

# Aircraft Gas Turbine Engine And Its Operation

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*Aircraft Propulsion* Saeed Farokhi 2014-04-01  
New edition of the successful textbook updated to include new material on UAVs, design guidelines in aircraft engine component systems and additional end of chapter problems Aircraft Propulsion, Second Edition follows the successful first edition textbook with comprehensive treatment of the subjects in airbreathing propulsion, from the basic principles to more advanced treatments in engine components and system integration. This new edition has been extensively updated to include a number of new and important topics. A chapter is now included on General Aviation and Uninhabited Aerial Vehicle (UAV) Propulsion Systems that includes a discussion on electric and hybrid propulsion. Propeller theory is added to the presentation of turboprop engines. A new section in cycle analysis treats Ultra-High Bypass (UHB) and Geared Turbofan engines. New material on drop-in biofuels and design for sustainability is added to reflect the FAA's 2025 Vision. In addition, the design guidelines in aircraft engine components are expanded to make the book user friendly for engine designers. Extensive review material and derivations are included to help the reader navigate through the subject with ease. Key features: General Aviation and UAV Propulsion Systems are presented in a new chapter Discusses Ultra-High Bypass and Geared Turbofan engines Presents alternative drop-in jet

fuels Expands on engine components' design guidelines The end-of-chapter problem sets have been increased by nearly 50% and solutions are available on a companion website Presents a new section on engine performance testing and instrumentation Includes a new 10-Minute Quiz appendix (with 45 quizzes) that can be used as a continuous assessment and improvement tool in teaching/learning propulsion principles and concepts Includes a new appendix on Rules of Thumb and Trends in aircraft propulsion Aircraft Propulsion, Second Edition is a must-have textbook for graduate and undergraduate students, and is also an excellent source of information for researchers and practitioners in the aerospace and power industry.

**Flight Engineer Written Test Book - 1991**

*Aircraft Propulsion and Gas Turbine Engines* Ahmed F. El-Sayed 2017-07-06  
Aircraft Propulsion and Gas Turbine Engines, Second Edition builds upon the success of the book's first edition, with the addition of three major topic areas: Piston Engines with integrated propeller coverage; Pump Technologies; and Rocket Propulsion. The rocket propulsion section extends the text's coverage so that both Aerospace and Aeronautical topics can be studied and compared. Numerous updates have been made to reflect the latest advances in turbine engines, fuels, and combustion. The text is now divided into three parts, the first two

devoted to air breathing engines, and the third covering non-air breathing or rocket engines.

### **Aircraft Powerplants: Powerplant**

**Certification, Tenth Edition** - Thomas W. Wild  
2022-11-18

The most comprehensive guide to aircraft powerplants—fully updated for the latest advances and regulations This up-to-date guide contains all the information you need to master the operation and maintenance of aircraft engines and achieve FAA Powerplant certification. The book offers plain-language explanations of all current engine components, mechanics, and technologies. This tenth edition features expanded coverage of turbine engine theory, operational procedures, maintainability, engine systems operation, and propeller systems. You will get new examples, exercises, and practice exam questions as well as revised content to align with 2022 FAA regulations. Hundreds of detailed diagrams and real-world examples throughout illustrate each topic. In addition, an up-to-date solutions manual is available online. Aircraft Powerplants: Powerplant Certification, Tenth Edition covers:

- Aircraft powerplant classification and progress
- Reciprocating-engine construction and nomenclature
- Internal-combustion engine theory and performance
- Induction, supercharger, and turbocharger systems
- Cooling, exhaust, and lubrication systems
- Basic fuel systems and carburetors
- Fuel injection systems
- Reciprocating-engine ignition and starting systems
- Operation, inspection, maintenance, and troubleshooting of reciprocating engines
- Reciprocating-engine overhaul practices
- Principal parts, construction, types, and nomenclature of gas-turbine engines
- Gas-turbine engine theory and jet propulsion principles and efficiencies
- Gas-turbine engine fuels and fuel systems
- Turbine-engine lubricants and lubricating systems
- Ignition and starting systems of gas-turbine engines
- Turboprop, turboprop, and turboshaft engines
- Gas-turbine operation, inspection, troubleshooting, maintenance, and overhaul
- Propeller theory, nomenclature, and operation
- Turbopropellers and control systems
- Propeller installation, inspection, and maintenance
- Engine indicating, warning, and control systems

### **Reference Materials and Subject Matter**

### **Knowledge Codes for Airman Knowledge Testing - 1996**

*Fundamentals of Gas Turbines* William W. Bathie 1996

Presents the fundamentals of the gas turbine engine, including cycles, components, component matching, and environmental considerations.

