
IMS ManuVation 4.0 Workshop
25-26 February 2019
South African Aerospace Preparedness and Impact of Digitalisation
AEROSUD
Johan Steyn
Managing Director of Aerosud


Contact us
Smart Supplier
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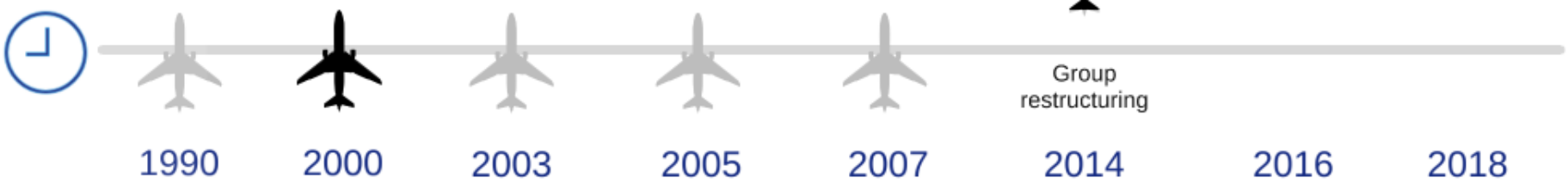
Group Introduction
Future Technologies
Strategic Partners
Aviation Market
AEROSUD


BUILT ON
PASSION
AEROSUD

Company Timeline



1990

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Company formed

2000

BOEING

First Production Program

2003

AIRBUS

SAFRAN

A320 Galley systems and welded assemblies.

2005

SPIRIT AEROSYSTEMS

A350 Build to Print – CFRTP and welded assemblies

2007

AIRBUS DEFENCE & SPACE

Design and Build risk share partner on Airbus A400M

2014

AHRLAC

aeroswift

Group restructuring

2016

AEROSUD Technology Solutions

2018

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Built to fly

employ **660** people

$ 70 Mil annual turnover

investment in **R&D** 6%

15 local sub-tier suppliers

28 years experience

300 international & local suppliers

100 % Export

local added value 40%

2016 - DTI Manufacturer of the year

2017 - DTI Exporter of the year

2018 - SADC Quality Award

SAFRAN

AIRBUS

SPIRIT AEROSYSTEMS

AIRBUS DEFENCE & SPACE

BOEING

EASA

Nadcap

iaqg

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Build smart. Fly further, faster

A smart supplier built on decades of innovation and versatility

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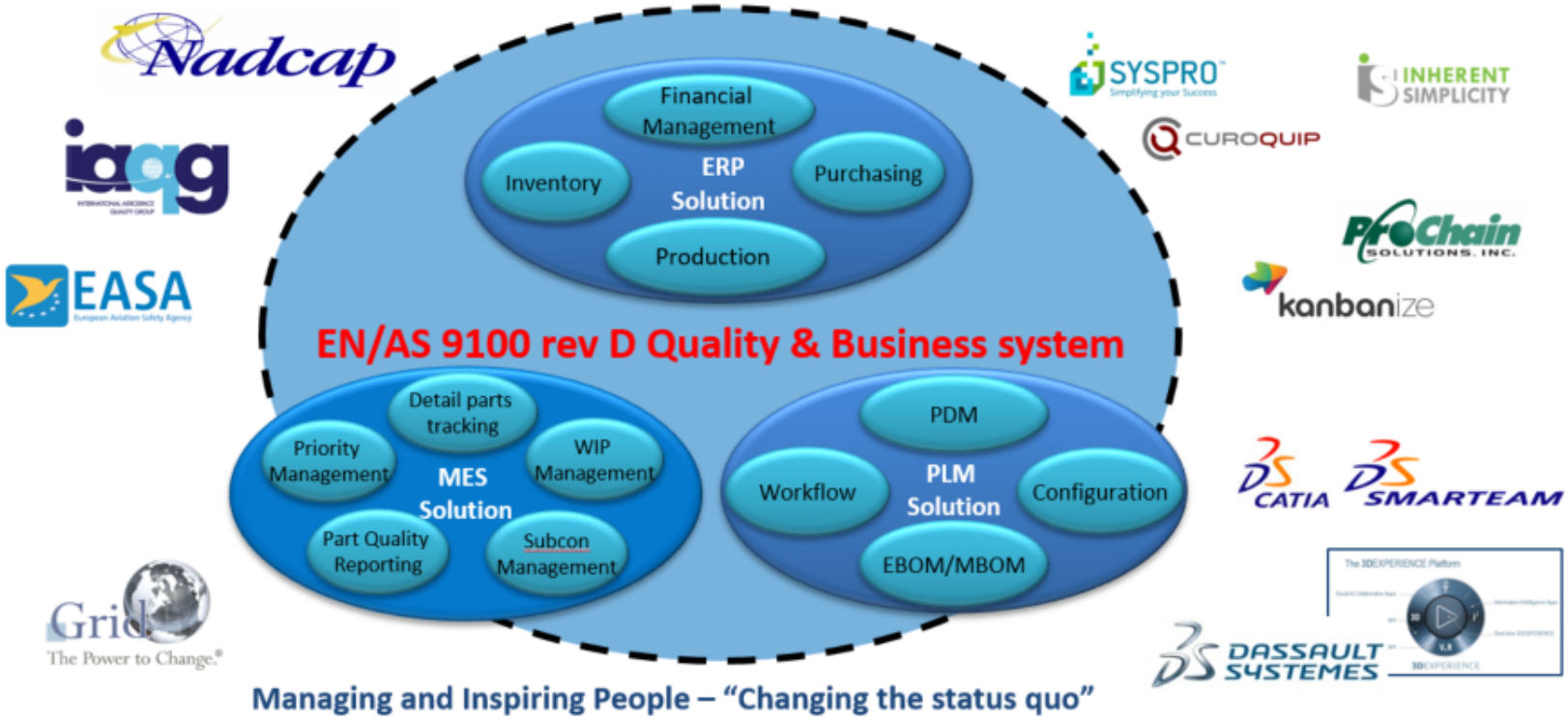
Integrated Systems



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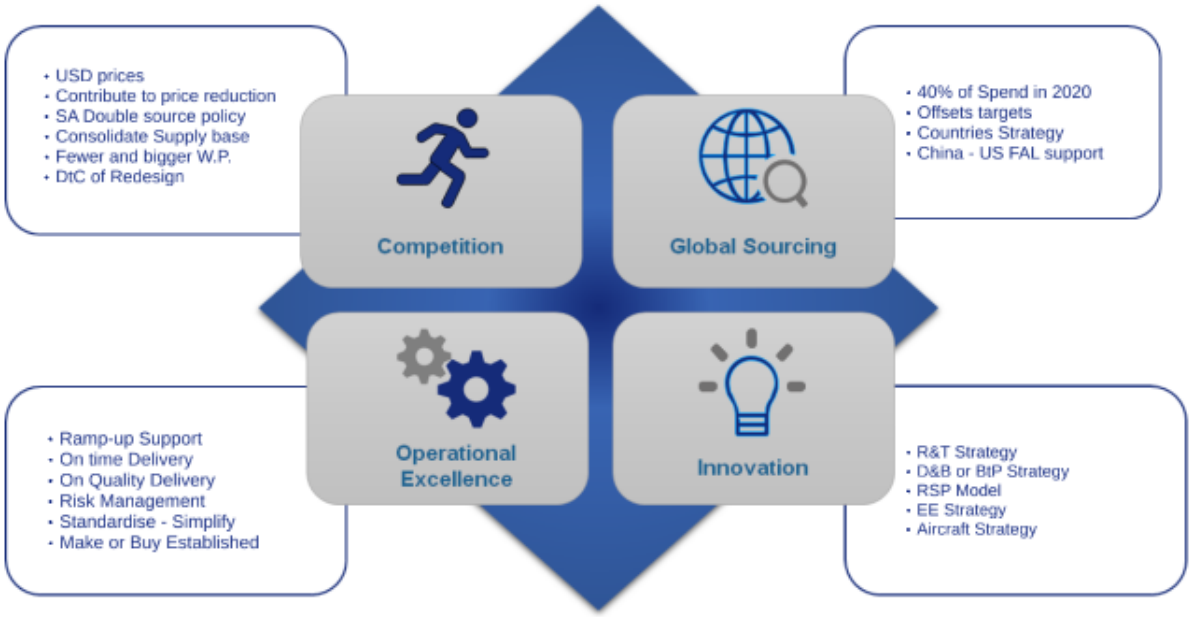
AVIATION
MARKET

