The Future of Air Mobility: who will own it

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September 2020


Goldman
Sachs


XOJET


Hawker
Beechcraft


AIRFINANCE

What makes this Different?

ELECTRIFICATION

Electric powertrains are lighter, more efficient, zero-emission, and less costly to maintain

Key Enablers:

- High-performance batteries
- High-power density motors
- Power electronics and thermal management

DISTRIBUTED PROPSULSION

Distributed propulsion enables more efficient designs with greater redundancy

Key Enablers:

- High-power density motors
- Lightweight materials
- Digital modeling & simulation tools

AUTONOMY

Autonomy reduces costs and improves reliability and safety in high-density environments

Key Enablers:

- Artificial Intelligence (AI)
- Advanced sensors
- High-bandwidth connectivity

Adoption Curve UAVs, VTOLs and Shared Mobility

Stage 5: 2040+
Commercial VTOL Deployment at Scale
UAV ubiquity

Stage 4: 2030-2040
Initial Broad VTOL Commercial Deployment
VTOL Infrastructure Building Continues
UAV usage extensive and growing

Stage 3: 2025-2030
UAV Commercial & Industrial Uses Widespread
Infrastructure Buildout Expands,
VTOL Limited Route Deployment,
Early Stage Autonomy Testing

Stage 2: 2020-2025
Proof of Concept, Regulatory Engagement
Infrastructure Planning & Beginning Buildout
2019 UAV Preliminary 135 Certs, some BVLOS, Industrial Uses Grow, 2023 VTOL certifications

Stage 1: 2018-2020
VTOL Stealth, Prototype Development & Testing, UAV Commercial Trials, Infrastructure Planning

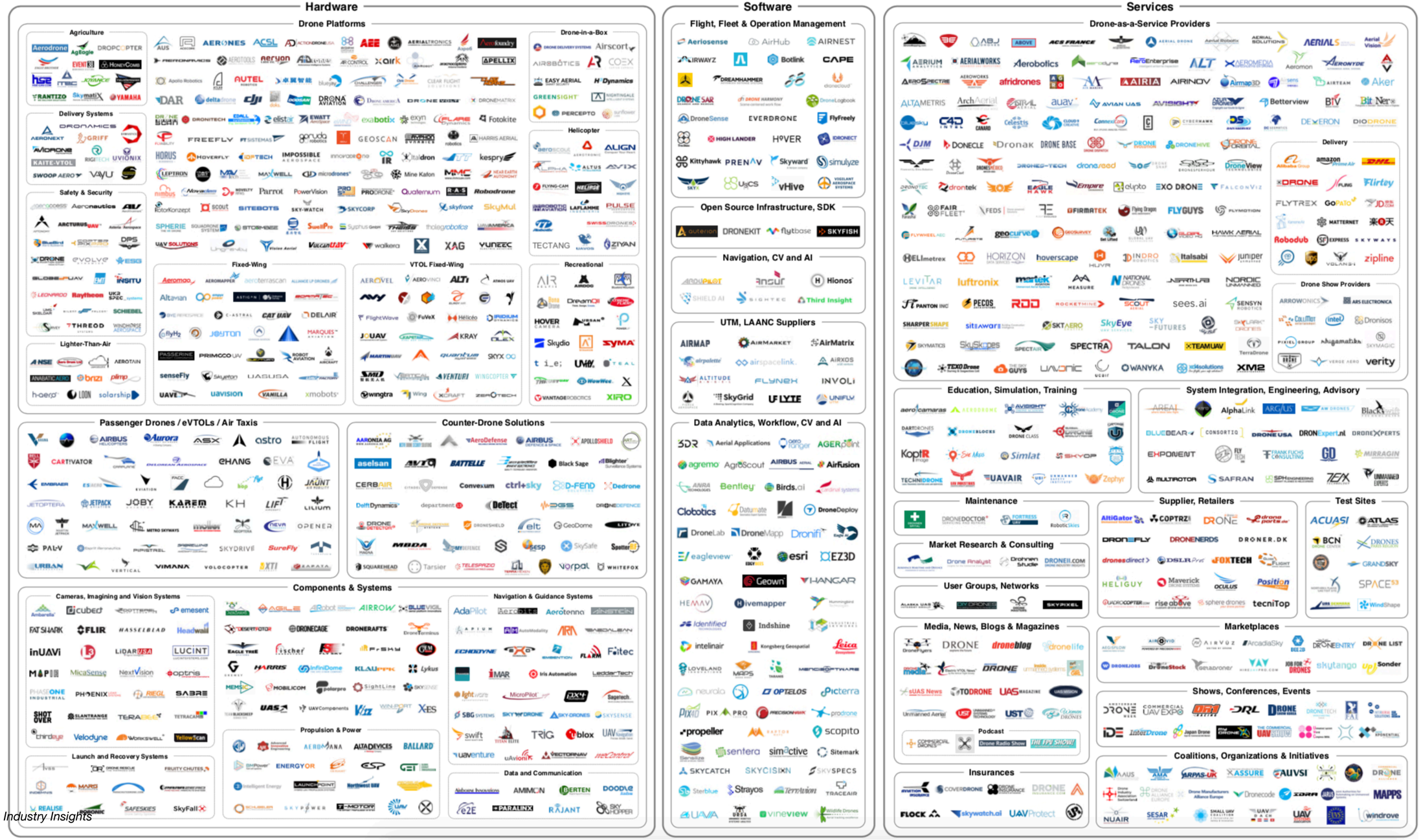
Credit: Morgan Stanley & Co. research as of December 2, 2018, with some modifications.

