



# EMBRAER TITANIUM OUTLOOK

Titanium USA 2015 Conference

# AGENDA

 **EMBRAER OVERVIEW**

 **AIRCRAFT MARKET  
FORECAST**

 **STRUCTURAL MATERIALS  
IN EMBRAER PROGRAMS**

 **TITANIUM  
PURCHASING PROFILE**

 **FUTURE  
PERSPECTIVES**

 **CONCLUSION**

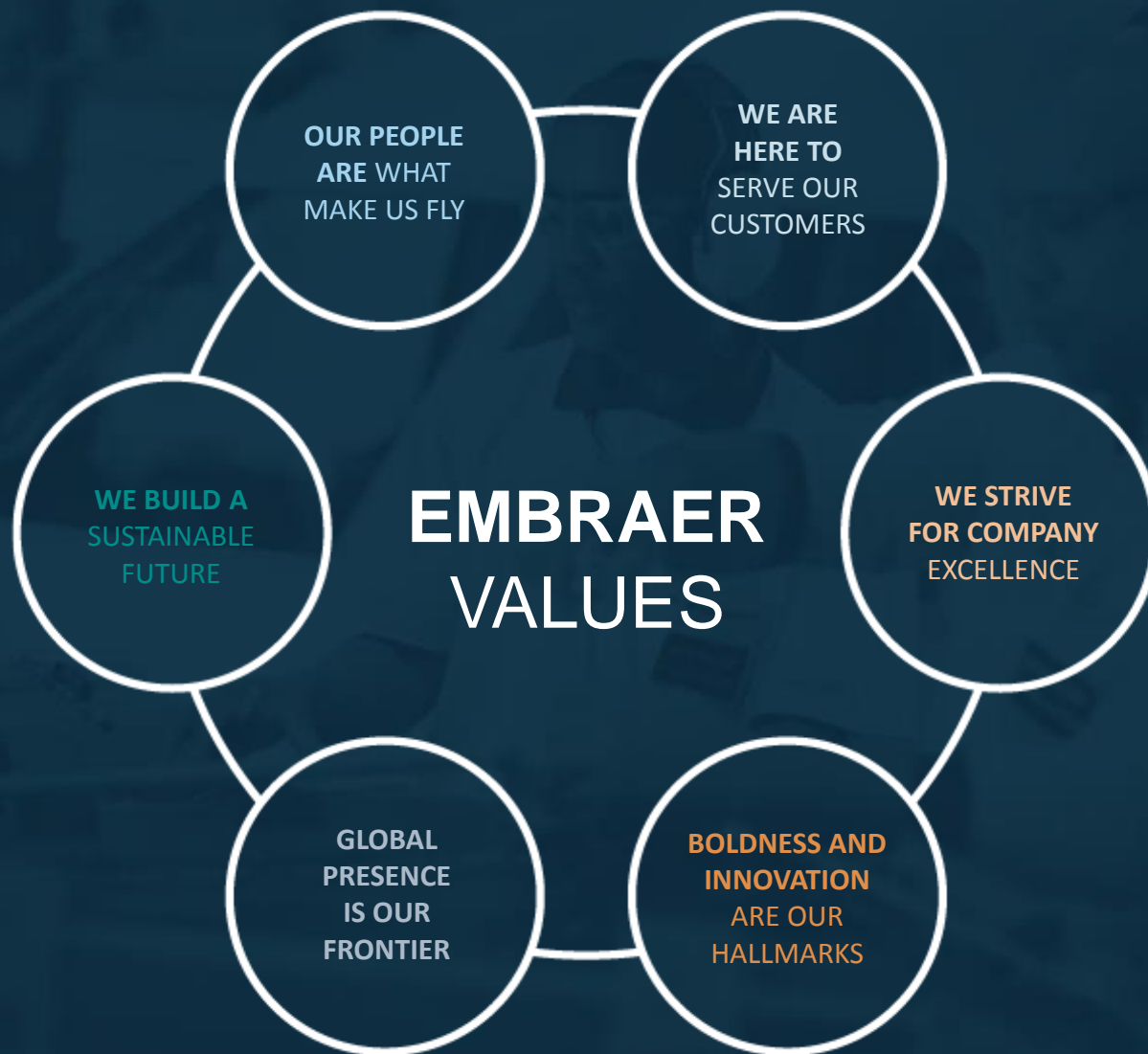


# EMBRAER OVERVIEW

# OUR COMMITMENT

OUR COMMITMENT IS ABOUT CREATING VALUE FOR OUR SHAREHOLDERS, CLIENTS, EMPLOYEES AND SOCIETY IN GENERAL. WE ARE ETHICALLY, SOCIALLY AND ENVIRONMENTALLY CONSCIOUS, ALWAYS ADHERING TO THE HIGHEST STANDARDS OF CORPORATE GOVERNANCE AND THE EMBRAER VALUES. THESE ARE WHAT MAKE EMBRAER STRONG AND GUIDE US AS WE STRIVE FOR LONG-TERM FUTURE SUCCESS.





