

What impact is China having on the global aerospace supply chain?



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Introduction

➔ China's major objectives

To become a major commercial aircraft OEM and integrate into the global supply chain

- 1 To be self-sufficient in all the necessary systems and components
- 2 To integrate into both the global supply chain and domestic and regional markets

China's objectives-Made in China 2025

Aerospace is one of the key sectors of the "Made In China 2025" initiative:

2020

- Commercial aerospace sector to generate annual revenue over **¥100billion yuan** (US\$15.61billion).
- Complete the development, production, and start delivery of the **150 seats single aisle (C919)** aircraft.
- **C919 >5%** of the domestic market, **ARJ21 to be 5-10%** of global market; GA and helicopter delivery to be 20% and 10% of the global market respectively.

2025

- Commercial aerospace sector to generate annual revenue over **¥200billion yuan** (US\$31.23billion).
- Complete the development, production, and start delivery of the **280 seats wide body (C929)** aircraft.
- **C919 >10%** of the domestic market, **ARJ21 to be 10-20%** of global market; GA and helicopter delivery to be 40% and 15% of the global market respectively.

China's objectives – self sufficiency

China's aerospace ambitions come from



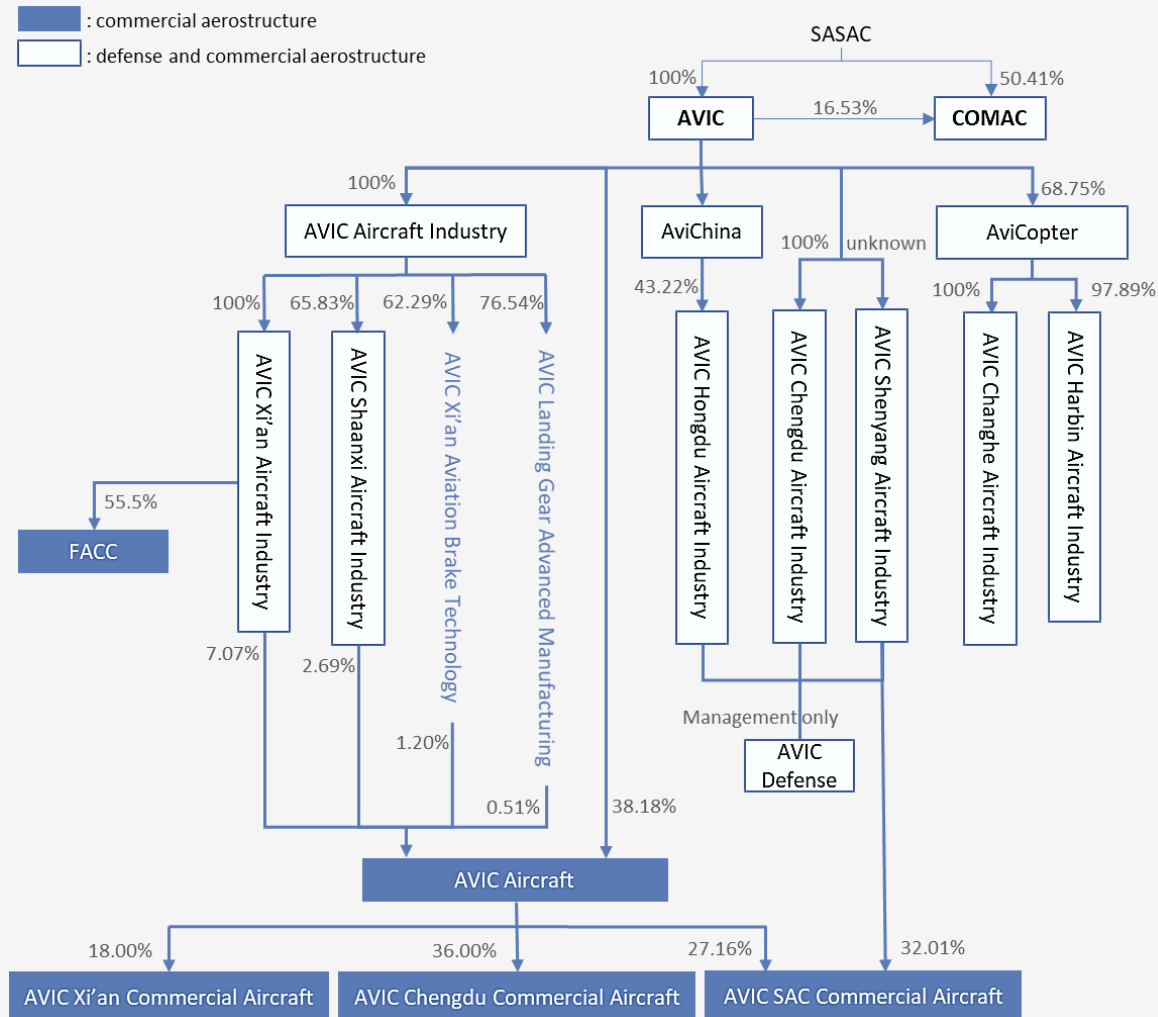
Why China emphasises self-sufficiency

- Past experience with embargos and high tariffs
- Put pressure over foreign suppliers on price
- Boost domestic technology and innovation, advanced manufacturing capabilities

China's objectives - integrate into the global supply chain

- Some AVIC's subsidiaries are public listed but most of the China's key aircraft manufacturing companies are still state-controlled
- As in other countries, military and commercial aerospace are closely linked
 - China is calling for deeper reform to boost civil-military integration
 - Most aerospace companies are involved in military and commercial programmes
