

# **Towards a new Titanium Sector: Aerospace**

## **4<sup>th</sup> Biennial Conference**



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**Director: Titanium Centre of Competence**

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# Outline



- Why Titanium?
- The Opportunity for South Africa
- The SA Titanium Industry Strategy
- Primary Titanium Production
- Conclusion: How are we doing?

# Why Titanium?

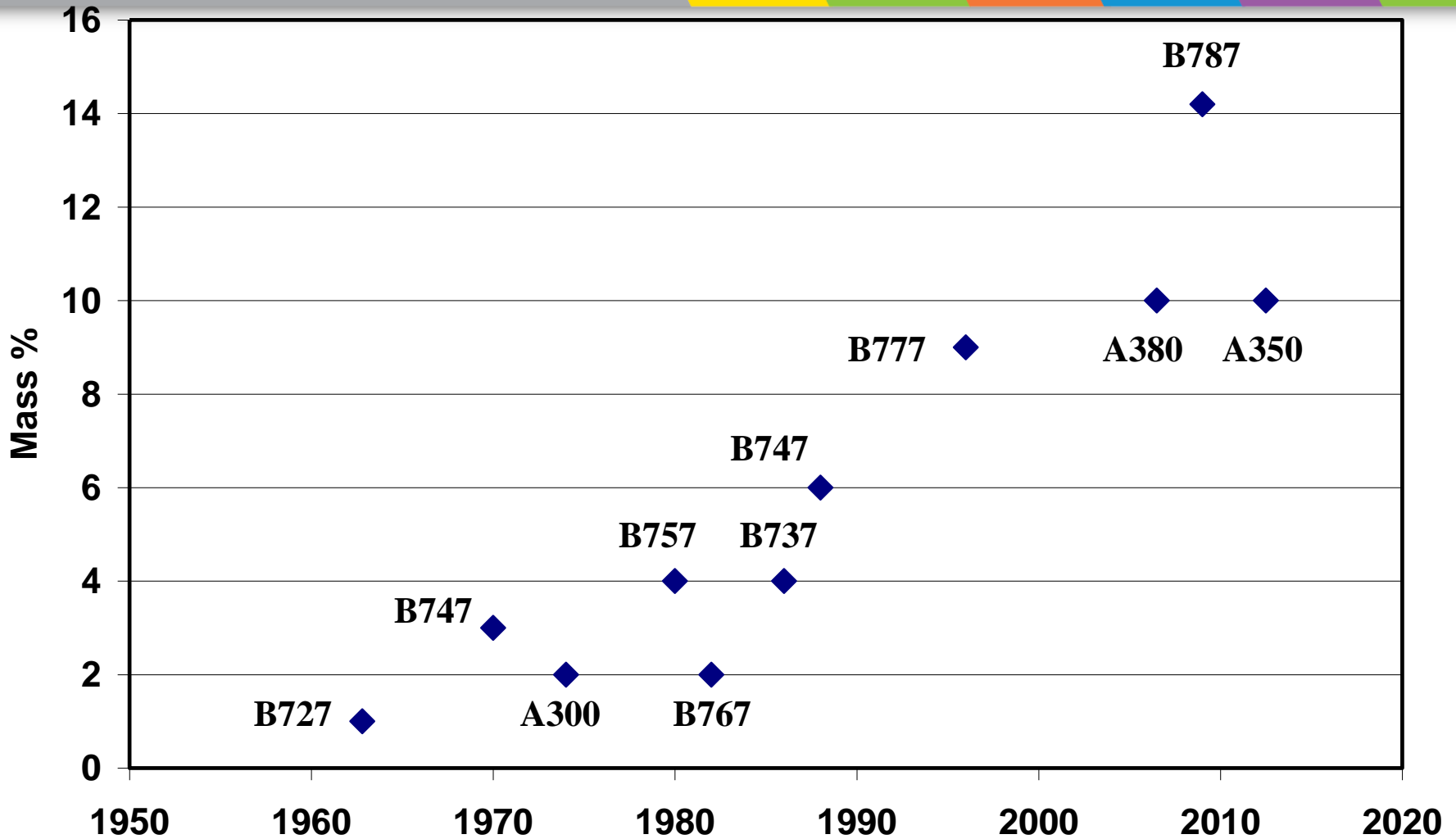
- Ti is the 4th most-abundant structural metal in the earth's crust
- A relatively new metal - Dr Wilhelm Kroll produced the first significant quantities of Ti in 1932 (Kroll process)
- Since the 1950s Ti has been an aircraft metal; first for military, later for commercial aircraft
- Titanium alloys' strength compares favourably to stainless steels and superalloys, but its density is only about 56% that of steel
- Commercial alloys of Titanium are useful to temperatures of about 540°C to 600°C
- Titanium is exceptionally corrosion resistant - outstanding in seawater and in the human body (used for implants)

