

DOWTY AEROSPACE
DIVISION

DOWTY IS AN INTERNATIONAL GROUP

of advanced engineering companies creating innovative systems and products using the latest electronic, hydromechanical and polymer technologies.

Its customers are mainly in aerospace, maritime, professional electronics, information technology, industrial and automotive industries.

THE GROUP OBJECTIVE

is to become the Preferred Partner of its customers and associates worldwide by providing competitive advantage to them through the quality of its products, performance and service.

SINCE ITS FOUNDATION

in Cheltenham in 1931, Dowty has expanded to over 50 operating units structured in four divisions and based in 17 countries across the world. It employs 15,000 people and has a turnover of £730 million (\$1.2 billion) of which 58% is overseas and 67% is civil.

Boeing, a main customer of Dowty Aerospace.



DOWTY AEROSPACE DIVISION



EFA contracts have been awarded for a range of Dowty's advanced technology products.

The division is one of the world's leading manufacturers of aircraft landing gear, flight control actuation systems and propellers and supplies most major aircraft manufacturers, including Airbus Industrie, Boeing, British Aerospace, Eurofighter, Fokker, Saab, McDonnell Douglas, Casa and Shorts.

Civil projects, a growing proportion of the business, represent 65% of sales, 32% being on military programmes and 3% industrial. North America accounts for 41% of sales.

In addition to manufacturing new equipment the division provides a comprehensive customer support service. The three main bases for repair and overhaul in the USA, UK and Singapore on Dowty and non-Dowty equipment form Dowty Aerospace Aviation Services. The repair business is growing rapidly and accounts for 17% of total aerospace sales. A new space projects operation designs and manufactures propellant tanks and control valves for spacecraft propulsion systems.

The division's products are also prominent in the maritime market with winching systems, cable handling equipment and submarine hydraulic systems. The division is supporting 30 air forces and 300 civil operators in 90 countries. Dowty aerospace equipment and systems feature on more than 200 current types of aircraft.



Dowty is a major supplier of equipment to the Airbus programme.

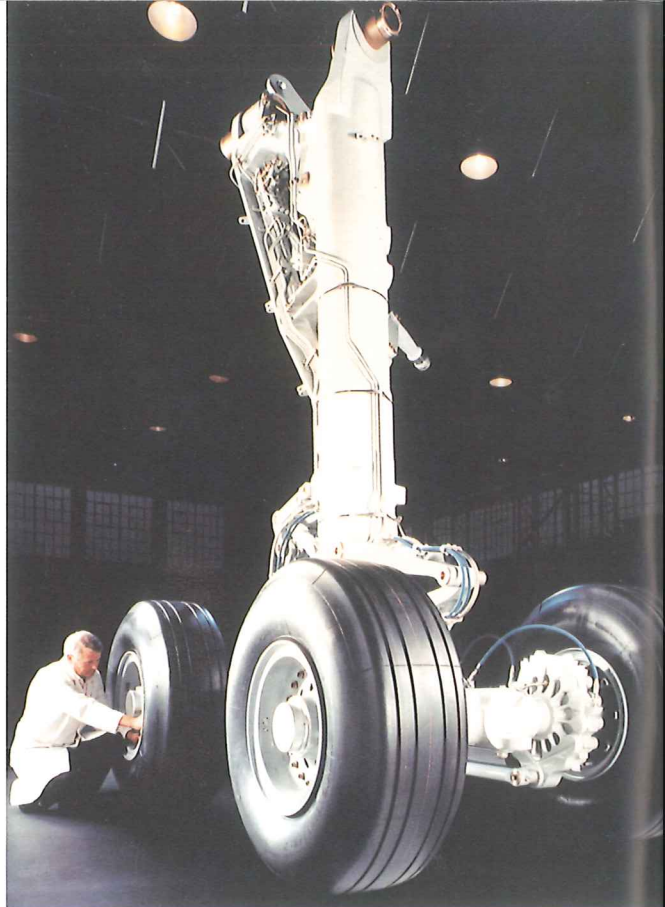
LANDING GEAR

Dowty Aerospace is a world leader in the design and manufacture of landing gear systems for civil and military aircraft.

