sUAS Trends in the United States

Federal Aviation Administration

Fleet, Pilots, Regulatory/Technological Environment and Emerging Trends

Droneport Seminar: Unlocking the Economic Potential for Your Community

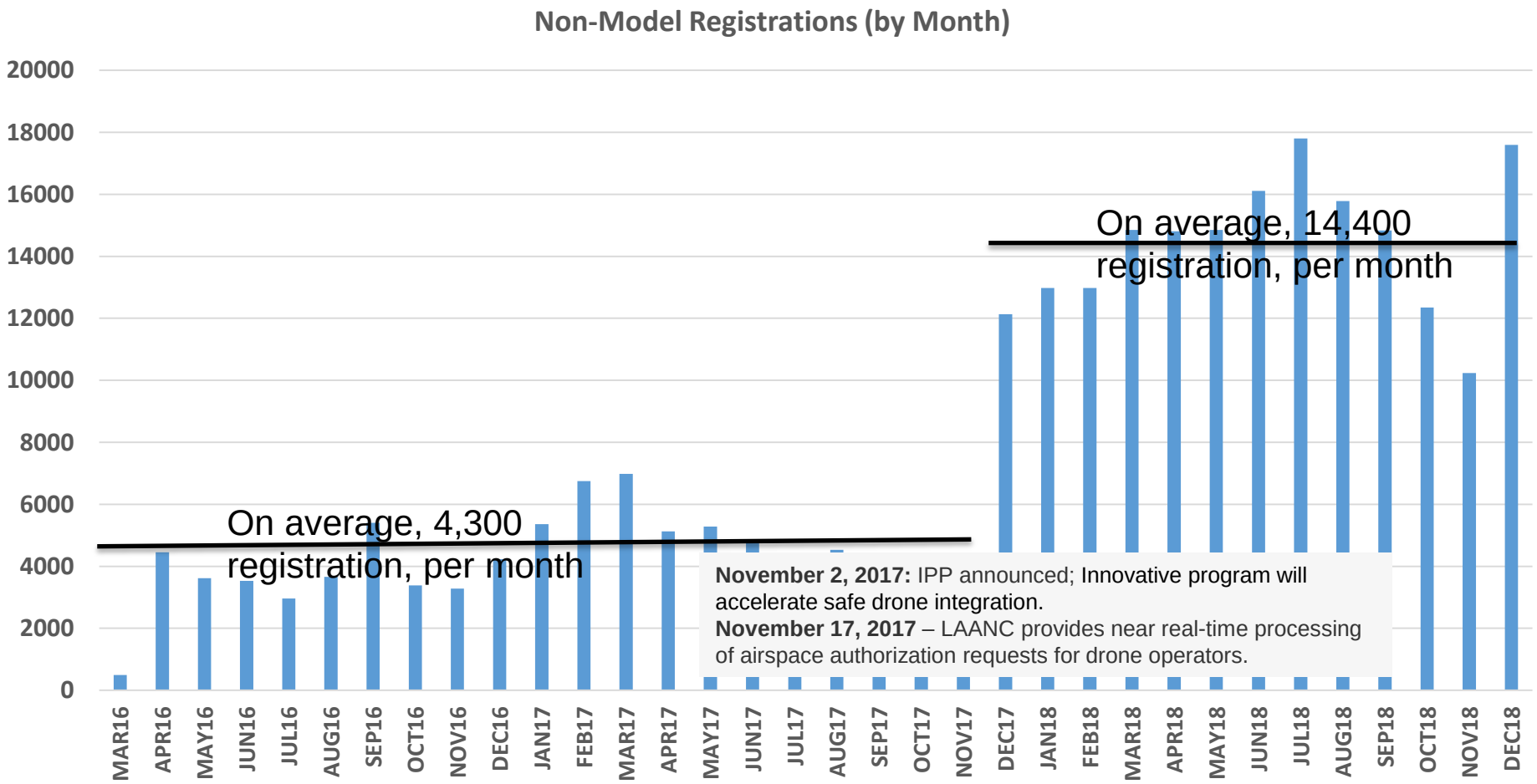
By: Dipasis Bhadra, Ph. D.

Date: Thursday, May 2, 2019

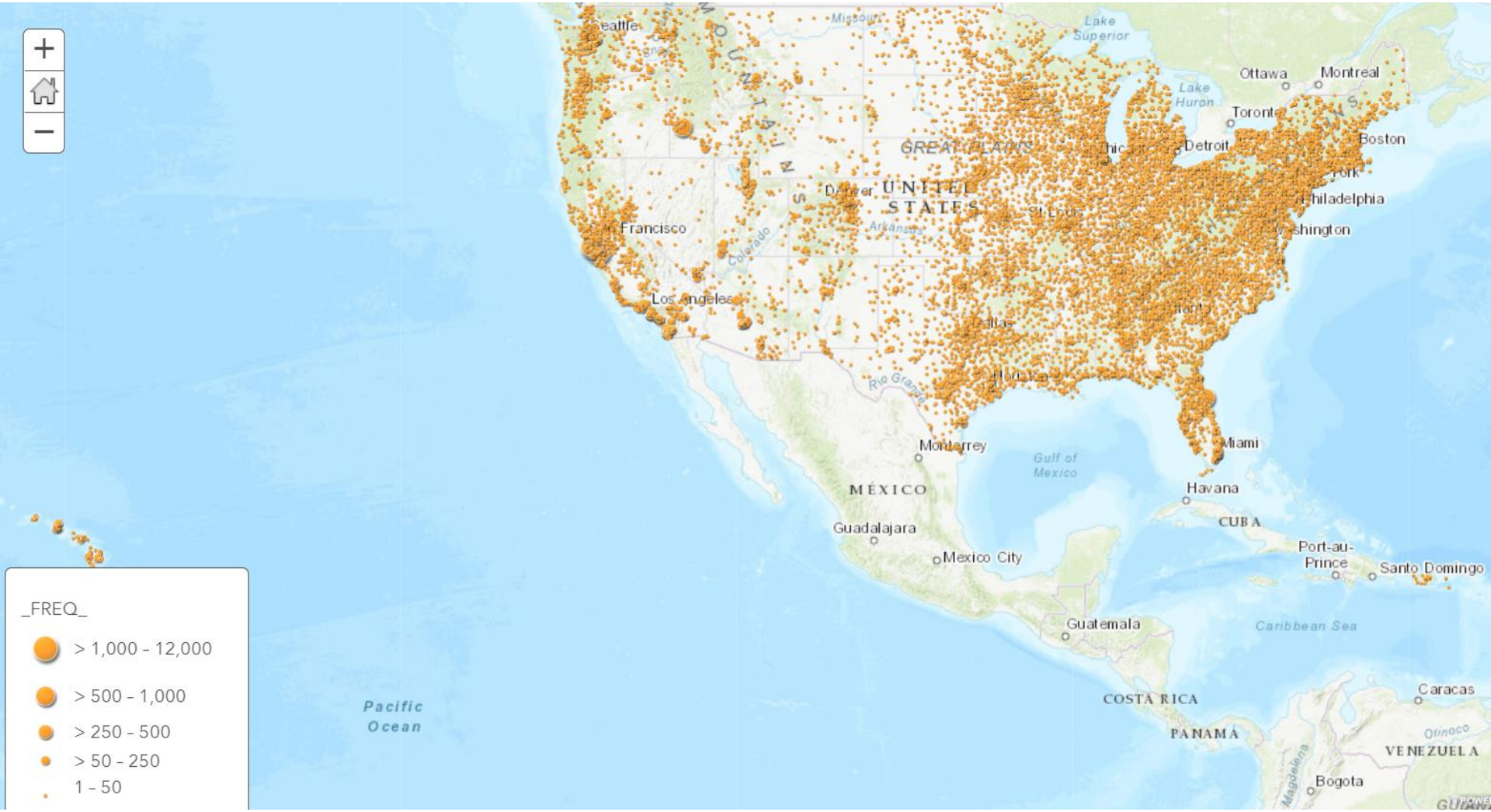
Agenda

- **sUAS trends** including monthly trends in commercials or non-recreation registration;
- Distribution **of sUAS by State/zip code** of commercial sUAS;
- **Forecasts** of commercial sUAS over the next 5 years;
- **Forecasts** of remote pilots;
- T**ypes of sUAS** and market dominance;
- Types **of economic activities** and **economic contributions**;
- **Future** of the sector: commercial trends including commercial delivery; C-UAS; and UAM;
- **Concluding thoughts:** regulatory framework, participation by increasing number of remote pilots, and role of safety and efficiency vis-à-vis productivity gains and economic contributions

