia-Pacific including Japan) global market share in routers grew 11.5% YoY in 2018, increasing to 41% of the global market share. **Huawei** (CN) grew 23.1% YoY in 2018, increasing its global market share in routers to 32.2%, which is 0.4% behind market leader **Cisco** (US)^{4, 5, 6}
 - **Magnets** – China is the world’s biggest supplier of rare earth magnets, accounting for ~70% of rare earth production^{4, 5, 6}
 - **Capacitors** – China has the largest global export quantity and manufacturers in the polymer capacitor market⁷

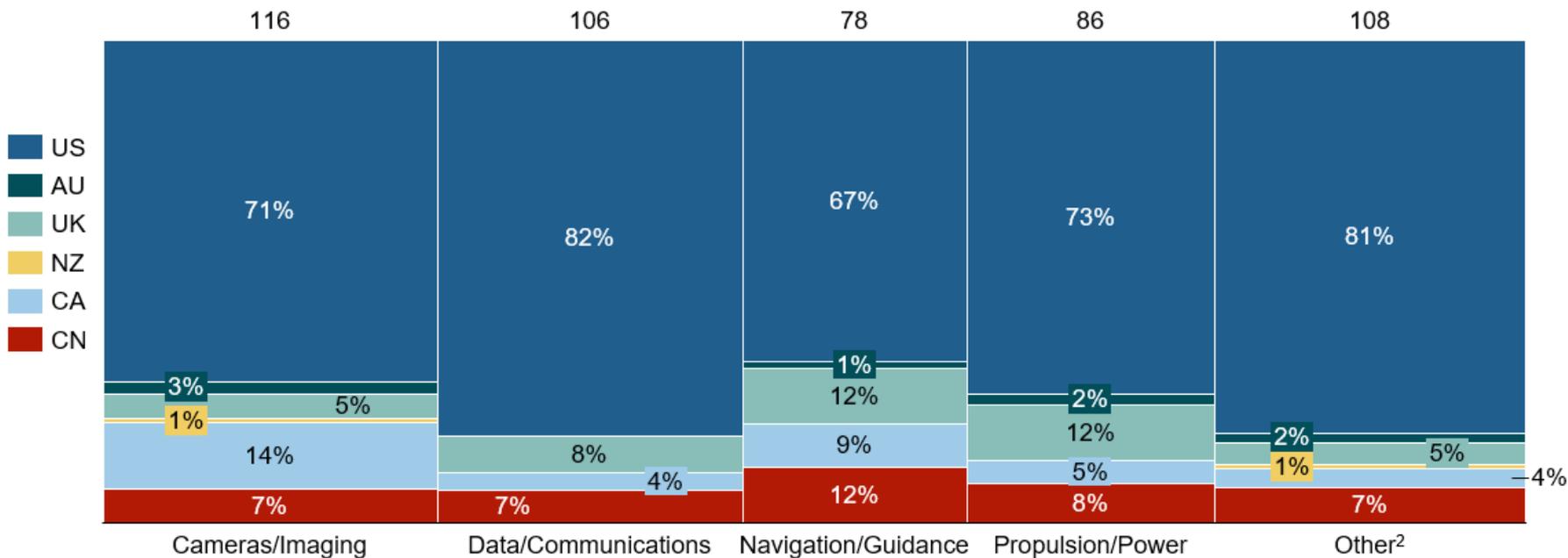
Note: not an exhaustive micro-electronic application list Source: 1) Congressional Bill, December 20th, 2019, "National Defense Authorization Act for Fiscal Year 2020"; 2) IPC, "World PCB Production Report for 2017"; 3) BCC Research, "Printed Circuit Boards: Technologies and Global Markets"; 4) ThompsonOne; 5) USGS, "Rare Earths Statistics and Information"; 6) TechNavio Analysis; 7) MarketWatch, November 20, 2019, "Polymer Capacitor Market";



Congressional Interest in sUAS

Entity by HQ in FVEY and China¹ with Finding Count

Total = 494 Entities / 44 Findings



44 Potential Chinese or Russian Influence Findings

| | Cameras/Imaging | Data/ Communications | Navigation/ Guidance | Propulsion/Power | Other |
|----------------------|-----------------|----------------------|------------------------|------------------|--------|
| Investment | | | | 2 (US); 1 (CA) | |
| Manufacturing | 5 (US) | 4 (US) | 2 (US); 1 (CA), 1 (UK) | 6 (US); 1 (CA) | 8 (US) |
| Subsidiary | 3 (US) | 5 (US) | 2 (US) | | 3 (US) |

Notes: 1) Includes Hong Kong; 2) Includes Ground Control Systems, Launch and Recovery, Cases, Actuators/Robotic Arms



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Emerging eVTOL Supply Chain

U.S. AIR FORCE

The collage features various eVTOL aircraft and their supply chain partners, organized into several rows:

- Top Row:** Airbus CityAirbus (Partner Audi), HYUNDAI SA-1 (Uber), Aurora Flight Sciences (A Boeing Company), Uber, Partners (Microsoft), THALES, GARMIN, MOOG, SAFRAN, and CHANG.
- Second Row:** KITTYHAWK Flyer & HEAVISIDE, Uber, BOEING PAV, Porsche, BELL Nexus Air Taxi, Investor (DAIMLER, VOLVO), and Workhorse SureFly.
- Third Row:** wisk (BOEING), Uber, Honeywell, skai by Alaka'i Technologies (Hydrogenics), Technologies Alia, Uber, and OVERAIR Butterfly.
- Bottom Row:** OPENER BLACKFLY, LIFT PRODUCTIONS Hexa, CONTINENTAL, SEYER, VERDEGO AERO, VERTICAL, Uber, and L3HARRIS FAST FORWARD.



