

# Vision RUAG Space Faster, Cheaper, Smarter

Conference LES LANCEURS EUROPÉENS

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# Partner in European launchers



# European partner in US launchers



# Payload Fairings & Launcher Structures



World market **leader**  
for composite  
Payload fairings

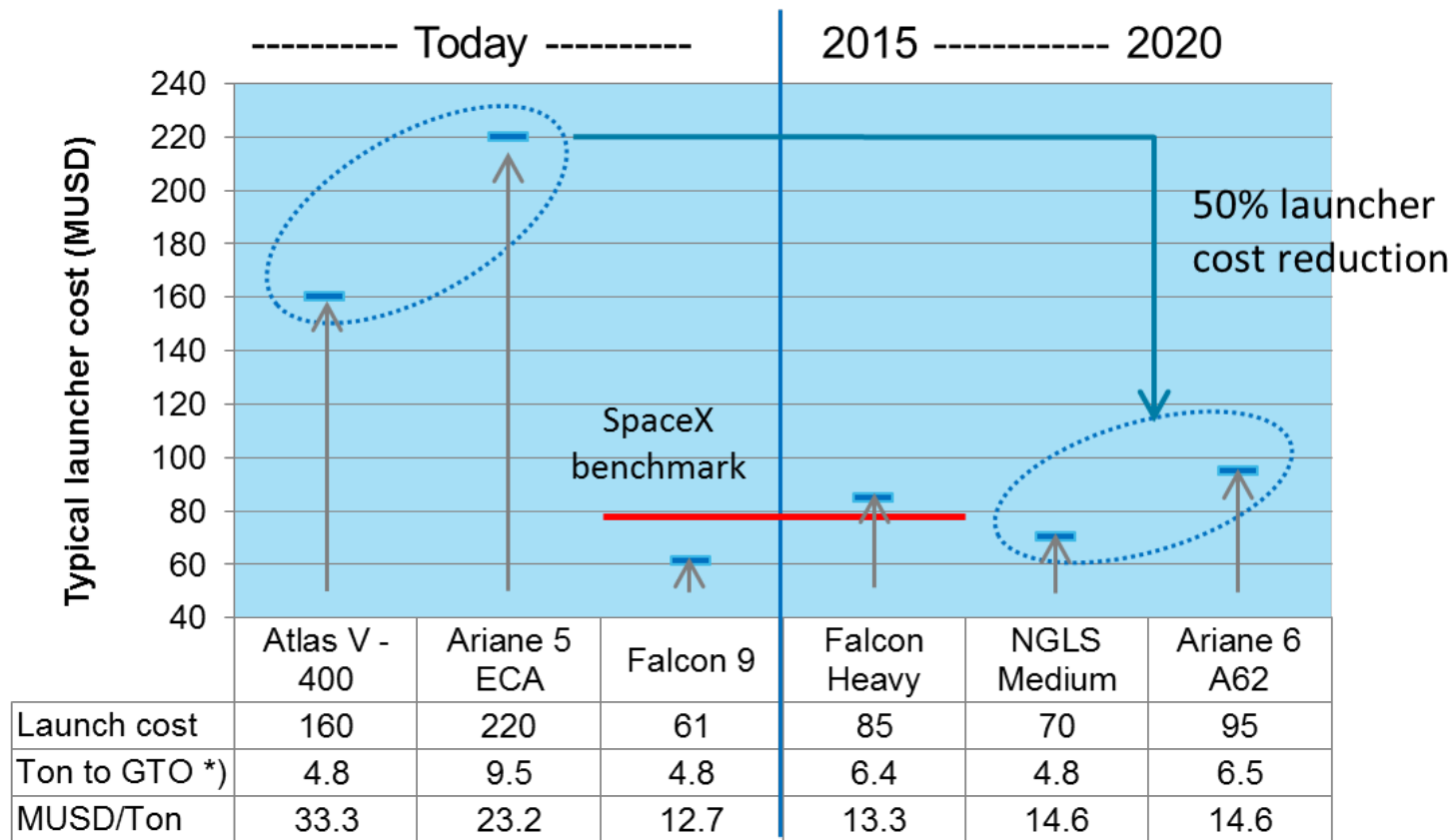
Supplier of **carbon fiber  
structures** for  
Ariane 5, Vega and Atlas