Gartner Hype Cycle for Emerging Technologies, 2019

Drone Industry 2015

Credit: 2019 Drone Industry Insights

Drone Industry 2019



Credit: 2019 Drone Industry Insights

VTOL

200+ Active VTOL Projects

Airbus Vahana

Boeing PAV

Bell Nexus Air Taxi

Kittyhawk Cora

Ehang 184

Joby Aviation S4

KittyHawk Flyer

Lilium Jet

Volocopter 2X

Workhorse SureFly

Opener BlackFly

Aston Martin Volante

Karem Butterfly

EmbraerX

Pipistrel 801 eVTOL

Jaunt Air Mobility eVTOL

Skai by Alaka'i Technologies

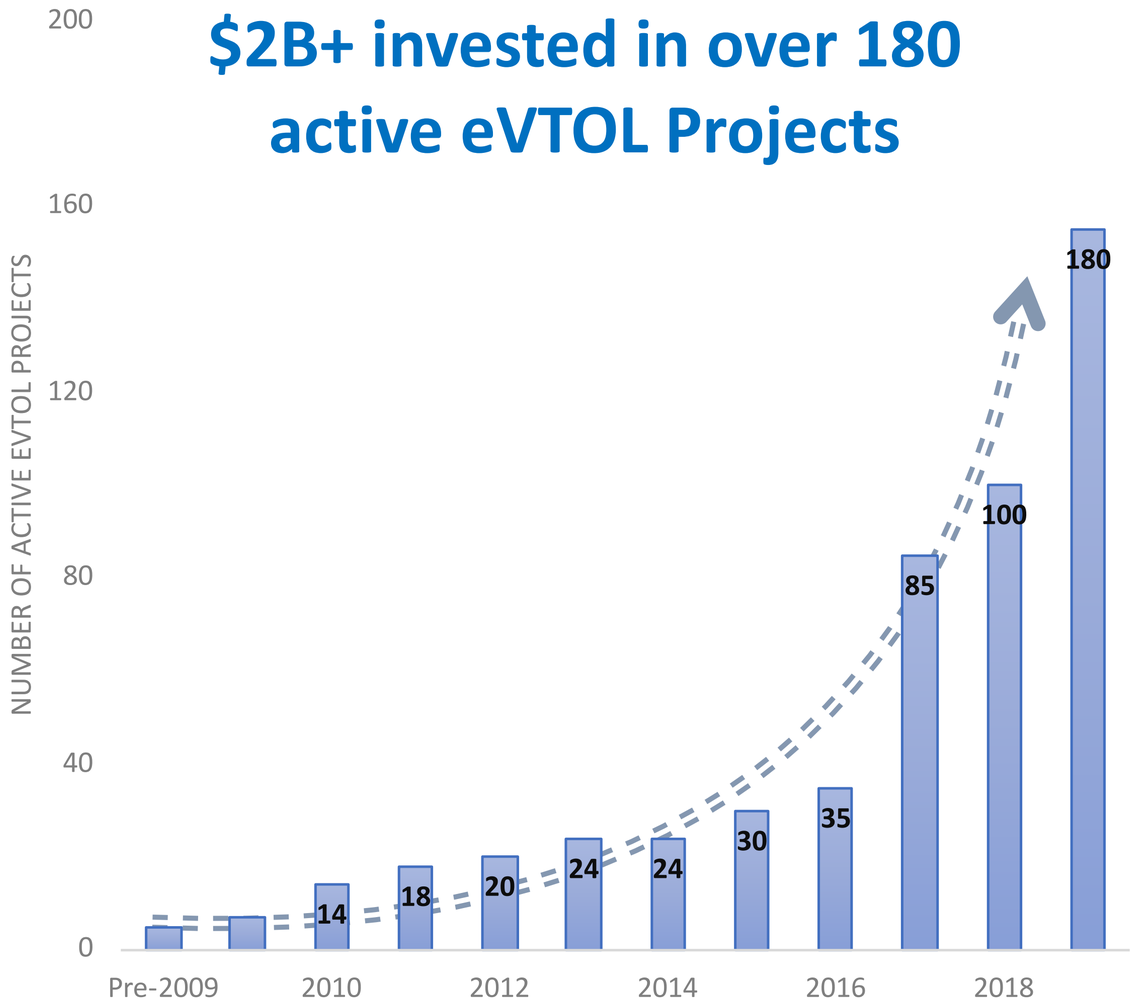
Beta Technologies Ava

Leonardo Helicopters AW609

Dozens more!

Credit: 2019 TransportUp

$2B+ invested in over 180 active eVTOL Projects



Source: VTOL Society, Mike Hershberg, Secondary research, Roland Berger, "Aircraft Electric Propulsion—Onwards and Upwards"

With interest from legacy aerospace leaders…


Airbus Vahana


Boeing PAV


Bell Nexus Air Taxi


EmbraerX

AIRBUS

BOEING

BELL

EMBRAER

…and numerous non-traditional and startup entities


Pipistrel eVTOL


Joby Aviation S4


KittyHawk Flyer


Lilium Jet


BlackFly


Kittyhawk Cora


Ehang 184


Karem Butterfly


Aston Martin Volante


Volocopter 2X


Workhorse SureFly


Beta Technologies Ava

Google

PIPISTREL

CARTER

BETA TECHNOLOGIES

JOBY AVIATION

UBER

VOLOCOPTER

LILIUM

KAREM AIRCRAFT, INC.

Challenge

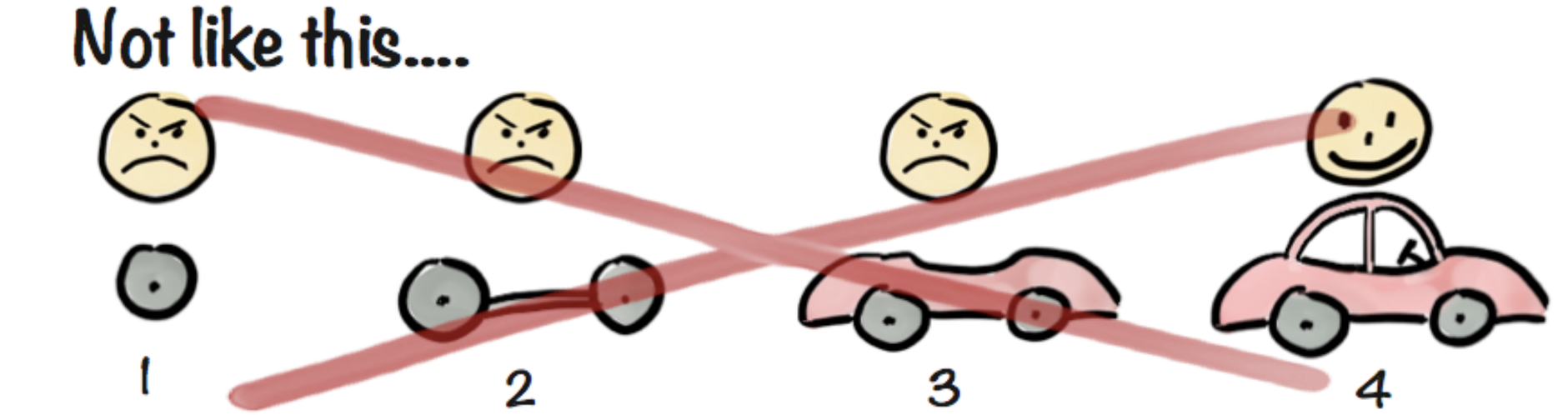
where will the billions of capital needed to build the UAVs/VTOLS will come from