*Airplane Flying Handbook (FAA-H-8083-3A)*  
Federal Aviation Administration 2011-09-11

The Federal Aviation Administration's Airplane Flying Handbook provides pilots, student pilots, aviation instructors, and aviation specialists with information on every topic needed to qualify for and excel in the field of aviation. Topics covered include: ground operations, cockpit management, the four fundamentals of flying, integrated flight control, slow flights, stalls, spins, takeoff, ground reference maneuvers, night operations, and much more. The Airplane Flying Handbook is a great study guide for current pilots and for potential pilots who are interested in applying for their first license. It is also the perfect gift for any aircraft or aeronautical buff.

*Aircraft Engine Design* Jack D. Mattingly 2002  
Annotation A design textbook attempting to bridge the gap between traditional academic textbooks, which emphasize individual concepts and principles; and design handbooks, which provide collections of known solutions. The airbreathing gas turbine engine is the example used to teach principles and methods. The first edition appeared in 1987. The disk contains supplemental material. Annotation c. Book News, Inc., Portland, OR (booknews.com).

### **Manuals Combined" ARMY AIRCRAFT GAS TURBINE ENGINES -**

**COURSE OVERVIEW:** Fulfilling the Army's need for engines of simple design that are easy to operate and maintain, the gas turbine engine is used in all helicopters of Active Army and Reserve Components, and most of the fixed-wing aircraft to include the Light Air Cushioned Vehicle (LACV). We designed this subcourse to teach you theory and principles of the gas turbine engine and some of the basic army aircraft gas turbine engines used in our aircraft today. **CHAPTERS OVERVIEW** Gas turbine engines can be classified according to the type

of compressor used, the path the air takes through the engine, and how the power produced is extracted or used. The chapter is limited to the fundamental concepts of the three major classes of turbine engines, each having the same principles of operation. Chapter 1 is divided into three sections; the first discusses the theory of turbine engines. The second section deals with principles of operation, and section III covers the major engine sections and their description. CHAPTER 2 introduces the fundamental systems and accessories of the gas turbine engine. Each one of these systems must be present to have an operating turbine engine. Section I describes the fuel system and related components that are necessary for proper fuel metering to the engine. The information in CHAPTER 3 is important to you because of its general applicability to gas turbine engines. The information covers the procedures used in testing, inspecting, maintaining, and storing gas turbine engines. Specific procedures used for a particular engine must be those given in the technical manual (TM) covering that engine. The two sections of CHAPTER 4 discuss, in detail, the Lycoming T53 series gas turbine engine used in Army aircraft. Section I gives a general description of the T53, describes the engine's five sections, explains engine operation, compares models and specifications, and describes the engine's airflow path. The second section covers major engine assemblies and systems. CHAPTER 5 covers the Lycoming T55 gas turbine engine. Section I gives an operational description of the T55, covering the engine's five sections. Section II covers in detail each of the engine's sections and major systems. The SOLAR T62 auxiliary power unit (APU) is used in place of ground support equipment to start some helicopter engines. It is also used to operate the helicopter hydraulic and electrical systems when this aircraft is on the ground, to check their performance. The T62 is a component of both the CH-47 and CH-54 helicopters -- part of them, not separate like the ground-support-equipment APU's. On the CH-54, the component is called the auxiliary powerplant rather than the auxiliary power unit, as it is on the CH-47. The two T62's differ slightly. CHAPTER 6 describes the T62 APU; explains its operation; discusses the reduction drive,

accessory drive, combustion, and turbine assemblies; and describes the fuel, lubrication, and electrical systems. CHAPTER 7 describes the T63 series turboshaft engine, which is manufactured by the Allison Division of General Motors Corporation. The T63-A-5A is used to power the OH-6A, and the T63-A-700 is in the OH-58A light observation helicopter. Although the engine dash numbers are not the same for each of these, the engines are basically the same. As shown in figure 7.1, the engine consists of four major components: the compressor, accessory gearbox, combustor, and turbine sections. This chapter explains the major sections and related systems. The Pratt and Whitney T73-P-1 and T73-P-700 are the most powerful engines used in Army aircraft. Two of these engines are used to power the CH-54 flying crane helicopter. The T73 design differs in two ways from any of the engines covered previously. The airflow is axial through the engine; it does not make any reversing turns as the airflow of the previous engines did, and the power output shaft extends from the exhaust end. CHAPTER 8 describes and discusses the engine sections and systems. Constant reference to the illustrations in this chapter will help you understand the discussion. TABLE OF