Non-Model Registration (Monthly) Trends

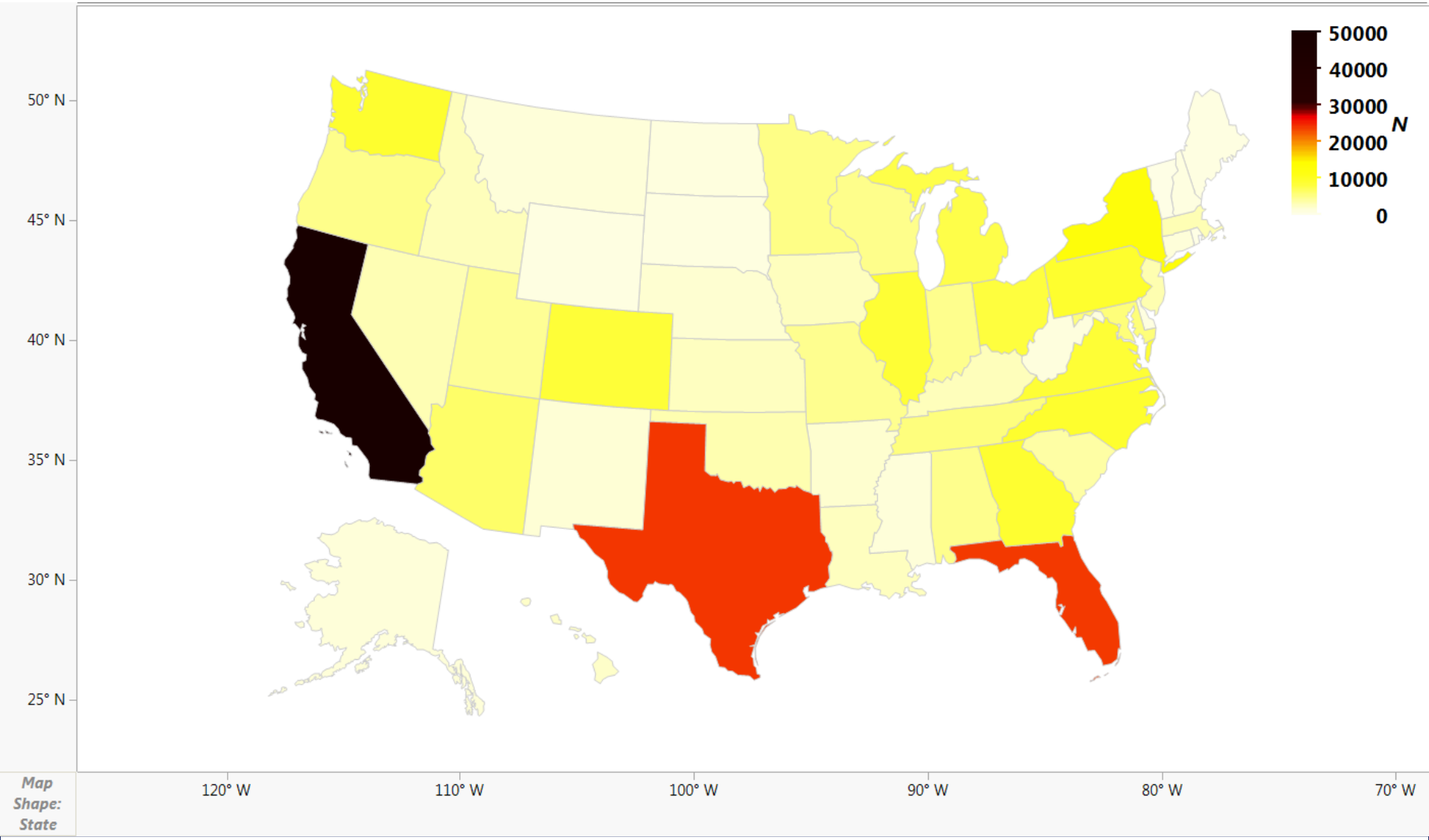


Zip-Code Distribution of Non-model Registrations

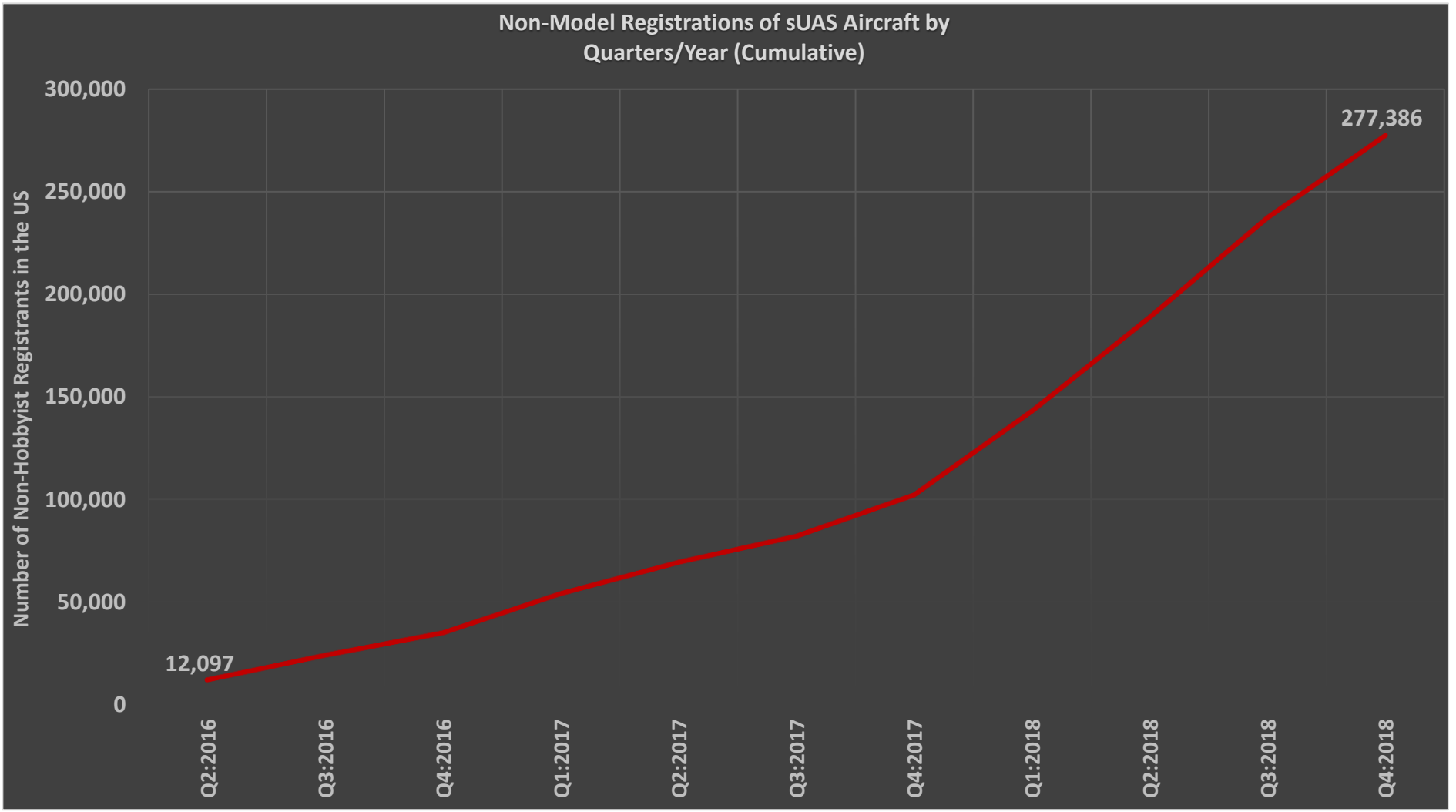


May be accessed at: http://arcg.is/19iPmv