# WE OPERATE IN FOUR BUSINESS AREAS:



COMMERCIAL  
AVIATION

EXECUTIVE  
AVIATION



EMBRAER DEFENSE &  
SECURITY

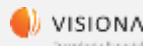
EMBRAER SYSTEMS



# WHERE WE OPERATE



# JOINT VENTURES & AFFILIATES



# DIVERSITY IS WEALTH

**19**  
THOUSAND

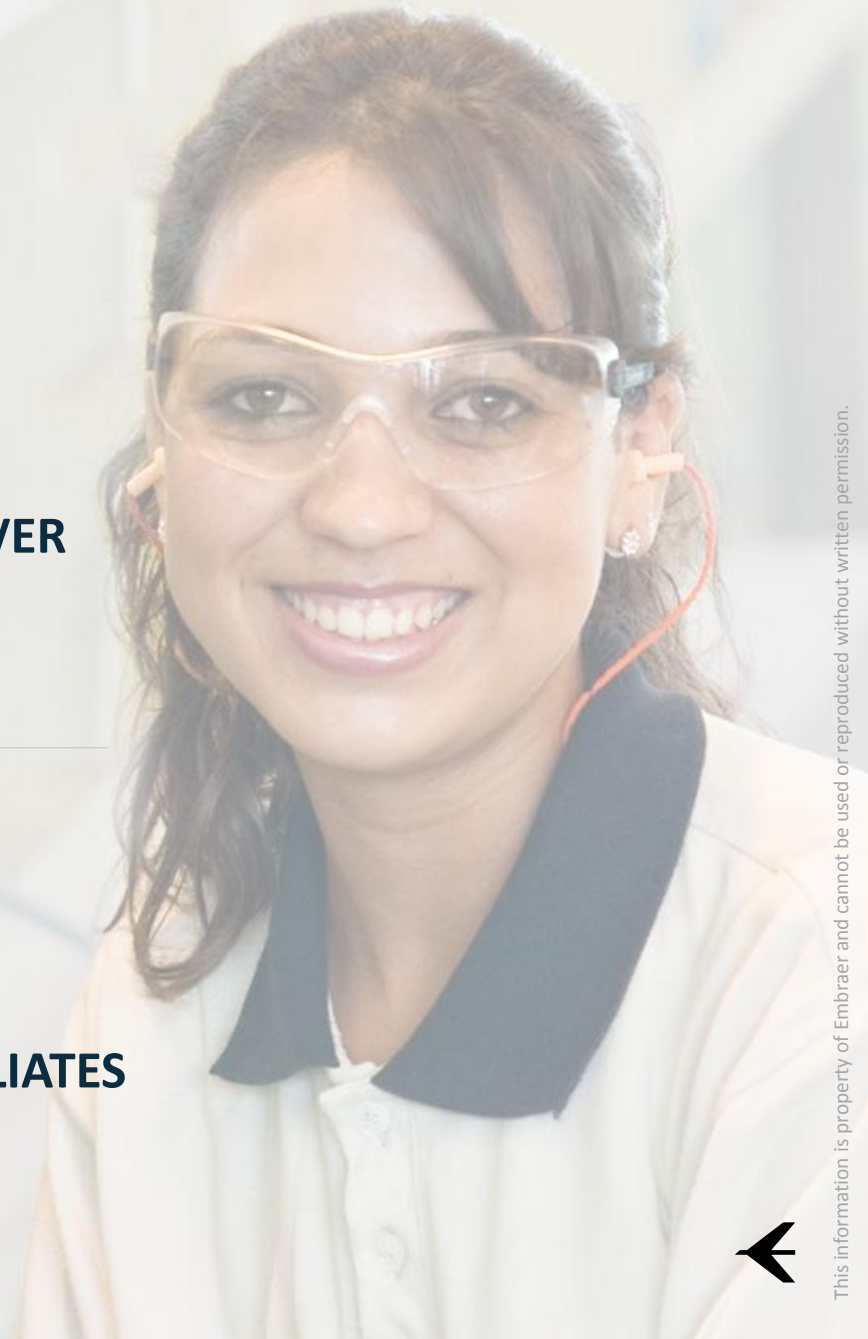


MORE THAN **19,000**  
**EMPLOYEES** FROM OVER  
**20 COUNTRIES**

**2.3**  
THOUSAND



MORE THAN **2,300**  
**EMPLOYEES** IN JOINT  
**VENTURES AND AFFILIATES**



# COMMERCIAL AVIATION



# CUSTOMERS

# COMMERCIAL AVIATION



AIRLINES

90 +

COUNTRIES

60

AIRCRAFT IN  
OPERATION

1.6  
THOUSAND +

\* E-Jets families and ERJ only; scheduled and non-scheduled airlines.



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# EXECUTIVE JETS PRODUCT PORTFOLIO

Ultra-large

**Lineage® 1000E**  
BY EMBRAER



Large

**LEGACY® 650**  
BY EMBRAER



Super-Midsize

**LEGACY® 600**  
BY EMBRAER



Midsize

**LEGACY® 500**  
BY EMBRAER



Midlight

**LEGACY® 450**  
BY EMBRAER



Light

**PHENOM® 300**  
BY EMBRAER



Entry

**PHENOM® 100E**  
BY EMBRAER



# CLIENTS

# EXECUTIVE AVIATION



JETS  
DELIVERED

900 +

COUNTRIES

60



# DEFENSE & SECURITY



Intelligence, Surveillance and  
Reconnaissance (ISR) Systems  
EMB ISR AEW&C / MP / Multi-Intel



Light Attack and Advanced Training  
A-29 Super Tucano



Tactical Military Transport  
KC-390



Transport of Authorities



Aircraft Modernization



Unmanned Air Vehicle (UAV)



