

THE ELECTRIC VTOL REVOLUTION



Mike Hirschberg, Executive Director
The Vertical Flight Society
www.vtol.org & www.evtol.news

Sponsored by:
Vertical

2nd Annual Panel

The Electric VTOL Revolution

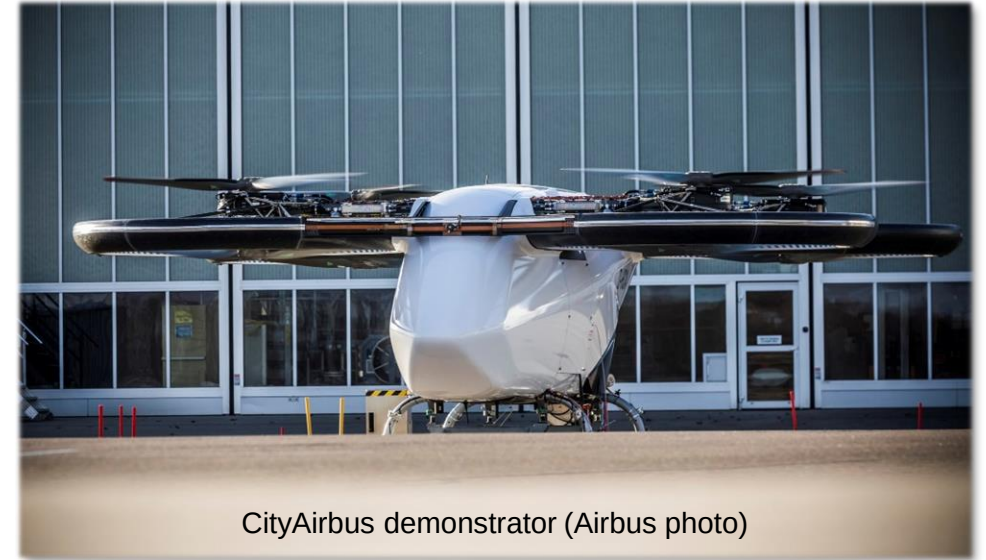
Wednesday, March 6 @ 9:00-11:00 am Room B310

Moderated by Elan Head, Vertical Magazine

- **Mike Hirschberg**, Executive Director, Vertical Flight Society
- **Scott Drennan**, VP Innovation, Bell
- **Zach Lovering**, VP of Urban Air Mobility Systems, Airbus UAM
- **Thierry Grison**, VP Business Development Hybrid New Market, Safran
- **Danny Sitnam**, President/CEO, Helijet International
- **Rex Alexander**, President, 5 Alpha
- **Michael Dymant**, Managing Partner, NEXA Capital Partners

eVTOL News @ Heli-Expo

- CityAirbus testing in Donauwörth
- Sikorsky officially announces in UAM
- Workhorse SureFly demonstrator
- Bell Nexus on display
- Airbus UAM talks



CityAirbus demonstrator (Airbus photo)



Bell Nexus mock-up (VFS photo)



SureFly Prototype #1 (VFS photo)

75+ Years of Advancing Vertical Flight

www.vtol.org/history

- Founded as “The American Helicopter Society (AHS)” 76 years ago in Connecticut on Feb. 25, 1943
- The first and longest-serving helicopter non-profit
- Pioneers envisioned a VTOL aircraft that was radically different from aircraft of the day
- Cooperation and collaboration essential to support transformative capabilities then and now
- Members are in industry, academia and government
- First Annual Forum in Philadelphia in April 1945
- 75th Annual Forum in Philadelphia in May 2019
 - 350 VTOL and eVTOL presentations!
- Now 6,000 individual and 105 corporate members

***Born with the American helicopter industry,
but advancing vertical flight worldwide***



Sikorsky XR-4 helicopter
Courtesy of Sikorsky Aircraft Corp.



