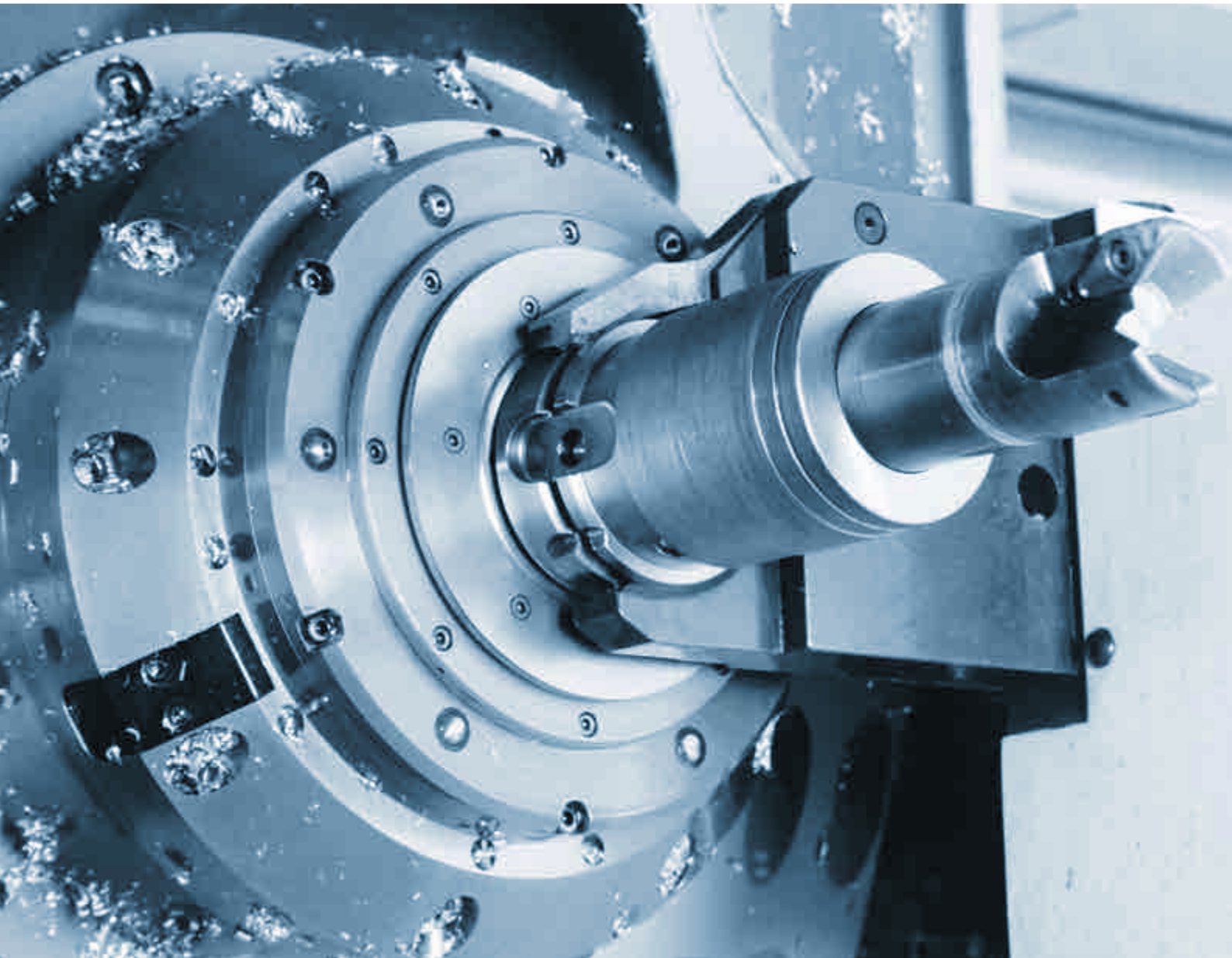




DENEL AEROSTRUCTURES



THE ADVANCED AEROSPACE MANUFACTURING  
AND ENGINEERING PARTNER





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## GROUP HISTORY

## SOUTH AFRICA'S LARGEST MANUFACTURER OF DEFENCE EQUIPMENT



Denel Aerostructures (DAe) is part of the Denel Group, South Africa's largest manufacturer of defence equipment. Denel operates in the military aerospace and landward defence environment. Denel was officially incorporated as a private company in 1992. Denel is a state-owned company with its sole share-holder the South African Government, reporting to the Department of Public Enterprises.

### KEY DOMESTIC SUPPLIER

Denel is a major defence contractor in its domestic market and a key supplier to the South African National Defence Force (SANDF), both as original equipment manufacturer (OEM) and for the overhaul, maintenance, repair, refurbishment and upgrade of equipment in the SANDF's arsenal.

### REPUTABLE INTERNATIONAL SUPPLIER

Over the years Denel has built a reputation as a reliable supplier to its many international clients. It supplies systems and consumables to end-users as well as sub-systems and components to its industrial client base.



## THE DENEL GROUP CONSISTS OF:

### DENEL AEROSTRUCTURES

As the leading aerospace company in Africa, a powerhouse in aerospace design and advanced manufacturing, Denel Aerostructures is associated with the best original equipment manufacturers (OEMs) in the global industry and recognised by Airbus as one of the most reliable suppliers on the A400M programme.

### DENEL AVIATION

A well-established Maintenance Repair and Overhaul (MRO) facility, Denel Aviation had been providing support services to the South African Air Force (SAAF) and the South African aviation industry for more than 40 years. Denel Technical Academy falls under Denel Aviation and is a well-established training institute, accredited by several training authorities and the South African Civil Aviation Authority. Denel Technical Academy consists of three training sectors: Apprenticeship Department (Aviation and Engineering Industry), Youth Foundation Programme, Advanced and Type Training (Aviation Industry).

### DENEL DYNAMICS

A leader in advanced systems engineering technology, Denel Dynamics' core business covers tactical missiles, precision-guided weapons, unmanned aerial vehicle systems (UAVS), integrated air defence and related technology solutions. The business is situated in Irene, near Pretoria and employs approximately 800 people (64% of its employees are technically highly qualified and world-class experts in their specialised fields). Denel Dynamics has successfully developed, produced, integrated and supported electronic and mechanical engineering systems since 1963, establishing a sound technology base and infrastructure along the way.

### DENEL PMP

PMP has been involved in the manufacture of ammunition since 1931, and develops and manufactures small-to-medium calibre ammunition, brass and copper strip, high quality percussion caps of all types, mining drill-bits as well as power cartridges and cutting charges.

### DENEL LAND SYSTEMS

Denel Land Systems is a landward defence system solutions business with its primary focus on the

# THE CREDIBLE STATE-OWNED SOUTH AFRICAN STRATEGIC PARTNER FOR INNOVATIVE DEFENCE, SECURITY AND RELATED TECHNOLOGY SOLUTIONS

South African National Defence Force's (SANDF) requirements as prime contractor and, where we have competitive advantage, also international customers as a systems integrator and subsystem and product supplier. DLS is a consolidated, program based systems house for the development, production, maintenance and upgrades of infantry systems, artillery gun systems and combat turrets as well as small arms. The company is based in Lyttelton, south of Pretoria. The company's strength lies in the unique fine balance of technologies and engineering capabilities allowing it to take complex systems or products through its whole life cycle, from conceptualisation, systems design, development, testing and qualification to industrialisation and production, product support and eventual decommissioning. This strength is enhanced by an entrenched culture of learning which is fostered in the company.

### DENEL OVERBERG TEST RANGE

Denel Overberg Test Range is a well established test facility located on the southernmost tip of Africa specialising in the in-flight testing and evaluation of missiles and aviation systems for the local and international aerospace industries.



## DENEL GROUP'S STRUCTURE

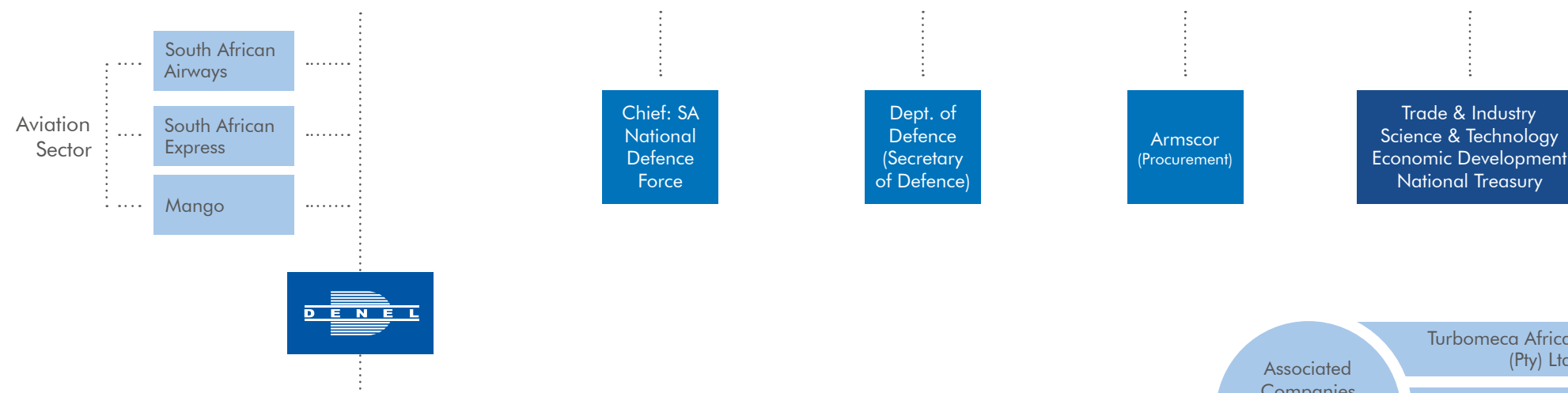


### SOUTH AFRICAN GOVERNMENT

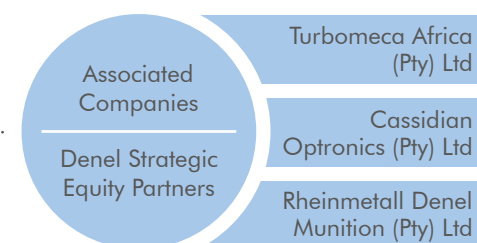
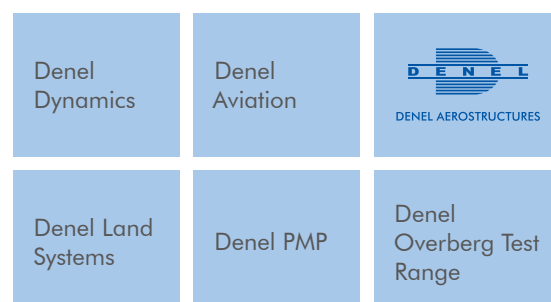
Minister of Public Enterprises

