

## Model Airplane Design And Theory Of Flight A Complete Exposition Of The Aerodynamics And Design Of Flying Model Aircraft

Devoted to advances in the field of computer simulation of aerospace equipment, this study is the most up-to-date coverage of the state-of-the-art on coastal and passenger aircraft, drones, and other recent developments in this constantly changing field. This book is devoted to unique developments in the field of computer modeling in aerospace engineering. The book describes the original conceptual models of amphibious aircraft, ground-effect vehicles, hydrofoil vessels, and others, from theory to the full implementation in industrial applications. The developed models are presented with the design of passenger compartments and are actually ready for implementation in the aircraft industry. The originality of the concepts are based on biological prototypes, which are ergonomic, multifunctional and aesthetically pleasing. The aerodynamic layout of prospective convertible land and ship-based aircrafts of vertical and short takeoff-landing is presented, as well as the development of the original model of the unmanned aerial vehicle, or drone. The results of full-scale experiments are presented, including the technology of modeling aerospace simulators based on the virtual reality environment with technical vision devices. Whether for the practicing engineer in the field, the engineering student, or the scientist interested in new aerospace developments, this volume is a must-have. This groundbreaking new volume: Presents unique developments of coastal aircraft concepts based on biological prototypes, from the idea to the finished model Gives the process of modeling the original unmanned aerial vehicle Investigates aerospace simulators based on virtual reality environment with technical vision devices Covers the original ideas of creating carrier-based aviation for sea ships and the results of field experiments simulating an unmanned aerial vehicle Provides many useful illustrations of naval aviation Audience: The book is intended for aerospace engineers, mechanical engineers, structural engineers, researchers and developers in the field of aerospace industry, for aircraft designers and engineering students. It will be useful for scientists, students, graduate students and engineers in the field of naval aviation and space simulators.

This book demonstrates the potential of the blended wing body (BWB) concept for significant improvement in both fuel efficiency and noise reduction and addresses the considerable challenges raised for control engineers because of characteristics like open-loop instability, large flexible structure, and slow control surfaces. This text describes state-of-the-art and novel modeling and control design approaches for the BWB aircraft under consideration. The expert contributors demonstrate how exceptional robust control performance can be achieved despite such stringent design constraints as guaranteed handling qualities, reduced vibration, and the minimization of the aircraft's structural loads during maneuvers and caused by turbulence. As a result, this innovative approach allows the building of even lighter aircraft structures, and thus results in considerable efficiency improvements per passenger kilometer. The treatment of this large, complex, parameter-dependent industrial control problem highlights relevant design issues and provides a relevant case study for modeling and control engineers in many adjacent disciplines and applications. Modeling and Control for a Blended Wing Body Aircraft presents research results in numeric modeling and control design for a large, flexible, civil BWB aircraft in the pre-design stage as developed within the EU FP7 research project ACFA 2020. It is a useful resource for aerospace and control engineers as it shows the complete BWB aircraft modeling and control design process, carried out with the most recent tools and techniques available. presents research results in numeric modeling and control design for a large, flexible, civil BWB aircraft in the pre-design stage as developed within the EU FP7 research project ACFA 2020. It is a useful resource for aerospace and control engineers as it

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shows the complete BWB aircraft modeling and control design process, carried out with the most recent tools and techniques available. Advances in Industrial Control aims to report and encourage the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

The design, development, analysis, and evaluation of new aircraft technologies such as fly by wire, unmanned aerial vehicles, and micro air vehicles, necessitate a better understanding of flight mechanics on the part of the aircraft-systems analyst. A text that provides unified coverage of aircraft flight mechanics and systems concept will go a long way.

The second edition of Flight Stability and Automatic Control presents an organized introduction to the useful and relevant topics necessary for a flight stability and controls course. Not only is this text presented at the appropriate mathematical level, it also features standard terminology and nomenclature, along with expanded coverage of classical control theory, autopilot designs, and modern control theory. Through the use of extensive examples, problems, and historical notes, author Robert Nelson develops a concise and vital text for aircraft flight stability and control or flight dynamics courses.