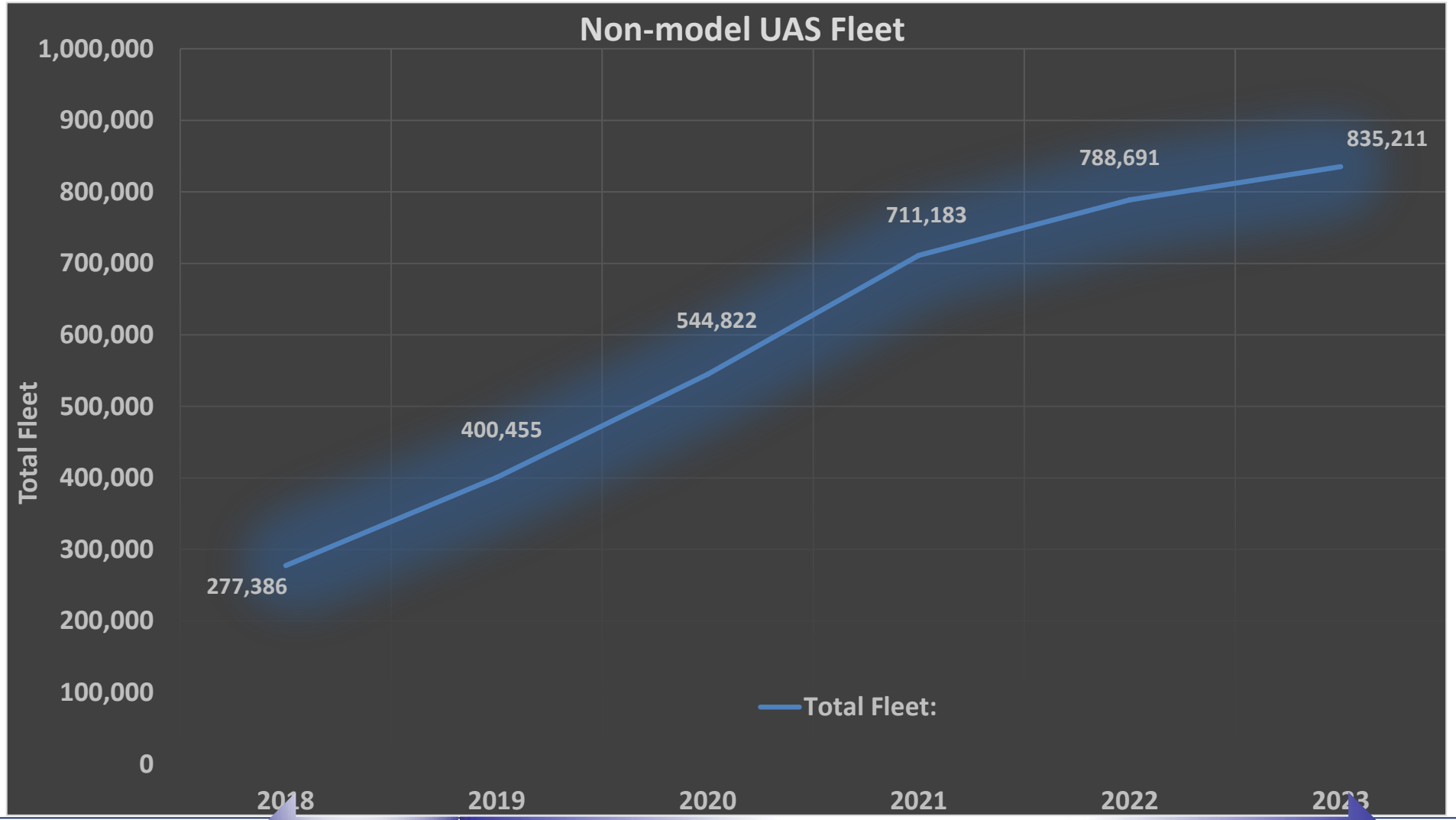
State-wide Distribution of Commercial sUAS



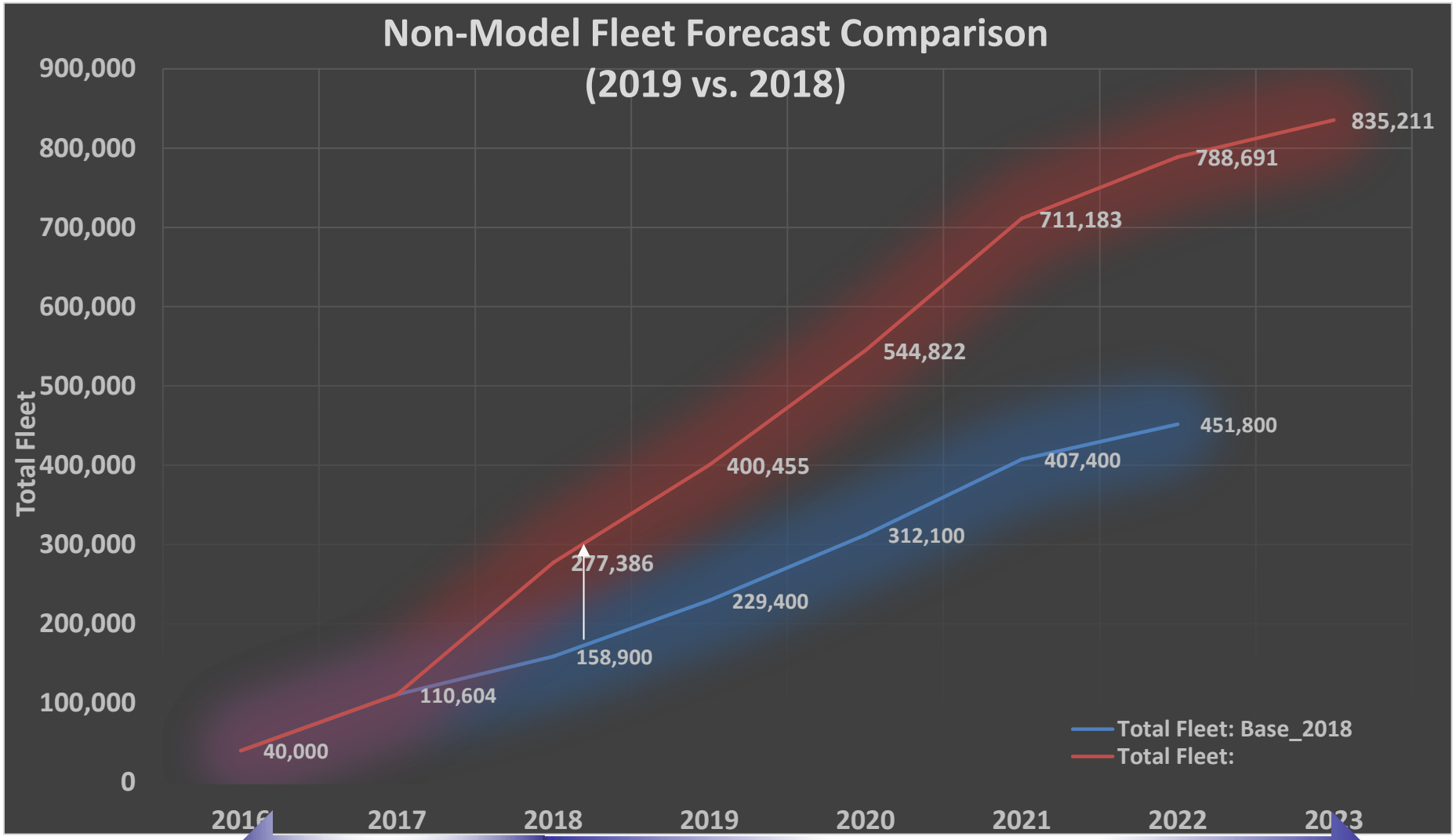
Non-Model sUAS in the System: Cumulative Totals by Qtrs