First Annual AHS Awards Banquet
Oct. 7, 1944

75 Years of VTOL Legacy

www.vtol.org/legacy

- VFS has a proud history of advocacy and support
 - Helped in establishment of NASA-Army joint office, university research centers, industry-govt collaborations
 - Worked with NASA and DOD to save the NFAC wind tunnels
- Provided major support to transformative initiatives
 - Joint Strike Fighter / F-35B STOVL beginning in 1995
 - XV-15 / V-22 Osprey tiltrotor beginning in 1970s
- Providing major foundational support to new transformative initiatives
 - Joint Multi-Role (JMR) / Future Vertical Lift (FVL) since 2008
 - Electric and hybrid-electric VTOL (eVTOL) since 2014



NFAC 40 ft x 80 ft full-scale wind tunnel
Courtesy of NASA



Future Vertical Lift (FVL)
Sikorsky-Boeing Defiant and Bell Valor

Disruptive Technologies

- App economy: Smart phones, ride-sharing, Airbnb, etc
- Drones: 1.2 millions drones in the US; DJI has 85% of the market due to FAA restrictions during 2000s
- EVs: Tesla S started in 2012, now all car companies have electric cars
- Airliners: P&W GTF and GE LEAP provide ~20% fuel reduction



Photo by A.Savin



Photo By User:Jusdafax

Electric Helicopters?



Sikorsky S-300 Firefly (2010)

- Eliminate complex rotors!
 - Cyclic, collective, swashplate
 - Transmissions, gearboxes, shafting, hydraulics, etc.
- Distributed Electric Propulsion
 - Replace single complex system with multiple simple thrusters
- Get on a wing for efficiency
 - Higher speed, longer range
- Environment
 - Noise, noise, noise!
 - “Tailpipe” emissions

The Electric VTOL Revolution

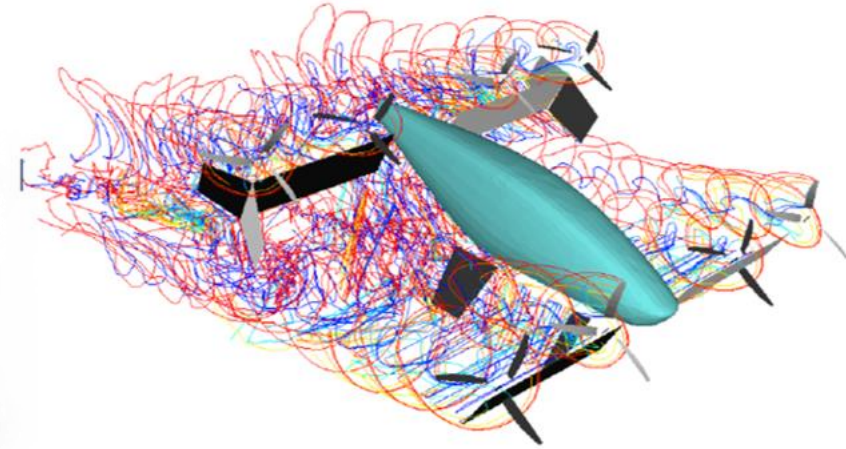
- Electric & hybrid electric propulsion enable new possibilities for:
- Regional Air Mobility (RAM)
 - Urban Air Mobility (UAM)/Air Taxis
 - Cargo Delivery/Disaster Relief
 - Personal Air Vehicles
 - Ultralights
 - Personal Flying Devices
 - Urban Package Delivery

Size and capability



Why Now?

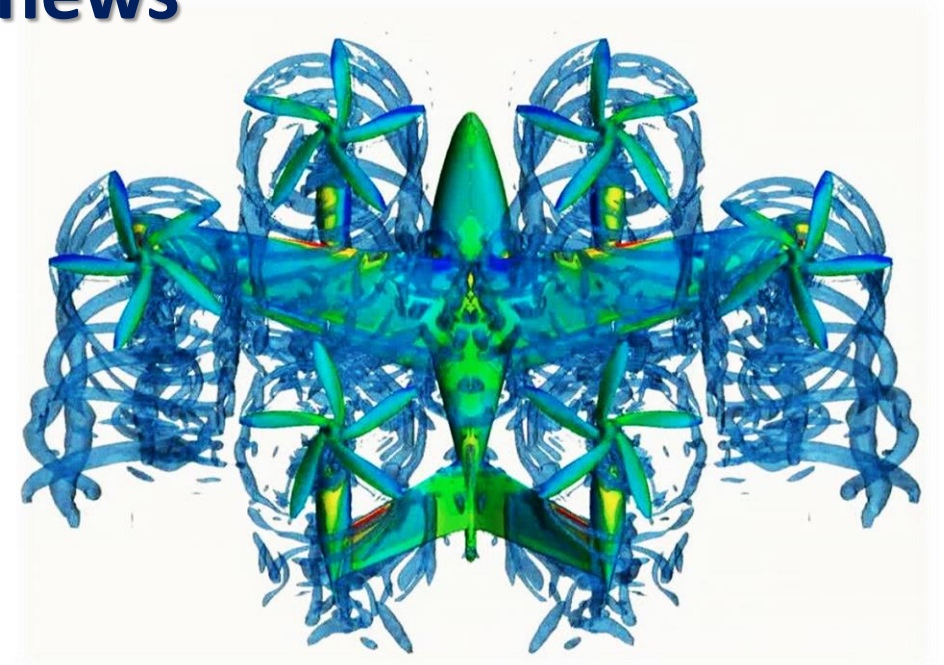
- Advancements in electric motors
- + Advancements in batteries
- + Advancements in computer modeling and simulation
- + Advancements in composites
- + Low cost manufacturing
- + Movement to performance regs
- + Tech innovations
- + Tech investments > \$2B
- = **Enabling new configurations and new innovations**