# The SR-71 Blackbird



- Designed & built in 1959 - 1963
- Constructed 90%+ from Ti alloys
- Fastest airplane ever:
  - Mach 3.2 (3700 km/h) at 80 000 ft (~ 24 km)
  - New York - London: 1h 55min
- Fuselage skin temperature up to 370°C
  - Needed to be lightweight, strong and corrosion-resistant

# Titanium Content in Commercial Aircraft



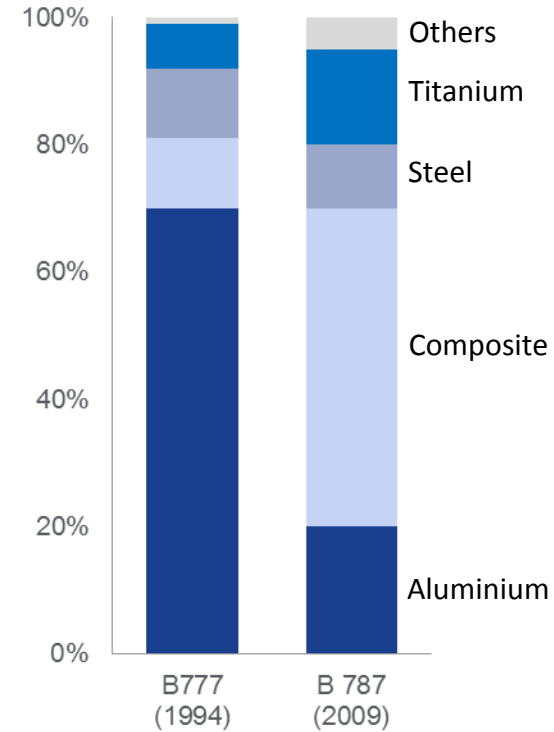
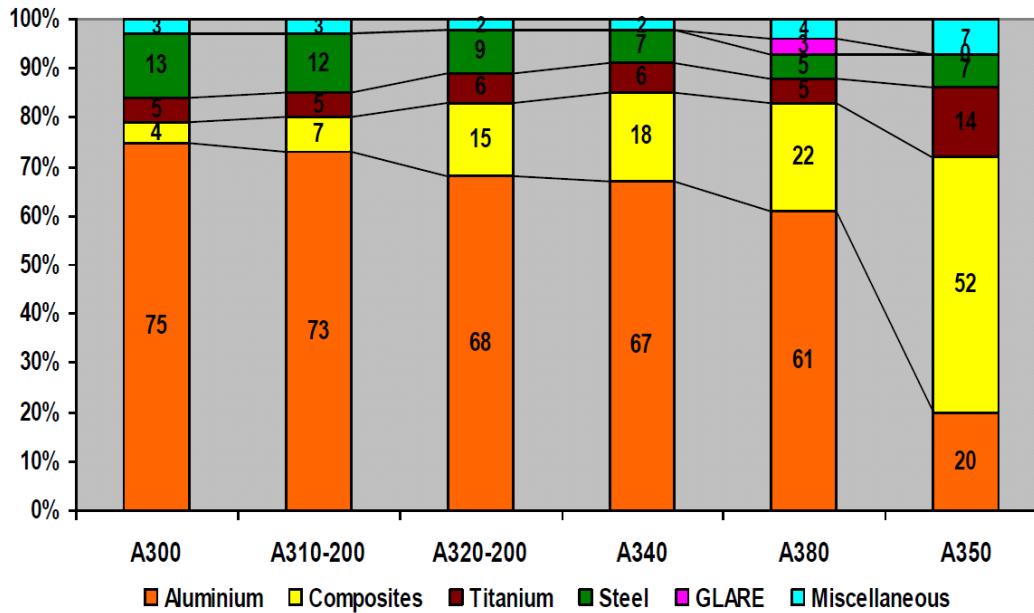
J Monahan, ITA Conference (2006)