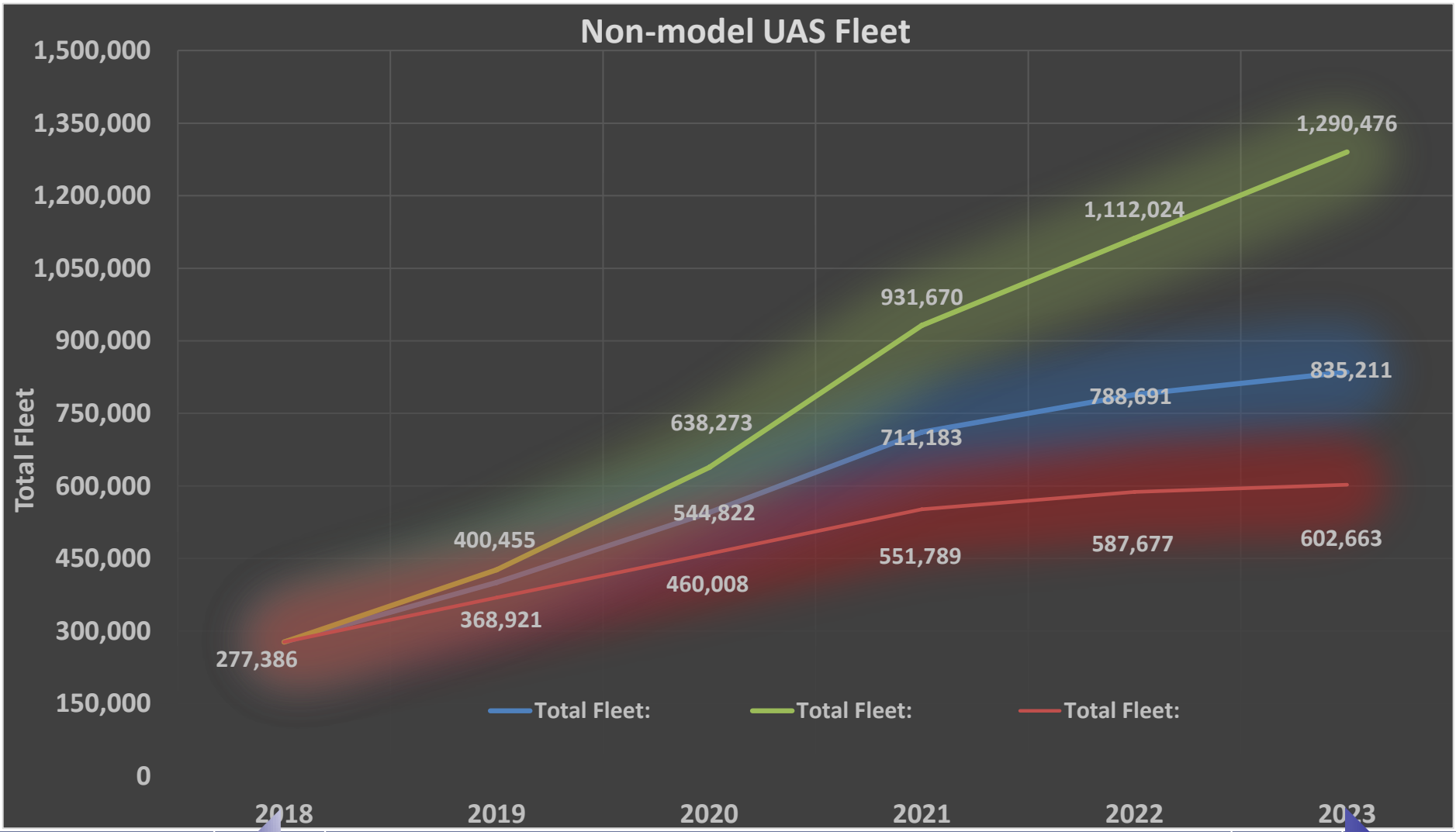
Doubling of Non-model Fleet Forecast



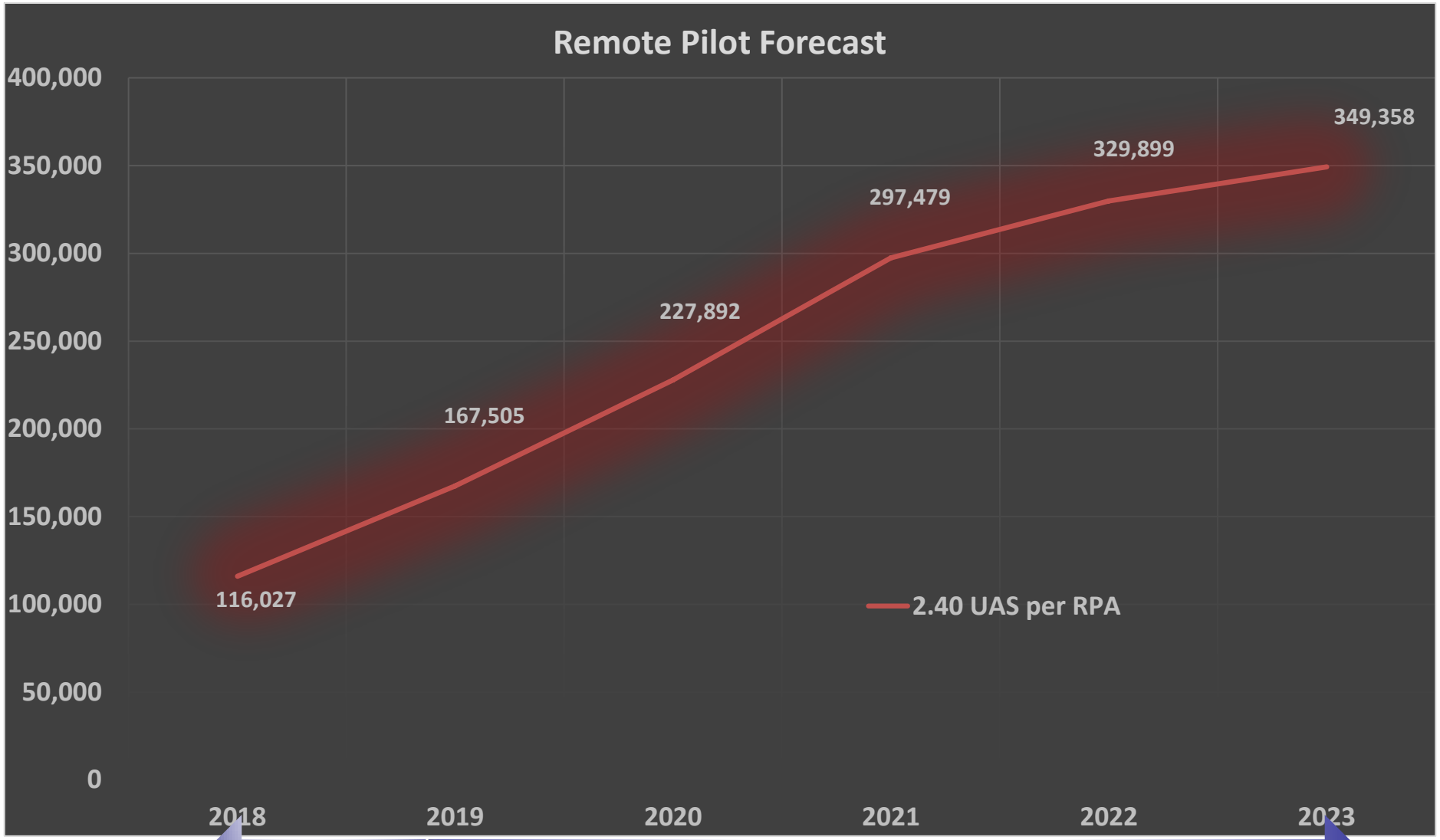
Comparison: Last year vs. this year



Slight Lowering of Base Forecast and Tracking on Both Up/Downside Uncertainty



Remote Pilot Forecasts are derived from
(a) Base non-model forecast; and (b) assumption of UAS per RPA



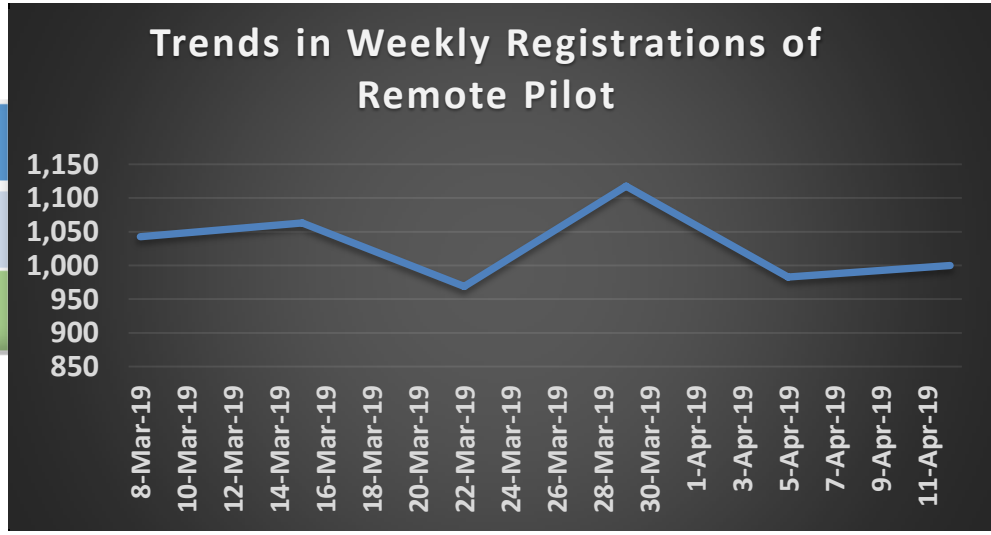
Remote Pilot Trends Keeping with Forecast