# CLIENTS

# DEFENSE & SECURITY



ARMED  
FORCES

50 +

Note: Excludes undisclosed clients

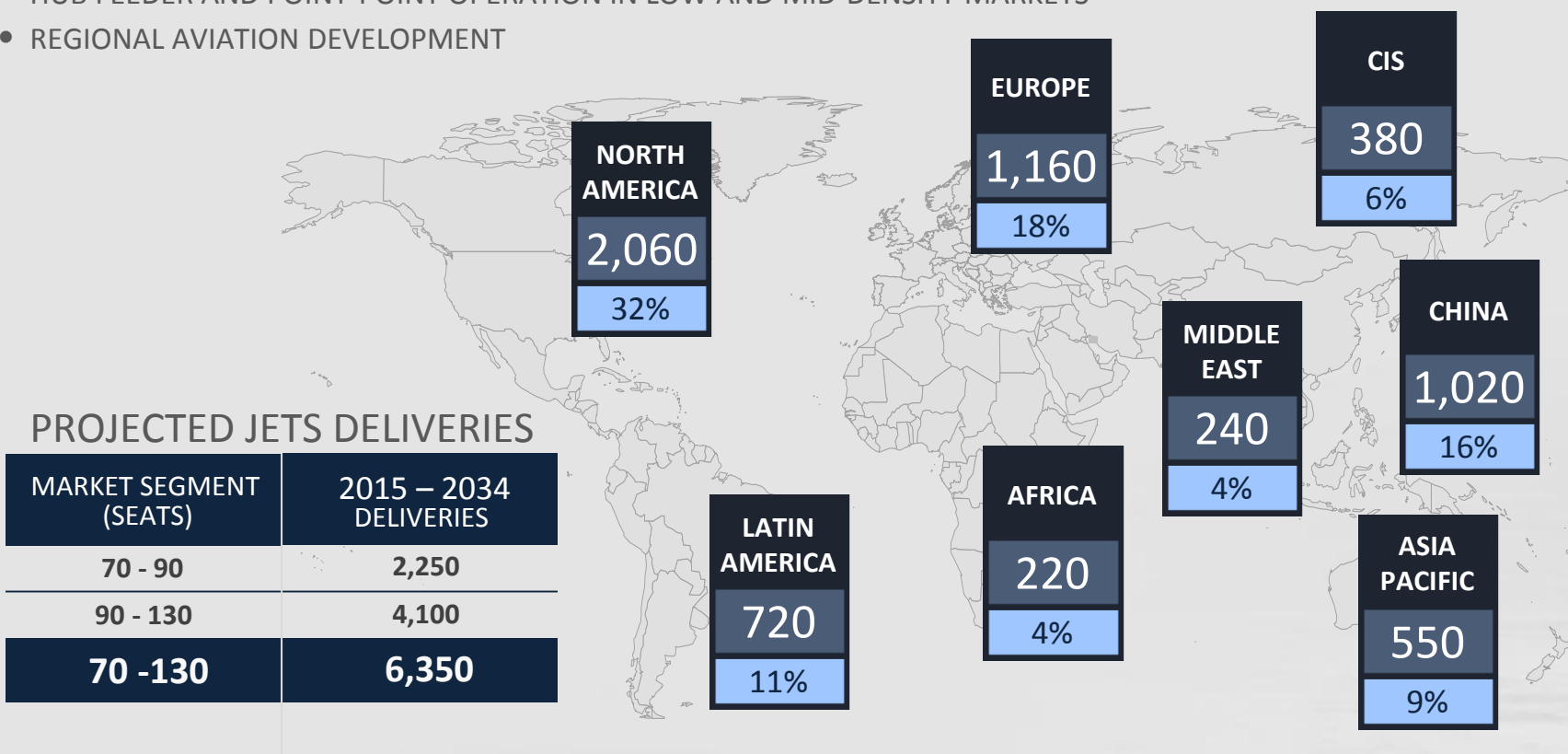


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# AIRCRAFT MARKET FORECAST

# Commercial Aviation Market Forecast (2015-2034)

- REPLACEMENT OF OLD/INEFFICIENT JETS
- RIGHT-SIZING OF NARROW-BODY OPERATIONS
- HUB FEEDER AND POINT-POINT OPERATION IN LOW AND MID-DENSITY MARKETS
- REGIONAL AVIATION DEVELOPMENT



**AROUND 6,350 JET DELIVERIES (70-130 SEATS) IN THE NEXT 20 YEARS (US\$ 300 BI)**

For more information: <http://www.embraermarketoutlook.com>



# Executive Jets Market Forecast (2015-2024)

## NORTH AMERICA

4,620 a/c (50%)  
US\$ 120 Bi (45%)

## EUROPE, MIDDLE EAST & AFRICA

2,360 a/c (26%)  
US\$ 77 Bi (29%)

## LATIN AMERICA

850 a/c (9%)  
US\$ 16 Bi (6%)

## ASIA PACIFIC

570 a/c (6%)  
US\$ 19 Bi (7%)

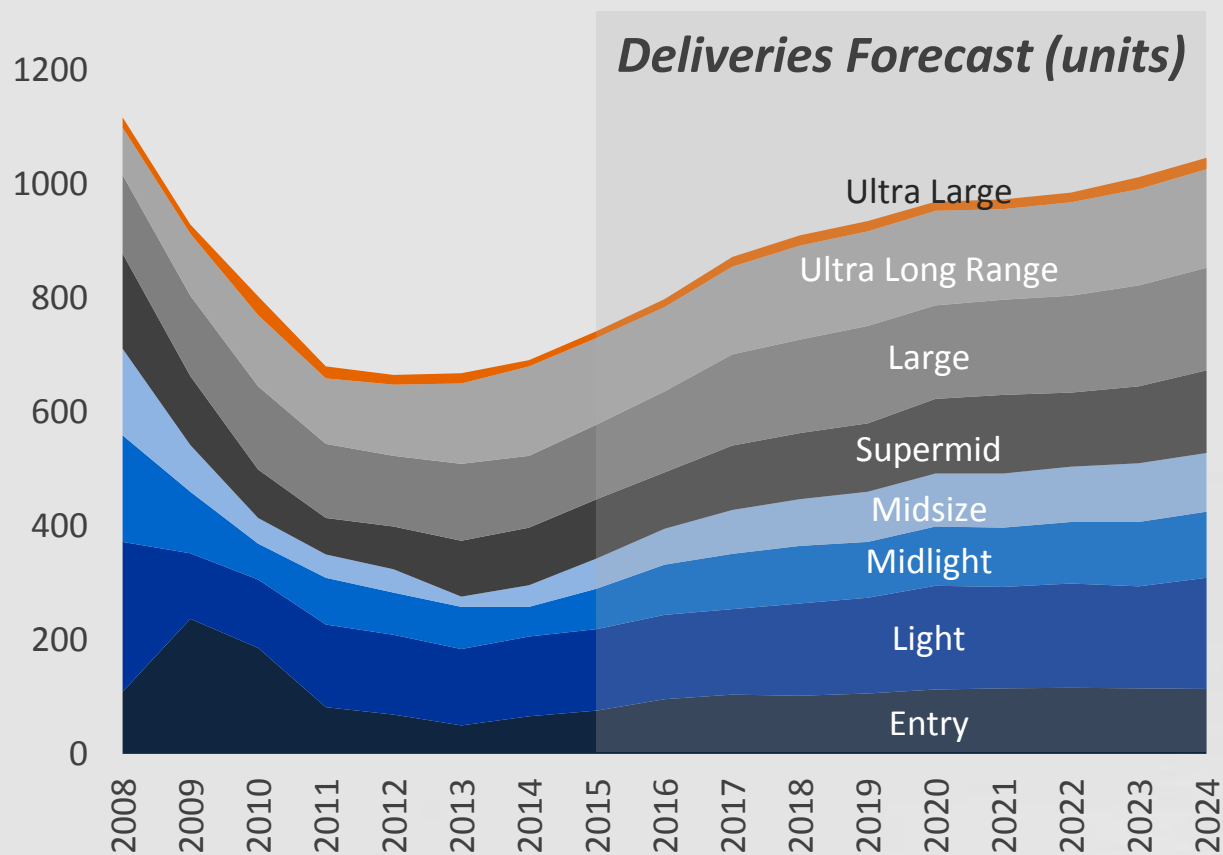
## CHINA

835 a/c (9%)  
US\$ 33 Bi (12%)