The Market Reality

- **40% Rate Increase**
- **20% Cost reduction drive**
- **Global Collaboration**
- **Innovation**



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Efficiency drive

Alternative supplier drive

Price reduction drives

Disruptive Manufacturing practices

Technology

effects of market reality

Global low cost sourcing

Risk management oversight

Increased quality audits

Industry 4.0

Open book pricing

Inefficient supply chain actions

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Efficiency drive

Alternative supplier drive

Price reduction drives

Disruptive Manufacturing practices

Technology

effects of market reality

Resulting conflict:

Profitability vs Reliability

Global low cost sourcing

Risk management oversight

Increased quality audits

Industry 4.0

Open book pricing

Inefficient supply chain actions

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Building and ever flourishing
Aerospace company

Adopting Theory of Constraints as a business methodology

Reliability Model = Stability + Growth

Key Implementation steps:

- TOC adopted in all aspects of the supply chain
- Comprehensive **Goal Tree**
- **Logical Thinking tools**
- **Critical Chain Program Management**
- Use of Throughput Accounting
- Consumption based replenishment (DDMRP)
- Management in full Supply Chain
- Deployed GRID to influence **Cultural behaviour**

Key Results achieved:

- Production **lead time reduction from 50 to 17 days**
- WIP and **SOH reduction by 30%**
- High reliability in new part Industrialisation and
- On time project completion
- **Increased Throughput by 20%**
- Reduced intervention and expediting
- Initiation of new strategic growth and Investment areas
- New Service offering

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COLLABORATIONS

CAMASA

Commercial Aviation Manufacturing Association South Africa

Purpose:

Growth-Bilateral between Government and Industry to significantly boost SA Commercial Aviation Manufacturing Exports through:

- Integrated Industry Growth Plan
- Expanding Advanced Manufacturing
- Future-orientated competitiveness (IoT, Ind 4.0)

and in particular

Promote direct partnerships with international Original Equipment Manufacturers (OEM's) and/or Technology partners, to demonstrate and showcase local industry capabilities and capacities to collaborate.
Forging stronger ties with the global Aviation Manufacturing.

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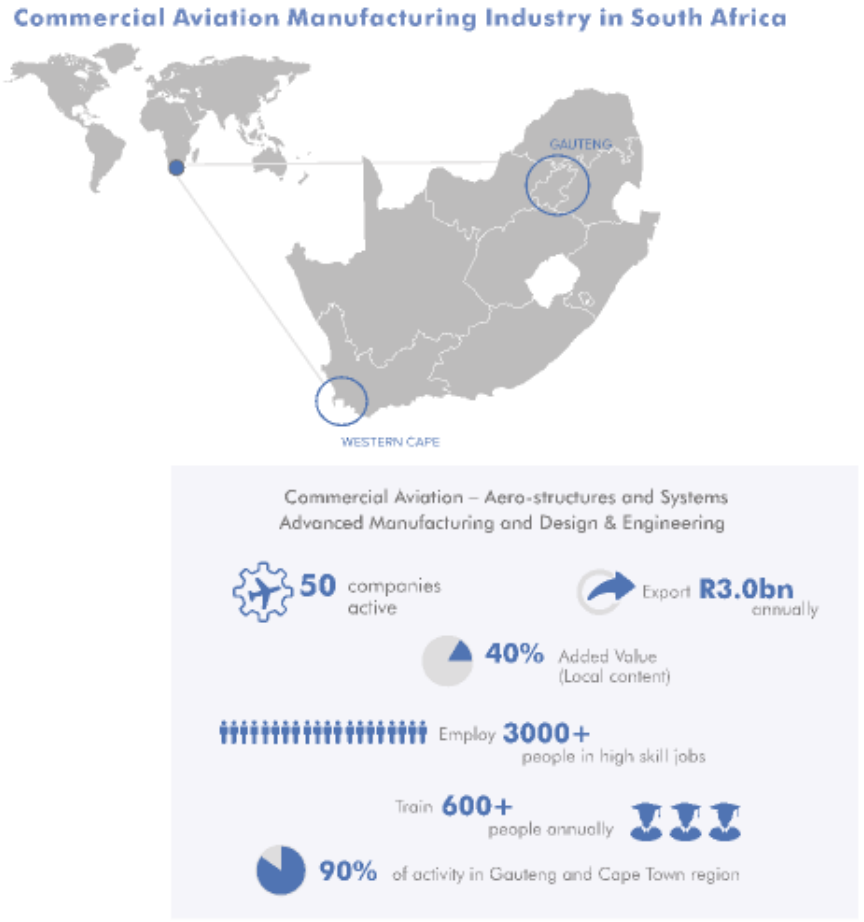

CAMASA - Domestic Collaboration

Aerospace Industry Support Initiative and Centurion Aerospace Village **(the dti)**

Provincial & Regional Economic Development Agencies

Titanium powder Production & Additive Laser Manufacture (ALM)

Scientific & Industrial Research and Innovation

International Partnerships with OEM's Tertiary Education

Advanced manufacturing & Tooling skills

Cross sectorial Composite Industry capability

Transport and Manufacturing sectors skills development

CAMASA - Centurion Aerospace Village

Gauteng Province

GGDA

the dti
Department: Trade and Industry
REPUBLIC OF SOUTH AFRICA

- Contribute 43% of GDP
- 25% of SA's mineral production
- World class Industrial infrastructure, roads, communication
- Main manufacturing center – 50% of all factories in SA

Aerospace Manufacturing Industry Requirements

• **Apprentice Training Centre**	**1 000 - 2 000 sqm**
• **SMME & Incubation centre**	**200 - 2 000 sqm**
• **Attract 5 – 10 SMME's to expand**	**500 - 2 000 sqm**
• **Advanced Manufacturing Showcase**	**3 000 - 5 000 sqm**
• Surface Treatment and Painting facility	1 500 – 3 000 sqm
• **Hard metal machining facility**	**1 000 – 2 000 sqm**
• **Large assembly facility**	**10 000 sqm**
• Central Logistics & Warehousing	10 000 sqm