Minister of Defence and Military Veterans

Other Ministers



### BUSINESS ENTITIES

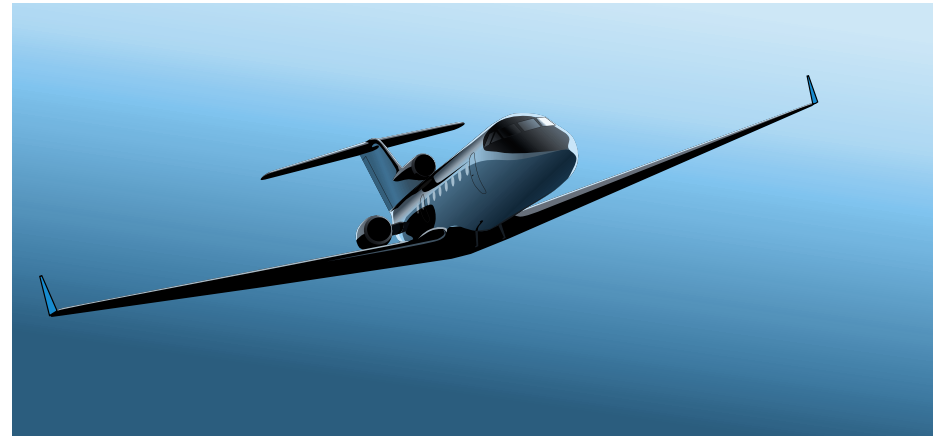


A RESPECTED  
SOUTH AFRICAN  
PROVIDER OF  
INNOVATIVE  
DEFENCE, SECURITY  
AND RELATED  
TECHNOLOGIES





# THE ADVANCED AEROSPACE MANUFACTURING AND ENGINEERING PARTNER



Denel Aerostructures (DAe) is part of the state-owned Denel Group, a respected South African provider of innovative defence, security and related technologies. As the leading aerospace company in Africa, a powerhouse in aerospace design and advanced manufacturing, we are associated with the best original equipment manufacturers (OEMs) in the global industry and recognised by Airbus as one of the most reliable suppliers on the A400M programme.

Our strategic customers include Airbus, AgustaWestland, Boeing, Gulfstream, BAE Systems, SAAB and a US Business Jet OEM. Denel Aerostructures invests extensively to establish modernised, world-class facilities for high-end machining, composites, manufacturing, assembly and special processes.

Denel Aerostructures aims to surpass customers' expectations with on-time delivery, innovation and on-quality standards with a full range of engineering capabilities - design, development, test and certification. As a strategic partner in global programmes, the company intends to build on its longstanding reputation for innovation, quality and specialised solutions in aerospace design and manufacturing. Our mastery of technology and depth of skills are forged through decades of experience in the aerospace sector.

Denel Aerostructures is at the core of the country's largest aerospace hub, the Aerotropolis. We are located next to OR Tambo International airport in Johannesburg - Africa's largest and busiest airport. With the Ekurhuleni Aerotropolis attracting aerospace and advanced manufacturing companies, DAe is well-positioned and close to a growing number of supply and partner

industries. As a strategic industrial and economic asset for South Africa and a primary contributor to the growth of the aerospace sector and high-tech manufacturing on the continent – Denel Aerostructures is ideally positioned to be a strategic aerospace design and manufacturing partner.



## WHAT DENEL AEROSTRUCTURES STANDS FOR

### VISION

Denel Aerostructures is the reliable African link in the global aerostructures supply chain:

- Providing on time, on quality service and value for our customers.
- Building a prosperous company for employees and our owners.

### MISSION

Denel Aerostructures shall design and produce complex metal and composite aerostructures, supplying to Original Equipment Manufacturers and other aerostructure suppliers.

### DENEL AEROSTRUCTURES VALUES



**PERFORMANCE**  
We embrace operational excellence.



**INTEGRITY**  
We are honest, truthful and ethical.



**INNOVATION**  
We create sustainable innovative solutions.



**CARING**  
We care for our people, customers, communities, nations and the environment.



**ACCOUNTABILITY**  
We take responsibility for our actions.



# COMPANY HISTORY

1964



Atlas Aircraft Corporation established

1968



Aermacchi MB-326 Impala

1970



Allouette / MRO

1980



Oryx / Super Puma conversion

1983



Cheetah / Design Authority

1990



Rooivalk / OEM

1992



Denel (Pty) Ltd established

1995



Ace / All composite turbo prop trainer

1996



Gulfstream G150

2000



SAAB Gripen

2005



Airbus A400M

2007



Denel Saab Aerostructures (Pty) Ltd established

2009



A400M MSN 001 first flight

2011



Denel Aerostructures SOC Ltd established

2011



A400M Interim Type Certification

2011



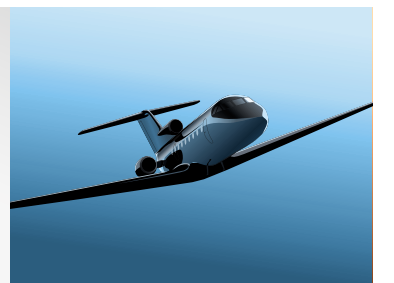
Completion of Gripen Programme

2011



Completion of A109 Programme

2012



New contract with US Business Jet





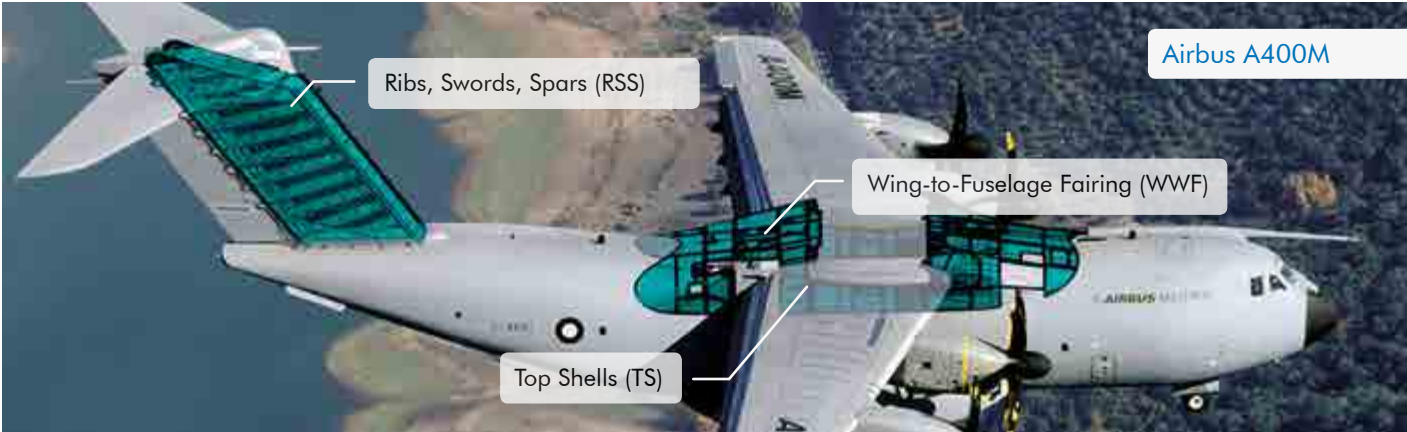
**INTERNATIONAL  
CUSTOMER BASE**

Developing complex aerostructure components and assemblies, Denel Aerostructures is a leading supplier with extensive and growing experience from its international partnerships. Denel Aerostructures has the capability and technology to develop all types of defence and commercial airframe structures and the ability to support our customers all the way from concept designs through high volume serial production of aerostructures, to in-service support.





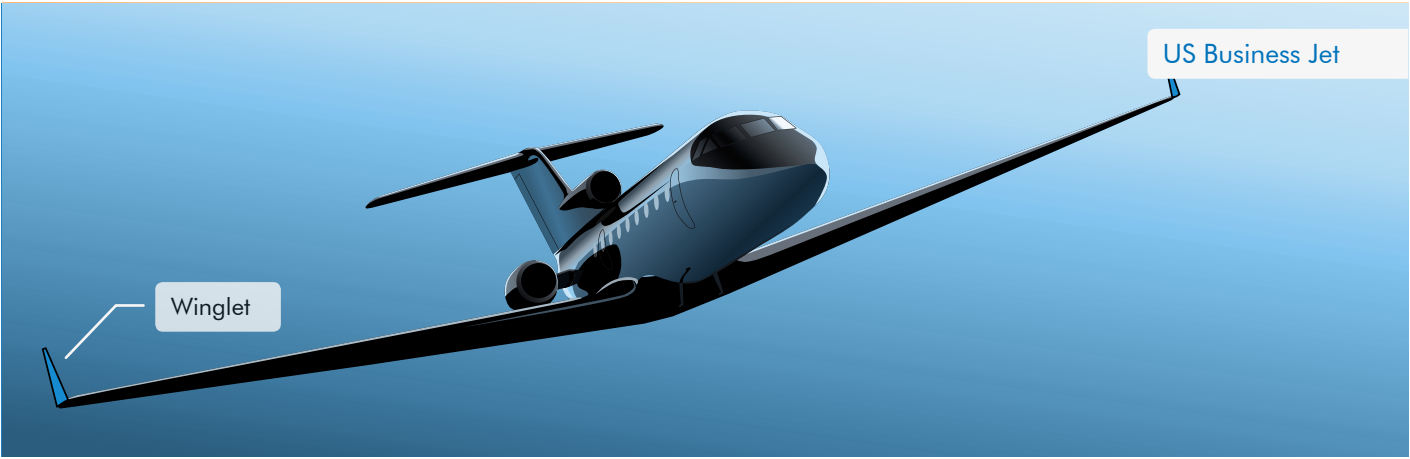
CURRENT PROGRAMMES



PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	DELIVERY/YEAR	QUANTITY DELIVERED TO DATE
Wing-to-Fuselage Fairing	Contract signature Jan 2005, MSN001 December 2006, bird strike, lightning & hail tests completed in April 2011, MSN006 new baseline December 2010, MSN007 1st production model December 2011. New negotiated contract signed September 2012.	Current 16 per year ramping up to 24 in two years time.	12
Top Shell	Contract signature Aug 2005, MSN001 May 2006, MSN006 new baseline Feb 2009, MSN007 1st production model December 2010. New negotiated contract signed July 2012.	Current 16 per year ramping up to 24 in two years time.	19
Ribs, Spars and Swords	Original contract signed Aug. 2006, transfer stopped in April 2010, transfer re-initialised in February 2012, first test parts production complete.	To ramp up to 24 per year.	New Programme



PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	DELIVERY/YEAR	QUANTITY DELIVERED TO DATE
Empennage	First Unit (unit 90) delivered in June 1997.	Max 48 per year	110



PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	DELIVERY/YEAR	QUANTITY DELIVERED TO DATE
Winglet	First article delivery 29 January 2014	80	New Programme



PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	DELIVERY/YEAR	QUANTITY DELIVERED TO DATE
Rooivalk	Concept design started in 1985.  XDM 1st Flight; 11 February 1990. ADM 1st Flight; 22 May 1992 1st helicopter with a glass cockpit. EDM 1st Flight; 18 November 1996. 1st Production unit 1st Flight; Nov 1998.	3 per year	12+ ADM, EDM and XDM





# PAST PROGRAMMES



PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	DELIVERY/YEAR	QUANTITY DELIVERED TO DATE
Main Landing Gear Unit	Umbrella agreement signed March 2000, SAAB has praised the build quality of DAe's MLGUs.	Max. 15 per year	145
Pylons	Umbrella agreement signed March 2000, NATO Export baseline designed, developed and manufactured at DAe; first production started in mid 2003 and delivery early 2004.	Max 96 per year.	343
Rear Fuselage	Umbrella agreement signed March 2000, March 2011 delivery of 100th.	Max. 15 per year	115



PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	DELIVERY/YEAR	QUANTITY DELIVERED TO DATE
Tailplane	Programme commenced May 2000. Tailplanes built with the final delivery made in August 2009.	12 per year	151
Flaps	Programme commenced July 2002. Flap sets built with the final delivery made in April 2009.	12 per year	46
Airbrakes	Programme commenced September 2003. Airbrakes built with the final delivery made in September 2008.	12 per year	83





PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	QUANTITY DELIVERED TO DATE
A109	Product Supply Agreement signed July 2000, 30 AC delivered to SAAF (5 AW built, 25 DAe built).	30



PRODUCTS	DELIVERY DATE OF SIGNIFICANT MILESTONE	QUANTITY DELIVERED TO DATE
Boeing	Period 2004 to 2011 - Total number of orders received from Boeing – approximately 3300. Total number of details delivered 45148	Detailed part with varying rates.
737 details and sub-assemblies	Programme commenced 2004 and completed in 2011. DAe contracted to produce 75 different parts and sub-assemblies for the 737 Aircraft.	Detailed part with varying rates.
747 details and sub-assemblies	Programme commenced 2004 and completed in 2011. DAe contracted to produce 148 different parts and sub-assemblies for the 747 Aircraft.	Detailed part with varying rates.
767 details and sub-assemblies	Programme commenced 2004 and completed in 2011. DAe contracted to produce 53 different parts and sub-assemblies for the 767 Aircraft.	Detailed part with varying rates.
777 details and sub-assemblies	Programme commenced 2004 and completed in 2011. DAe contracted to produce 113 different parts and sub-assemblies for the 777 Aircraft.	Detailed part with varying rates.

# FIRST COMPANY IN AFRICA TO BE NADCAP ACCREDITED

**QUALITY ACCREDITATIONS**

Accredited

Accredited for:

- Non-Destructive Testing
- Chemical Processes
- Heat Treatment
- Composites

ACCREDITED BY



CERTIFIED BY

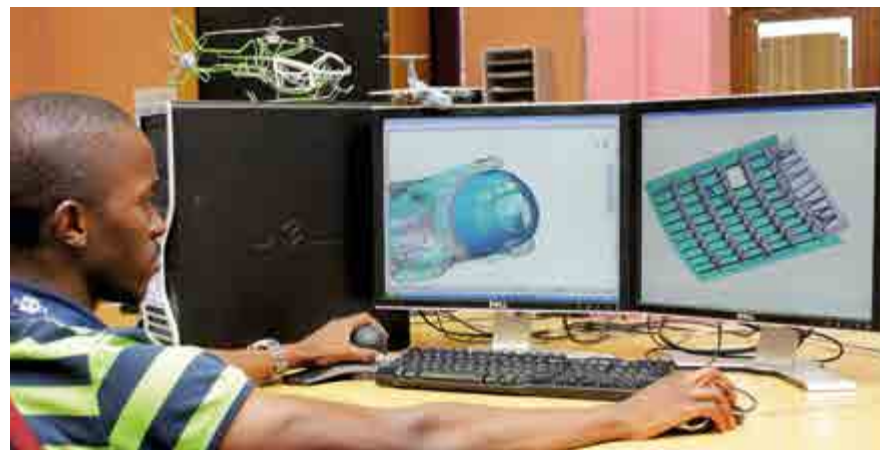
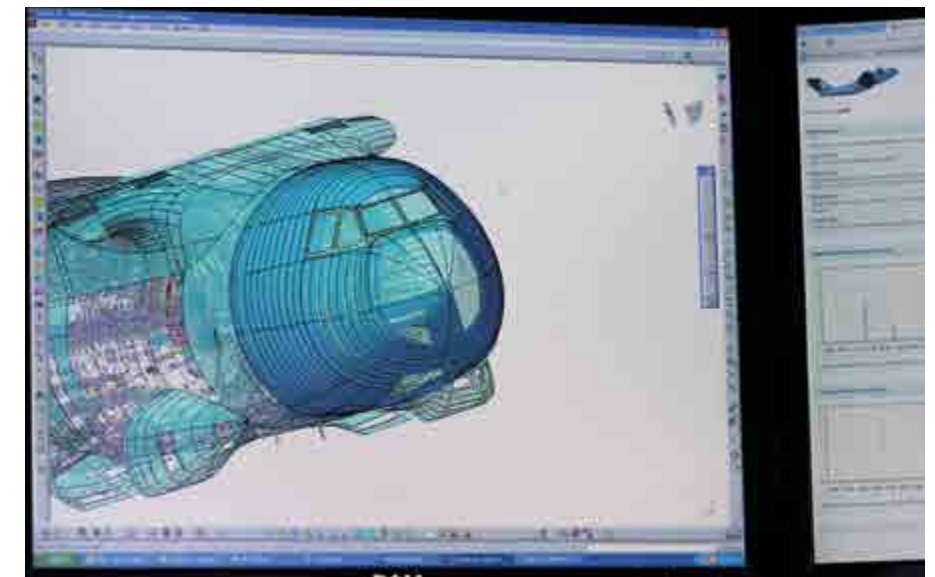
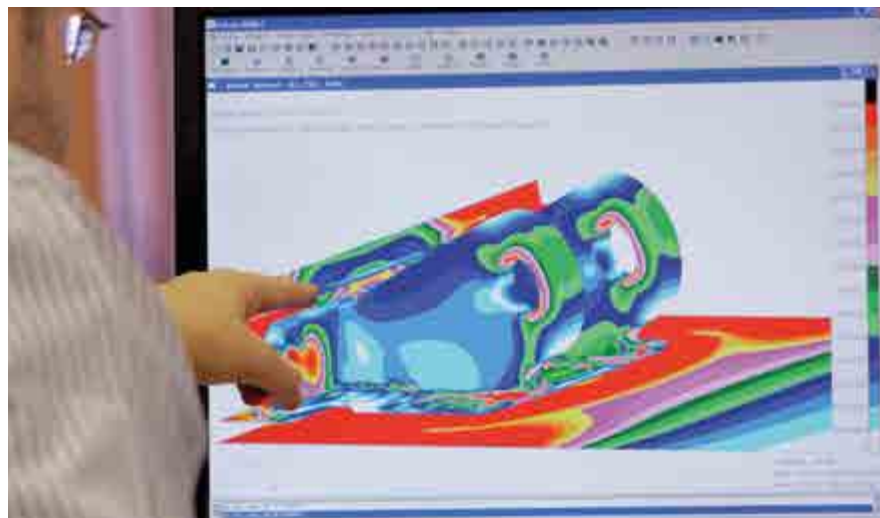


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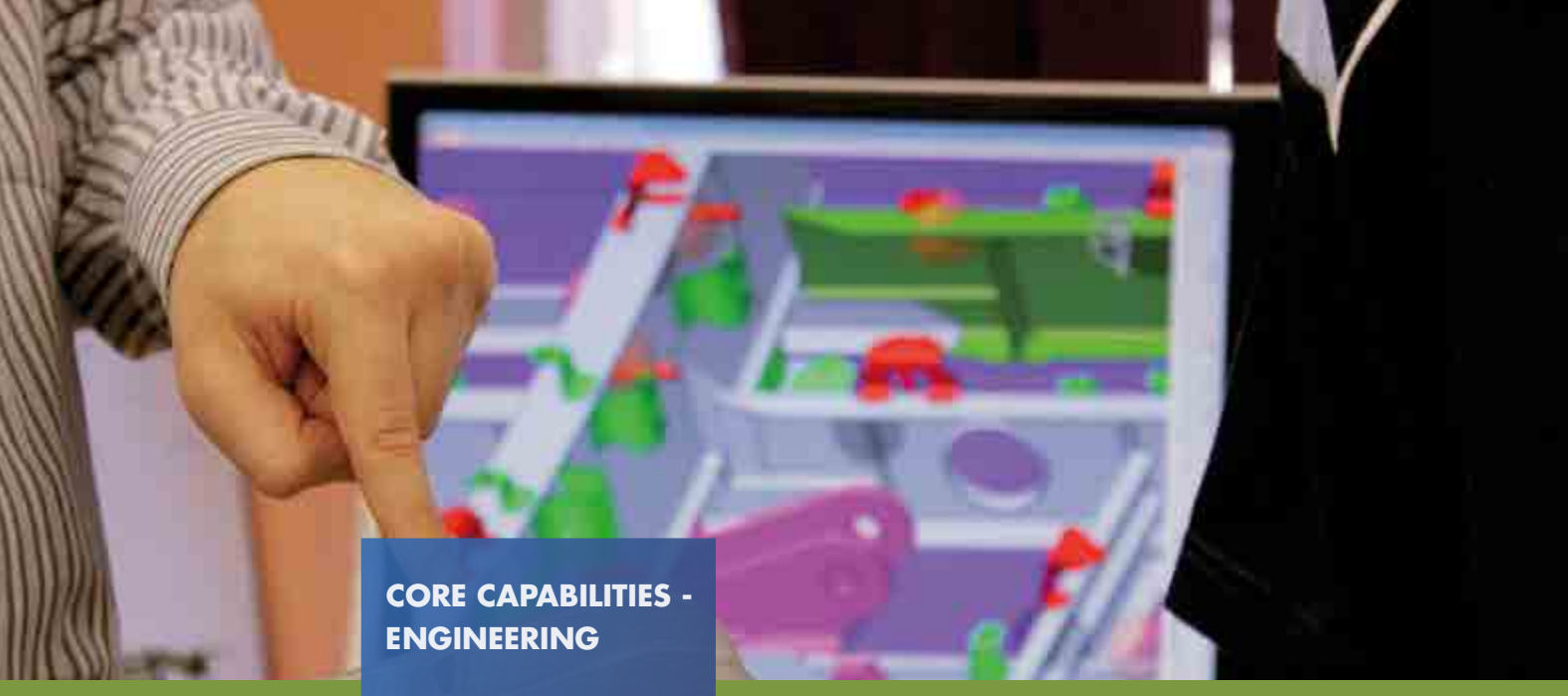