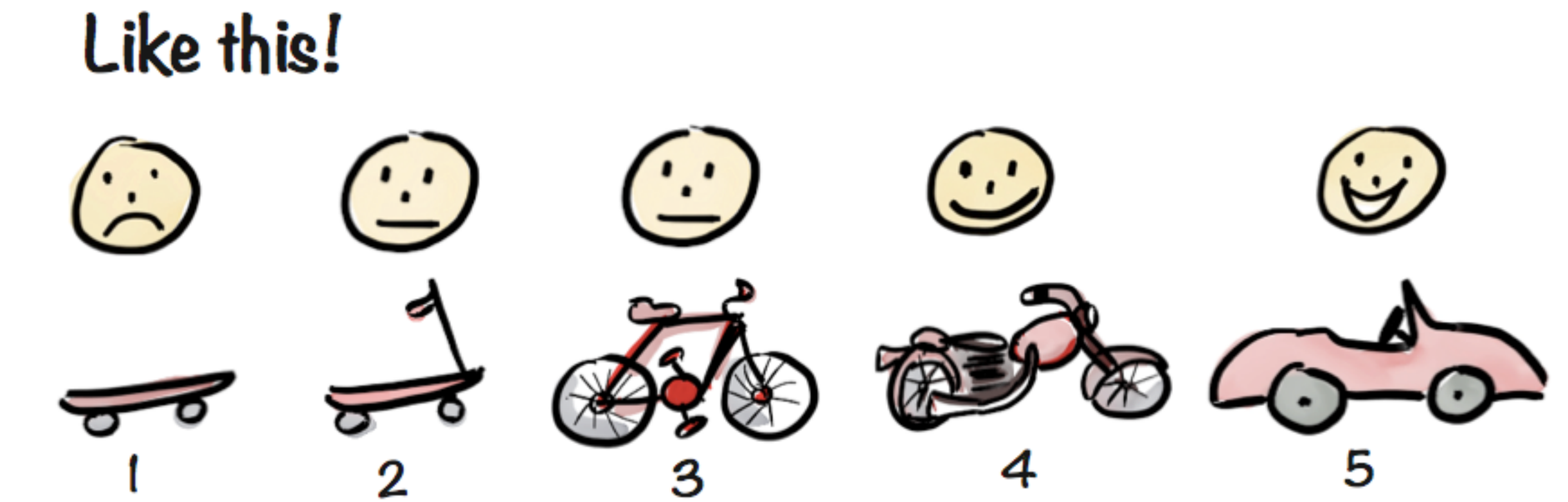
Early Commercial Success MVP

Minimum Viable Product (MVP)

- A key premise behind the idea of MVP is that you produce an actual product (which may be no more than a landing page, or a service with an appearance of automation, but which is fully manual behind the scenes) that you can offer to customers and observe their actual behavior with the product or service.
- Seeing what people actually do with respect to a product is much more reliable than asking people what they would do.

Minimally Viable Product





Why approach it this way?

Aerospace has had many
many very public failures
And to continue to attract capital we need
some near term success

Legacy of large failures

Eclipse Aviation circa 2007
$1+ billion spent

Adam Aircraft circa 2007
raised $182 millio

Hawker Beechcraft
purchased for $3.3 billion

Bankrupt

A lot of money has been lost, investors feel burned

So how is today

Different?

Starting point: drones / uav

Natural Progression

drone

cargo drone

2 person multi rotor

tilt wing with vectored thrust or lift+push

Full-stack Startup

full stack companies need

enormous amounts of capital

Cost of Certification

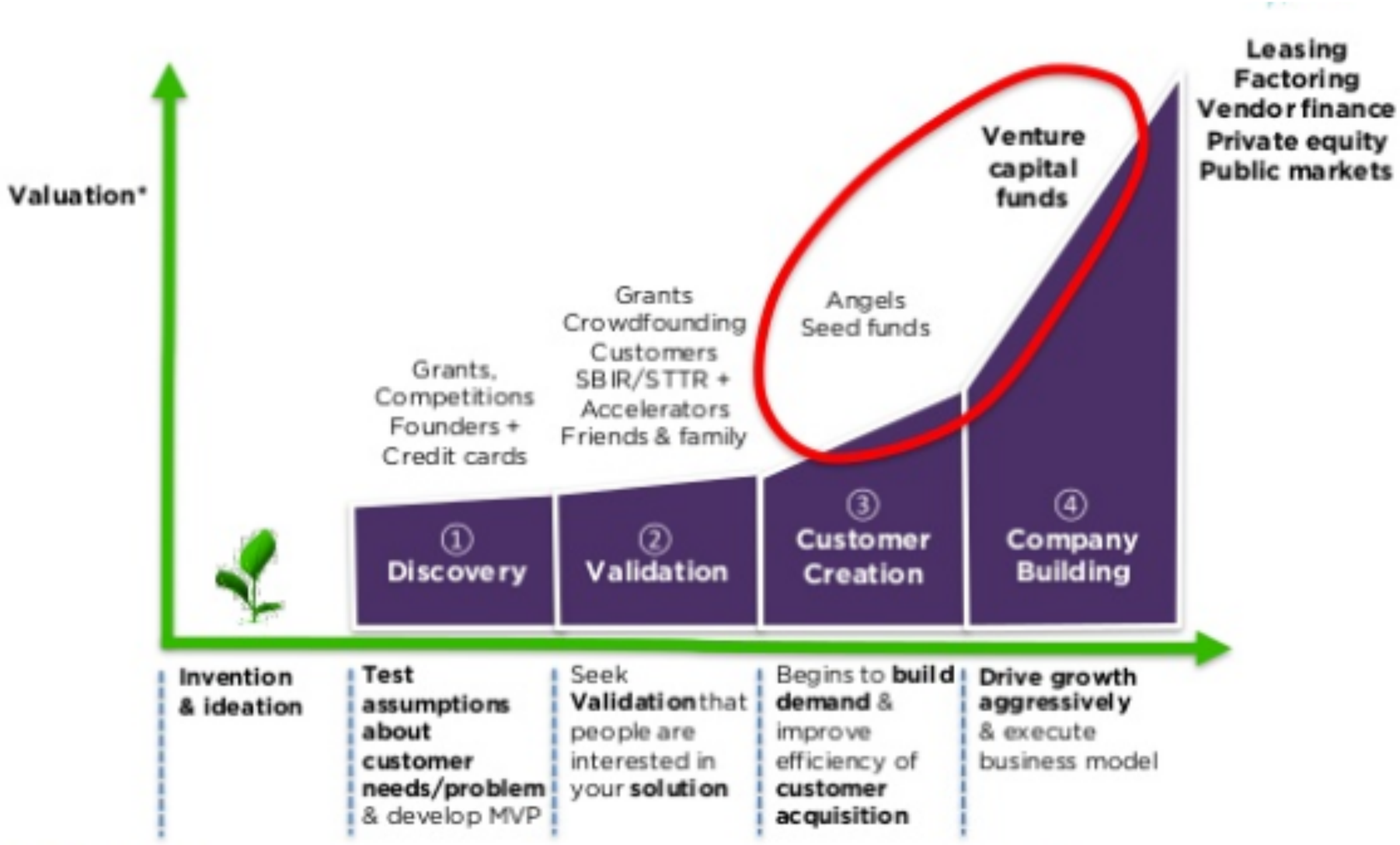
Fundraising Quandary

So if you need
$500M - $1B
where are you going
to get it?