CONTENTS: 1 Theory and Principles of Gas Turbine Engines - 2 Major Engine Sections - 3 Systems and Accessories - 4 Testing, Inspection, Maintenance, and Storage Procedures - 5 Lycoming T53 - 6 Lycoming T55 - 7 Solar T62 Auxiliary Power Unit - 8 Allison T62, Pratt & Whitney T73 and T74, and the General Electric T700 - Examination. I

Flight and Ground Instructor Written Test Book - 1995  
Aircraft Propulsion and Gas Turbine Engines - Ahmed F. El-Sayed 2017

History and classifications of aero-engine --  
Performance parameters of jet engines --  
Pulsejet and ramjet engines -- Turbojet engine --  
Turbofan engines -- Shaft engines -- High speed supersonic and hypersonic engines -- Industrial gas turbines -- Power plant installation and intakes -- Combustion systems -- Exhaust system -- Centrifugal compressors -- Axial flow compressors and fans -- Axial turbines -- Radial inflow turbines -- Module matching -- Selected

topics -- Introduction to rocketry -- Rocket engines

Gas Turbine Handbook - Tony Giampaolo 2009

**A & P Technician Powerplant Textbook** - Jeppesen Sanderson, Inc 1997

*The Aerothermodynamics of Aircraft Gas Turbine Engines* 1978

*Jet Engines* Klaus Hunecke 2010-04-15

This book is intended for those who wish to broaden their knowledge of jet engine technology and associated subjects. It covers turbojet, turboprop and turbofan designs and is applicable to civilian and military usage. It commences with an overview of the main design types and fundamentals and then looks at air intakes, compressors, turbines and exhaust systems in great detail.

**Aircraft Turbine Engines** - Thomas W. Wild 2008-03-01

Systems of Commercial Turbofan Engines - Andreas Linke-Diesinger 2008-05-21

To understand the operation of aircraft gas turbine engines, it is not enough to know the basic operation of a gas turbine. It is also necessary to understand the operation and the design of its auxiliary systems. This book fills that need by providing an introduction to the operating principles underlying systems of modern commercial turbofan engines and bringing readers up to date with the latest technology. It also offers a basic overview of the tubes, lines, and system components installed on a complex turbofan engine. Readers can follow detailed examples that describe engines from different manufacturers. The text is recommended for aircraft engineers and mechanics, aeronautical engineering students, and pilots.

**Fuel Effects on Operability of Aircraft Gas Turbine Combustors** - Meredith Colket 2021

In summarizing the results obtained in the first five years of the National Jet Fuel Combustion Program (NJFCP), this book demonstrates that there is still much to be learned about the combustion of alternative jet fuels.

**Aircraft Powerplants, Eighth Edition** - Thomas W. Wild 2013-07-30

The most comprehensive, current guide to aircraft powerplants Fully revised to cover the latest industry advances, Aircraft Powerplants, Eighth Edition, prepares you for certification as an FAA powerplant technician in accordance with the Federal Aviation Regulations (FAR). This authoritative text has been updated to reflect recent changes in FAR Part 147. This new edition features expanded coverage of turbine-engine theory and nomenclature; current models of turbofan, turboprop, and turboshaft engines; and up-to-date details on turbine-engine fuel, oil, and ignition systems. Important information on how individual components and systems operate together is integrated throughout the text. Clear photos of various components and a full-color insert of diagrams and systems are included. Review questions at the end of each chapter enable you to check your knowledge of the topics presented in this practical resource. Aircraft Powerplants, Eighth Edition, covers:

- Aircraft powerplant classification and progress
- Reciprocating-engine construction and nomenclature
- Internal-combustion engine theory and performance
- Lubricants and lubricating systems
- Induction systems, superchargers, turbochargers, and cooling and exhaust systems
- Basic fuel systems and carburetors
- Fuel injection systems
- Reciprocating-engine ignition and starting systems
- Operation, inspection, maintenance, and troubleshooting of reciprocating engines
- Reciprocating-engine overhaul practices
- Gas-turbine engine: theory, jet propulsion principles, engine performance, and efficiencies
- Principal parts of a gas-turbine engine, construction, and nomenclature
- Gas-turbine engine: fuels and fuel systems
- Turbine-engine lubricants and lubricating systems
- Ignition and starting systems of gas-turbine engines
- Turbofan, turboprop, and turboshaft engines
- Gas-turbine operation, inspection, troubleshooting, maintenance, and overhaul
- Propeller theory, nomenclature, and operation
- Turbopropellers and control systems
- Propeller installation, inspection, and maintenance
- Engine indicating, warning, and control systems