The division's extensive capability is derived from a wide range of proprietary designs for landing gears of all sizes. More than 200 different types of aircraft have been fitted with 140,000 landing gears over the last 60 years.

Responsibility for the complete landing gear system is undertaken from design concept, to delivery of a completely dressed and tested gear through to in-service support.

Fokker 50 with Dowty main and nose gear.



Airbus A330/340 main landing gear, the world's largest civil gear.

landing gear. The centreline gear for the A340 will be supplied by Dowty Aerospace Toronto.

Other civil applications are the landing gear for the BAe ATP and 146, Fokker 50 and 100, Piaggio Avanti, Shorts 360, Boeing Canada de Havilland Dash 8 100 and 300, Canadair CL-601 and Regional Jet.

Dowty landing gear for military aircraft includes Sepecat Jaguar, Panavia Tornado, BAe/McDonnell Douglas AV-8B/Harrier II, GR5, Sea Harrier, BAe EAP and Bell Boeing V-22.

The most recent order is for the main and nose gears of the new Eurofighter programme. Dowty Aerospace is the lead company in a collaborative partnership with Liebherr, Nardi and CESA.

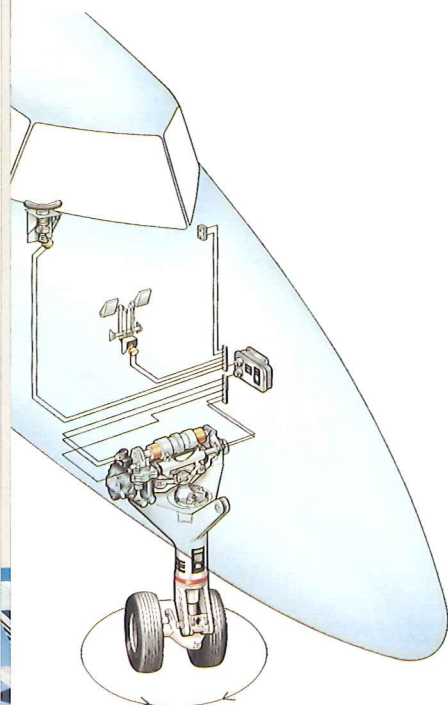
The division is involved in development programmes for future landing gear technologies including advanced landing gear suspension systems for improved rough runway capability; landing gear steer-by-wire systems; landing gear computers; advanced materials and fibre optics.



EFA main gear.

Divisional and Group capability extends to landing gear control computers, landing gear steer-by-wire systems, associated hydraulic and actuation systems, switches and indicators.

Civil applications include the main landing gear for the Airbus A310 and A320, in collaboration with Messier-Bugatti, Dowty being design leaders for the A320 gear. The latest series of Airbus Industrie airliners, the A330/340, will be fitted with Dowty main landing gear and the additional centreline landing gear on the A340. Dowty Aerospace Gloucester has sole responsibility for the design, development and manufacture of the A330/340 main landing gear. This represents a formidable technical challenge as the A330/340 main gear will be the largest one ever produced for a civil aircraft. The single piece, ultra high tensile steel main fitting will be the largest forging of its type used in



Boeing Canada de Havilland Canada Dash 8 with Dowty landing gear and electronically controlled steer-by-wire system.

ACTUATION SYSTEMS

The actuation system business unit is a world leader in the design, manufacture and support of actuation systems for a variety of applications including flight control and engine actuation equipment. The advanced expertise has been applied to a variety of civil and military aerospace applications for both fixed and rotary wing aircraft. The business unit offers a total systems capability for:

- Full Authority Quadruplex Primary Flight Controls
- High Pressure Rotary Vane Actuators
- Hydromechanical Synchronised Engine Thrust Reversers
- High Temperature Exhaust Nozzle Actuation Systems
- High Lift Systems
- Electro-Hydrostatic Actuation Systems
- Flight Control Surface Dampers
- Direct Drive Control Valves
- Servo Valves.