# Materials used in Modern Aircraft: Composites vs Titanium

## Airbus Basics

- Share of structural materials, Airbus a/c



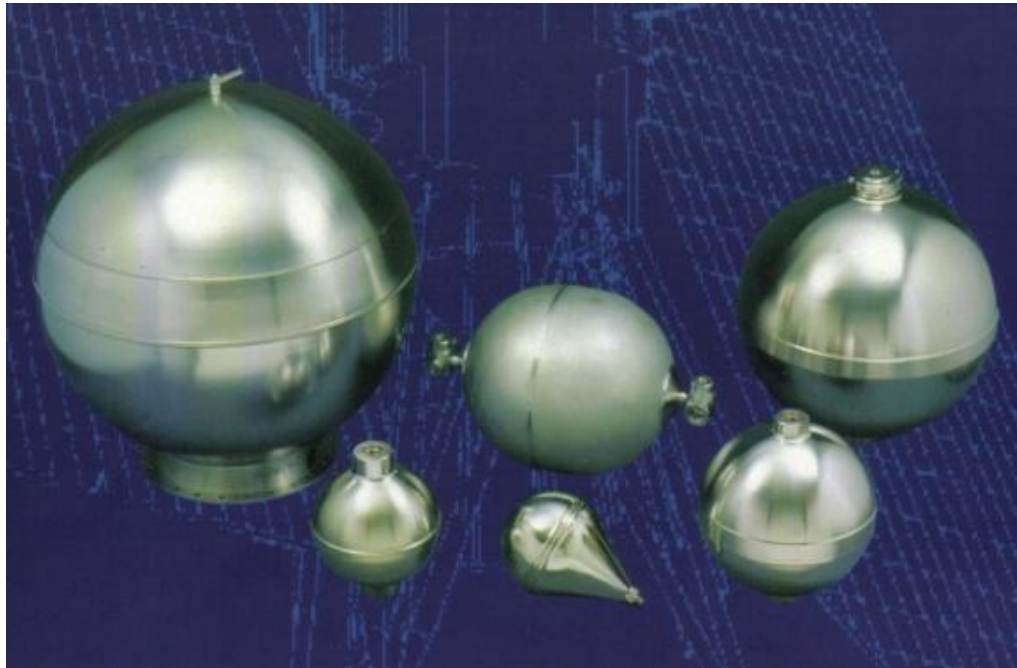
Source: Engineering News Online, American Institute of Aeronautics & Astronautics



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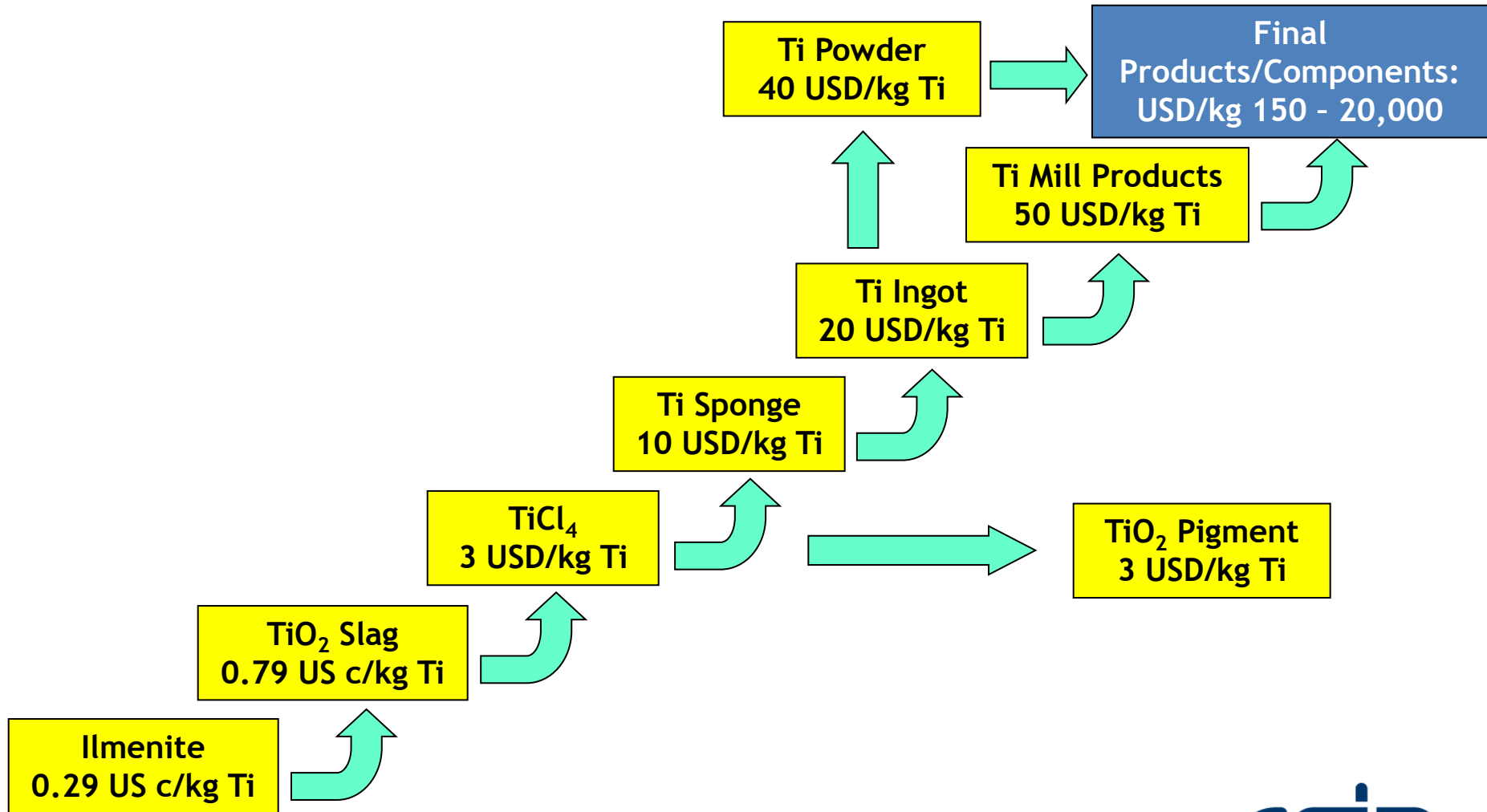
# Titanium for the SA Space Strategy