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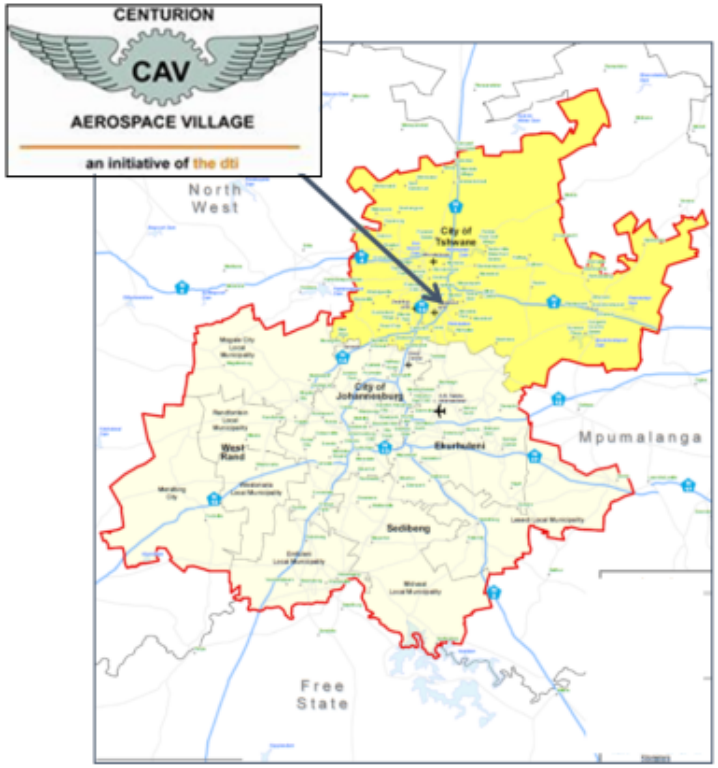

BRICS Collaboration

BRICS countries encompass 42% of the world's population and cover 26% of the world's territorial area. Additionally, Intra-BRICS trade now accounts for approximately 18% of global trade, and its young people make up 47% of the world's youth (aged 15-24).

With their economic aggregate covering 23% of the world's total, the five countries of the BRICS, along with other emerging-market countries, have become the main engines op global growth. The immanence of the Fourth Industrial Revolution and the rise of the digital economy loom over each BRICS country; both are full of promise and peril.

Agreed focus areas for BRICS Aviation Work stream

Regional Aviation Seminar:
- Public Policy and Regulations
- Airline Business models
- Infrastructure
- CNS/ATM

B2B Supply Chain Development :
- Capability assessment
- Capacity Development
- SME development

Skills development & Qualifications:
- Pilot training
- MRO Engineering and Technicians
- Aviation school

Development Funding:
- BRICS Aviation Fund
- NDB – New Development Bank
- Venture Capital (Angel network)

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FUTURE TECHNOLOGY

Future of Production in South Africa

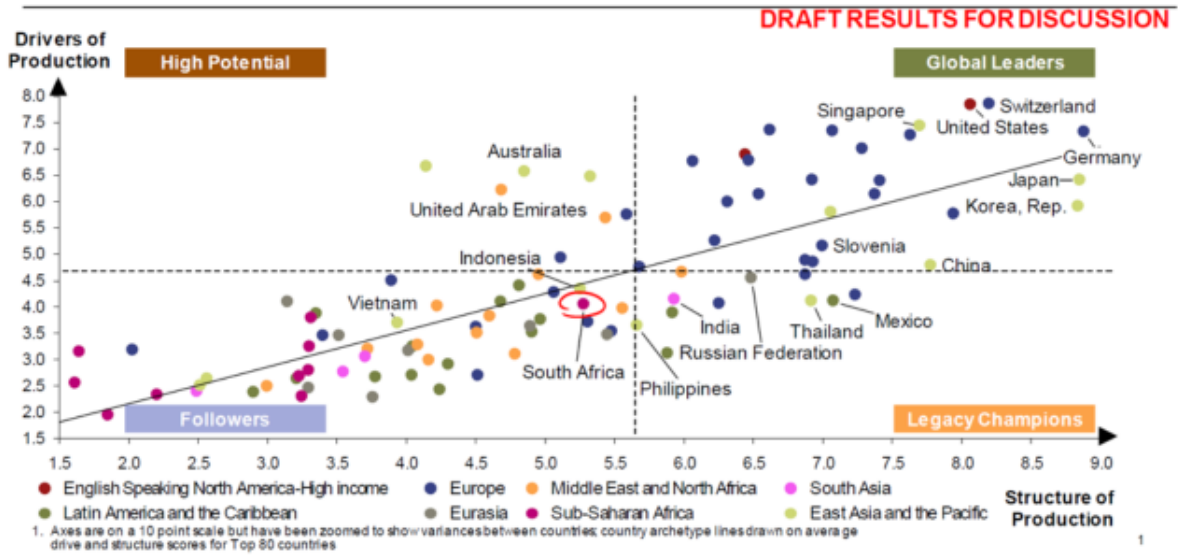
Readiness for the Future of Production Report 2018

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

In collaboration with A.T. Kearney

The country archetype framework has been applied to conduct analysis[1] of the 100 countries included in the beta model



1. Axes are on a 10 point scale but have been zoomed to show variances between countries; country archetype lines drawn on average drive and structure scores for Top 80 countries

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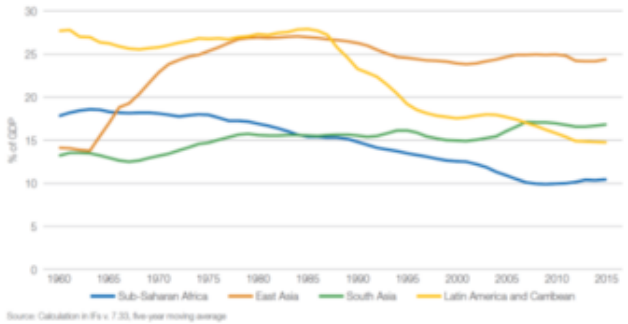
Future of Production in South Africa

Made in Africa
Manufacturing and the fourth industrial revolution

ISS | INSTITUTE FOR SECURITY STUDIES

Figure 3: Manufacturing as a percentage of GDP by selected global regions



Source: Calculation in IFs v. 7.33, five-year moving average

Recommendations

- Capitalising on the opportunities presented by the fourth industrial revolution will require a concerted effort from African governments that will have to lead the charge.
- Leaders in key growth-locomotive countries need to implement concrete measures such as the establishment and support of special economic zones and clear national and regional industrial policies.
- Developmentally focused leaders need to put the right incentives in place, such as export orientation, support to embryonic manufacturing, and policies to move labour and capital into more productive enterprises.
- Rapid growth in manufacturing, agro-industry and tradable services requires access to larger markets, hence the imperative of progress with regard to Africa's regional economic integration.
- Nationally, industrialisation efforts require well-administered, supportive public policies and effective administrative systems.
- Efforts to combat corruption associated with facilitating export procedures, such as removing trade friction costs due to poor logistics, require specific and ongoing attention.
- The private sector needs effective government support, such as tax incentives and institutional reforms, to lower transaction costs in customs and business regulation to offset the costs for first movers.