**9,250 JETS WORLDWIDE IN THE NEXT 10 YEARS (US\$ 265 Bi)**



# Executive Jets Market Forecast (2015-2024)



**9,250 JETS WORLDWIDE IN THE NEXT 10 YEARS (US\$ 265 Bi)**



# Defense & Security: Super Tucano

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- FIRM ORDERS: MORE THAN 220 AIRCRAFT
- OVER 190 AIRCRAFT DELIVERED



**300 AIRCRAFT BY 2020 (US\$ 3.5 Bi)**



# Defense & Security: KC-390



**BRAZIL: 28**



**ARGENTINA: 6**



**CHILE: 6**



**COLOMBIA: 12**



**CZECH REP.: 2**



**PORTUGAL: 6**



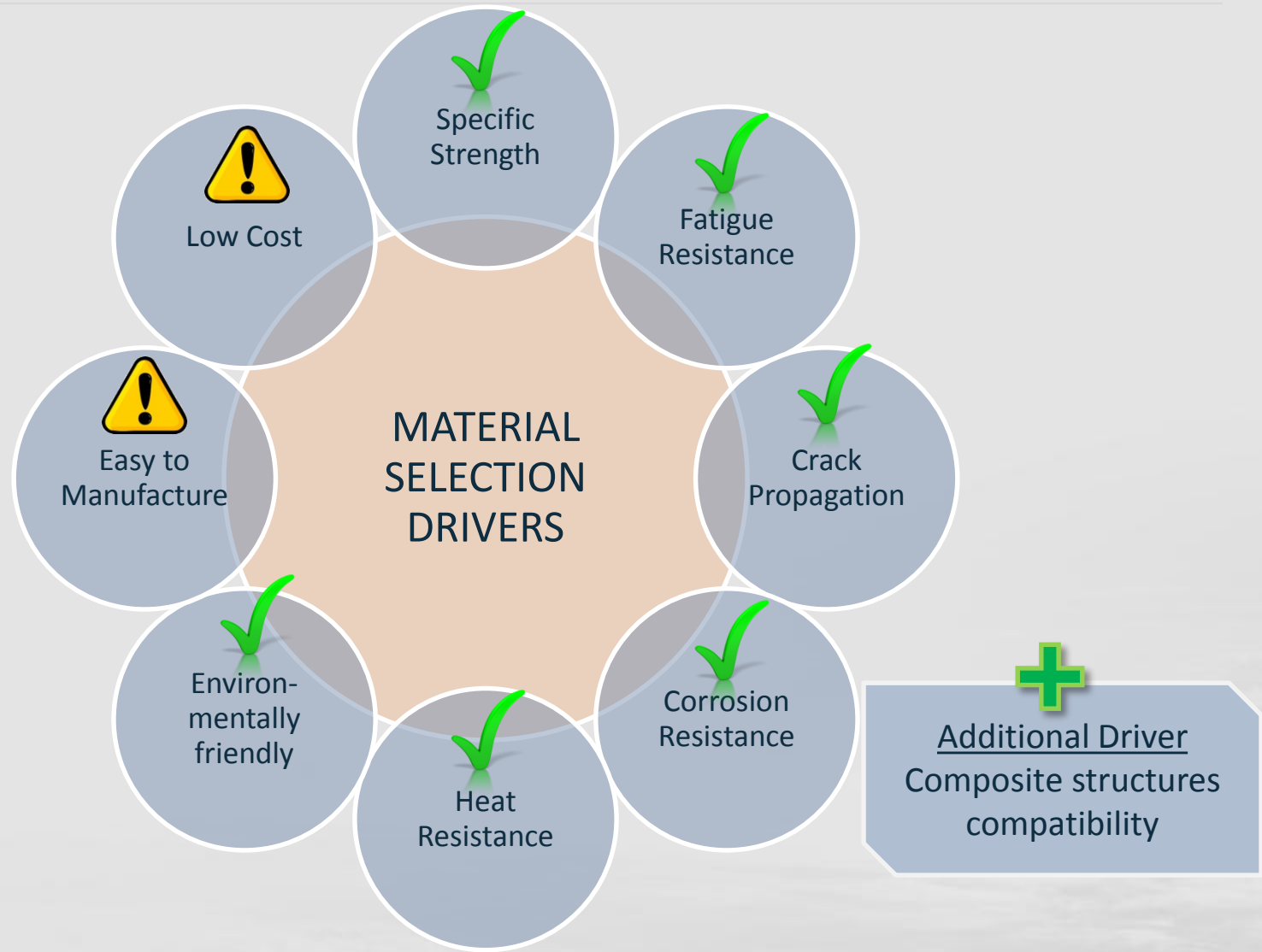
- A NEW TACTICAL MILITARY TRANSPORT AND TANKER AIRCRAFT
- TECHNICAL PARTNERSHIP WITH BOEING TO INCREASE KC-390 SALES IN CERTAIN MARKETS
- SIX COUNTRIES LETTERS OF INTENT, TOTALIZING 60 AIRCRAFT
- FAB AND EMBRAER SIGNED THE SERIES PRODUCTION CONTRACT FOR 28 KC-390
- FIRST FLIGHT IN FEBRUARY 2015

