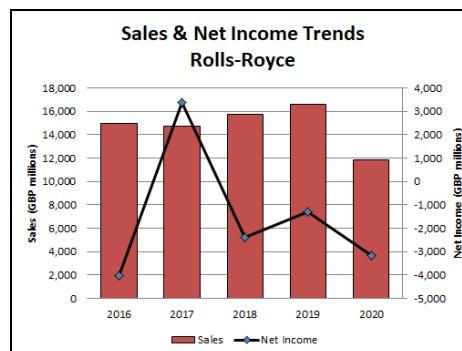


Rolls-Royce plc

Outlook

- For 2020, Rolls-Royce reported revenue of GBP11.8 billion, down almost 29 percent from GBP16.6 billion in 2019
- The company posted a loss of GBP3.2 billion, compared to a loss of GBP1.3 billion in 2019
- Rolls-Royce cutting 9,000 jobs in response to COVID-19; 7,000 already furloughed as of the end of 2020
- Civil Aerospace is being reorganized and consolidated; ITP Aero unit likely to be next unit divested



Headquarters

Rolls-Royce plc
90 York Way
London N1 9FX
United Kingdom
Telephone: + 44 01332 242424
Website: <https://www.rolls-royce.com>

Rolls-Royce was established in 1904 in Manchester, England, when C.S. Rolls and Henry Royce joined forces to produce and market the latter's automobiles in the United Kingdom. The company moved to Derby in 1908, and during World War I became involved in the production of aircraft engines for the Royal Fighting Corps. In the ensuing years, Rolls-Royce produced a wide variety of piston engines, and during World War II, the company led development of the Whittle gas turbine engine. After the war, Rolls-Royce continued to refine its capabilities in both aero and industrial/marine gas turbine engines.

During the 1960s, Rolls-Royce began development of the RB211 turbofan engine. The RB211 series design featured the use of a new carbon-fiber material – Hyfil –

that was lighter than aluminum and stronger than steel. However, protracted and costly development of the Hyfil resulted in Hyfil components being substituted with those made of titanium. The subsequent redesign, labor, and material costs escalated rapidly, culminating in the company declaring bankruptcy in 1971. At that time, the restructured, nationalized Rolls-Royce Ltd concern was formed, with Rolls-Royce Motors Ltd restructured as a separate public company. Rolls-Royce Motors Ltd is currently a company of the Vickers plc group.

In 1995, Rolls-Royce expanded its presence in its largest market, the U.S., through the acquisition of Allison Engine Company. The acquisition gave Rolls-Royce a firm base from which its engines could compete for U.S. military programs.

In November 1999, Rolls-Royce completed the purchase of Vickers plc, further enhancing its global position in marine power systems. The company divested Vickers Defence Systems in late 2002.

Structure and Personnel

Executive Leadership Team

Warren East
Chief Executive Officer
Stephen Daintith
Finance Director

Tom Bell
President, Defence and
Chairman & Chief Executive Officer,
Rolls-Royce North America Inc
Chris Cholerton
President, Civil Aerospace

Rolls-Royce plc

Mark Gregory
General Counsel
Harry Holt
Chief People Officer
Andreas Schell
CEO, Rolls-Royce Power Systems AG

Paul Stein
Chief Technology Officer
Ben Story
Strategic Marketing Director

Product Area

Rolls-Royce is an OEM and Tier 1 manufacturer of gas turbines for the aviation, marine, and power generation industries. The company is believed to manage its operations as follows:

1. Civil Aerospace
 - 1.1 Large Engines
 - 1.2 Business Aviation
 - 1.3 V2500
 - 1.4 Regional
2. Defence
 - 2.1 Combat
 - 2.2 Transport
 - 2.3 Naval
 - 2.4 Submarines
3. Power Systems
 - 3.1 Power Generation
 - 3.2 Marine
 - 3.3 Industrial
 - 3.4 Civil Nuclear
 - 3.5 Defence
4. ITP Aero
 - 4.1 Civil
 - 4.2 Defense
 - 4.3 In-Service Support

Civil Aerospace. This unit produces turbofans, turboprops, and turboshaft engines for commercial

aircraft. Rolls-Royce powers more than 30 types of commercial aircraft and has 13,000 engines in service with customers around the world. This unit is considered the world's second-largest aircraft engine manufacturer, behind General Electric.

Defence. This division produces turbofan, turboprop, turbojet, and turboshaft engines that power aircraft in all of the major military aviation market sectors, from military transport aircraft and helicopters to trainers and combat aircraft. Rolls-Royce is undertaking propulsion systems development for all planned U.K. Royal Navy platforms, including the Type 45 destroyer, Future Attack Submarine, Future Carrier, and Future Surface Combatant. In addition, this unit provides through-life support for the Royal Navy's nuclear-powered submarine fleet.

Power Systems. This unit offers high-speed and medium-speed reciprocating engines and complete propulsion systems. It serves the marine, defense, power generation and industrial markets. In the civil nuclear market, it provides systems and support for nuclear electrical generation plants around the world.

ITP Aero. ITP Aero provides MRO services for regional airlines and business aviation, and for helicopters and industrial and defense platforms.

Facilities

Rolls-Royce plc, 90 York Way, London, N1 9FX, U.K.
Telephone: + 44 01332 242424.

Rolls-Royce Civil Aerospace, PO Box 31, Moor Lane,
Derby DE24 8BJ, U.K. Telephone: + 44 1332 248704.

Website: <https://www.rolls-royce.com/products-and-services/civil-aerospace>

Rolls-Royce Defence Aerospace, PO Box 3, Gipsy
Patch Lane, Filton, Bristol BS12 7QE, U.K. Telephone:
+ 44 117 979 12 34.

Website: <https://www.rolls-royce.com/products-and-services/defence>

Rolls-Royce, Civil Nuclear UK, Barnwood 4, Barnett
Way, Barnwood, Gloucester GL4 3RT, U.K.
Telephone: + 44 0 1452 616 898.

Website: <https://www.rolls-royce.com/products-and-services/nuclear>

Rolls-Royce Deutschland Ltd & CO KG,
Eschenweg 11, 15827 Dahlewitz, Germany.

Website: <https://www.rolls-royce.com/country-sites/deutschland.aspx>

Rolls-Royce plc

Rolls-Royce North America Inc, 1875 Explorer St, Suite 200, Reston, VA 20190. Telephone: + 1 (703) 834-1700.

Website: <https://www.rolls-royce.com/country-sites/northamerica>

Rolls-Royce Corporation, 450 S Meridian St, Indianapolis, IN 46225. Telephone: + 1 (317) 230-2000. Indianapolis businesses include: Defense, LibertyWorks, Civil Small & Medium Engines, Marine and Helicopters.

Rolls-Royce Singapore Pte Ltd, 3 Temasek Ave, #19-01 Centennial Tower, Singapore 039190.

Website: <https://www.rolls-royce.com/country-sites/sea/our-locations/singapore>

Rolls-Royce Turbomeca Ltd, 4 Grosvenor Pl, London SW1X 7HH, U.K. Telephone: + 44 20 72594090. This is a joint subsidiary of Rolls-Royce and Turbomeca of France that produces the Adour engine. Since 2013, the RTM322 helicopter engine program has been owned by Turbomeca.

Eurojet Turbo GmbH, Lilienthalstrasse 26, 85399, Hallbergmoos, Germany. Telephone: + 49 811 5505 0. A consortium developing the EJ200 engine for the Eurofighter (see **Teaming/Competition/Joint Ventures** for details).

Website: <https://www.eurojet.de/>

MTU Turbomeca Rolls-Royce GmbH, Am Söldnermoos 17, 85399, Hallbergmoos, Germany. Telephone: + 49 811 60090 0. MTR is a joint venture between MTU Aero Engines, Turbomeca, and Rolls-Royce.

Website: <https://www.mtr390.com>

Rolls-Royce Power Systems AG, Maybachplatz 1, 88045, Friedrichshafen, Germany. Under the MTU brand, Rolls-Royce Power Systems (formerly Tognum) markets large high-speed engines and propulsion systems for ships; heavy land, rail, and military vehicles; and the oil and gas industry.

Website: <https://www.mtu-solutions.com>

MTU Friedrichshafen GmbH, Maybachplatz 1, 88040 Friedrichshafen, Germany. Telephone: + 49 7541 90 0. A core subsidiary of Rolls-Royce Power Systems specializing in the manufacture of large diesel engines and propulsion systems.

Website: <https://bit.ly/2OPwxM9>

ITP Aero, a Rolls-Royce Company, Parque Tecnológico, Edificio 300, 48170 Zamudio, Bizkaia - España. Telephone: + 34 944 662 100. Produces engine components and provides MRO services.

Website: <https://www.itpaero.com>

Corporate Overview

Rolls-Royce is an engineering group bringing advanced technology to aerospace and industrial power systems markets worldwide. It is considered a market leader in the fields of aero, marine, and industrial gas turbines and power generation.

New Products and Services

Nuclear Power for Space. In January 2021, Rolls-Royce signed a contract with the UK Space Agency for a study into future nuclear power options for space exploration. Dr. Graham Turnock, chief executive of the UK Space Agency, said, "This study will help us understand the exciting potential of atomic-powered spacecraft, and whether this nascent technology could help us travel further and faster through space than ever before." Nuclear power systems could be used to meet the increasing demand for on-orbit activities, in-situ resource utilization and exploration.

MTU Series 500. In December 2020, Rolls-Royce launched the new MTU Series 500 for power generation. With a power range of 250 to 550 kilowatts and peak efficiencies of up to 42.6 percent, the gas

gensets offer a climate-friendly and economical solution for the industrial and utility sector in addition to other applications. The products will initially be offered for operation with natural gas, and after 2021 also for biogas. In addition, the 500 series is H2-ready, which means that the engines can be converted to hydrogen operation later.

ColdFire Solutions. In December 2020, Rolls-Royce delivered an upgraded thermal management and power system from its ColdFire Solutions technology line to power directed energy field-testing in 2021. The ColdFire Solutions system was delivered to Lockheed Martin for integration and testing. It is a standalone system, minimizing platform resource demands, and will power a Lockheed Martin 100-kW directed energy system during range testing in 2021. This will be the latest field test of the Rolls-Royce technology, developed at the company's LibertyWorks advanced technology unit in Indianapolis. The technology has been developed to support military customers to meet their needs for enhanced directed energy platforms.



Rolls-Royce plc

Type 31 Propulsion. In May 2020, Rolls-Royce was selected to supply complete MTU propulsion systems for five new Type 31 general-purpose frigates for the Royal Navy. In total, the order comprises 40 engines and generator sets to be used for main propulsion and onboard power generation, as the MTU Callosum propulsion control and monitoring system, and for integrated logistics support (ILS). Each new frigate will be powered by four MTU 20V 8000 M71 engines, each delivering over 8,000 kW. Onboard power will be provided on each vessel by four MTU generator sets based on 16V 2000 M41B units, each delivering in excess of 900 kW. In September 2021, Rolls-Royce will deliver the first shipset, comprising four main propulsion engines and four generator sets, to prime contractor Babcock International Group.

UltraFan Demonstrator. In February 2020, Rolls-Royce started manufacture of the world's largest fan blades for its UltraFan demonstrator engine. As a set, the composite blades have a 140-inch diameter, which is almost the size of a current narrowbody fuselage, and are being made at the company's technology hub in Bristol, U.K. The milestone also marks the official start of production of parts for the demonstrator. UltraFan is targeting a 25 percent fuel reduction compared to the first generation of Trent engines, and it delivers the same percentage reduction in emissions. Part of that efficiency improvement comes from UltraFan's composite fan blades and fan case, which reduce weight on a twin-engine aircraft by 700 kilograms.

UltraFan was originally to begin ground tests in 2021 and become available toward the end of the decade. However, in early 2021 *AviationWeek* reported that the program had slowed and may be paused to allow the airline industry to recovery from the COVID-19 pandemic. This was tempered with the possibility that the engine could see use on a new Boeing aircraft that is in the very early stages of development (see NMA in **Teaming/Competition/Joint Ventures**, below).

V-22 MissionCare. In November 2019, Rolls-Royce secured a five-year MissionCare contract valued at \$1.2 billion to maintain AE 1107C engines on U.S. Marine Corps, Navy, and Air Force V-22 aircraft. Under the contract, the company will be responsible for all aspects of propulsion system support on a "Power by the Hour" basis.

Artificial Chief Engineer. In September 2019, Rolls-Royce announced its Artificial Chief Engineer program to develop an autonomous machinery control system, which allows naval vessels to undertake long-endurance missions with less human interaction. Artificial Chief Engineer is an onboard, secure, decision-making control system designed to intelligently operate the machinery of lean-manned and

unmanned naval vessels. The technology makes condition-based decisions about how best to operate the machinery – including the engines, propulsion system, electrical network, and fuel system – using algorithms to optimize the ship for maximum efficiency, lowest noise, top speed, or to preserve damaged equipment, as required by the ship's mission.

Hypersonic Propulsion. In July 2019, Rolls-Royce was awarded a contract to develop hypersonic propulsion systems for increased aircraft performance and capability. The U.K. MoD's procurement arm, Defence Equipment and Support, intends to place a two-year, single-sourced contract for a U.K. program to undertake design studies, research, development, analysis, and experimentation relating to high-Mach advanced propulsion systems. The contract will be with Rolls-Royce Plc (RR) and its technology partners, BAE Systems and Reaction Engines, and will focus on enabling technologies for increased aircraft performance and capability. A value was not reported.