Titanium alloys are widely used for satellite components and sub-systems and launch vehicle components



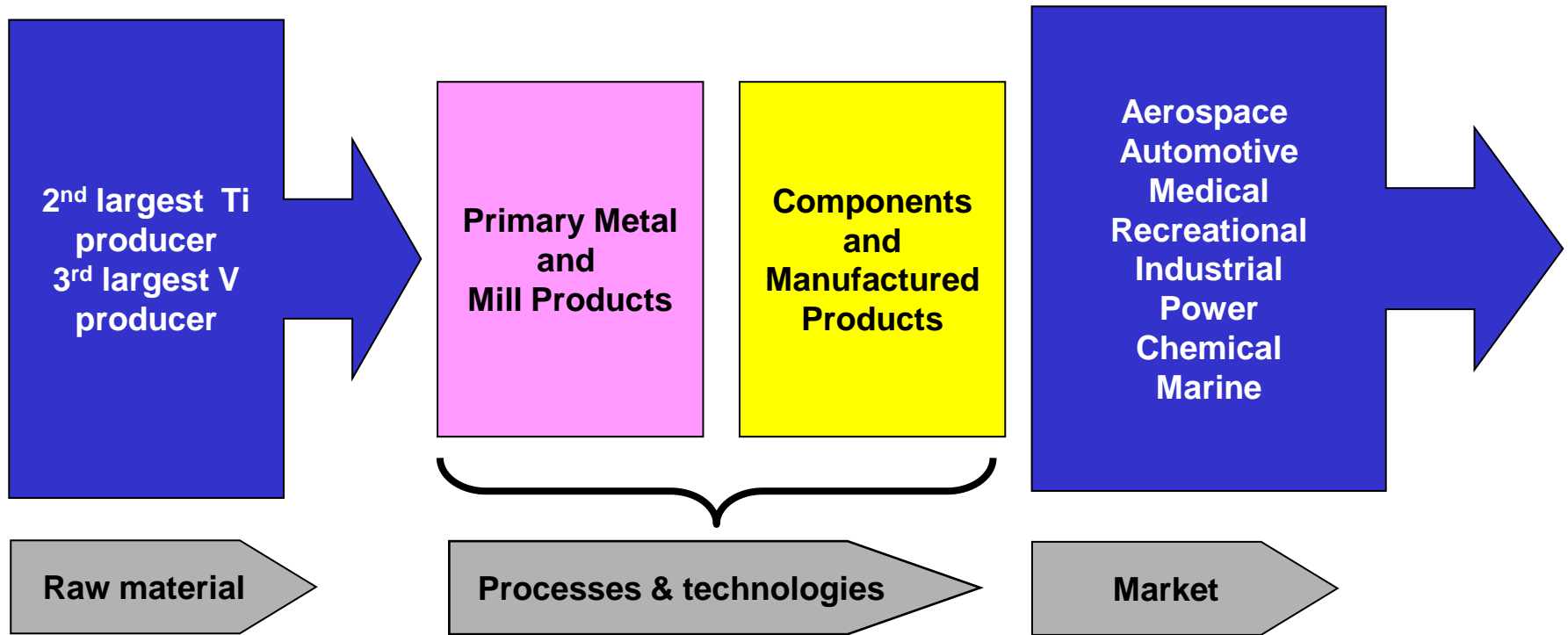
Pressure vessels for satellites produced from titanium alloy in South Africa in the 1990s