## WORLD-CLASS- ENGINEERING - CAPABILITIES



Denel Aerostructures portfolio of engineering capabilities include full spectrum Conceptual Design, Definition, Development, Testing and Certification





## CORE CAPABILITIES - ENGINEERING

### RESOURCES

- Core team of 55
- Aerospace specific experience: Total collective > 870 years Average ~ 19 years
- 18 graduates (7 post-graduate)
- 11 Technical diplomas
- 19 Other (CMII, PM etc)
- Average age 43

### SOFTWARE

- MSC Nastran
- MSC Patran
- MSC Marc
- Mathcad
- MATLAB
- Catia V5
- Catia V4
- ESDU
- Dytran
- iSight
- CPD (Composite Part Design)
- Airbus tools (ISSY, SAMTECH tools etc.)
- In-house developed tools (DCU etc.)

### STRUCTURAL TEST LABORATORY

- Material testing to International Specifications
- Coupon, element, detail, sub- component and component level testing
- Static and fatigue testing
- Ground vibration testing
- Impact testing (Bird strike, hail, debris etc.)
- Environmental conditioning

### CONFIGURATION MANAGEMENT

- Processes aligned to ISO 10007 & customer requirements
- Processes aligned to CMII
- Primes (Windchill) used for EBOM management
- eBrowser (eB) used for documentation management;
- Q-Muzik ERP used for MBOM management

### DESIGN OFFICE

- Full conceptual design, definition and development
- Metallic and composite structures
- Digital mock-up (DMU) integration, e.g. Airbus A400M

### STRUCTURAL ANALYSIS

- Classical & numerical methods
- Linear and non-linear finite element analysis
- Metallic and Composite Materials
- Static & dynamic analysis
- Durability and damage tolerance analysis
- Aero-elastic analysis (flutter & divergence)
- Loads analysis
- Weights engineering

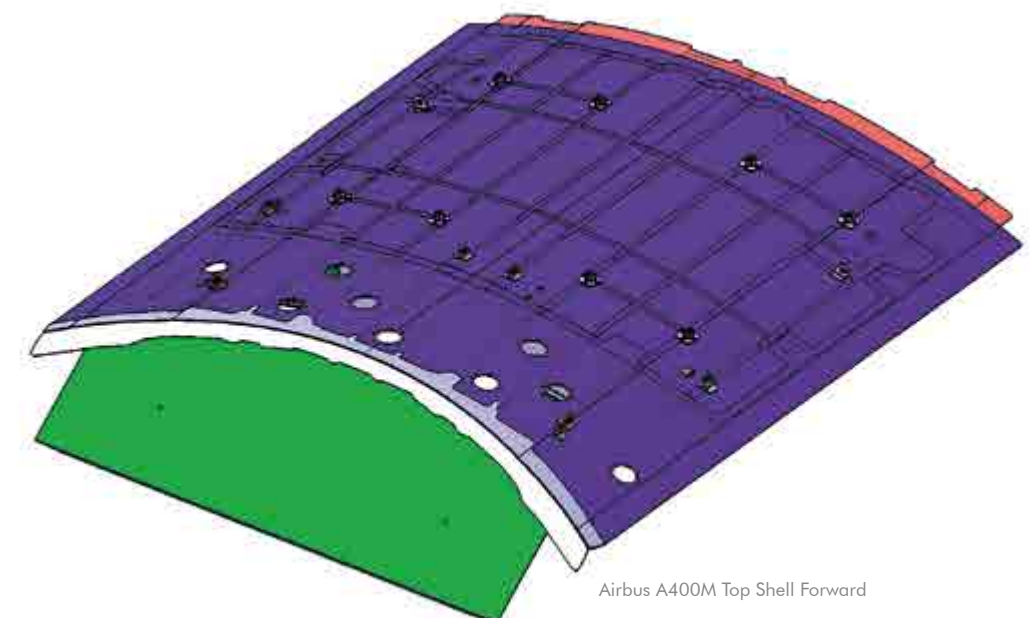
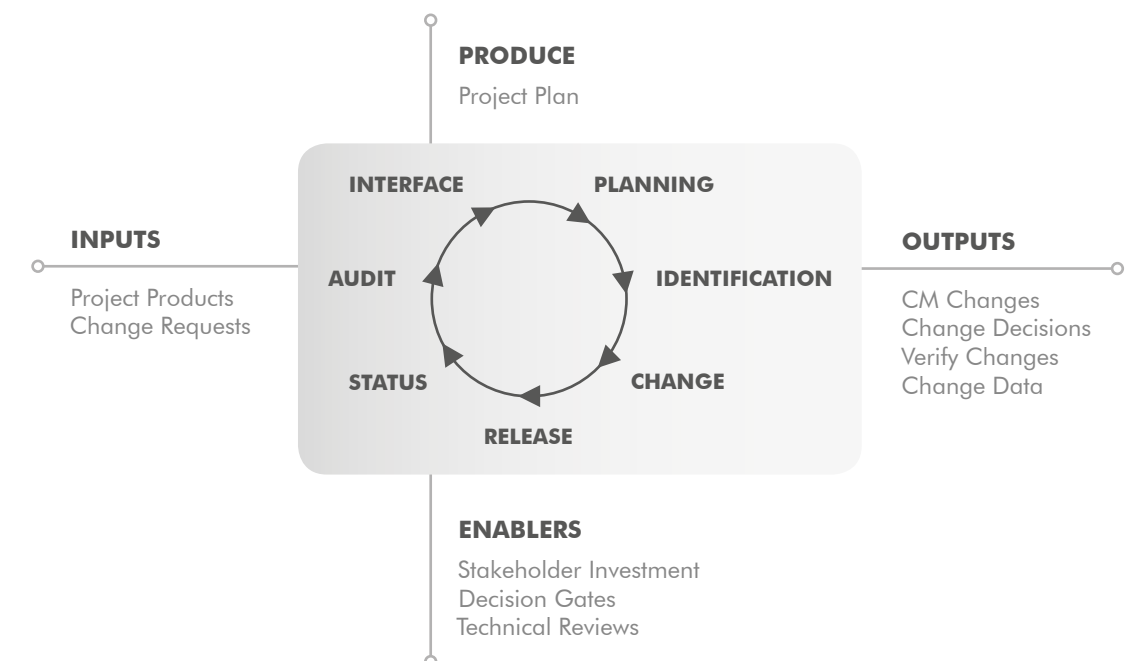
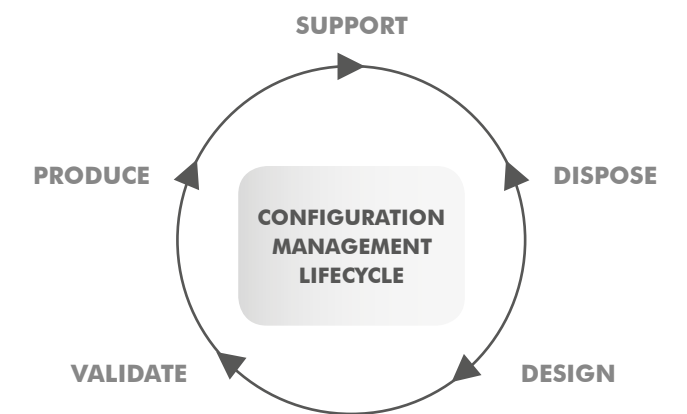
## ENGINEERING CAPABILITIES

## CONFIGURATION MANAGEMENT

Configuration Management processes are aligned to CMII, ISO10007 and OEM customer requirements. Primes (Windchill) is used for EBOM management, QMUZIK ERP is used for MBOM management and eBrowser (eB) is used for documentation management.

The main Configuration Management activities include:

- Development of configuration management plans
- Identification of configuration items to be placed under change management
- Change control of the configuration items
- Requirements and release management
- Status accounting which tracks change information
- Audits to verify that configuration item changes match the documentation



Airbus A400M Top Shell Forward





## CORE CAPABILITIES - ENGINEERING

### DESIGN OFFICE

DAe's portfolio of engineering capabilities include full Conceptual Design, Definition and Development.

This covers:

- Initial sizing and layout
- Preliminary studies
- Stress layouts
- Final detail design
- Creation of manufacturing drawings
- Design studies, which incorporate corrosion, bird strike, environmental impacts and trade-off studies
- Design for low cost, ease of manufacture and low weight

### METALLIC AND COMPOSITE STRUCTURE

- Sheet metal parts
- Machined components
- Composite design using CPD (includes the creation of CD and CM models and DXF files)

### DIGITAL MOCK-UP (DMU) INTEGRATION

- Creation of highly detailed mock-ups to show all parts and components that make up the structure.
- This increases the visibility of the model for various phases of development and manufacturing, for both DAe and its customers.
- Reduces development time and cost, by optimising processes and methods.

### STRUCTURAL ANALYSIS

DAe has very strong capabilities in airframe structural analysis. Our team of experienced engineers are highly skilled in classical aircraft stress analysis methods and their effective implementation. In addition, they are also highly experienced in the effective use of computer-aided analysis of engineering systems through the use of Finite Elements for stressing and flow simulation for aerodynamic design.

Our capabilities and experience include numerous examples of static as well as dynamic analysis, and we are equally comfortable with analysing metallic or composite structures. Our experience of dynamic analysis included simulations of impact as well as simulations of phenomena such as flutter and divergence.