Many design milestones in aircraft control systems have been achieved including the development of fly-by-wire technology and in particular the first full authority quadruplex control actuation system made to production standards. Dowty also produced the first trailing edge flap system to be signalled and monitored by digital electronics.

Actuation equipment has been supplied to the world's leading aircraft manufacturers including Airbus Industrie, Boeing, British Aerospace, Eurofighter, Fokker, McDonnell Douglas and Saab.

The business unit operates at two principal locations: Dowty Aerospace Wolverhampton and Dowty Aerospace Los Angeles.



Dowty's high lift system for the British Aerospace 146 trailing edge flaps, signalled and monitored by digital electronics.



Detailed final assembly and inspection of actuators.



Assembly of Boeing 737-300 thrust reverser actuators.

PROPELLERS

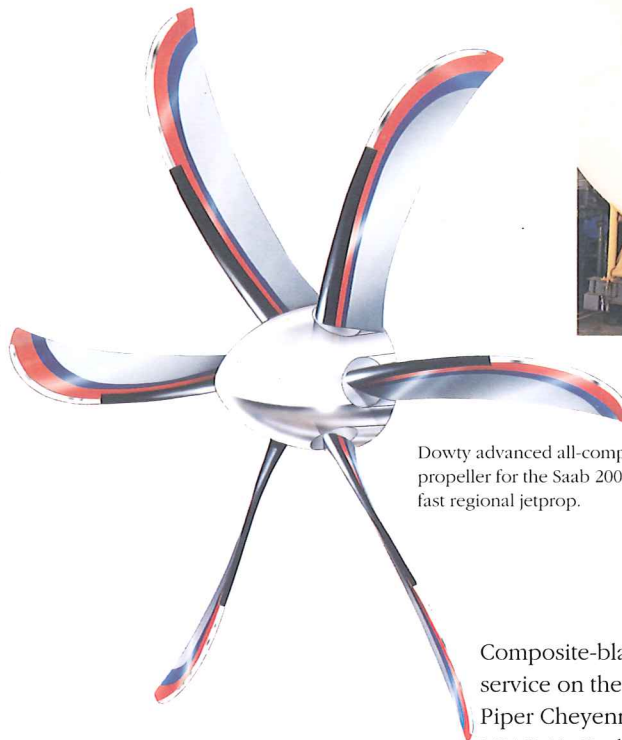
Dowty Aerospace is a world leader in propeller technology. The wide range of advanced technology propellers include blades of metal and all-composite construction.

During the last 60 years over 186,000 propellers have been produced by the company with in excess of 120 million flying hours in passenger carrying airline service.

Dowty metal bladed propellers are currently operating on the BAe Jetstream 31, Casa C-212, Metro III and Gulfstream Commander.

Dowty Aerospace's composite propeller technology has been developed and refined over 20 years in volume production, the only facility of its kind in the world. The company is the one manufacturer of large propellers with extensive in-service experience of all-composite blades.

Testing a large composite propeller in an Allison engine test cell.



Dowty advanced all-composite propeller for the Saab 2000 fast regional jetprop.

Fokker 50 with Dowty 6-blade propellers.



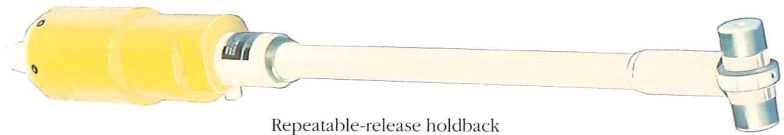
Composite-bladed propellers are in service on the Fokker 50, Saab 340, Piper Cheyenne 400LS, Textron Marine LCAC Air Cushion Vehicle and the Grumman S-2 Tracker re-engining programme. The most recent all-composite propeller is the large swept six-bladed propeller selected for the new Saab 2000 fast regional jetprop.