The book focuses on the synthesis of the fundamental disciplines and practical applications involved in the investigation, description, and analysis of aircraft flight including applied aerodynamics, aircraft propulsion, flight performance, stability, and control. The book covers the aerodynamic models that describe the forces and moments on maneuvering aircraft and provides an overview of the concepts and methods used in flight dynamics. Computational methods are widely used by the practicing aerodynamicist, and the book covers computational fluid dynamics techniques used to improve understanding of the physical models that underlie computational methods.

A comprehensive guide to designing radio control model airplanes. Andy Lennon presents a thorough and comprehensive introduction to the intriguing world of model aerodynamics. Whatever your modeling background, this book will be a valuable reference source in your R/C library and will never be outdated. Fully illustrated.

Commercial Airplane Design Principles is a succinct, focused text covering all the information required at the preliminary stage of aircraft design: initial sizing and weight estimation, fuselage design, engine selection, aerodynamic analysis, stability and control, drag estimation, performance analysis, and economic analysis. The text places emphasis on making informed choices from an array of competing options, and developing the confidence to do so. Shows the use of standard, empirical, and classical methods in support of the design process Explains the preparation of a professional quality design report Provides a sample outline of a design report Can be used in conjunction with Sforza, Commercial Aircraft Design Principles to form a complete course in Aircraft/Spacecraft Design

Get a complete understanding of aircraft control and simulation Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous Systems, Third Edition is a comprehensive guide to aircraft control and simulation. This updated text covers flight control systems, flight dynamics, aircraft modeling, and flight simulation from both classical design and modern perspectives, as well as two new chapters on the modeling, simulation, and adaptive control of unmanned aerial vehicles. With detailed examples, including relevant MATLAB calculations and FORTRAN codes, this approachable yet detailed reference also provides access to supplementary materials, including chapter problems and an instructor's solution manual.

Aircraft control, as a subject area, combines an understanding of aerodynamics with knowledge of the physical systems of an aircraft. The ability to analyze the performance of an aircraft both in the real world and in computer-simulated flight is essential to maintaining proper control and function of the aircraft. Keeping up with the skills necessary to perform this analysis

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is critical for you to thrive in the aircraft control field. Explore a steadily progressing list of topics, including equations of motion and aerodynamics, classical controls, and more advanced control methods Consider detailed control design examples using computer numerical tools and simulation examples Understand control design methods as they are applied to aircraft nonlinear math models Access updated content about unmanned aircraft (UAVs) Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous Systems, Third Edition is an essential reference for engineers and designers involved in the development of aircraft and aerospace systems and computer-based flight simulations, as well as upper-level undergraduate and graduate students studying mechanical and aerospace engineering.

This is the latest edition - fully revised and updated - of the standard textbook on aerodynamic theory, as applied to model flight. Everything is explained in a concise and practical form for those enthusiasts who appreciate that a better understanding of model behaviour is the sure path to greater success and enjoyment, whether just for fun or in competition. The revisions for this new edition reflect the significant developments in model aircraft during the last few years, and include brand new data: \* The chapter on aerofoils has been rewritten to take account of the vast amount of testing carried out recently in the USA by the University of Illinois. \* A brand new chapter explains the latest research into the flight of birds and insects and how it is applied to small drones and model-sized surveillance aircraft. \* Older wind tunnel test reports all replaced with the latest trials and measurements.

Experience firsthand the joys of building and flying your very own model airplane design. Put into practice the lessons from my previous book, RCadvisor's Model Airplane Design Made Easy. Follow along as we design, build, and fly a modern radio-controlled model airplane. Lofty Design Goals Incorporating the latest innovations and research results, the design looks deceptively simple. However, 20 prototypes had to be built before one finally met all the design goals: Build it in just one day for less than \$5. A joy to fly with no bad habits. Build either a park flyer or an indoor slow flyer. New pilots can fly it without ailerons. Sturdy enough to survive hard landings. Easy to build for new scratch builders. Kid-friendly free flight glider version. Use inexpensive electric power systems and radio gear. Great starting point for your own unique designs. You can easily find the construction materials for the airplane at local discount or craft stores. So what are you waiting for? An Inside Look at the Design Process The book starts by describing the goals and the long prototyping process that led to the final design. Along the way you get to see firsthand the challenges that creating an innovative design presents. Learn the reasoning behind all the decisions that led to this unique design. A stand-alone book, it is complemented nicely by RCadvisor's online model airplane calculator and my first model airplane design book. Picking up where that book left off, it takes a very pragmatic approach to the entire design process. Carlos Reyes founded [www.RCadvisor.com](http://www.RCadvisor.com) in 2007. He's had a life-long love affair with aviation, building and flying model airplanes since childhood. He holds a Private Pilot-Glider license and is the Vice President of his local model airplane club.

