THE ADVANCED AEROSPACE MANUFACTURING AND ENGINEERING PARTNER
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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 strips, 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 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.

**THE CREDIBLE STATE-OWNED SOUTH AFRICAN STRATEGIC PARTNER FOR INNOVATIVE DEFENCE, SECURITY AND RELATED TECHNOLOGY SOLUTIONS**
DENEL GROUP’S STRUCTURE

SOUTH AFRICAN GOVERNMENT
- Minister of Public Enterprises
- Minister of Defence and Military Veterans
- Other Ministers
  - Aviation Sector
    - South African Airways
    - South African Express
    - Mango
  - Chief: SA National Defence Force
  - Dept. of Defence (Secretary of Defence)
  - Armscor (Procurement)
  - Trade & Industry Science & Technology Economic Development National Treasury

BUSINESS ENTITIES
- Denel Dynamics
- Denel Aviation
- Denel Land Systems
- Denel PMP
- Denel Overberg Test Range
- Associated Companies
  - Turbomeca Africa (Pty) Ltd
  - Cassidian Optronics (Pty) Ltd
  - Rheinmetall Denel Munition (Pty) Ltd
- Denel Strategic Equity Partners

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

INNOVATION
We create sustainable innovative solutions.

PERFORMANCE
We embrace operational excellence.

INTEGRITY
We are honest, truthful and ethical.

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
Alouette / MRO

1980
Oryx / Super Puma conversion

1992
Denel (Pty) Ltd established

1995
Ace / All composite turbo prop trainer

1996
Gulfstream G150

1999
SAAB Gripen

2000
Airbus A400M

2005
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
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**
- **Horizontal Stabiliser**
- **Vertical Stabiliser**
- **Winglet**
- **Wing-to-Fuselage Fairing (WWF)**
- **Top Shells (TS)**
- **Ribs, Swords, Spars (RSS)**

**PRODUCTS DELIVERY DATE OF SIGNIFICANT MILESTONE**

<table>
<thead>
<tr>
<th>PRODUCTS</th>
<th>DELIVERY DATE OF SIGNIFICANT MILESTONE</th>
<th>DELIVERY/YEAR</th>
<th>QUANTITY DELIVERED TO DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribs, Swords and Swords</td>
<td>Original contract signed Aug, 2006, transfer stopped in April 2010, transfer re-initiated in February 2012, first test parts production complete.</td>
<td>To ramp up to 24 per year.</td>
<td>New Programme</td>
</tr>
</tbody>
</table>

**PRODUCTS DELIVERY DATE OF SIGNIFICANT MILESTONE**

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Empennage</td>
<td>First Unit (unit 90) delivered in June 1997.</td>
<td>Max 48 per year</td>
<td>110</td>
</tr>
</tbody>
</table>

**PRODUCTS**
- **Airbus A400M**
- **Gulfstream G150**
- **US Business Jet**
- **Denel Rooivalk**

**PRODUCTS DELIVERY DATE OF SIGNIFICANT MILESTONE**

<table>
<thead>
<tr>
<th>PRODUCTS</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Winglet</td>
<td>First article delivery 29 January 2014</td>
<td>80</td>
<td>New Programme</td>
</tr>
<tr>
<td>Rooivalk</td>
<td>Concept design started in 1985.</td>
<td>3 per year</td>
<td>12 + ADM, EDM and XDM</td>
</tr>
<tr>
<td>Rooivalk</td>
<td>XDM 1st Flight; 11 February 1990.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rooivalk</td>
<td>ADM 1st Flight; 22 May 1992 1st helicopter with a glass cockpit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rooivalk</td>
<td>EDM 1st Flight; 18 November 1996.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rooivalk</td>
<td>1st Production unit 1st Flight; Nov 1998.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### PAST PROGRAMMES

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

**PRODUCTS**

- **Main Landing Gear Unit**
- **Pylons**
- **Rear Fuselage**

**SAAB Gripen**

**BAE Systems Hawk**

<table>
<thead>
<tr>
<th>PRODUCTS</th>
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<th>QUANTITY DELIVERED TO DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>尾翼</td>
<td>Programme commenced May 2000. Tailplanes built with the final delivery made in August 2009.</td>
<td>12 per year</td>
<td>151</td>
</tr>
<tr>
<td>襟翼</td>
<td>Programme commenced July 2002. Flap sets built with the final delivery made in April 2009.</td>
<td>12 per year</td>
<td>46</td>
</tr>
<tr>
<td>空气刹车</td>
<td>Programme commenced September 2003. Airbrakes built with the final delivery made in September 2008.</td>
<td>12 per year</td>
<td>83</td>
</tr>
</tbody>
</table>
### QUALITY ACCREDITATIONS

