

Flying Into The Future UAM Evolution



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What is UAM:

The concept of "urban air mobility" was defined by NASA in 2016 as "safe and efficient transportation operations for manned and unmanned aerial vehicle systems in cities".



Key Elements: Hardware & Software



The level of a UAM system can be determined by two elements:
hardware & software

- ✓ Hardware mainly refers to equipment or vehicles, including conventional helicopters, electric aircrafts, and autonomous aerial vehicles (AAVs), etc.
- ✓ Software refers to the command-and-control systems behind the UAM, including conventional call centers, online booking platforms, and more intelligent command-and-control platforms for AAVs.

UAM: key characteristics

01

Network-based

- ✓ Real-time Online
- ✓ Computer IoT
- ✓ 5G network

02

Automation

- ✓ Fully autonomous
- ✓ Cluster management

03

Electric powered

- ✓ Zero emission
- ✓ Low noise level
- ✓ Eco-friendly
- ✓ Good manoeuvrability

04

Vertical take-off and landing

- ✓ Nimble & flexible
- ✓ Easy site selection
- ✓ Convenient taking off and landing in cities

05

Intelligent

- ✓ Electronic module
- ✓ Self-detection and alarm troubleshooting
- ✓ Navigation
- ✓ Minimize maintenance costs

UAM 1.0

Conventional helicopters and aircraft are applied to provide transportation services

Real use case: China's Eastern General Airline operates an low-altitude air route for city tour in Shenzhen, by using EC135 helicopters.

- **Key elements: No online platforms; conventional helicopters**



UAM 1.5

Application of new generation electric aerial vehicles for transportation services

New generation models designed by various OEMs, including traditional auto-makers.

- **Key elements: Lack of online platforms; upgraded versions of equipment**



Volocopter



Terrafugia



Voyager T1

UAM 1.5

Application of online booking systems to conventional helicopters

- ✓ **Uber Elevate:** Launched Uber Copter (Uber Helicopter) in New York in September 2019. Platinum and diamond users can book an eight-minute ride from Lower Manhattan to JFK (normally a half an hour ride without traffic congestion) for about \$200 per trip.
- ✓ Voom, an **Airbus**-backed helicopter "booking" platform, has been operating since 2016 in Sao Paulo, Mexico City, and San Francisco, the world's most populous and crowded metropolises. Nearly 150,000 people registered the Voom App, and more than 15,000 have used the Voom Helicopter service, with 60% of first-time helicopter users and 45% of re-users. Voom stated the average fare for its helicopter service is about twice the cost of a private car service and a tenth of the time taken by ground transportation.
- **Key elements: Online booking platforms; conventional helicopters**



UAM 2.0

Combination of online systems with new generation electric aircraft

Archer's eVTOL is a tilt-rotor fixed-wing configuration, all-electric, five-seater (4 passengers +1 pilot) with a range of 100 km and a maximum cruising speed of 240 km/h.

- **Key elements: Online booking platforms; upgraded version of aerial vehicles**



UAM 3.0

Fully autonomous, 5G network, cluster management

EHang 216 passenger-grade autonomous aerial vehicles have successfully completed more than 10,000 trial flights in more than 40 cities globally.

- **Key elements: Online booking, comman-and-control platform; autonomous aerial vehicles (AAVs)**



Safety remains as the first priority :



Hardware

Power redundancy,
System backup



Flying Mode

Autonomous,
Avoid human error



Route Planning

Rigorous point-to-point flight,
Fixed route, Survey in advance



Intelligent Management

Network platform,
Cluster management,
Connection to AAV Fleet



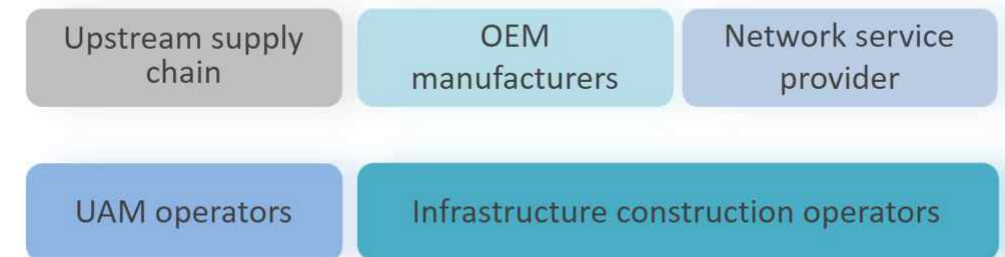
UAM Industry Positioning

From geographic perspective :