Possible Investors

Sovereign
Wealth
Funds

Company Funding Lifecyle



*NYU

VC Statistics

single fund
= $135 million
spread over
between 30-80
startups

Is Growth Equity an Option?

	VENTURE CAPITAL	GROWTH EQUITY
DEFAULT RISK	No: Venture stage businesses do not typically have debt in their capital structure.	No: Growth stage businesses do not employ significant amounts of debt. As a result, credit default risk is not a primary feature of growth stage investing.
MARKET RISK	Yes: Venture stage businesses often operate in new markets.	No: Growth stage businesses typically operate in emerging or mature markets.
PRODUCT RISK	Yes: Venture stage businesses often do not yet have a commercial grade product.	No: Growth stage businesses have developed a commercial grade product and often require capital to expand their offerings.
EXECUTION RISK	Yes: Execution risk is unavoidable.	Yes: Execution risk is unavoidable.
MANAGEMENT RISK	Yes: The venture stage management team is typically an engineering-oriented founding team.	Yes: Growth stage businesses frequently go through periods of significant growth, requiring the addition of new corporate functions and management team members. Building a capable and well-functioning management team is a critical issue for growth stage businesses and a focus of growth equity investors.
RISK OF CAPITAL LOSS	High	Moderate

Sovereign Wealth Funds

TEMASEK

MUBADALA

جهـــاز قطـــر للاستثـــمـــار
QATAR INVESTMENT AUTHORITY

KHAZANAH
NASIONAL

Strategics


DAHER
DASSAULT AVIATION
BOEING
AIRBUS
PORSCHE
intel Capital
Verizon Ventures
TOYOTA
SAFRAN
jetBlue
technology ventures
Honeywell
THE POWER OF CONNECTED
ASTON MARTIN
ASTON MARTIN
BELL
SIKORSKY
A LOCKHEED MARTIN COMPANY
DAIMLER
Gulfstream
A GENERAL DYNAMICS COMPANY
M12
MICROSOFT'S VENTURE FUND
United Technologies
QUALCOMM VENTURES
HYUNDAI
Falcon
DASSAULT AVIATION
Collins Aerospace
ROLLS ROYCE
CAE
NORTHROP GRUMMAN
MOOG
THALES
HondaJet
Tencent 腾讯
GEELY
LEONARDO
EMBRAER
L3
Raytheon
BOMBARDIER

Thesis One

TEXTRON AIRBUS BOEING Honeywell Raytheon Technologies

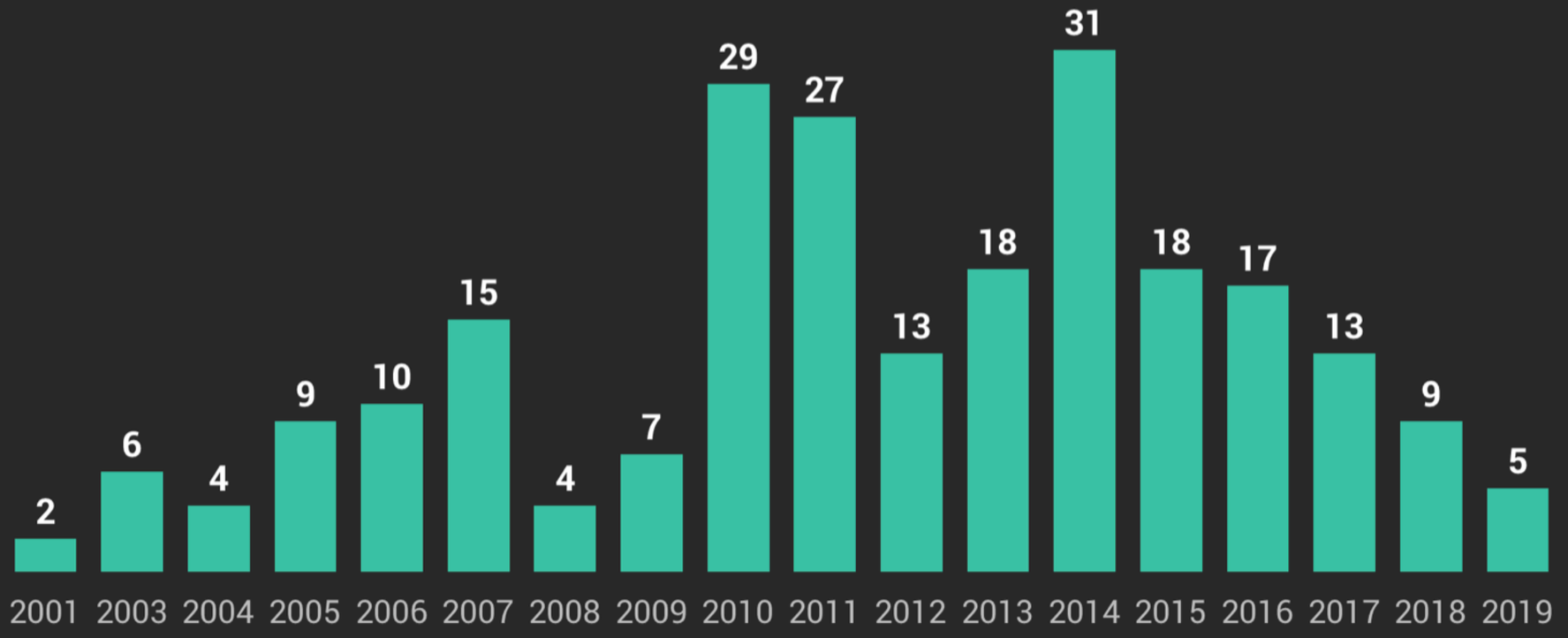
Large legacy companies don’t innovate terribly well, so to continue to grow they need to acquire/invest companies to grow and innovate.

But can aerospace companies **pay** the multiples necessary to make the venture capital work
- and attract more venture capital


Google

Google's Acquisitions, By Year

Based on Crunchbase data. Excludes acquisitions made by Google's subsidiary organizations, or its parent company Alphabet. Data is current through November 1, 2019.