Remote Pilot Knowledge Exam Testing

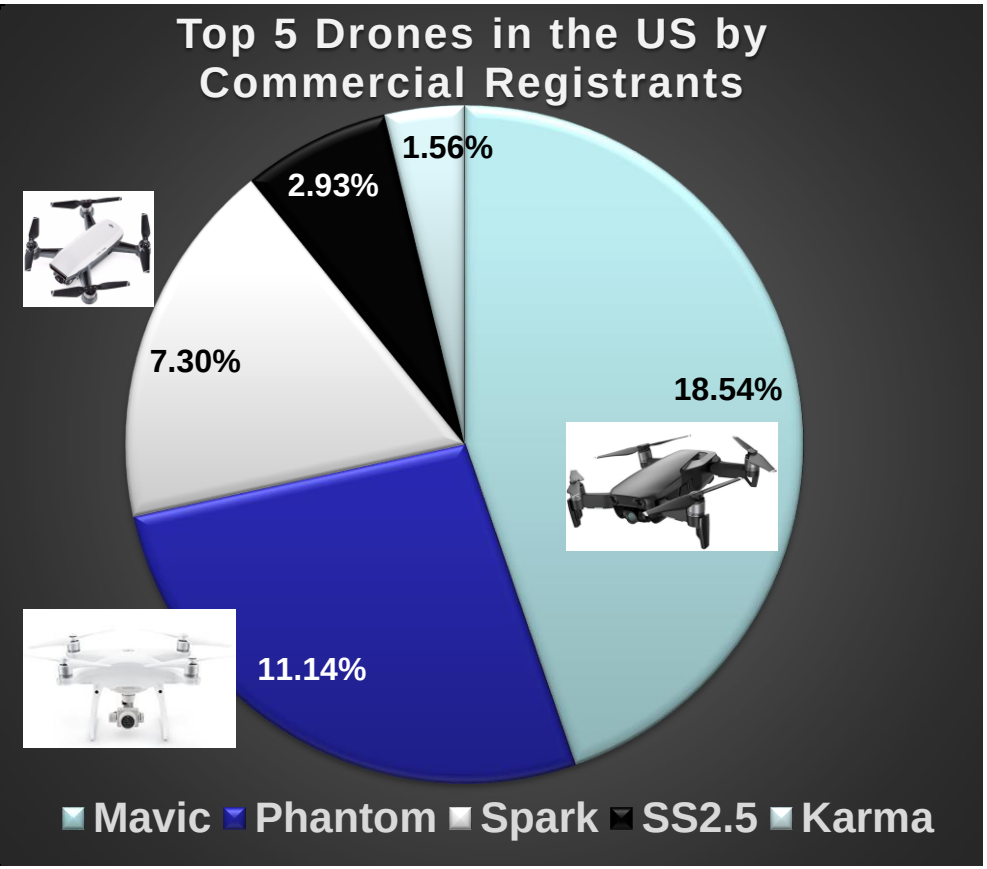
Exam Type	Completed	Passed	Pass Rate
Initial Test	110,894	102,674	93%
Recurrent Test	8,541	8,283	97%

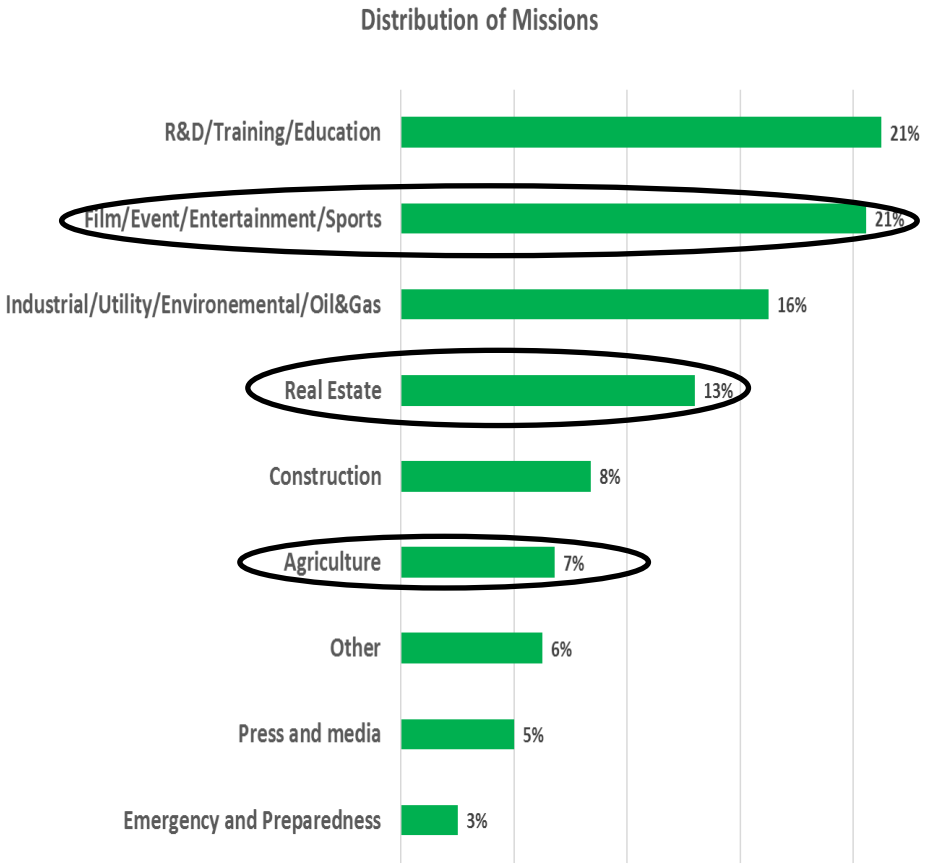
Total Remote Pilots: 130,369*

**includes remote pilots who took the initial knowledge test + current manned pilots who took online training in lieu of the knowledge test*



Model Types and Activities/Missions of Commercials

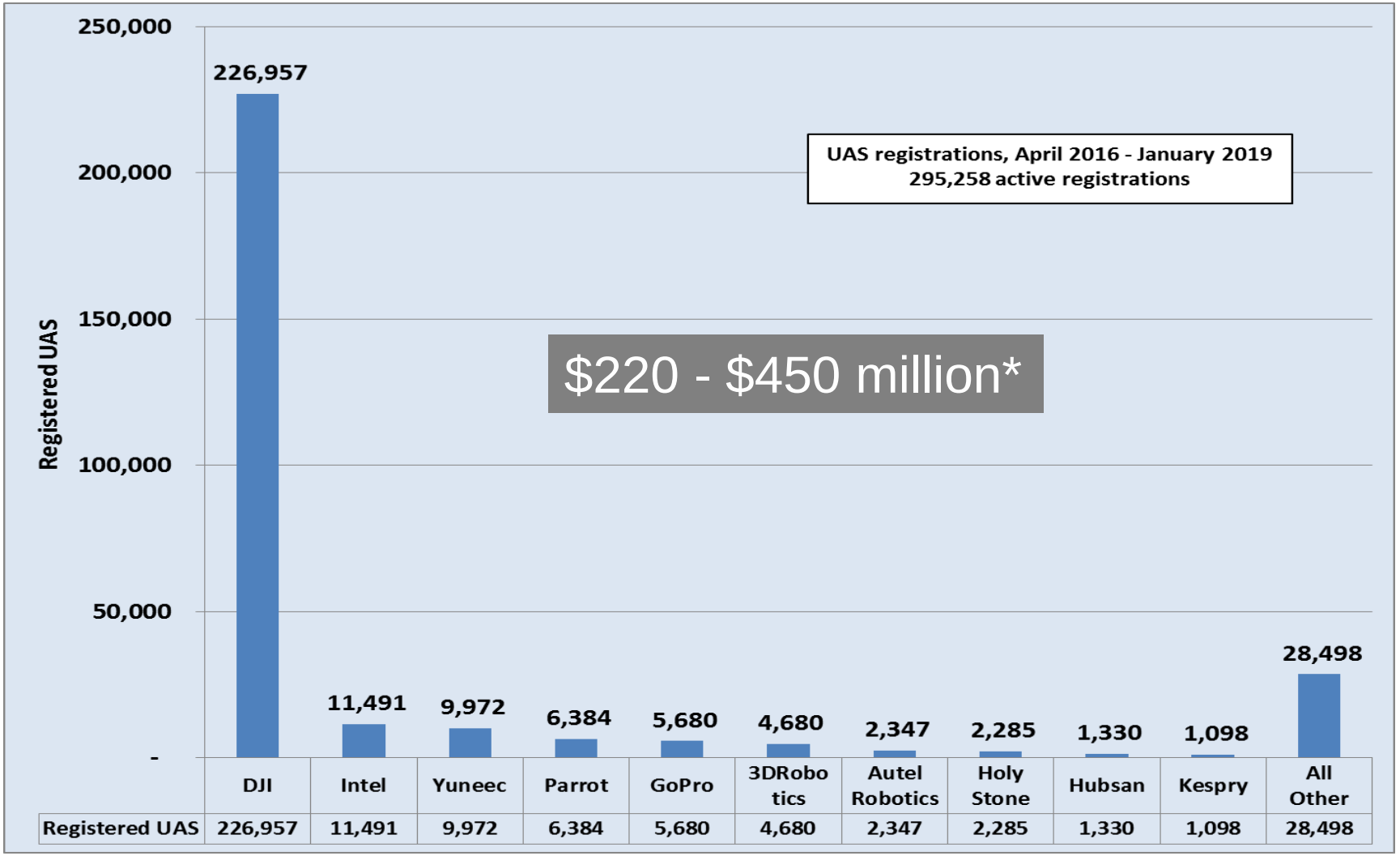




Although DJI owns the top 3 models above (i.e., Mavic, Phantom and Shark), it's total share in all models presently stand around 77% in total in the US.