# The Titanium Value Chain





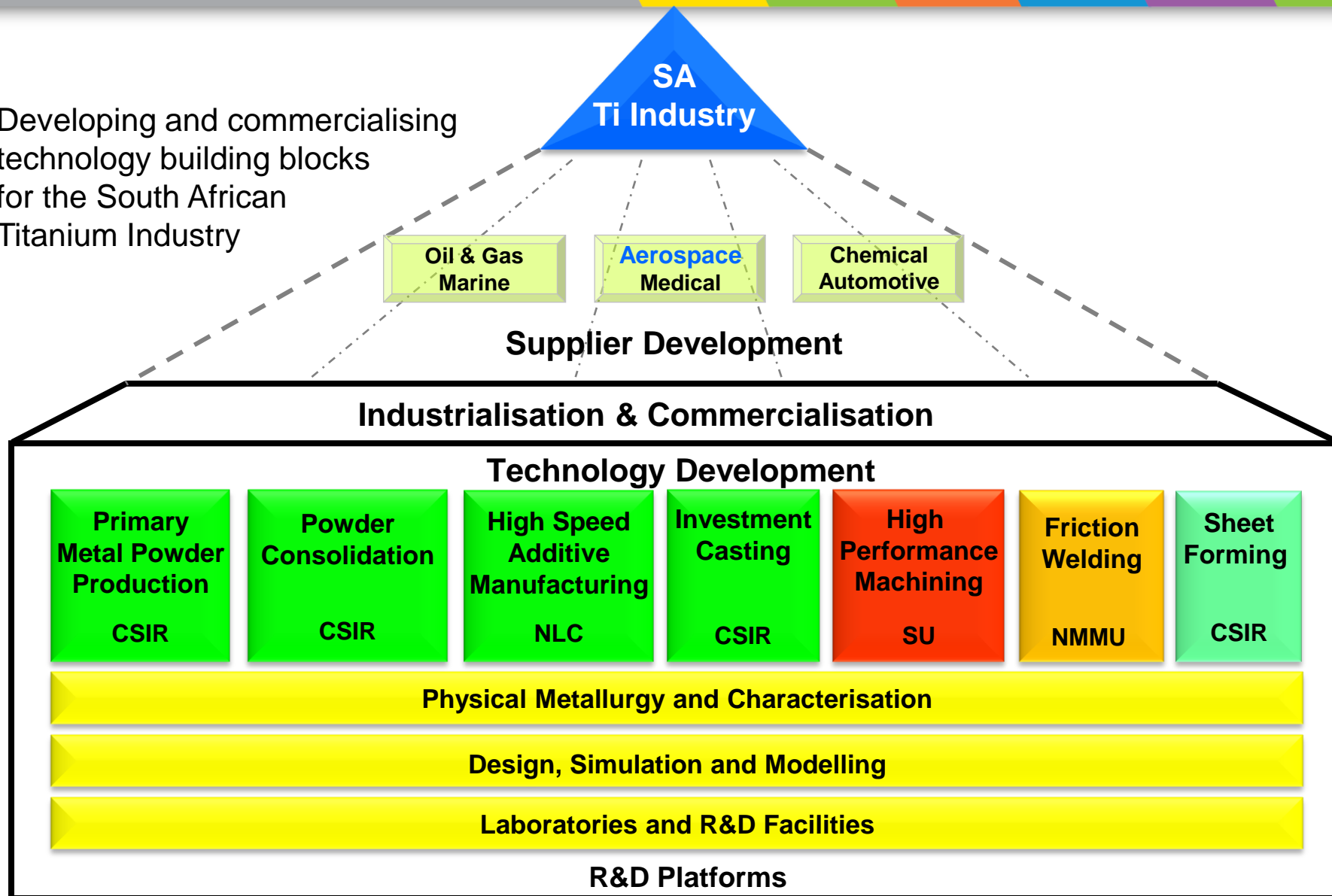
# SA Opportunity – Technology-led Industry Development



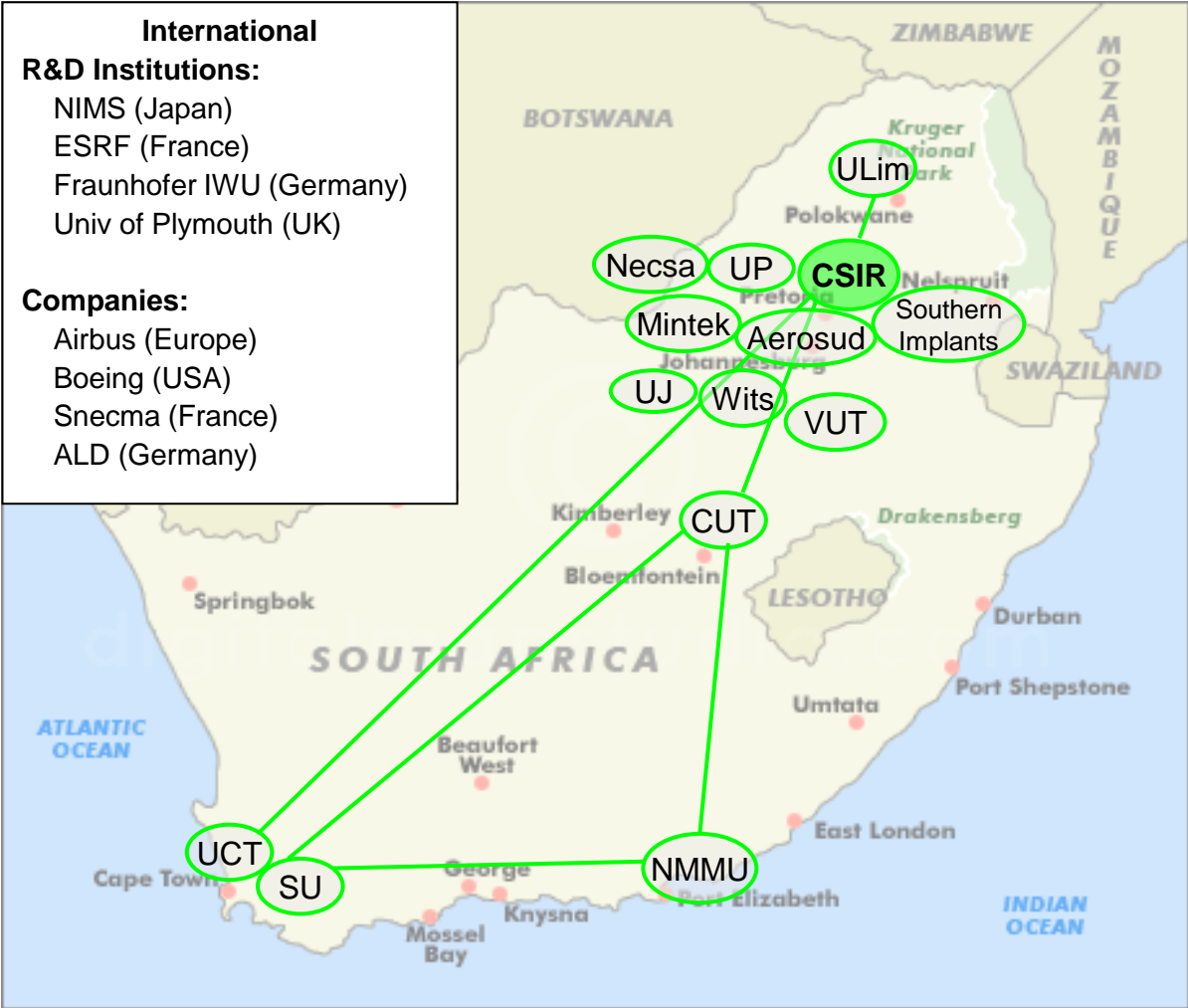
**The Titanium Centre of Competence integrates and coordinates R&D and commercialisation across the value chain**