V-Engines. In September 2018, Rolls-Royce launched a V-line version of the new B33:45 liquid fuel and B36:45 gas engine series for the powergen market. The new engine is applicable for different operational modes, which include baseload, grid balancing, load following and peaking. Waste heat and CO₂ can also be efficiently used for industrial processes, district heating, air conditioning, or to drive a combined cycle.

MQ-25A Engine. In September 2018, Rolls-Royce engines were selected by Boeing to power the U.S. Navy's new MQ-25 Stingray aircraft, which will provide unmanned, carrier-based air-to-air refueling. Each MQ-25 aircraft will be powered by a single Rolls-Royce AE 3007N engine, manufactured in Indianapolis, Indiana. The Navy awarded the MQ-25A engineering and manufacturing contract to Boeing to provide four aircraft.

U.S. UAV MRO. In July 2018, Rolls-Royce was awarded a sustainment contract to maintain, repair and overhaul engines for the U.S. Air Force Global Hawk and U.S. Navy Triton fleets, valued at up to \$420 million over six years. The contract also covers program management and sustainment engineering services for the F137 engine fleet. F137 is the USAF designation for the Rolls-Royce AE 3007H engine, which powers the Global Hawk and Triton. The engines are engineered and manufactured at Rolls-Royce facilities in Indianapolis, Indiana.

Plant Expansion/Organization Update

COVID-19 Impacts. In May 2020, Rolls-Royce announced that in response to the impact of the COVID-19 pandemic on its aerospace operations, the

Rolls-Royce plc

company would undertake a major restructuring. Under this plan, the company will cut more than 9,000 from its workforce of 52,000. By year-end 2020, about 7,000 of these cuts had been completed.

The reorganization has predominantly affected the Civil Aerospace business, where the company continues to consolidate operations. In Inchinnan, Scotland, the company consolidated production of aero-engine shafts to its site in Derby, U.K. Aero-engine turbine blades and compressor aerofoils will continue to be produced in the Scottish location. The company has entered into negotiations with union officials at its Ansty, U.K., facility, which manufactures aero-engine fan cases. Here the company is looking to make Ansty more competitive, reduce operating costs, and define the medium-term direction for the site. In the U.S., Rolls-Royce North America announced it would close its Crosspointe facility by the middle of 2021.

The biggest restructuring announced so far was centered on ITP Aero, which is slated to be divested. In December 2020, Rolls-Royce announced it would increase the scope of ITP Aero's supply chain activity and engineering and manufacturing capabilities. Under the effort, the company plans to transfer the facility and workforce in Hucknall, U.K. to ITP Aero. Hucknall, which manufactures a range of aero-engine parts, will bring ITP Aero new capabilities and become a critical part of the enlarged business, helping to secure the future of the site.

A second step would see the manufacture of aero-engine structures consolidated into ITP Aero. ITP Aero offers a more cost-competitive option than the existing structures facility in Barnoldswick, U.K., where structures operations would cease. According to Rolls-Royce, "Due to the significant reduction in global demand for our products and services from commercial aviation customers, which is forecast to last several years, we must reduce our manufacturing capacity and cost base in order to protect our remaining workforce. ITP Aero, currently undergoing its own restructuring, offers a more cost competitive option than our existing structures facility in Barnoldswick, U.K."

Overall, the company is aiming to achieve total annual pre-tax cash savings of at least GBP1.3 billion by the end of 2022 through these actions.

In early 2021, the company said that it would temporarily halt commercial engine production for two weeks in the summer as it seeks to manage expenses. The suspension comes in light of new COVID-19 variants and countries tightening rather than loosening their travel restrictions, which is delaying long-haul traffic resumption.

Pascagoula Expansion. In August 2020, Rolls-Royce and the Defense Production Act Title III office announced that they would invest millions of dollars in upgrading the company's capability and capacity for U.S. Navy ship propulsion components at its facility in Pascagoula, Mississippi. The DPA Title III office agreed to invest \$22 million in equipment, with Rolls-Royce making an additional investment in building improvements, supplemented with support from Jackson County and the state of Mississippi. Naval components manufactured by Rolls-Royce at Pascagoula include controllable-pitch propeller systems, fixed pitch propellers, and water jets. The components help power the majority of U.S. Navy ships, including aircraft carriers, destroyers and other vessels.

Engine Controls Facility. In March 2020, Rolls-Royce created new engine controls capability near the campus of Purdue University to support the company's U.S. defense business, including the F130 engine competing for the U.S. Air Force B-52 program. Rolls-Royce will assemble and test electronic engine controllers, which help manage in-flight engine operations. The facility at Purdue will assemble electronic controllers for Rolls-Royce F130 engines for the Air Force B-52 strategic bomber re-engining program if the company wins the engine competition.

Canadian Facility Expanded. In February 2020, Rolls-Royce broke ground on a new expansion of its Centre of Excellence for Naval Handling equipment in Peterborough, Ontario. Design and manufacture of the Mission Bay Handling System (MBHS) will take place inside the new facility expansion. The MBHS is a feature of the Global Combat Ship design, selected for the Canadian Surface Combatant (CSC), Australian Hunter class, and U.K. Type 26 programs. Construction was completed in October 2020.

U.S. Naval Defense Facility Expansion. In December 2019, Rolls-Royce broke ground on a new \$7.7 million, 24,000-square-foot facility that will enhance and modernize the company's naval operations in Walpole, Massachusetts. Upon completion in late 2020, Rolls-Royce's Naval Defense facility planned to add water-jet maintenance, repair, and overhaul (MRO) servicing to its portfolio of capabilities. Rolls-Royce expected demand for spare equipment and MRO services associated with the U.S. Navy's Littoral Combat Ship (LCS) program to ramp up beginning in 2020. Each *Freedom* class variant of the LCS is equipped with four Rolls-Royce water jets.

Rauma Thruster Facility Upgraded. In January 2019, Rolls-Royce completed a EUR57 million upgrade and refurbishment of its thruster manufacturing plant in

Rolls-Royce plc

Rauma, Finland, consolidating production at a single site. The upgrade, which began in mid-2016, included the complete rebuilding of the site's existing production hall, along with the building of a new, 35-meter-high hall. The new facility streamlines production and enables the simultaneous testing of a wide range of mechanical thrusters, including the US and UUC type azimuthing thrusters and Elegance pods.

Reaction Engines. In August 2020, Reaction Engines Ltd and Rolls-Royce plc announced a new strategic partnership agreement to develop high-speed aircraft propulsion systems and explore applications for Reaction Engines' thermal management technology within civil and defense aerospace gas turbine engines and hybrid-electric systems. The two companies have been working together since 2018, including on the first phase of a U.K. Ministry of Defence contract to undertake design studies, research, development, analysis and experimentation related to high-Mach advanced propulsion systems.

R2 Data Labs Formed. In December 2017, Rolls-Royce launched R2 Data Labs to act as an acceleration hub for data innovation. Using advanced data analytics, industrial artificial intelligence and machine learning techniques, R2 Data Labs develops data applications that unlock design, manufacturing, and operational efficiencies within Rolls-Royce, and creates new service propositions for customers. R2 Data Labs has data innovation capability hubs in the United Kingdom, United States, Germany, Singapore, India, and New Zealand.

Website: <https://www.rolls-royce.com/products-and-services/r2datalabs.aspx>

Divisions Restructured. In January 2018, Rolls-Royce restructured from five operating businesses to three core units based on Civil Aerospace, Defence, and Power Systems. Under this effort, the Naval Marine and Nuclear Submarines operations would be merged with the existing Defence business, and Civil Nuclear operations within the Power Systems business. The Commercial Marine unit, which supplies equipment and vessel design across the oil and gas, merchant, and other commercial markets, was put up for sale and subsequently bought by Kongsberg. Rolls-Royce retained the Marine operations that supply complex power and propulsion systems to naval customers, including the Royal Navy and U.S. Navy.

In June 2018, the restructuring effort moved to its next phase with the company announcing plans to cut 4,600 jobs by mid-2020. The total cash cost of the restructuring is expected to be GBP500 million.

Aeroengine Plant Expansion. In June 2017, Rolls-Royce announced a GBP150 million investment in new and existing civil aerospace facilities in the U.K. to support the planned doubling of engine production to fulfill record backlogs. The majority of the investment provided a new facility for the testing of large civil aero engines in Derby. The new testbed is capable of testing a range of engines, including the Trent XWB, which powers the Airbus A350 XWB. There was also investment in Derby's large engine MRO facility, as well as in manufacturing facilities in Derby and Hucknall, Nottinghamshire. The company also decided to retain the Precision Machining Facility (PMF) in Derby, which was previously slated for closure.

U.S. Service Delivery Center Opened. In April 2016, Rolls-Royce opened a new Service Delivery Center at Naval Air Station Kingsville, Texas, to support T-45 aircraft used to train U.S. Navy and Marine Corps pilots. The SDC, the first such facility opened by Rolls-Royce in the United States, provides on-site repair and management of service for Rolls-Royce F405 (Adour) engines, which power the T-45.

Washington U.K. Facility Expansion. In January 2016, Rolls-Royce announced plans to invest more than GBP30 million in its site in Washington, Tyne & Wear, U.K., creating a new facility to manufacture a range of aerospace discs for in-service engines. The new fleet support plant was expected to become operational in 2018 and would be located alongside the firm's U.K. discs manufacturing facility, which opened in June 2014.

Mergers/Acquisitions/Divestitures

Bergen Engines Divested. In February 2021, Rolls-Royce signed an agreement to sell the Bergen Engines medium speed gas and diesel engines business to TMH International, the international branch of Russia's TMH Group, for net proceeds of approximately EUR150 million. The sale would include the medium speed engine factory, service workshop and foundry in Norway; engine and powerplant design capability; and a global service network spanning more than seven countries. Bergen Engines had been a part of Rolls-Royce since 1999 and had approximately 950 employees, with the majority based in Bergen, Norway. In 2019, the business generated revenues of GBP239 million, which were consolidated within the results of the Power Systems business.

However, in March Norway blocked the deal on national security grounds. Rolls-Royce is planning talks with the government to discuss options for the unit, which the company is intent on disposing.

Website: <https://bergen.rolls-royce.com>

Rolls-Royce plc

Civil Nuclear I&C Business Sold. In December 2020, Rolls-Royce signed an agreement to sell its civil nuclear instrumentation and control (I&C) business to Framatome. The I&C business includes all of the Rolls-Royce activities and teams based in Grenoble (France), Prague (Czech Republic), Beijing and Shenzhen (China). No U.K.-based operations were impacted, as this agreement does not include Rolls-Royce's U.K. civil nuclear business or small modular reactor activities. In 2019, the I&C business subject to the agreement had 550 employees and reported revenues of EUR94 million, which were consolidated within the results of the Power Systems business.

Servowatch Systems Acquired. In December 2020, Rolls-Royce acquired Servowatch Systems, a U.K.-based international supplier of integrated marine automation solutions for navies, commercial vessels and large yachts. Servowatch, based in Heybridge, Essex, will expand the ship automation division of the MTU brand of Rolls-Royce's Power Systems business. Terms were not announced.

Website: <https://servowatch.com>

Kinolt Acquired. In July 2020, Rolls-Royce strengthened its business in power supply for safety-critical systems with the completion of the acquisition of Kinolt SA, a Belgian-based specialist in dynamic uninterruptible power supply. Kinolt is based in the town of Grace-Hollogne in the Belgian province of Liège and was known as Euro-Diesel until mid-2019. The operation is now part of the Rolls-Royce Power Systems business under the MTU brand. Terms were not announced.

North America Civil Nuclear Sold. In February 2020, Rolls-Royce completed the sale of its mainly North American nuclear services business to Westinghouse. The sale comprised civil nuclear services businesses in the U.S. and Canada along with sites at Mondragon, France, and Gateshead, U.K., which are currently part of the Power Systems business unit. It does not include the instrumentation and controls business based in Grenoble, France, which remains under review. It also does not include U.K. nuclear new-build operations or small modular reactor activities. The deal was announced in September 2019; terms were not reported. In 2018, the businesses subject to the agreement reported revenues of \$70 million and a workforce of about 500 employees.

Siemens Unit Acquired. In October 2019, Rolls-Royce completed the acquisition of the electric and hybrid-electric aerospace propulsion activities of Siemens (formerly known as the eAircraft business). The former Siemens business, based in Germany and Hungary, employs around 180 who have been

developing a range of all-electric and hybrid electric propulsion solutions for the aerospace industry. They will continue to work in their existing locations. The deal was first announced in June 2019; terms were not reported.

Indra ITP Acquisition Talks Ended. In July 2019, Rolls-Royce confirmed that talks with Spain's Indra to acquire a majority stake in ITP Aero had ended. Talks between the two over a possible acquisition were first announced in June.