**Gas Turbine Propulsion Systems** - Bernie MacIsaac 2011-08-29

Major changes in gas turbine design, especially in the design and complexity of engine control systems, have led to the need for an up to date,

systems-oriented treatment of gas turbine propulsion. Pulling together all of the systems and subsystems associated with gas turbine engines in aircraft and marine applications, *Gas Turbine Propulsion Systems* discusses the latest developments in the field. Chapters include aircraft engine systems functional overview, marine propulsion systems, fuel control and power management systems, engine lubrication and scavenging systems, nacelle and ancillary systems, engine certification, unique engine systems and future developments in gas turbine propulsion systems. The authors also present examples of specific engines and applications. Written from a wholly practical perspective by two authors with long careers in the gas turbine & fuel systems industries, *Gas Turbine Propulsion Systems* provides an excellent resource for project and program managers in the gas turbine engine community, the aircraft OEM community, and tier 1 equipment suppliers in Europe and the United States. It also offers a useful reference for students and researchers in aerospace engineering.

*German Jet Engine and Gas Turbine Development, 1930-45* Antony Kay 2002-07-08  
The German war machine resulted in many innovations in jet engine and gas turbine development. The most noteworthy was the Me262, the world's first operational jet fighting aircraft.

*Systems of Commercial Turbofan Engines* Andreas Linke-Diesinger 2010-10-19  
To understand the operation of aircraft gas turbine engines, it is not enough to know the basic operation of a gas turbine. It is also necessary to understand the operation and the design of its auxiliary systems. This book fills that need by providing an introduction to the operating principles underlying systems of modern commercial turbofan engines and bringing readers up to date with the latest technology. It also offers a basic overview of the tubes, lines, and system components installed on a complex turbofan engine. Readers can follow detailed examples that describe engines from different manufacturers. The text is recommended for aircraft engineers and mechanics, aeronautical engineering students, and pilots.

### **Airframe and Powerplant Mechanics**

**Powerplant Handbook** - United States. Flight Standards Service 1971

**Advanced Technologies for Gas Turbines** - National Academies of Sciences, Engineering, and Medicine 2020-04-19

Leadership in gas turbine technologies is of continuing importance as the value of gas turbine production is projected to grow substantially by 2030 and beyond. Power generation, aviation, and the oil and gas industries rely on advanced technologies for gas turbines. Market trends including world demographics, energy security and resilience, decarbonization, and customer profiles are rapidly changing and influencing the future of these industries and gas turbine technologies. Technology trends that define the technological environment in which gas turbine research and development will take place are also changing - including inexpensive, large scale computational capabilities, highly autonomous systems, additive manufacturing, and cybersecurity. It is important to evaluate how these changes influence the gas turbine industry and how to manage these changes moving forward. *Advanced Technologies for Gas Turbines* identifies high-priority opportunities for improving and creating advanced technologies that can be introduced into the design and manufacture of gas turbines to enhance their performance. The goals of this report are to assess the 2030 gas turbine global landscape via analysis of global leadership, market trends, and technology trends that impact gas turbine applications, develop a prioritization process, define high-priority research goals, identify high-priority research areas and topics to achieve the specified goals, and direct future research. Findings and recommendations from this report are important in guiding research within the gas turbine industry and advancing electrical power generation, commercial and military aviation, and oil and gas production.

**Dynamic Modelling of Gas Turbines** - Gennady G. Kulikov 2013-12-11

Whereas other books in this area stick to the theory, this book shows the reader how to apply the theory to real engines. It provides access to up-to-date perspectives in the use of a variety of modern advanced control techniques for gas

turbine technology.

**Gas Turbine Performance** - Philip P. Walsh  
2008-04-15

A significant addition to the literature on gas turbine technology, the second edition of *Gas Turbine Performance* is a lengthy text covering product advances and technological developments. Including extensive figures, charts, tables and formulae, this book will interest everyone concerned with gas turbine technology, whether they are designers, marketing staff or users.