In collaboration with Allison, USA, Dowty has developed composite propellers for the Allison GMA 2100 prototype engine. This programme will develop a proven and reliable propeller system in the 4000-6000 SHP range, and integrate propeller and engine electronic controls. The first application to flow from this programme is the Saab 2000.

Dowty has been involved in the development of unducted fan blades, collaborating with GE, USA for new generation of ultra high by pass rotor engines. In a further collaborative project Dowty and BAe are investigating future high efficiency propulsion systems.

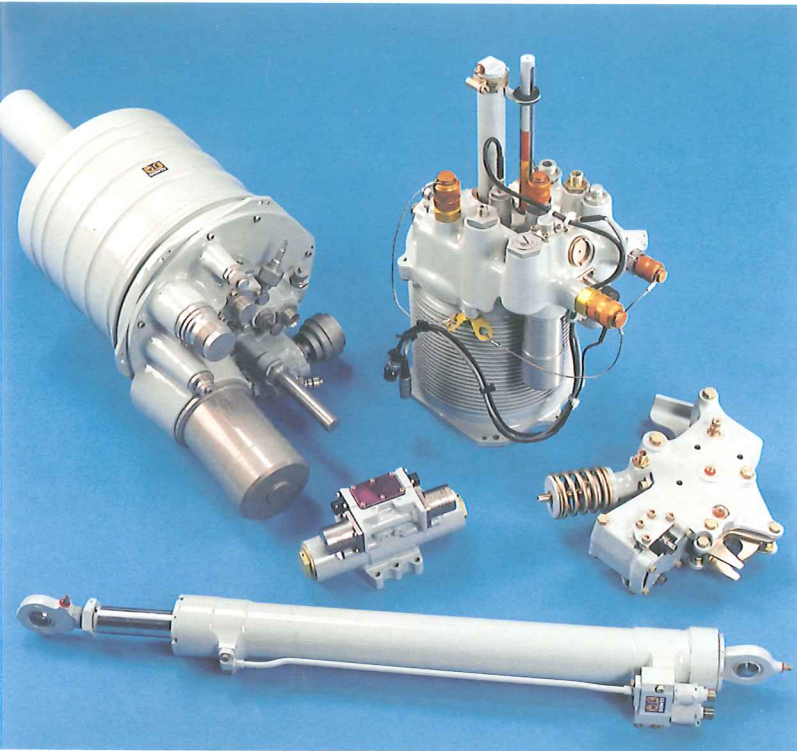
HYDRAULICS

Dowty Aerospace has 60 years of experience in the design and manufacture of high technology hydraulic units and systems. Over 200 different types of aircraft fly with Dowty hydraulic equipment.



Repeatable-release holdback bar used for carrier-launched aircraft.

A selection of Dowty hydraulic components for civil and military aircraft.



The company pioneered the world's first 4000 psi aircraft hydraulic system and a wide range of units has been developed to meet high operating requirements demands of new aircraft.

Dowty Aerospace offers constructors both individual units, packaged components and complete systems. The packaging of components minimises weight and space, improves reliability and simplifies maintenance.

Health monitored hydraulics such as the system for the Saab JAS 39 represent a major advance in hydraulics technology and electronic control.



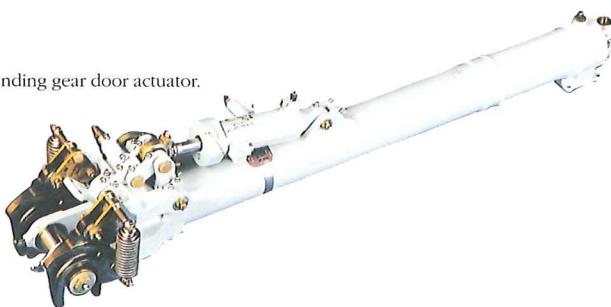
Superfuse – a family of hydraulic safety devices for detection of abnormal conditions in fluid circuits.



Recent hydraulic developments include a family of hydraulic safety devices or superfuses, which is opening up new markets around the world.

Many of the world's aircraft constructors specify and use Dowty hydraulic equipment, including Airbus Industrie, Saab, BAE, Fokker and Boeing.

