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Alloying: Understanding the Basics is a comprehensive guide to the influence of alloy additions on mechanical properties, physical properties, corrosion and chemical behavior, and processing and manufacturing characteristics. The coverage considers "alloying" to include any addition of an element or compound that interacts with a base metal to influence properties. Thus, the book addresses the beneficial effects of major alloy additions, inoculants, dopants, grain refiners, and other elements that have been deliberately added to improve performance, as well the detrimental effects of minor elements or residual (tramp) elements included in charge materials or that result from improper melting or refining techniques. The content is presented in a concise, user-friendly format. Numerous figures and tables are provided. The coverage has been weighted to provide the most detailed information on the most industrially important materials.

The book provides a comprehensive approach to configuration management from a variety of product development perspectives, including embedded and IT. It provides authoritative advice on how to extend products for a variety of markets due to configuration options. The book also describes the importance of

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configuration management to other parts of the organization. It supplies an overview of configuration management and its process elements to provide readers with a contextual understanding of the theory, practice, and application of CM. The book illustrates the interplay of configuration and data management with all enterprise resources during each phase of a product lifecycle.

This practical guide to product and process engineering of various aluminum castings emphasizes process and material characteristics; product-process-alloy integration; manufacturing aspects of aluminum casting; product design features; tooling design, feeding and gating design; product quality needs and specifications; product launches; and successful conversions of aluminum from steel and iron.

On 27 April 2005, an aircraft lifted away from the runway of Toulouse-Blagnac Airport under the power of six massive Rolls-Royce Trent 900 turbofan engines. It carried a six-man crew, it was making its first flight, and it was making history. For this was the Airbus A380, the largest passenger aircraft in the world. Airbus Industrie was a latecomer to the commercial airliner market, and initially struggled to win orders away from the well-established US giants, Boeing and McDonnell Douglas. Part of Airbus's strategy for success was to offer customers distinct families of aircraft that could be tailored to meet a wide range of

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performance and capacity demands. Before 2005, the largest and arguably most important members of this family strategy were the Airbus A330 and 340 high-capacity airliners; then along came the A380. With air traffic continuing to double every 15 years, the A380 was designed to meet the needs of the passengers and airports, while also delivering the level of efficiency necessary to protect the environment for future generations. The design incorporated two full-length decks with wide-body dimensions, meaning its two passenger levels offered an entire deck's worth of additional space compared to the next largest twin-engine jetliner. With more seats than any other aircraft, the A380 offered solutions to overcrowding; needing fewer journeys to carry 60 percent more passengers, making it the perfect solution to airport congestion, fleet planning optimization and traffic growth. Typical seating capacity was 525, although the aircraft was certified to carry up to 853 passengers. By mid-2019, fifteen airlines were operating 238 aircraft throughout the world, the original customer being Singapore Airlines, which launched its first A380 service in October 2007. Production of the A380 peaked at 30 aircraft per year in 2012 and 2014. Then, in February 2019, the biggest customer, Emirates, announced that it was to reduce its latest order by 39 aircraft in favour of two other Airbus Models, the A350 and A330neo, a version using the same engines as the Boeing 787 Dreamliner. For

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Airbus, it was the last act. The Company announced that production of the A380 would cease by 2021.

This book provides a state-of-the-art overview of the changes and development of the civil international aircraft/aviation industry. It offers a fully up-to-date account of the international developments and structure in the aircraft and aviation industries from a number of perspectives, which include economic, geographical, political and technological points of view. The aircraft industry is characterized by very complex, high technology products produced in relatively small quantities. The high-technology requirements necessitate a high level of R&D. In no other industry is it more of inter-dependence and cross-fertilisation of advanced technology. Consequently, most of the world's large aircraft companies and technology leaders have been located in Europe and North America. During the last few decades many developing countries have tried to build up an internationally competitive aircraft industry. The authors study a number of important issues including the political economy of the aircraft industry, globalization in this industry, innovation, newly industrializing economies and the aircraft industry. This book also explores regional and large aircraft, transformation of the aviation industry in Central and Eastern Europe, including engines, airlines, airports and airline safety. It will be of great value to students

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and to researchers seeking information on the aircraft industry and its development in different regions.

