Welcome to RUAG Australia

The Partner of Choice for Defence and Industry customers for aircraft component and subsystems manufacture and support, offering innovative solutions and excellent customer service.

RUAG Australia’s primary lines of business – engineering, maintenance, repair and overhaul (MRO), precision manufacturing and metal treatment & finishing – together with our commitment to the research and development of advanced repair technologies, are underpinned by a highly skilled, dedicated and committed workforce. Combined, they create a unique and highly valued capability within Australia.

The RUAG Operating System (ROS) underpins RUAG’s commitment to continuous improvement and focus on customer satisfaction. ROS incorporates a Six Sigma Green Belt program enabling process efficiency and LEAN practitioner focused on 5S.

A 100% owned subsidiary of the RUAG Group and fully integrated within RUAG Aviation, RUAG Australia has easy and ready access to the full suite of RUAG capabilities and knowledge base, adding considerable depth and breadth to our Australian customer offering.
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RUAG Australia Capability Booklet

This booklet describes the capabilities of RUAG Australia. It provides an overview of our portfolio of services and their value to the operations of customers, suppliers and partners.

We bring together the best of Swiss precision and Australian innovation. Our promise is excellent support and service to the Defence and Aerospace markets. We combine fully-accredited manufacturing, MRO and engineering expertise to deliver best value expertise and service in the maintenance, repair and overhaul of aircraft mechanical, hydraulic and airframe components and systems.

RUAG Australia specialise in:
- component/system level deeper maintenance
- non-destructive testing, repair and overhaul of repairable items
- design engineering, including research and development
- adaptation and modification
- build-to-print manufacture of airframe-related components
- assembly and testing
- specialist surface treatments and finishing

RUAG Australia focuses its expertise on:
- undercarriage systems
- flight control systems
- fuel systems
- environmental control systems

Innovation is a major characteristic of RUAG Australia’s approach to MRO and manufacturing, underpinned by strong and sustained engineering competencies.

Quality Assurance is the basis for great customer satisfaction

RUAG Australia’s Quality Management System is compliant with the requirements outlined in AS9100D, Civil Aviation Safety Regulation Part 145, Defence Aviation Safety Regulation Part 145, Defence Aviation Safety Regulation Part 21J and RUAG Australia’s own Quality Policy.

Our Quality Management System is tailored to meet specific quality requirements of customers and/or regulatory authorities. The Quality Management System comprises quality policies and quality objectives, and governs our organisational procedures, the procurement of resources, minimisation of risks, maximisation of efficiencies, and identification and rectification of non-conformities.

Certifications
RUAG Australia holds the following accreditations:
- AS9100D Quality Management Systems – Requirements for Aviation, Space and Defence Organisations
- DASR Part 21J Design Organisation
- CASR Part 145 Maintenance Organisation
- DASR Part 145 Maintenance Organisation
- Nadcap Chemical Processing
- Nadcap Non-Destructive Testing
- Nadcap Surface Enhancement
Better customer component reliability and affordability is achieved through innovative applications engineering. Modern modelling, analytical and diagnostic tools are used by engineers at RUAG Australia to improve component reliability and to cost-effectively retain items in service.

RUAG Australia’s engineering goal is to assure that the customer’s systems and components can be operated safely, correctly, reliably and economically throughout their service life. To achieve this goal, we combine standard and innovative engineering practices in our core areas of expertise: aeronautics, mechanics, hydraulics, pneumatics, materials, chemical processing, non-destructive inspection, and additive manufacturing.

Our engineering practices are documented and controlled through our Engineering Management System which is compliant with ADF airworthiness regulations and AS9100D requirements. Our Engineering Management System represents good engineering practice, and can be applied to a variety of industry environments.

Safety is the priority feature of our Engineering Management System.
- We operate a Safety Management System which assures proactive engagement with all stakeholders and effective management of risks.
- We operate Workplace Health and Safety and Environmental Management Systems which are compliant with Australian law, and which assure the protection of people and the environment.

The key outcomes for our Engineering Management System include:
- Development and approval of standard and non-standard repair designs.
- Application of additive manufacturing techniques (Supersonic Particle Deposition and Laser Cladding).
- Research and approval of substitutes for obsolete parts.
- Actions to counter the characteristics of ageing equipment.
- Management of technical publications, including control, change and audit functions.
- Configuration management, including planning, identification, control, status accounting, verification and audit functions.
- Management of technical data, including adherence to export control and intellectual property requirements.
- Technical and logistics contributions to customer Planned Withdrawal Date (PWD) and Life of Type Extension (LOTEX) programs.
- Cost control through Reliability Centred Maintenance, Lean and 6-Sigma practices.
RUAG Australia has been providing aircraft maintenance, repair and overhaul (MRO) services to the Royal Australian Air Force since 1985 and, over time, has established a reputation as a centre of excellence.

MRO serves to retain or restore components so as to avoid the need for complete system replacement. MRO activities may include unforeseen repairs as well as scheduled and preventative maintenance. For RUAG Australia, MRO is the combination of all technical and corresponding administrative, managerial, and supervisory actions necessary to return equipment to a ‘fit for purpose’ condition whilst, ideally, increasing the mean time between failures.

RUAG Australia's MRO capabilities are focused on, but not exclusive to, aircraft and helicopter mechanical systems and components, including:

- Hydraulic components, such as pumps, motors, actuators, valves, piping, accumulators and fittings
- Undercarriage assemblies, including wheels and brakes
- Pneumatic systems
- Mechanical items, such as gearboxes, linkages and couplings, canopies, locks and latches, rotating assemblies, doors and access equipment, and structural components
- Electrical generators
- Engine controls and accessories

To meet the full breadth of customer demands, RUAG Australia delivers MRO services from a variety of sites and through a field service engineer.