Source: FAA Survey (2018) of Commercial sUAS

Valuing the Sector by Equipment Sales



'*': Based on assumed price of Mavic: $750-$1500

RP's Business Cost and Likely Earning

Sample baseline drone startup costs

Here's a low-end estimate of what a drone pilot can expect to spend when launching a simple drone business, such as real estate photography*

EXPENSE	COST
DJI Mavic Pro Fly More Combo	$1,299
FAA Remote Pilot Certificate Testing Fee	$150
FAA test preparation course	$299
Total	$1,758

*Not including standard business expenses like computers, web hosting fees, office supplies, etc.)

Source: DJI, Drone Pilot Ground School, FAA

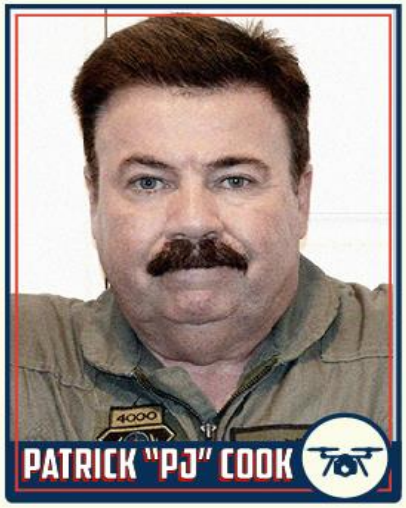
Sample startup costs for more complex drone operations

Here's an estimate of what a drone pilot can expect to spend when launching a more complex drone business, such as a 3D mapping business*

EXPENSE	COST
DJI Inspire 2 Professional	$9,850
DJI Matrice 100 drone	$3,299
DJI Zenmuse XT Thermal Camera	$5,500
Extended warranty plan for drone	$299 (annually)
FAA Remote Pilot Certificate Testing Fee	$150
FAA test preparation course	$299
Drone mapping software	$995 (annually)
$1,000,000 Flight Liability coverage	$598 (annually)
Level I Thermography Certification	$1,995
Total	$22,985

*Not including standard business expenses like computers, web hosting fees, office supplies, etc.)

Sources: DJI, Drone Pilot Ground School, FAA, DroneDeploy, DroneInsurance.com, Infrared Training Center



- **Drone business:** Monthly updates of construction projects.
- **Startup cost:** $7,000
- **Unexpected cost of doing business:** Drone Liability Insurance (approximately $1,000/year)
- **Drone project niche:** Construction
- **Projected income for 2018:** $30,000
- **Hours spent working/week:** 30
- **What should potential drone pilots know about job competition:** If you live in an area with lots of Drone Pilots, you will not get rich!

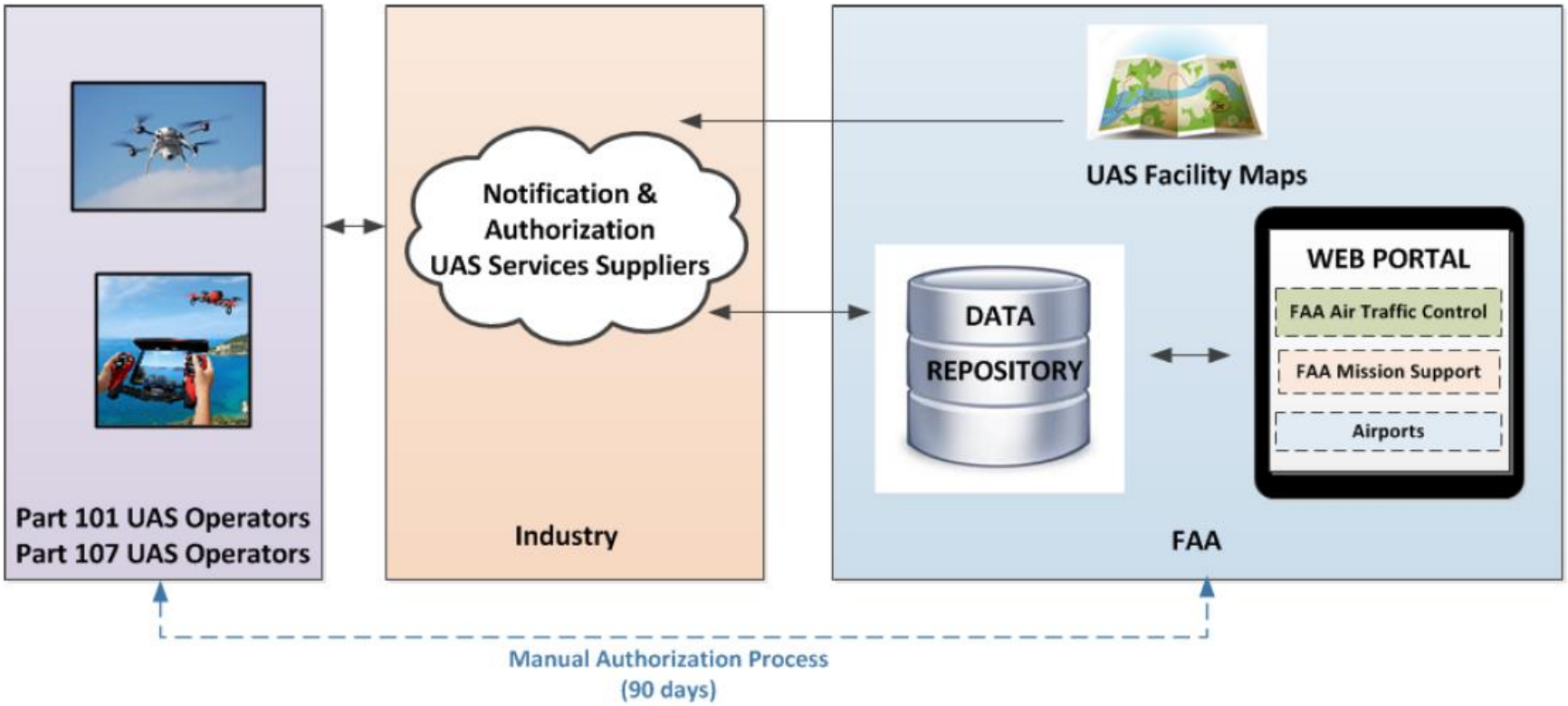
Source: https://www.marketwatch.com/story/want-to-make-six-figures-try-being-a-drone-pilot-2018-08-10

Regulatory and Technological Environment

- **Part 107**:
  - The maximum allowable altitude is 400 feet above the ground, and higher if your drone remains within 400 feet of a structure. The *maximum speed is 100 mph* (87 knots);
  - Can't fly a small UAS over anyone who is not directly participating in the operation, not under a covered structure, or not inside a covered stationary vehicle. No operations from a moving vehicle are allowed unless you are flying over a sparsely populated area;
  - Operations in Class G airspace are allowed without air traffic control permission.
  - Operations in Class B, C, D and E airspace need ATC approval.

- Technological solutions to ease Part 107:
- **LAANC**: Low Altitude Authorization and Notification Capability, a collaboration between FAA and Industry. It directly supports UAS integration into the airspace.
- **UASFM**: UAS Facility Maps show the maximum altitudes around airports where the FAA may authorize part 107 UAS operations without additional safety analysis.