Since its first flight on 27 April 2005, the Airbus A380 has been the largest passenger airliner in the world. Instantly recognizable with its full-length upper deck, it represents the pinnacle of modern airliner design. Flying the A380 gives a pilot's eye view of what it is like to fly this mighty machine. It takes the reader on a trip from London to Dubai as the flight crew see it, from pre-flight planning, through all the phases of the flight to shut-down at the parking stand many thousands of miles from the departure point.

The primary human activities that release carbon dioxide (CO₂) 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 CO₂ emissions only make up approximately 2.0 to 2.5 percent of total global annual CO₂ emissions, research to reduce CO₂ 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 CO₂ emissions. Commercial Aircraft Propulsion and Energy Systems Research develops a national research

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agenda for reducing CO₂ 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 CO₂, they make only a minor contribution to global emissions, and many technologies that reduce CO₂ 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, CO₂ 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 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

Airbreathing Propulsion covers the physics of combustion, fluid and thermo-

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dynamics, and structural mechanics of airbreathing engines, including piston, turboprop, turbojet, turbofan, and ramjet engines. End-of-chapter exercises allow the reader to practice the fundamental concepts behind airbreathing propulsion, and the included PAGIC computer code will help the reader to examine the relationships between the performance parameters of different engines. Large amounts of data have on many different piston, turbojet, and turboprop engines have been compiled for this book and are included as an appendix. This textbook is ideal for senior undergraduate and graduate students studying aeronautical engineering, aerospace engineering, and mechanical engineering.

?This edited volume examines metallurgical technologies and their place in society throughout the centuries. The authors discuss metal alloys and the use of raw mineral resources as well as fabrication of engineered alloys for a variety of applications. The applications covered in depth include financial, mining and smelting, bridges, armor, aircraft, and power generation. The authors detail the multiple levels and scales of impact that metallurgical advances have had and continue to have on society. They include case studies with guidance for future research design and innovation of metallic materials relevant to societal needs. Includes case studies written by industry professionals with guidance for future research design and innovation; Demonstrates metal materials design that

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reflects relevant societal needs; Covers a broad range of applied materials used in aircraft, armor, bridges, and power generation, among others.

This one-stop reference is a tremendous value and time saver for engineers, designers and researchers. Emerging technologies, including aluminum metal-matrix composites, are combined with all the essential aluminum information from the ASM Handbook series (with updated statistical information).

How can this field develop in an age of global markets, growing information technology, and diminishing resources? A transnational collaboration between two senior scholars, *Reimagining Business History* offers direction in forty-four short, pithy essays.

Did you know that American icon 7-Eleven is controlled by Japanese retail giant Ito-Yokado, Miller Beer is brewed by South African Brewer SABMiller, and that the Los Angeles Dodgers are owned by The News Corporation, an Australian company?.

A comprehensive approach to the air vehicle design process using the principles of systems engineering. Due to the high cost and the risks associated with development, complex aircraft systems have become a prime candidate for the adoption of systems engineering methodologies. This book presents the entire process of aircraft design based on a systems engineering approach from

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conceptual design phase, through topreliminary design phase and to detail design phase. Presenting in one volume the methodologies behind aircraftdesign, this book covers the components and the issues affected bydesign procedures. The basic topics that are essential to theprocess, such as aerodynamics, flight stability andcontrol, aero-structure, and aircraft performance are reviewedin various chapters where required. Based on thesefundamentals and design requirements, the author explains thedesign process in a holistic manner to emphasise the integration ofthe individual components into the overall design. Throughout thebook the various design options are considered and weighed againsteach other, to give readers a practical understanding of theprocess overall. Readers with knowledge of the fundamental concepts ofaerodynamics, propulsion, aero-structure, and flight dynamics willfind this book ideal to progress towards the next stage in theirunderstanding of the topic. Furthermore, the broad variety ofdesign techniques covered ensures that readers have the freedom andflexibility to satisfy the design requirements when approachingreal-world projects. Key features: • Providesfull coverage of the design aspects of an air vehicle including:aeronautical concepts, design techniques and design flowcharts • Featuresend of chapter problems to reinforce the learning process as wellas fully solved design examples at component level •

