中国民航大学
Civil Aviation University of China

Overview of research project at ARC CAUC

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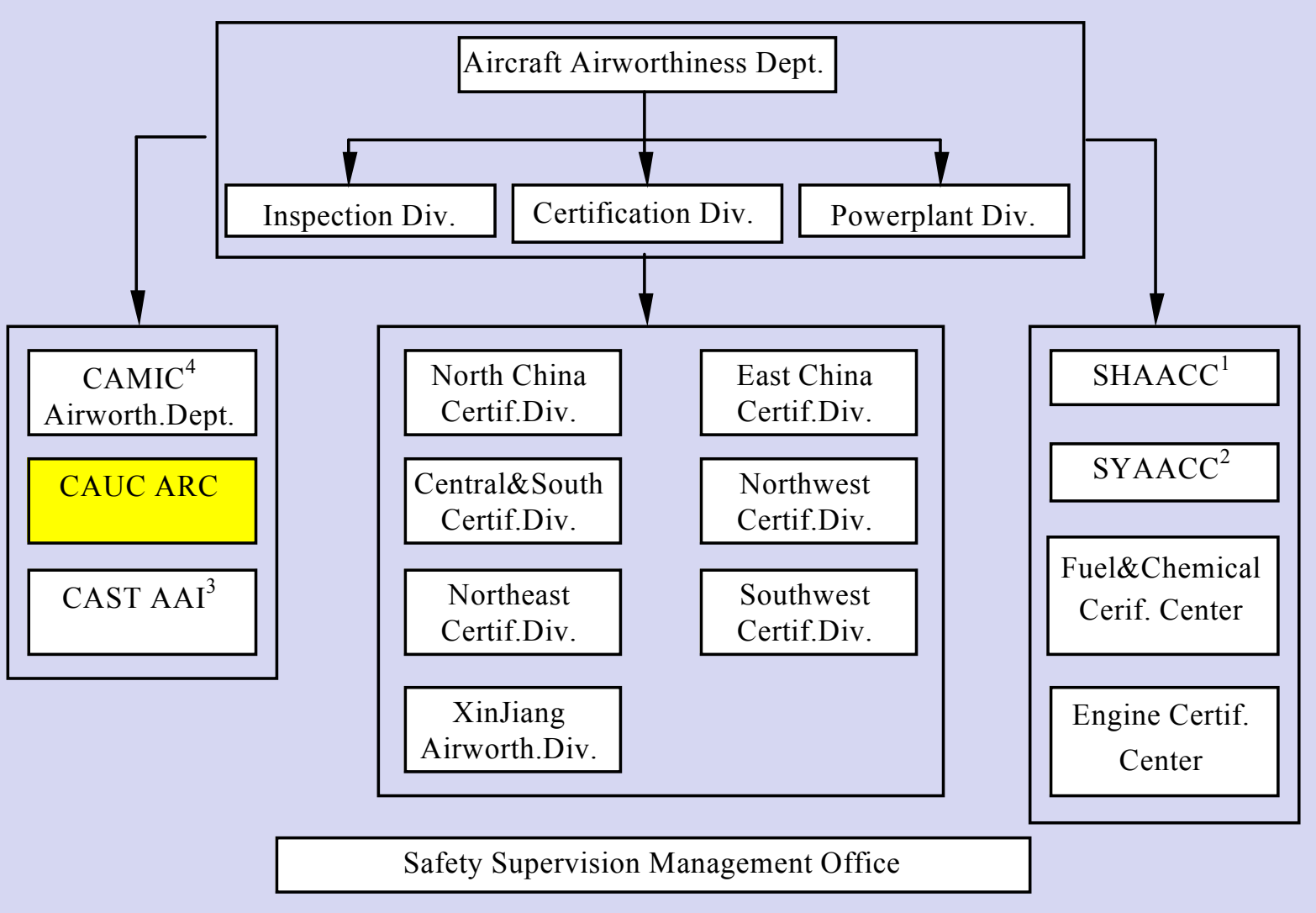
The organization of Aircraft Airworthiness Department(AAD) of Civil Aviation Administration of China(CAAC)