The Electric VTOL News

www.eVTOL.news

- World eVTOL Aircraft Directory
 - Everything from the silly to the serious
- 155 aircraft (as of March 6, 2019)
 - 55 Vectored Thrust
 - 20 Lift + Cruise
 - 35 Wingless (Multicopters)
 - 34 Hover Bikes/Flying Devices
 - 11 eHelos & eGyros
- 180 VFS articles on eVTOL
- Timeline, maps, company directory, educational videos, etc

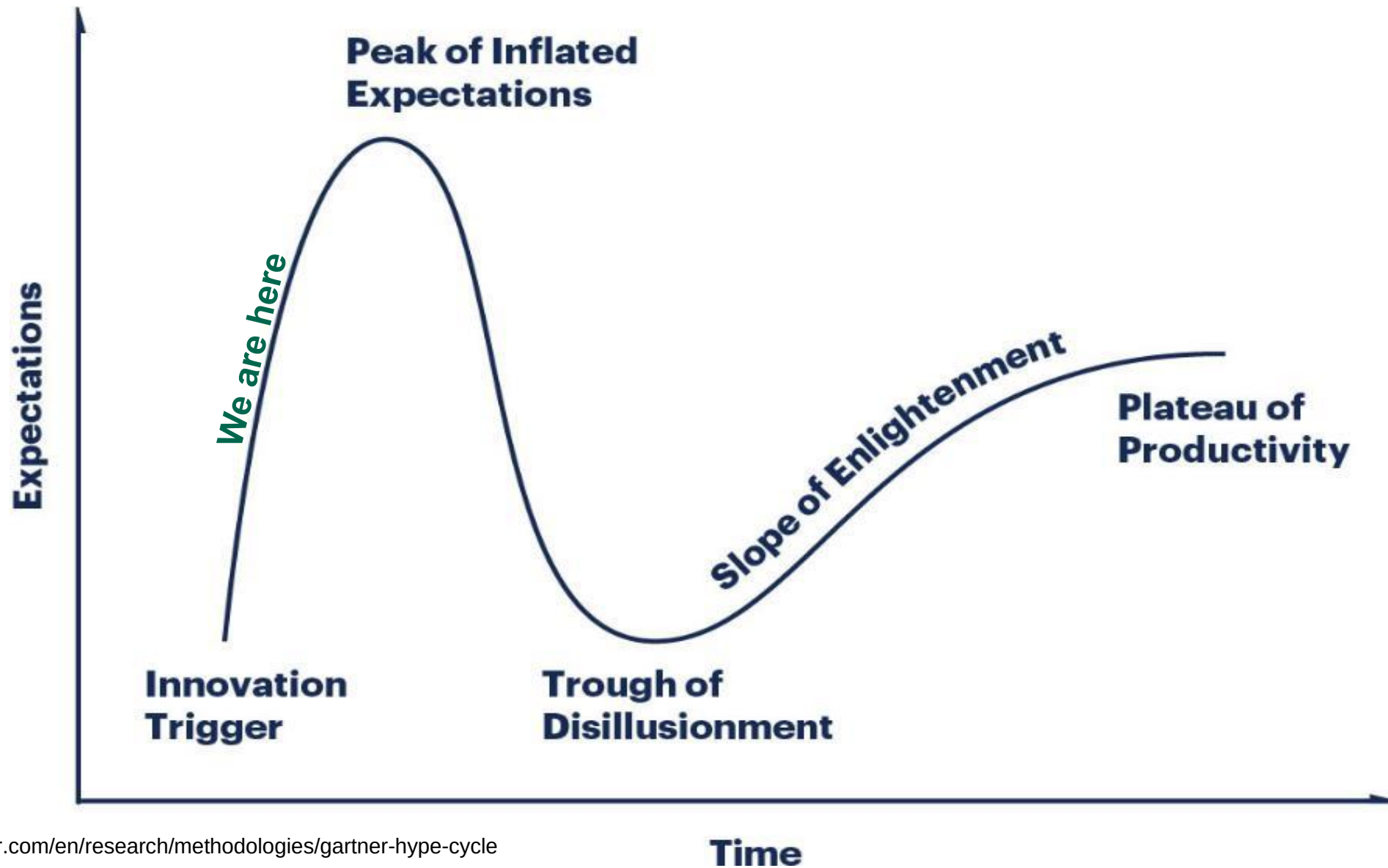