Accredited for:
- Non-Destructive Testing
- Chemical Processes
- Heat Treatment
- Composites

### PRODUCTS DELIVERY DATE OF SIGNIFICANT MILESTONE QUANTITY DELIVERED TO DATE

<table>
<thead>
<tr>
<th>PRODUCTS</th>
<th>DELIVERY DATE OF SIGNIFICANT MILESTONE</th>
<th>QUANTITY DELIVERED TO DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A109</td>
<td>Product Supply Agreement signed July 2000, 30 AC delivered to SAAF (5 AW built, 25 DAe built)</td>
<td>30</td>
</tr>
</tbody>
</table>

Boeing

<table>
<thead>
<tr>
<th>PRODUCTS</th>
<th>DELIVERY DATE OF SIGNIFICANT MILESTONE</th>
<th>QUANTITY DELIVERED TO DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boeing</td>
<td>Period 2004 to 2011 - Total number of orders received from Boeing – approximately 3300. Total number of details delivered 45148</td>
<td>Detailed part with varying rates.</td>
</tr>
<tr>
<td>737 details and sub-assemblies</td>
<td>Programme commenced 2004 and completed in 2011. DAe contracted to produce 75 different parts and sub-assemblies for the 737 Aircraft.</td>
<td>Detailed part with varying rates.</td>
</tr>
<tr>
<td>747 details and sub-assemblies</td>
<td>Programme commenced 2004 and completed in 2011. DAe contracted to produce 148 different parts and sub-assemblies for the 747 Aircraft.</td>
<td>Detailed part with varying rates.</td>
</tr>
<tr>
<td>757 details and sub-assemblies</td>
<td>Programme commenced 2004 and completed in 2011. DAe contracted to produce 53 different parts and sub-assemblies for the 757 Aircraft.</td>
<td>Detailed part with varying rates.</td>
</tr>
<tr>
<td>777 details and sub-assemblies</td>
<td>Programme commenced 2004 and completed in 2011. DAe contracted to produce 113 different parts and sub-assemblies for the 777 Aircraft.</td>
<td>Detailed part with varying rates.</td>
</tr>
</tbody>
</table>
Denel Aerostructures portfolio of engineering capabilities include full spectrum Conceptual Design, Definition, Development, Testing and Certification.
CONFIGURATION MANAGEMENT

Configuration Management processes are aligned to CMII, ISO 10007 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

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
- CFD (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

ENGINEERING CAPABILITIES

- Catia V5
- Catia V4
- ESDU
- Dytran
- ESDU
- iSight
- CFD (Composite Part Design)
- Airbus tools (ISSY, SAMTECH tools etc.)
- In-house developed tools (DCU etc.)

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

ENABLERS

Stakeholder Investment
Decision Gates
Technical Reviews
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

**CORE CAPABILITIES - ENGINEERING**

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

- **METALLIC AND COMPOSITE STRUCTURE**
  - Sheet metal parts
  - Machined components
  - Composite design using CPD (includes the creation of CD and CM models and DWF 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.

- **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

- **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
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.

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.
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.

CURRENT ENGINEERING PROJECTS

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.
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.

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.

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.

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.
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

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 built in ICY Jigs
  - Airbus Wing to Fuselage Fairing
  - Airbus Tip 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

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
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.

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.

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.

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

QUALITY

Accredited for:

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

MANUFACTURING ENGINEERING

Manufacturing Engineering specialize in developing holistic manufacturing method data packs for aero-structure 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.

OPERATIONS

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MACHINING PLANT CAPABILITY

<table>
<thead>
<tr>
<th>NO.</th>
<th>PRODUCT TYPE</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ALUMINIUM</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>NC Parts</td>
<td>Up to 800 mm x 300mm</td>
</tr>
<tr>
<td>2</td>
<td>5 Axis DMU</td>
<td>Up to 800mm x 800mm</td>
</tr>
<tr>
<td>3</td>
<td>3 Axis Parts (Long Beds)</td>
<td>Up to 5m x 2.5m</td>
</tr>
<tr>
<td>4</td>
<td>Large 5 Axis Parts</td>
<td>Up to 6m x 2.5m</td>
</tr>
<tr>
<td>5</td>
<td>CMS 5 Axis Router</td>
<td>3m x 1.8m</td>
</tr>
<tr>
<td>B</td>
<td>STEEL</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Complex Parts Eg. Main Rotor Heads</td>
<td>Up to 800mm x 800mm</td>
</tr>
<tr>
<td>C</td>
<td>PROCURE</td>
<td>Conventional machining – no special processes</td>
</tr>
<tr>
<td>1</td>
<td>South African Supplier base</td>
<td>Cliffway, Dailiff, MicroMax, Panonia</td>
</tr>
</tbody>
</table>