Commercial Marine Sold. In April 2019, Rolls-Royce completed the sale of its Commercial Marine business to Kongsberg for GBP500 million (\$661 million). The move followed a strategic review by Rolls-Royce of its Commercial Marine operations announced in January 2018. The sale included propulsion, deck machinery, automation and control, a service network spanning more than 30 countries, and ship design capability. Kongsberg would, through a trading arrangement, continue to have access to products from Bergen Engines, which remains part of Rolls-Royce Power Systems. Rolls-Royce Power Systems will continue to supply MTU engines to a range of customers in the marine market, including operators of commercial vessels and yachts. The naval marine gas turbine and U.S.-based propeller operations of the former Marine business unit have been consolidated within Rolls-Royce's Defence business. Commercial Marine had approximately 3,600 employees, with the majority based in the Nordic region. In 2017, the Commercial Marine business generated revenue of GBP817 million, with an operating loss of GBP70 million. The deal was first announced in July 2018.

Qinous Investment. In October 2018, Rolls-Royce invested in Berlin-based start-up company Qinous GmbH, a provider of energy storage and control systems, adding turnkey microgrids to its portfolio. Terms were not announced.

Reaction Engines Investment. In April 2018, Rolls-Royce invested in Reaction Engines Ltd, a U.K.-based aerospace technology company. The investment is part of a strategic fundraising by Reaction Engines to support further development of the SABRE (Synergetic Air-Breathing Rocket Engine) concept and associated technologies. Terms were not announced.

L'Orange Divested. In April 2018, Rolls-Royce agreed to sell L'Orange, a wholly owned subsidiary of Rolls-Royce Power Systems, to Woodward Inc, for an enterprise value of EUR700 million (estimated \$834 million). L'Orange supplies fuel injection technology for engines that power a wide range of industrial applications, including marine power and



Rolls-Royce plc

propulsion systems, special application vehicles, oil and gas processing, and power generation. Woodward, headquartered in Fort Collins, Colorado, is an independent designer, manufacturer, and service provider of control system solutions and components for the aerospace and industrial markets. L'Orange, which would be renamed Woodward L'Orange, would be integrated into Woodward's Industrial segment. The deal was completed in June 2018.

Industria de Turbo Propulsores Acquired. In July 2016, Rolls-Royce paid EUR720 million to acquire the remaining 53.1 percent stake in ITP owned by SENER Grupo de Ingeniería SA. The European Union cleared the deal in April 2017. ITP was created in 1989, merging companies from the public and private sectors of the Spanish aeronautical industry with Rolls-Royce. It manufactures low-pressure turbines for the Trent family of engines and works closely with Rolls-Royce on research for its new "UltraFan" class of engines. Rolls-Royce initially held a 46.9 percent stake in the venture.

Energy Business Sold to Siemens. In December 2015, Rolls-Royce concluded the sale of its Energy gas turbine and compressor business to Siemens for GBP785 million in cash. Rolls-Royce also received a further GBP200 million for a 25-year licensing agreement granting Siemens access to relevant Rolls-Royce aeroderivative technology for use in the 4- to 85-MW power output gas turbine range.

The gas turbine and compressor business of Rolls-Royce's Energy sector has about 2,400 employees. In 2013 it was reported within the results of the Energy business, where it contributed GBP871 million of revenue and GBP72 million of underlying profit.

Michell Bearings Divested. In April 2015, Rolls-Royce sold its Michell Bearings business to British Engines Ltd for GBP12.6 million (\$19 million). Michell Bearings had been part of the Rolls-Royce Marine business for the past 15 years. It is a designer and manufacturer of hydrodynamic bearings for marine and industrial applications.

R.O.V. Technologies Acquired. In March 2015, Rolls-Royce acquired R.O.V. Technologies Inc, a U.S.-based business that provides nuclear utility operators with remote visual inspection services for boiling water reactors and pressurized water reactors. Terms were not disclosed.

Rolls-Royce Power Systems Wholly Owned. In August 2014, Rolls-Royce bought out Rolls-Royce Power Systems and made it a wholly owned operation. Rolls-Royce acquired the shares from Daimler, which had been a 50-50 joint venture partner in RRPS since

2011. RRPS, which previously operated as Tognum AG, is headquartered in Friedrichshafen in southern Germany and employs about 11,000 people. The firm specialized in reciprocating engines and propulsion and distributed energy systems. The transaction, first announced in March 2014, was valued at about EUR2.43 billion.

Hyper-Therm HTC Acquired. In May 2013, Rolls-Royce acquired Hyper-Therm High Temperature Composites Inc. Hyper-Therm HTC is a producer of ceramic matrix composites (CMCs), engineered coatings, and thermal-structural components. It became a wholly owned subsidiary of Rolls-Royce based in Huntington Beach, California. The site serves as the hub for technical development of CMCs, which will find applications in a broad range of future Rolls-Royce power systems. Terms were not disclosed.

R Brooks Associates Acquired. In September 2011, Rolls-Royce acquired R Brooks Associates, a civil nuclear reactor services business in the United States. Terms were not disclosed.

Tognum Acquisition. In September 2011, Rolls-Royce and Daimler completed their acquisition of Tognum AG through their 50-50 joint venture, Engine Holding GmbH. The deal was valued at approximately \$4.4 billion. The operation is now known as Rolls-Royce Power Systems AG.

Teaming/Competition/Joint Ventures

Aero Gearbox International. In August 2015, Rolls-Royce and Safran Transmission Systems (formerly known as Hispano-Suiza) named their joint venture Aero Gearbox International and announced plans to construct a new production plant in Poland. The news followed the signing of a final agreement in October 2014 to create a jointly owned company that will design, develop, produce, and support accessory drive trains (ADTs) for all of Rolls-Royce's future civil aircraft engines. Based on an initial exclusive 25-year contract, Aero Gearbox International will cover the entire range of civil aircraft, from business jets to widebody commercial jets. The new 145,300-square-foot facility officially opened in April 2017. Production is currently underway of ADTs for the Rolls-Royce Trent XWB used on the Airbus A350.

Website: <https://www.aerogearboxinternational.com>

Aerospace Transmission Technologies. In October 2015, Rolls-Royce and Liebherr-Aerospace's 50-50 joint venture Aerospace Transmission Technologies GmbH began operations at the site of Liebherr-Aerospace in Friedrichshafen. This new company develops manufacturing capability and

Rolls-Royce plc

capacity for the power gearbox of Rolls-Royce's new UltraFan engine.

Website: <https://www.aerotrastech.com>

Airbus. In April 2018, Rolls-Royce and Airbus signed a collaboration agreement to integrate the Rolls-Royce UltraFan demonstrator for flight testing. UltraFan is a scalable jet engine design suitable for widebody or narrowbody aircraft that offers a 25 percent improvement in fuel efficiency over the first-generation Rolls-Royce Trent engine.

AirTanker. In January 2001, Airbus Defence and Space, Rolls-Royce, Cobham, Thales UK, and the VT Group (which joined in 2004) formed the AirTanker consortium to bid for the U.K. Ministry of Defence's Future Strategic Tanker Aircraft (FSTA) program. The GBP13 billion (EUR19 billion) Private Finance Initiative program would provide strategic air refueling services to the Royal Air Force for 27 years. AirTanker's proposal was based on the latest generation of Airbus widebody aircraft powered by Rolls-Royce Trent engines. Bids were submitted in July 2001. In January 2004, the U.K. MoD announced that AirTanker had been judged to offer the best prospective value for the money for the FSTA program. The MoD then entered into detailed negotiations with AirTanker for the next phase of the program. This effort bore fruit in February 2005, when AirTanker was selected as the preferred bidder for the FSTA.

Website: <https://www.airtanker.co.uk>

Aviation Industries of China. In May 1996, Rolls-Royce and Aviation Industries of China (AVIC) announced the formation of a joint aero engine company to manufacture components for Rolls-Royce engines as a step toward building complete units. The venture between Rolls-Royce and the Xi'an Aero Engine Company now produces several items for various Rolls-Royce engines, including turbine blades. At the time, it was thought that the venture could prove quite lucrative should China go ahead with plans to build a 100-seat aircraft. In October 1997, this teaming was further reinforced when Rolls-Royce signed a long-term agreement with AVIC. Under the agreement, Xi'an produces steel and light alloy ring components for a wide range of Rolls-Royce engines, mainly for civil aircraft but also for the Adour engine. In January 2000, AVIC and Rolls-Royce signed a five-year agreement to collaborate on aero engine research and development. The agreement was focused on high-pressure core engines and systems integration technologies.

B-52 Engine Replacement. The U.S. Air Force is looking to replace the Pratt & Whitney TF33-PW-103 engines that currently power the B-52. The service is

interested in a new engine that provides greater fuel efficiency and reliability than the TF33, and similar performance characteristics. Rolls-Royce is proposing the F130 engine, based on its BR725 turbofan, which currently powers U.S. Air Force aircraft, including the E-11A and C-37 aircraft. Other competitors include GE Aviation, with either the CF34-10 or Passport engine; Pratt & Whitney with the PW800 design; and possibly Safran. Boeing, the prime contractor for the B-52, is positioning itself to be the project's systems integrator. Some 608 engines would be needed to equip the entire inventory of 76 B-52s. In February 2019, Rolls-Royce selected Indianapolis, Indiana, as the location to build its F130 powerplant should it win the competition.

A contract award is planned for June 2021. A notional schedule would see testing of the selected design begin in 2022, with production to run from 2026 to 2034. The re-engining program has a potential value of around \$11 billion.

Website: <https://www.rolls-royce.com/products-and-services/defence/aerospace/combat-jets/f130.aspx>

Babcock Team 31. In September 2019, the MoD selected Babcock Team 31 as the preferred bidder to deliver new warships with its Arrowhead 140 design. Team members include Thales, BMT, Harland & Wolf, and Ferguson Marine. A contract was officially signed in November. Under the U.K. Ministry of Defence's GBP1.25 billion Type 31e general-purpose light frigate program, the team will deliver five general-purpose frigates. The first Type 31e warship is planned to be delivered in 2023.

In April 2020, Rolls-Royce Power Systems was selected to provide MTU diesel engines and diesel generators as part of the propulsion machinery package.

Website: <https://www.arrowhead140.com>

Boeing. In June 2011, Rolls-Royce and Boeing launched a shared data service that allows both companies to offer faster, better-informed advice to airlines in order to maximize aircraft availability. Data from an aircraft and the engines that power it are combined on a single system, providing customers with an integrated data source and improving an airline's ability to manage its product health monitoring. The service, available to airlines with both Rolls-Royce Engine Health Monitoring (EHM) and Boeing Airplane Health Management (AHM) data, would initially be available for the Trent 1000/Boeing 787 Dreamliner and Trent 800/Boeing 777 combinations. The program also covers RB211-524/Boeing 747 and RB211-535 / Boeing 757 combinations.

CAE. In October 2000, Rolls-Royce formed an alliance with Canadian group CAE to cooperate on

Rolls-Royce plc

major U.K. naval projects. Under the alliance, CAE provides naval automation expertise for integration projects, with Rolls-Royce providing electric propulsion expertise. Both companies are working closely on the U.K. Royal Navy's Astute class nuclear submarine program and will extend this cooperation to future projects such as the Type 45 destroyers. CAE also provides digital control systems for two Rolls-Royce marine propulsion engines: the Spey SM1C and the WR-21 intercooled recuperated gas turbine.

CEZ. In November 2020, Rolls-Royce and CEZ signed a Memorandum of Understanding to explore the potential for compact nuclear power stations, known as small modular reactors, to be built in the Czech Republic. Rolls-Royce is leading the U.K. SMR Consortium that is designing this type of low-cost nuclear power station. Its standardized, factory-made components and advanced manufacturing processes reportedly push down costs, and the rapid assembly of the modules inside a weatherproof canopy at the power station site itself speeds up schedules.

Clean Sky. Launched in 2008, Clean Sky is a European public-private research program focused on developing technology aimed at reducing CO₂, gas emissions, and noise levels produced by aircraft. The Clean Sky 1 effort has six focus areas: Green Regional Aircraft (led by Leonardo and Airbus), Smart Fixed Wing Aircraft (Airbus and Saab), Green Rotorcraft (Leonardo and Airbus), Sustainable and Green Engines (Rolls-Royce and Safran), Systems for Green Operations (Liebherr and Thales), and Eco-Design (Dassault Aviation and Fraunhofer Gesellschaft). A larger Clean Sky 2 program was launched in 2014 and will run through 2024. This phase is studying improvements to large passenger aircraft, regional aircraft, fast rotorcraft, airframes, engines, systems, small air transport, and eco design.

Website: <https://www.cleansky.eu>

E-Fan X. In November 2017, Airbus, Rolls-Royce, and Siemens formed a partnership that aims at developing a near-term flight demonstrator, which will be a significant step forward in hybrid-electric propulsion for commercial aircraft. The E-Fan X hybrid-electric technology demonstrator was expected to fly in 2020 following a ground test campaign, provisionally on a BAe 146 flying testbed, with one of the aircraft's four gas turbine engines replaced by a 2-megawatt electric motor. However, the program was shelved in April 2020. Technology from the effort will be utilized in future endeavors.

Emer2gent. In April 2020, Rolls-Royce invited a group of leading companies to collaborate on Emer2gent, a new alliance of data analytics experts

challenged with finding new, faster ways of supporting businesses and governments globally as they recover from the economic impacts of COVID-19. Early alliance members are Leeds Institute for Data Analytics, IBM, Google Cloud, The Data City, Truata, Rolls-Royce, and ODI Leeds. The alliance will be facilitated and coordinated by innovation specialist Whitespace. Emer2gent models will help get people and businesses back to work as soon as possible by identifying lead indicators of economic recovery cycles. The alliance is voluntary, and insights will be published for free.