Landing gear door actuator.



AVIATION SERVICES

Dowty hanger facilities in Singapore.



Dowty Aerospace Aviation Services is a repair and overhaul organisation offering total support to airlines and air forces worldwide.

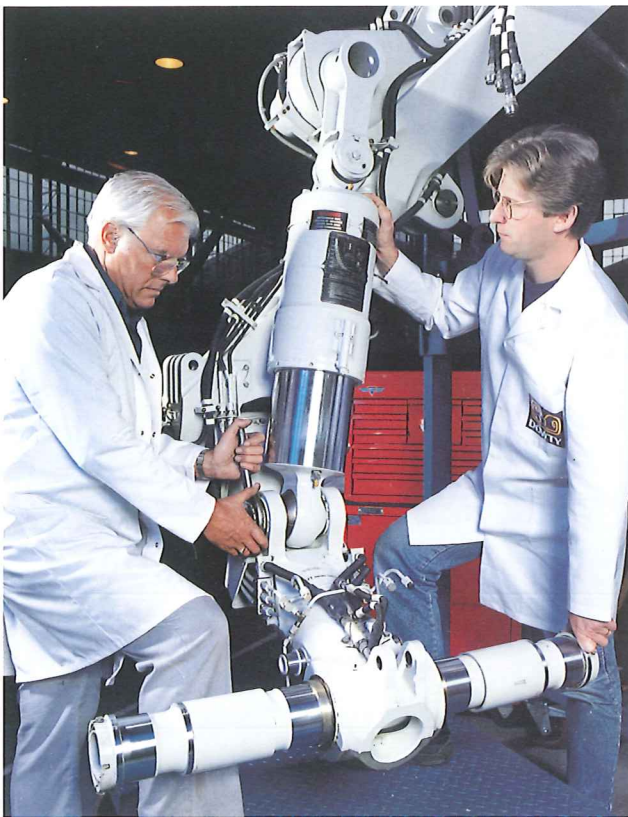
In order to provide this support the company has repair bases in North America, Singapore, Indonesia and the United Kingdom. It also has regional offices in Bahrain, The Philippines, The People's Republic of China, Pakistan and Australia. Additionally, it has repair agencies in Sweden, Germany, France and Australia.

The company provides a capability for fixed and rotary winged aircraft including servicing, structural repair and refurbishment from its Singapore facility.

C130 propellers undergo repair and overhaul.



BAe 146 landing gear repair and overhaul.



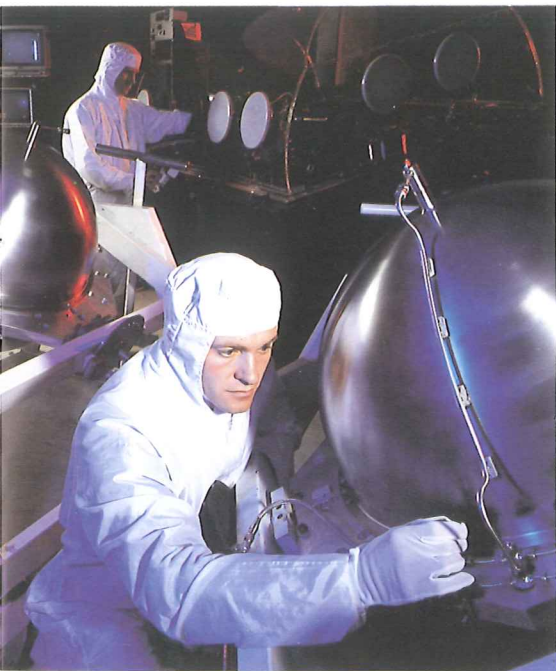
Equipment repair and overhaul includes landing gear, propellers, hydraulics, pneumatics, gearboxes, transmissions, avionics, electrical and instruments.

Recent high investment in Singapore has seen the expansion of the Dowty factory there to include a 65,000 square feet large component overhaul facility for heavy landing gear.