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A decade of development Collaboration 2008-2018

Focus Areas and Outcomes

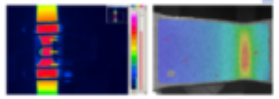
- *Long term friendships built on research*
- *Programmes including 7 Fraunhofer institutes*
- *Deep integration in SU Engineering department*

High Performance Machining of Light Metals 2008 -2013

Resource Efficient Process Chains 2013- 2018

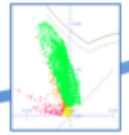
Stellenbosch Technology Centre 2016

Superplastic forming of Ti64 sheet 2016- 2019



MOU signed February 2018

Metallic Forming limit curves 2018 - 2019



Active projects

Future projects 2019 - 2023

- ***Heat Assisted Forming***
- ***Benchmark study***
- ***Composite demonstrator***
- ***Ultra high pressure forming***

Fraunhofer

UNIVERSITEIT iYUNIVESITHI STELLENBOSCH UNIVERSITY

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Digitalisation of CFRTP Forming and Cellular Core Technology Development Cycle

Focus Areas and Outcomes

CCT Manufacturing process (cure) digitalization

MSC Marc® Non Linear simulation for design feasibility and optimisation

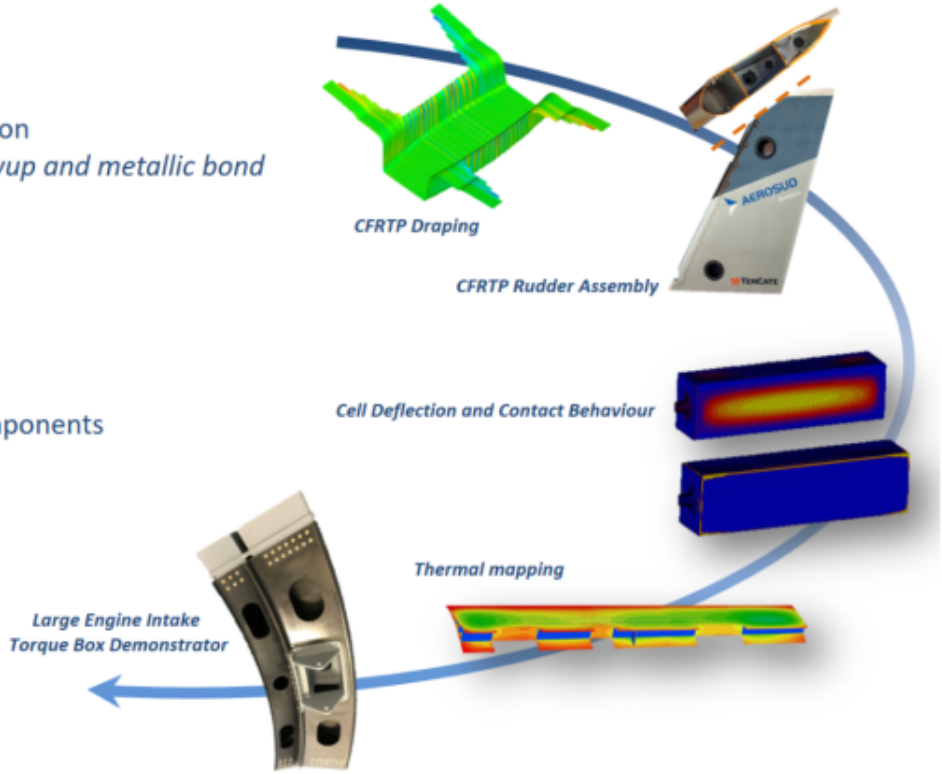
- *Established interact between the thermoplastic cell, thermoset layup and metallic bond assembly tool*
- *Final component geometry and internal stress state*
- *Eliminating expensive "trial and error" prototype manufacturing*

CCT tooling and component thermal digitalisation

MSC SC Cradle® CFD simulation for thermal mapping of tools and components

- *Efficient autoclave loading configuration*
- *Location of control thermocouples*

Collaboration partners



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Digitalisation of Advanced Metallic Forming

Focus Areas and Outcomes

- *Stamping and fluid cell forming process digitization*
- ***ESI Group** Pam-stamp forming simulation software is used for concept feasibility studies, tooling and blank optimisation and manufacturability validation.*
- *Efficient tooling and blank concept development.*
- *Less dependant on "trial-and-error" method for concept validation.*
- *Cost saving with the improved accuracy of final components*

Collaboration partners

the dti
Department:
Trade and Industry
REPUBLIC OF SOUTH AFRICA

UNIVERSITEIT
IYUNIVESITHI
STELLENBOSCH
UNIVERSITY

Fraunhofer
IWU

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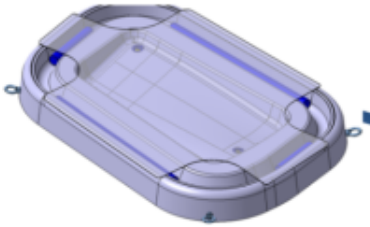
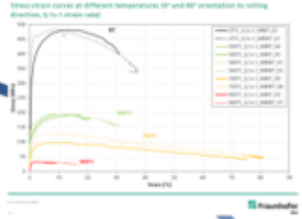
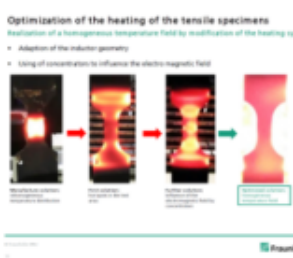
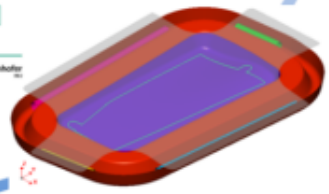


Blank and Tool Die Concept Designs

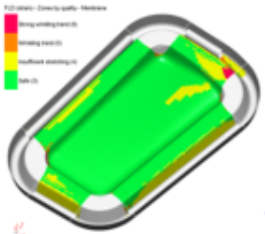


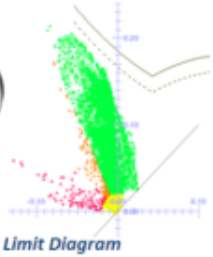
Material Characterisation





Pam-stamp Finite Element Model



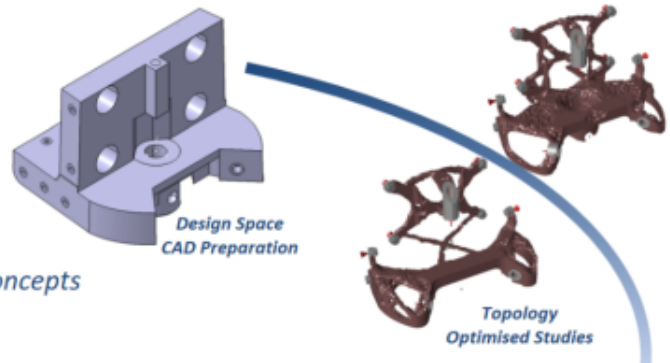


Pam-Stamp Forming Limit Diagram Manufacturability Validation

ALM Knowledge base
- Design and Optimisation for certification

Focus Areas and Outcomes

- *Optimisation studies for both prismatic and biomimetic design philosophies.*
- *Internal featuring and surfacing concepts*
- *Optimisation and validation in build preparation & process through simulation.*
- *Component qualification and certification investigations and validation.*
- *Component weight saving with equivalent strength compared to traditional design concepts*
- *Reduced ALM build failure risk.*



Design Space CAD Preparation

Topology Optimised Studies

NURB Surfaced Concept

Simufact Additive Displacement Contour Plot - Build Process Assessment

Pre-certification Assessment

Final Concept Ready For Formal Qualification/Certification Acceptance

Collaboration partners

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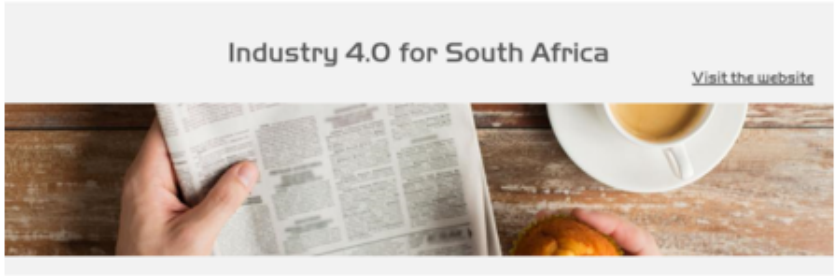
Trusted Online Community