ADVANCE PRAISE "Carlos Reyes is quickly building a reputation as a talented and experienced RC model aircraft expert and author. His first book, titled RCadvisor's Model airplane Design Made Easy, set the stage for what I'm sure will be a series of books that will allow a rank beginner to get a start and then progress to any desired level in our wonderful hobby. The amount of detail in this new book is incredible and will certainly apply to many other aircraft that you build as you grow in the hobby. Carlos Reyes has a truly enjoyable style of writing. Fun to read while you are learning so much at the same time! This new book is excellent for any age group be they young or old. This is absolutely A MUST READ! I can only imagine (and look forward to) what book number three will be like!" - Bob Aberle, AMA 215, Technical Editor, Model Aviation magazine "I was really hoping Carlos' next book would be informative, entertaining, helpful, and have a brilliant educational aspect for RC flying

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hobbyists. However, this book didn't quite do this; it was BEYOND these expectations! Carlos kicks out another winner with this one. Yes, you can have entertaining and helpful media in RC other than podcasts!" - Jamie Burke, Host, [www.AllThingsThatFly.com](http://www.AllThingsThatFly.com) "Invading the mind of a designer is an intriguing adventure. After reading just the first chapter about the goals, along with what did and didn't work on the prototypes, I was eager to read on to see how the modified design worked out. Carlos continues by explaining what considerations were used, and how they were derived, to pick a "Winner" from the many prototypes. I carefully studied Carlos' ideas and techniques and learned a lot about designing this type of plane. I am so excited about the design that I just have to build one to try it out. - Ken Myers, Editor, The Ampeer

Beskriver modellfly og bygning af modellfly herunder beregninger m.m. vedr. aerodynamik, design og flyveegenskaber.

Build and fly your very own model airplane design. Using clear explanations, you will learn about important design trade-offs and how to choose among them. The latest research and techniques are discussed using easy to understand language. You will discover: The special challenges faced by the smaller models and how to overcome them. How to choose the right material for each part of the airplane. Easy rules for selecting the right power system, gas or electric. When it makes sense to use one of the innovative Kfm airfoils. Pros and cons of canard and multi-wing configurations. A step-by-step design process that includes goal setting and flight testing. In-depth discussions of important topics like airfoils and wing design. The sources of air drag and how to minimize their impact. ADVANCE PRAISE "This book is a joy to read! The writing style and wit add dimension in a way that is rarely found in today's reference materials. If someone has considered designing their own airplane and been put off because of complicated formulas, vocabulary and reference style that would bore even an engineer, this will convince them to go ahead and try it. Written with real people in mind and not engineers - and I mean that in a good way. This is a book that will reside along the other favorites on my bookshelf. Carlos really managed to produce a book that will last a long time and become one of the standards for modelers." - Greg Gimlick, Electric's columnist, Model Aviation magazine "RCAdvisor's Model Airplane Design Made Easy is the ultimate model airplane design book for both beginning and experienced modelers." - Richard Kline, Inventor, Kfm airfoils "RCAdvisor's Model Airplane Design Made Easy is a real contribution to the world's literature on the subject. It provides an excellent bridge between full scale aviation and aeromodelling, showing the relationship between the two, for better understanding of the differences and similarities which should be applied for good model performance. While thorough in detail, the book is also easily readable so that the information is simple to understand. It is a very good combination of theory and practical application. Nicely illustrated, the book is also full of common sense explanations and references to other sources of information." - John Worth, former President and Executive Director of the AMA "Carlos Reyes personably leads the reader through some basic aerodynamics, materials considerations, electric power system planning and a practical application of theory as it is applied to a finished flying model. The background history of various types of aircraft shows the development of aviation and how it relates to the models that we build and fly today, as well as how models have influenced general aviation. It is always exciting to find some 'new to me' concepts and theories, and there were several in this well-written narrative." - Ken Myers, Editor, Ampeer electric flight newsletter "No matter how long you've been aeromodelling, or what your interests are in our great hobby, the greatest thrill of all is standing behind a unique model that you've designed and built yourself, from a blank sheet of paper - or even a blank CAD file - and preparing to make that first take off. So sit yourself down in a comfy chair, read RCAdvisor's Model Airplane Design Made Easy and set off on aeromodelling's greatest adventure. Let Carlos Reyes - an aeromodeler of long standing and great talent - take you through the mysteries of how to