# Titanium Centre of Competence

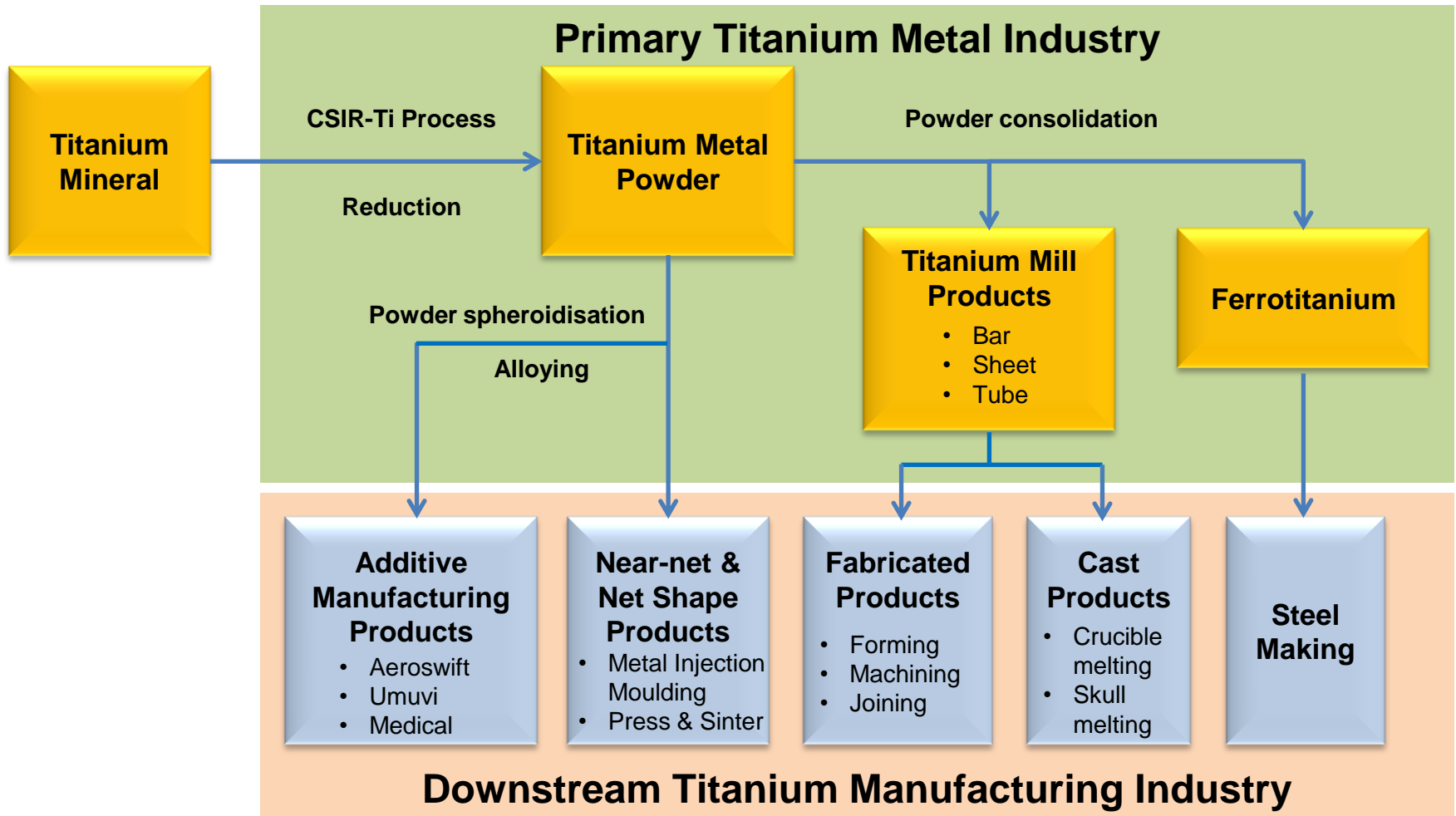
Developing and commercialising technology building blocks for the South African Titanium Industry