EuroJet Turbo GmbH. Rolls-Royce holds a 33 percent interest in the EuroJet Turbo consortium, working with AvioAero (21 percent), MTU Aero Engines (33 percent), and Spain's Industria de Turbo Propulsores – ITP (13 percent) to develop the EJ200 turbofan for the Eurofighter Typhoon.

Website: <https://www.eurojet.de>

European Space Agency. In November 2017, Rolls-Royce and the European Space Agency (ESA) signed a cooperation agreement aimed at pursuing space activities in support of autonomous, remote-controlled shipping and promoting innovation in European digital logistics. The collaboration aims to develop and validate new solutions for communication between vessel systems and shore-based systems in addition to ship-to-ship communication.

Europrop International. In May 2003, Europrop International was selected to power the new Airbus Military A400M military transport with what EPI states is the Western world's largest-ever turboprop engine. EPI comprises ITP (16 percent), MTU Aero Engines (28 percent), Rolls-Royce (28 percent), and Safran (28 percent). Initially, more than 750 TP400-D6 engines would be required for the 180 four-engine A400M aircraft committed to by participating nations. ITP is responsible for the low-pressure turbine, including the turbine exit casing, the dressing, and the front frame. MTU is responsible for the intermediate-pressure spool, comprising the intermediate-pressure compressor and turbine. It also cooperates with Safran in producing the engine control system and has final assembly responsibility for all of the engines produced. Rolls-Royce is responsible for engine integration, the high-pressure compressor, the low-pressure shaft, the intermediate casing, and the structural parts for the bearing supports.

Website: <http://www.europrop-int.com>

Fermi Energia. In March 2021, Rolls-Royce and Fermi Energia signed a Memorandum of Understanding to study the potential for the deployment of affordable, compact nuclear power stations, known as small

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modular reactors, in Estonia. The study will cover all aspects of deployment, including grid suitability, cooling, emergency planning, human resources, licensing feasibility, economics and supply chain.

HAESL. Hong Kong Aero Engine Services Ltd is jointly owned by Rolls-Royce, HAECO (Hong Kong Aircraft Engineering Company), and SIAEC (Singapore International Airlines Engineering Company). HAESL was opened in 1997 to provide repair and overhaul services for the Trent and RB211 in the Asia-Pacific region and the Middle East.

Website: <https://www.haesi.com>

International Engine Component Overhaul.

Formed in 1997, International Engine Component Overhaul Pte Ltd is a 50-50 joint venture between Rolls-Royce plc and SIAEC. IEICO's core business is the repair and overhaul of the Rolls-Royce Trent and RB211 nozzle guide vanes and compressor stators.

Kale Group. In May 2017, Rolls-Royce and Kale Group formed a joint venture company to target aero engine opportunities in Turkey. Kale Group would own 51 percent and Rolls-Royce 49 percent of the joint venture, which aims to develop aircraft engines for Turkey, initially targeting the TF-X National Fighter Jet Project.

Light Helicopter Turbine Engine Co (LHTEC).

Headquartered in West Madison, Alabama, the LHTEC manufacturing team consists of Honeywell Engines and Systems and Rolls-Royce North America. The venture's primary program was the LHTEC T800 engine, which was to power the canceled RAH-66 Comanche helicopter. Despite the cancellation, LHTEC has had some success in selling the T800, and its civil CTS800 model, for other applications.

MTU Turbomeca Rolls-Royce GmbH. Formed in 1988, MTR is equally owned by MTU Aero Engines (Germany), Turbomeca (France), and Rolls-Royce. The major project of this group is the MTR390 engine, which is being developed as part of the Airbus Helicopters PAH-2/HAP/HAC Tiger program.

Website: <https://www.mtr390.com>

MTU Yuchai Power. In April 2017, MTU Friedrichshafen and Guangxi Yuchai Machinery Company Ltd established a new joint venture, MTU Yuchai Power Co Ltd. The venture builds Version 03 of MTU's Series 4000 engines in China. These will be suitable for use in the oil & gas and power generation industries.

Mubadala. In November 2013, Rolls-Royce entered into a Strategic Framework Agreement with Mubadala

Aerospace, Communications Technology and Defense Services (ACTDS) to establish the emirate of Abu Dhabi as a key member of Rolls-Royce's global network for maintenance and manufacturing activities. As part of the agreement, Rolls-Royce is assisting Mubadala in becoming an approved Trent XWB MRO provider.

In July 2008, Rolls-Royce and Mubadala Development Company of the United Arab Emirates launched a new joint venture company to serve the rapidly expanding Middle East aviation services market. The joint venture offers on-wing care through Abu Dhabi Aircraft Technologies (ADAT). The company offers a wide range of line maintenance support services – from borescoping to engine changes for Rolls-Royce Trent family operators in the region. In addition, it planned to launch a new service to provide asset management services for engine system accessories.

MVM Group. In January 2018, Rolls-Royce signed a Memorandum of Understanding with Hungarian state-owned MVM OVIT National Power Line Company Ltd, part of the MVM Group, to explore how they can work together on the provision and maintenance of I&C systems for the second reactor planned to be built at the Paks Nuclear Power Plant in Hungary.

N3 Engine Overhaul Services. In February 2003, Lufthansa Technik AG and Rolls-Royce formed a 50-50 joint venture called N3 Engine Overhaul Services that specializes in the repair and overhaul of three Rolls-Royce Trent engine types. In 2007, the new operation began overhauling Trent engines for Airbus A330, A340-500/600, and A380 series aircraft for customers in Europe, the Americas, and Africa. The facility will ultimately have the capacity to handle 200 engines a year. The investment of the two partners for the joint venture totals more than EUR100 million.

Website: <https://www.n3eos.com>

Naval Group. In October 2000, Northrop Grumman and Rolls-Royce signed an agreement with French marine engineering company Naval Group (then DCNS) to market and produce the WR-21 marine gas turbine engine. The business agreement, augmented by a license agreement between Northrop Grumman and Naval Group, established a "world-class team" for the intercooled and recuperated WR-21. The team was selected as the preferred supplier of marine gas turbine engines for Britain's first three new Type 45 destroyers.

NMA Engine Competition Withdrawal. In February 2019, Rolls-Royce withdrew from the competition to power Boeing's proposed middle of the market – or New Midsize Airplane (NMA) – platform, citing the program's tight schedule. General Electric and Pratt & Whitney remained contenders to supply the

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NMA engines. However, the NMA program was shelved in 2020 due to the COVID-19 pandemic.

In February 2021, Boeing began taking tentative steps toward a new aircraft model, which would compete against Airbus' A321 XLR. The company has begun talking with suppliers for interest in the project, reportedly called the -5X. With the schedule for the aircraft now extended, Rolls-Royce may re-enter the process with its UltraFan.

Northstar Aerospace. In February 2006, Rolls-Royce and Northstar Aerospace Inc signed a Memorandum of Understanding to discuss advanced technology and parts production. Under the agreement, Northstar would provide Rolls-Royce with flight-critical engine parts with the goal of meeting increased customer needs. Northstar has unique gear system capabilities that Rolls-Royce is looking to incorporate.

Pratt & Whitney. In December 2001, Pratt & Whitney and Rolls-Royce signed a contract covering Rolls-Royce's short takeoff and vertical landing (STOVL) development work for the F135 propulsion system that equips the Lockheed Martin Joint Strike Fighter. The contract, worth approximately \$1 billion to Rolls-Royce over 10 years, is for the System Development and Demonstration phase of the program. The SDD phase covers design and development work on the LiftFan, the roll posts, the three-bearing swivel duct, and the nozzle system that together provide the STOVL capability for the JSF. P&W is responsible for development of the propulsion and lift system for the JSF, under the terms of a \$4.8 billion contract awarded by the U.S. Department of Defense. Activities include the design and manufacture of ground test engines, as well as subsequent production and support of flight test engines. The two companies also signed a teaming agreement for the F135 propulsion system, formalizing their relationship. Under the agreement, Rolls-Royce would continue to design and develop major F135 STOVL components for Pratt & Whitney.

Purdue University. In April 2016, Rolls-Royce and Purdue University announced plans to form a \$33 million jet engine research and development program to create next-generation aircraft propulsion systems. Under the plans, Rolls-Royce would designate Purdue as a University Technology Partner (UTP). This partnership will initially encompass two research centers, one in the area of advanced thermal management systems and the other for advanced compressor systems – expanding beyond the current University Technology Center (UTC) designation.

Reaction Engines. In April 2018, Rolls-Royce invested in Reaction Engines Limited, a U.K.-based aerospace technology company. The investment is part

of a strategic fundraising by Reaction Engines, which will support the further development of the SABRE concept, which combines air breathing rocket and associated technologies.

Rolls-Royce Snecma Ltd. In 2001, Rolls-Royce and Snecma Moteurs (now Safran) set up an equally owned joint venture company to run programs related to military combat aero engines that are supported by the U.K. and French governments, starting with joint technology acquisition programs. The venture acts as prime contractor and single point of contact to the two governments, and conducts whole-engine integration studies.

In November 2014, Rolls-Royce Snecma signed a new contract with the U.K. Ministry of Defence, in collaboration with the Armaments Procurement Agency of the French Ministry of Defense, to continue design studies for the Future Combat Air System (FCAS). This contract marks the start of a two-year Feasibility Phase, designed to study the operational parameters for the Future Combat Aircraft. The French and U.K. governments have allocated GBP120 million for this new phase to the companies involved in the FCAS project: Dassault Aviation, BAE Systems, Thales, Selex ES (now Leonardo), and Rolls-Royce Snecma Ltd. The FCA, which could bring new levels of capability to the air forces of the future, could enter service toward 2030.

Rolls-Royce Turbomeca Ltd. Formed in 1966, Rolls-Royce Turbomeca Ltd is a joint venture that manufactures the RTM322 turboshaft engine and Adour turbofan engine. In September 2013, Rolls-Royce sold its shareholding and interest in the RTM322 helicopter engine program to Turbomeca (a Safran company) for EUR293 million in cash. Turbomeca now has full responsibility for managing the design, production, and support of the RTM322 engine, which powers the Apache, EH101 Merlin and NH90 helicopters. The Adour engine program was unaffected by this agreement.

Rosatom. In September 2011, Rolls-Royce announced it would collaborate with Russian state-owned atomic energy corporation Rosatom in the area of civil nuclear power.

Saab. In December 2020, Saab and Rolls-Royce began a joint research program, dubbed Project FibreSense, which will develop and demonstrate fiber-optic sensing technology for aerospace propulsion systems. Fiber-optic sensing technologies have the potential to provide a novel solution that acquires multiple measurements such as strain, pressure and temperature along a single wire. Compared to existing technologies, this low-weight integrated solution could offer higher

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temperature and accuracy within the harsh operating environment of an engine. Such advanced measurement systems complement the "journey to the Intelligent Engine and enhanced data driven engine services."

Singapore Aero Engine Services. In March 1999, a joint venture involving Rolls-Royce and several Asia-Pacific partners in the repair and overhaul of Trent engines was officially launched with an agreement signing in Singapore. The new facility, Singapore Aero Engine Services Ltd (SAESL), is owned by SIA Engineering Co (50 percent), Rolls-Royce (30 percent), and Hong Kong Aero Engine Services Ltd, which has a 20 percent stake. SAESL, which opened in February 2002, was to initially undertake repair and overhaul of the Trent 800s that power Singapore Airlines' fleet of up to 61 Boeing 777s.

In February 2008, SAESL broke ground on the site for a new two-story development located in Changi, Singapore. The new development, built at a cost of SGD60 million (\$43 million), integrated with the existing facility and enhanced SAESL's service offerings. This expansion significantly increased the facility's capacity.

Website: <https://www.saesl.com.sg>

SMR Consortium. In January 2020, Rolls-Royce began leading a consortium formed to build and install small modular reactors on former nuclear sites to power the U.K. by 2029. Each power station will be able to operate for 60 years and provide 440 MW of electricity. The consortium, which is developing the power station, comprises Assystem, Atkins, BAM Nuttall, Jacobs, Laing O'Rourke, National Nuclear Laboratory, Nuclear Advanced Manufacturing Research Centre, Rolls-Royce, and TWI.

Team Tempest. A team led by BAE Systems and including Leonardo, MBDA, Rolls-Royce, and the RAF's Rapid Capabilities Office is developing the Tempest concept for the U.K.'s Future Combat Air effort. The British MoD's aim is to develop a sophisticated future fighter to replace the RAF's Eurofighter fleet in the 2040s, at which time the aircraft will serve alongside the F-35 Lightning II combat aircraft.

The Team Tempest joint program office will spearhead development of a new design by 2025. This phase will be underwritten by GBP2 billion (\$2.6 billion) in funding originally committed under the 2015 Strategic Defence and Security Review (SDSR). According to government and industry officials, the Tempest aircraft is necessary to sustain the U.K.'s combat aerospace sector. The Tempest is intended to enter service around 2035, replacing the Eurofighter Typhoon.

A full-scale model of the Tempest was shown at the 2018 Farnborough Air Show. In September 2019, the partners signed a Statement of Intent to define a concept and partnership model. In July 2020, the U.K. selected seven other companies to support Team Tempest: Bombardier Belfast, Collins Aerospace Systems, GE Aviation UK, GKN Aerospace, Martin-Baker, Qinetiq, and Thales UK.