The organization of AAD of CAAC



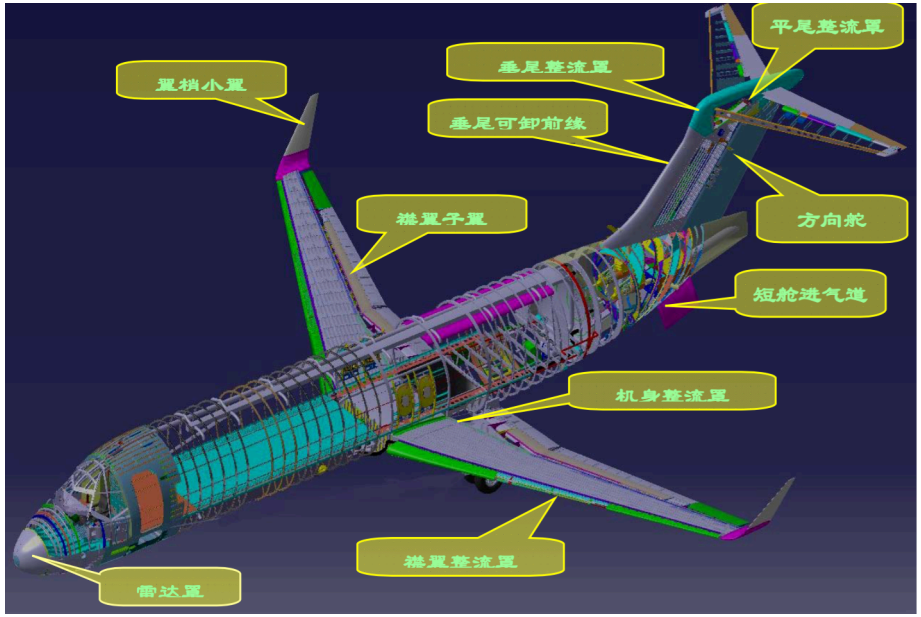
1 Shang Hai Aircraft Airworthiness Certification Center of CAAC： CCAR 25
2 Shen Yang Aircraft Airworthiness Certification Center of CAAC: CCAR23 27 and 29
3 China Academy of Civil Aviation Science and Technology(CAST) Aircraft Airworthiness Institute(AAI)
4 Civil Aviation Management Institute of China

Brief overview of certification projects in China

Type certification in China

ARJ 21-700

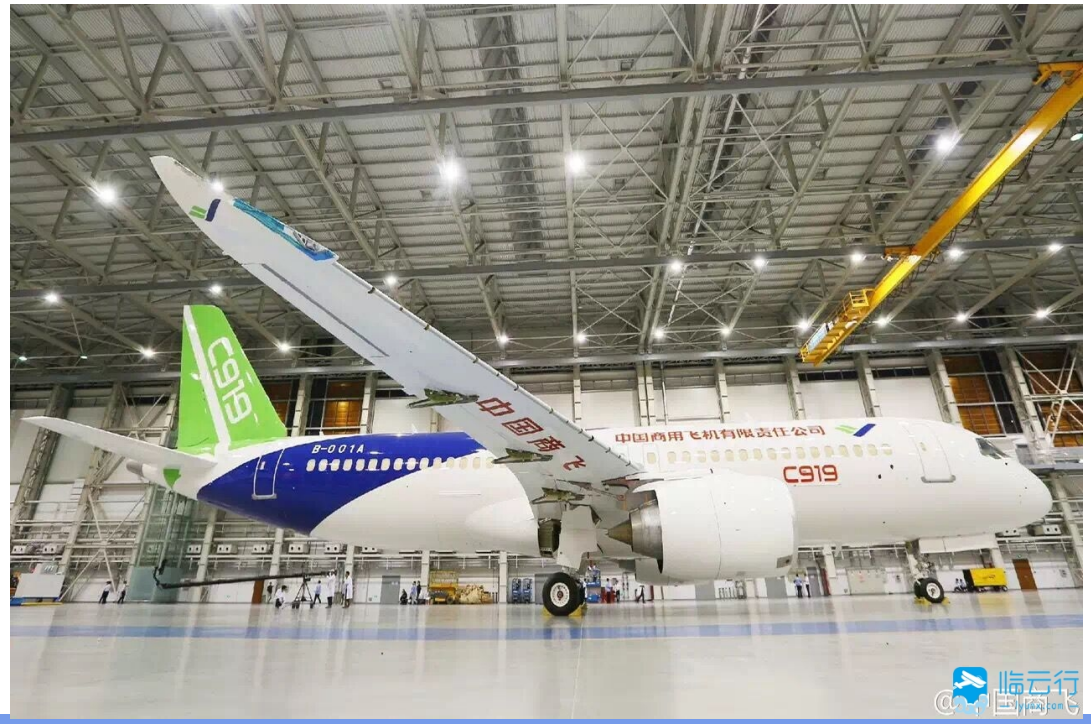
- Seats:90(1-class), 78(2-class)
- 30 Dec.,2014, the TC of ARJ21-700 was issued by CAAC.
- 29 Nov. 2015, the first ARJ21-700 was delivered to Chengdu Airlines.
- Composite is used for secondary structure of ARJ21-700. Around 2% of weight ratio.