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arrive at the point that every lover of model aircraft should experience." - Dereck Woodward, aeromodeller, designer and magazine writer for the past fifty years

**BUILD YOUR OWN REMOTE-CONTROLLED AIRPLANES QUICKLY, EASILY, AND INEXPENSIVELY!** Take to the skies with a majestic motorized model aircraft you create and pilot yourself. Written by the founder of the Brooklyn Aerodrome, *DIY RC Airplanes from Scratch* shows you how to build a Flack (Flying + Hack) delta wing from the ground up using widely available, low-cost materials and tools. You'll also learn the skills you need to get your plane into the air and keep it there. By the end of the book, you'll be able to create your own customized designs. The sky's the limit! Discover how to: Select the components you'll need and get them at a low cost Build a sturdy deck and secure all of your airplane's electronics to it Construct the airframe with the proper trim and center of gravity Learn to fly--one crash at a time Diagnose and repair your airplane Decorate your aircraft for dazzling daytime flights Illuminate a night flyer with otherworldly effects Experiment with unique airframe shapes, including the Flying Heart, the Bat, and the Manta Ray Learn the basics of aerodynamics Devise, build, and fly your own unique designs Companion videos available at <http://brooklynaerodrome.com/bible>

A collection of easy-to-fold paper airplane designs and innovative theories of flight, including the author's Guinness World Record-breaking airplane. Will YOU be the next to break the **WORLD RECORD**? Anything is possible with *The New World Champion Paper Airplane Book*, the newest collection of designs and theories of flight from John M. Collins, the man behind the Guinness World Record-breaking distance plane. Featuring twenty-two unique airplane designs with step-by-step instructional photos, plus tear-out models printed on regulation-weight paper stock, this entertaining and informative guide promises hours of flying fun. Take your paper airplane-making to the next level with features such as: · Instructions for folding "Suzanne," the plane that shattered the previous world record by flying an unprecedented 226 feet, 10 inches, and garnered more than three million views on YouTube · Four "Follow Foil" aircraft that can stay aloft for minutes at a time · A pioneering cambered-wing plane · A primer on flight theory, and how it applies to paper airplanes · Tips for improving the accuracy and distance of your throws · The adjusting technique that helped break the record · And more! *Model Airplane Design and Theory of Flight* A Complete Exposition of the Aerodynamics and Design of Flying Model Aircraft, with Fundamental Rules, Formulas and Graphs

Autonomous unmanned air vehicles (UAVs) are critical to current and future military, civil, and commercial operations. Despite their importance, no previous textbook has accessibly introduced UAVs to students in the engineering, computer, and science disciplines--until now. *Small Unmanned Aircraft* provides a concise but comprehensive description of the key concepts and technologies underlying the dynamics, control, and guidance of fixed-wing unmanned aircraft, and enables all students with an introductory-level background in controls or robotics to enter this exciting and important area. The authors explore the essential underlying physics and sensors of UAV problems, including low-level autopilot for stability and higher-level autopilot functions of path planning. The textbook leads the student from rigid-body dynamics through aerodynamics, stability augmentation, and state estimation using onboard sensors, to maneuvering through obstacles. To facilitate understanding, the authors have replaced traditional homework assignments with a simulation project using the MATLAB/Simulink environment. Students begin by modeling rigid-body dynamics, then add aerodynamics and sensor models. They develop low-level autopilot code, extended Kalman filters for state estimation, path-following routines, and high-level path-planning algorithms. The final chapter of the book focuses on UAV guidance using machine vision. Designed for advanced undergraduate or graduate students in engineering or the sciences, this book offers a bridge to the aerodynamics and control of UAV flight.