RUAG Australia employs more than thirty skilled technicians, all with a base qualification of Aircraft Maintenance Engineer (AME) and with further specializations in airframe, air-flow, and assembly and test. To support its MRO activities, RUAG Australia complements its disassembly/assembly capabilities with a broad and comprehensive suite of test equipment. Supporting and guiding the skilled technicians is a team of highly qualified and experienced engineers.

RUAG Australia is a DASR/CASR Part 145 Maintenance Organisation and a DASR Part 21J Design Organisation with delegated engineering authority over the F/A-18 Classic Hornet, AP-3C Orion, C-130H and C-130J Hercules, PC-9, S-70A Blackhawk, S-70B Seahawk, CH-47 Chinook, Bell 206 Kiowa and Squirrel. RUAG Australia is also an approved Honeywell Service Centre.
RUAG Australia possesses and provides a comprehensive suite of test capabilities in support of its MRO and manufacturing activities. These are to ensure that you benefit from only the highest quality components and subsystems.

Our capability comprises more than 25 different test benches, each capable of testing and simulating a variety of operational conditions. We also operate world-class cleanroom facilities (Class 10,000, Class 100) for performing precision metrology, sub-micron machining, finishing, assembly and testing.

RUAG Australia's breadth of test capabilities covers the following areas:
- Hydraulic components, pumps and valves
- Electro-hydraulic components
- Actuation components
- Mechanical components
- Fluid flow components and systems, incl. actuators, flight controls, servo valves, landing gear and pneumatics, as well as airframe, mechanical and airflow components
- Aircraft wheels and brakes

Hydraulic Pump and General Purpose Test
The Hydraulic Pump/Motor and General Purpose Hydraulic Test Facility is a computer-assisted system designed for testing hydraulic pumps and motors.

Specifications:
- Test medium: MIL-H-83282 Fire Retardant Hydraulic Fluid
- Operating pressure: 0 to 4,500 psi (0 to 317 Bar)
- Static pressure: 0 to 20,000 psi
- Flow capacity: Dual System @ 70 US GPM each
- Electric output: 115 VAC, 400 Hz, Three Phase 0 to 35 VDC
- Flow capacity: Single System @ 70 US GPM
- Oil temperature control: 15.5° C (60 °F) to 71.1° C (160 °F)

Pneumatic Test
The Pneumatic Component Test System is a manually controlled system designed to test pneumatic components.

Specifications:
- Test medium: Air and Nitrogen
- Flow capacity: 0 cu inch/minute to 15 standard cu feet/minute
- Operating pressure: -15 inches mercury to 5,000 psi

Fuel Test
The Fuel Component Test Facility (FCTF) and the Fuel Pump Test Facility are manually operated systems designed to test aircraft fuel components and electric fuel pumps.

Specifications:
- Test medium: MIL-C-7024 Type II Calibrating Fluid (Stoddard’s Solvent)
- Operating pressure: 0 to 200 psi
- Flow capacity: 0 to 250 GPM
- Flow capacity: 320 to 45,000 pound per hour
- Electric output: 115 VAC, 400 Hz, Three Phase
- Fuel testing of engine and APU fuel system accessories and submerged fuel pumps
- Fuel pressure: Supply up to 1,900 psi
- Flow capacity: 1,400 L/hr
- Power output: DC and AC power supplies
Hydraulic and Electro-Hydraulic Test
A computer-assisted system, the electro-hydraulic test facility is designed to test hydraulic and electro-hydraulic components. It is capable of simultaneously controlling up to three electro-hydraulic components utilising both two-wire and three-wire control technology.

Specifications:
- Test medium: MIL-H-83282 Fire Retardant Hydraulic Oil
- Operating pressure: 0 to 4,600 psi (0 to 317 Bar)
- Flow capacity: Dual System @ 3 USGPM
  Single System @ 6 USGPM
- Electrical output: 0 to 30 Volt DC
- 26 Volt AC, 400 Hz, Single Phase

F-18 Specific Test Capability

Electrical Generators:
- Generator Converter unit*

F404 Engine Controls and Accessories:
- Main Fuel Control units
- Power Lever Control unit
- Variable Exhaust Nozzle Actuator and Position Transmitter
- Variable Exhaust Nozzle Power unit and Lube and Scavenge Rotary Pumps*
- Fan Variable Geometry Actuator
- Internal Tank Pressure Regulating Valve

Hydraulic Pumps*

* can be used for testing of other aircraft-systems

Servocylinder Test
The Servocylinder Test Station (STS) is a purpose-built test facility for testing a range of F/A-18 hydraulic components. It consists of two units: Test Fixture and Hydraulic Supply (TFHS) and Electrical Control Console (ECC).

Specifications:
- Test medium: MIL-H-83282 – Fire Retardant Hydraulic Oil
- Operating pressure: 0 to 4,500 PSI
- Flow capacity: 15 GPM
- Coolant fluid: Water
- Operating voltage
  - ECC: 115 VAC, 60 Hz, Single Phase
  - TFHS: 440 VAC, 60 Hz, Three Phases

Pressurisation, Bleed Air and Environmental Control Systems Test
Used for testing of pressurisation, bleed air and environmental control system components, including:
- Cabin pressure regulating valves and cabin pressure safety valves (pressurisation)
- Bleed control valves (bleed air)
- Pressure regulators (bleed air and environmental control system)

Pressurisation
- Operating pressure: 50,000 ft
- Air flow rate: 75 lb/min

Bleed Air
- Operating temperature: Ambient temperature
- Flow rate: 150 lb/min
- Simulated altitude: 40,000 feet
Bleed Air, Anti-Ice, ATS Control and Environmental Control Systems Test
Simulates shut-off and regulating valves for bleed air, anti-ice and environmental control systems, in addition to anti-ice and ECS flow control valves. Starter control valves of air turbine starters can also be tested.
- Simulation of APU and engine bleed air flow
- Air pressure: Up to 1,000 psig
- Air temperature: Up to 537.7° C (1,000 °F)
- Air flow: Up to 250 lb/min
- Port and case leakage measurement

Auxiliary Power Unit Test
Replicates the operating environment of F/A-18 Hornet auxiliary power units (APU) for testing purposes, including the fuel and hydraulic supplies and the APU bleed air system.