Urban air mobility centers around the “city”

- ✓ **Intra-city transportation (20-30 km range)** alleviate traffic congestion, connect with conventional transportation modes (aviation, high-speed rail, ferry, etc.), solve the urban transport problem.
- ✓ **Intercity transport (50-400 km range)** convenient connection within city clusters (e.g. Big bay area, YRD, Bohai Rim).

Value chain perspective :



Latest update: Government's emphasis



The General Office of the State Council issued the *Notification on the Opinions and Suggestions of the Seventh State Council Supervision and Collection of Transfer Parts*, pointing out that the strategic layout and standard formulation of urban air mobility development should be accelerated and the development of UAM should be included in the national strategy.



The U.S. Federal Aviation Administration (FAA) has released the Preliminary Concept for Urban Air Mobility (ConOps). The 30-page document describes how urban air taxis can safely operate in the U.S. national airspace system.

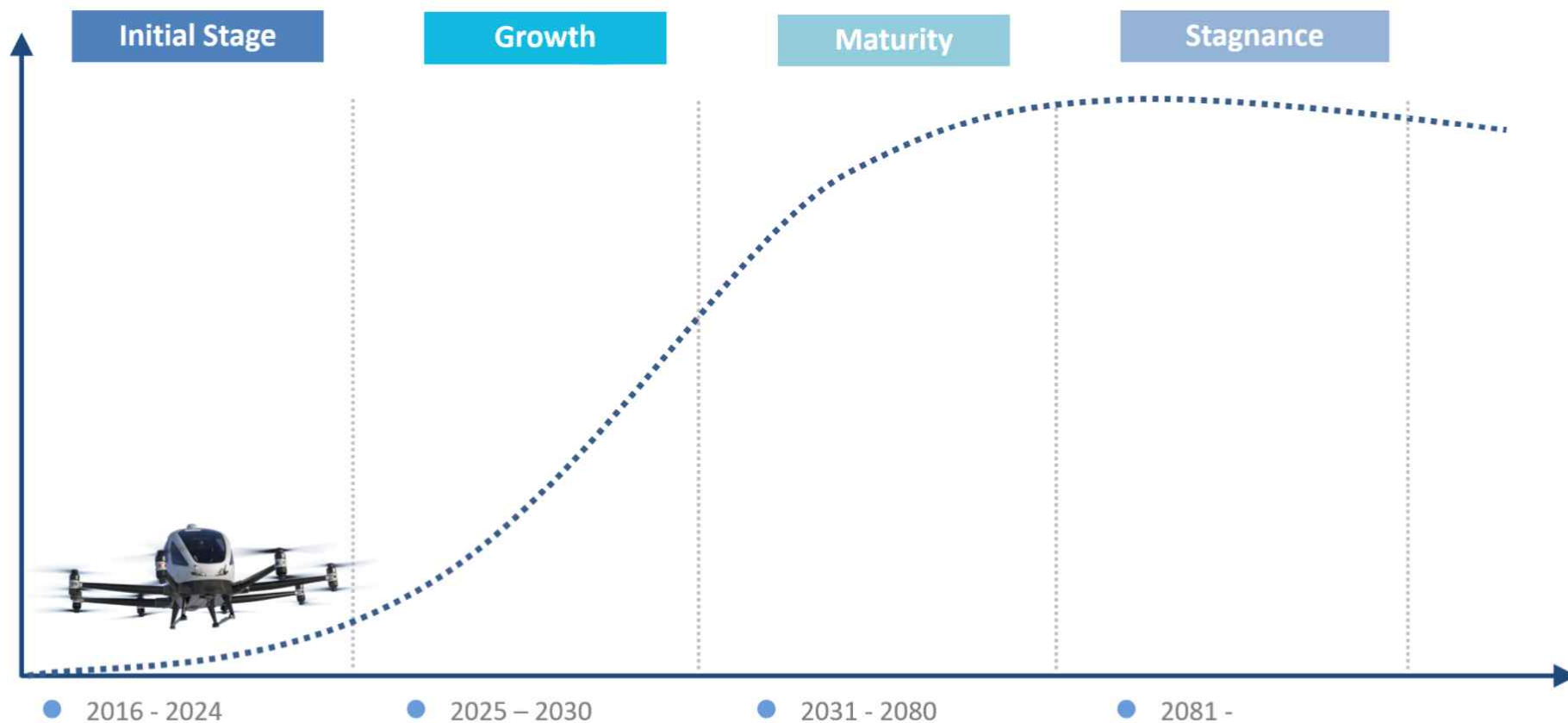


Japan has proposed a plan for urban air traffic, with systems such as operating safety standards for flying cars to be developed from 2020.



South Korea has unveiled the K-UAM Roadmap for commercial urban air mobility between 2023 and 2025.

What can be the future for UAM?



Comparison with traditional airlines

- ✓ Huge Capex: more than RMB10-20 billion
- ✓ High fuel cost
- ✓ Depreciation and leasing
- ✓ Take-off and landing
- ✓ High labor costs (pilots, crew, ground maintenance)
- ✓ Low margins

Spring Airlines 2015-2019 Income Statement					
CNY (B)	2019	2018	2017	2016	2015
Gross revenue	148	131.1	109.7	84.29	80.94
Gross margin	9.9	6	5.8	3.79	10.21
Gross profit rate	6.70%	4.60%	5.30%	4.50%	12.60%

Air China 2015-2019 Income Statement					