4IR RSA | Monthly Newsletter



Foundation(s) of I4.0

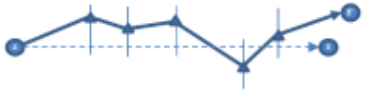
- IT Infrastructure
- Processes and Procedures
- Value streams
- Business Model

Pillars of I4.0

- Big Data
- Augmented Reality
- Simulation
- Internet of Things
- Cloud Computing
- Cyber Security
- Systems Integration
- Additive Manufacturing
- Autonomous Systems

"Soft" Issues

- Culture of the organisation
- Awareness in the organisation
- Knowledge in the organisation and or access to such knowledge
- Mind set of the people involved and affected in the organisation
- Approach to the challenge(s), i.e. a "roadmap" for the I4.0 journey



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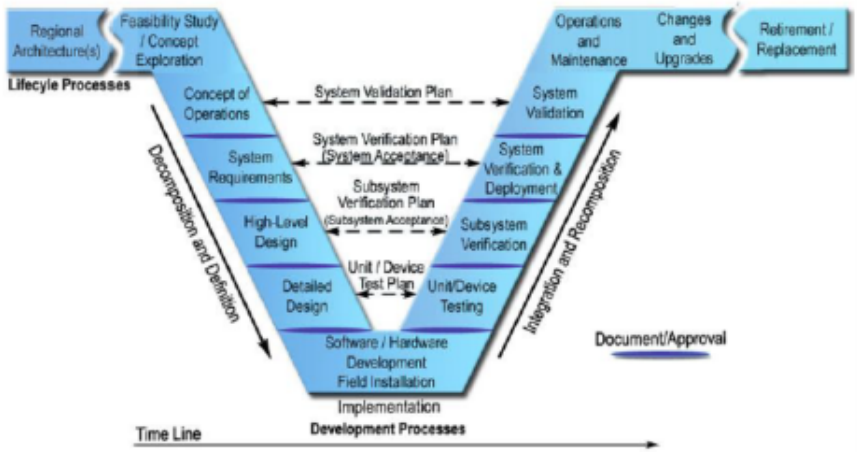
DIGITAL
TRANSFORMATION
Digital Landscape
Industrial Revolution
PLM
AEROSUD
OCTi
OCTi
4IR
Road Map
Future Technologies

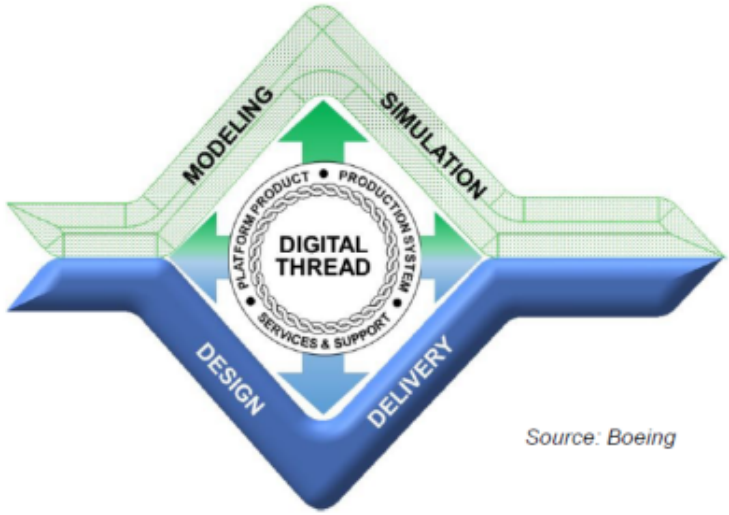
Design for Certification

1990s SE V



SOURCE: US Department of Transportation Federal Highway Administration
https://ops.fhwa.dot.gov/publications/seitsguide/section3.htm

2020s MBE Diamond



Source: Boeing

Transitioning from a document-focused mindset to a digital engineering mind set that leverages information flow across the lifecycle.