Turbine-Compressor Test
Provides vibration, speed and shaft displacement measurement for testing turbine and compressor components. These include cooling turbines, air cycle machines, P-3 Orion multiplier packs, P-3 Orion engine-driven compressors and turbine-driven components.

Specifications:
- Air pressure: Regulated air pressure supply to simulate APU and engine bleed air
- Water-air: Water-air heat exchanger to simulate aircraft heat exchangers
- Air pressure: Regulated air pressure supply to simulate APU/Engine bleed air 50 psig
- Air flow: Up to 200 lb/min
- Air temperature: Up to 400° C (752 °F)

Royal Australian Navy (RAN) Starter Air Compressor Test
Test facilities maintained for testing Royal Australia Navy LM2500 Starter Air Compressors. The test simulates the diesel engine output used to drive Starter Air Compressors (560 kW electric motor), as well as the bleed air output systems. This is then used to measure vibration, speed and shaft displacement.

Heat Exchanger Test
Tests heat exchangers by simulating APU and engine bleed air flow, and measuring bleed and ram air core flow.

Specifications:
- Air pressure: Up to 1,000 psig
- Air temperature: Up to 400° C (752 °F)
- Air flow: Up to 250 lb/min

Single and Dual Torque Motor EHV Test Rig, Computer Controlled
Electro-Hydraulic Valve (EHV) test rigs in the Class 100 cleanroom are used to test F/A-18 Hornet electro-hydraulic flow control valves to operational standards. These receive electrical signals from the aircraft control system and converts them to hydraulic pressure/flow.

Specifications:
- Temperature: Controlled
- Pressure: 0–4,000 psi static
- Flow: 0–15 gpm
- Electric output: 24 vdc 0–25 ma
Non-Destructive Test Capability

A means of examining an object, material or system without impairing its future usefulness. RUAG Australia provides an extensive and approved NDT capability secured by our dedicated and experienced NDT specialists.

Fluorescent Penetrant Inspection (FPI)
Fluorescent dye is applied to a part in order to detect defects that may compromise its integrity or quality. If a flaw is present, the dye will bleed from these areas. Ultraviolet radiation is used to view the penetrant in a darkroom.

This process is usually carried out on non-ferrous materials (e.g. aluminium, titanium).

Accreditations/Approvals:
- Nadcap, Goodrich*, BAE UK*, ASTM E 1417, LMA-PC201*, 981-060-021*, Lockheed Martin*

Capacity:
- Up to 4.5 m length × 0.8 m width × 1.5 m height
  (14.9 ft length × 2.7 ft width × 4.11 ft height)

* Bayswater, VIC
* Wingfield, SA
**Magnetic Particle Inspection (MPI)**
Detecting flaws and defects in ferromagnetic parts (e.g. iron, nickel and cobalt-based materials), the process involves applying magnetic powder in liquid to the part and subjecting it to a magnetic field. Defects present at right angles or near right angles to the magnetic field will leak magnetic flux. This attracts the powder particles to these areas, which is easily witnessed by the operator.

Compatible with ferromagnetic parts, Magnetic Particle Inspection has the advantage of being able to detect sub-surface flaws.

**Accreditations/Approvals:**
- Nadcap, Goodrich*, Eaton* and 981-060-014*, ASTM E 1444

**Capacity:**
- 200 cm length × 40 cm width × 40 cm height
  (78.74 in. length × 15.74 in. width × 15.74 in. height)

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**Eddy Current Crack Detection**
Using electromagnetic induction, Eddy Current inspection detects defects or flaws in conductive materials. It is able to detect very small cracks in or near the surface, requires minimal surface preparation and can investigate complex geometries. Conductive materials with accessible surfaces are necessary for accurate readings, with penetration depth dependent on the conductivity of the material. The Eddy Current inspection equipment provides immediate feedback, and has the added advantage of being fully portable.

**Accreditations/Approvals:**
- ASNT 460

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**Temper Etch Inspection**
Ensuring hardness critical parts do not experience any operation failures, Temper Etch Inspections are conducted on parts that are hardness critical and/or have had some form of machining or blending carried out. The inspection process ensures that no localised heat is induced into the part at any stage that would be undetectable in a hardness test.

**Accreditations/Approvals:**
- Nadcap, MIL-STD-867, LGPS 3000 and several OEM approvals

**Capacity:**
- 50 cm length × 50 cm width × 60 cm height
  (19.68 in. length × 19.68 in. width × 23.62 in. height)
Additive Manufacturing

Increasingly referred to as the third industrial revolution, additive manufacturing enables complex shapes to be created via the reconstitution of fine particles (powder). This allows worn/damaged profiles to be restored to their original shape while simultaneously reestablishing lost performance integrity. Additive manufacturing provides a viable alternative to subtractive manufacturing, which is no longer a feasible repair strategy for a growing number of modern aircraft components.

RUAG Australia is a major industry research centre for the development and application of Powder Deposition Technologies focusing on both Supersonic Particle Deposition (also known as Cold Spray) and Laser Assisted Deposition for Defence applications. These technologies offer a number of exciting and cost-effective outcomes, particularly in the areas of geometry restoration and corrosion protection. In addition, these technologies enable the restoration of corroded/damaged metallic components/structures to an acceptable level of structural integrity and functionality.