This facility is the only one outside Europe and the USA with full in-house overhaul capability for the whole range of wide-bodied aircraft including Boeing, Airbus and McDonnell Douglas.

All Dowty aviation services are backed by comprehensive logistic and technical support.

OTHER AEROSPACE EQUIPMENT AND SYSTEMS



SPACE SYSTEMS

Dowty has achieved recognition as a supplier of high performance propellant system components. Space Projects offers a full capability for the design, manufacture and test of propellant tanks and flow control valves for spacecraft propulsion systems. The latest advances in design and production technology have been incorporated in a new facility in Wolverhampton which includes Class 1 Clean Room conditions.

Manufacture of propellant tanks in Dowty ultraclean facilities.

GEARED SYSTEMS

Dowty Aerospace has 40 years experience in geared systems with units fitted to a wide range of civil and military aircraft, hovercraft and military vehicles.

Over 50 different basic designs of gearbox have been produced which have earned a reputation for high reliability and extended overhaul periods.

Dowty gearbox variants include main propulsion drives and secondary power systems, also landing gear steering, flap actuation and airborne winching.

Secondary power system gearboxes supply essential aircraft services. Driven from an engine take-off shaft, a gearbox would typically mount an air turbine starter (ATS), an integrated drive generator (IDG) and two hydraulic pumps.

The most recent is the aircraft mounted accessory gearbox for Eurofighter in conjunction with Fiat and ZF.

Current aircraft flying with Dowty gearboxes are the BAe EAP, Saab JAS 39, Boeing 747 (flap drive gearbox) and BAe 748 (Dart gearbox).



Airbus A320 ram air turbine.

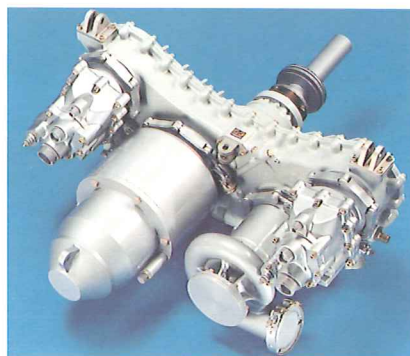
RAM AIR TURBINES

Dowty Aerospace is a leading supplier of ram air turbines for civil and military aircraft to provide emergency or auxiliary power.

Ram air turbines for emergency use are deployed in-flight to provide immediate hydraulic or electrical power. Units have been responsible for saving several civil and military aircraft over the years.