 - Technology: Comac (commercial) outsources a lot of design & manufacturing to AVIC (mainly military)
 - Some see Comac as a spin-off of AVIC
- Both AVIC and Comac are vertically integrated conglomerates.
- 'Walk out of China'; domestic demand is still weak at the moment. Companies are encouraged to integrate into the global supply chain.

China's civil military integration



China's aerospace supply chain

To achieve its objectives, China needs a globally competitive supply chain:

Chinese programmes

- Domestic programmes
 - ARJ21, C919 and C929
- Including through joint ventures with western suppliers

Western programmes

- western OEM FALs located in China
 - Airbus A320
 - Business jets; Citation XLS+(Cessna-Avic Aircraft (Zhuhai) Co. joint venture)
 - Helicopters; Airbus Helicopters H135
- western programme completion centres located in China
 - A330
 - Boeing 737
- western aircraft OEMs in the West
 - We estimate that China exported aerostructures worth \$1.5billion in 2017

Acquire in the West

to become part of the global industry through acquisition to gain:

- Technology
- Market access
- High quality aerospace revenues

Commercial aircraft & engines

→ Progress so far

→ Future prospects

Commercial aircraft & engines

→ Aircraft currently in production

- **MA600 turboprop** – sales limited, market impact minimal
- **ARJ21 regional jet** – late to market, fundamental problems persist

→ Aircraft in development

○ **MA700 turboprop**

Larger than MA600 – should increase its appeal
First flight due late 2019, ISD 2022

- **C919 single aisle** – Conventional, similar to A320, but with all the challenges of a new entrant
 - Recently grounded for modification, costing three months in the flight testing schedule.
 - Delayed and flight test proceeding slowly, ISD 2021?
- **C929 twin aisle** – Sino-Russian – early days
 - Targeted first flight in 2023, ISD 2026– looks optimistic

Progress has been slow so far

→ Aircraft engines – a long way to go

- Commercial aircraft in production and development have Western engines
- CJ-1000A (C919), ISD 2030? and CJ-2000A (C929), in development