CNY (B)	2019	2018	2017	2016	2015
Gross revenue	1362	1368	1214	1127	1089
Gross margin	49	50	97	78	66
Gross profit rate	3.60%	3.70%	8.00%	6.90%	6.10%

China Southern Airline 2015-2019 Income Statement					
CNY (B)	2019	2018	2017	2016	2015
Gross revenue	1543	1436	1275	1148	1115
Gross margin	-15	-14	35	28	21
Gross profit rate	-1.00%	-1.00%	2.80%	2.40%	1.90%

China Eastern Airline 2015-2019 Income Statement					
CNY (B)	2019	2018	2017	2016	2015
Gross revenue	1209	1149	1017	985.6	938.4
Gross margin	-32	-32	5	6	-0.3
Gross profit rate	-2.60%	-2.80%	0.50%	0.60%	0.00%

Comparison with Airports

- ✓ Huge infrastructure investment, long payback period
- ✓ Labor intensive
- ✓ In China, over 70% of civil airports were reported in losses

Shanghai Airport 2015-2019 Income Statement					
CNY (B)	2019	2018	2017	2016	2015
Gross revenue	109.4	93.13	80.62	69.51	62.85
Gross margin	55.33	47.41	38.68	29.87	27.16
Gross profit rate	50.60%	50.90%	48.00%	43.00%	43.20%

Guangzhou Baiyun Airport 2015-2019 Income Statement					
CNY (B)	2019	2018	2017	2016	2015
Gross revenue	78.7	77.47	67.62	61.67	56.33
Gross margin	11.78	14.73	20.86	18.7	17.29
Gross profit rate	15.00%	19.00%	30.80%	30.30%	30.70%

Shenzhen Airport 2015-2019 Income Statement					
CNY (B)	2019	2018	2017	2016	2015
Gross revenue	38.07	35.99	33.2	30.36	29.53
Gross margin	7.57	7.85	8.02	7.07	7.45
Gross profit rate	19.90%	21.80%	24.20%	23.30%	25.20%

Comparison with general aviation

- ✓ High fuel cost
- ✓ Low equipment utilization
- ✓ Depreciation of aircraft equipment and high leasing costs
- ✓ High pilot cost

<i>CITIC COHC 2015-2019 Income Statement</i>					
<i>CNY (B)</i>	<i>2019</i>	<i>2018</i>	<i>2017</i>	<i>2016</i>	<i>2015</i>
<i>Gross revenue</i>	15.67	14.26	12.7	11.72	12.89
<i>Gross margin</i>	1.86	0.98	0.61	0	1.86
<i>Gross profit rate</i>	11.9%	6.9%	4.8%	0.0%	14.4%