RUAG Australia has developed a variety of successful metal depositions including aluminium alloys (2000 series, 6000 series, 7000 series), steels (low carbon, stainless, low thermal high tensile), titanium, nickel, copper, tantalum and many others.

We maintain and operate a fixed and mobile supersonic particle deposition capability as well as a pulsed wire laser deposition capability. We are in the process of supplementing our laser capability with a powder bed system.

Supersonic Particle Deposition
A technology in which powder particles in a supersonic jet of compressed gas impact a solid surface and cause plastic deformation, thus bonding with the underlying material. Bonding occurs as a result of high strain rate deformation and adiabatic shear instabilities at the bond interface. Also referred to as Cold Spray, Supersonic Particle Deposition (SPD) uses powder particles of metal, composite or polymer. In addition to the permanent capability, we have developed a Field Portable SPD Unit (FPSPDU) which enables the SPD technology to be applied in the field.

Laser Additive Deposition
Also known as Laser Cladding, this processing technique is used for adding one material to the surface of another in a controlled manner. A stream of a desired powder/wire is fed into a focused laser beam as it is scanned across the target surface, leaving behind a deposited coating of the feed stock material that is fused to the substrate. The required geometry is built up layer by layer. This technology yields high quality depositions with high bond strength.

Commercialisation
SPD Technology is approved as a Military Standard (MIL-STD-3021 Materials Deposition, Cold Spray) technology. In 2009, RUAG Australia successfully introduced SPD onto operational aircraft. Since then, the Australian Defence Technical Airworthiness Authority in excess of 40 applications have been certified under RUAG Australia SPD applications on Royal Australian Navy Seahawk transmissions and other components. We continue to instigate component geometry repairs using SPD, and are addressing its use for structural repairs.
Manufacturing

Used to convert raw materials or to modify existing materials into finished products, manufacturing processes include one or both of two major functions:

- forming materials into desired shapes
- altering or improving the properties of a material

Finishing processes serve to:

- modify the material surface to protect against deterioration from corrosion, oxidation, mechanical wear or deformation
- provide special surface characteristics such as reflectivity, electrical conductivity/insulation or bearing properties
- give the material special decorative effects

To satisfy customers’ manufacturing needs, RUAG Australia boasts an extensive machining and finishing capability, which is supported by comprehensive additional capabilities in non-destructive test, precision measurement and assembly and test. Coupled with exploratory prototyping, successful research and development activity in recent years has enabled us to develop a unique additive manufacturing capability that provides an affordable, approved alternative to subtractive manufacturing techniques.

Machining Capability

Performed to the highest quality standards on well maintained, modern machines operated by experienced machinists, RUAG Australia’s machining capabilities include milling, turning, jig boring, gun drilling, grinding and honing, and shot and flap peening. As part of our additive manufacturing capability, we maintain supersonic particle deposition and laser deposition systems.
Milling

The process of using rotary cutters to remove material from a work piece, and is one of the most common processes for machining parts to precise sizes and shapes. RUAG Australia’s milling capability comprises four 5-axis machining centres and three 4-axis machines, all with dedicated tooling and machine fixtures specific to each individual component.

Makino D500

The D500 provides superior sustained dynamic accuracy, with Makino Thermal Stabiliser technology isolating the machine from external environmental conditions. Insulated castings, core-cooled ballscrews, temperature-controlled DD motors and spindle all combine to deliver thermal stability. The rotary axes deliver high levels of accuracy when machining away from the centre of rotation.

At RUAG Australia, the Makino D500 is primarily used in support of steel and aluminium component manufacture for the Joint Strike Fighter (JSF). It is also heavily used to finish small undercarriage components.

Specifications:
- 5-axis vertical machining centre
- Work envelope:
  - X-axis: 550 mm (21.65 in.)
  - Y-axis: 1,000 mm (39.37 in.)
  - Z-axis: 500 mm (19.68 in.)
- A-axis (head): +30/-120
- C-axis (table): 360
- Spindle speed: 20,000 RPM
- Tool magazine capacity: 60 tools

Makino A66

The A66 5-axis horizontal machining centre delivers high-efficiency machining of small to mid-size, complex 5-axis components. It is ideal for high-speed machining of small components (300 mm or less) in its 5-axis setting, and for medium components (600 mm or less) in its 4-axis setting. RUAG Australia primarily uses this capability to machine weapon bay door actuators.

Specifications:
- 5-axis horizontal machining centre
- 5 pallet
- Work envelope:
  - X-axis: 800 mm (31.49 in.)
  - Y-axis: 700 mm (27.55 in.)
  - Z-axis: 640 mm (25.19 in.)
- A-axis (head): 360
- C-axis (table): 360 in 4-axis Mode
- Spindle speed: 20,000 RPM
- Tool magazine capacity: 120 tools
- Extra functions: Multi-pallet Changer for quick job setup or large production runs
Makino GF6
The GF6 vertical machining center implements FF machining for medium to large dies and molds. Its high-torque, high-speed spindle employs high feedrates at shallow depths of cut to achieve high-efficiency milling. Also provides heavy-duty cutting performance equal to a standard spindle, enabling it to execute deep cuts as well. The spindle features Makino’s oil jet lubrication system to minimise thermal distortion during high-speed operation for enhanced machining accuracy.

Specifications:
- Vertical machining/milling centre
- Number of axes: 3
- Work envelope:
  - X-axis: 1,050 mm (41.30 in.)
  - Y-axis: 600 mm (23.60 in.)
  - Z-axis: 560 mm (22.00 in.)
- Maximum work piece: 1900 mm × 800 mm × 355 mm (74.80 in. × 31.50 in. × 14.00 in.)
- Tool storage capacity: 20 tools

Mazak Integrex CNC Turn Mill
The multitasking Integrex series provide higher performance machining and greater workpiece capacity than any other multi-tasking machines in their size range. The Mazak Integrex can complete all turning and machining operations from raw material to finished component in a single set up, and is one of the most successful machines in its class. The Integrex is predominantly used to rough and finish landing gear cylinders.