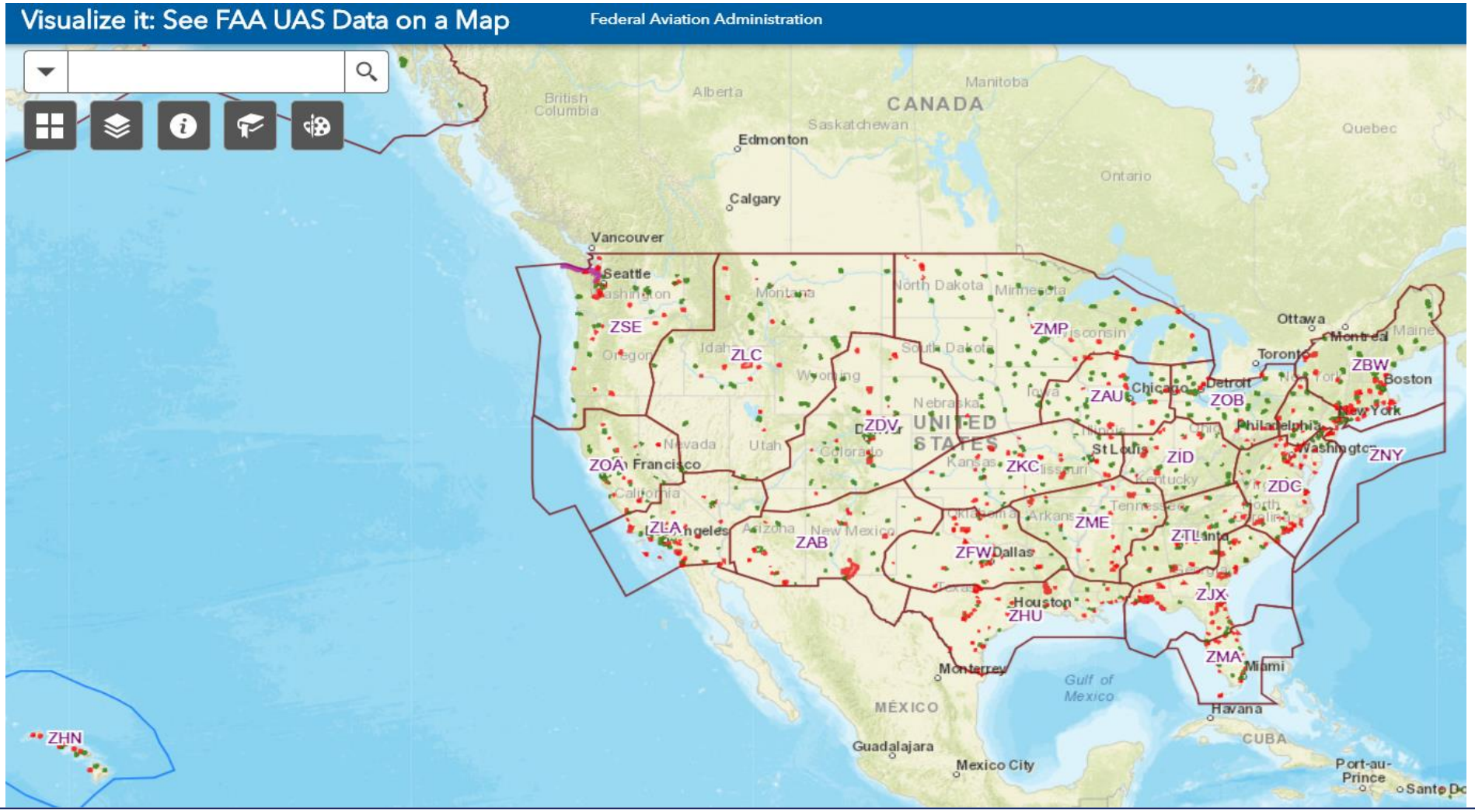
Low Altitude Authorization and Notification Capability



Goals

- Enable efficient Part 101/107 notification and authorization services to small UAS operators
- Provide the data exchange framework for UAS traffic management (UTM)

UAS Facility Maps



Integration Pilot Program (IPP)

The Unmanned Aircraft Systems (UAS) Integration Pilot Program (IPP) is designed to foster innovation, advance the safe integration of drones into our nation's airspace and to ensure U.S. global leadership in the emerging UAS industry.

- **The nine Lead Participants are evaluating several advanced operational concepts, including:**
  - **Night operations;**
  - **Flights over people;**
  - **Beyond the pilot's visual line of sight;**
  - **Package delivery;**
  - **Detect-and-avoid technologies; and**
  - **Reliability and security of data links between pilot and aircraft.**

- **Fields that could see immediate opportunities from the program include commerce, photography, emergency management, agricultural support and infrastructure inspections**

Integration Pilot Program (IPP)

Choctaw Nation

Innovation and Entrepreneurship Investment Authority (VA)

Kansas DOT

North Carolina DOT

City of San Diego

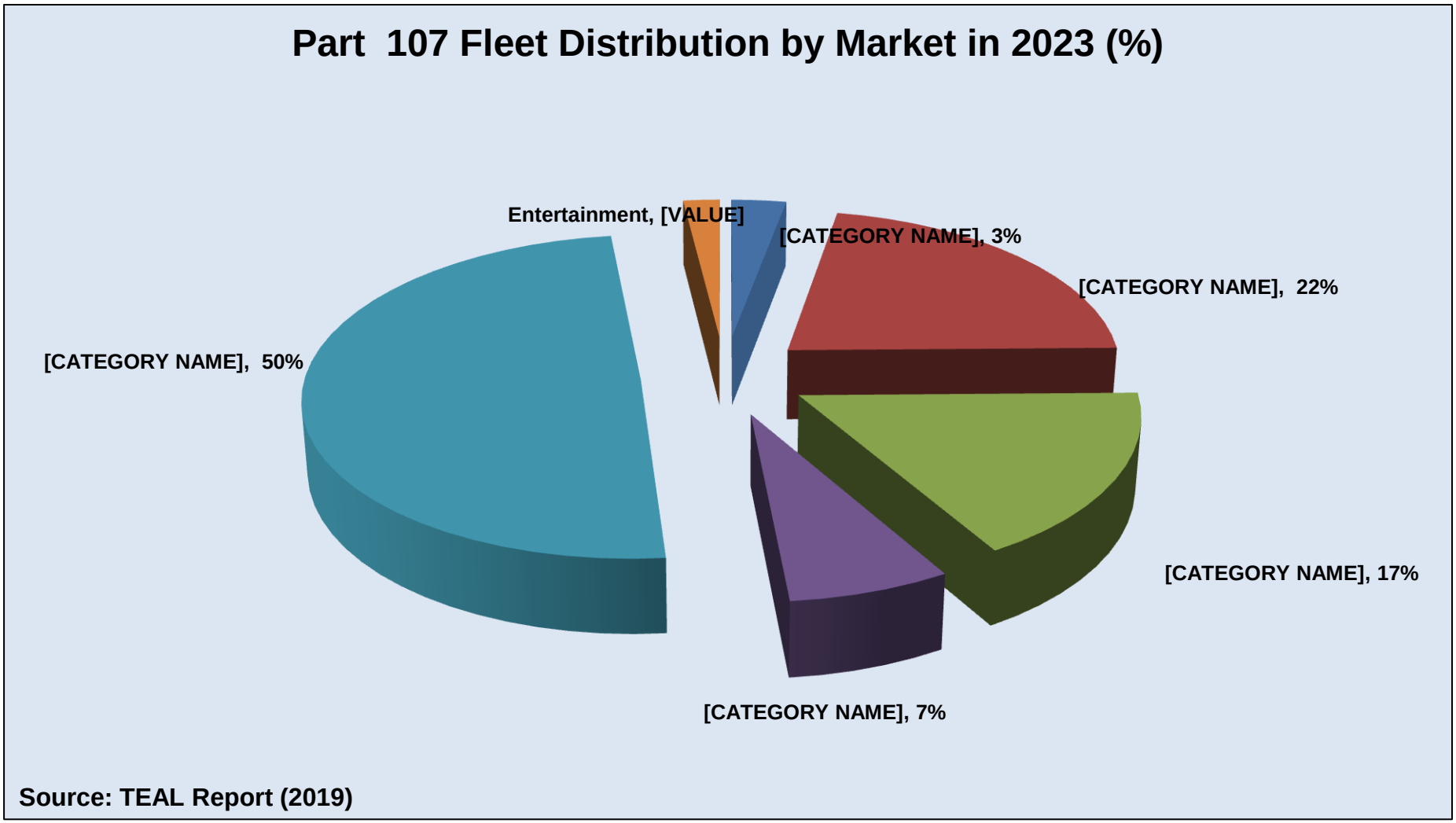
Memphis-Shelby County Airport Authority

City of Reno

North Dakota DOT

Univ. of Alaska – Fairbanks

Where is it Heading? Sector Composition in the Future



Source: TEAL Report (2019)

Where is it Heading? C-UAS

- **Technological solutions**
- **Collaboration Imperative**
- **#HackTheSky**
- **Hacking for Defense (H4D)**