DAe's structural analysis department also has strong capabilities and experience in durability and damage tolerance analysis. This includes the analysis of ultra-high-cycle fatigue such as sonic fatigue which was performed on the Airbus A400M project.

DAe has the ability to estimate and predict flight loads and experience at performing mass and balance calculations and other weight engineering functions to the requirements of customers.

### STRUCTURAL TESTING

The DAe engineering team comprises of experienced test engineers that work closely together with our test laboratory, a facility that is constantly growing in capabilities and accreditation.

In addition to the test laboratory, DAe also has access to a range of other test facilities at sister companies, such as Denel Dynamics, where we perform impact testing and component level testing.

DAe has experience and skills in static and fatigue testing as well as ground vibration testing. Our capabilities include environmental conditioning of test specimens to specified moisture absorption and temperature conditions.

### PARTICULAR RISK ANALYSIS (PRA)

- Blade Release
- Sonic Fatigue
- APU Thermal Risks
- Water Tightness
- Lightning Strike
- Rapid Decompression and Leak Pressures
- Bird Strike
- Hail Strike
- Hard Body Impact
- Propeller Ice Strike



### SUPPORT LIAISON ENGINEERING

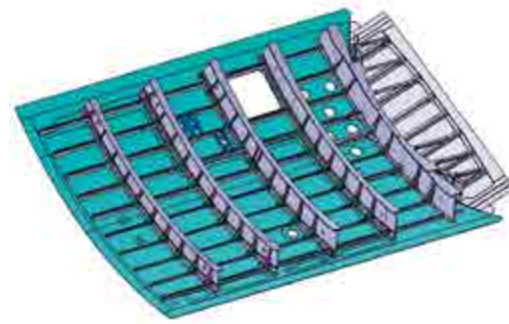
The engineering team applies its experience and skills in the support of production processes where required.

This is applied on a variety of industrialised programmes such as:

- Ribs, Swords and Spars on the A400M Vertical Stabilizer, for Airbus Military
- Winglets for a US Business Jet OEM
- Empennage on the Gulfstream G150 jet



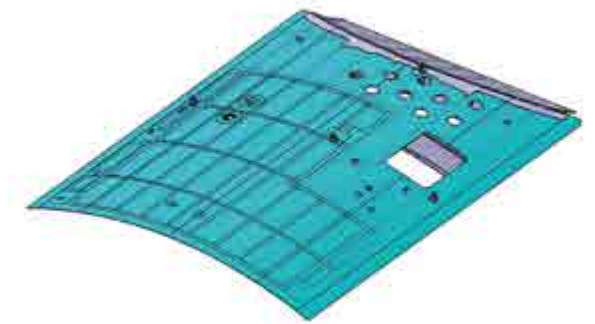
## CURRENT ENGINEERING PROJECTS



Airbus A400M Top Shell Aft Inner

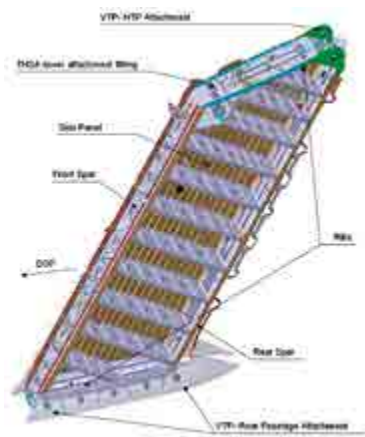
### AIRBUS A400M TOP SHELLS (TS)

The Top Shells are metallic semi-monocoque structures that form an integral part of the A400M Centre Fuselage. These are located at the forward and aft parts of the Centre Wing Box cut-out. As a result of the location, the Top Shells also provide structural provision for various systems housed in the space between the Wing-to-Fuselage Fairing (WFF) and the Centre Fuselage. DAe is responsible for the complete design, manufacture and certification of the Top Shells with Airbus Germany as the customer.



Airbus A400M Top Shell Aft

### AIRBUS A400M VERTICAL TAIL PLANE (VTP) RIBS, SWORDS AND SPARS (RSS)

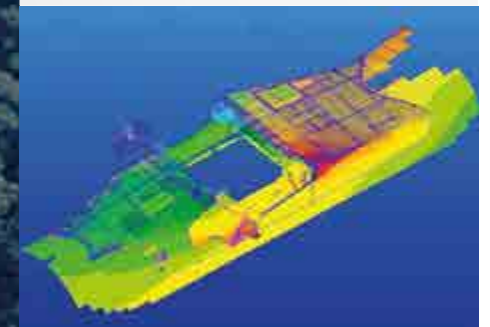


DAe was involved in the development of the Airbus A400M VTP Ribs, Swords and Spars. An engineering team comprising of design and stress engineers was stationed at the Airbus Finkenwerder site in Hamburg, Germany. The team was involved in the redesign and weight saving exercise that was required for the MSN6 aircraft and onwards. The Ribs, Swords and Spars are composite monolithic structures with co-bonded stiffeners. Production and transfer of design authority for these class 1 and flight critical structural parts are planned for 2013.



### AIRBUS A400M WING TO FUSELAGE FAIRING (WFF)

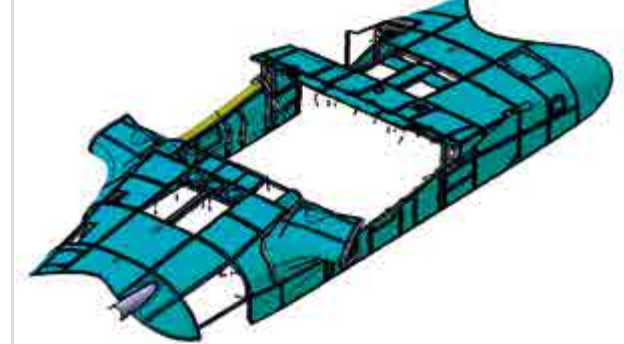
The WFF comprises a metallic substructure covered by 80 composite panels. The WFF provides aerodynamic efficiency over the Wing Box and protects critical aircraft systems. DAe is responsible for complete design, manufacture and certification of the WFF with Airbus France as the customer.



The metallic substructure of the WFF



The LH & RH Onglet showing the composite Panels highlighted on the Metallic substructure.



WFF showing the Composite Panels that cover the metallic substructure.

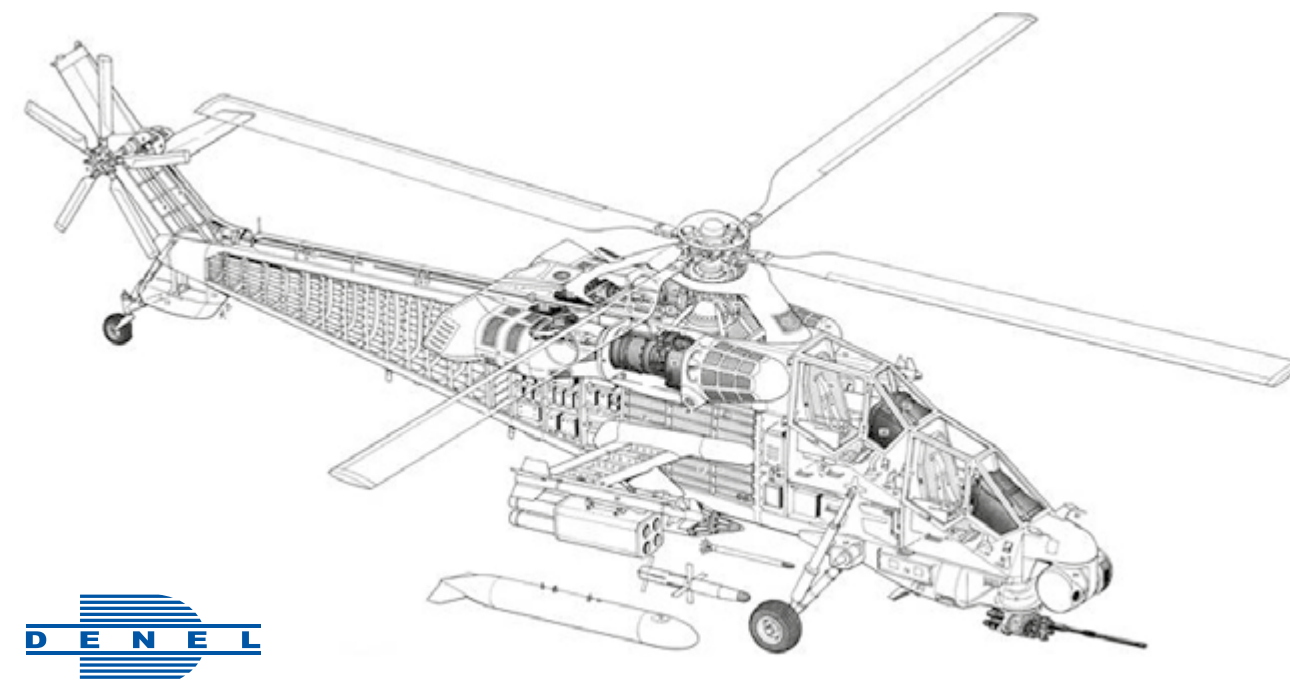
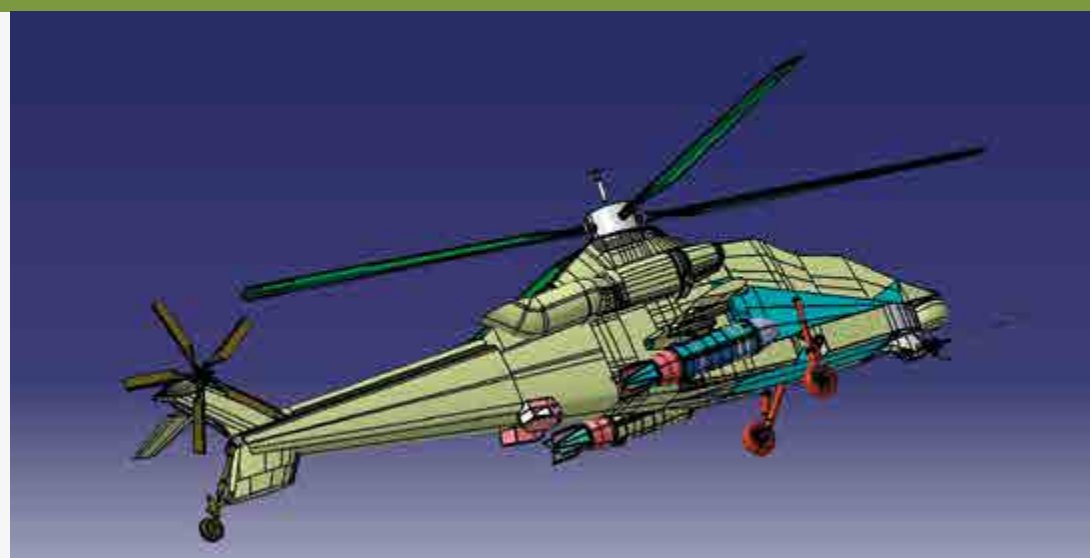




## CURRENT ENGINEERING PROJECTS

### DENEL ROOIVALK (OEM)

The Rooivalk combat support helicopter is the most comprehensive development programme yet undertaken by Denel, through Denel Aviation and Denel Aerostructures. DAe's responsibilities on this project included system concept through detailed design, flight testing, development, integration, system support and qualification.