Specifications:
- Twin Spindle, 7-axis machine
- Work Envelope:
  - X-axis: 580 mm (22.83 in.)
  - Y-axis: Combination
  - Z-axis: 1,045 mm (41.14 in.)
- C-axis (Spindle): 360° Index
- B-axis (Tool): 180°
- Milling Spindle speed: 12,000 RPM
- Tool magazine capacity: 80 tools; lower turret 9 tools
- Bar feeder
- Maximum work piece length: 995 mm (39.17 in.)
- Maximum diameter: 660 mm (25.98 in.) upper turret; 260 mm (10.23 in.) lower turret
Okuma Millac 800VH
A highly modern 5-axis multi-plane machining centre, the Millac 800VH combines high speed with high rigidity, secured by a box type bed and rectangular/wide sliding surface. Large ball screws and rigid supports with pre-tension ensure stability and accuracy, and multiface machining capability allows for the machining of complex workpieces in a single setup. This is performed using the Renishaw probe system, which improves part accuracy by eliminating setup errors associated with frequent repairs. The rotary type 2APC is a standard feature that also reduces setup time and increases productivity.

The Millac enhances RUAG Australia’s capability for finishing large F/A-18 undercarriage components, and potentially reduces machining operation times by up to 75%.

Specifications:
- 5-axis vertical machining centre
- Work envelope:
  - X-axis: 1,020 mm (40.15 in.)
  - Y-axis: 1,020 mm (40.15 in.)
  - Z-axis: 1,020 mm (40.15 in.)
- A-axis (head): +30°/90°/-30°
- C-axis (table): 360°
- Spindle speed: 10,000 RPM
- Tool magazine holds: 80 tools
- Accuracy: 0.001 mm (0.000039 in.)
- Ideal for machining large components (max. 1,000 mm × 1,000 mm × 1,000 mm), medium roughing and all finish operations on steel components of complex shapes.
- Extra functions: Pallet Changer for quick setups; Renishaw Probe System

Agietron Impact 2 Electrical Discharge Machine
Electric discharge machining (EDM), also referred to as spark machining, spark eroding, burning, die sinking or wire erosion, is a manufacturing process whereby a desired shape is obtained using electrical discharges. Material is removed from the workpiece by a series of rapidly recurring current discharges between two electrodes, separated by an electric liquid and subject to an electric voltage. One of the electrodes is called the tool-electrode, or simply the ‘tool’ or ‘electrode’, while the other is called the workpiece-electrode, or ‘workpiece’. EDM can cut intricate contours or cavities in pre-hardened steel without the need for heat treatment to soften and re-harden them. This method can be used with any other metal or metal alloy, including titanium. EDM is used principally for hard metals, or those that would be very difficult to machine with traditional techniques. RUAG Australia uses EDM to machine F-35 main landing gear metering snubbing rings, which require a precise, slotted shouldered scarf through the ring. EDM has also been used to support production of Rolls Royce turbine hub NDT test units, solid carbide shotpeen lance nozzles and very high precision flight control servo components.

Specifications:
- 5 programmable axes: X-, Y-, Z-, C- and integrated A-axis
- Programmable bath level
- OS/2 multitasking operating system
- Multiprocessor operating mode
- Pentium CPUs for operator interface
- Command format: absolute/incremental
- Smallest programmable step: 0.0001 mm (0.000039 in.)
- Max. command length: 15 places with floating point
- Electrode changer
- Fire extinguishing system
Turning

A machining process in which a cutting tool, typically a non-rotary tool bit, describes a helical tool path by moving relatively linearly while the work piece rotates.

The term ‘turning’ is usually reserved for the cutting of external surfaces, while the same action applied to internal surfaces is known as ‘boring’. Turning can be done manually in a traditional form of lathe, usually requiring continuous operator supervision, or by using an automated lathe that allows for multiple cutting actions, better known as computer numerical control (CNC).

RUAG Australia maintains three CNC lathes, a jig borer and numerous manual lathes to accommodate a broad spectrum of machining requirements.

Okuma LB3000 EX

A 4-axis version of the LB4000, the LB3000 delivers similar capability and precision, suiting it to finishing operations.

Specifications:
- 4-axis turning centre
- Work envelope:
  - X-axis: 300 mm (11.81 in.)
  - Y-axis: Combination
  - Z-axis: 840 mm (33.07 in.)
- C-axis (spindle): 360° Index
- Spindle speed: 4,200 RPM
- Tool magazine capacity: 12 tools
- Maximum machining length: 500 mm (19.68 in.)
- Maximum machining diameter: 410 mm (16.14 in.)

Okuma LB4000 EX

Delivering consistently high accuracy, the Okuma LB4000 is extremely efficient at removing metal and is ideal for finishing operations. Capable of machining components with a diameter of up to 480 mm (18.89 in.), the LB4000 is primarily used to finish turn internal diameters of landing gear cylinders of intricate design.

Specifications:
- 4-axis turning centre
- Work envelope:
  - X-axis: 300 mm (11.81 in.)
  - Y-axis: Combination
  - Z-axis: 840 mm (33.07 in.)
- C-axis (spindle): 360° Index
- Spindle speed: 4,200 RPM
- Tool magazine capacity: 12 tools
- Maximum machining length: 750 mm (29.52 in.)
- Maximum machining diameter: 480 mm (18.89 in.)
- Renishaw touch probe measuring system
DMG Mori Seiki CTX 510 Ecoline V3
The CTX 510 ECOline is a robust universal CNC turning machine with 3D software. It features MAPPS IV, a new high-performance operating system that combines advanced hardware with leading edge application/network systems and 3D simulation. Made for small and medium-scale serial production, with large turning diameters and bar capacities, the CTX 510 is ideal for light roughing and finishing of steel and aluminium components.