Source: Defense Systems Information Analysis Center

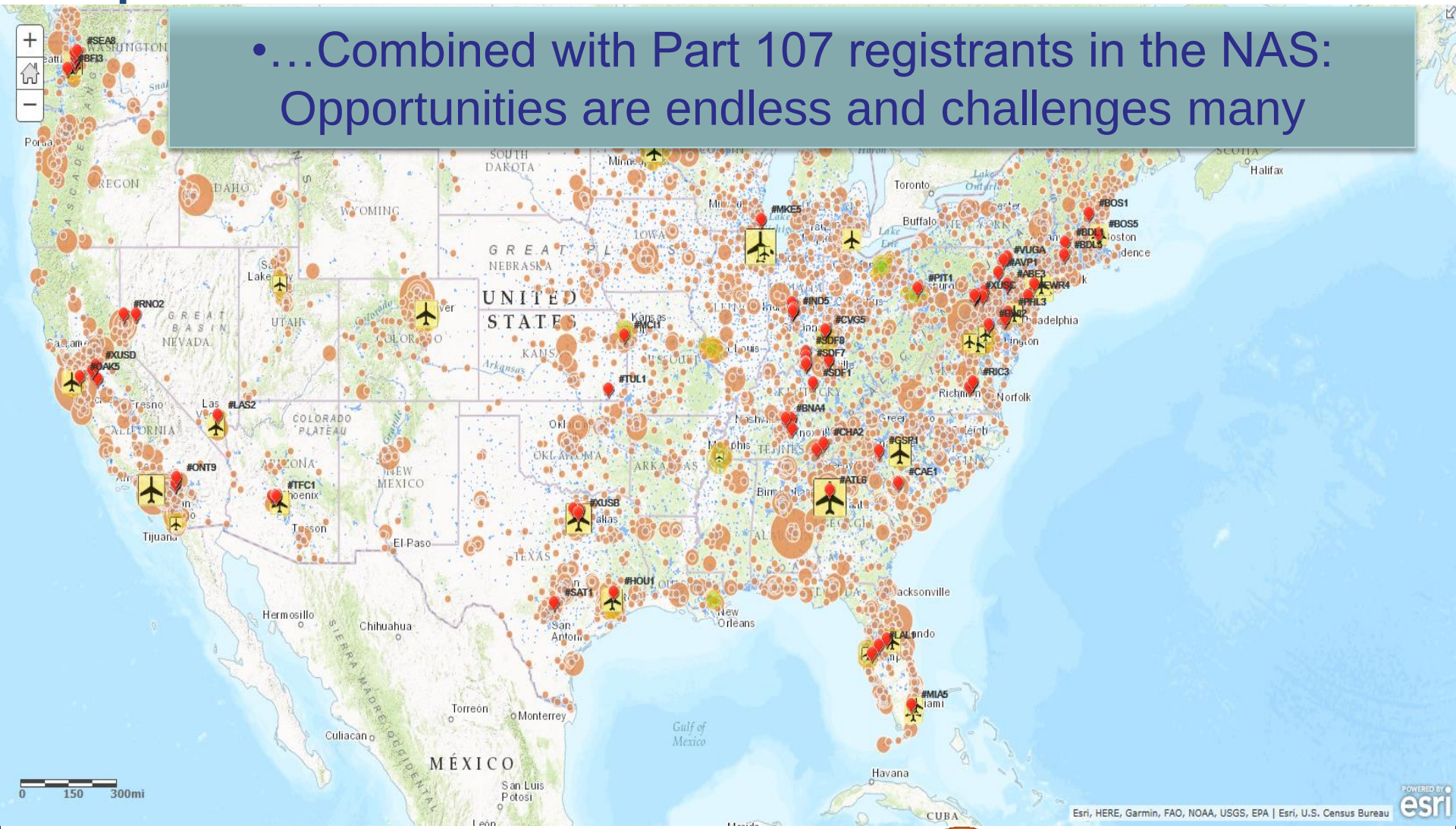
Where is it Heading? Urban Air Mobility

Source: Thipphavong, et. al. (2018): Urban Air Mobility Airspace Integration Concepts and Considerations, AIAA ARC

- Mix of onboard/ground-piloted and increasingly autonomous operations;
- Vertical take-off and landing (VTOL);
- Two NASA-sponsored studies concluded:
  - UAS may play a significant role in transforming the short-haul urban air transportation, e.g., airport shuttle, air taxi, air ambulance, last-mile parcel delivery;
  - Substantial financial and business opportunities exist but there are significant technological, operational, and regulatory challenges including issues involving public perceptions and acceptance; and
  - Gradual integration of sUAS into the overall system may facilitate integration of UAM by around 2030.

Emerging Patterns: Retail Delivery by Drones and Implications on NAS

- …Combined with Part 107 registrants in the NAS: Opportunities are endless and challenges many



UAS Delivery: Now a Reality

Source: https://www.auvsi.org/industry-news/wing-launches-uas-delivery-service-north-canberra-Australia

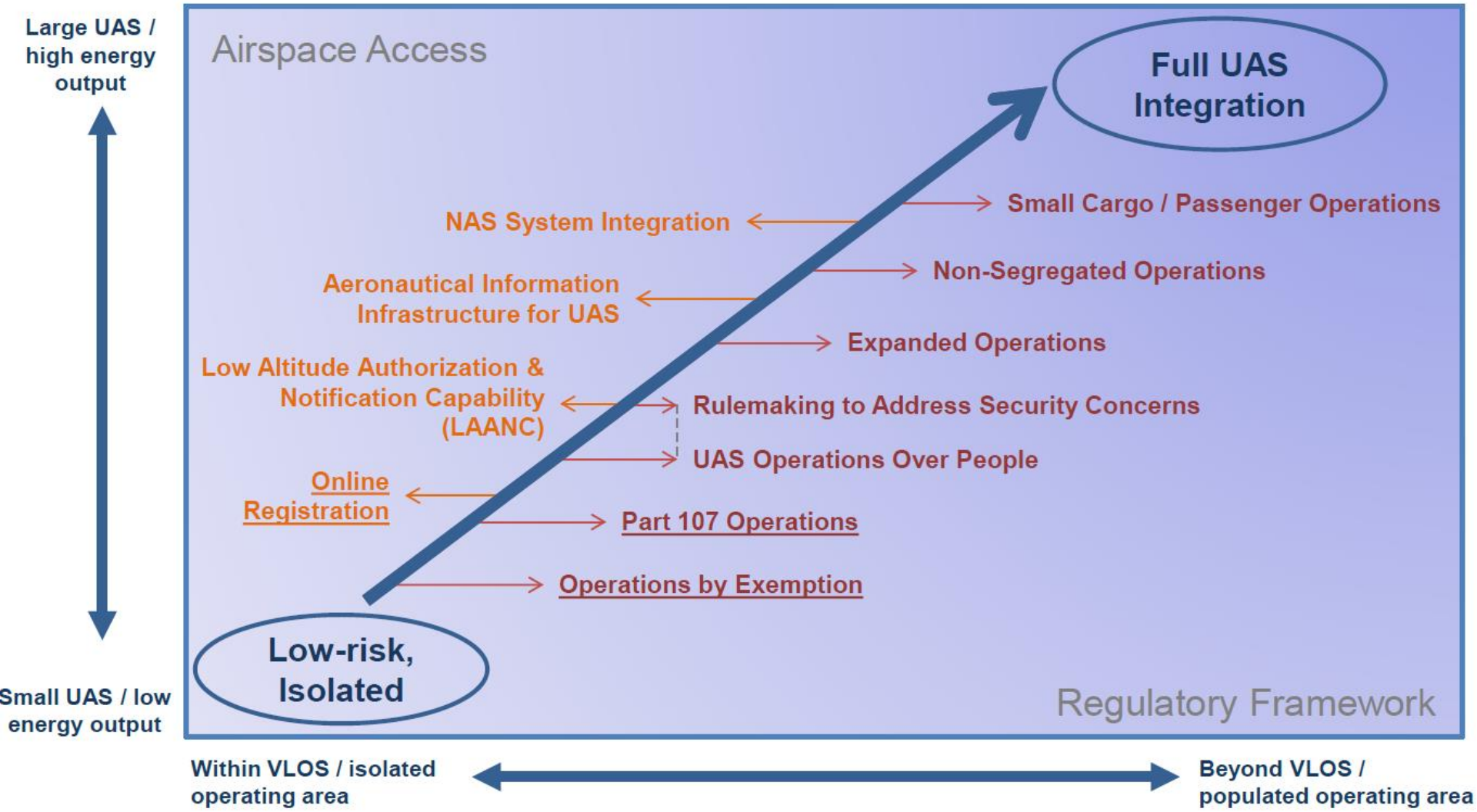
Source: https://wing.com/australia/canberra

Press Release – U.S. Transportation Secretary Elaine L. Chao Announces FAA Certification of Commercial Package Delivery; April 23

Open Questions

- **When will cargo delivery by drone begin? How will it change the industry and delivery logistics?**
  - Market Intelligence combined with industry knowledge required
- **How widespread such logistical network will be?**
  - Industry knowledge combined with operations research required
- **How will such network be integrated with existing NAS? Or a new network of some kind be required?**
  - NASA UTM, FAA research, Industry, and Academic research
- **Regulatory path facilitating this process**
  - Internal LOB efforts and coordination necessary
- **FAA sponsored a research project with ASSURE/COE to examine these questions**
  - ASSURE/COE and lead investigators from MSU

The Path to Full Integration: Agency view



Concluding Thoughts

- Interesting business development taking place all over the country and abroad;
- Tremendous growth and expansion into many activities are anticipated;
- Regulatory environment and associated facilitation via technological and institutional arrangement are aiding the sector further;
- FAA is keenly aware of these development and working hard to facilitate the sector while ensuring safety of the system.

FAA Annual Forecast: April 25, 2019

FAA Auditorium

PLEASE BOOKMARK THE WEBSITE:
HTTPS://WWW.FAA.GOV/DATA_RESEARCH/AVIATION/

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