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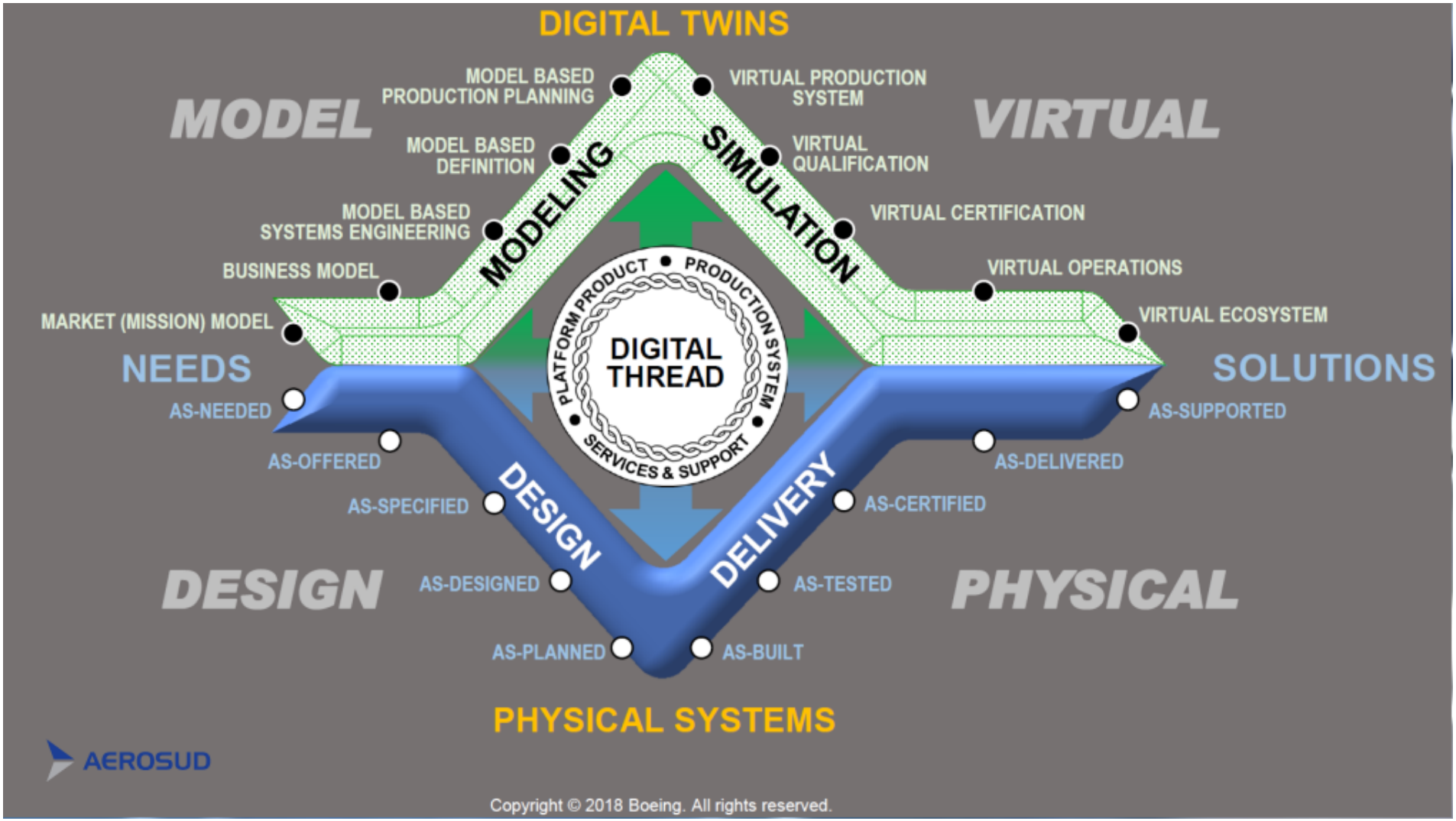
DIGITAL TWINS
MODEL
VIRTUAL
MODEL BASED PRODUCTION PLANNING
VIRTUAL PRODUCTION SYSTEM
MODEL BASED DEFINITION
VIRTUAL QUALIFICATION
MODEL BASED SYSTEMS ENGINEERING
VIRTUAL CERTIFICATION
BUSINESS MODEL
VIRTUAL OPERATIONS
MARKET (MISSION) MODEL
VIRTUAL ECOSYSTEM
MODELING
SIMULATION
NEEDS
SOLUTIONS
DIGITAL THREAD
PLATFORM PRODUCT
PRODUCTION SYSTEM
SERVICES & SUPPORT
AS-NEEDED
AS-SUPPORTED
AS-OFFERED
AS-DELIVERED
AS-SPECIFIED
AS-CERTIFIED
DESIGN
DELIVERY
DESIGN
PHYSICAL
AS-DESIGNED
AS-TESTED
AS-PLANNED
AS-BUILT
PHYSICAL SYSTEMS
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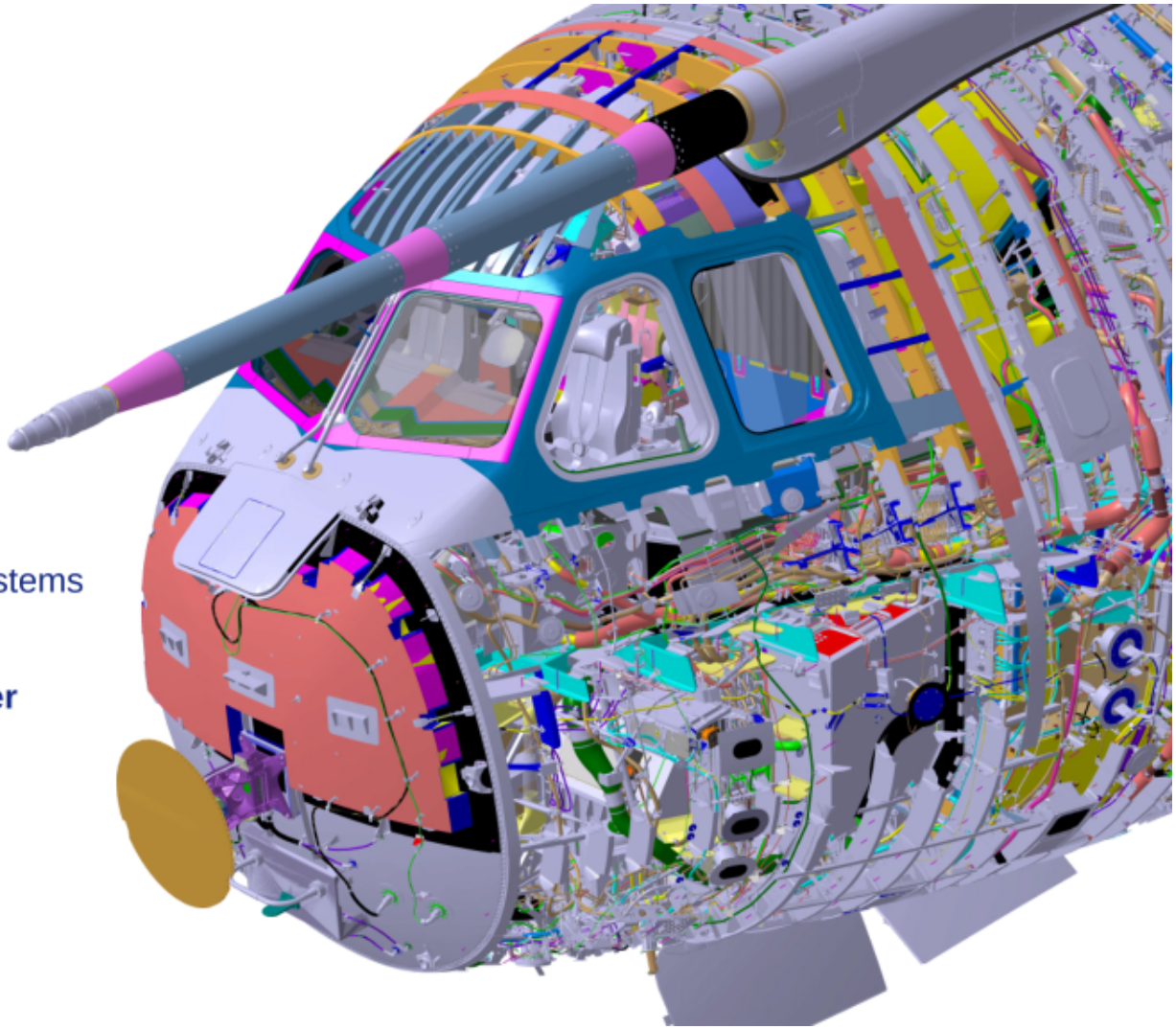
Digital Twin

Company Experience

- Collaborative Design
- Concurrent Engineering
- Digital Mockup
- Around the world
- Integration across different PLM systems

Design & Build risk sharing partner



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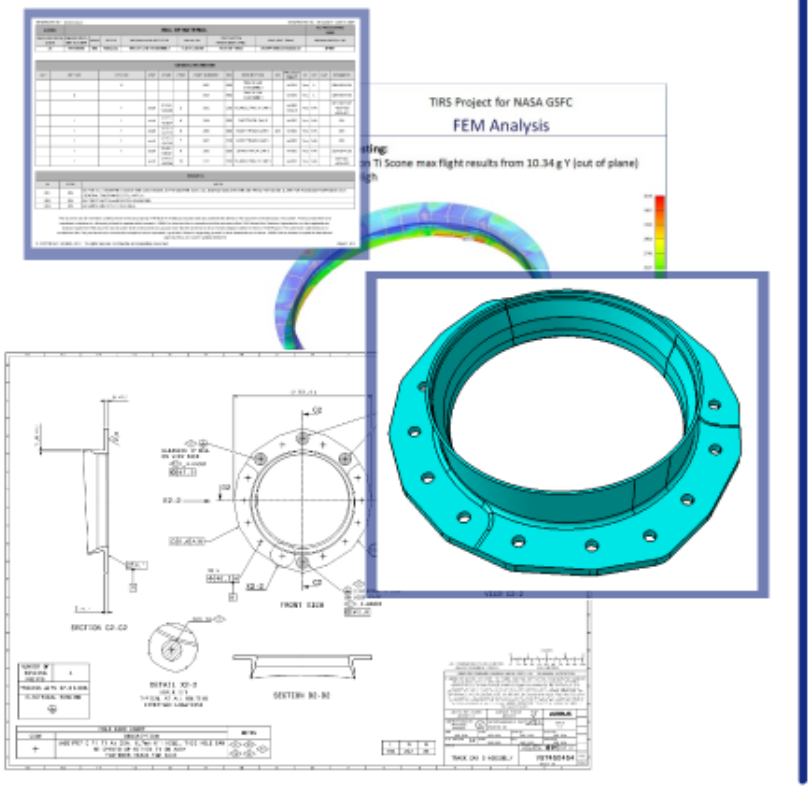
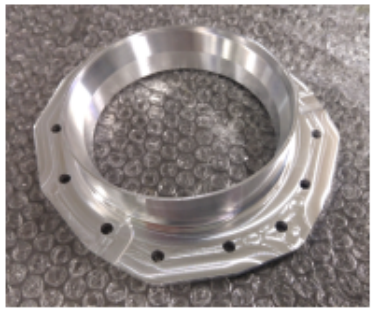
Digital Twin Part