In July 2020, Italy and Sweden entered into formal discussions with the U.K. on the program. Under the new trilateral framework, industry from the three nations will collaborate on the research and development effort. The three national industries comprise companies from the U.K. (BAE Systems, Leonardo UK, Rolls-Royce, and MBDA UK), Italy (Leonardo Italy, Elettronica, Avio Aero, and MBDA Italia), and Sweden (Saab and GKN Aerospace Sweden). This framework is another step on the path toward a full agreement between these national industries to formalize areas of collaboration on future combat air systems development.

Website: www.raf.mod.uk/what-we-do/team-tempest/

Techjet Aerofoils Ltd. In May 1999, Rolls-Royce announced the creation of a joint venture with partners in Israel for the manufacture of aero engine compressor blades. The company, Techjet Aerofoils Ltd, is 50 percent owned by Rolls-Royce, with Blades Technology Ltd holding a 30 percent share and Wertheimer Co Ltd the remaining 20 percent. The joint venture, based in northern Israel, forges and machines up to 450,000 compressor blades a year.

Trent 7000 Partners. In June 2015, Rolls-Royce announced several risk and revenue sharing partners on the Trent 7000. These include Spain's ITP Aero SA and Japan's Kawasaki Heavy Industries Ltd (KHI) and Mitsubishi Heavy Industries Aero Engines Ltd (MHIAEL). ITP is a joint venture with Rolls-Royce (46.9 percent) and a subsidiary of SENER (53.1 percent). ITP is responsible for design and assembly of the low-pressure turbine (LPT) module and the majority of manufacturing. KHI supplies the intermediate-pressure compressor (IPC) module from its Seishin facility. MHIAEL supplies components for combustion modules and LPT blades from its facility in Nagoya. The Trent 7000 was designed for the Airbus A330neo aircraft, deliveries of which began in 2018.

Turbo-Union Ltd. Rolls-Royce is in partnership with Avio and MTU Aero Engines, which produces RB199 turbofans for the Panavia Tornado multirole combat aircraft. Rolls-Royce holds a 40 percent interest in Turbo-Union.

Rolls-Royce plc

Vertical Aerospace. In March 2021, Rolls-Royce was selected to power Vertical Aerospace's flagship VA-X4 urban air mobility (UAM) aircraft. A Rolls-Royce electrical power system will be integrated into the piloted all-electric vertical takeoff and landing (eVTOL) vehicle, which will carry up to four passengers for 120 miles at cruise speeds of over 200 mph and is on course for certification in 2024.

Vertical Aerospace is a key collaboration for Rolls-Royce Electrical, as it marks its first commercial deal in the UAM market. Rolls-Royce will design the system architecture of the electrical propulsion system; the electric power system, which will include its latest 100-kW-class lift and push electrical propulsion units; the power distribution system; and the monitoring system.

Widerøe. In March 2021, Rolls-Royce and airframer Tecnam teamed with Widerøe – a regional airline in Scandinavia – to deliver an all-electric passenger aircraft for the commuter market, to be ready for revenue service in 2026. The project expands on the research program between Rolls-Royce and Widerøe on sustainable aviation and the existing partnership between Rolls-Royce and Tecnam on powering the all-electric P-Volt aircraft, which is based on the Tecnam P2012 Traveller airframe. Rolls-Royce will bring its expertise in propulsion and power systems, and Tecnam will provide aircraft design, manufacturing and certification capabilities.

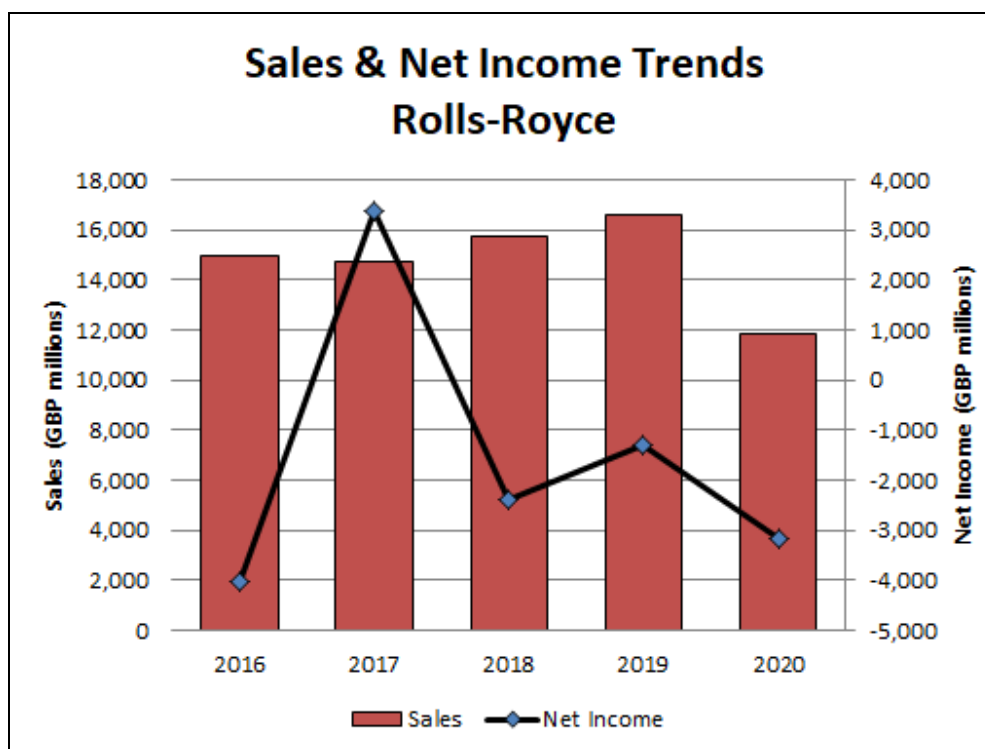
Rolls-Royce has an existing strategic partnership with Tecnam to develop the modified Tecnam P2010 aircraft with the H3PS propulsion system.

Financial Results/Corporate Statistics

For 2020, Rolls-Royce reported revenue of GBP11.8 billion, down almost 29 percent from GBP16.6 billion in 2019. The company posted a loss of GBP3.2 billion, compared to a loss of GBP1.3 billion in 2019. The 2020 loss was due to the impact of the COVID-19 pandemic, primarily on the Civil Aerospace business. The loss in 2019 was attributed to problems with the Trent 1000. The loss in 2018 was attributed to problems with both the Trent 900 and Trent 1000 engines as well as costs associated with a new restructuring effort. The record loss for 2016 was the result of fines to settle bribery charges and the impact of a weaker pound due to Brexit issues.

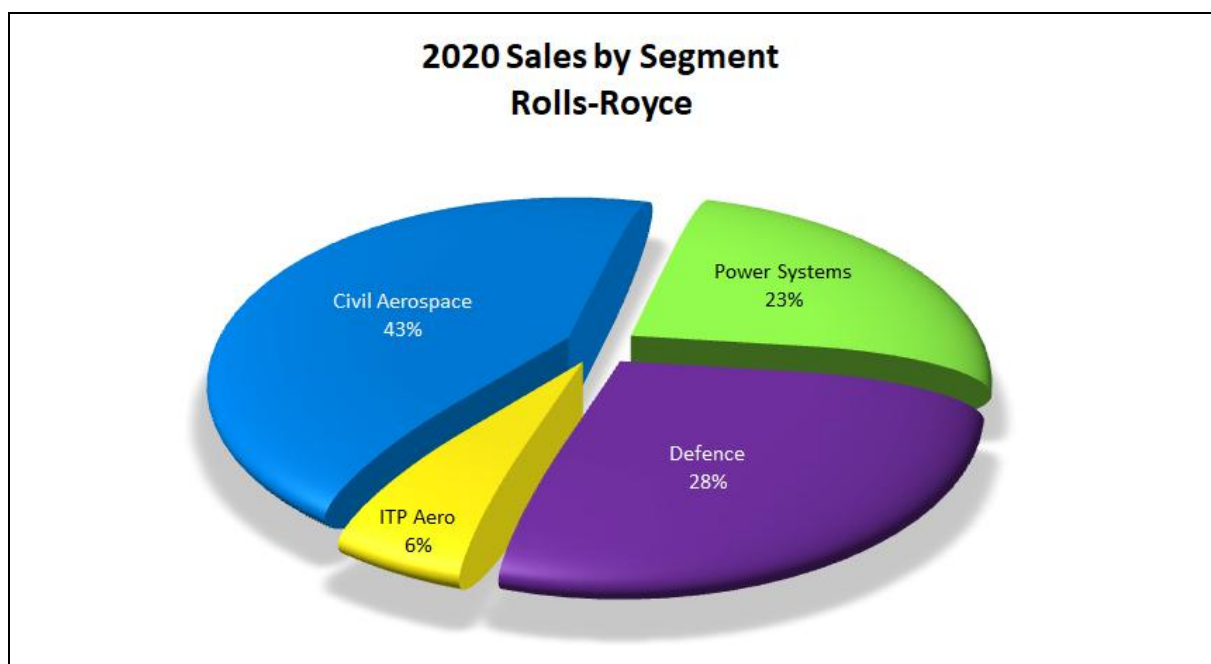
Latest year statistics are provided below. Rolls-Royce's net income figure is derived from its reported "(loss)/profit for the year" data. Results have been restated to the company's current presentation. U.S. dollar figures are in millions, translated as of December 31, 2020, at the rate of GBP1 = USD 1.35772.

| Rolls-Royce (LON: RR) | | | | | | |
|------------------------------|-------------|-------------|-------------|-------------|-------------|-------------------|
| (GBP millions) | 2016 | 2017 | 2018 | 2019 | 2020 | (USD) 2020 |
| Net Sales | 14,955 | 14,747 | 15,729 | 16,587 | 11,824 | 16,054 |
| Net Income | -4,032 | 3,383 | -2,393 | -1,311 | -3,169 | -4,303 |
| R&D Expenditures | 918 | 843 | 768 | 770 | 1,254 | 1,703 |
| Order Backlog | 80,910 | 55,000 | 63,100 | 60,900 | 53,700 | |
| Long-Term Debt | 3,185 | 3,406 | 3,804 | 4,910 | 6,058 | 8,225 |
| Shareholder Equity | 1,862 | 930 | -1,074 | -3,376 | -4,897 | -6,649 |
| Debt-to-Equity Ratio | 1.71 | 3.66 | -3.54 | -1.45 | -1.24 | - |
| Employees | 49,900 | 50,000 | 54,500 | 51,700 | 48,200 | - |

Rolls-Royce plc**Industry Segments**

A breakdown of the firm's sales and income by its current business segments is provided below.

| UNDERLYING REVENUE | | 2017 | 2018 | 2019 | 2020 |
|---------------------------|--|-------------|-------------|-------------|-------------|
| (GBP millions) | | | | | |
| Civil Aerospace | | 6,598 | 7,378 | 8,107 | 5,089 |
| Power Systems | | 3,008 | 3,484 | 3,545 | 2,745 |
| Defence | | 3,180 | 3,124 | 3,250 | 3,366 |
| ITP Aero | | 725 | 779 | 936 | 705 |
| | | | | | |
| OPERATING INCOME | | 2017 | 2018 | 2019 | 2020 |
| (GBP millions) | | | | | |
| Civil Aerospace | | -343 | -162 | 44 | -2,574 |
| Power Systems | | 261 | 317 | 367 | 178 |
| Defence | | 454 | 427 | 415 | 448 |
| ITP Aero | | 65 | 67 | 111 | 68 |

Rolls-Royce plc**Segment Details**

Below is a breakdown of key financial data for the company's current business segments and geographic regions.

| CIVIL AEROSPACE | 2017 | 2018 | 2019 | 2020 |
|----------------------------------|-------------|-------------|-------------|-------------|
| (GBP millions) | | | | |
| Net Sales | 6,598 | 7,378 | 8,107 | 5,089 |
| Original Equipment | 44% | 42% | 40% | 45% |
| Large Engines | 2,089 | 2,373 | 2,568 | 1,711 |
| Business Aviation | 582 | 620 | 643 | 579 |
| V2500 | 219 | 126 | 35 | 8 |
| Services | 56% | 58% | 60% | 55% |
| Large Engines | 2,327 | 2,666 | 3,205 | 1,609 |
| Business Aviation | 396 | 464 | 477 | 444 |
| Regional | 277 | 292 | 355 | 184 |
| V2500 | 708 | 837 | 824 | 554 |
| Revenue Mix | | | | |
| Large Engines | - | 5,017 | 5,756 | 3,308 |
| Business Aviation | - | 1,107 | 1,135 | 1,018 |
| Regional | - | 295 | 324 | 204 |
| V2500 | - | 959 | 892 | 560 |
| Operating Income | -343 | -162 | 44 | -2,574 |
| R&D Expenditures | 454 | 332 | 374 | 436 |
| Order Backlog | 45,700 | 52,300 | 48,500 | 42,400 |
| Engine Deliveries (units) | | | | |
| Large Engine Deliveries | 483 | 469 | 510 | 264 |
| Small Engine Deliveries | 283 | 217 | 219 | 184 |
| Employees | - | 25,620 | 26,100 | 23,400 |