Specifications:
- 2-axis turning centre
- Work envelope:
  - X-axis: 300 mm (11.81 in.)
  - Z-axis: 1,050 mm (41.33 in.)
- C-axis (Spindle): 360° Index
- Spindle speed: 3,250 RPM
- Tool magazine holds: 12 tools
- Accuracy: 0.014/0.016/0.030 mm (0.0005/0.0006/0.0011 in.)

Jig Boring
Jig boring is the production of precise hole centre locations and limited precision milling on both large and small components. RUAG Australia holds a number of Jig borers, both Manual and CNC controlled, capable of accurate hole and bore generation in a variety of workpiece sizes and shapes.

DIXI Jig Borer
An example of our Jig Boring capability is the DIXI 350 TPA jig centre. At RUAG Australia, the DIXI is typically used to precision machine high-value components, including landing gear systems and helicopter gear boxes.

Specifications:
- 4-axis milling centre
- Work envelope:
  - X-axis: 1,000 mm (39.37 in.)
  - Y-axis: 1,000 mm (39.37 in.)
  - Z-axis: 1,100 mm (39.37 in.)
- Spindle speed: 3,000 RPM
- Tool magazine capacity: 100 tools
- Accuracy: 0.0005 mm (0.000019 in.)
- Extra functions: Renishaw touch probe for in-cycle measurement and part setting; 4-station automatic pallet changer for autonomous operations
Gun Drilling

Produces deep, straight holes in a variety of materials. A gundrill tool differs from a conventional twist drill due to its unique head geometry: a standard gundrill has a single effective cutting edge. Guide pads burnish the hole while drilling, allowing straightness to be retained. The result of the burnishing is a very round hole with a precise diameter.

Gun Drill Capability
Rapid, precision drilling of deep bore holes of diameters between 2 mm (0.078 in.) and 100 mm (3.93 in.) over a length of 1,752 mm (68.97 in.), with a maximum workpiece diameter of 300 mm (11.81 in.).

An example of our Gun Drill Capability is the Giana TB1000 Single Tube System Deep Hole Drill, which is employed in the initial stages of main landing gear cylinder manufacturing. In typical operations, the Giana will drill a 93 mm hole, 360 mm deep, at a production rate of less than 3 minutes per part.

RUAG Australia’s Gun Drill capability is employed in the initial stages of main landing gear cylinder manufacturing.

Grinding and Honing

Grinding is an abrasive machining process that uses a grinding wheel as the cutting tool. It is a true metal-cutting process, as each grain of abrasive functions as a microscopic single-point cutting edge. Grinding can produce very fine finishes and very accurate dimensions; yet in mass production contexts it can also rough out large volumes of metal quite rapidly. It is particularly suited to the machining of very hard materials. Lapping, which is also performed by RUAG Australia, is a grinding process in which two surfaces are rubbed together with an abrasive between them, either by hand or using a machine.

Honing is the use of fine abrasive slips held in a machine head, rotated and reciprocated to impart a smooth finish to machined components. It is used by RUAG Australia for ultra-precision manufacturing.

We maintain and operate fourteen grinding machines and four honing machines housed in environmentally-controlled environments, including Class 10,000 and Class 100 state-of-the-art clean room facilities.

Studer ECO Grinder
Ideal for cylindrical grinding of internal and external diameters, the open design of the machine allows for visual control of the grinding process.

Specifications:
- Distance between centres: 650 mm (25.59 in.)
- Centre height: 175 mm (6.88 in.)
- Max. work piece weight between centres: 80 kg (176 lbs.)
- Drive power: 9 kW (12 hp)
- Tolerances: 0.0005 mm (0.000019 in.)
- Tolerances achieved: 0.0005 mm
**Studer S40 CNC Cylindrical Grinding Machine**

The S40 CNC universal cylindrical grinding machine is designed for grinding complex workpieces in small and large batch productions, as well as individual components. Capable of controlled edge grinding, the S40 uses the Movomatic R-axis with a length positioning gauge, which is a unique capability in Australia. The R-axis measures the amount of material ground in process, providing modern measuring and precision while avoiding wheel wear and positional errors.

The S40 is ideal for internal and external diameter roughing and precision finishing of steel components.

**Specifications:**
- Distance between centres: 1,000/1,600 mm (39.37/62.92 in.)
- Centre height: 175/225 mm (6.88/8.85 in.)
- Max. workpiece weight between centres: 130/150 kg (286/330 lbs.)
- Drive power: 7.5/9.0 kW (10.0/12.3 hp)
- Capable of internal grinding
- Tolerances achieved: 0.0005 mm (0.000019 in.)

**Studer S21 CNC Cylindrical Grinding Machine**

Utilising in-process gauges, the S21 precisely measures and grinds components to tolerances down to 0.0005 mm. Our specialists determine tolerances, and using the S21 grind Eaton spools to tolerances of 0.0038–0.0050 mm and Varian air-bearing assemblies to 0.0340–0.0360 mm. These components are used in medical and engineering analyses.

The S21 features match grinding capabilities, in which two process gauges are used to achieve the clearance between two matched components. The experienced technicians at RUAG Australia are experts in the intricacies of the match grinding process, and are able to match grind valve guide and spool assemblies to clearance tolerances of 0.0040–0.0070 mm.