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Includes fundamental explanations for aeronautical engineering students and practicing engineers • Features a solutions manual to sample questions on the book's companion website Companion website - <http://www.wiley.com/go/sadraey> www.wiley.com/go/sadraey/a "Brian H. Rowe took General Electric to world market leadership in commercial engines. A brilliant engineer, a sound businessman, and a popular leader, Rowe established relationships of trust with Boeing, Douglas, and Airbus and most most importantly, the world's airlines. He also worked effectively with the French industry and government." --book jacket.

Este libro está dedicado al Profesor Josep M. Costa en ocasión de su 70 aniversario. Reúne un total de 73 artículos y revisiones originales, tanto científicas como tecnológicas, escritas en español e inglés por unos 250 investigadores de todo el mundo, y que son exponentes representativos de la investigación internacional en materias de gran interés en la Electroquímica y la Corrosión de principios de este siglo XXI. El libro se ha estructurado en dos grandes secciones. La primera sección correspondiente a la Electroquímica consta de 33 trabajos distribuidos en 5 capítulos dedicados a los campos de Electroquímica Molecular, Electrodeposición, Electroodos Modificados, Descontaminación Electroquímica, y Sensores y Electroanálisis. La segunda

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sección relativa a la Corrosión comprende 40 trabajos que se agrupan en otros 5 capítulos que versan sobre Corrosión en Ambientes Corrosivos Seleccionados, Protección contra la Corrosión y Monitorización, Recubrimientos, Nuevos Materiales y Tratamientos, y Educación en la Corrosión....This book is dedicated to Professor Josep M. Costa in occasion of his 70th birthday. It collects a total number of 73 original articles and reviews, both scientific and technologic, written in English and Spanish by about 250 researchers of all around the world who are representative exponents of the international research in topics of great interest in Electrochemistry and Corrosion at the beginning of the 21st Century. The book has been structured in two large sections. The first section corresponds to Electrochemistry and includes 33 articles distributed into five chapters related to the fields of Molecular Electrochemistry, Electrodeposition, Modified Electrodes, Electrochemical Depollution, and Sensors and Electroanalysis. The second section is related to Corrosion and contains 40 articles gathered into other five chapters devoted to Corrosion in Selected Environments, Corrosion Protection and Monitoring, Coatings, New Materials and Treatments, and Corrosion Education.

Composites are versatile engineered materials composed of two or more constituent materials which, when combined, lead to improved properties over

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the individual components whilst remaining separate on a macroscopic level. Due to their versatility, composite materials are used in a variety of areas ranging from healthcare and civil engineering to spacecraft technology. Composites forming technologies reviews the wealth of research in forming high-quality composite materials. The book begins with a concise explanation of the forming mechanisms and characterisation for composites, as well as covering modelling and analysis of forming techniques. Further chapters discuss the testing and simulation of composite materials forming. The book also considers forming technologies for various composite material forms including thermoset and thermoplastic prepreg, moulding compounds and composite/metal laminates. With its distinguished editor and array of international contributors, Composites forming technologies is an essential reference for engineers, researchers and academics involved with the production and use of composite materials. Reviews the wealth of research in forming high-quality composite materials Includes a concise explanation of the forming mechanisms and characterisation for composites Considers forming technologies for various composite material forms Volume is indexed by Thomson Reuters CPCI-S (WoS). This special volume comprises 85 refereed papers. The selection of the papers was based upon the recommendations of the reviewers and the discretion of the editors. In most

