Is There Really "Over-Supply" in China's UAS & eVTOL Industry?

By AeroLink Consultancy, Shenzhen, China

Part One: What Aviation and Railway History Can Tell Us

Recently, we have heard increasing discussion within the industry that there are "too many UAS and eVTOL manufacturers in China" and that the sector may be suffering from unhealthy over-supply.

With our background in helicopter operations and aviation safety management, this argument prompted us to look at the question from a much broader perspective - perhaps from 30,000 feet above the ground.

A familiar saying tells us:

> *"History does not repeat itself, but it often rhymes."*

What we are seeing today in China's UAS and eVTOL sectors may, in fact, resemble a recurring pattern seen during the early stages of many major technological revolutions.

When an industry is still trying to discover the winning technology, aircraft architecture, operating model, use case and business model, the appearance of a large number of competing designs and manufacturers may not necessarily represent unhealthy over-supply.

It may be part of the discovery process itself.

Let us look at two examples from engineering history: the development of the aeroplane and the American railroad industry.

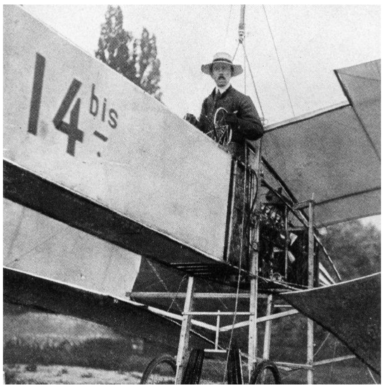
1. The Development of the Aeroplane

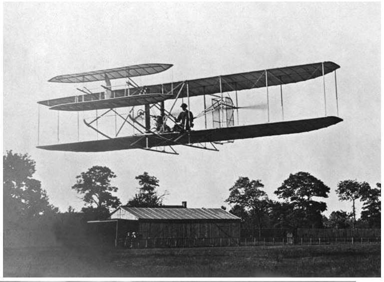
Competition to Solve the Problem of Flight

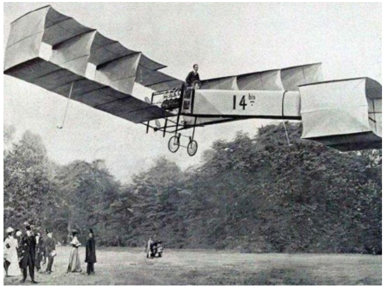
The Wright brothers made their famous first successful powered, controlled and sustained heavier-than-air flight on 17 December 1903.

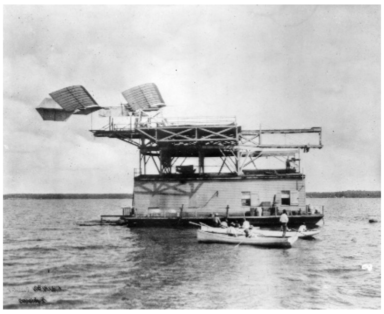
But the Wright brothers were by no means the only people trying to solve the problem of powered flight.

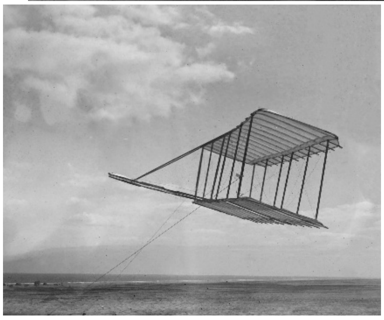
At the turn of the twentieth century, inventors in the United States and Europe were experimenting with radically different ideas: monoplanes, biplanes, tandem wings, gliders, powered aircraft, airships and different methods of aircraft control.

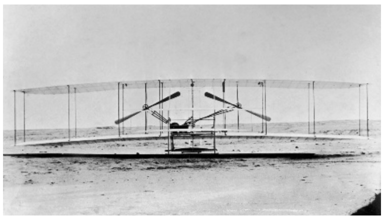












Even the fundamental architecture of the aeroplane had not yet been settled.

One particularly interesting competitor was Samuel Pierpont Langley, Secretary of the Smithsonian Institution. His aircraft development programme received US$50,000 from the U.S. War Department, with another US$20,000 provided by the Smithsonian.

Despite having substantial institutional and financial support, Langley's full-scale Aerodrome failed in its attempted flights in 1903.

Nine days after Langley's second failed attempt, the Wright brothers succeeded at Kitty Hawk.

The lesson is interesting: The best-funded or most institutionally supported project is not necessarily the engineering architecture that ultimately wins.

Prizes Encouraged Experimentation

At that time, prizes were also offered to encourage inventors to solve different aviation challenges.

One famous example was the Deutsch de la Meurthe Prize, established in 1900. It offered 100,000 francs to anyone who could fly from Saint-Cloud around the Eiffel Tower and return within 30 minutes. Alberto Santos-Dumont eventually won the prize using a dirigible.