**Specifications:**
- Distance between centres: 400 mm (15.74 in.)
- Centre height: 125 mm (4.92 in.)
- Max. workpiece weight between centres: 30 kg (66 lbs.)
- Drive power: 5.5 kW (7.5 hp)
- Tolerances achieved: 0.0005 mm (0.000019 in.)
Moore Jig Grinder
The positional accuracy of the jig grinder enables the precision grinding of components including in-service F/A-18 axle journals, Sikorsky retention plates, JSF rod end bores as well as in-service and newly manufactured F/A-18 planning arms.

Specifications:
- Table working surface: 280 × 610 mm (11.02 × 24.01 in.)
- Travel: 450 mm (X) × 280 mm (Y) (17.71 × 11.02 in.)
- Spindle housing vertical travel: 320 mm (12.59 in.)
- Spindle quill travel: 89 mm (3.50 in.)
- Grinding wheel speed: 6,000–175,000 RPM
- Grinding capacity (hole diameter): 0.5 mm–340.0 mm (0.019 in.–13.38 in.)
- Least increment: 0.0001 mm (0.000019 in.)
- Positional accuracy: 0.003 mm (0.00011 in.)

Sunnen HTA 2100 Horizontal Hone
Optimal for stock resurfacing, repair work and surface finishing, the HTA 2100 can be set up to operate autonomously, automatically sensing internal diameter honing requirements.

Specification:
- Spindle speed: 20–300 RPM
- Spindle power: 3 hp (2.24 kW)
- Stroke speed: 1.52/2.74 m/min (5–90 ft/min)
- I.D diameter range: 64–533 mm (2.5–21 inches)
- O.D diameter range: 610 mm (24 in.)
- Maximum part length: 6.56 feet (1.99 metres)
- Maximum part weight: 2,400 lbs. (1,088 kg)
**Shot and Flap Peening**

Shot peening is a cold working process that produces a compressive residual layer and modifies the mechanical properties of the material. It involves impacting surfaces with steel shot at a controlled rate, using varying air pressure delivered through a nozzle over a number of passes.

During the shot peening process, each shot that strikes the material acts as a tiny peening hammer, imparting a small indentation or dimple to the surface. To create the dimple, the surface of the material must yield in tension. Below the surface, the material tries to restore its original shape, thereby producing a hemisphere of highly stressed cold-worked material in compression below the dimple.

Shot peening considerably increases part life due to the uniform layer of compressive stress on metal surfaces created by overlapping dimples. It is thus used to increase resistance to fatigue failures, stress corrosion cracking and erosion caused by cavitation.

**Accreditations/Approvals:**
- Nadcap approved for Automated Peening, Peen Forming and Glass Bead Peening
- Shot peen: AMS 2430, MIL-S-13165
- Rotor peen: AMS 2590, MIL-R-81841

**Capacity:**
- 1,200 cm length × 600 cm width (472.44 in. × 236.22 in.)
**Electroplating**

Our expertise and experience in the art of chemical processing of aerospace components is extensive. Coupled with the advantages of our dedicated laboratory facilities, you can be sure to benefit from both premium quality and cost-effectiveness.

**Chemical Conversion Coating of Aluminium Alloys**

Chemical Conversion surface treatment of aluminium alloys for the purpose of:
- Increased surface corrosion resistance
- Increased bonding of surface adhesives
- Increased paint adhesion
- Maintaining electrical conductivity

**Accreditations/Approvals:**
- Nadcap, MIL-C-5541+, MIL-DTL-5541 Type I Classes 1A and 3+, MIL-DTL-5541 Type II Class 3+(hexavalent free), AMS 2473+, BAE UK Rochester+, AP00044149+, AP00042308+, BAE UK+, R15-6131+

**Capacity:**
- Up to 4.5 m length × 0.6 m width × 1.5 m height (14.9 ft length × 1.96 ft width × 4.11 ft height)

**Chromate Conversion Coating of Titanium**

Chemical conversion surface treatment of titanium alloys for the purpose of:
- Increased bonding of surface adhesives
- Increased paint adhesion

**Accreditations/Approvals:**
- Nadcap, BAE UK+, LMA-PH016+, Lockheed+

**Capacity:**
- Up to 4.5 m length × 0.6 m width × 1.5 m height (14.9 ft length × 1.96 ft width × 4.11 ft height)

**Titanium Alloys Pre-Penetrant Etch**

Removal of smeared metal post-machining, prior to fluorescent penetrant inspections that may mask surface defects.

**Accreditations/Approvals:**
- Nadcap+, Lockheed+, BAE UK+, LMA-PG001+

**Capacity:**
- Up to 4.5 m length × 0.6 m width × 1.5 m height (14.9 ft length × 1.96 ft width × 4.11 ft height)

**Aluminum Alloys Pre-Penetrant Etch**

Removal of smeared metal post-machining, prior to fluorescent penetrant inspections that may mask surface defects.

**Accreditations/Approvals:**
- Nadcap, Lockheed+, LMA-PG001+

**Capacity:**
- Up to 4.5 m length × 0.6 m width × 1.5 m height (14.9 ft length × 1.96 ft width × 4.11 ft height)
**Sulphuric Acid Anodise (Nickel Acetate or Sodium Dichromate Seal)**
Surface conversion treatment of titanium and aluminium alloys to provide:
- Environmental surface protection
- Abrasion resistance
- Corrosion resistance
- Exceptional base for painting
- Minimal or no effect on fatigue strength

**Accreditations/Approvals:**
- Nadcap, MIL-A-8625 Type II & IIB*, BAE UK Rochester*, AP00044150*

**Capacity:**
- Up to 4.5 m length × 0.6 m width × 1.5 m height
  (14.9 ft length × 1.96 ft width × 4.11 ft height)

**Thin Film Sulphuric Acid Anodise (Nickel Acetate or Sodium Dichromate Seal)**
Surface conversion treatment of aluminium alloys to provide:
- Environmental surface protection
- Abrasion resistance
- Corrosion resistance
- Exceptional base for painting
- Minimal or no effect on fatigue strength