**Dual spacecraft** system  
for Atlas V and Delta IV

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# Challenges in a changing space world

Continuing price pressure and increasing competition will be the major challenges



\*) GTO: Geostationary Transfer Orbit

Source: "The Space Report 2014", Space Foundation, and RUAG internal evaluations, SpaceX prices from SpaceX homepage

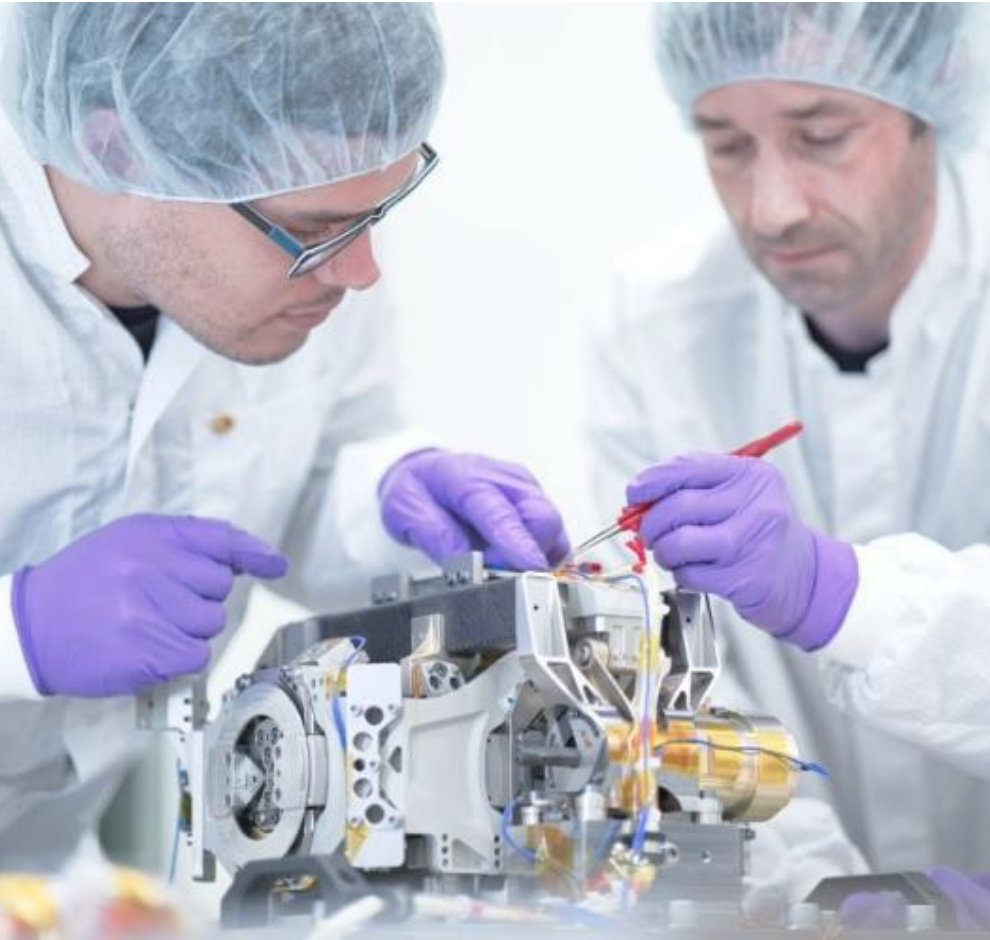
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# Role of a major space supplier

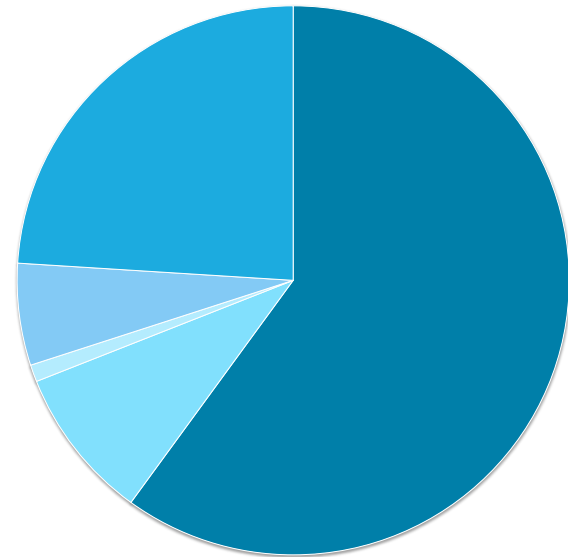


- Create value for our customer
- Provide solutions
- Improve position of our customer in the market