Rolls-Royce plc

| POWER SYSTEMS | 2017 | 2018 | 2019 | 2020 |
|----------------------------------|-------------|-------------|-------------|-------------|
| (GBP millions) | | | | |
| Net Sales | 3,008 | 3,484 | 3,184 | 2,745 |
| <i>Original Equipment</i> | 65% | 67% | 67% | 65% |
| <i>Services</i> | 35% | 33% | 33% | 35% |
| Revenue Mix | | | | |
| Industrial | - | 1,045 | 993 | 659 |
| Marine | - | 1,010 | 886 | 878 |
| Power Generation | - | 1,010 | 1,241 | 906 |
| Defence | - | 244 | 319 | 302 |
| Civil Nuclear | - | 174 | 106 | - |
| Operating Income | 261 | 317 | 367 | 178 |
| R&D Expenditures | 181 | 188 | 166 | 167 |
| Order Backlog | 2,400 | 3,100 | 2,900 | 2,400 |
| Employees | - | 10,355 | 10,400 | 8,900 |
| | | | | |
| DEFENCE | 2017 | 2018 | 2019 | 2020 |
| (GBP millions) | | | | |
| Net Sales | 3,180 | 1,452 | 3,250 | 3,366 |
| <i>Original Equipment</i> | 44% | 46% | 44% | 43% |
| <i>Aftermarket Services</i> | 56% | 54% | 55% | 57% |
| Revenue Mix | | | | |
| Transport | - | 1,156 | 1,170 | 1,111 |
| Combat | - | 687 | 748 | 808 |
| Submarines | - | 625 | 618 | 606 |
| Naval | - | 250 | 325 | 370 |
| Other | - | 406 | 390 | 471 |
| Operating Income | 454 | 427 | 415 | 448 |
| R&D Expenditures | 89 | 100 | 105 | 96 |
| Order Backlog | 5,800 | 6,800 | 8,600 | 7,500 |
| Engine Deliveries (units) | | | | |
| <i>Transport</i> | 323 | 311 | 262 | 211 |
| <i>Helicopters</i> | 226 | 213 | 200 | 133 |
| <i>Combat</i> | 38 | 23 | 27 | 44 |
| <i>Trainers/Other</i> | 18 | 13 | 10 | 9 |
| Employees | - | 10,355 | 9,900 | 10,500 |
| | | | | |
| ITP AERO | 2017 | 2018 | 2019 | 2020 |
| (GBP millions) | | | | |
| Net Sales | 725 | 779 | 936 | 705 |
| <i>Original Equipment</i> | - | 85% | 84% | 76% |
| <i>Aftermarket Services</i> | - | 15% | 16% | 24% |
| Revenue Mix | | | | |
| Civil | - | 522 | 721 | 515 |
| Defence | - | 140 | 122 | 127 |
| Services/MRO | - | 117 | 94 | 63 |
| Operating Income | 65 | 67 | 111 | 68 |
| R&D Expenditures | - | 30 | 33 | 27 |
| Order Backlog | 1,100 | 900 | 900 | 800 |
| Employees | - | 3,815 | 3,900 | 3,800 |

Sources: Rolls-Royce Annual Reports; 2020 full year press release, presentation, and appendices.

Rolls-Royce plc

The following is a breakdown of Rolls-Royce's sales by geographic location.

| GEOGRAPHICAL SALES | 2016 | 2017 | 2018 | 2019 | 2020 |
|----------------------|-------|-------|-------|-------|-------|
| (GBP millions) | | | | | |
| United Kingdom | 1,821 | 1,709 | 1,505 | 1,805 | 1,234 |
| Germany | 850 | 915 | 1,177 | 961 | 832 |
| Switzerland | 745 | 787 | 675 | 520 | 259 |
| Spain | 289 | 256 | 343 | 375 | 321 |
| France | 294 | 379 | 251 | 284 | 234 |
| Italy | 232 | 283 | 304 | 235 | 211 |
| Russia | 75 | 56 | 79 | 106 | 102 |
| Norway | 279 | 194 | 246 | 87 | 113 |
| Rest of Europe | 700 | 664 | 664 | 979 | 723 |
| USA | 4,176 | 4,279 | 5,041 | 4,720 | 40,29 |
| Canada | 341 | 313 | 366 | 298 | 322 |
| South America | 314 | 173 | 351 | 377 | 133 |
| Central America | - | - | - | 78 | 63 |
| United Arab Emirates | - | - | 105 | 438 | 191 |
| Saudi Arabia | 486 | 285 | - | - | - |
| Rest of Middle East | 570 | 734 | 584 | 714 | 719 |
| China | 1,417 | 1,534 | 1,483 | 1,698 | 1,082 |
| Singapore | 518 | 449 | 452 | 702 | 341 |
| Japan | 333 | 216 | 365 | 607 | 327 |
| South Korea | 251 | 243 | 334 | 252 | 139 |
| India | 99 | 110 | 82 | 82 | 78 |
| Malaysia | 117 | 89 | 111 | - | - |
| Rest of Asia | 508 | 530 | 588 | 622 | 130 |
| Africa | 290 | 235 | 152 | 246 | 238 |
| Australasia | 188 | 205 | 229 | 361 | 225 |
| Other | 62 | 109 | 91 | 40 | 2 |

Major Competitors

Rolls-Royce's major competitors in the gas turbine market include GE Aviation, Honeywell, Pratt & Whitney, Safran Helicopter Engines, MTU Aero Engines, and CFM International.

Strategic Outlook

Just when things couldn't get any worse for Rolls-Royce, a global pandemic arrived, decimating its commercial aviation operations. Prior to COVID-19, the company was just getting its house in order after dealing with corruption issues, problems on a flagship engine program, and Brexit.

The troubles reached their nadir in 2017 when Rolls-Royce agreed to pay over \$800 million to resolve several long-running bribery and corruption inquiries. Even more damaging was the \$3.7 billion write-down on its currency hedge brought on by a Brexit-induced weakening of the British pound versus the U.S. dollar. All told, the company posted a record-setting loss of some \$5 billion.

In an effort to right the ship, CEO Warren East wasted no time in ordering a review of Rolls-Royce's operations. New compliance policies and ethics training

have since been implemented, and the number of intermediaries – a key problem in the scandal – has been reduced. The company is being monitored over a set period, with no prosecution taking place provided that no infractions occur.

With one fire out, another appeared in the form of ongoing issues with the Trent 1000 engine, which powers the Boeing 787 Dreamliner. Turbine blades on some of the engines have worn out sooner than expected, resulting in delivery disruptions and aircraft groundings. This led to 2019 results being hit with a GBP1.4 billion charge related to Trent 1000 issues. The company is progressing on fixing the program, with the certification of the new blade design expected in 2021. However, the lingering problems, coupled with reduced air travel in light of the pandemic, do not bode well for near-term engine sales, and it will be several years before demand returns to pre-pandemic levels.

Rolls-Royce plc

Moreover, it is the COVID-19 pandemic that overshadows all. Commercial aviation has been hammered by the crisis as airframe production slows. Both Airbus and Boeing have cut production across their product lines – a dramatic reversal from the past years of booming production to fill record backlogs. As a result, Rolls-Royce sales dropped almost 29 percent to GBP11.8 billion, from GBP16.6 billion in 2019. The company posted a loss of GBP3.2 billion, compared to a loss of GBP1.3 billion in 2019. The 2020 loss was due to the impact of the pandemic, primarily on the Civil Aerospace business.

Exacerbating the matter is that Rolls-Royce's engines are heavily exposed to the widebody aircraft market, which is forecast to have a slower recovery than the narrowbody sector. Stringent global travel restrictions will likely remain in place as new COVID variants emerge, further dampening the recovery in long-haul, widebody air travel. As a result, the delivery of new engines is not expected to rebound for several years.

In response, Rolls-Royce has moved to slash 9,000 employees from its 52,000 workforce, consolidate facilities, and sell off assets. As of the end of 2020, the company had already consolidated some operations while trimming about 7,000 jobs while the remainder will be eliminated by 2022.

Meanwhile, the company has begun selling off various assets to raise cash. Under its latest strategy, the firm hopes to raise some GBP2 billion from such disposals. So far, the firm has divested its civil nuclear instrumentation and control operations and is working to sell its Bergen Engines unit, though a deal to sell it to Russia's TMH has been halted. Next on the block is the Spain-based ITP Aero, whose operations Rolls-Royce has been tweaking in order to make the unit more attractive. The company is continuing to review its operations, and additional divestitures are expected in 2021.

While the bad news certainly outweighed the good, Rolls-Royce's defense-related operations held their ground during the crisis. The sector not only produces engines for the military aviation market but also supplies propulsion systems for marine systems. The company is looking ahead to some major competitions such as the U.S. Air Force's B-52 bomber re-engining effort and the U.S. Army's Future Vertical Lift program. A win on either of these efforts, both valued in the billions, would certainly help the bottom line and corporate morale.

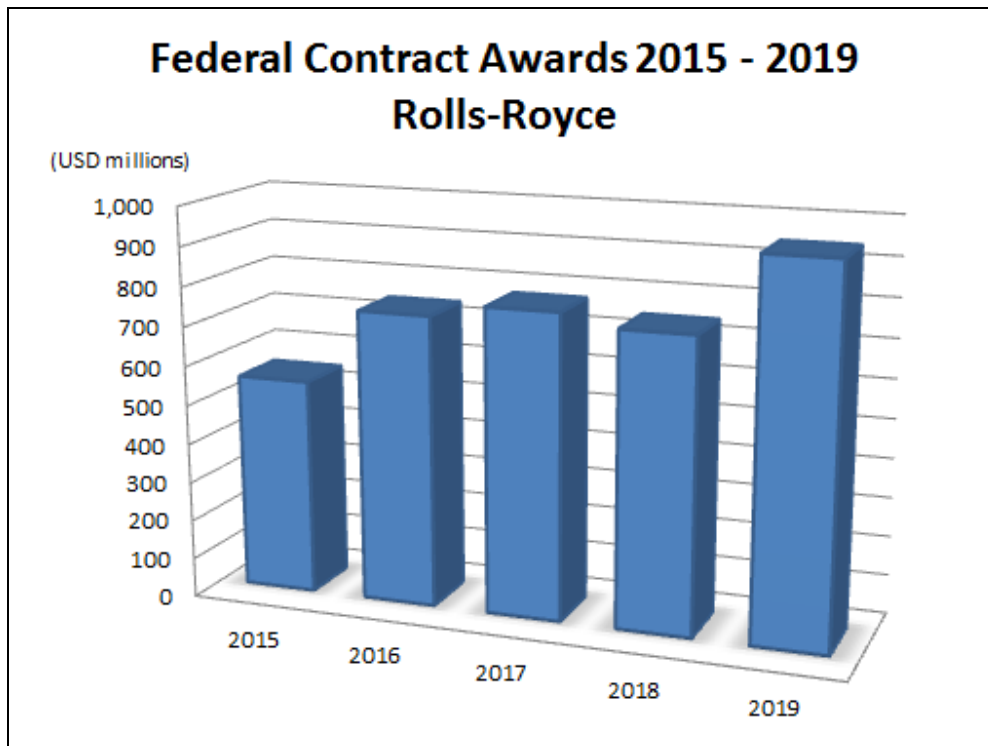
While the worst of the pandemic is hopefully in the rearview thanks to vaccines and public awareness, it will take some time for firms to heal from the deep wounds it inflicted.

Prime Award Summary

The following chart and table show the dollar volume of U.S. federal prime contracts awarded from 2015 through 2019, and the top 100 rank (if applicable) of the company in terms of federal contracts issued for each of the five years.

| Rolls-Royce | 2015 | 2016 | 2017 | 2018 | 2019 |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|
| (USD millions) | | | | | |
| Rank | 93 | 76 | 78 | 79 | 68 |
| Total Federal Awards | 551 | 743 | 776 | 746 | 945 |

Rolls-Royce plc



Source: Federal Procurement Data System - Next Generation (www.fpds.gov) Top 100 Contractors Report

Program Activity

Business Interests. Some important aerospace and government programs currently underway at Rolls-Royce are listed below. The briefs are intended to provide a listing of programs that are of major importance to the company. For detailed information on or analysis of specific aerospace and defense programs or equipment, please refer to the applicable Forecast International service (for example, *Civil Aircraft*, *Military Aircraft*, *Military Vehicles*, *Warships*, *Missiles*, *Electronic Systems*, and *Aviation Gas Turbines*). The following are the company's business interests:

- Commercial turbofan engines
- Military turbofan engines
- Commercial turboprop engines
- Military turboprop engines
- Commercial turboshaft engines
- Military turboshaft engines
- Aero, industrial, and marine engine MRO
- Nuclear engineering
- Power plant engineering
- Electrical transmission and distribution

In 1995, Rolls-Royce expanded its presence in its largest market, the U.S., through the acquisition of Allison Engine Company from General Motors Corporation. Allison has since been fully melded into Rolls-Royce plc, and the Indianapolis-based entity is now referred to as Rolls-Royce Corporation.

Aviation Gas Turbines

Next-Gen Engine Designs. In February 2014, Rolls-Royce provided details of its next generation of engine designs. The first design, **Advance**, "will offer at least 20 percent better fuel burn and CO2 emissions than the first generation of Trent engines and could be ready for entry into service from 2020." The second design, **UltraFan**, a geared design with a variable-pitch fan system, is based on technology that could be ready for service from 2025 and "will offer at least 25 percent improvement in fuel burn and emissions against the same baseline." In addition, Rolls-Royce has developed and tested technologies to support the open rotor engine concept and is positioned to mature them should demand warrant.