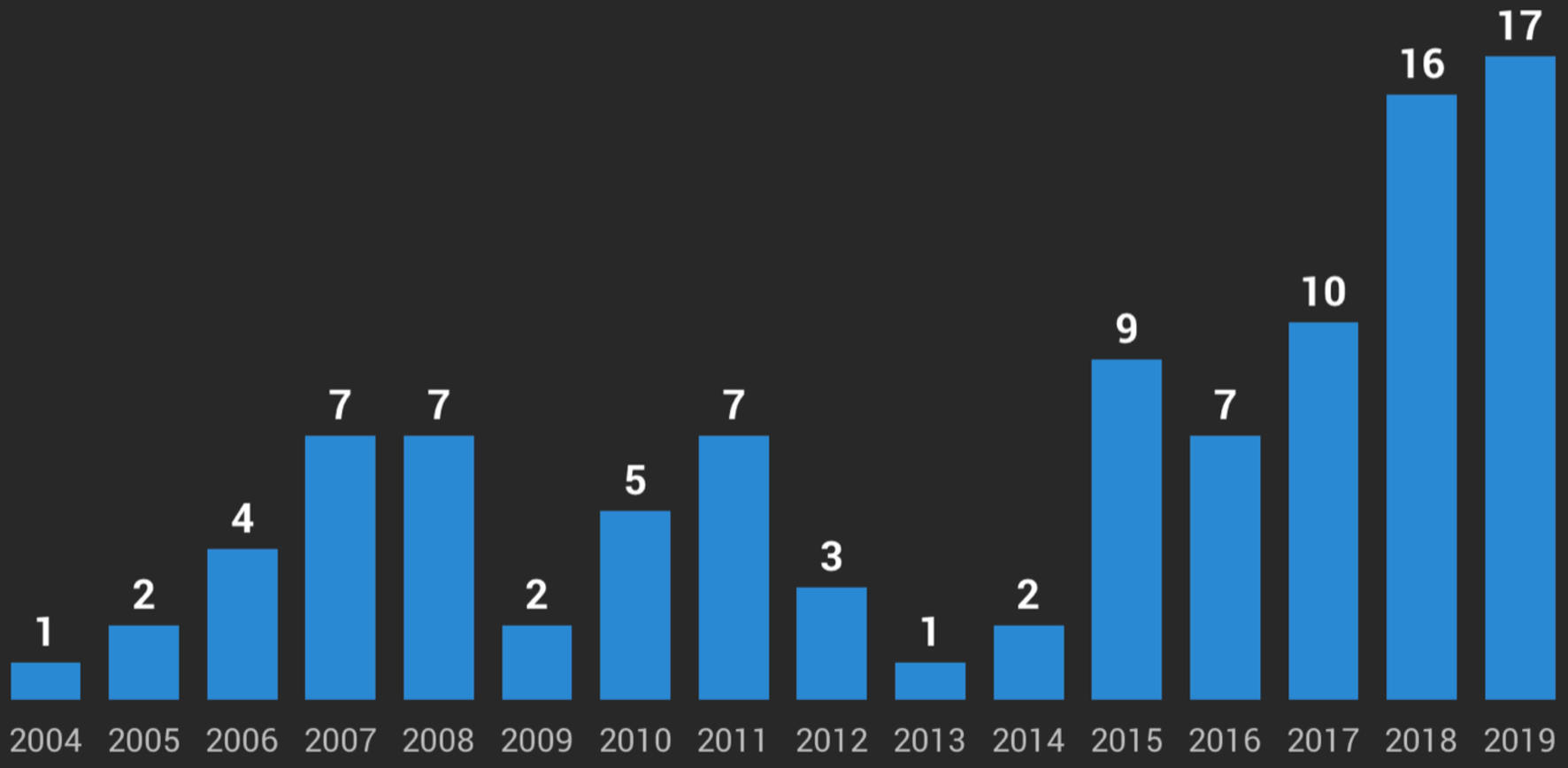


crunchbase news

*as of November 1, 2019

Count Of Google's Corporate Venture Investments

Based on Crunchbase data. Excludes investments made by Google's subsidiary organizations, or its parent company Alphabet. Data is current through November 1, 2019.



crunchbase news

*as of November 1, 2019

Fundraising Prowess Matters

JOBY

$720 million

LILIUM

$375 million

VOLOCOPTER

$132 million

BETA FLIGHT RECHARGED

VERTICAL Aerospace

JAUNT AIR MOBILITY

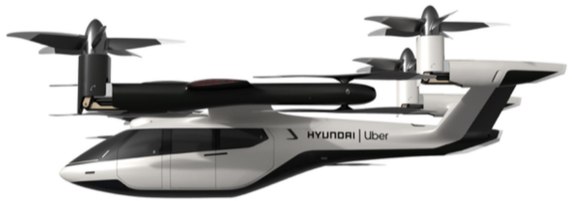
?