### DEVELOPMENT

The Rooivalk development has comprised of the following:

- A complete new airframe and undercarriage.
- A propulsion system based on a modified Super Puma power train.
- A main transmission vibration isolation system.
- An integrated avionics suite on a 1553 data bus.
- An integrated weapons system suite on a 1760 data bus.
- An integrated Health Usage and Monitoring System (HUMS).
- A complete mission, ground support and training system.
- Test flying and certification of this system.

### SEEKER 400 UAV

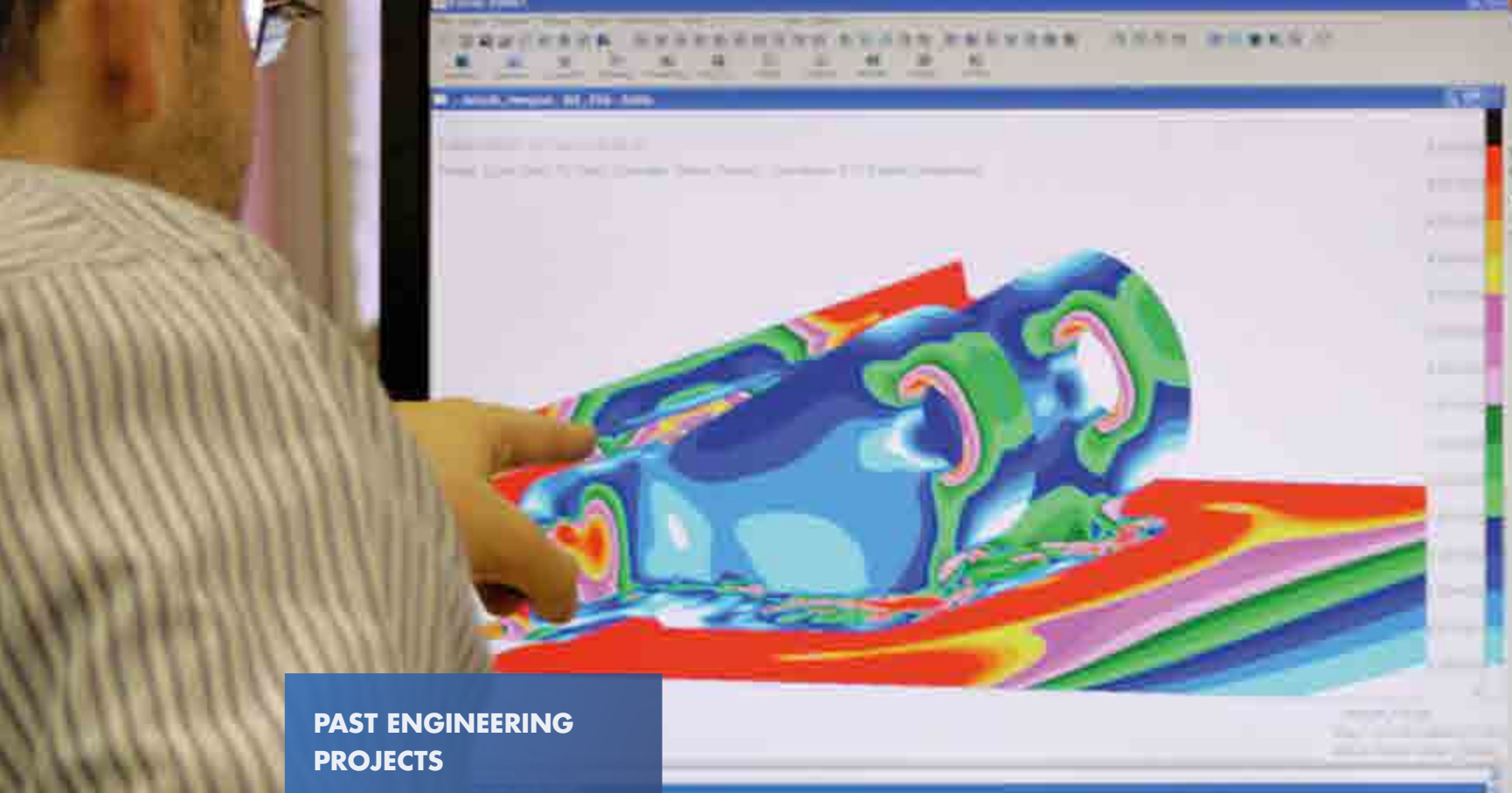
Denel Aerostructures has a well-established global reputation in the field of weight saving. Denel Dynamics, another company in the Denel Group, is responsible for the design and development of the first prototype of the Seeker 400 Unmanned Aerial Vehicle. During the weight optimisation phase. DAe was commissioned to redesign the wing of the Seeker 400 production model to achieve vital savings.



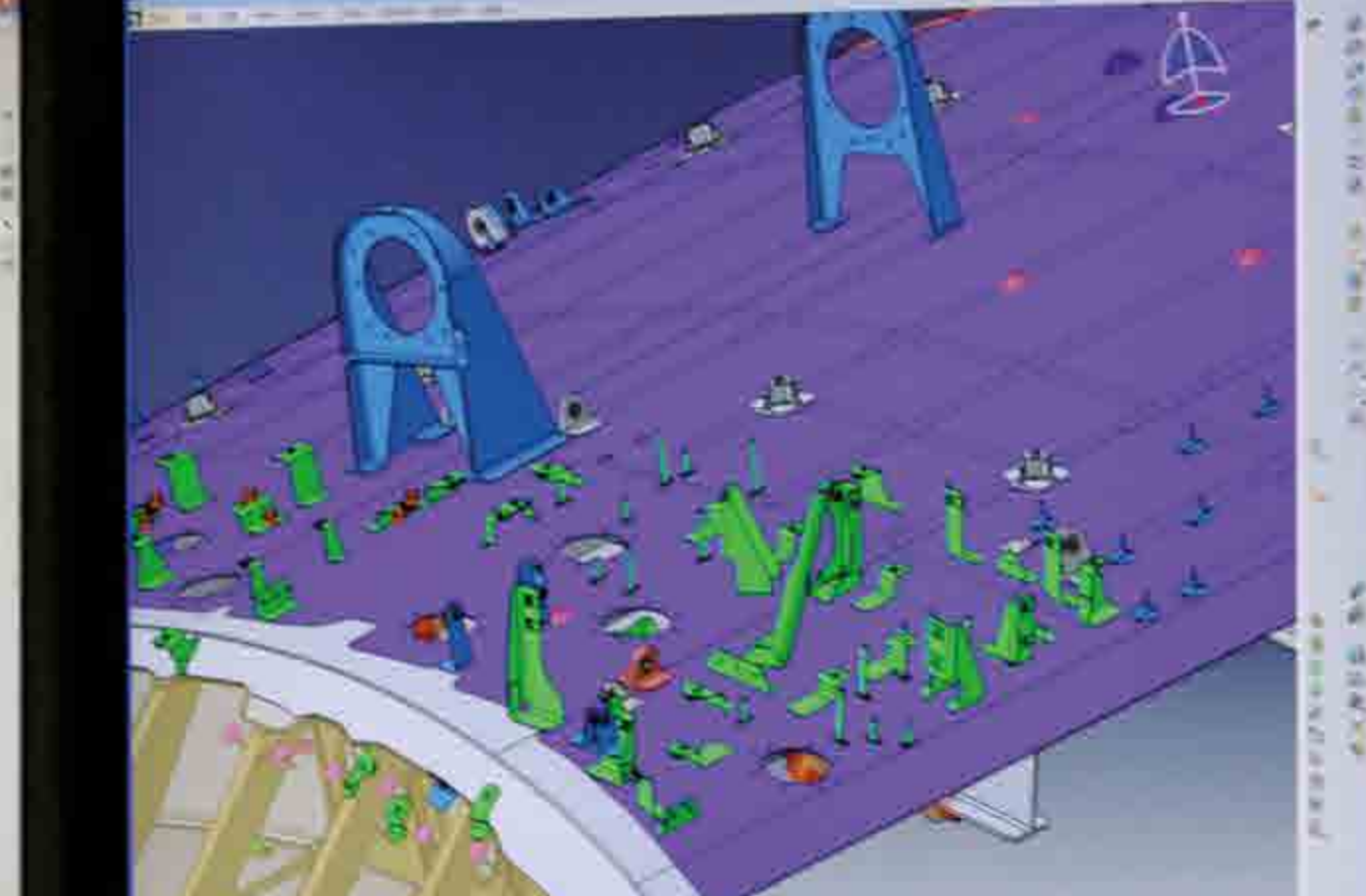
### ROOIVALK EXTERNAL LONG RANGE FUEL TANK DEVELOPMENT

- Size - 3450mm long x 640 diameter.
- Mass - 51.5kg empty and 496kg full.
- Fuel capacity - 550 litres.
- Construction - metallic centre section comprising pressed sheet metal pressed bulkheads, frames, external skin with machined aircraft attachment fitting and machined system fittings for the fuel transfer pumps valves electrical plugs etc.
- The nose and tail section being manufactured from composite material.
- Lightning protection was designed into the tank for all weather operation.





## PAST ENGINEERING PROJECTS



### SAAB GRIPEN

The Gripen is a multi-role jet fighter operated by the South African Air Force. Engineering activities included the development, design and testing of the Weapons Pylons, weapons integration, structural and flutter analysis and Ground Vibration Testing. Major components such as the Main Landing Gear Unit, Rear Fuselage and the Weapons Pylons were produced by DAe.