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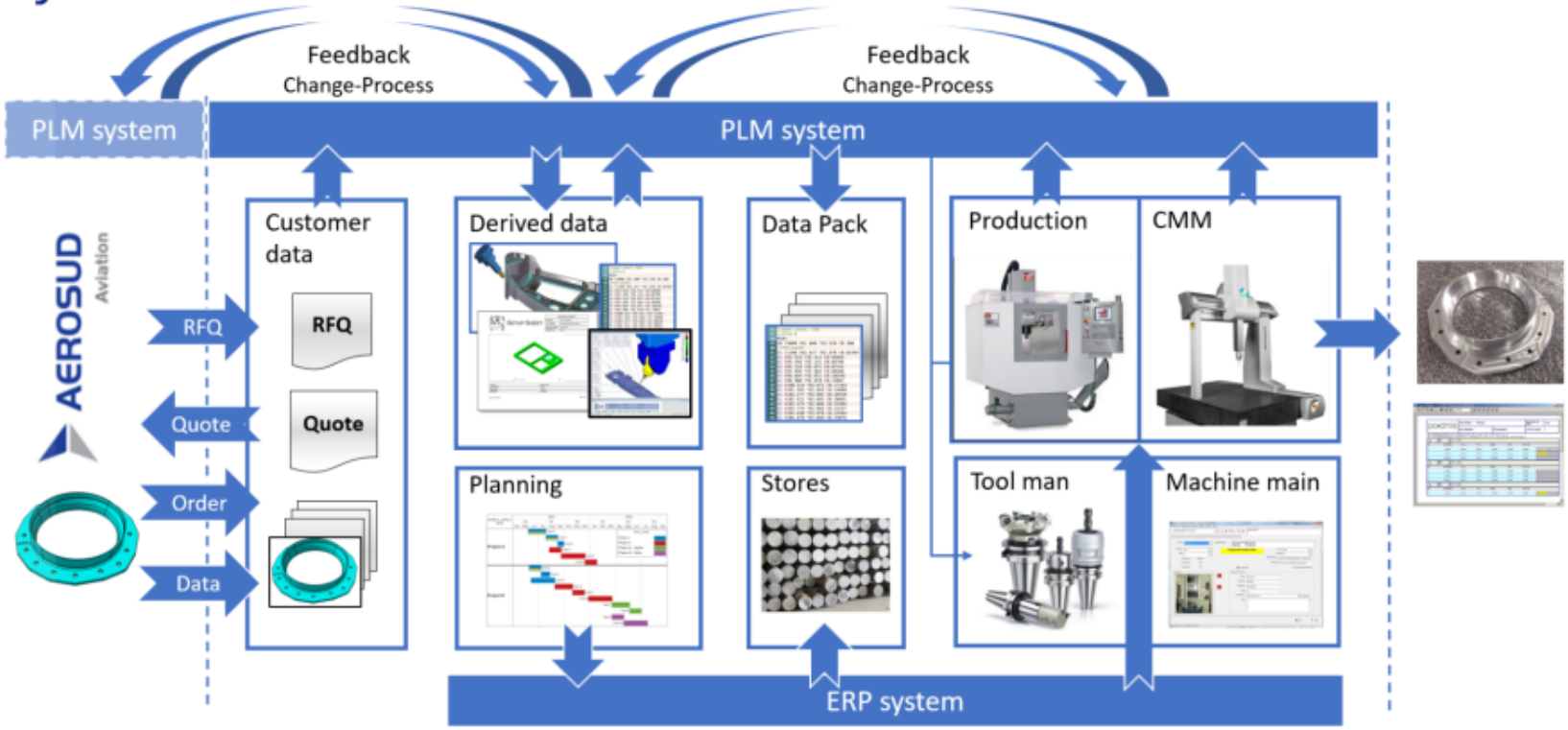
Digital Twin Facility



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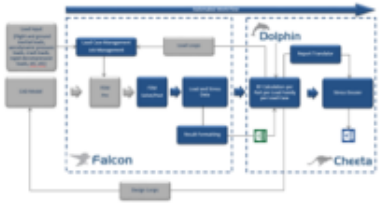
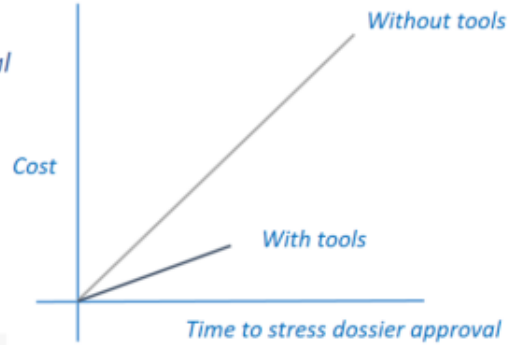
Design for Certification

Design Automation Tools

- *Automate CAE stress analysis process to account for load loops and design loops*
- *Standard stress analysis process using standard methods for RF/MoS calculation*
- *Automate process for Stress Dossier generation*
- *Reduce the quantity of stress recourses required*
- *Fast track stress engineer learning process*
- *Fast track Airworthiness Authority approval*





Patran
MSC Nastran
MSC Apex
Altair HyperWorks

Falcon
CAE Automation Tool

Dolphin
Collection of Stress Analysis Methods

Cheeta
Stress Analysis Automation Tool

EASA APPROVED

OEM APPROVED

FEDERAL AVIATION ADMINISTRATION Approved

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PLM Systems on the market

High End

TeamCenter, 3D Experience,
Windchill, SAP PLM

- Comprehensive functionality
- Expensive
- Long to implement
- Complex

Entry Level

Autodesk Vault, Solidworks PDM,
Various cloud based sysems

- Easy to implement - from the box
- Limited functionality
- Not very customisable
- Very little local expertise

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PLM Systems on the market

High End

TeamCenter, 3D Experience,
Windchill, SAP PLM

- Comprehensive functionality
- Expensive
- Long to implement
- Complex

Serious commitment

Entry Level

Autodesk Vault, Solidworks PDM,
Various cloud based sysems

- Easy to implement - from the box
- Limited functionality
- Not very customisable
- Very little local expertise

Does not deliver

AEROSUD

aras INNOVATOR®

aras INNOVATOR®

Comprehensive functionality
Fully Customisable
Low startup cost
Quick, agile implementation
Business Automation Framework

aras INNOVATOR®

Comprehensive functionality
Fully Customisable
Low startup cost
Quick, agile implementation
Business Automation Framework

Local Expertise ?