As heavier-than-air aviation developed, other prizes followed. In Britain, the *Daily Mail* offered large cash prizes for aviation achievements including long-distance flights and the crossing of the English Channel.

There was therefore a period in aviation history that could almost be summarised as:

“Nobody yet knows exactly how this technology should work. Here is the

objective. Whoever solves it first wins."

That is very different from a mature industry in which dozens of manufacturers are producing essentially interchangeable products.

Finding the Winning Architecture

Once the world knew that powered flight was possible, the number of people, projects and companies entering aviation expanded rapidly.

But many fundamental questions still had to be answered.

Should an aeroplane use a monoplane or biplane configuration? A tractor or pusher propeller? Wing warping or separate control surfaces? One engine or several? Wood, fabric or metal? Landplane or seaplane?

And what would aircraft ultimately be used for: passenger transport, military operations, mail, sport or something else entirely?

Many early designs, projects and manufacturers eventually disappeared.

But their efforts were not necessarily wasted.

Through experimentation, failure, learning and competition, the industry gradually converged towards aircraft architectures and engineering solutions that proved to be safer, more practical and commercially viable.

That is one way of looking at what may be happening in the UAS and eVTOL industry today.

2. The Development of the American Railroad Industry

American steam railroads began appearing around 1830. By 1860, the United States already had approximately 31,000 miles of railway track.




Then came extraordinary expansion. Companies built railway lines connecting towns, mines, ports, agricultural regions and industrial centres. Many were relatively small regional companies rather than the giant railway systems that later emerged.

During the 1880s alone, approximately 71,000 miles of additional railway track were constructed.

And, unlike our aviation example, there genuinely was considerable overbuilding.

Competing railway companies sometimes constructed redundant routes. Speculation encouraged excessive expansion. Some railway lines could not generate enough traffic to justify the capital invested in them.

Then came the reckoning.

Following the financial turmoil of the 1890s, thousands of miles of railway passed into receivership. Between 1892 and 1897, failed railway companies represented close to one-third of the total U.S. railway mileage.

What followed was consolidation.

Bankers and financiers, including J. P. Morgan, reorganised bankrupt railroads, combined networks and created larger integrated railway systems.

Yet here lies the important lesson:

> *The collapse of railway companies did not mean that railways were a bad idea.*

Quite the opposite.

Rail transport went on to transform the American economy.

Many companies failed while the underlying technology and industry succeeded spectacularly.

So, Is China Really Experiencing "Over-Supply"?

We would therefore be cautious about automatically describing the presence of 50 or more UAS or eVTOL manufacturers as evidence of unhealthy over-supply.

A more appropriate description might be:

> *Pre-Consolidation Technological Proliferation*

There is an important difference between the two.

Suppose that, twenty years from now, only five major eVTOL OEMs remain in China.

Looking backwards, it would be easy to say that today's other 45 manufacturers were therefore "surplus."

But another interpretation is possible:

The industry does not yet know which five deserve to survive.

Today's competing companies are helping the industry answer fundamental questions.

Should the dominant configuration be multirotor, lift-plus-cruise, vectored thrust, tilt-rotor, tilt-wing or ducted fan?

Should the aircraft be piloted, remotely piloted or autonomous?

Perhaps there will not even be one single winning architecture. Different architectures may eventually dominate different missions.

None of this means that every company operating today will survive.

Nor does it mean that genuine production overcapacity, excessive investment or economically unsustainable projects cannot exist.

They certainly can.

Our argument is narrower:

The number of manufacturers alone is not sufficient evidence that an emerging technological industry is suffering from unhealthy over-supply.

Many of today's UAS and eVTOL manufacturers may eventually fail, merge or disappear.

History suggests, however, that we should distinguish between the failure of individual companies and the failure of an industry.

In many technological revolutions, most early participants disappeared while the industry they helped to create eventually became vastly larger than anyone had initially imagined.

During our research, we came across an historical example that may be even closer to today's Chinese UAS and eVTOL sector:

the early American automobile industry.

At its peak in 1909, one academic study identified 272 automobile manufacturers operating in the United States.

By 1941, only nine remained.

Yet during exactly the same period, the automobile went from an experimental machine for relatively few people to one of the world's largest industries.

How did hundreds of manufacturers disappear while the automobile market itself exploded?

That is the story we will examine in **Part Two**.

To be continued...

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Part Two: When 272 Automobile Manufacturers Became Nine

Learning from Automobile History in USA

Imagine that you are standing in the United States in 1900.

The automobile already exists, but nobody really knows what the automobile industry will eventually look like.



Today, we take it for granted that gasoline-powered automobiles dominated road transport for most of the twentieth century.

But around 1900, even the basic question of what should power an automobile had not yet been settled.

There were three serious competitors:

Steam – Electricity - Gasoline.

The Smithsonian's National Museum of American History notes that, in the early 1900s, more than 100 American companies were building gasoline, steam and electric automobiles, often in very small quantities.