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In 2017, the company was also working on a new business aviation engine dubbed **Advance2**. This engine would cover the 10,000-20,000-lbshp range. An **Advance3** demonstrator has also been developed that combines the fan system from a 84,200-lbshp Trent XWB-84 with a modified low-pressure turbine from an ex-test Trent 1000.

(Aviation Turbofans)

EuroJet EJ200

Rolls-Royce has a 33 percent share of the EuroJet consortium, which is developing the EJ200 turbofan for the Eurofighter Typhoon. Rolls-Royce plc is responsible for the combustion chamber, HP turbine, intermediate casing, LP and HP compressors, LP turbine interstage, reheat system, and convergent / divergent nozzle. Eurofighter is searching for new orders from other export customers, but the market for new heavy twin-engine fighters is limited to a few Persian Gulf states and wealthy Asian nations, many of which have already contracted for advanced fighters. Germany may order at least 38 more Typhoons as part of its Project Quadriga program.

Rolls-Royce AE 3007

The AE 3000 turbofan series has been in production since the FAA granted it certification in March 1995. Production for the Embraer ERJ family of regional jets is complete. The program now has only a single civil application, Embraer's Legacy 650 large cabin business jet. Embraer will terminate production of the Legacy 650 amid the economic fallout of the COVID-19 pandemic. Limited numbers are produced for the Global Hawk unmanned air vehicle (UAV) program. Rolls-Royce is the prime contractor.

Rolls-Royce BR700/Pearl

The BR700 is a family of turbofans currently being produced by Rolls-Royce GmbH to span the 8,000- to 22,000-lbshp range to power business jets, regional transports, and commercial airliners seating up to 130 passengers. The BR710 is in production for both the Gulfstream 550 and Bombardier Global 5000/6000 aircraft. The BR725 is used on the popular Gulfstream G650. The new Pearl 15 engine is the latest iteration of the BR700 family and offers higher fuel efficiency. Gulfstream's new G700 business jet is the newest addition to the list of applications; deliveries will begin around 2022.

Rolls-Royce Tay

Derived from Rolls-Royce's earlier Mk 555 Spey turbofan, the Tay is a two-shaft turbofan in the 12,420- to 18,000-lbshp power range. Both engines are used on light- to medium-weight civil transports, military transports, and attack/fighter aircraft. The engine

entered service in 1987 and became established on Gulfstream aircraft. However, Gulfstream's G450 is the only remaining application for the Tay turbofan engine, production of which concluded in 2018.

Rolls-Royce Trent

Rolls-Royce's Trent turbofan engine has had a long history since the U.K. firm began study of the high-thrust turbofan engine market in 1961. Currently, Rolls-Royce's Trent engine family powers widebody aircraft from Boeing and Airbus, and is the core of its large civil engine product line. The first production version, the RB211-22B, was certificated in 1973. The Trent core-derived RB211-524G/H-T (which powers the 747) became the only series production -524 variant in 1998, superseding earlier -524G/H variants. The RB211-535 (which powers the 757) is in production. The Trent 700 (which powers the A330) was certificated in December 1994 and is in production. The Trent 800 (which powers the 777) was certificated in February 1995 and is in production. The Trent 500 entered service in 2002 on the A340-600.

The Trent 1000/-TEN (the TEN designation is for Thrust, Efficiency and New technology) was developed for Boeing's 787. However, ongoing problems with Trent 1000s in service may have contributed to lost market share on the Boeing 787. Production of the Trent XWB for the Airbus A350 and the Trent 7000 for the Airbus A330neo is a positive long-term development for the program. The A380 program will end in 2021, removing demand for the Trent 900.

Rolls-Royce Turbomeca Adour

Rolls-Royce Turbomeca Ltd produces the Adour turbofan in both augmented and non-augmented versions. Rolls-Royce is responsible for the combustor system, the LP and HP turbines, the LP shaft, the exhaust cone, the mixer, and the oil tank. The Adour powers a number of military trainer, fighter, and attack aircraft, and is currently in production for the BAE two-seat Hawk trainer and its single-seat Hawk 200 attack variant, as well as for the T-45 Hawk variant chosen for the U.S. Navy's undergraduate jet trainer requirement. The U.S. designation for the Adour engine used on the T-45 (the Adour Mk 871) is F405-RR-401. To keep the line running past 2022, BAE Systems will need to secure new orders.

(Aviation Turboprops)

Europrop International TP400-D6

The Europrop International (EPI) TP400-D6 is a three-shaft turboprop engine being produced for the Airbus Military A400M transport – its sole application. Rolls-Royce is responsible for the HP compressor, LP shaft, intermediate casing, bearing support structures, hot

Rolls-Royce plc

struts, internal gearbox, air/oil and heat management system, and whole engine mechanics. Total A400M orders stand at 174 aircraft.

In June 2019, Airbus and the European defense procurement agency OCCAR amended the contract covering A400M production to restructure the program. Under the new contract amendment, Airbus and OCCAR will stretch out production of the current order backlog until 2030, adjust the timetable for the provision of new aircraft capabilities, and reschedule aircraft retrofits.

Rolls-Royce AE 2100

This is a large single-shaft, axial-flow, free-turbine turboprop engine designed for large regional/commuter transport aircraft and military intra-theater transports. It is in serial production for use on the Lockheed C-130J military transport. AE 2100 engines are manufactured, assembled, and tested in Indianapolis, Indiana.

In February 2014, Rolls-Royce completed a long-term agreement with Lockheed Martin worth up to \$1 billion to deliver approximately 600 engines to power future C-130J Super Hercules aircraft. The agreement secures the Rolls-Royce AE 2100 as the "engine of choice" for all variants of the C-130J to 2025.

Rolls-Royce Model 250 (Turboprop)

This is an axial-centrifugal and centrifugal-flow free-turbine turboprop engine designed for light- to medium-weight commercial and military aircraft. Developed by Rolls-Royce Corp, the Model 250 turboprop is one of the smallest and lightest in operation today. Despite that, the Model 250 holds only a small share of the turboprop engine market due to its narrow power range.

Rolls-Royce T56

Developed by Rolls-Royce Corp, this is a single-shaft, axial-flow large turboprop engine for heavy fixed-wing military and commercial aircraft. Applications have included the Lockheed C-130H transport, Lockheed Martin P-3C anti-submarine warfare aircraft, and Northrop Grumman E-2D airborne early warning aircraft, the latter being its only current application. The E-2D program is in full-rate production. The U.S. Navy has increased its planned procurement of E-2Ds to 84 production aircraft. Japan and France are also procuring the E-2D, which will lead to increased production of T56 engines.

(Aviation Turboshfts)

LHTEC CTS800

This is an advanced technology, centrifugal-flow, free-turbine turboshaft engine for light commercial and military helicopters. The prime contractor is Light Helicopter Turbine Engine Company, St. Louis,

Missouri. The LHTEC manufacturing team consists of Honeywell (formerly AlliedSignal) and Rolls-Royce. The engine powers Leonardo's T129 attack helicopter and Lynx multirole helicopter. One new opportunity for LHTEC is TAI's T625 medium helicopter program.

MTR GmbH MTR390

In partnership with MTU Aero Engines of Germany and Turbomeca of France, Rolls-Royce has developed the MTR390 two-shaft turboshaft engine. This engine powers the Franco-German Tiger anti-tank helicopter. Rolls-Royce is responsible for design and production of 20 percent of the powerplant, including the development of a two-stage free-power turbine section. The company is also working with Turbomeca on the engine's dual centrifugal compressor. Production of new Tigers was suspended in 2020 pending new orders. Airbus' Tiger production facility will work on upgrades to the existing fleet as the manufacturer searches for new customers.

Rolls-Royce AE 1107

The Rolls-Royce T406/AE 1107C is a single-shaft, axial-flow, front-drive, free-turbine turboshaft engine in the 6,000- to 7,000-shp class. The military T406 (commercial designation AE 1107C) is the production engine for Bell/Boeing's V-22 series of tiltrotor aircraft. Through 2020, Rolls-Royce produced an estimated 925 T406/AE 1107 engines. The U.S. military plans to procure a total of 461 aircraft; deliveries will run through 2026 unless more nations order the V-22.

Rolls-Royce Model 250/RR300 (Turboshaft)

Developed by Rolls-Royce Corp, this turbine turboshaft engine is in production for light civil and military helicopters. Bell's Model 407 and the Robinson R66 account for most demand for M250 family engines. Previous applications have also included light fixed-wing aircraft. The newest variant, the M250-C47E, powers the Northrop Grumman MQ-8C Fire Scout rotary UAV.

Industrial & Marine Turbines

Rolls-Royce MT-7 Marine

The MT-7 is a large single-shaft, axial-flow, free-turbine turboshaft engine. It is used as the primary propulsion for small surface combatants and as a Ship Service Gas Turbine Generator (SSGTG) for larger surface combatants. Rolls-Royce produces the MT-7 for LCAC-style landing craft and possibly patrol boats and fast attack craft. A total of 72 craft are planned for the U.S. Navy and, with each LCAC-100 having four turbines, the requirement for 288 MT-7s is significant for Rolls-Royce. Production is planned to run to the late 2020s.

Rolls-Royce plc**Rolls-Royce MT30 Marine**

The twin-shaft Marine Trent MT30 is an axial-flow, aeroderivative marine gas turbine. The MT30 Marine was selected for the DDG-1000 Zumwalt class and LCS-1 Freedom class programs. Its adoption by the Royal and U.S. navies provides it with a prestigious order book that will support future sales efforts. Moreover, the adoption of the MT30 by South Korea for

its Incheon class light frigates points toward a successful future for this gas turbine.

Sales of the Type 26 frigate to Australia and Canada have boosted that design to top place in the international frigate market, displacing the Anglo-Italian FREMM. As a result of these successes, the prominence of the MT30 in the marine propulsion market has significantly grown. However, Brexit may limit access to the European market.

U.S. Contract Awards

Below is a listing of major contracts awarded to Rolls-Royce from the United States government from 2018 through early 2021 (contracts as of press date). Note that the Description section is excerpted directly from U.S. DoD listings. For full details on contracts and their associated modifications, visit <https://www.defense.gov/Newsroom/Contracts/>

| Date | Award (USD millions) | Contract # | Description |
|-------------|-------------------------|------------------|--|
| 2018 | | | |
| 1/30/18 | 47.7 | FA8504-17-D-0002 | C-130J PROPULSION LONG-TERM SUSTAINMENT. |
| 3/19/18 | 69.4 | N00019-14-D-0016 | PROVIDE INTERMEDIATE, DEPOT-LEVEL MAINTENANCE & RELATED LOGISTICS SUPPORT FOR APPROXIMATELY 209 IN-SERVICE T-45 F405-RR-401 ADOLPHUS ENGINES. |
| 3/20/18 | 31.0 | N00019-17-C-0081 | PROCURE 14 AE 1107C ENGINES, 12 FOR THE NAVY & TWO FOR THE MARINE CORPS, IN SUPPORT OF THE V-22 OSPREY PROGRAM. |
| 5/7/18 | 25.9 | N00383-16-G-001M | PURCHASE OF THE TURBOFAN ENGINE AE 3007H USED WITH THE TRITON PLATFORM. |
| 5/31/18 | 28.3 | N00019-17-C-0081 | OPTION FOR THE PROCUREMENT OF 15 PRODUCTION AE 1107C ENGINES FOR THE V-22 OSPREY FOR THE MARINE CORPS (7); NAVY (6), AND AIR FORCE (2). |
| 6/29/18 | 420.0 | FA8124-18-D-0004 | AE 3007H (F137) ENGINE-SUSTAINMENT SERVICES. THIS CONTRACT PROVIDES FOR MAINTENANCE, REPAIR & OVERHAUL OF THE ENGINE, AS WELL AS PROGRAM MANAGEMENT & SUSTAINING ENGINEERING SERVICES. |
| 7/18/18 | 25.8 | FA8504-17-D-0002 | C-130J PROPULSION LONG-TERM SUSTAINMENT. |
| 9/20/18 | 17.6 | N00019-15-D-0033 | PROCURE T56-A-427A ENGINES, POWER SECTION MODULES & REDUCTION GEARBOX MODULES FOR THE E-2D AIRCRAFT. |
| 10/11/18 | 100.0 | FA8650-19-D-2063 | ADVANCED TURBINE TECHNOLOGIES FOR AFFORDABLE MISSION-CAPABILITY (PHASE I). THE MISSION OF THE ATTAM PHASE I PROGRAM IS TO DEVELOP, DEMONSTRATE, AND TRANSITION ADVANCED TURBINE PROPULSION, POWER & THERMAL TECHNOLOGIES THAT PROVIDE IMPROVEMENT IN AFFORDABLE MISSION CAPABILITY. THIS APPROACH EXTENDS TO A RANGE OF LEGACY, EMERGING, AND FUTURE MILITARY PROPULSION, POWER & THERMAL TECHNOLOGY NEEDS IN MULTIPLE APPLICATIONS. |
| 11/15/18 | 40.9 | N00019-17-C-0081 | PROCUREMENT OF 20 PRODUCTION MT7 MARINE TURBINE ENGINES FOR LCAC 100 CLASS CRAFT 109 THROUGH 113. |