Commercial aircraft & engines

- ARJ21 and C919 have significant Chinese state-backed order books;
 - C919, in particular, may gain a significant share of the Chinese market in the next decade
 - At the expense of Boeing and Airbus
- If Comac can demonstrate good in-service support of its home fleet, international sales may follow later in the decade;
 - Competing on price
 - But Boeing and Airbus will have economies of scale advantage
- China is making significant progress in some engine technologies
 - E.g. turbine blades and CMC composite
 - But overall engine systems technology likely to remain a challenge
- Significant GA acquisitions;
 - Cirrus in the US (aircraft)
 - Continental Motors in the US (piston engines)
 - Diamond in Austria (aircraft)

Future prospects may be better

Raw materials

→ Metal

Key players

Acquisitions and JVs

Competitiveness

→ Composites

Key players

Acquisitions and JVs

Competitiveness

Raw materials - Metal

→ **Metal** key players

○ Aluminium alloy:

Southwest Aluminium (Group) (SWA) - state owned

Alnan Aluminium - private company

Shandong Nanshan Aluminium - public listed

China Zhongwang - private company

○ Titanium alloy:

BaoTi Group - state owned

Western Metal Materials - public listed

Baoji First Titanium Industry - private company

BaoSteel-Special Steel Company - state owned

→ **Acquisition of western suppliers/joint ventures**

○ China Zhongwang  Aluminiumwerk Unna, 2017 - seamless tubes

○ Zhongwang International Group  Aleris, 2017 (CFIUS difficulties)

○ Alcoa  China Power Investment Corporation (CPI), 2012

Raw materials - Metal

→ How competitive are Chinese Metal suppliers?

1 Technology

- just started 3rd generation Al-Li alloy production
- behind in aluminium alloy R&D, mainly rely on reproduction of mature alloy by using imported facilities.
- very limited production capacity, Southwest Aluminium so far the only company capable of producing aerospace grade Al-Li alloy.
- 4th largest titanium production country, only 10% are advanced aerospace grade titanium alloy, a quarter of the capacity in developed countries.

2 Aerospace approvals

- June 2017, Shandong Nanshan Aluminium passed Boeing's 7050 AMS approval.

China lacks high value added aluminium products, but recent acquisitions reflect China's ambition to close the gap

→ Chinese suppliers on western programmes

- In 2016, Southwest Aluminum, signed a new framework agreement with Airbus, making it the only supplier of 2024-series aluminium alloy product to Airbus in China. It also supplies Safran.

Raw materials - Composite-CF

→ Composites-carbon fibre key players

- CASIC Aerospace **Haiying Special Materials** - design and manufacturing capability for aerospace composite materials
- **GW Compos** (private company) - integrated supplier, technology leader in China, reproduced Toray's M55J.
- **Zhongfu Shengying Carbon Fibre** (state owned) - integrated supplier, over 50% domestic market share. It recently achieved mass production of T1000 carbon fibre.
- **Kangde Composites** (private company) - integrated supplier, fastest growing composite supplier, have the production capability on T1100 carbon fibre, ahead of all other domestic competitors.

→ Acquisition of Western suppliers/Joint ventures

- Kangde Composite ← **JV** → Roding Automobile GmbH, Germany, 2015.
- Kangde Composite ← **JV** → Leonardo, Zhangjiagang, 2018.
- Future Aerospace ← **JV** → Hexcel, Shanghai, 2018.
- HRC → Engenuity*, Shanghai, 2018. (*automotive)

Raw materials - CF

→ How competitive are Chinese carbon fibre suppliers

1 Technology

- China's CF repeatability and general quality is still lagging behind the major suppliers.
- Poor quality and repeatability because processing facilities cannot withstand temp, pressure & time needed.
- Although China is slowly catching up on CF grade, a reliable production line is another challenge.
- China still has long way to go in composite design.

2 Aerospace approvals

- No Chinese suppliers have received any approval from either domestic and overseas aerospace OEMs.