Type certification in China

C919

- 158-174 seats
- narrow-body twin -engine jet airliners
- The first C919 was assembled at Nov. 2015
- Close to its Debut flight
- Weight ratio of Composite used is around 12%



Type certification in China

AG 600

- ✈ Large amphibious flying boat
- ✈ The aircraft will be suitable for aerial firefighting dropping 12 tones of water, and search and rescue operations for 50 passengers

Type certification in China

MA 700

- ✈ 70-80 passengers,
- ✈ Propeller driven regional aircraft under CCAR 25
- ✈ Dec., 2015, the application of TC for MA 700 was accepted.

A mockup model on Paris Air Show, 17 June 2013–23 June 2013

Overview of research project by ARC CAUC

Civil Aviation University of China(CAUC)

Civil Aviation University of China(CAUC)

- In the East of Tianjin
- Campus separated by highway into two parts.
- Tianjin Binhai Airport nearby.

Airworthiness Research Center (ARC)

- **Established in 2007 to support CAAC-AAD by:**
  - Providing technical support for the decision-making of CAAC-AAD
  - Conducting research on airworthiness development strategies, planning and policy
  - Organizing and conducting airworthiness certification technology research
  - Developing and providing airworthiness training/ workshop, carry out certification under entrusted and provide public services and consultancy
  - Organizing international exchange activities

Introduction of Research projects
By ARC

Interpretation on CCAR25

- ✈ CCAR 25-R4 is harmonized to Part 25 Amendt. 125
- ✈ interpret CCAR 25 by understanding the background of rule-making, comparison with CS 25.
- ✈ According to the practice and experience in Chinese industry, try to recommend means of compliance for the rules of CCAR 25.

Interpretation on ACs

- interpret FAA AC for the certification of transportation category aircraft
- ACs published by CAAC are inadequate so far for the certification. FAA ACs are directly accepted and used by authority and industry. Difficulties in reading and understanding arise in this situation.
- Around 160 ACs identified are related to CCAR 25.
- Recognize criteria for showing compliance and techniques involved for substantiation.
- AC 20-107B CHG 1
- AC 25.629-1B
- AC 25.571-1D
- AC 21-36 AC 20-31
- drafting AC for CAAC

Reference guide for certification engineer

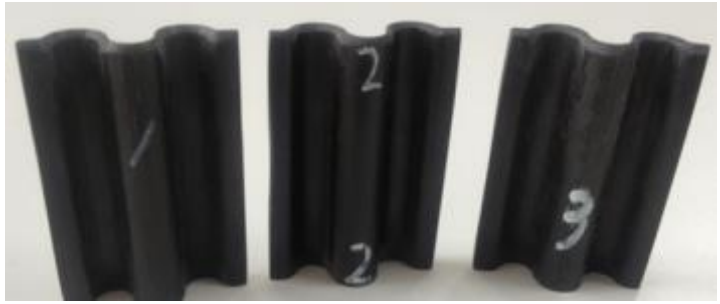
- Provide guidance for certification engineer on specific topics, composites structure is one of those.
- Intended to improve certification efficiency.
- Ongoing project, will last 3 years.