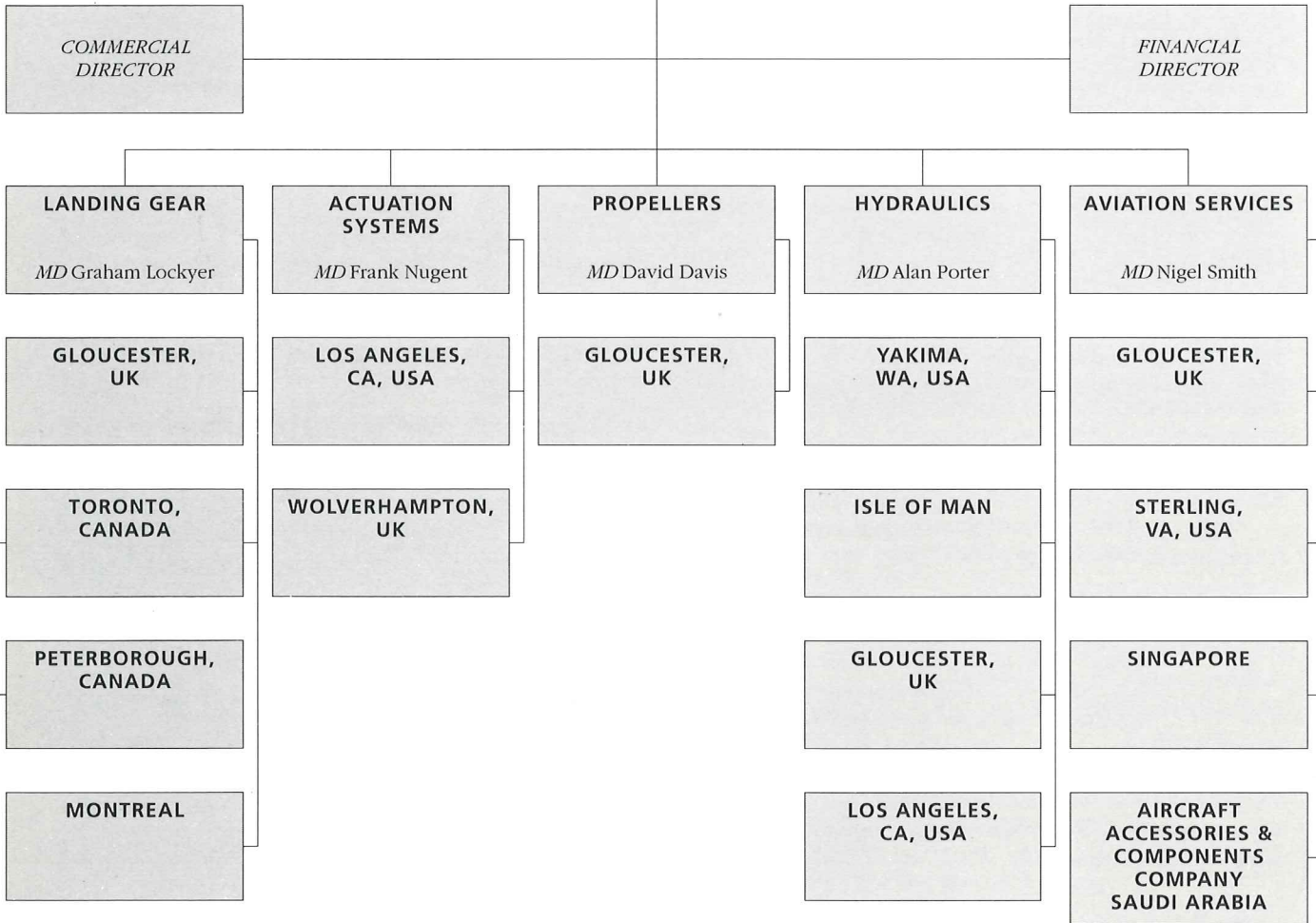
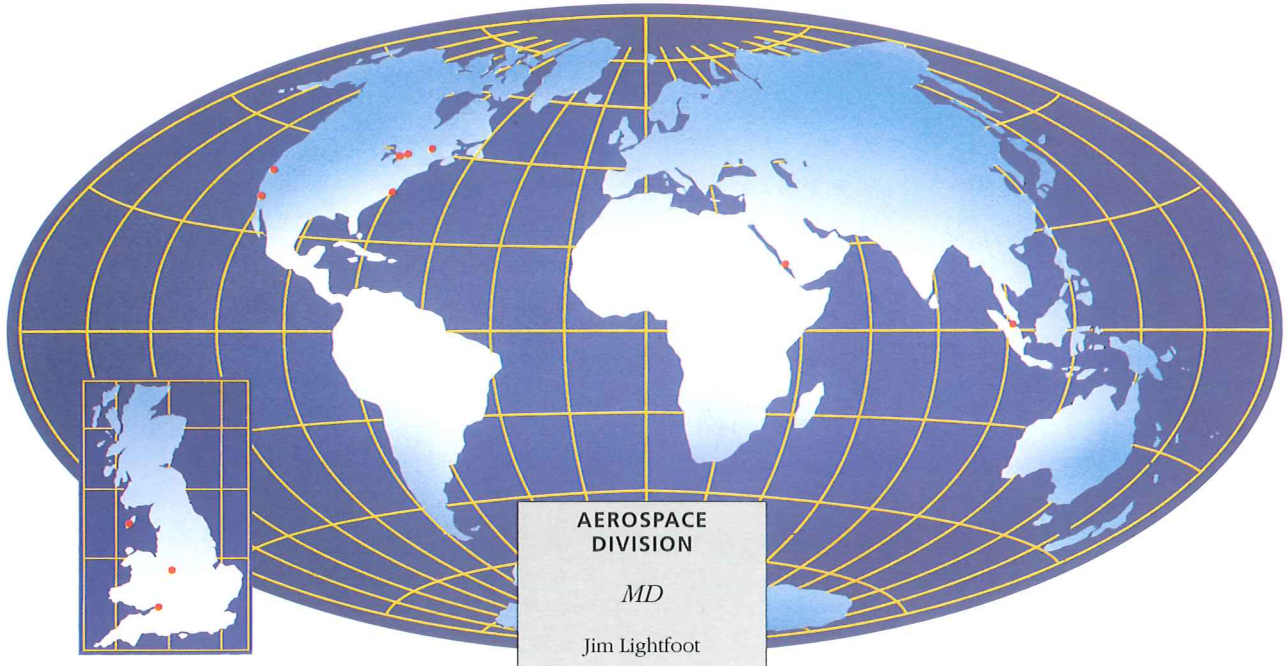
Current aircraft fitted with ram air turbines include Panavia Tornado ADV, BAe Hawk, BAe Sea Harrier, Concorde, Airbus A300 and Airbus A320.