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cases, the accepted papers were further polished to improve their readability. Presents information on flight operations in aircraft with the latest "glass cockpit" advanced avionics systems, covering such topics as automated flight control, area navigation, weather data systems, and primary flight display failures. Finish Manufacturing Processes are those final stage processing techniques which are deployed to bring a product to readiness for marketing and putting in service. Over recent decades a number of finish manufacturing processes have been newly developed by researchers and technologists. Many of these developments have been reported and illustrated in existing literature in a piecemeal manner or in relation only to specific applications. For the first time, Comprehensive Materials Finishing integrates a wide body of this knowledge and understanding into a single, comprehensive work. Containing a mixture of review articles, case studies and research findings resulting from R & D activities in industrial and academic domains, this reference work focuses on how some finish manufacturing processes are advantageous for a broad range of technologies. These include applicability, energy and technological costs as well as practicability of implementation. The work covers a wide range of materials such as ferrous, non-ferrous and polymeric materials. There are three main distinct types of finishing processes: Surface Treatment by which the properties

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of the material are modified without generally changing the physical dimensions of the surface; Finish Machining Processes by which a small layer of material is removed from the surface by various machining processes to render improved surface characteristics; and Surface Coating Processes by which the surface properties are improved by adding fine layer(s) of materials with superior surface characteristics. Each of these primary finishing processes is presented in its own volume for ease of use, making Comprehensive Materials Finishing an essential reference source for researchers and professionals at all career stages in academia and industry. Provides an interdisciplinary focus, allowing readers to become familiar with the broad range of uses for materials finishing Brings together all known research in materials finishing in a single reference for the first time Includes case studies that illustrate theory and show how it is applied in practice

The first book on Prognostics and Health Management of Electronics Recently, the field of prognostics for electronic products has received increased attention due to the potential to provide early warning of system failures, forecast maintenance as needed, and reduce life cycle costs. In response to the subject's growing interest among industry, government, and academic professionals, this book provides a road map to the current challenges and opportunities for

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research and development in Prognostics and Health Management (PHM). The book begins with a review of PHM and the techniques being developed to enable a prognostics approach for electronic products and systems. building on this foundation, the book then presents the state of the art in sensor systems for in-situ health and usage monitoring. Next, it discusses the various models and algorithms that can be utilized in PHM. Finally, it concludes with a discussion of the opportunities in future research. Readers can use the information in this book to:

- Detect and isolate faults
- Reduce the occurrence of No Fault Found (NFF)
- Provide advanced warning of system failures
- Enable condition-based (predictive) maintenance
- Obtain knowledge of load history for future design, qualification, and root cause analysis
- Increase system availability through an extension of maintenance cycles and/or timely repair actions
- Subtract life cycle costs of equipment from reduction in inspection costs, down time, and inventory

Prognostics and Health Management of Electronics is an indispensable reference for electrical engineers in manufacturing, systems maintenance, and management, as well as design engineers in all areas of electronics. Reflecting the rapid advances in new materials development, this work offers up-to-date information on the properties and applications of various classes of metals, polymers, ceramics and composites. It aims to simplify the materials selection process and show

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how to lower materials and manufacturing costs, drawing on such sources as vendor supplied and quality control test data.

Research into the manufacture of lightweight automobiles is driven by the need to reduce fuel consumption to preserve dwindling hydrocarbon resources without compromising other attributes such as safety, performance, recyclability and cost. Materials, design and manufacturing for lightweight vehicles will make it easier for engineers to not only learn about the materials being considered for lightweight automobiles, but also to compare their characteristics and properties. Part one discusses materials for lightweight automotive structures with chapters on advanced steels for lightweight automotive structures, aluminium alloys, magnesium alloys for lightweight powertrains and automotive structures, thermoplastics and thermoplastic matrix composites and thermoset matrix composites for lightweight automotive structures. Part two reviews manufacturing and design of lightweight automotive structures covering topics such as manufacturing processes for light alloys, joining for lightweight vehicles, recycling and lifecycle issues and crashworthiness design for lightweight vehicles. With its distinguished editor and renowned team of contributors, Materials, design and manufacturing for lightweight vehicles is a standard reference for practicing engineers involved in the design and material selection for motor vehicle bodies and components as well as material scientists, environmental scientists, policy makers, car companies and automotive component manufacturers. Provides a