**Accreditations/Approvals:**
- MIL-A-8625 Type IC*, Lockheed Martin*, LMA-PH090* (Sodium Dichromate Seal only)

**Capacity:**
- Up to 4.5 m length × 0.6 m width × 1.5 m height
  (14.9 ft length × 1.96 ft width × 4.11 ft height)

**Cadmium Plating (Low Embrittlement)**
Cadmium plating has a bright or dull/matte finish which is used to provide:
- Corrosion protection
- Exceptional base for painting

**Accreditations/Approvals:**
- Nadcap, Goodrich*, AMS QQ-P-416*, MIL-STD-870*, LGPS 1100*, AMS 2400*, AMS 2401*

**Capacity:**
- Bright: 70 cm length × 60 cm width × 70 cm height
  (27.55 in. length × 23.62 in. width × 27.55 in. height)
- Low embrittlement: 110 cm length × 70 cm width × 70 cm height
  (43.30 in. length × 27.55 in. width × 27.55 in. height)
Nickel Sulphamate
An electrolytic process in which nickel is deposited on steel or stainless steel.
A nickel strike plating process is used as an underlay to apply cadmium on stainless steel and copper materials, and to apply electroless nickel on stainless steels. Nickel Sulphamate provides:
- Wear resistance
- Corrosion protection
- Low stress deposit
- Reclamation of worn journals
- Greater thickness than other nickel plating methods
- High ductility

Accreditations/Approvals:

Capacity:
50 cm length × 60 cm width × 60 cm height
(19.68 in. length × 23.62 in. width × 23.62 in. height)

Electroless Nickel
Electroless nickel (also known as e-nickel and NiP) differs from other electroplating processes in that it is an autocatalytic process that does not require any external electrical current to produce a deposit. Much of the chrome plating performed in the aerospace industry can be replaced with electroless nickel plating. Environmental costs, costs of hexavalent chromium waste disposal and the tendency of uneven current distribution play in favour of electroless nickel plating. E-nickel offers many benefits:
- Uniform layer thickness over most complicated surfaces
- Direct plating of ferrous metals (steel)
- Great wear and corrosion resistance
- Lubricity in the ability to slide over other metal surfaces

Approvals/Accreditations:
- Nadcap, AMS 2404*, Goodrich UK (Nickel Strike)*

Capacity:
60 cm length × 70 cm width × 90 cm height
(23.62 in. length × 27.55 in. width × 35.43 in. height)

Hard Chromium Plating
Hard chromium plating is deposited on a wide range of metals, leaving a surface for grinding to the perfect finish. Materials that offer the best results include steel, stainless steel, copper and brass. Benefits include:
- Wear resistance
- Corrosion protection
- Reclamation of worn journals
- Electrical current conductivity

Accreditations/Approvals:
- AMS 2460*, AMS 2406*, AMS QQ-C-320*, MIL-STD-1501*

Capacity:
- 60 cm length × 60 cm width × 80 cm height
  (23.62 in. length × 23.62 in. width × 31.49 in. height)
Iron-Manganese and Zinc Phosphate
Applicable to recessed areas incompatible with electroplating, coating is used on steel spines or gear components to provide:
- Wear resistance
- Corrosion protection with the addition of oil or organic finish
- Oil retentive film (lubricity)
- Base for subsequent coatings or organic finishes

Accreditations/Approvals:
- Nadcap*, DEFSTAN 03-11*, MIL-STD-16232*

Capacity:
60 cm length x 60 cm width x 70 cm height
(23.62 in. length x 23.62 in. width x 27.55 in. height)

Stainless Steel Passivate
A treatment process to eliminate contaminates. Passivation promotes the formation of a passive film on a component, which helps prevent rust and corrosion.

Accreditations/Approvals:

Capacity:
Up to 4.5 m length x 0.6 m width x 1.5 m height
(14.9 ft length x 1.96 ft width x 4.11 ft height)

Silver Plating
Silver plating consists of a matte finish and provides:
- Wear resistance
- Corrosion protection
- High electrical and heat conductivity

Accreditations/Approvals:
- Nadcap*, 914-026-037/041*, AMS 2410*, AMS 2411*, DEFSTAN 03-9*

Capacity:
- 45 cm length x 25 cm width x 30 cm height
  (17.71 in. length x 9.84 in. width x 11.81 in. height)

Stress Relieving and De-Embrittlement
Stress induced into the part through regular use or rework conditions is relieved, while any post-plating hydrogen embrittlement is removed.

Accreditations/Approvals:
- Nadcap*, ASTM B 519 (specimen testing)*
- Hardening of Stainless Steels: Goodrich*, AMS 2759/3*, 914-010-004*, HTS 132*, HTS 133*, HTS 134*, HTS 135*, HTS 137*, AMS 2759/9*

Capacity:
- Up to 195° C: 130 cm length x 90 cm width x 160 cm height
  (51.18 in. length x 35.43 in. width x 62.99 inches height)
- Up to 552° C: 60 cm length x 60 cm width x 90 cm height
  (23.62 in. length x 23.62 in. width x 35.43 in. height)
Prime and Paint

Painting increases the service life of a component and enhances its appearance.

RUAG Australia's capability includes two temperature-controlled, air-filtered, down-draft water wash paint booths and two temperature and humidity-controlled dry paint booth.

Paint Accreditations/Approvals:

Dry film:
- MIL-PRF-46010*

Fuel tank coating:
- AMS-C-27725*

Capacity:
- Up to 4.5 m length × 0.8 m width × 1.5 m height
  (14.9 ft length × 2.7 ft width × 4.11 ft height)

* Bayswater, VIC
+ Wingfield, SA
Staying engaged with our customers is important to us, and we look forward to establishing a partnership with you. Please feel free to contact us.

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