Ram air turbines provide auxiliary power for specialised self-contained pod applications such as target towing, in-flight refuelling and ECM equipment.



Saab JAS 39 secondary power system gearbox.

DOWTY AEROSPACE DIVISION STRUCTURE





DOWTY AEROSPACE DIVISION

Managing Director Jim Lightfoot

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Fax 0452 713821

Total systems capability for advanced aerospace, military and naval equipment. Products and services include the design, development, manufacture and marketing of special purpose: landing gear, advanced technology propellers, actuation systems, ram air turbines, gearboxes and hydraulics.

Dowty Aerospace Wolverhampton
Wobaston Road,
Wolverhampton WV9 5EW, England
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Fax 0902 394394

Designs and manufactures fly-by-wire and powered flight control actuators and associated system equipment. Products include: electro-hydraulic servo valves for aerospace and defence, hydraulic systems and deck machinery for defence and maritime precision handling applications, spacecraft propellant tanks and control valves, specialised metal pressings and fabrication work.

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Fax 0624 72472

Precision machining.

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Installation and servicing of aircraft and helicopter spares, repair and overhaul, product support for components and airframes.

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Telephone 6729365 Telex 601558
Fax 6725463

Aircraft accessories repair and overhaul.

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Ontario L1S 2G8, Canada
Telephone 416 683 3100 Telex 06 981295
Fax 416 686 2914

Designers and manufacturers of fixed wing and helicopter landing gear systems and a total capability in microprocessor-controlled hybrid actuation systems for aerospace, marine and other defence and commercial applications.

Dowty Aerospace Peterborough
2000 Fisher Drive, PO Box 4525, Peterborough,
Ontario K9J 7B1, Canada
Telephone 705 743 6903
Fax 705 745 1394

Specialising in the design and manufacture of microprocessor-based high reliability avionics control systems. The plant is approved to full military quality levels and includes temperature and vibration testing facilities.

Dowty Aerospace Montreal
1300 du Parc, Mirabel,
Quebec J0N 1L0, Canada

Dowty Aerospace Yakima
PO Box 9907, Yakima,
Washington 98909, USA
Telephone 509 248 5000 Telex 510775352
Fax 509 452 7022

Designs and manufactures hydraulic equipment for aerospace, naval and land vehicles. Products include: electro-hydraulic servoactuators, internal locking actuators, high energy weapons release systems, repeatable release holdback bars, hydraulic fuses and shuttle valves, brake control valves.

Dowty Aerospace Los Angeles
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California 91010-0259, USA
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A key supplier of precision flight control hardware to the aerospace industry and a leader in the field of thrust reverser systems. Other advanced technology products are vane rotary actuators, electrohydrostatic actuators and direct drive servovalves.



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