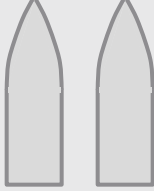


# RUAG is investing \$ 150 million per year in research and development



Space **60%**



# Out-of-Autoclave Process permits to achieve cost reduction objectives

	today		future
<b>1</b> <b>Technology</b>	Today: small size autoclave 		Future: big size out-of autoclave 
<b>2</b> <b>Material</b>	Today: Sandwich CFRP / GFRP face sheets Al core 		Future: Sandwich CFRP / GFRP with new resin face sheets Al core 
<b>3</b> <b>Design</b>	Today: 14 small panels 		Future: 2 x 180° panels 
<b>4</b> <b>Process</b>	Today: hand lay-up 		Future: assisted hand lay-up 



# State of the art composite manufacturing



RUAG Composite  
Center Emmen

New manufacturing  
facility for **large  
composite** structures

# Composite production without autoclave



Minimum part count

All under one roof

High degree of automation

First flight model in 2016



# High degree of automation supports lean concept and additional savings



■ Products

■ Manufacturing

■ Production facility (equipment, NDI, ...)

**Production process**

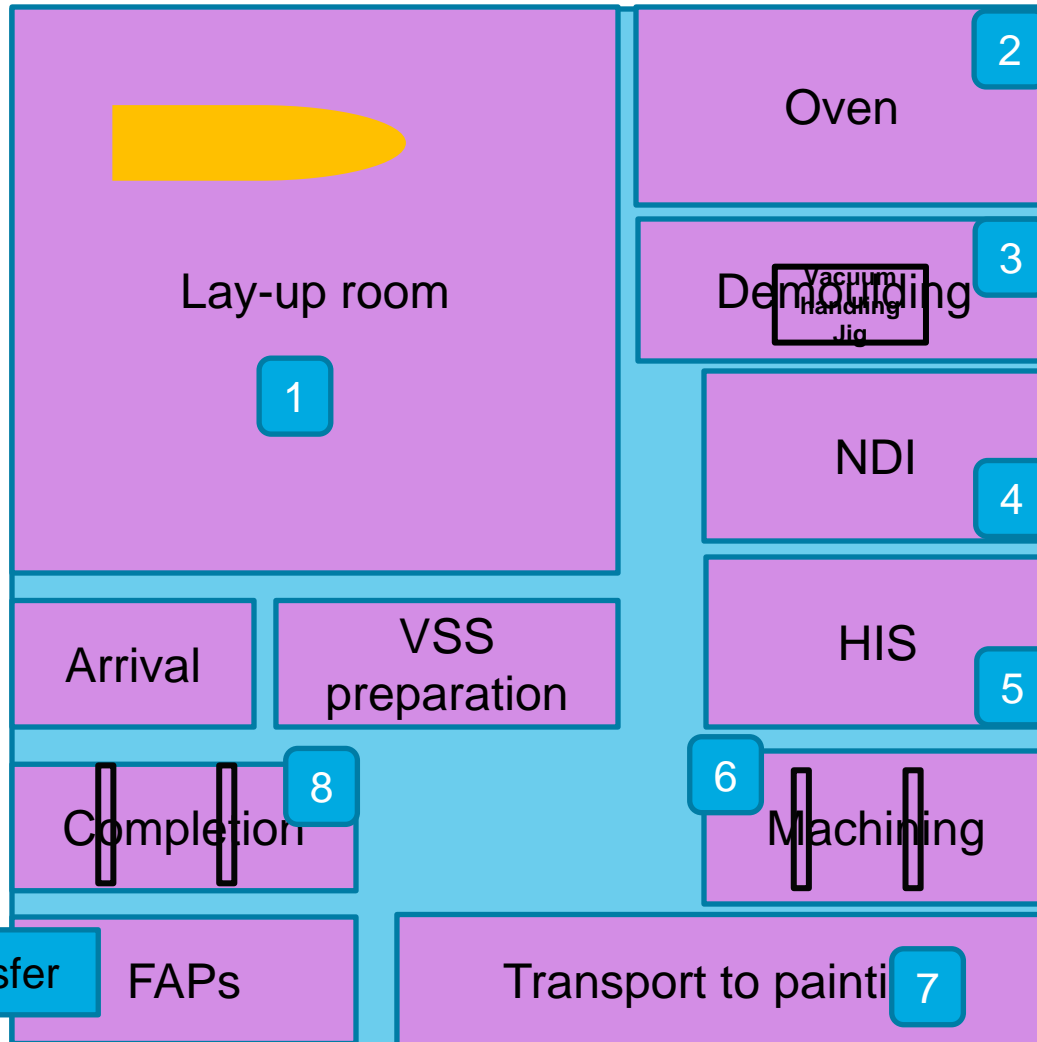
Production of **different fairing configurations**