→ The barriers to entry for new carbon fibre manufacturers include:

- Technical barriers- the intellectual property involved in processing precursor to CF is closely guarded
- Financial barriers - economies of scale – Toray; CF manufacturers need production capacity of >400t/year to be profitable. Margin still low at 1000t/year. Major players all have production capacity of >10kt/year.

Aerostructures

- Major players
- Market shares
- Acquisitions and JVs

Aerostructures - major players

→ We estimate that China exported aerostructures worth **\$1.5 billion in 2017**

→ Most of this is accounted for by AVIC

- AVIC Aircraft Co
- AVIC SAC Commercial Aircraft Co. Ltd (SACC)
- AVIC Changhe Aircraft Industry Group Co
- AVIC Chengfei Commercial Aircraft Co (CCAC)
- Harbin Aircraft Industry Group (HAIG)
- Jiangxi Hongdu Aviation Industry (Hongdu)
- Xi'an Aircraft Industry Company (XAC)

China is a major player in the world market

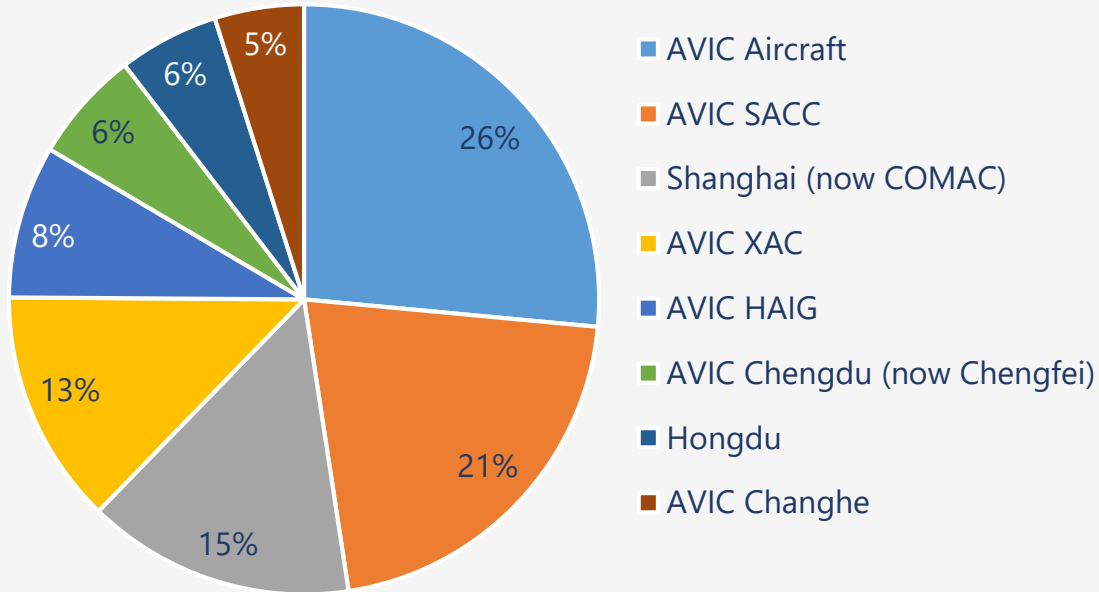
→ But COMAC still manufactures some for Airbus and Boeing

→ Participation from the private sector

- Future Aerospace; the largest private aerostructures supplier in China – machined parts.
- XIZI UHC, a large industrial conglomerate, entered the market in 2012 principally to target the C919

Aerostructures – a major player - market shares

Market shares of China's domestic aerostructures suppliers



Sales in million \$ USD	2007	2017	CAGR	Domestic market share
XAC	35	150	16%	13%
SACC	25	345	30%	21%
Chengdu (now Chengfei)	25	100	15%	6%
Shanghai (now COMAC)	28	240	24%	15%
AVIC Changhe	49	80	5%	5%
HAIG	3	137	47%	8%
Hongdu	20	60	12%	6%
AVIC Aircraft		433		26%
Total	185	1,545	24%	