**ADRESSABLE MARKET UNTIL 2025: 700 AIRCRAFT**



# STRUCTURAL MATERIALS IN EMBRAER PROGRAMS

# Titanium x Structural Materials

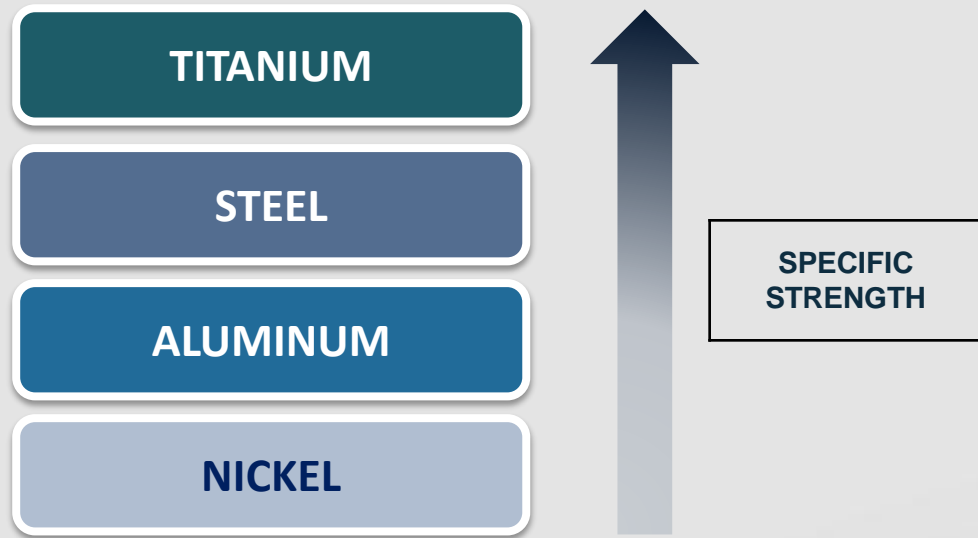


**TITANIUM IS A GOOD CHOICE FOR SPECIFIC STRUCTURAL APPLICATIONS**

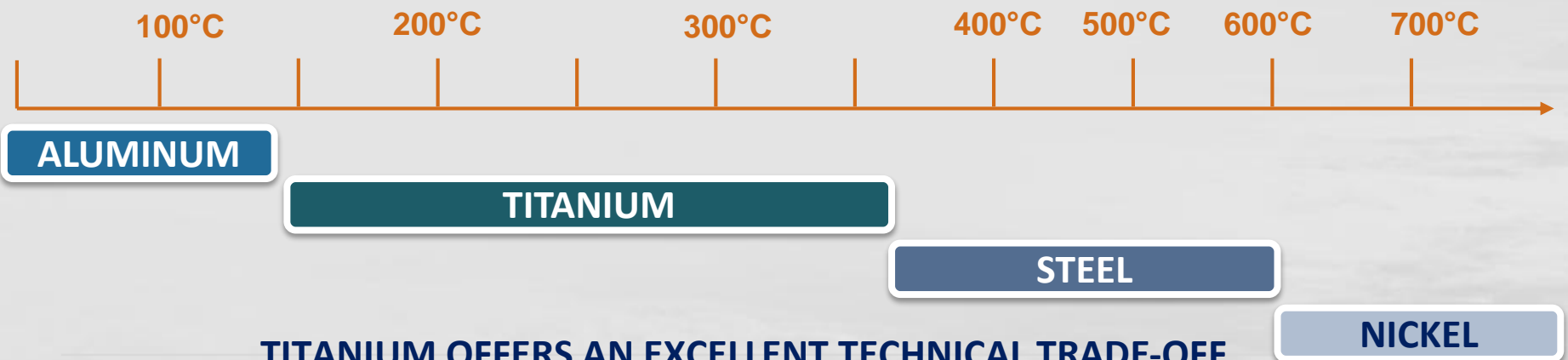


# Titanium Performance

## ❑ Structural Efficiency:



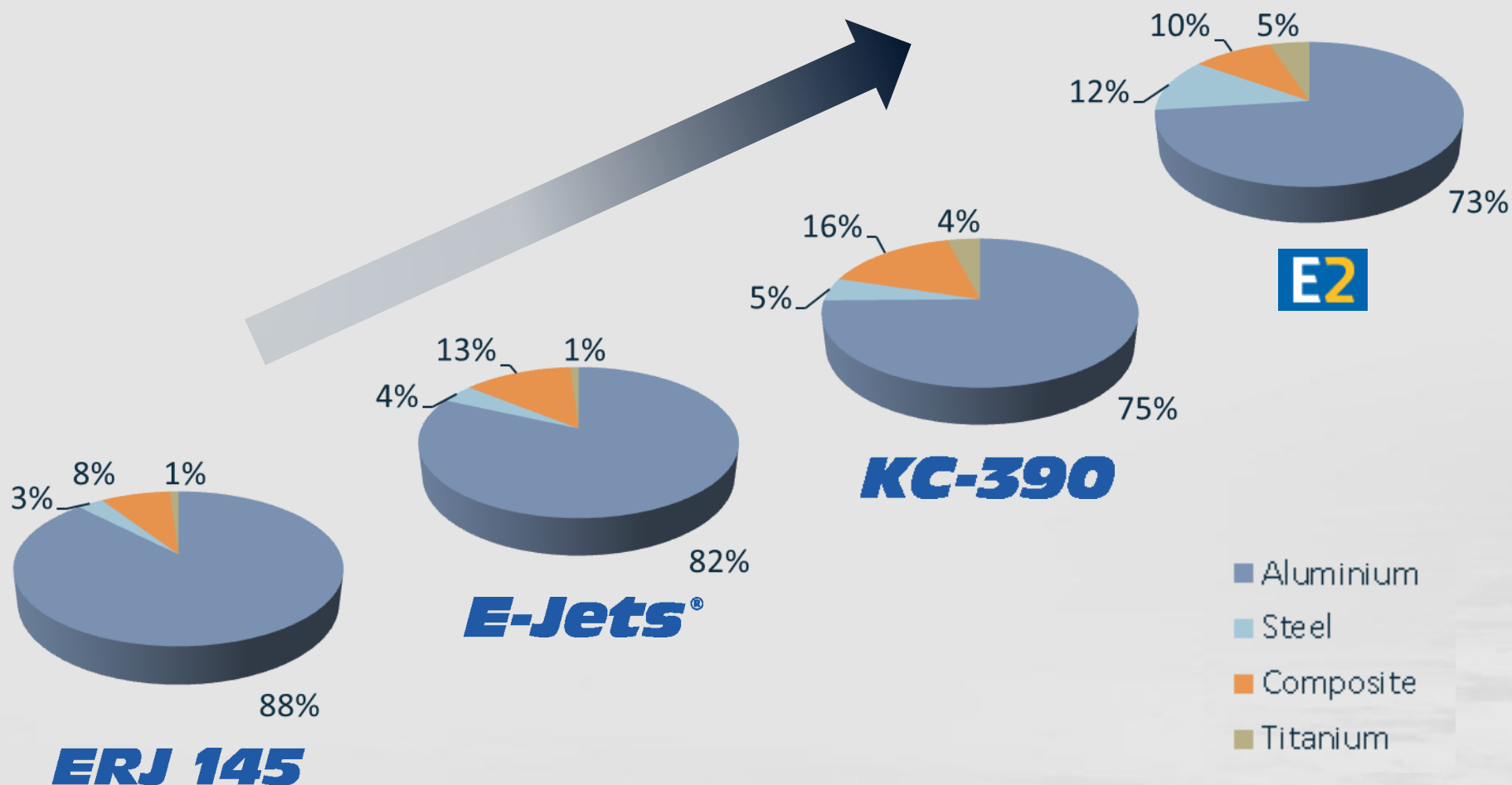
## ❑ High Temperature Application:



**TITANIUM OFFERS AN EXCELLENT TECHNICAL TRADE-OFF**



# Evolution of Ti Usage in Embraer Programs



**Ti AND COMPOSITES APPLICATIONS TEND TO INCREASE IN NEW PROGRAMS**



# E-Jets E2

## Floor & Doors

Tracks, Stop Doors, Shafts

- Corrosion resistance improvement
- High strength
- Weight reduction

## Wing

Spar, Rib, Caps

Fasteners: Stringers/Skins/Ribs/Spars joints

- High strength
- Weight reduction
- Environmental compliance



## Landing Gear

Trailing Arm

- Corrosion resistance improvement
- Weight reduction

## Pylon

Frames, Fittings, Spars, Skins, Links

- High specific strength
- High temperature resistance

## Tail Cone

Fire wall

- Weight reduction
- High temperature resistance



# KC-390

## Wing

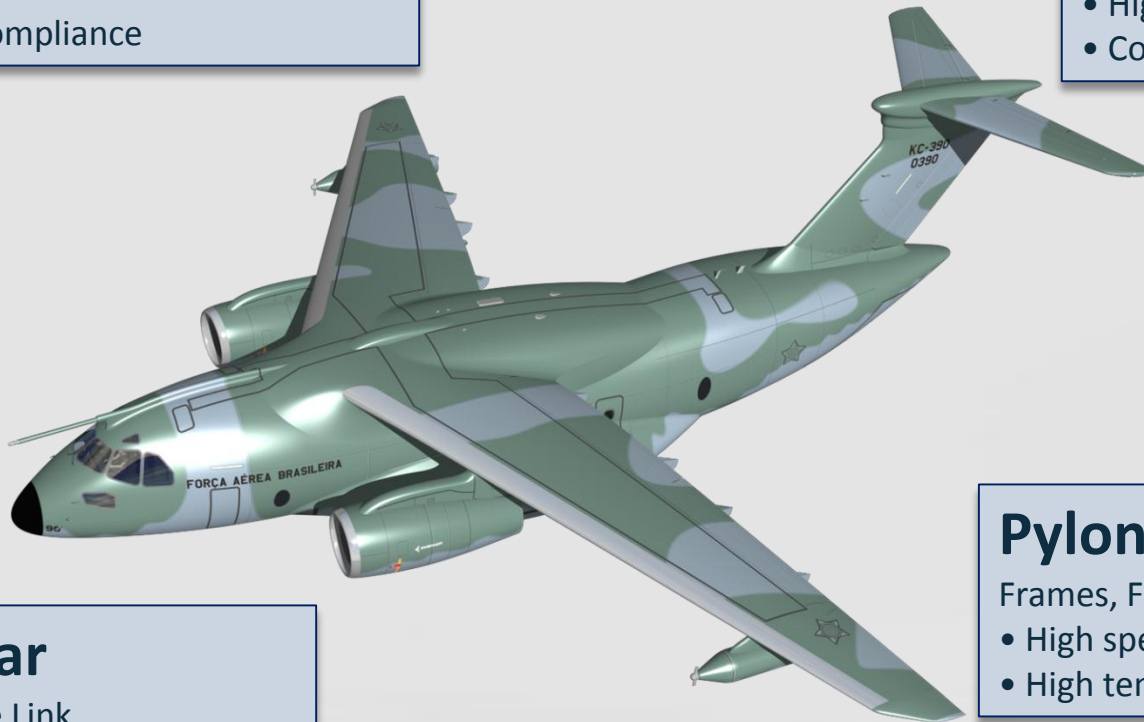
Fasteners: Stringers/Skins/Ribs/Spars joints