### ACE

An all composite turbo prop trainer developed by Aerotech (a division of the CSIR Council for Scientific and Industrial Research) in conjunction with Denel. Built as a demonstrator it was used to develop the technical and manufacturing technologies associated with carbon fibre airframes.



### ORYX RADOME DOOR

DAe was involved in the development of a large composite Radome door for the Oryx helicopter from the concept phase through to qualification. The development included the composite Radome door and the local reinforcement of the existing interfaces and airframe to withstand increased door loads.



### AGUSTAWESTLAND A109LUH

The A109LUH is a military light utility helicopter built under license for South African Air Force. The development of the LUH was a joint venture with AgustaWestland and activities included the structural integration of the avionics suite, design and integration of the chaff and flare dispensing system and cockpit modifications. Major components such as main rotor heads and main rotor blades were produced by DAe for AgustaWestland.





**PAST ENGINEERING PROJECTS**

**AERMACCHI MB-326 IMPALA**

The Impala was a light military jet built under license for the South African Air Force. Engineering activities included fatigue monitoring, battle damage repairs and the redesign and testing of a prototype composite dive brake.



**ATLAS C4M KUDU**

The Kudu was a light utility aircraft based on the Aermacchi AL-60B and was built under licence for the South African Air Force. The development of the Kudu was a joint venture with Aermacchi and activities included the conversion of the type from a tricycle gear to a taildragger configuration, modifications to the vertical stabilizer and redesign of the engine cowling for improved acoustics and cooling.



**ATLAS CHEETAH**

The Cheetah was an upgrade from the Dassault Mirage III fighter jet. Major Engineering activities focused on the development and flight testing of a prototype reconnaissance variant which involved the redesign of the nose to accommodate cameras and an electronic warfare suite. Other Cheetah engineering projects included the design, manufacture and flight testing of a wing with a revised leading edge for increased manoeuvrability, and the redesign and testing of the main spar of the wing for improved fatigue life.





## WORLD-CLASS MANUFACTURING CAPABILITIES



Denel Aerostructures has state-of-the-art technology and manufacturing facilities for composite and metallic aerostructures





## CORE CAPABILITIES - OPERATIONS

DAe IS ASSOCIATED WITH THE BEST ORIGINAL EQUIPMENT MANUFACTURERS (OEM'S) IN THE GLOBAL INDUSTRY AND RECOGNISED BY AIRBUS AS ONE OF THE MOST RELIABLE SUPPLIERS ON THE A400M PROGRAMME

### MANUFACTURING ENGINEERING

- Process Engineering
- Jig and Tool design
- NC programming
- Material Technology

### ASSEMBLY

- Sub Assemblies: T&J sub assemblies, Main Rotor Head, Bearing and Bush Installation
- Main assemblies build in ICY Jigs
  - Airbus Wing to Fuselage Fairing
  - Airbus Top shells
  - G150 Empennage
- Semi-automated C-Frame Riveter
- Leica Laser Inspection

### COMPOSITES

- Utilise glass fibre, Kevlar, and pre-preg carbon materials, as well as metal bonding (fixing of metallic parts to composite structures)
- Typical assemblies range from Cowlings, Fairings, to A400M composite panels
- The facility has Class 7 and 8 rated clean rooms
- NADCAP Accredited
- Autoclaves 8 - 13m

### SHEET METAL

- Fluid Cell Press
- 5-axis CNC Router and Drilling
- Hand forming
- Stretch forming
- Press and roll forming

### MACHINING

- 5 Axis high speed machining
- 3 axis machining (including long bed)
- Jig Boring, grinding and conventional machining
- CMM Inspection

### SPECIAL PROCESSES

- Heat Treatment caters for both aluminium (DAe) and Steel (Turbomeca Africa) treatments.
- Surface treatment caters for Chromic Acid Anodising & Chemical milling.
- Paint shop
- NADCAP Accredited for:
  - Non Destructive Testing
  - Chemical Processing
  - Heat Treatment
  - Composites

### PRODUCTION





## CORE CAPABILITIES - OPERATIONS

### MANUFACTURING ENGINEERING

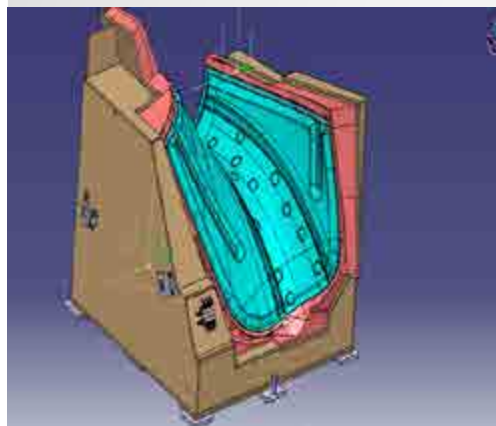
MACHINING  
SHEET METAL  
SPECIAL PROCESSES  
COMPOSITES  
ASSEMBLY

### MANUFACTURING ENGINEERING

Manufacturing Engineering specialize in developing holistic manufacturing method data packs for aerospace assemblies. This includes detail metallic machined, sheet metal and composite parts.

### PROCESS ENGINEERING

Develop manufacturing data packs for detail sheet metal parts, high speed machined parts, complex composite parts as well as the sub assemblies and full structural assemblies. The data pack contains the quality as well as the special process requirements which are detailed step by step. Q-muzik software is used.



### JIG AND TOOL DESIGN

Design all tools needed to produce a structural assembly. This includes all detail part tooling up to final assembly and inspection tooling software used is Catia V5.



### QUALITY



Accredited for:

- Non Destructive Testing
- Chemical Processes
- Heat Treatment
- Composites

### NC PROGRAMMING

NC programming develop machine programs for the manufacture of aluminium components on 3, 4 and 5 axis High Speed machines.

- Catia V4 and V5
- Visi Cad Cam
- VERICUT tool path verification software
- ICAM for generating post processors

### MATERIALS TECHNOLOGY

Responsible for assessing qualification status of special processes against customer requirements and developing special process cards for surface and heat treatment processes. This includes Anodic, Cathodic, Paint and Heat treatment processes.





## CORE CAPABILITIES - OPERATIONS



MANUFACTURING  
ENGINEERING  
**MACHINING**  
SHEET METAL  
SPECIAL PROCESSES  
COMPOSITES  
ASSEMBLY

## MACHINING

### MACHINING CAPABILITY

5 AXIS N.C. MILLING	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
Deckel Maho DMU 80 P	2	700	650	650
Deckel Maho DMU 125	2	1100	800	800
Starrag ZT 800	1	1600	1000	1320
Zimmerman FZ37	1	4500	3000	1500
Zimmerman FZ37	1	6500	3000	1500
70kw High Speed Spindle 24000 RPM				
A third Zimmerman machine will be commissioned January 2014				

3 AXIS N.C. MILLING	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
Leadwell V40	10	1000	500	650
Leadwell LBV 3215	2	3000	1500	800
Leadwell LBV 5229	2	5000	3000	1000

CONVENTIONAL MACHINES	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
Milling Machines	5	Various sizes		
Lathes	1	With copy attachments		
Grinders: Internal	1			
External	1			
Surface	1			
Jig	1			
Centre less	1			

JIG BORING	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
SIP 700	1	1500	800	1300
SIP 640	1	1000	800	1300 full NC

## MACHINING PLANT CAPABILITY

NO.	PRODUCT TYPE	SIZE
<b>A</b>	<b>ALUMINIUM</b>	
1	NC Parts	Up to 800 mm x 300mm
2	5 Axis DMU	Up to 800mm x 800mm
3	3 Axis Parts (Long Beds)	Up to 5m x 2,5m
4	Large 5 Axis Parts	Up to 6m x 2,5m
5	CMS 5 Axis Router	3m x 18m
<b>B</b>	<b>STEEL</b>	
1	Complex Parts Eg. Main Rotor Heads	Up to 800mm x 800mm
<b>C</b>	<b>PROCURE</b>	<b>Conventional machining – no special processes</b>
1	South African Supplier base	Cliffsway, Dailiff, MicroMax, Panonia

## SWarf AND WATER MANAGEMENT SYSTEM

Semi automated management of all swarf generated by the NC milling operations within the main machining area. Additional to this capability, manage the cooling temperature of the cutting fluid utilized in all the equipment.

## NC-MILLING MACHINES – 3 AND 5-AXIS

Have the capability to mill most aerostructures component. Recent accomplishments include the machining of a Rib-D (prototype) for the Airbus programme.







## CORE CAPABILITIES - OPERATIONS



MANUFACTURING  
ENGINEERING  
MACHINING  
**SHEET METAL**  
SPECIAL PROCESSES  
COMPOSITES  
ASSEMBLY

### SHEET METAL PLANT CAPABILITY

#### FLUID CELL PRESS (QUINTUS PRESS TYPE QFC 1.1 X 4 - 1000)

High pressure forming press. The press has the capability to do multiple sheet metal part forming cycles with a usable tray of 1.1 x 4 meters. It has an estimated capacity of 200,000 parts per year on a one shift scenario.

NO.	PRODUCT TYPE	SIZE
A	MANUFACTURE	
1	Large parts which make up the assemblies	Up to 7m
2	Stringers	Up to 2m
3	Stretch Forming & Profiling of Extrusion	Up to 3m
4	Skins	1.1m x 4m max
NOTE	Fluid Cell Press parts which can be produced with tooling	

### SPECIAL PROCESSES PLANT CAPABILITY

#### SURFACE TREATMENT

Refurbished and upgraded Phase 1 of the surface treatment area in order to manage larger parts through these facilities.

Qualified facility for the processing of Airbus A400M Top Shells (Chromic Anodising).