Barrier to entry : furthest along with certification

VTOL Programs

Invest

HYUNDAI



ASTON MARTIN

Volante

PORSCHE

DAIMLER

GEELY

TOYOTA

Build

EMBRAER X

TEXTRON

AIRBUS

BOEING

ROLLS ROYCE

Program Investments

JOBY

TOYOTA

jetBlue | technology ventures

intel Capital

VOLOCOPTER

GEELY

Mitsui Sumitomo Insurance Group
MSIG

DB SCHENKER

DAIMLER

Micron

JAL
JAPAN AIRLINES

LILIUM

Tencent 腾讯

Aurora FLIGHT SCIENCES
A BOEING COMPANY

wisk

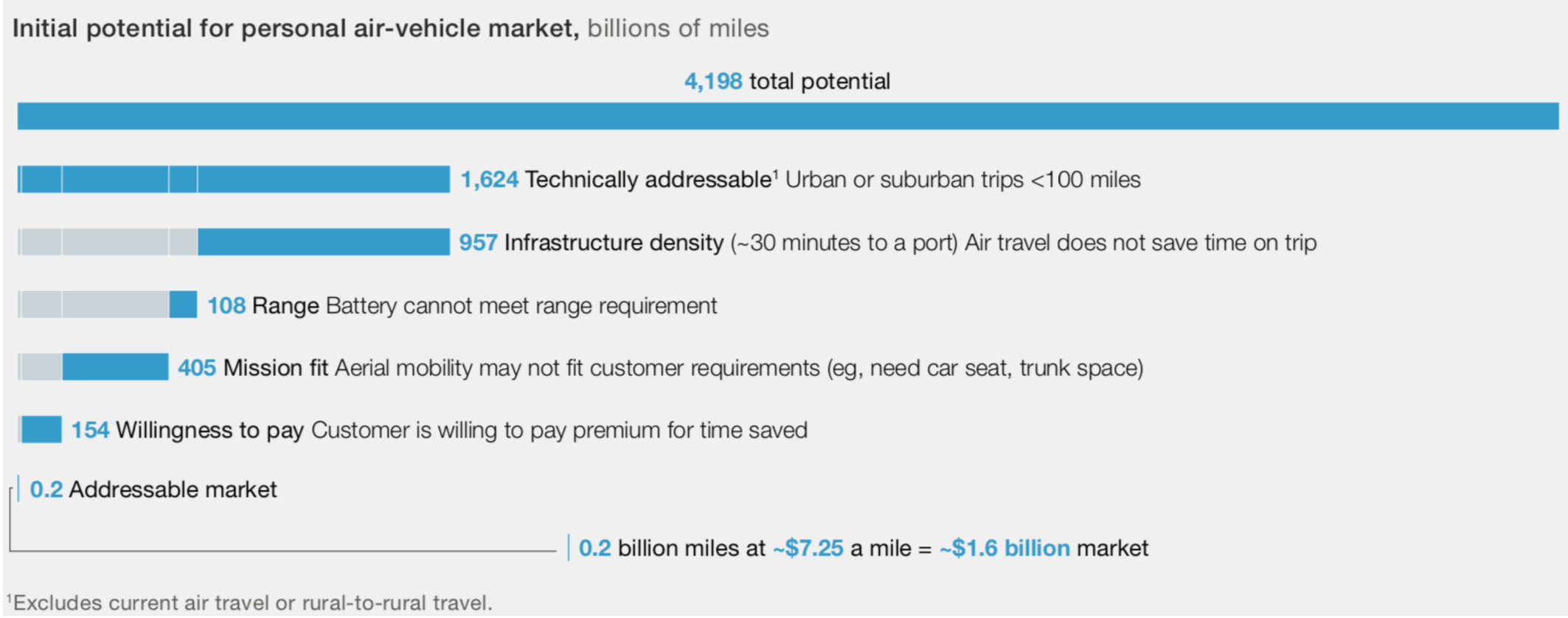
BOEING

KAREM AIRCRAFT, INC.

Hanwha Systems

McKinsey Base Case: 1000 cars/year

The ‘flying taxi’ operator market could reach approximately $1.6 billion by 2040.

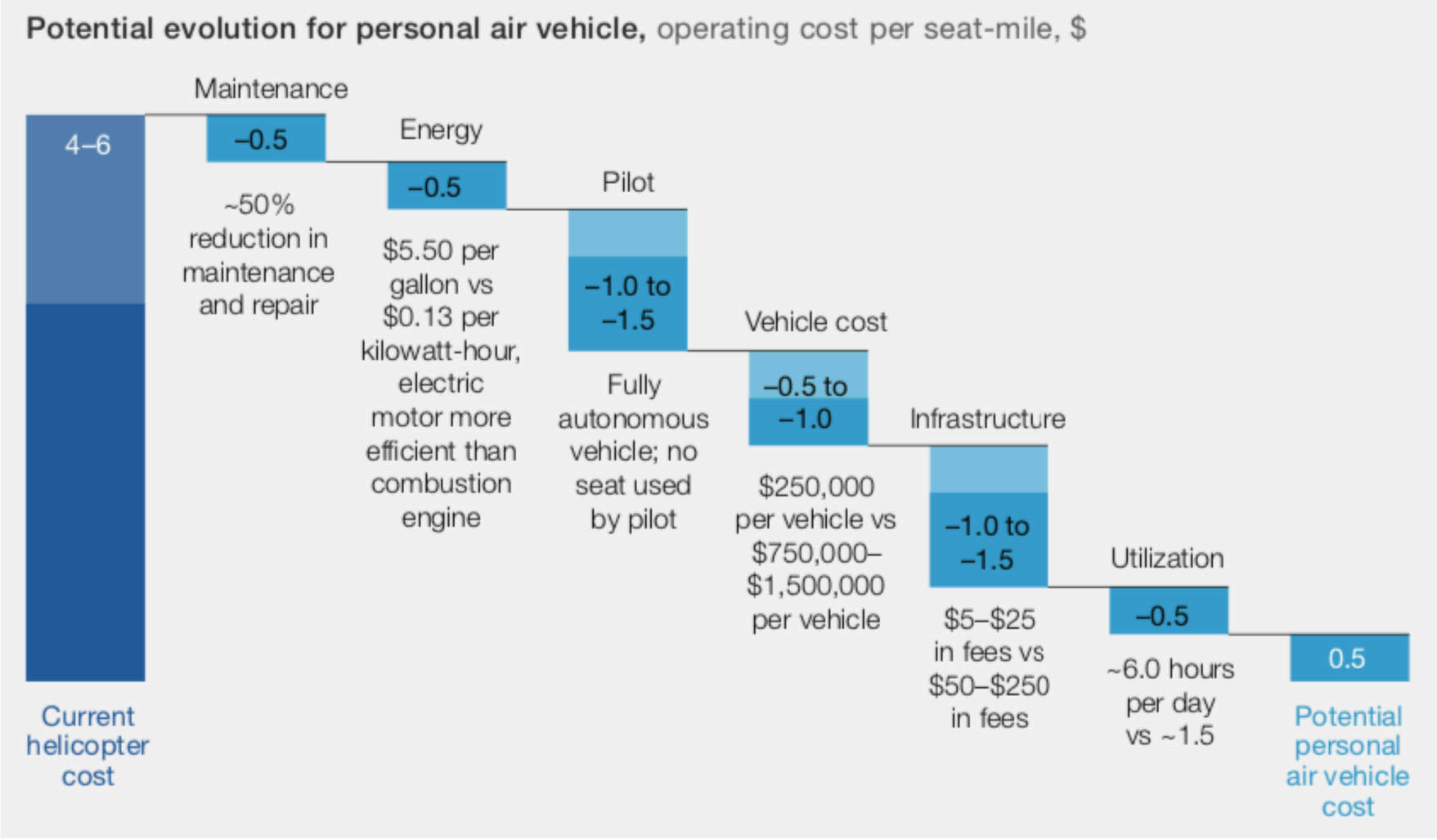


[1]Excludes current air travel or rural-to-rural travel.

McKinsey & Company

This assumes a vehicle at $760,000 - $1.5M

Operating Costs / seat mile = 90% less



Optimistic case: 25,000 vehicles in the US annually @ $25K unit = $500+billion annually.