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**

**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.

---

**METALLIC MANUFACTURING**

<table>
<thead>
<tr>
<th>NO.</th>
<th>PRODUCT TYPE</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>MANUFACTURE</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Large parts which make up the assemblies</td>
<td>Up to 7m</td>
</tr>
<tr>
<td>2</td>
<td>Stringers</td>
<td>Up to 2m</td>
</tr>
<tr>
<td>3</td>
<td>Stretch Forming &amp; Profiling of Extrusion</td>
<td>Up to 3m</td>
</tr>
<tr>
<td>4</td>
<td>Skins</td>
<td>1.1 m x 4m max</td>
</tr>
</tbody>
</table>

**NOTE** Fluid Cell Press parts which can be produced with tooling

---

**STRETCH FORMING**

<table>
<thead>
<tr>
<th>QTY</th>
<th>X-AXIS (mm)</th>
<th>Y-AXIS (mm)</th>
<th>Z-AXIS (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2400</td>
<td>2000</td>
<td>1500</td>
</tr>
</tbody>
</table>

**Horizontal Stretch Forming**

<table>
<thead>
<tr>
<th>QTY</th>
<th>X-AXIS (mm)</th>
<th>Y-AXIS (mm)</th>
<th>Z-AXIS (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3000</td>
<td>750</td>
<td>250</td>
</tr>
</tbody>
</table>

**ROLLERS**

<table>
<thead>
<tr>
<th>QTY</th>
<th>X-AXIS (mm)</th>
<th>Y-AXIS (mm)</th>
<th>Z-AXIS (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5900</td>
<td>continuous</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2300</td>
<td>continuous</td>
<td></td>
</tr>
</tbody>
</table>

**NC ROUTER**

<table>
<thead>
<tr>
<th>QTY</th>
<th>X-AXIS (mm)</th>
<th>Y-AXIS (mm)</th>
<th>Z-AXIS (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4700</td>
<td>1200</td>
<td></td>
</tr>
</tbody>
</table>

**FREEZER**

<table>
<thead>
<tr>
<th>QTY</th>
<th>LENGTH (mm)</th>
<th>WIDTH (mm)</th>
<th>HEIGHT (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6000</td>
<td>3000</td>
<td>2000</td>
</tr>
</tbody>
</table>

---

**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

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>QTY</th>
<th>LENGTH (mm)</th>
<th>WIDTH (mm)</th>
<th>DEPTH (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrome Anodizing</td>
<td>1</td>
<td>8000</td>
<td>1000</td>
<td>3000</td>
</tr>
<tr>
<td>Chrome Anodizing</td>
<td>1</td>
<td>10000</td>
<td>750</td>
<td>2000</td>
</tr>
<tr>
<td>Chrome Anodizing</td>
<td>1</td>
<td>5300</td>
<td>700</td>
<td>2000</td>
</tr>
<tr>
<td>Sulphuric Anodizing</td>
<td>1</td>
<td>6000</td>
<td>800</td>
<td>2000</td>
</tr>
<tr>
<td>Pickling Processing</td>
<td>2</td>
<td>8000</td>
<td>1000</td>
<td>3000</td>
</tr>
<tr>
<td>Chrome Anodizing</td>
<td>1</td>
<td>1900</td>
<td>1000</td>
<td>2000</td>
</tr>
<tr>
<td>Hard Anodizing</td>
<td>1</td>
<td>1000</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>Chemical Milling</td>
<td>1</td>
<td>450</td>
<td>800</td>
<td>600</td>
</tr>
<tr>
<td>Sulphuric Etch</td>
<td>1</td>
<td>1000</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>Cadmium Plating</td>
<td>1</td>
<td>2000</td>
<td>1000</td>
<td>1600</td>
</tr>
<tr>
<td>Phosphating (Zink)</td>
<td>1</td>
<td>2000</td>
<td>1000</td>
<td>1600</td>
</tr>
<tr>
<td>Titanium Pickling</td>
<td>1</td>
<td>400</td>
<td>400</td>
<td>600</td>
</tr>
<tr>
<td>Passivation Stainless Steel</td>
<td>1</td>
<td>1200</td>
<td>440</td>
<td>800</td>
</tr>
<tr>
<td>Passivation Stainless Steel</td>
<td>1</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Glass Peening</td>
<td>1</td>
<td>1000</td>
<td>1500</td>
<td>800</td>
</tr>
</tbody>
</table>