**Automation** on specific stations contribute to cost reduction

Standard cycle-time of **2x10** days for Ø5.4m Fairing

# RUAG Composite Center Baseline process flow

Transfer of the part with an  
amending handling jigs



- 1- Lay-up area
- 2- Curing - oven
- 3- Demoulding area
- 4- Non destructive inspection station
- 5- Horizontal integration station
- 6- Machining on “Machining rotating station”
- 7- Painting trolley - transfer to paint shop
- 8- Finish on “Completion rotating Station”
- 9- Transfer to current production hall for storage

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# Example of highly automated and adaptable production station





# Main production means

Lay-up table

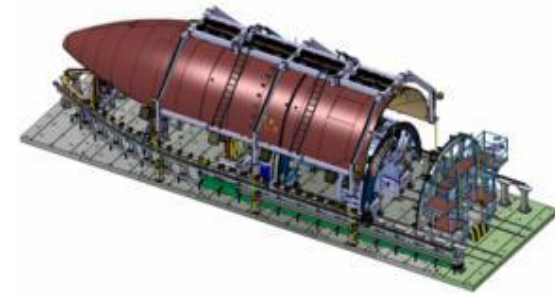


Ogive face sheet transfer jig

Bonding mould & oven



Horizontal integration station



Machining station



# Payload Adapters & Separation Systems

> 566 satellites in orbit

100% mission success

World **leading** supplier  
for Ariane, Atlas, Antares, Delta,  
Falcon, Proton, Sea Launch,  
Soyuz with **75%** market share

Multi-satellite **dispensers**



# The five main satellite builders were asked for input: Main feed-back is less cost

**Compatibility** with several LV's important

**Reactivity** for S/C accommodation and testing

**Stacked** configurations (= no Sylda) by several (2 x 4000 kg)

Buy **OWN** rocket and maximize its utilization seen as alternative

**EP** will significantly reduce and simplify S/C processing and launch preparation

**Limit** 7000 kg even power will grow



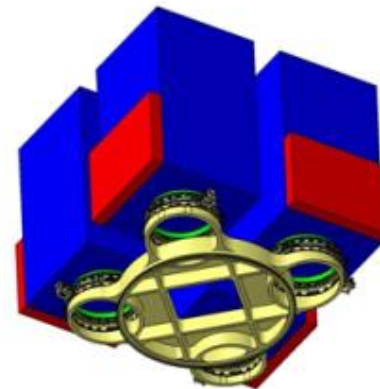
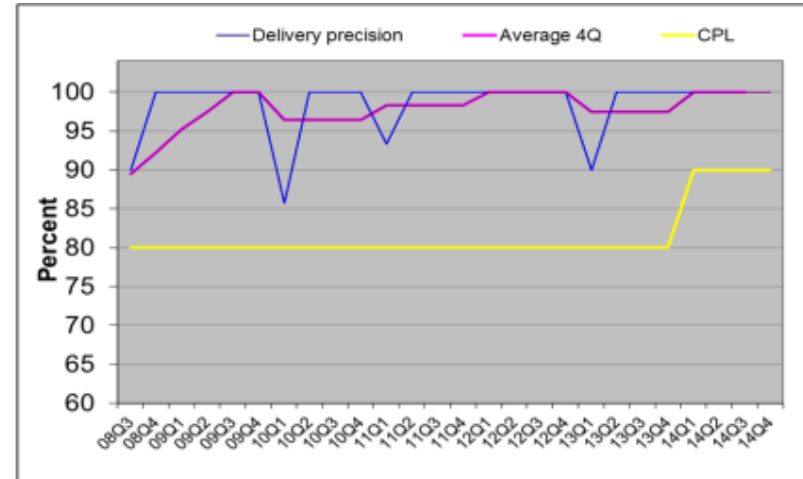