Study on crashworthiness of Composite Structures

Test condition: Quasi-static load applied axially

Before crushed

Corrugated plate:



index	layups	initiator
1	$[0/90]_{4s}$	45°chamfer
2	$[45/-45]_{4s}$	45°chamfer
3	$[0/45/-45/90]_{2s}$	45°chamfer

Cylinder:

index	layups	initiator
1	$[0/90]_{3s}$	Null
2	$[0/90]_{3s}$	45°chamfer
3	$[45/-45/0/90/0]_{s}$	45°chamfer

Rectangular tube:

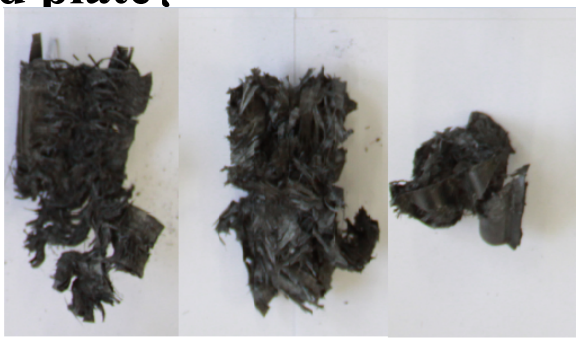
index	layups	initiator
1	$[0/90]_{3s}$	45°chamfer
2	$[45/-45]_{3s}$	45°chamfer
3	$[45/-45/0/0/90/0]_{s}$	45°chamfer

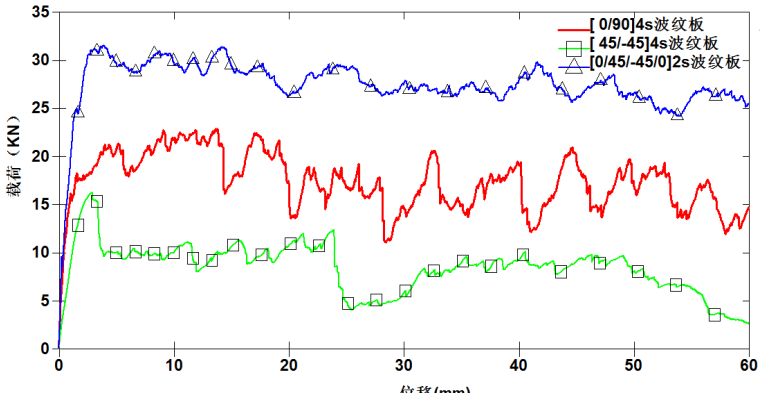
Study on crashworthiness of Composite Structures