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comprehensive analysis of the materials being used for the manufacture of lightweight vehicles whilst comparing characteristics and properties Examines crashworthiness design issues for lightweight vehicles and further emphasises the development of lightweight vehicles without compromising safety considerations and performance Explores the manufacturing process for light alloys including metal forming processes for automotive applications

Hydrothermal Behavior of Fiber- and Nanomaterial-Reinforced Polymer Composites provides critical information regarding the in-service environmental damage and degradation studies of nano/fiber reinforced polymer (FRP) composites focusing on hydrothermal degradation. Covering hydrothermal properties of a wide range of polymer composites, the book is aimed at graduate students, researchers, and professionals in material engineering, composite materials, nanomaterials, and related fields.

Suitable as a reference for industry practitioners and as a textbook for classroom use, Case Studies in System of Systems, Enterprise Systems, and Complex Systems Engineering provides a clear understanding of the principles and practice of system of systems engineering (SoSE), enterprise systems engineering (ESE), and complex systems engineering (CSE). Multiple domain practitioners present and analyze case studies from a range of applications that demonstrate underlying principles and best practices of transdisciplinary systems engineering. A number of the case studies focus

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on addressing real human needs. Diverse approaches such as use of soft systems skills are illustrated, and other helpful techniques are also provided. The case studies describe, examine, analyze, and assess applications across a range of domains, including: Engineering management and systems engineering education Information technology business transformation and infrastructure engineering Cooperative framework for and cost management in the construction industry Supply chain modeling and decision analysis in distribution centers and logistics International development assistance in a foreign culture of education Value analysis in generating electrical energy through wind power Systemic risk and reliability assessment in banking Assessing emergencies and reducing errors in hospitals and health care systems Information fusion and operational resilience in disaster response systems Strategy and investment for capability developments in defense acquisition Layered, flexible, and decentralized enterprise architectures in military systems Enterprise transformation of the air traffic management and transport network Supplying you with a better understanding of SoSE, ESE, and CSE concepts and principles, the book highlights best practices and lessons learned as benchmarks that are applicable to other cases. If adopted correctly, the approaches outlined can facilitate significant progress in human affairs. The study of complex systems is still in its infancy, and it is likely to evolve for decades to come. While this book does not provide all the answers, it does establish a platform, through which analysis and knowledge application can take place and

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conclusions can be made in order to educate the next generation of systems engineers.

Flying the Airbus A380Crowood

Offers a comprehensive review of the currently existing energy production and consumption technologies Offering unique perspectives from one social and one natural scientist and combining them with the view of an industry expert, this book covers definitions and ways of quantifying energy and sustainability, and examines today's energy production and consumption technologies?paying particular attention to the environmental, historic, and regulatory aspects of each introduced energy technology. It also deals with alternative and future energy technologies, as well as examples of sustainable approaches to everyday issues of transportation, urban planning, and home construction. Introduction to Energy and Sustainability starts with a section on introductory concepts and covers such things as the history of our relationship with energy; defining and quantifying both energy and sustainability; flows and conversions of energy and matter; and the laws of thermodynamics energy production today. It examines how energy is produced and consumed in our modern world?and looks at what types of energy exist and how we use it. The book also discusses the future of energy and how we will provide and utilize our current and forthcoming sources of power as our world changes. -Balances the treatment of hard science and engineering concepts of energy and sustainability with a thorough discussion of their socioeconomic and geopolitical implications -Offers a unique

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perspective of one social and one natural scientist, combined with the view of an industry expert -Filled with chapters that feature practice questions and solutions -Relevant to students in energy fields and environmentalists Introduction to Energy and Sustainability is an ideal text for post-graduate level students of energy fields. It will also greatly benefit environmentalists, engineers, power engineers, and chemists in industry. 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.