# Change vector – shorter lead time & higher degree Upper Compartment customization

Increased **self** 'quick' funded R&D **key** to create building blocks to accommodate any S/C

**50%** of all **internal** R&D need to lead to an order intake within **24 months**

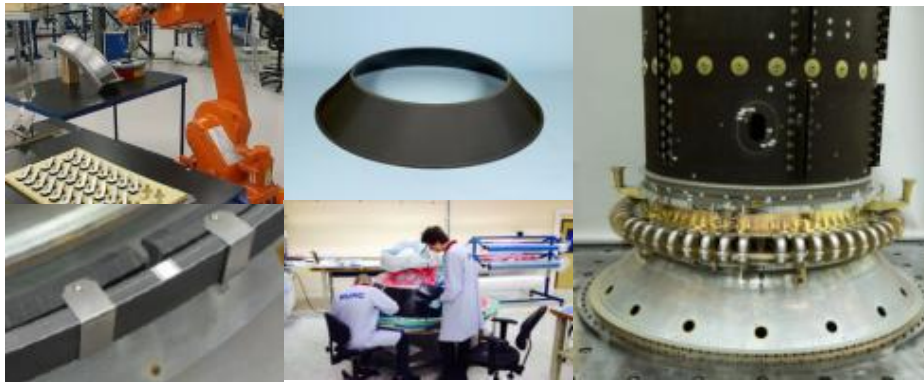
Lead time to be reduced by **30%** within **24 months** and 50% in five years with delivery precision maintained



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# Tomorrow is today!

Feature	Today	Tomorrow
Overall design	One per LV-S/C combo (5x7=35)	One per S/C bus (7)
Material	Aluminum + CFRP	CFRP
Process	Autoclave	Vacuum bag only
Tooling	One per version	Flexible
Initiation	Pyro	Non-pyro
H/W certification	By documentation	By testing



-30% in mass  
 -20% in cost  
 -50% in lead time

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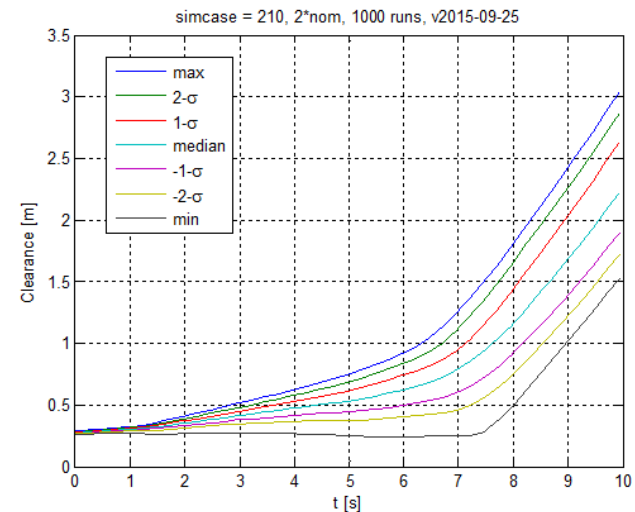
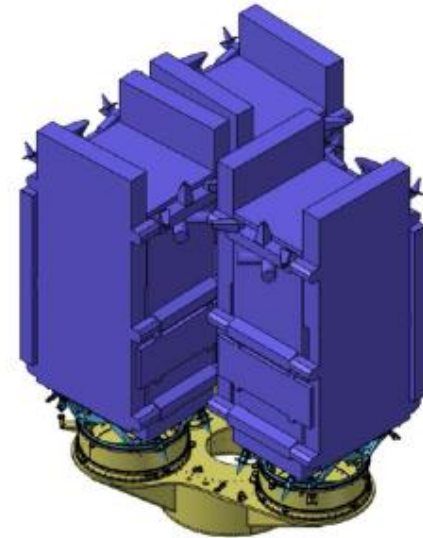
# Case example – Radarsat on Falcon 9 for MDA

Large satellites are typically launched with **dual** structures, stacked or as single passengers

**Side-by-side** has the advantage of not having any S/C carrying the load of the other (similar to Sylda)

**Close mounting** of each S/C will allow additional volume and less overall structural mass

**Tilting** of satellites pre separation to ensure clearance



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