- High strength
- Weight reduction
- Environmental compliance

## Empennage

Spars, Ribs, Fittings

- High specific strength
- Composites compatibility



## Landing Gear

Trailing Arm, Torque Link

- Corrosion resistance improvement
- Weight reduction

## Pylon

Frames, Fittings, Pre Cooler Box

- High specific strength
- High temperature resistance

## Fuselage

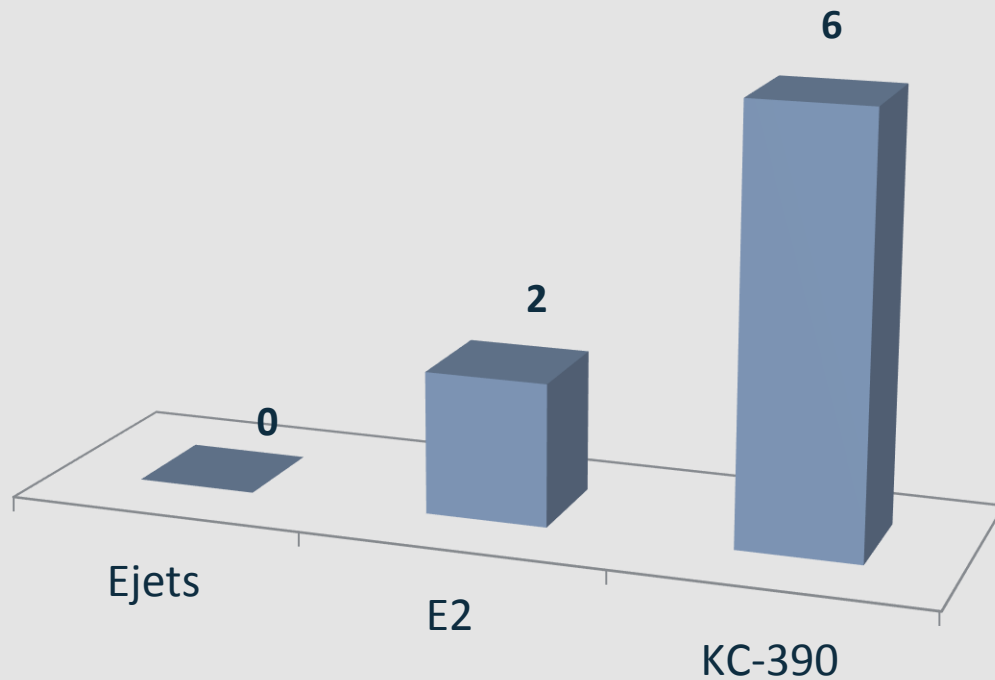
Main Brace, Hop Damper

- High strength
- Weight reduction



# Landing Gear Ti Evolution

## Titanium Structural Parts

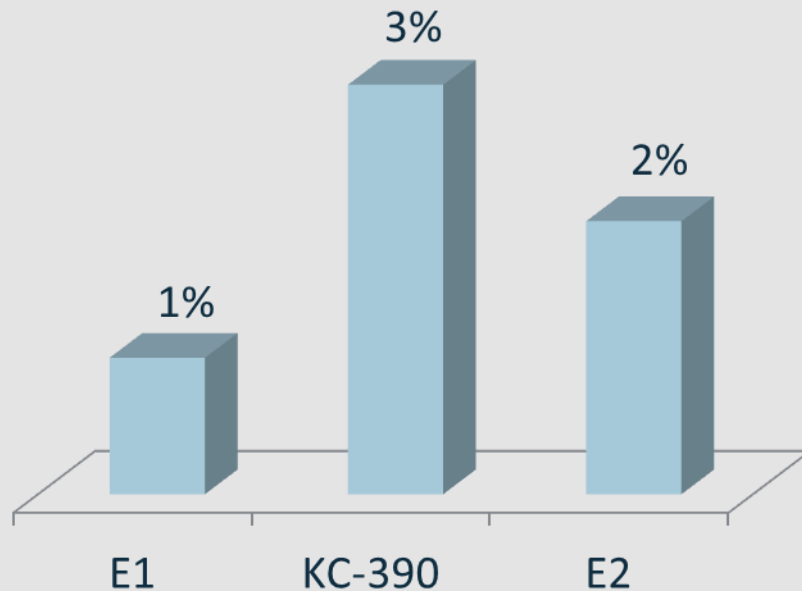


**TI6AL4V REPLACES 300M STEEL**



# Titanium Fasteners

**Titanium Fasteners % of Aircraft Structural Weight**



**PIN AND  
COLLAR**



**STANDARD  
BOLT**



**BLIND BOLT**

## Fasteners

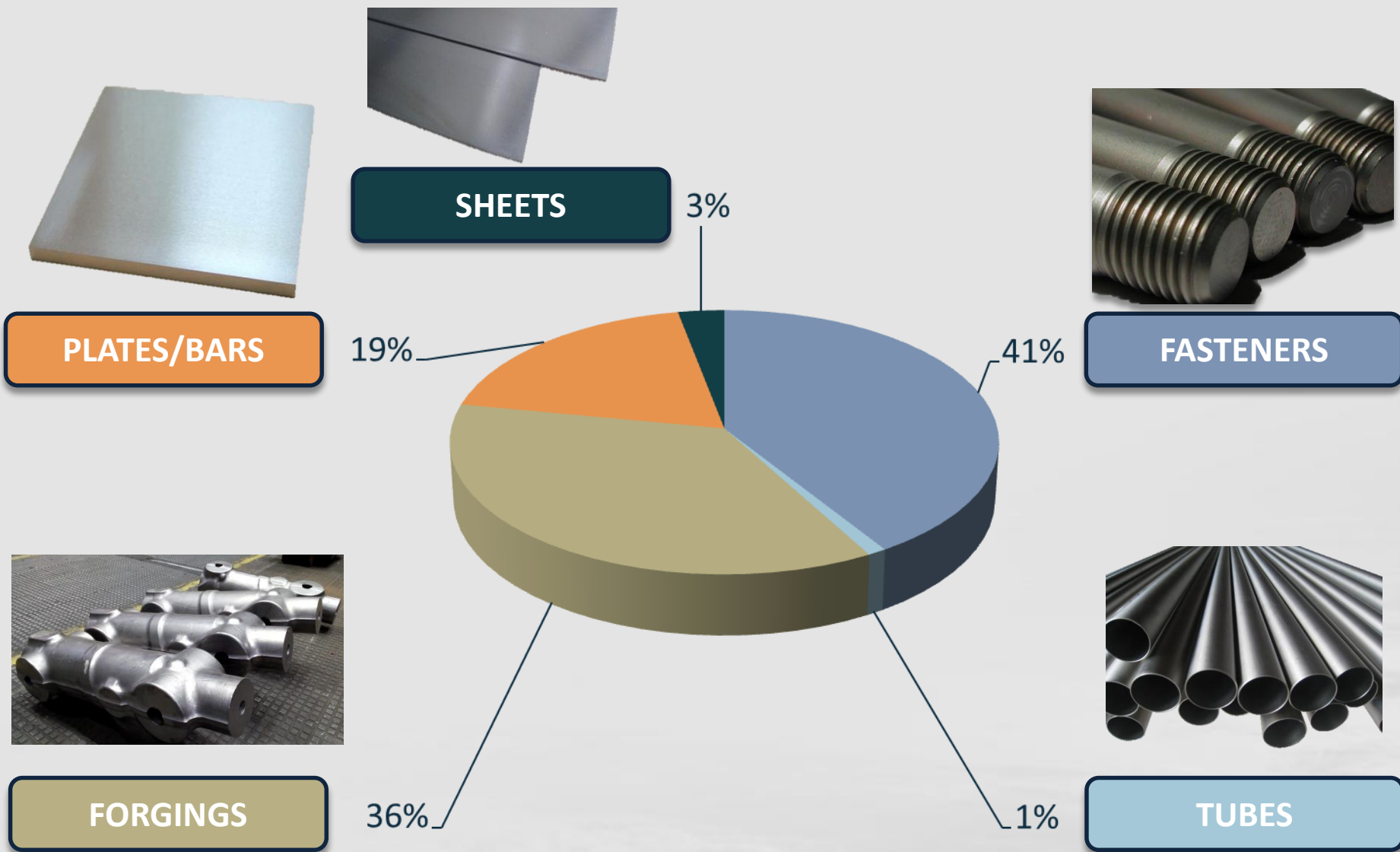
- Weight reduction
- Compatibility with carbon fiber structures
- Environmentally friendly (REACH compliant)