Test condition: Quasi-static load applied axially

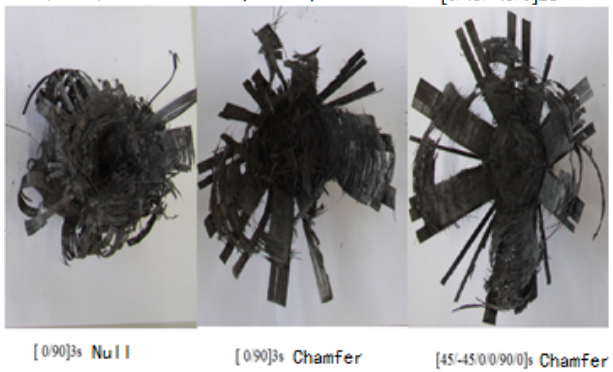
Post crushed

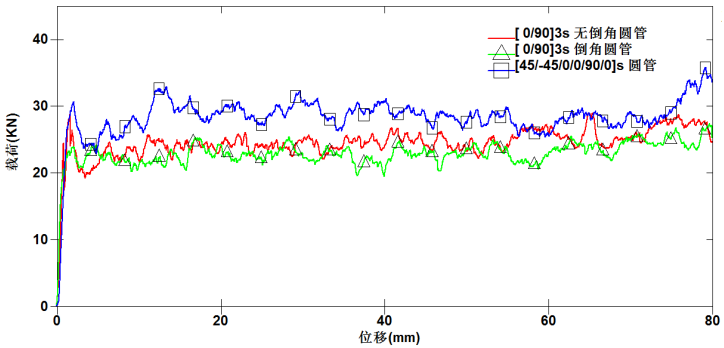
Corrugated plate：



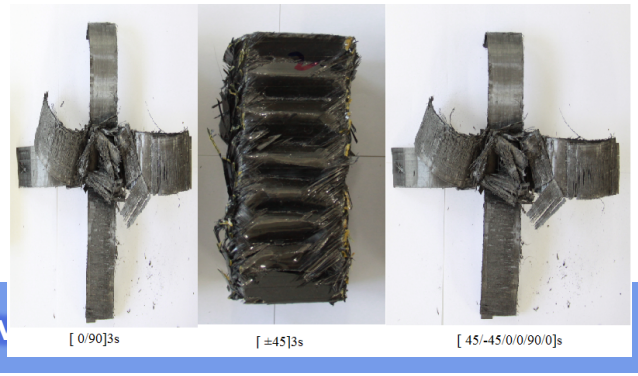


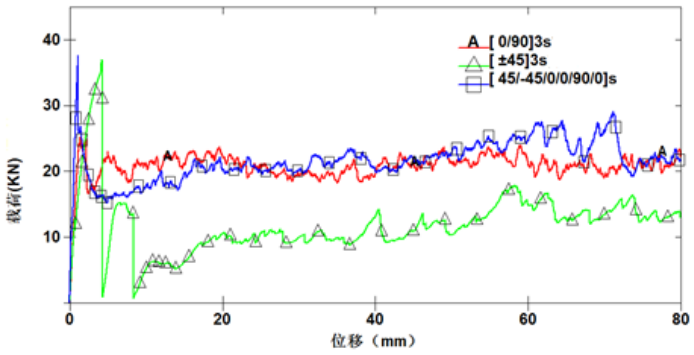
Cylinder：





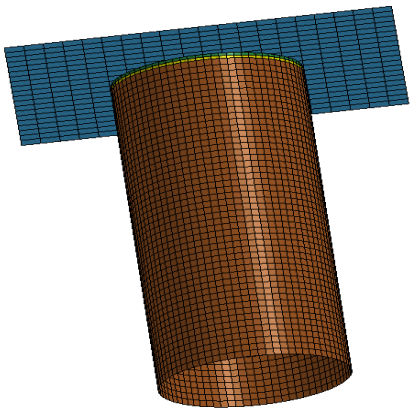
Rectangular tube：

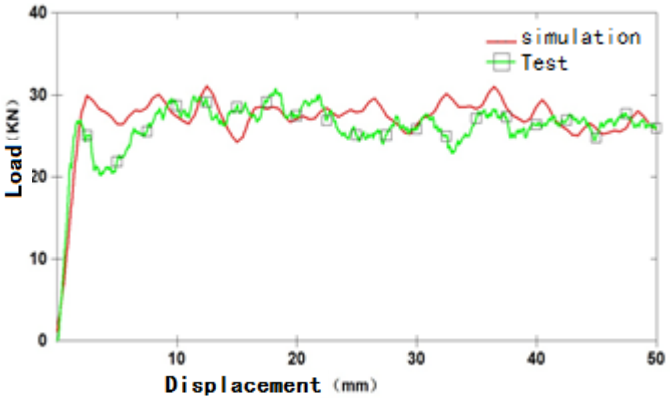




LS-DYNA MAT 54(ENHANCED_COMPOSITE_DAMAGE)

Parameter	Value	Parameter	Value
ρ	1.53 g/cm³	Y_c	184MPa
E_x	126 GPa	S_c	98.8MPa
E_y	8.71GPa	BETA	0.0
G_{xy}	3.60GPa	FBRT	1.0
ν_{ba}	0.011	YCFAC	1.5
X_t	2571 MPa	TFAIL	0.4
X_c	1060 MPa	SOFT	0.6
Y_t	41.8 MPa	EFS	0.7





Load vs displacement

	Peak force (KN)	Error %	SEA(J/g)	Error %
test	26.67	—	74.86	—
simulation	29.58	10.91	77.41	3.82

Simulation is able to repeat test

Training and workshop

- In collaboration with authority, operator and MRO, a workshop was organized 2015.
  - Composite structure certification is addressed and discussed, emphasis was put on composite structure repair.
  - SAE AIR 5719 and FAA DOT/FAA/AR-08/54 were used to develop the workshop.
  - The workshop will be separated into two in 2016. One is composites structure certification, the other is structure repair.

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Thanks for your attention!

Great Honor !