Early automobile manufacturers came from very different engineering backgrounds. They included bicycle makers, carriage makers, metalworkers and machinists.

Almost anybody with suitable mechanical knowledge could look at this emerging technology and think:

“Perhaps we can build the winning automobile.”

Hundreds tried.

Calling this situation simply an “over-supply of automobile manufacturers” would miss what was really happening.

America was conducting a gigantic technological and commercial experiment.

From 272 Manufacturers to Nine

An academic study of the evolution of the U.S. automobile industry identified a peak of:

272 automobile manufacturers in 1909.

Then the number began to fall dramatically.

By 1929, only 44 active manufacturers remained under another widely cited historical series.

By that time, approximately 80% of U.S. automobile production was already accounted for by just three companies: Ford, General Motors and Chrysler.

The consolidation continued.

By 1941, the academic study recorded only nine manufacturers remaining.

But here is the paradox:

> *While the number of manufacturers collapsed, the automobile market exploded.*

That is perhaps the most important lesson from automobile history for China's UAS and eVTOL industry.

The disappearance of hundreds of automobile manufacturers was not primarily evidence that there was insufficient demand for automobiles.

Quite the opposite.

Demand ultimately became enormous.

What changed was the level of capability required to compete successfully.

Henry Ford Changed the Question

Early automobile companies were largely trying to answer:

> "Can we build a working automobile?"

Henry Ford eventually changed the competitive question to:

> *"Can we manufacture reliable automobiles in enormous quantities at a price ordinary people can afford?"*

Ford introduced the Model T in 1908 and subsequently developed production methods centred on standardisation, interchangeable parts and the moving assembly line.

The result was mass production on a previously unimaginable scale.

A small manufacturer capable of building a few hundred cars a year was no longer merely competing against another small manufacturer.

It was competing against an industrial system capable of producing hundreds of thousands of cars efficiently and consistently.

The basis of competition had changed.

Engineering remained important, but engineering alone was no longer enough.

Manufacturing scale, supply chains, cost control, distribution, servicing, financing and brand recognition increasingly determined who would survive.

General Motors Discovered Another Lesson

Ford demonstrated the power of mass production.

General Motors demonstrated something different:

There did not need to be only one type of winning automobile.

GM developed different brands and products for customers at different income levels and with different requirements.

That lesson may be highly relevant to eVTOL.

There may ultimately be no single winning eVTOL configuration.

An aircraft optimised for a 20-km urban passenger mission may not be the best aircraft for a 150-km intercity mission.

The best aircraft for offshore logistics may not be the best aircraft for emergency medical services, tourism, cargo transport, mountainous operations, surveillance or airport transfer.

Technological consolidation therefore does not necessarily mean that one architecture will eventually win everything.

Different architectures may prove optimal for different missions.

Number of Manufacturers Down - Number of Vehicles Up

This brings us back to the present discussion about supposed over-supply in China's UAS and eVTOL sector.

The automobile experience demonstrates that two apparently contradictory things can happen simultaneously:

> *The number of manufacturers can fall dramatically while the size of the market grows dramatically.*

The fact that hundreds of automobile manufacturers disappeared therefore did not mean that automobiles had been overestimated as an industry.

It meant that the industry was undergoing technological selection, commercial selection and consolidation.

We believe this distinction deserves serious consideration when looking at China's emerging low-altitude aviation industry.

Failure Can Also Create Knowledge

There is one final lesson from engineering history that is easily overlooked.

Failure is not always wasted effort.

Imagine that today's UAS and eVTOL manufacturers collectively discover the following:

- One discovers an important battery limitation.
- Another solves a rotor-noise problem.
- Another encounters a certification obstacle that teaches regulators and industry something new.
- Another discovers that a particular design is too expensive to maintain.
- Another proves that a passenger configuration is commercially unattractive.
- Another develops a better flight-control architecture.
- Another develops a superior composite-manufacturing process.
- Another discovers poor dispatch reliability in a particular propulsion configuration.
- Another identifies a highly profitable cargo application.
- Another solves an important thermal-management problem.

Even if some of those manufacturers eventually disappear, their knowledge does not necessarily disappear with them.

Engineers move between companies.

Intellectual property may be acquired.

Suppliers learn.

Regulators learn.

Operators learn.

Investors learn.

Manufacturing techniques improve.

Industry standards emerge.

Successful ideas are adopted, while unsuccessful approaches are avoided.

This is how an industrial ecosystem learns.

What may appear from the outside to be wasteful duplication can, during the formative stage of a new technology, actually represent: Distributed Experimentation

This does not mean that unlimited investment or unlimited manufacturing capacity is economically desirable.

It means something more specific:

> *Experimentation, competition, failure and consolidation are often part of the process through which a new industry discovers what actually works*.

The early American automobile industry went from 272 manufacturers to nine.

Most companies disappeared.

But the automobile did not.

It changed the world.

Perhaps that is one useful perspective from which to consider today's rapidly evolving UAS and eVTOL industry in China.

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