Emerging eVTOL Supply Chain

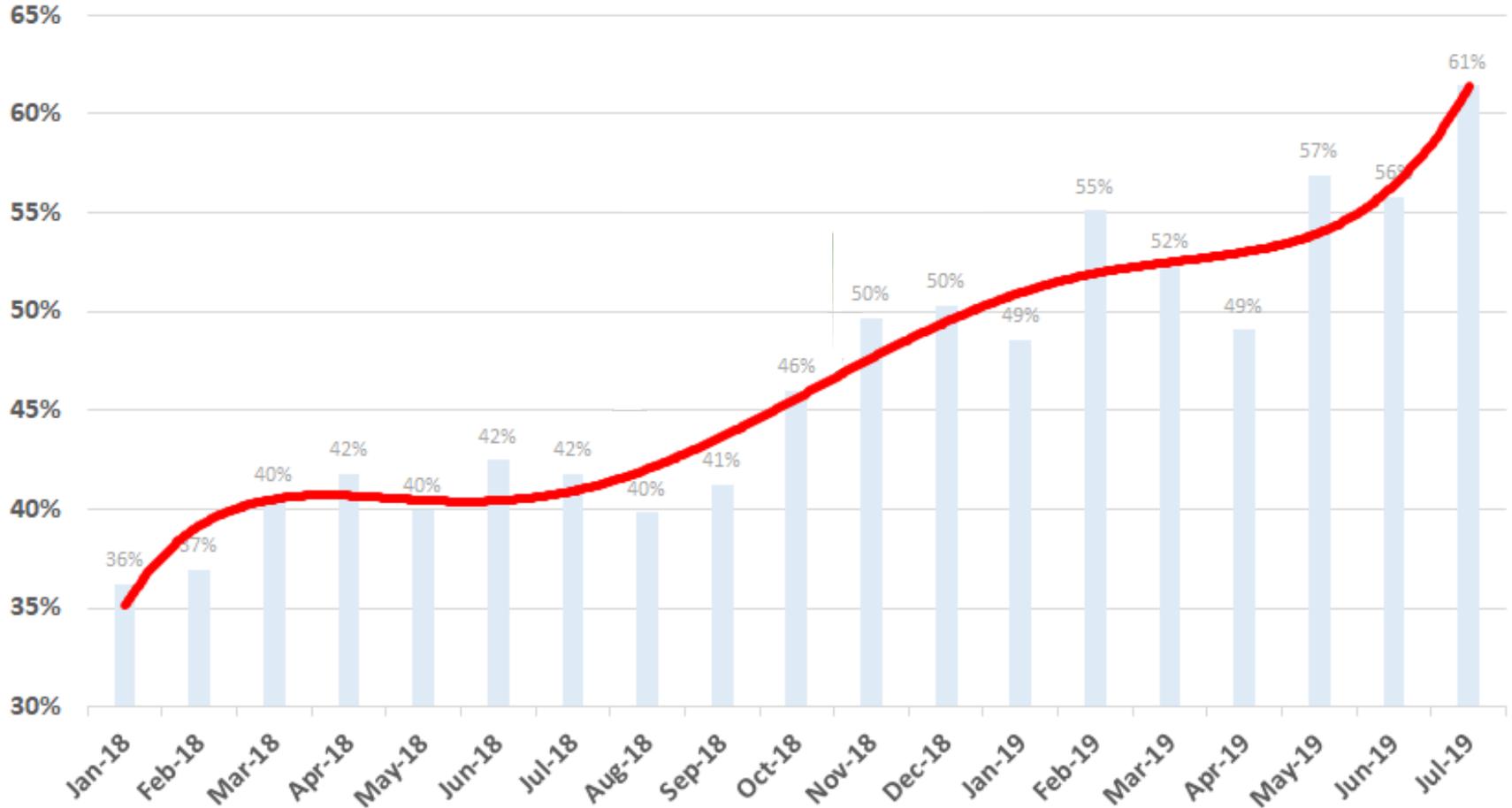
- Air Force is assessing the potential impact of eVTOL aircraft, and is establishing a collaborative strategy with commercial partners to accelerate development and fielding of the most promising vehicles, based on an assessment of their potential for success in the commercial market.
- These platforms could provide operational agility and cost savings for logistics, and sustainment, with particular utility in civil and military disaster relief, medical evacuation, firefighting, installation and border security, search and rescue, and humanitarian operations.
- As these systems mature towards certified commercial operations, the Air Force will assess opportunities to serve as an early adopter, with procurement and fielding in the next three years. This early government adoption could occur prior to commercial certification and could provide data to accelerate broader adoption and technology development.
- Air Force anticipates that these aircraft may incorporate non-traditional electric, hybrid, and non-electric propulsion for manned, or optionally manned missions, with onboard pilot, remote pilot, or autonomous control. Air Force's focus tends toward vehicles with significant commercial market potential and planned payloads of 3-8 personnel, ranges >100nm, and speeds in excess of 100kts. None of these criteria are set in stone, however.





Decreasing Private Investment Transparency

Investments in US Private Firms by Undisclosed Investors





Air Force believes it is in the US national interest that the American eVTOL ecosystem reach its full competitive potential.

We want to follow the market's lead, help with certification where we can, buy early where it makes sense, and help you protect your intellectual property along the way.

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Discussion



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