**Aircraft Gas Turbine Engine Technology** - Irwin E. Treager 1979

**Airline Transport Pilot, Aircraft Dispatcher, and Flight Navigator Written Test Book** - 1993

*Commercial Pilot Written Test Book* 1993

**Gas Turbines for Model Aircraft** - Kurt Schreckling 1994

Elements of Gas Turbine Propulsion - Jack D. Mattingly 2005-01-01

This text provides an introduction to gas turbine engines and jet propulsion for aerospace or mechanical engineers. The text is divided into four parts: introduction to aircraft propulsion; basic concepts and one-dimensional/gas dynamics; parametric (design point) and performance (off-design) analysis of air breathing propulsion systems; and analysis and design of major gas turbine engine components (fans, compressors, turbines, inlets, nozzles, main burners, and afterburners). Design concepts are introduced early (aircraft performance in introductory chapter) and integrated throughout. Written with extensive student input on the design of the book, the book builds upon definitions and gradually develops the thermodynamics, gas dynamics, and gas turbine engine principles.

Recreational Pilot and Private Pilot Written Test Book - 1993

**The History of North American Small Gas Turbine Aircraft Engines** - Richard A. Leyes 1999

This landmark joint publication between the

National Air and Space Museum and the American Institute of Aeronautics and Astronautics chronicles the evolution of the small gas turbine engine through its comprehensive study of a major aerospace industry. Drawing on in-depth interviews with pioneers, current project engineers, and company managers, engineering papers published by the manufacturers, and the tremendous document and artifact collections at the National Air and Space Museum, the book captures and memorializes small engine development from its earliest stage. Leyes and Fleming leap back nearly 50 years for a first look at small gas turbine engine development and the seven major corporations that dared to produce, market, and distribute the products that contributed to major improvements and uses of a wide spectrum of aircraft. In non-technical language, the book illustrates the broad-reaching influence of small turbines from commercial and executive aircraft to helicopters and missiles deployed in recent military engagements. Detailed corporate histories and photographs paint a clear historical picture of turbine development up to the present. See for yourself why *The History of North American Small Gas Turbine Aircraft Engines* is the most definitive reference book in its field. The publication of *The History of North American Small Gas Turbine Aircraft Engines* represents an important milestone for the National Air and Space Museum (NASM) and the American Institute of Aeronautics and Astronautics (AIAA). For the first time, there is an authoritative study of small gas turbine engines, arguably one of the most significant spheres of aeronautical technology in the second half of

Aircraft Powerplants, Ninth Edition - Thomas W. Wild 2018-02-02

The most comprehensive guide to aircraft powerplants—fully updated for the latest advances This authoritative textbook contains all the information you need to learn to master the operation and maintenance of aircraft engines and achieve FAA Powerplant certification. The book offers clear explanations of all engine components, mechanics, and technologies. This ninth edition has been thoroughly revised to include the most current and critical topics. Brand-new sections explain the latest engine

models, diesel engines, alternative fuels, pressure ratios, and reciprocating and turbofan engines. Hundreds of detailed diagrams and photos illustrate each topic. Aircraft Powerplants, Ninth Edition covers:

- Aircraft powerplant classification and progress
- Reciprocating-engine construction and nomenclature
- Internal-combustion engine theory and performance
- Lubricants and lubricating systems
- Induction systems, superchargers, and turbochargers
- Cooling and exhaust systems
- Basic fuel systems and carburetors
- Fuel injection systems
- Reciprocating-engine ignition and starting systems
- Operation, inspection, maintenance, and troubleshooting of reciprocating engines
- Reciprocating engine overhaul practices
- Principal parts, construction, types, and nomenclature of gas-turbine engines
- Gas-turbine engine theory and jet propulsion principles
- Turbine-engine lubricants and lubricating systems
- Ignition and starting systems of gas-turbine engines
- Turbofan, turboprop, and turboshaft engines
- Gas-turbine operation, inspection, troubleshooting, maintenance, and overhaul
- Propeller theory, nomenclature, and operation
- Turbopropellers and control systems
- Propeller installation, inspection, and maintenance
- Engine indicating, warning, and control systems

### **Code of Federal Regulations - 2000**

#### Aircraft Propulsion and Gas Turbine Engines -

Ahmed F. El-Sayed 2017-07-06

Aircraft Propulsion and Gas Turbine Engines, Second Edition builds upon the success of the book's first edition, with the addition of three major topic areas: Piston Engines with integrated propeller coverage; Pump Technologies; and Rocket Propulsion. The rocket propulsion section extends the text's coverage so that both Aerospace and Aeronautical topics can be studied and compared. Numerous updates have been made to reflect the latest advances in turbine engines, fuels, and combustion. The text is now divided into three parts, the first two devoted to air breathing engines, and the third covering non-air breathing or rocket engines.