# Titanium Centre of Competence Collaborators



# Envisaged New SA Titanium Metal Industry



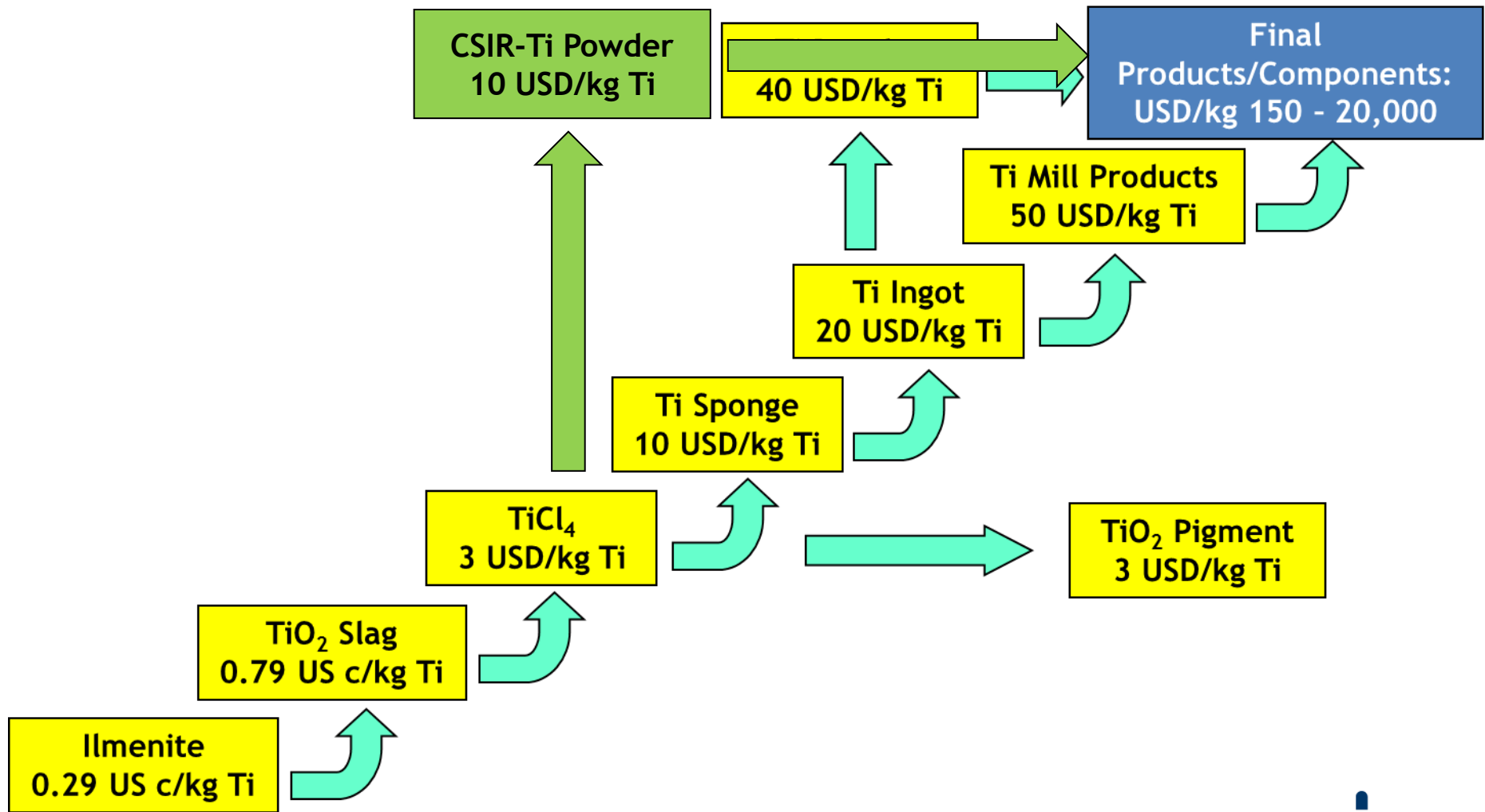
# Primary Titanium Production Objective



Commercialise a cost-effective and internationally competitive alternative process for producing primary titanium metal powder in South Africa