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| Date | Award (USD millions) | Contract # | Description |
|-------------|-------------------------|------------------|--|
| 12/3/18 | ? | N00178-18-R-7000 | ROLLS-ROYCE MARINE NORTH AMERICA IS ONE OF 1,870 INDEFINITE DELIVERY/INDEFINITE QUANTITY, MULTIPLE-AWARD CONTRACTS TO BUSINESSES IN MULTIPLE LOCATIONS ACROSS 46 STATES, THE DC, AND GUAM FOR FUTURE COMPETITION OF SUPPORT SERVICE REQ TO BE SOLICITED BY THE NAVY UNDER THE SEAPORT NEXT GENERATION (SEAPORT-NXG) MULTIPLE-AWARD CONTRACT VEHICLE. THE GOVERNMENT ESTIMATES APPROXIMATELY \$5,000,000,000 WORTH OF SERVICES WILL BE PROCURED PER YEAR VIA ORDERS ISSUED UNDER THE SEAPORT-NXG CONTRACTS. |
| 12/20/18 | 218.7 | N61340-19-D-0004 | PROVIDE INTERMEDIATE & DEPOT LEVEL MAINTENANCE & RELATED LOGISTICS SUPPORT FOR IN-SERVICE T-45 F405-RR-401 ADOUR ENGINES. |
| 2019 | | | |
| 1/22/19 | 35.7 | N00019-17-C-0081 | PRODUCE & DELIVER 17 AE 1107C ENGINES IN SUPPORT OF THE V-22 AIRCRAFT, TO INCLUDE ONE ENGINE FOR THE MARINE CORPS, EIGHT ENGINES FOR THE NAVY, AND EIGHT ENGINES FOR THE GOVERNMENT OF JAPAN. |
| 1/25/19 | 26.3 | N00019-19-D-0024 | DEPOT REPAIR OF T56-A-427 ENGINES, UTILIZED ON E-2 HAWKEYE AIRCRAFT, INCLUDING THE REPAIR OF THE POWER SECTION, TORQUE METER, GEARBOX, AND ACCESSORIES IN ACCORDANCE WITH NAVY DEPOT MANUALS & APPROVED REPAIR PRACTICES. |
| 1/31/19 | 70.7 | FA8504-17-D-0002 | C-130J PROPULSION LONG-TERM SUSTAINMENT. |
| 1/31/19 | 41.9 | N00019-17-C-0081 | PROCUREMENT OF 20 PRODUCTION MARINE TURBINE (MT7) ENGINES FOR THE LCAC 100 CLASS CRAFT IN SUPPORT OF THE SHIP-TO-SHORE CONNECTOR PROGRAM. |
| 2/25/19 | 19.6 | FA8504-17-D-0002 | C-130J PROPULSION LONG-TERM SUSTAINMENT. |
| 3/22/19 | 32.5 | N00024-19-G-4108 | TWO SPARE MT30 & ONE MT5S MARINE GAS TURBINE ENGINES. THESE ARE INSTALLED IN LCS 1 LITTORAL COMBAT SHIPS (HULLS 5 THROUGH 25 ONLY) & DDG 1000 CLASS DESTROYERS. |
| 5/9/19 | 8.6 | N00019-17-C-0081 | THIS MODIFICATION IS FOR THE PROCUREMENT OF 10 MT7 MARINE TURBINE INSTALLATION PARTS KIT SHIPSETS FOR THE LCAC 100 CLASS CRAFT. |
| 8/28/19 | 47.9 | FA8504-17-D-0002 | C-130J PROPULSION LONG-TERM SUSTAINMENT. |
| 9/19/19 | 23.7 | N61340-19-D-0004 | HIGH-PRESSURE COMPRESSOR STATOR VANE ASSEMBLIES TO SUPPORT T-45 F405-RR-401 ADOUR ENGINES. |
| 10/1/19 | 109.2 | SPE4AX-20-D-9400 | SUPPLIES RELATED TO THE SUPPORT OF THE T56 FAMILY OF AIRCRAFT ENGINES. |
| 10/11/19 | 9.1 | N00019-17-C-0081 | OPTION TO PROCURE THREE SPARE AE 1107C ENGINES IN SUPPORT OF THE V-22 OSPREY PROGRAM FOR THE GOVERNMENT OF JAPAN. |
| 11/14/19 | 1,207.9 | N00019-20-D-0004 | THIS CONTRACT PROVIDES SUSTAINMENT SUPPORT OF THE V-22 AE 1107C ENGINE AT VARIOUS V-22 AIRCRAFT PRODUCTION, TEST & OPERATING SITES. SUSTAINMENT SUPPORT INCLUDES PROGRAM MANAGEMENT, INTEGRATED LOGISTICS SUPPORT, SUSTAINING ENGINEERING, MAINTENANCE, REPAIR, RELIABILITY IMPROVEMENTS, CONFIGURATION MANAGEMENT & SITE SUPPORT. |

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| Date | Award (USD millions) | Contract # | Description |
|-------------|-------------------------|------------------|--|
| 11/15/19 | 67.1 | SPE4AX-20-D-9405 | SUPPLIES RELATED TO THE UPGRADE OF THE T-56 ENGINE FROM SERIES 3.0 TO SERIES 3.5. |
| 12/17/19 | 140.3 | N61340-19-D-0004 | THIS MODIFICATION PROVIDES INTERMEDIATE LEVEL & DEPOT LEVEL MAINTENANCE, LOGISTICS & ENGINEERING SUPPORT FOR THE F405-RR-401 ENGINE & THE 096 MK II GAS TURBINE STARTER SYSTEM. |
| 12/19/19 | 83.7 | FA8553-20-D-0003 | CONTRACT FOR MISSIONCARE PROPULSION SUPPORT ON THE C-130J AIRCRAFT, AS WELL AS THE INITIAL TASK ORDER IN SUPPORT OF THE FRENCH AIR FORCE. |
| 12/26/19 | 20.4 | FA8504-17-D-0002 | CONTRACT FOR C-130J PROPULSION LONG TERM SUSTAINMENT. THIS ORDER PROVIDES FUNDING FOR OPTION III. |
| 2020 | | | |
| 1/24/20 | 20.5 | N00019-19-D-0024 | THIS MODIFICATION EXERCISES THE OPTION TO PROVIDE T56-A-427 ENGINE DEPOT REPAIR TO INCLUDE REPAIR OF THE POWER SECTION, TORQUE METER, GEARBOX & ACCESSORIES IN ACCORDANCE WITH NAVY DEPOT MANUALS & APPROVED REPAIR PRACTICES. |
| 1/31/20 | 63.0 | FA8504-17-D-0002 | DELIVERY ORDER MODIFICATION TO PREVIOUSLY AWARDED CONTRACT FOR C-130J PROPULSION LONG-TERM SUSTAINMENT. THIS ORDER PROVIDES FUNDING FOR OPTION 3 & POWER BY THE HOUR FLYING HOURS. |
| 2/3/20 | 57.4 | FA8504-17-D-0002 | MODIFICATION TO PREVIOUSLY AWARDED CONTRACT FOR C-130J PROPULSION LONG-TERM SUSTAINMENT. THIS ORDER PROVIDES FUNDING FOR OPTION THREE & POWER BY THE HOUR FLYING HOURS. |
| 2/5/20 | ? | N00024-20-D-6348 | A FFP, FPIF-TARGET, CPIF, CPFF & COST ONLY IDIQ, MULTIPLE-AWARD CONTRACT TO SUPPORT THE UNMANNED SURFACE VEHICLE FAMILY OF SYSTEMS. THE IDIQ-MACS HAVE A FIVE-YEAR BASE PERIOD & ONE FIVE-YEAR ORDERING PERIOD OPTION, WHICH, IF EXERCISED, WOULD BRING THE CUMULATIVE VALUE OF THIS CONTRACT TO \$982,100,000. THESE BUSINESSES WILL HAVE THE OPPORTUNITY TO COMPETE IN THE AWARDED FUNCTIONAL AREA FOR INDIVIDUAL DELIVERY ORDERS. |
| 2/18/20 | 62.4 | N00019-17-C-0081 | THIS MODIFICATION EXERCISES AN OPTION TO PROCURE 29 AE 1107C ENGINES FOR NAVY V-22 AIRCRAFT. |
| 3/27/20 | 14.3 | N00019-19-G-0013 | THIS ORDER PROVIDES FOR ORGANIZATIONAL LEVEL MAINTENANCE FOR AE 1107C ENGINES, PARTS PROVISIONING, JAPAN GROUND SELF-DEFENSE FORCE TRAINING AS WELL AS A FIELD SERVICE REPRESENTATIVE, SUSTAIN ENGINEERING, LOGISTICS ANALYSIS & AUTHORIZED MILITARY OVERHAUL FACILITY SUPPORT FOR THE GOVERNMENT OF JAPAN. |

Rolls-Royce plc

| Date | Award (USD millions) | Contract # | Description |
|----------|-------------------------|------------------|---|
| 4/3/20 | 70.3 | N64498-20-D-4000 | SERVICES RELATED TO THE MAINTENANCE & REPAIR OF THE CONTROLLABLE PITCH PROPELLER (CPP) HUBS & OIL DISTRIBUTION BOXES ESSENTIAL TO THE PROPULSION OF DDG 51 FLEET & ACTIVE DUTY TRAINING; TICONDEROGA-CLASS CRUISERS CG 47 & CG 66; SAN ANTONIO AMPHIBIOUS TRANSPORTATION DOCKS LPD 17; U.S. SHIP WHIDBEY ISLAND CLASS LSD-41; U.S. SHIP HARPERS FERRY CLASS LSD-49; U.S. SHIP AMERICA CLASS LHA 6; U.S. SHIP MAKIN ISLAND CLASS LHD 8; & MINE COUNTERMEASURES SHIP CLASSES. |
| 5/29/20 | ? | N64498-20-R-4011 | \$67,000,000 FOR IDIQ, FFP CONTRACTS WITH FFP TASK ORDER PROVISIONS FOR THE REPAIR & REFURBISHMENT OF CONTROLLABLE PITCH PROPELLERS BLADES & FIXED PITCH PROPELLERS ON BEHALF OF THE NAVAL SEA SYSTEMS COMMAND S05Z 2SCOG PROGRAM. THE CONTRACTS AWARDED TO RRMNA & WARTSILA ARE NOT TO EXCEED A COMBINED TOTAL OF \$67,000,000. WORK UNDER THE RRMNA CONTRACT WILL BE COMPLETED IN WALPOLE, MA, AND UNDER THE WARTSILA CONTRACT, WORK WILL BE PERFORMED IN CHESAPEAKE, VA. THIS REQUIREMENT INVOLVES PROVIDING THE REPAIR OF THE U.S. SHIP ARLEIGH BURKE DDG 51, U.S. SHIP TICONDEROGA CG 47, U.S. SHIP SAN ANTONIO LPD 17, U.S. SHIP WIDBEY ISLAND LSD 41, U.S. SHIP AVENGER MCM 1, U.S. SHIP PELELIU LHA 6 CLASS PROPULSION CONTROLLABLE PITCH PROPELLER ASSEMBLIES, U.S. SHIP WASP LHD 1 & U.S. SHIP ZUMWALT DDG 1000 CLASS PROPULSION MONOBLOC PROPELLERS. |
| 6/1/20 | 34.4 | N00019-17-C-0081 | EXERCISE AN OPTION FOR THE PRODUCTION OF 16 MT7 GAS TURBINE ENGINES IN SUPPORT OF THE SHIP-TO-SHORE CONNECTOR (SSC) LCAC 100 CLASS CRAFT. |
| 6/8/20 | 10.9 | N64498-20-F-4221 | MAIN PROPULSION MONOBLOC PROPELLERS, PROPELLER HUBS, OIL DISTRIBUTION BOXES, BLADES & PROPELLER BLADES FOR VARIOUS NAVY SHIP CLASSES. |
| 9/24/20 | 8.6 | N00019-17-C-0081 | THIS MODIFICATION IS FOR THE PROCUREMENT OF FOUR PRODUCTION MARINE TURBINE ENGINES FOR THE LCAC 100 CLASS CRAFT. |
| 9/24/20 | 197.0 | N61340-19-D-0004 | THIS MODIFICATION EXERCISES AN OPTION TO CONTINUE TO PROVIDE INTERMEDIATE & DEPOT LEVEL MAINTENANCE, LOGISTICS & ENGINEERING SUPPORT FOR THE F405-RR-401 ENGINE & THE 096 MK II GAS TURBINE STARTER SYSTEM. |
| 12/29/20 | 7.6 | N64498-21-F-4004 | ORDER FOR MAIN PROPULSION MONOBLOC PROPELLERS, AND PROPELLER BLADES FOR VARIOUS NAVY SHIP CLASSES. |

Rolls-Royce plc

| Date | Award (USD millions) | Contract # | Description |
|-------------|-------------------------|------------------|--|
| 2021 | | | |
| 1/29/21 | 72.9 | N00019-17-C-0081 | THIS MODIFICATION EXERCISES AN OPTION TO PROCURE 33 PRODUCTION AE 1107C V-22 OSPREY ENGINES; 14 FOR THE MARINE CORPS & 19 FOR THE NAVY, FOR PRODUCTION OF MV-22 & CMV-22 TILTROTOR AIRCRAFT. |
| 2/1/21 | 96.9 | FA8504-17-D-0002 | CONTRACT FOR C-130J PROPULSION LONG-TERM SUSTAINMENT. THIS ORDER PROVIDES FUNDING FOR OPTION IV. |

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