The Airbus A380 is the world's most recognised and most talked about airliner since the Boeing 747 and Concorde appeared in the skies in the late 1960s. Designed to challenge Boeing's monopoly in the large-aircraft market, it made its first flight in April 2005, entering commercial service two years later with Singapore Airlines. This jet has become so popular that every four minutes--24 hours a day, seven days a week--an A380 is taking off or landing somewhere in the world. There is no other development in recent aviation history to rival this remarkable aircraft.

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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.

This volume presents a selection of papers from the WASTES 2015 conference, a platform for scientists and industries from the waste management and recycling sectors from around the world, who shared experiences and knowledge at the meeting. Covering discussions regarding the balance between economic, environmental and social outcomes, the developme

The Light Metals symposia are a key part of the TMS Annual Meeting & Exhibition, presenting the most recent developments, discoveries, and practices in primary aluminum science and technology. Publishing the proceedings from these important symposia, the Light Metals volume has become the definitive reference in the field of aluminum production and related light metal technologies. The 2014 collection includes papers from the following symposia: •Alumina and Bauxite •Aluminum Alloys:

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Fabrication, Characterization and Applications •Aluminum Processing •Aluminum Reduction Technology •Cast Shop for Aluminum Production •Electrode Technology for Aluminum Production •Light-metal Matrix (Nano)-composites

QF32 is the award winning bestseller from Richard de Crespigny, author of the forthcoming *Fly!: Life Lessons from the Cockpit of QF32*. On 4 November 2010, a flight from Singapore to Sydney came within a knife edge of being one of the world's worst air disasters. Shortly after leaving Changi Airport, an explosion shattered Engine 2 of Qantas flight QF32 - an Airbus A380, the largest and most advanced passenger plane ever built. Hundreds of pieces of shrapnel ripped through the wing and fuselage, creating chaos as vital flight systems and back-ups were destroyed or degraded. In other hands, the plane might have been lost with all 469 people on board, but a supremely experienced flight crew, led by Captain Richard de Crespigny, managed to land the crippled aircraft and safely disembark the passengers after hours of nerve-racking effort. Tracing Richard's life and career up until that fateful flight, QF32 shows exactly what goes into the making of a top-level airline pilot, and the extraordinary skills and training needed to keep us safe in the air. Fascinating in its detail and vividly compelling in its narrative, QF32 is the riveting, blow-by-blow story of just what happens when things go badly wrong in the air, told by the captain himself. Winner of ABIA Awards for Best General Non-fiction Book of the Year 2013 and Indie Awards' Best Non-fiction 2012 Shortlisted ABIA Awards' Book of the Year 2013

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This book will give students an understanding of the history of flight right up to the technology and scientific discoveries that allow us to fly planes as large as today's super jumbo jets. How are airplanes designed so they can operate safely? What is the future of flight? All of these questions and more will be answered as students take a look at super jumbo jets, inside and out!

The focus of *Thermodynamics: Concepts and Applications* is on traditional thermodynamics topics, but structurally the book introduces the thermal-fluid sciences. Chapter 2 includes essentially all material related to thermodynamic properties clearly showing the hierarchy of thermodynamic state relationships. Element conservation is considered in Chapter 3 as a way of expressing conservation of mass. Constant-pressure and volume combustion are considered in Chapter 5 - Energy Conservation. Chemical and phase equilibria are treated as a consequence of the 2nd law in Chapter 6. 2nd law topics are introduced hierarchically in one chapter, important structure for a beginner. The book is designed for the instructor to select topics and combine them with material from other chapters seamlessly. Pedagogical devices include: learning objectives, chapter overviews and summaries, historical perspectives, and numerous examples, questions and problems and lavish illustrations. Students are encouraged to use the National Institute of Science and Technology (NIST) online properties database.

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