CFD of Joby S4, Aug 2015



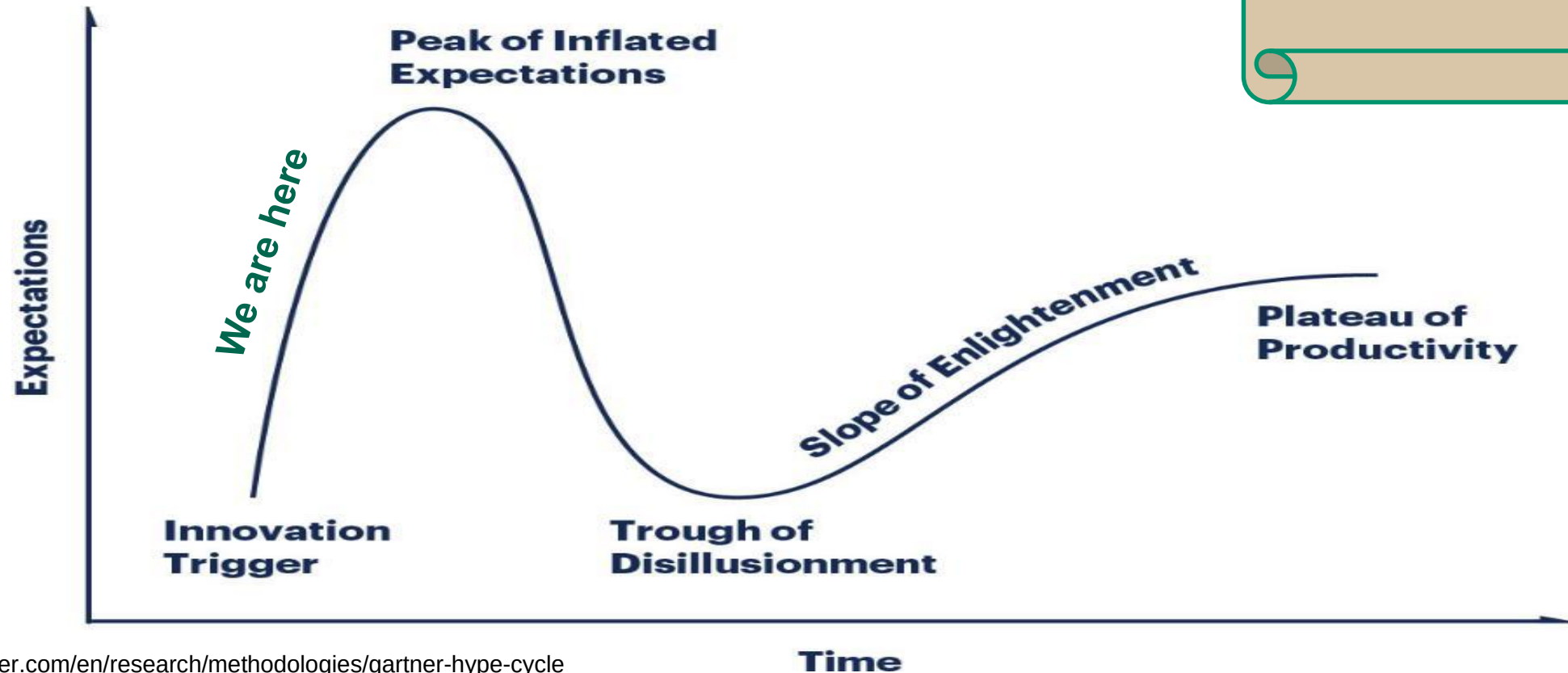
Avianovations HeparD

“The Hype Cycle”



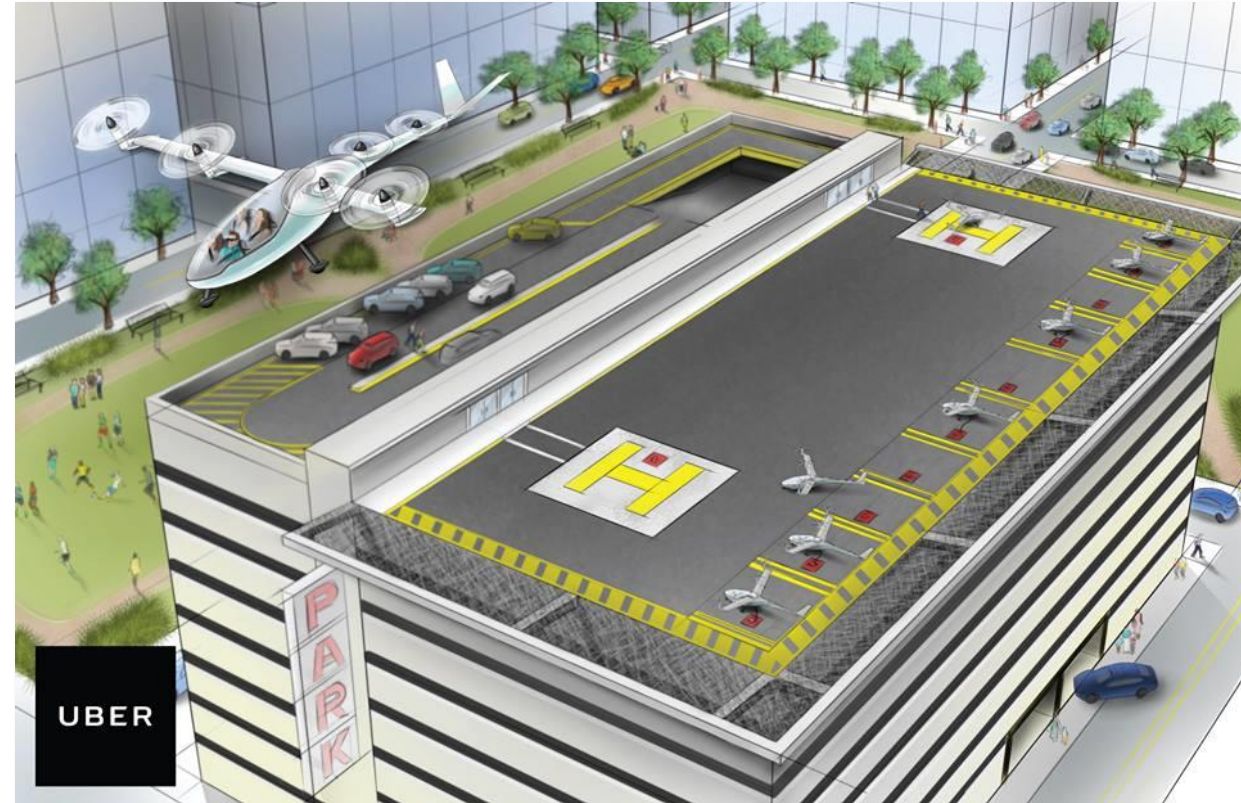
“The Hype Cycle”

The eVTOL
Revolution
Needs YOU!