---

**STEEL, STAINLESS STEEL, TITANIUM**

<table>
<thead>
<tr>
<th>QTY</th>
<th>LENGTH (mm)</th>
<th>WIDTH (mm)</th>
<th>DEPTH (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000</td>
<td>1000</td>
<td>1600</td>
</tr>
<tr>
<td>1</td>
<td>2000</td>
<td>1000</td>
<td>1600</td>
</tr>
<tr>
<td>1</td>
<td>400</td>
<td>400</td>
<td>600</td>
</tr>
<tr>
<td>1</td>
<td>1200</td>
<td>440</td>
<td>800</td>
</tr>
<tr>
<td>1</td>
<td>600</td>
<td>600</td>
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**MECHANICAL PROCESSES**

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<tr>
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<th>DEPTH (mm)</th>
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<tr>
<td>1</td>
<td>1000</td>
<td>1500</td>
<td>800</td>
</tr>
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**COMPOSITES**

**ASSEMBLY**
SPECIAL PROCESSES

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).

FURNACE 41
Range 0-550°C
Maximum 550°C
Size 5.35m x 2m height x 1.1m width

FURNACE 17
Range 0-400°C
Maximum 400°C
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

MANUFACTURING
ENGINEERING
MACHINING
SHEET METAL
SPECIAL PROCESSES
COMPOSITES
ASSEMBLY

CORE CAPABILITIES - OPERATIONS

HEAT TREATMENT CAPABILITY
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<th>X-AXIS (mm)</th>
<th>Y-AXIS (mm)</th>
<th>Z-AXIS (mm)</th>
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</thead>
<tbody>
<tr>
<td>Solution Treatment Furnace</td>
<td>1</td>
<td>7000</td>
<td>3000</td>
<td>2000</td>
</tr>
<tr>
<td>Furnace ageing/ Stress relieving</td>
<td>1</td>
<td>7000</td>
<td>1500</td>
<td>2000</td>
</tr>
</tbody>
</table>

STEEL – ONLY VIA TURBOMECA AFRICA (TMA)
Various Ageing/Hardening, Stress Relieving, Annealing Furnaces, Various Salt Baths

PAINT SHOP BOOTHS

<table>
<thead>
<tr>
<th>Length</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>3,2m</td>
<td>2,8m</td>
<td>3,2m</td>
<td>3,2m</td>
<td>1,5m</td>
</tr>
<tr>
<td>Width</td>
<td>4m</td>
<td>4m</td>
<td>4,3m</td>
<td>4,3m</td>
<td>1,0m</td>
</tr>
</tbody>
</table>

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)
COMPOSITES PLANT CAPABILITY

CMS ROUTER  QTY 2
The CMS has two independent spindle heads with maximum speed of 22000 rpm. The table envelope includes a maximum length of 18m X 3.8m X 1.8m.

COMPOSITE CAPABILITY

Clean Rooms  QTY 2
471m²  Class 7
464m²  Class 8

MAIN PRODUCTION EQUIPMENT  QTY
Surface treatment plant  1
Automatic ply cutters  2
NDT ultrasonic and X-ray  1
Matrisnor 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.

<table>
<thead>
<tr>
<th>AUTOCLAVE</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.5m x 13m</td>
</tr>
<tr>
<td>2</td>
<td>3m x 8m</td>
</tr>
<tr>
<td>3</td>
<td>2.5m x 9m  (on order)</td>
</tr>
</tbody>
</table>

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.

<table>
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<th>PRODUCT TYPE</th>
<th>MATERIAL TYPE</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>STRUCTURAL</td>
<td>Composite/Metallic</td>
<td>Up to 7m</td>
</tr>
<tr>
<td>1</td>
<td>Empennages</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tail units</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Elevators/Tubs/Flaps</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Airbrakes</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Wing Tips</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Small to Medium aircraft structures</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Fairings/Cowlings</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>MECHANICAL</td>
<td>Composite/Metallic</td>
<td>Between 0.5m &amp; 3m</td>
</tr>
<tr>
<td>1</td>
<td>Small complex critical assemblies</td>
<td>Composite/Metallic</td>
<td></td>
</tr>
</tbody>
</table>
Denel Aerostructures (SOC) LTD operates a dynamic world class supply chain, offering end-to-end managed solutions through:
- Value realisation driven by an integrated customer-focused lean global supply chain network
- Sales & operations planning and logistics solutions
- Supplier collaboration and creation of strategic supply agreements
- Management of material flows from sources of supply through plants to customer

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

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

Advanced Composite Facility
Airbus A400M partner

State Owned Company
Thin Web Machining
Our Customer Base
Supply Chain

Engineering and Design
Nadcap accredited
World Class Engineering Capabilities
World Class Manufacturing Capabilities

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