**Aircraft Gas Turbine Engines - J. Vennard**  
2008-01-01

Provides the reader with a working

understanding of modern aircraft gas turbine engines, with the applicability (or lack of applicability) to military use such as Army jets and helicopters, interwoven into the text. Details of specific makes and models of turbines are provided as examples. Chapters include ... (1) Theory of Gas Turbine Engines ... (2) Principles of Operation ... (3) Engine Components ... (4) Testing and Inspection ... (5) The Lycoming T53 ... (6) The Lycoming T55 ... (7) The Solar T62 ... (8) The Allison T63 ... (9) The Pratt and Whitney T73 ... (10) The Pratt and Whitney T74 ... (11) The General Electric T700 ... (12) Appendix, References and Subject Index.

### **Gas Turbine Engineering Handbook -**

Meherwan P. Boyce 2017-09-01

The Gas Turbine Engineering Handbook has been the standard for engineers involved in the design, selection, and operation of gas turbines. This revision includes new case histories, the latest techniques, and new designs to comply with recently passed legislation. By keeping the book up to date with new, emerging topics, Boyce ensures that this book will remain the standard and most widely used book in this field. The new Third Edition of the Gas Turbine Engineering Handbook updates the book to cover the new generation of Advanced gas Turbines. It examines the benefit and some of the major problems that have been encountered by these new turbines. The book keeps abreast of the environmental changes and the industries answer to these new regulations. A new chapter on case histories has been added to enable the engineer in the field to keep abreast of problems that are being encountered and the solutions that have resulted in solving them.

Comprehensive treatment of Gas Turbines from Design to Operation and Maintenance. In depth treatment of Compressors with emphasis on surge, rotating stall, and choke; Combustors with emphasis on Dry Low NOx Combustors; and Turbines with emphasis on Metallurgy and new cooling schemes. An excellent introductory book for the student and field engineers. A special maintenance section dealing with the advanced gas turbines, and special diagnostic charts have been provided that will enable the reader to troubleshoot problems he encounters in the field. The third edition consists of many Case Histories of Gas Turbine problems. This should enable the

field engineer to avoid some of these same generic problems

*Commercial Aircraft Propulsion and Energy Systems Research*- National Academies of Sciences, Engineering, and Medicine 2016-08-09

The primary human activities that release carbon dioxide (CO<sub>2</sub>) into the atmosphere are the combustion of fossil fuels (coal, natural gas, and oil) to generate electricity, the provision of energy for transportation, and as a consequence of some industrial processes. Although aviation CO<sub>2</sub> emissions only make up approximately 2.0 to 2.5 percent of total global annual CO<sub>2</sub> emissions, research to reduce CO<sub>2</sub> emissions is urgent because (1) such reductions may be legislated even as commercial air travel grows, (2) because it takes new technology a long time to propagate into and through the aviation fleet, and (3) because of the ongoing impact of global CO<sub>2</sub> emissions. Commercial Aircraft Propulsion and Energy Systems Research develops a national research agenda for reducing CO<sub>2</sub> emissions from commercial aviation. This report focuses on propulsion and energy technologies for reducing carbon emissions from large, commercial aircraft—single-aisle and twin-

aisle aircraft that carry 100 or more passengers—because such aircraft account for more than 90 percent of global emissions from commercial aircraft. Moreover, while smaller aircraft also emit CO<sub>2</sub>, they make only a minor contribution to global emissions, and many technologies that reduce CO<sub>2</sub> emissions for large aircraft also apply to smaller aircraft. As commercial aviation continues to grow in terms of revenue-passenger miles and cargo ton miles, CO<sub>2</sub> emissions are expected to increase. To reduce the contribution of aviation to climate change, it is essential to improve the effectiveness of ongoing efforts to reduce emissions and initiate research into new approaches.

*The Jet Engine* Rolls Royce 2015-07-20

The Jet Engine provides a complete, accessible description of the working and underlying principles of the gas turbine. Accessible, non-technical approach explaining the workings of jet engines, for readers of all levels Full colour diagrams, cutaways and photographs throughout Written by RR specialists in all the respective fields Hugely popular and well-reviewed book, originally published in 2005 under Rolls Royce's own imprint