McKinsey & Company

@25,000 units/yr
can aerospace OEMs adapt?

The at-scale market implies a different world—one in which at least 25,000 vehicles sell per year in the United States alone at prices below $250,000 each. This price point will emerge as the industry achieves manufacturing scale and the vehicle platform commoditizes. In this scenario, downstream services like UTM and infrastructure are much more likely to be larger, with higher-margin profit pools. This is because these services will feature higher complexity and end up having higher barriers to entry once a player builds a viable solution.

McKinsey
& Company

Commerical Aircraft Deliveries

Airbus 863

Boeing 380

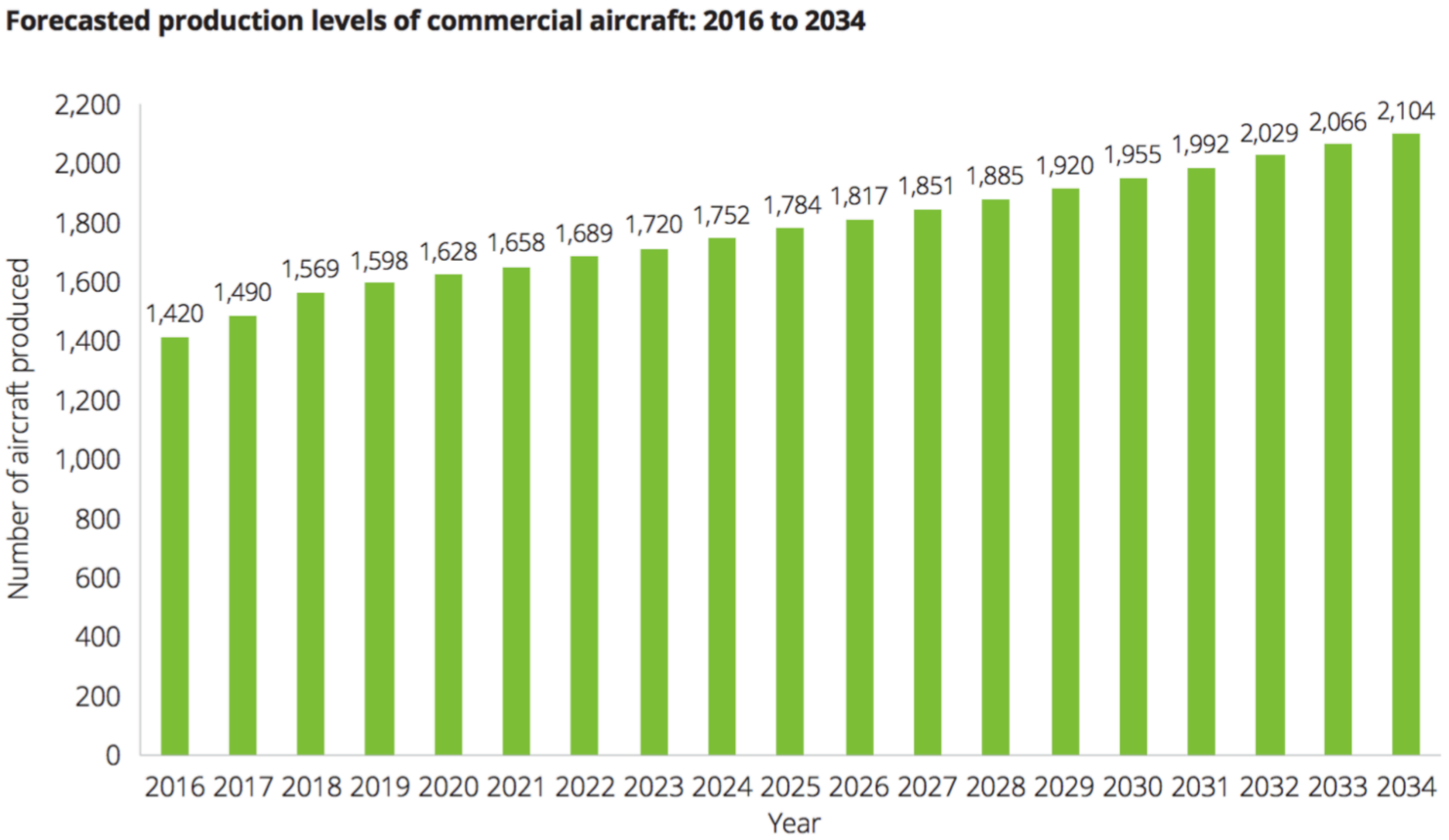
Dassault 40

Bombardier 148

Cessna 209

Embraer 95

Gulfstream 150



Luxury Automakers in USA — Q2 2019

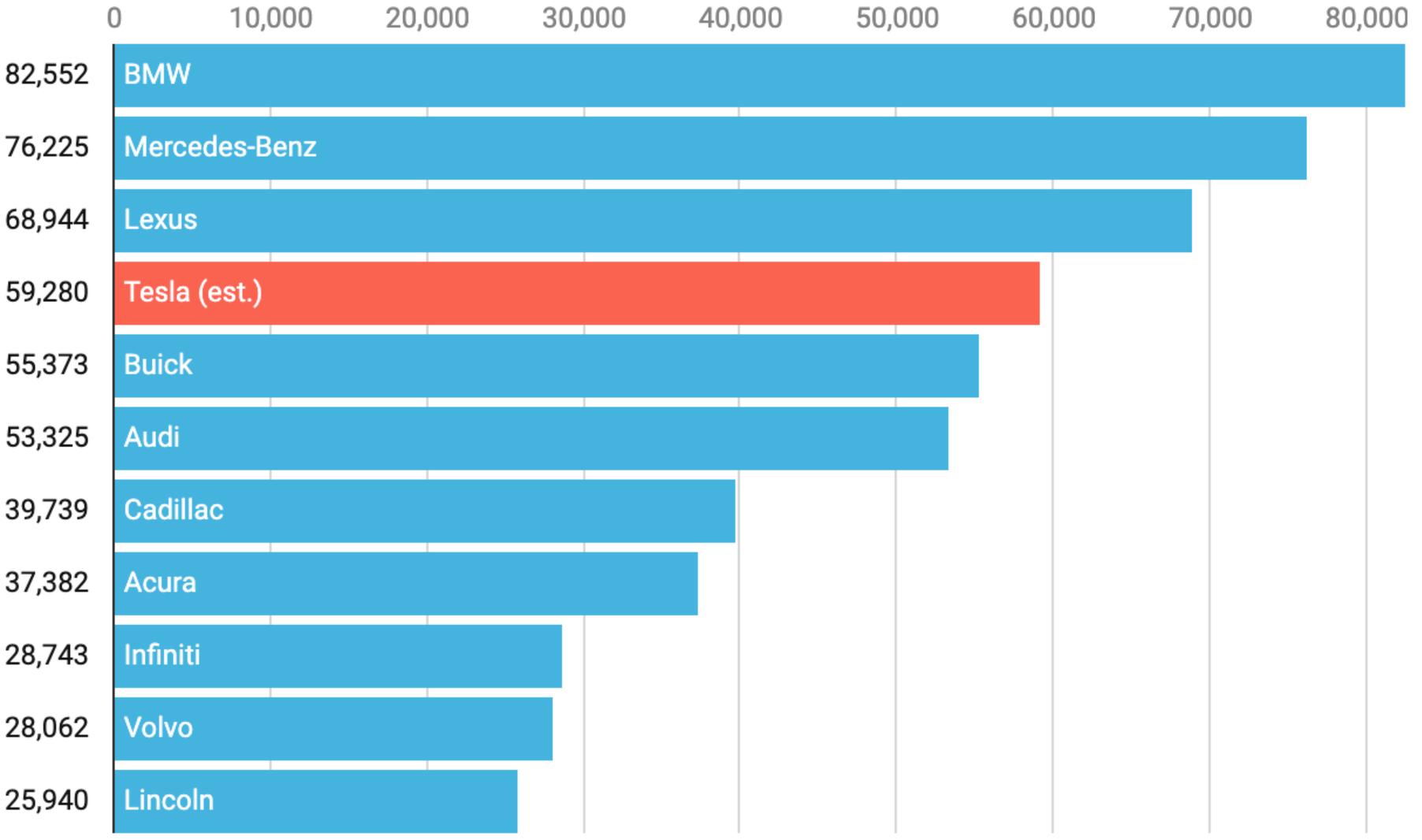