#### SURFACE TREATMENT CAPABILITY

##### Metallic Manufacturing – Aluminium, Steel and Other

ALUMINIUM	QTY	LENGTH (mm)	WIDTH (mm)	DEPTH (mm)
Chrome Anodizing	1	8000	1000	3000
Chrome Anodizing	1	10 000	750	2000
Chrome Anodizing	1	5300	700	2000
Sulphuric Anodizing	1	6000	800	2000
Pickling Processing	2	8000	1000	3000
Chromate Conversion Coating	1	1900	1000	2000
Hard Anodizing	1	1000	400	800
Chemical Milling	1	450	800	600
Sulphuric Etch	1	1000	1200	1200

STEEL, ,STAINLESS STEEL, TITANIUM	QTY	LENGTH (mm)	WIDTH (mm)	DEPTH (mm)
Cadium Plating	1	2000	1000	1600
Phosphating (Zink)	1	2000	1000	1600
Titanium Pickling	1	400	400	600
Passivation Stainless Steel	1	1200	440	800
Passivation Stainless Steel	1	600	600	600

MECHANICAL PROCESSES	QTY	LENGTH (mm)	WIDTH (mm)	DEPTH (mm)
Glass Peening	1	1000	1500	800



#### METALLIC MANUFACTURING

FLUID CELL PRESS	QTY	DIMENSION
Fluid Cell Press	1	1.1m X 4m (100 MPA)

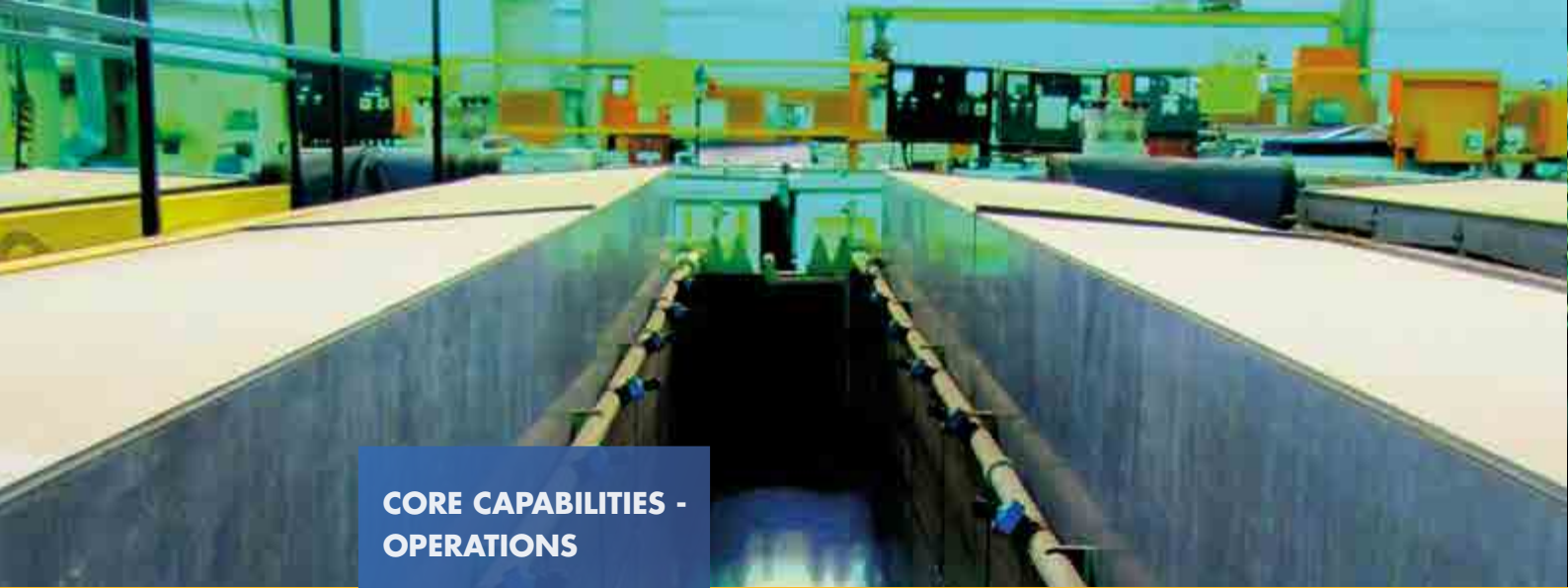
STRETCH FORMING	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
Vertical Stretch Forming	1	2400	2000	1500
Horizontal Stretch Forming	1	3000	750	250
ROLLERS	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
Farnham Roller	1	5900	continuous	
Lisse Roller	1	2300	continuous	

ROUTER	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
NC Router	1	4700	1200	

FREEZER	QTY	LENGTH (mm)	WIDTH (mm)	HEIGHT (mm)
Various Freezer	1	6000	3000	2000







CORE CAPABILITIES - OPERATIONS



MANUFACTURING  
ENGINEERING  
MACHINING  
SHEET METAL  
**SPECIAL PROCESSES**  
COMPOSITES  
ASSEMBLY

SPECIAL PROCESSES PLANT CAPABILITY

ALUMINIUM HEAT TREATMENT

This semi-automated aluminium solution treatment furnace has the ability to manage large panel parts. The furnace has dedicated cooling water support and has an operating temperature range of 500° to 550°C (Max = 600°C).

<b>FURNACE 41</b>	<b>FURNACE 17</b>
Range 0-550°C	Range 0-400°C
Maximum 550°C	Maximum 400°C
Size 5.35m x 2m height x 1.1m width	Size 4.6m x 1.65m height x 1m width

NON-DESTRUCTIVE TESTING

Facility capable of the following testing:

- Magnetic Particle Inspection
- Die Penetrant Eddy Current
- X-Ray - Real Time
- Ultrasonic Testing

PAINT SHOP BOOTHS	1	2	3	4	5
Length	7m	7m	7,8m	3m	1,5m
Height	3,2m	2,8m	3,2m	3,2m	1,5m
Width	4m	4m	4,3m	4,3m	1,0m

Drying Tunnel	
Length	24m
Height	2,3m
Width	2,5m

Spray Curtains (Qty 4)	
Length	2,8m
Height	2m
Width	0,5m

Ovens (Qty 3)



HEAT TREATMENT CAPABILITY  
Metallic Manufacturing – Aluminum, Steel and Other

ALUMINIUM	QTY	X-AXIS (mm)	Y-AXIS (mm)	Z-AXIS (mm)
Solution Treatment Furnace	1	7000	3000	2000
Furnace ageing/ Stress relieving	1	7000	1500	2000

STEEL – ONLY VIA TURBOMECA AFRICA (TMA)

Various Ageing/Hardening,  
Stress Relieving,  
Annealing Furnaces  
Various Salt Baths





CORE CAPABILITIES -  
OPERATIONS

MANUFACTURING  
ENGINEERING  
MACHINING  
SHEET METAL  
SPECIAL PROCESSES  
**COMPOSITES**  
ASSEMBLY

COMPOSITES PLANT CAPABILITY

CMS ROUTER QTY 2

The CMS has two independent spindle heads with a maximum speed of 22000rpm. The table envelope includes a maximum length of 18m X 3.8m X 1.8m.

COMPOSITE CAPABILITY

Clean Rooms	QTY 2	
	471m <sup>2</sup>	Class 7
	464m <sup>2</sup>	Class 8

MAIN PRODUCTION EQUIPMENT	QTY
Surface treatment plant	1
Automatic ply cutters	2
NDT ultrasonic and X-ray	1
Metronor measuring equipment	1
Paint shop	1
Automated surface treatment plant	1
A&C Scanners	2

AUTOCLAVE

The composite facility currently has two autoclaves with a third to be commissioned October 2013. Operating pressure range up to 10 bar at 200°C.

AUTOCLAVE	LENGTH
1	2,5m x 13m
2	3m x 8m
3	2,5m x 9m (on order)



MANUFACTURING  
ENGINEERING  
MACHINING  
SHEET METAL  
SPECIAL PROCESSES  
COMPOSITES  
**ASSEMBLY**

ASSEMBLY PLANT CAPABILITY

ASSEMBLY LINE

Currently DAe assemble sub and main assemblies for the following OEM's:

- AIRBUS
- Gulfstream

A Semi Automatic C Frame riveter was also installed with a reach of 2m.



NO.	PRODUCT TYPE	MATERIAL TYPE	SIZE
<b>A</b>	<b>STRUCTURAL</b>		<b>Up to 7m</b>
1	Empennages	Composite/Metallic	
2	Tail units	Composite/Metallic	
3	Elevators/Tabs/Flaps	Composite/Metallic	
4	Airbrakes	Composite/Metallic	
5	Wing Tips	Composite/Metallic	
6	Small to Medium aircraft structures	Composite/Metallic	
7	Fairings/Cowlings	Composite/Metallic	
<b>B</b>	<b>MECHANICAL</b>		<b>Between 0.5m &amp; 3m</b>
1	Small complex critical assemblies	Composite/Metallic	





State Owned Company



Thin Web Machining



Our Customer Base



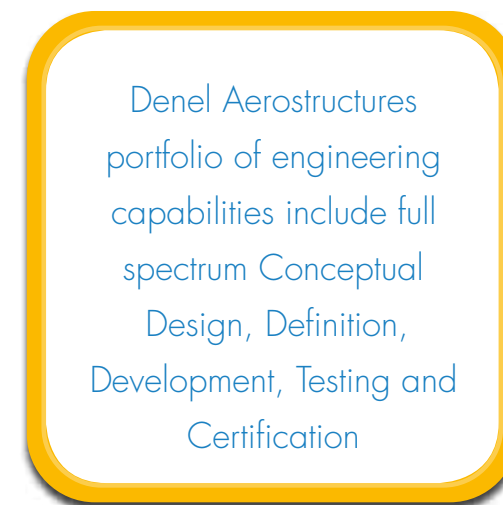
Supply Chain



Engineering and Design



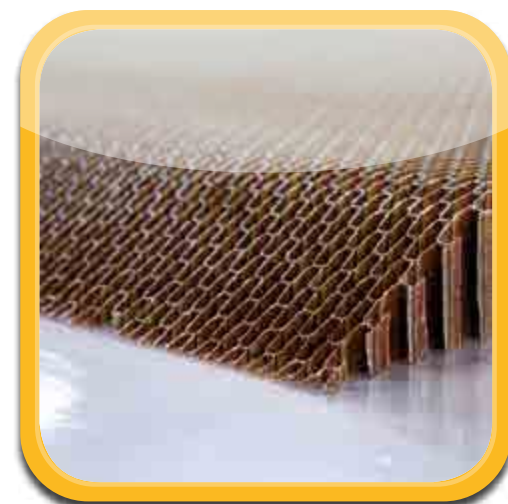
Nadcap accredited



World Class Engineering Capabilities



World Class Manufacturing Capabilities



Advanced Composite Facility



Airbus A400M partner



# NOTES







DENEL AEROSTRUCTURES

## CONTACT DETAILS

**Address:** Astropark, Atlas Road,  
Bonaero Park, Gauteng

**GPS:** S 26.14522 E 028.26659

**Email:** [marketing@denelaero.co.za](mailto:marketing@denelaero.co.za)

**Tel:** 011 927 3319

**Fax:** 011 927 2632

**Visit us:** [www.denelaero.co.za](http://www.denelaero.co.za)