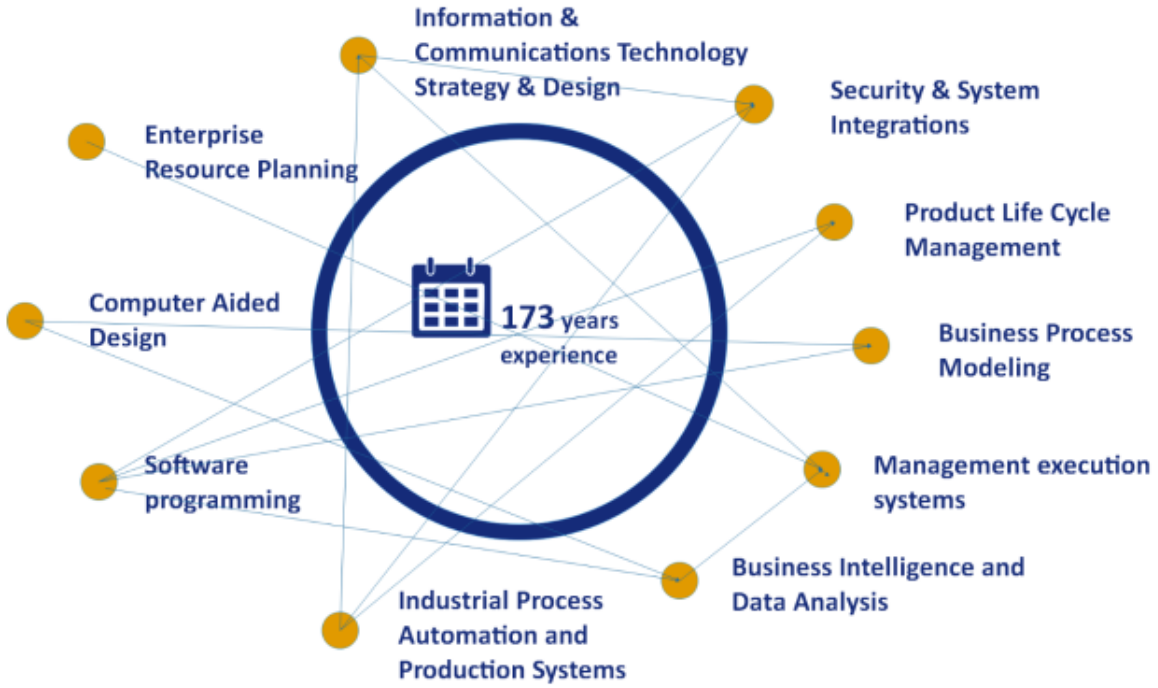
Transform to Survive & Thrive ...

Our goal…

We believe that we can share and transfer our skills and experience to other businesses in such a manner that it provides solutions to their immediate challenges so that the businesses and we can continue to thrive.

Our origin…

We have gained our real-life skills and experience across business functions and systems over the last 10 years in the high volume manufacturing environment of Aerosud Aviation.



AEROSUD OCTi

Typical Roadmap

Best practice
Mode of Operation

Best practice
Mode of Operation

Data Management

Typical Roadmap

Best practice
Mode of Operation

Digital Twin - Parts
Data Management

Typical Roadmap

Acceptance Criteria	Data Exchange
Tool Management	Kitting
Quotations	Machine Maintenance
Quality Management	Change process
Project Management	Process Planning
Digital Twin - Parts	
Data Management	

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Typical Roadmap

Digital Twin - Facility	
Acceptance Criteria	Data Exchange
Tool Management	Kitting
Quotations	Machine Maintenance
Quality Management	Change process
Project Management	Process Planning
Digital Twin - Parts	
Data Management	

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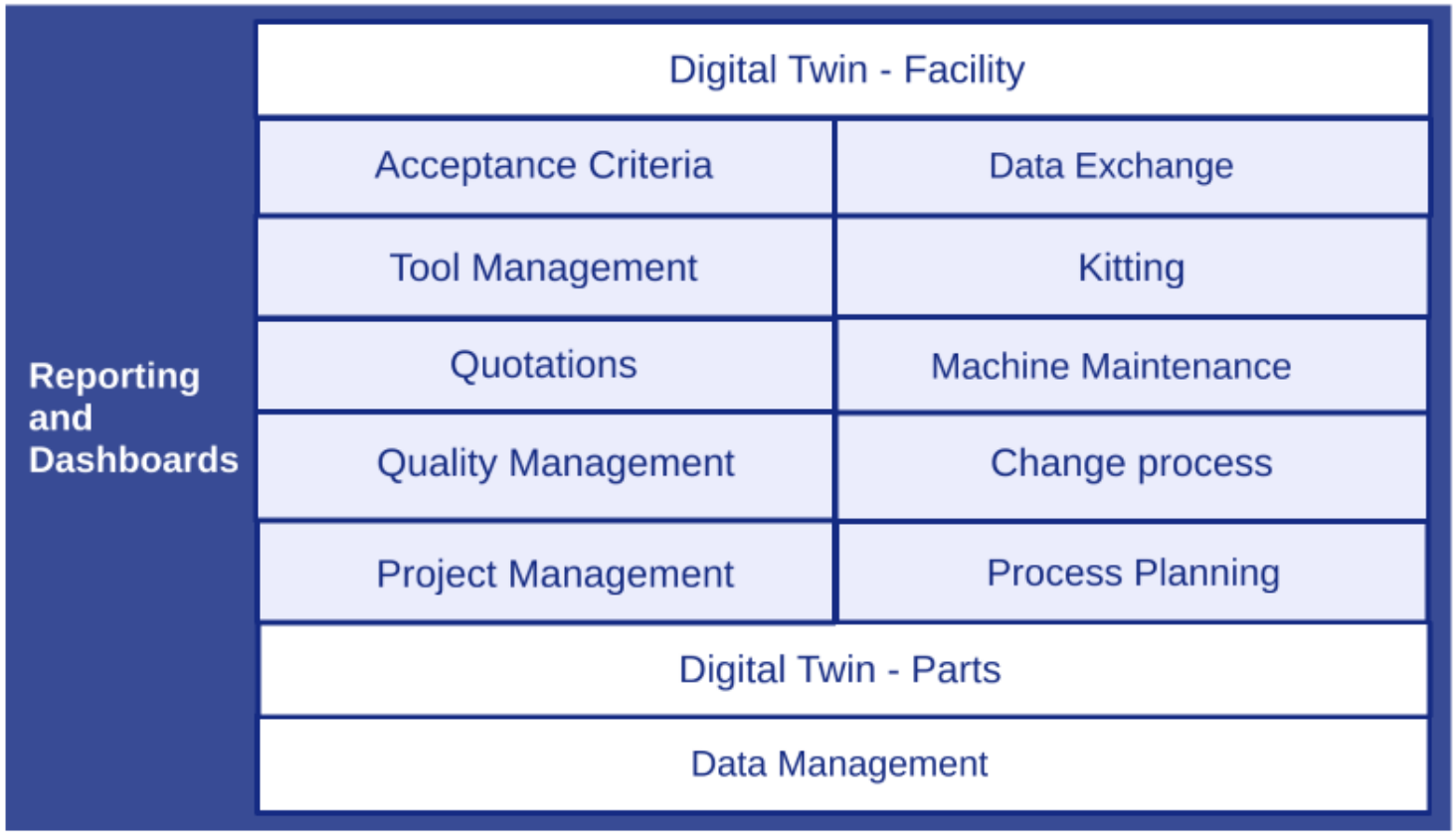
Typical Roadmap



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