Uber Elevate

- **Uber Elevate**
 - Unveiled at eVTOL Workshop in Sep 2016
 - White Paper in Oct 2016
 - Summits April 2017, May 2018, June 2019
- **Developing an “Ecosystem”**
 - Partnerships with cities, real estate companies, aircraft manufacturers, EV charger manufacturers etc.
 - Connecting innovators, investors, regulators, technical experts, media
- **Small aircraft, but high barriers**
 - Technical, regulatory, environmental, economic, infrastructural and cultural



Uber Elevate: “Impossible Challenges”

1. Flight demos in 2020; operational in 2023
2. Technology: all-electric (not hybrid) for 5 seats (pilot + 4 pax)
3. Infrastructure (physical and ATM/UTM)
4. Pilot shortage vs. autonomy
5. Regulations



Bell



Aurora Flight Sciences



Pipistrel Vertical Solutions



Karem Aircraft



EmbraerX

"It always seems impossible until it's done" – Nelson Mandela

eVTOL Ultralights

- Flight experience offerings
- Ultralights under FAR Part 103 do not require certification
- Less than 254 lb (115 kg) plus 30 lb *per float* plus parachutes, etc.
- Restricted in speed, overflights, etc.
- Already operational



Kitty Hawk Flyer (<254 lb)



Hoversurf Scorpion (<254 lb)



Opener BlackFly (310 lb)



LIFT Aircraft Hexa (432 lb)

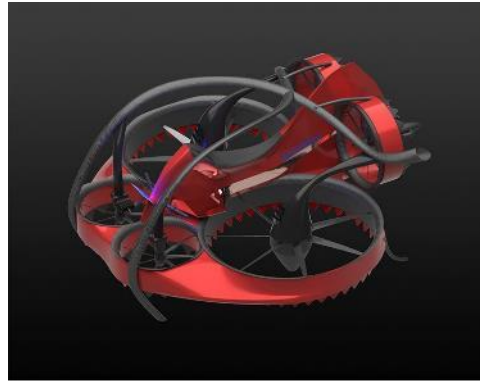
GoFly Prize Phase 1 Winners

10 winners announced 14 June @ \$20k each



TEAM
AEROXO LV

DEVICE
ERA AVIABIKE



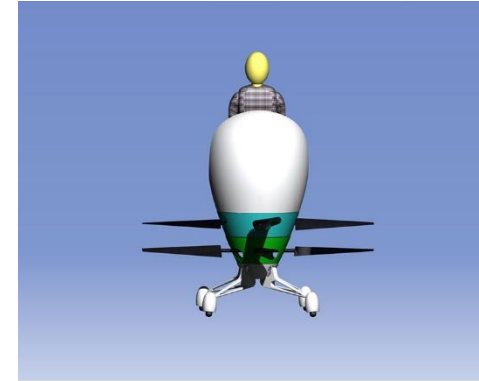
TEAM
MAMBA

DEVICE
MAMBA



TEAM
TETRA

DEVICE
TETRA 3



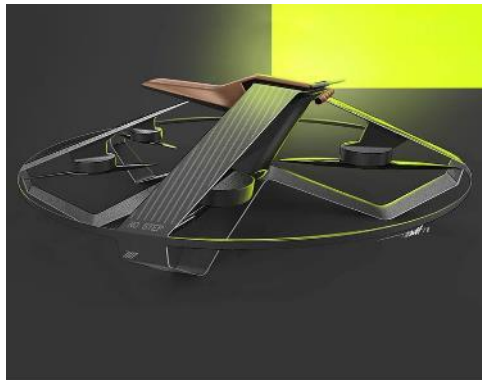
TEAM
TEXAS A&M UNIVERSITY

DEVICE
HARMONY



TEAM
GEORGIA TECH

DEVICE
HUMMINGBUZZ



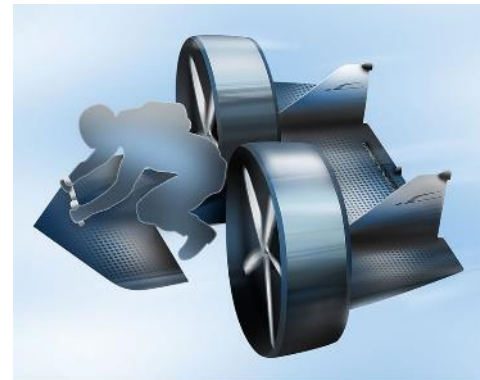
TEAM
LEAP

DEVICE
VANTAGE



TEAM
SCOOP

DEVICE
PEGASUS 1



TEAM
SILVERWING

DEVICE
S1



TEAM
BLUE SPARROW

DEVICE
BLUE SPARROW



TEAM
TREK AEROSPACE

DEVICE
FLYKART 2

www.goflyprize.com

eVTOL Online Resources

■ Electric VTOL News

- www.eVTOL.news
- www.facebook.com/electricVTOL
- www.twitter.com/electricVTOL
- www.youtube.com/VTOLsociety
- www.instagram.com/VTOLsociety