Chart: CleanTechnica • Source: Automakers, CleanTechnica

Assembly lines of the future

So who is going to control the future of passenger UAV?

Can the aerospace industry manufacture at high unit volumes?

Assembly lines of the future

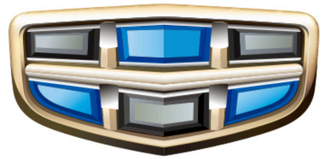
HARDWARE

Why are automakers investing millions into flying vehicles?

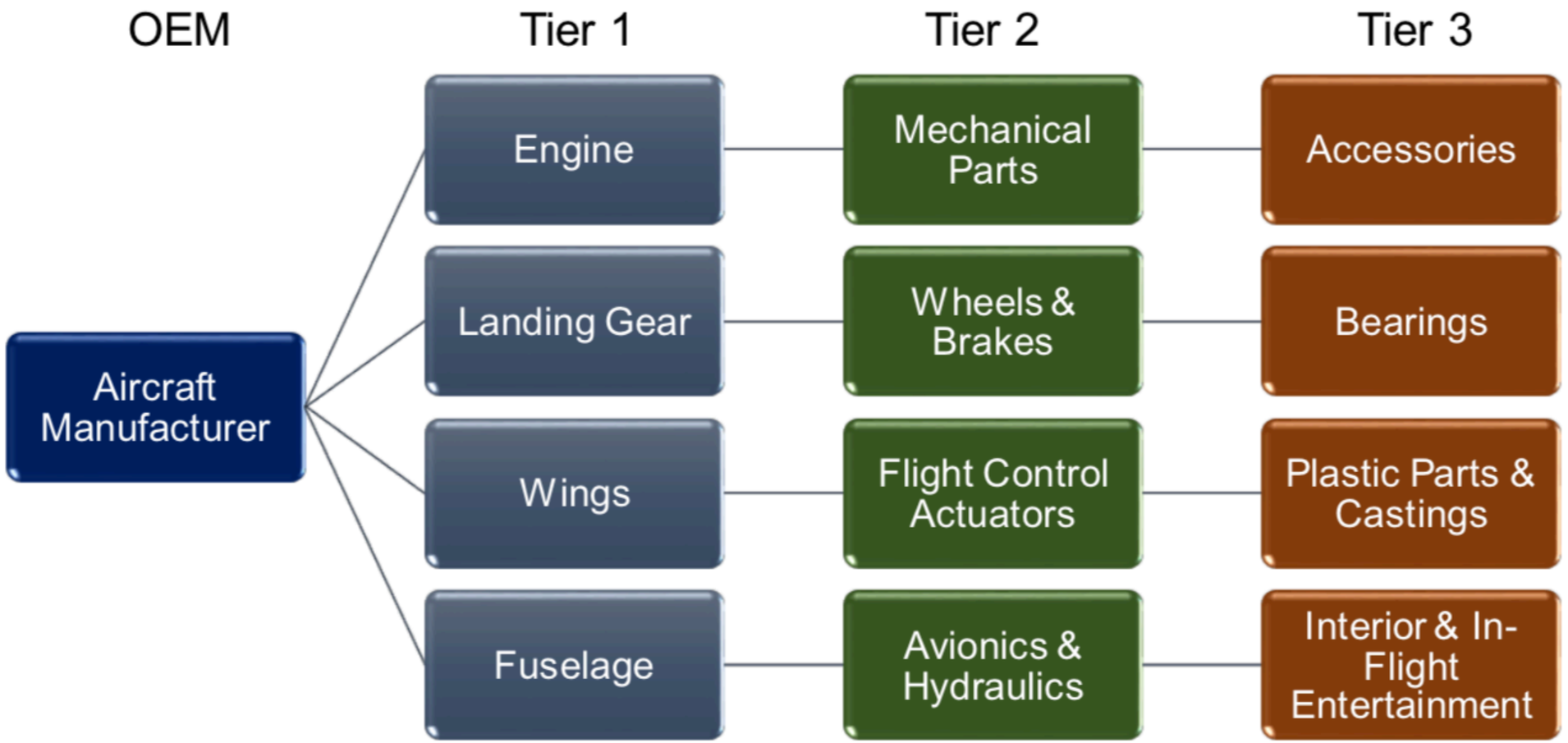
From Uber to Toyota, leading tech and auto brands are doubling down on investments into 'flying taxis'.

21 January 2020 | 47 Shares

Automakers vs. Aerospace



Supply Chain Manufacturing



Source:https://www.tresvista.com/wp-content/samples/landscaping/Research%20Report_Aerospace%20-%20Supply%20Chain%20Overview.pdf

Thesis Two

A silo’d world:Will there be 3 spheres of influence?

US - EUROPE - China

FAA - EASA - CAAC


Where do you see the future?
WALLPAPERSWIDE.COM