**THE USE OF TI FASTENERS HAS INCREASED IN NEW PROGRAMS**



# TITANIUM PURCHASING PROFILE

# Embraer Titanium Purchasing Profile (\$)



# Embraer Ti Projected Demand Increase – All Programs



# FUTURE PERSPECTIVES

# Research and Development



More than **5,900** people dedicated to Research and Development



Nearly **US\$ 277 million** invested  
in R&D in 2014 (4.4 % of revenue)



**46%** of net income derives from innovations  
implemented between 2010 and 2014



**271** international patents  
applied for between 2010 and 2014



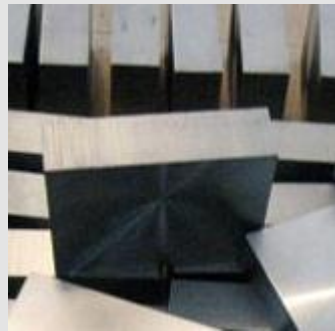
**FINEP** innovation prize



**Innova** program  
Fostering innovations and making them viable



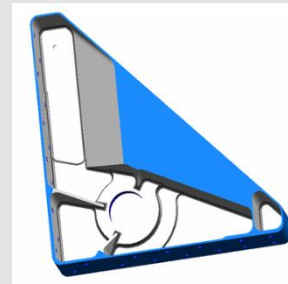
# Consolidated Technology: Near-net Shape Castings



14kg  
Ti Raw Material



40 HOURS  
machining



Final Part  
(1.5kg)



12.5kg  
Ti Scrap

**Buy-to-fly  $\approx 9$**



2kg  
Ti AS-CAST



30 MINUTES  
machining



Final Part  
(1.5kg)



**Buy-to-fly  $\approx 1$**

**BUY-TO-FLY REDUCED BY A FACTOR OF NINE, LEADING TO A MORE COMPETITIVE TI COST**



# Next Generation Technology: Additive Manufacturing

## Conventional Milling (Subtractive)



## Laser Additive Manufacturing



Manufacturing Process	Buy-to-Fly
Conventional Milling	16.0
Laser Additive Manufacturing	1.5

**BUY-TO-FLY REDUCED BY A FACTOR OF TEN, LEADING TO A MORE COMPETITIVE TI COST**



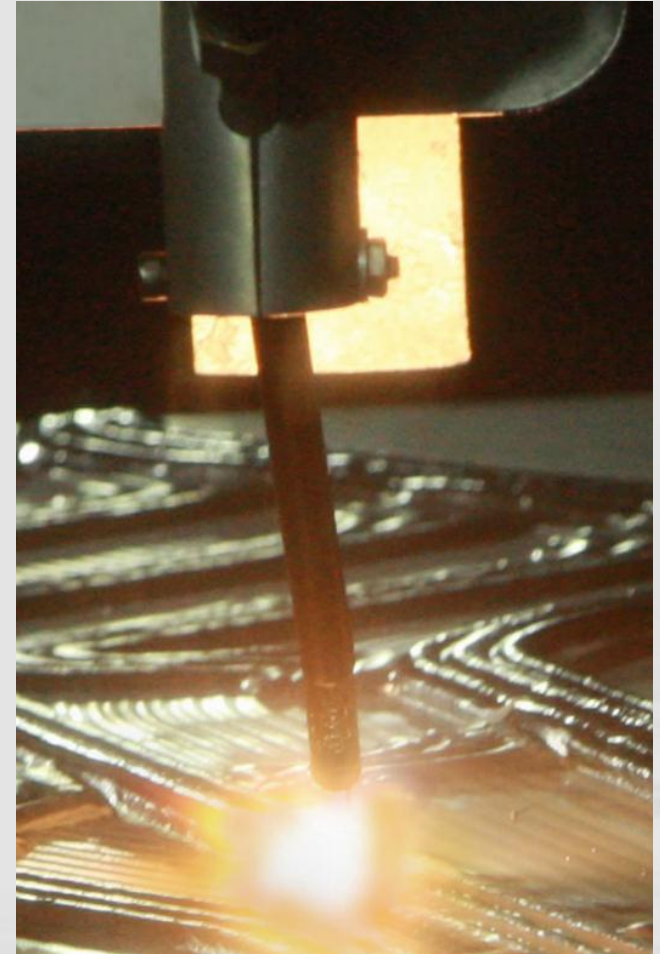
# CONCLUSION

# Conclusion

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Titanium has become the material of choice for numerous aerospace applications

However, new manufacturing processes are essential to enhance Ti cost competitiveness





ESTAS INFORMAÇÕES SÃO PROPRIEDADE DA EMBRAER E NÃO PODEM SER USADAS OU REPRODUZIDAS SEM AUTORIZAÇÃO POR ESCRITO.