# Cheaper Titanium Powder – Changing the Game



# Primary Titanium Industrialisation Plan

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

## Titanium Centre of Competence

### Primary Ti Production (CSIR Process)

Basic Development

Pilot Phase  
(2kg/h)

Feasibility Phase

Demonstration Plant  
500 tpa  
Commercially Pure (CP) Ti

World-Class Plant  
Production: 20 000 tpa  
CP Ti and Ti Alloy

Completed

Under construction

Commercial partners

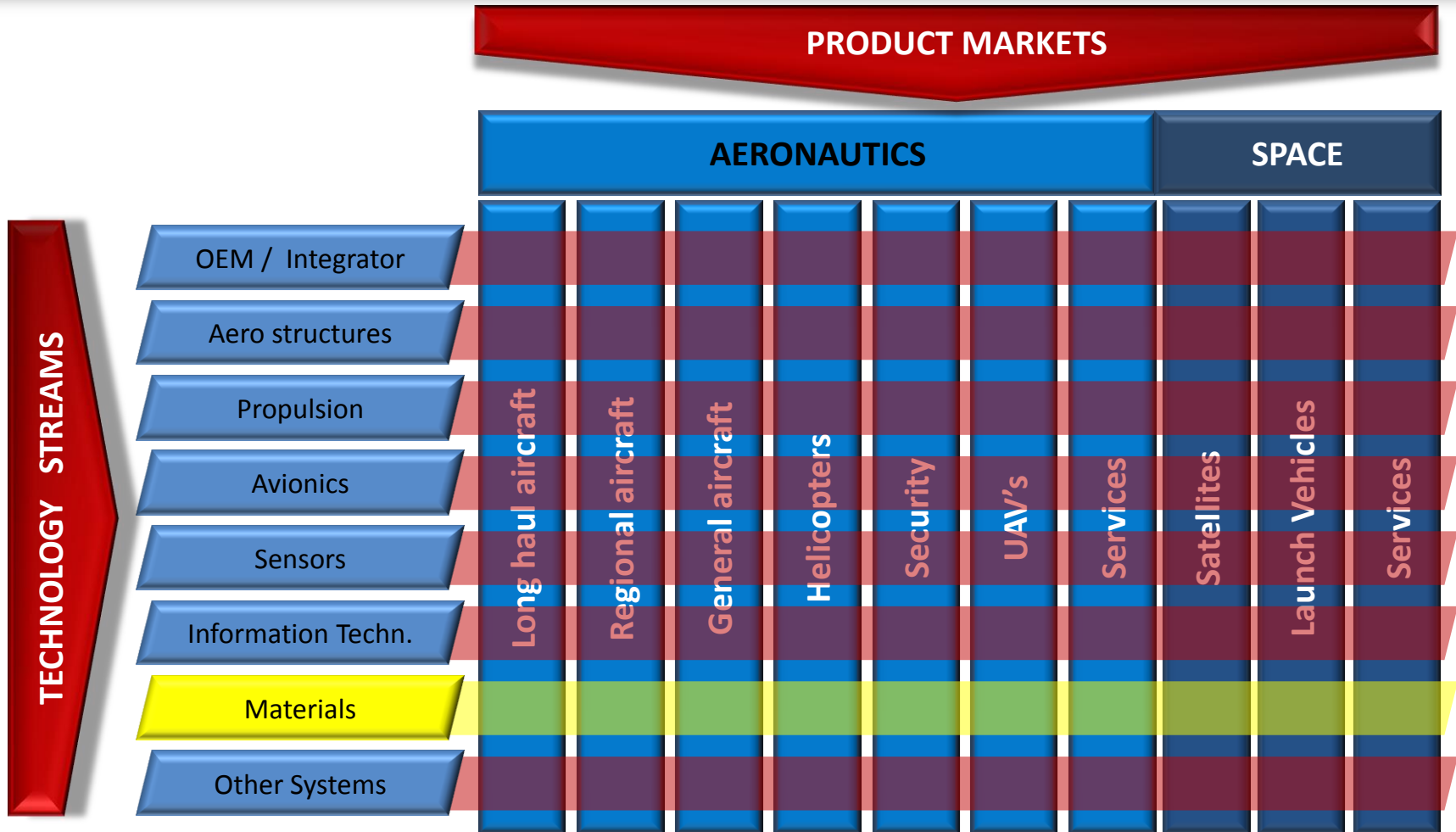
### Downstream Products

Additive Manufacturing

LAM large parts (Aeroswift)

Upscaling, Qualification, Industrialisation

# Potential Impact on South African Aerospace



Significant industry revenue from Materials is possible



# CSIR Light Metals Team





# Thank you