Aerostructures - acquisitions and JVs

→ **Almost all make to print for western OEMs**

- Industrial participation in the Chinese market now the main driver--Low labour costs still a factor but costs in China are rising

→ **Some JVs – focussed on composites**

- **Boeing Tianjin Composites (BTC)** began operations in 2001. Now 88% owned by Boeing and 12% by AVIC
- **Harbin Hafei Airbus Composite Manufacturing Centre (HMC)** JV with Airbus (25%) and Harbin (75%), which produces A320 rudders and several A350 work packages. In February 2014, Airbus increased its share in the HMC to 25%.
- **Harbin Carbures Guanglian Composite Aeronautic** was formed in 2013 by Carbures, SC and Guanglian Aeronautic to supply composite parts for Airbus aircraft supplied through Harbin Hafei Airbus Composite Manufacturing Centre
- **Xian SAVI Nacelles**; JV formed in 2011 between Safran Nacelles and AVIC Aircraft Co. Ltd. makes nacelle components. Since 2013, it has been producing all the blocker doors for CFM56 for A320s. Also components for Nexcelle nacelles on the C919.

→ **Acquisitions;**

- FACC of Austria acquired by Xi'an Aircraft Industry in 2009 – AVIC now has a 55.5% share
- Gardner Aerospace (UK) acquired by Shaanxi Ligeance Mineral Resources (SLMR) in June 2017.
- Cotesa of Germany acquired by Advanced Technology and Materials(AT&M) in June 2018 after German government approval

Engine Components

- Major players
- Acquisitions and JVs

Engine components - major players

- ➔ **Most work for western engine OEMs is accounted for by AVIC-owned companies**
 - Xi'an Aero Engine Corporation, including Xi'an Aero Engine Disk and Ring Factory
 - Harbin Dong'an Engine (Group) Corporation
 - China National South Aero-Engine Company (SAEC)
 - Chengdu Engine
 - Guizhou Aviation Industry Corporation (GAIC), including Anda Forging Plant

- ➔ **But other manufacturers are active too**
 - Wuxi Shanfa precision Casting Technology Co

Engine components - acquisitions and JVs

→ All four major western OEMs procure from China

- Industrial participation in the Chinese market is the main driver

→ A number of JVs

- **Chengdu Aerotech Manufacturing Co. Ltd.** founded in 1996 - the first equity joint venture in the Chinese aviation industry. The partners are Pratt & Whitney, AVIC and Chengdu Engine Group Corporation.
- **Xi'an Airfoil Technology Co. Ltd.** 1997 JV between Pratt & Whitney, Xi'an Aircraft Industry (Group) Co., Ltd. and Airfoil Technology International, makes forged & machined compressor blades and vanes, fan blades & forged structure parts.
- **Xian XR Aerocomponents Ltd (XRA)**; joint venture with Rolls-Royce, which specialises in casting and machining for turbine blades and nozzle guide vanes.
- **Snecma Xinyi Airfoil Castings Co., Ltd** was created in 2006 to produce turbine parts for CFM56 engines
- **South Pratt & Whitney Aero-Engine Company Ltd.** JV between Pratt & Whitney Canada and China National South Aero-Engine Company (SAEC) manufactures engine parts for P&WC

→ Acquisitions

- FACC of Austria acquired by Xi'an Aircraft Industry in 2009 – AVIC now has a 55.5% share