■ Also

- Electric VTOL eNewsletter
- eVTOL News videos
- eVTOL video proceedings (50 hours)
- eVTOL short course videos (20 hours)



The screenshot shows the homepage of the Electric VTOL News website. The header includes the site's logo, navigation links (About, News, Vertiflite Articles, World eVTOL Directory, Events, Courses, Videos, Resources), and social media icons. A banner at the top right promotes the 75th Annual Forum and Technology Display by the Vertical Flight Society. The main content area features an article about the Electric VTOL News™ mission, a featured article titled "Bell Unveils Nexus Air Taxi" with a Vertiflite magazine cover, and a section for "FOLLOW EVTOL NEWS ON TWITTER" with two tweets from @ElectricVTOL. The footer includes a sign-up form for the Electric VTOL™ Newsletter.

NEWS Fantastic eVTOL Forecasts

The Vertical Flight Society presents the 75th Annual Forum and Technology Display
The Future of Vertical Flight
MAY 13-16, 2019 PHILADELPHIA, PENNSYLVANIA

Electric VTOL News™
by the Vertical Flight Society

About News Vertiflite Articles World eVTOL Directory Events Courses Videos Resources

The Electric VTOL News™ highlights the incredible promise and progress of electric and hybrid-electric powered vertical takeoff and landing (eVTOL) aircraft, focusing on non-helicopter VTOL aircraft large enough to carry passengers without conventional helicopter flight controls (though eHelos are now listed as well). Electric propulsion throws open the VTOL aircraft design space by harnessing concepts such as distributed electric propulsion (DEP) as well as facilitating new approaches to wingborne VTOL.

The Electric VTOL News™ is published by the Vertical Flight Society. Founded as the American Helicopter Society (AHS) in 1943, VFS is the world's oldest and largest VTOL technical organization. In January 2019, VFS hosted the 6th Annual Electric VTOL Symposium — the world's largest and longest-running eVTOL conference.

Here you can read our news stories, learn about the different aircraft being developed and the new enabling technologies such as motors and batteries, find out about applications like the Uber Elevate ecosystem, Urban Air Mobility and the NASA UAM Grand Challenge, or check out our social media and other resources available for those tracking or learning about eVTOL, including a timeline, world map and ways to sort through our World eVTOL Directory — we currently have 150+ eVTOL aircraft listed! And check out our upcoming events and resources from past events.

We also have some 50 hours of presentations on eVTOL aircraft and technology in our video library, including a six-hour "Short Course on eVTOL Technology," taught by four leading eVTOL technology experts.

Sign up for the Electric VTOL™ Newsletter to get regular updates on progress in Electric VTOL, resources and important upcoming events. You can also check out our past issues.

Enter your email below:

Vertiflite, March-April 2019

Bell Unveils Nexus Air Taxi

FOLLOW EVTOL NEWS ON TWITTER

eVTOL News by The Vertical Flight Soc
@ElectricVTOL

This is apparently "not" an early April Fool's joke. "Goodyear Designs Tire to Turn Cars Into Flying DeLoreans," Tom's Guide, March 5: "But Goodyear's yearly tire design stunts — which usually come... tomsguide.com/us/goodyear-ae...

Goodyear Designs Tire to Turn Cars Into F...
The company's new Aero two-in-one concept...
tomsguide.com

eVTOL News by The Vertical Flight Soc
@ElectricVTOL

First official high resolution image of the @AirbusHeli #CityAirbus #eVTOL for #UrbanAirMobility. Find out more at eVTOL.news.

VTOL Innovators – Then and Now

(Industry, academia and government)

1st AHS Banquet
1944



1st eVTOL Workshop
2014



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