EHang AAV vs. Helicopters



	EHang AAV	Helicopter
• Safety	High (power redundancy, multiple backups)	medium
• Flexibility	High (small size, high hovering accuracy)	medium
• Noise	Medium (70 dB)	High (100 dB and above)
• Power energy	Electrical	Fuel
• Route	Point-to-point, 21mins	Free route, 1hr+
• Pilot	N/A	One
• Ground crew	2-4 Ground crew	4-6 Professional Technical Engineers
• Application for airspace	Easy	Complicated
• Sales price	RMB2.16 million	RMB3m – 25m

Conclusion: Intelligent UAM Operation Projects Have Attractive Investment Prospects

High profit

Gross profit rate above 50%

Low input

Generally at the level of millions to ten of millions of RMB

Short payback period

Short return period (2+ years)

High ROI

ROI ~ 20%+



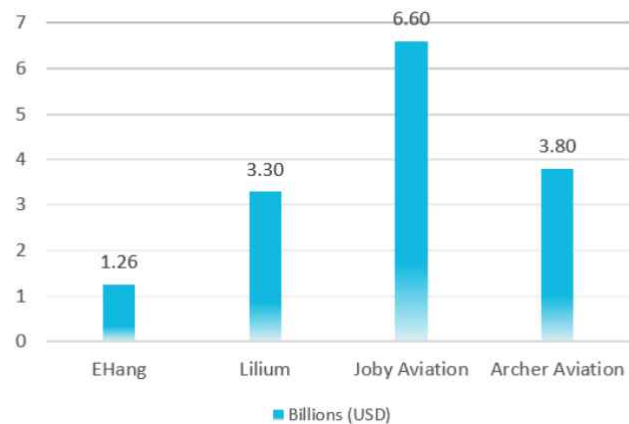
What makes a future UAM platform operator?

Network platform + AAV operation management + infrastructure management

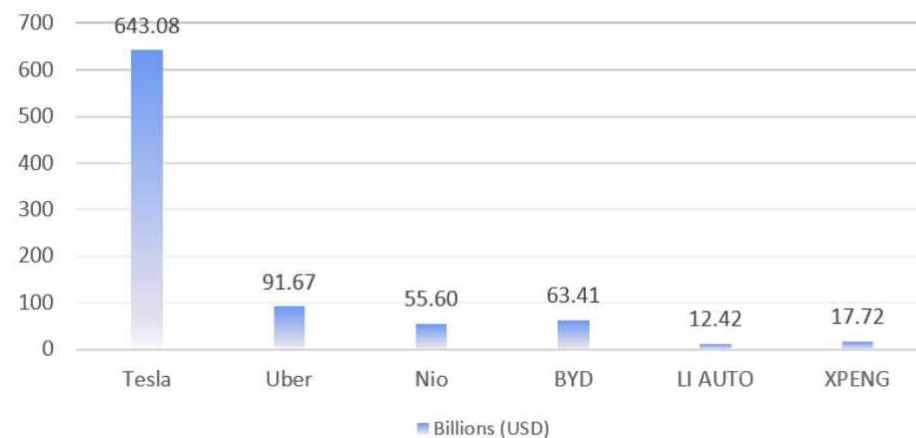
Reasons : ① Network technology ② Unmanned ③ Small investment scale ④ Simple infrastructure, low floor space requirement

Industry Valuation Comparison

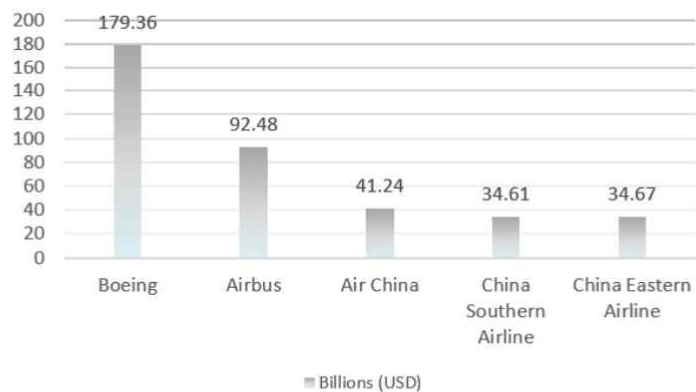
UAM



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