Aircraft equipment and systems

→ JVs

→ Future prospects

Aircraft equipment and systems

China lacks competitive commercial suppliers

- ➔ **Almost all equipment and systems on the C919 are sourced from western suppliers**
- ➔ **There are some JVs to provide domestic capability;**
 - **NEIAS Parker Aero Systems Equipment** Co. Ltd. a JV between Parker Aerospace and AVIC Jincheng Nanjing Engineering Institute of Aircraft Systems. Developing the complete fuel, inerting, and hydraulic systems for the C919, plus future Chinese commercial programs.
 - **Parker FACRI Actuation Systems** Co., Ltd. a JV between Parker Aerospace and AVIC Flight Automatic Control Research Institute. It provides engineering & final assembly for flight control actuation system components for the ARJ21, C919, MA700, and C929 Programs
 - **Liebherr LAMC Aviation (Changsha)** Co., Ltd., a JV AVIC Landing Gear Advanced Manufacturing Corp. and Liebherr-Aerospace Lindenberg GmbH. Established in 2012 to develop and manufacture landing gear systems for Chinese commercial programs
- ➔ **But acquisitions are likely to be very difficult** *We don't see China competing here any time soon*

Aircraft interiors

→ Current status

→ Acquisitions

→ Future prospects

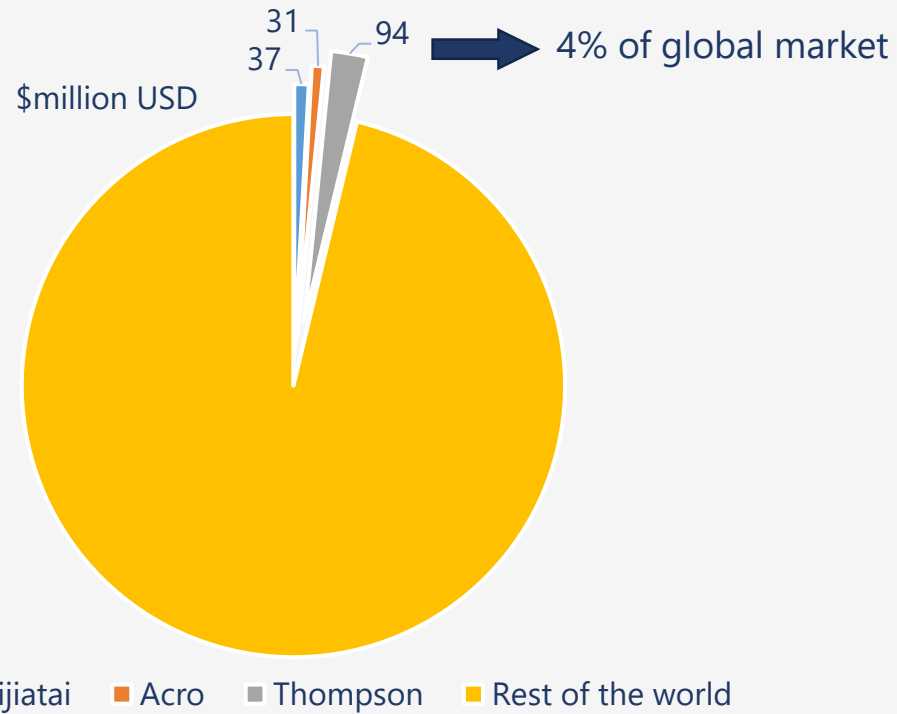
Aircraft interiors - current status

A completely different market

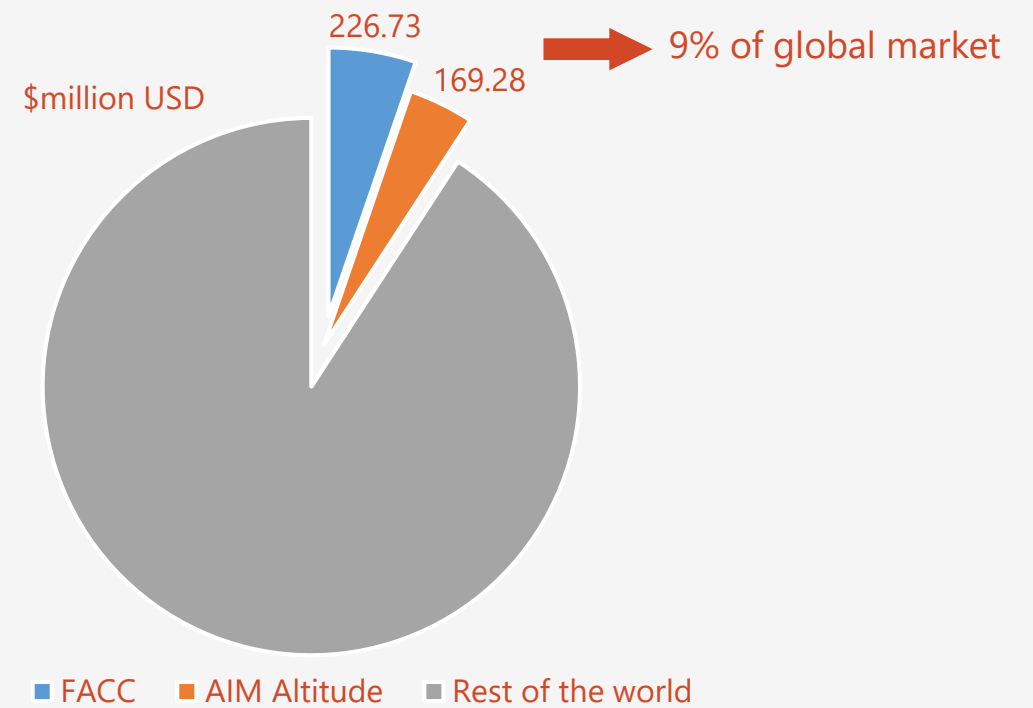
- ➔ **Commercial only – no security concerns**
- ➔ **AVIC has taken the opportunity to acquire a significant presence**
 - **FACC** of Austria acquired by Xi'an Aircraft Industry in 2009 – AVIC now has a 55.5% share
 - **AIM Altitude** (UK) acquired in May 2016 by International Holding Corporation
 - **Thompson Aero seating** (UK) acquired in September 2016 by AVIC acting in concert with state-owned investment company CNIC Corporation Limited
- ➔ **The private sector is also active**
 - **Acro Holdings** Ltd (UK) acquired in November 2017 by Zhejiang Tiancheng Tech-Investment Co, which is owned by the Chen Family

Aircraft interiors - current status

Global market share of China owned aircraft seating companies



Global market share of China owned interiors companies (non seating)



Aircraft interiors - acquisitions and future prospects

China now has a comprehensive offering in interiors

→ **AVIC announced the new AVIC Cabin Systems company at the 2018 Farnborough Airshow**

- FACC (Austria) – luggage bins, side walls, ceiling panels, galleys, lavs
- AIM Altitude (UK) - galleys, monuments, luggage bins, side walls,
- Thompson Aero seating (UK) – seating; business class and premium economy
- Hubei Ali Jiatai Aircraft Equipment Co (China) – seating; principally economy but also business class
- Fesher (China) – interior panel and composite components

→ **China is also targeting IFEC**

- **AVIC Samri**, leads C919 IFE system development and is collaborating with Rockwell Collins
- **CETC**, state-owned avionics company, is also developing IFE via a JV with Thales
- **Tianyi Advanced Aviation Technology** Inc. a private company is also seeking opportunities to enter the market.

We expect to see more acquisitions both by AVIC and private sector companies

Conclusions

- China is an important part of the global supply chain –
 - But mostly using western IP
 - Aerostructures is where China has the greatest presence
 - Potential to grow in raw materials
- The US has significant control/influence on the commercial aerospace market
 - Sees China as a rival and potentially hostile power
 - Chinese companies' ability to acquire in the West is limited
- Chinese suppliers will not be genuine competitors until Chinese aircraft OEMs are competitive with western OEMs
- A significant exception is interiors
 - Technology is not seen as strategic
 - Chinese companies can acquire in the west
 - Chinese products can be fitted on western and Chinese aircraft

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