A vital resource for pilots, instructors, and students, from the most trusted source of aeronautic

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information.

"A collection of two dozen easy-to-fold paper airplane designs (using no cutting or glue), as well as innovative theories of flight. Includes the author's Guinness World Record-breaking airplane as well as 16 tear-out model planes"--

This definitive text describes the theory and design both of Air Cushion Vehicles (ACV) and Surface Effect Ships (SES). It begins by introducing hovercraft types and their development and application throughout the world in the last three decades, before going on to discuss the theoretical aspects of ACV and SES craft covering their hovering performance, dynamic trim over calm water, resistance, stability, manoeuvrability, skirt configuration and analysis of forces acting on the skirts, ACV and SES seakeeping, and the methodology of scaling aerodynamic and hydrodynamic forces acting on the ACV/SES from model test data. The latter chapters describe a design methodology, including design criteria and standard methods for estimating craft performance, lift system design, skirt design, hull structure, propulsion systems and power unit selection. Much technical information, data, and references to further work on hovercraft and SES design is provided. The book will be a useful reference to engineers, technicians, teachers, students (both undergraduate and postgraduate), operators etc. who are involved in ACV/SES research, design, construction and operation. Guides the reader on how to perform machinery and systems selection within ACV and SES overall design For teachers, students (both at under- and post-graduate level), engineers and technicians involved in ACV/SES

Seldom has a long-established hobby been transformed more than radio controlled model aircraft flying has been with the development of light-weight, inexpensive electric power systems. After decades of dominance by glow and gas powered internal combustion engines, the hottest thing in RC flying today is electric powered model aircraft. Energy dense lithium polymer batteries, powerful brushless electric motors and the digital devices that control them have taken the radio control hobby by storm. With them has come a veritable tsunami of molded foam models of nearly every type of airplane imaginable. Warbirds like the P-51 Mustang, aerobatic aircraft like the Edge 540 and a variety of trainers similar to the Cessna 172 fill the online marketplaces and the shelves of local hobby shops around the world. Traditional models, too, are being developed or converted to fly with electric power systems. These models have their own body of knowledge. Instead of tinkering with the needle valve settings of internal combustion engines, now modelers are computing watts, managing amps, determining volts and shopping for components that maximize power without exceeding the electronic limits of their model's components. RC Ground School provides you with the information you need to get started in the exciting hobby of model aviation. You'll get answers to these and other questions: What should I consider in choosing a model aircraft? What kind of transmitter should I consider? Should I go with a ready-to-fly kit or an almost-ready-to-fly model? What if I need to teach myself to fly? How can I find an instructor? How do I operate my model safely? How do

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electric models work? Come join the thousands of other modelers enjoying this fun and interesting hobby. RC Ground School is the perfect tool to help you get started. Already flying glow or gas airplanes? Thinking about converting to or adding an electric model to your hangar? The second half of the book is a deeper dive into what makes up an electric model's power system and what you'll need to know to convert that old friend to electric power or at least keep up with the conversations at the field.

Mises' classic avoids the formidable mathematical structure of fluid dynamics, while conveying — by often unorthodox methods — a full understanding of the physical phenomena and mathematical concepts of aeronautical engineering. Some have said that if God had wanted us to fly, He would have given us wings. And yet, we were given the ability to dream, to think with our heads, to have courage in our hearts, and to build with our hands. Truly, we have been given everything we need: We really can fly on our own wings! Chris Heintz is a professional aeronautical engineer with a prolific career spanning over 40 years designing and building light aircraft. Recognized worldwide as a uniquely talented and accomplished designer, his aircraft are known and appreciated for their simplicity of construction, pilot-friendly cabins and controllability as well as remarkable performances. Today, Chris Heintz designs are flown throughout the world, mostly by recreational pilots who have assembled their own planes from a kit. His most popular models are also factory-assembled and sold as ready-to-fly sport aircraft on three continents. In *FLYING ON YOUR OWN WINGS*, Mr. Heintz shares his knowledge and insights into the art and science of light aircraft design. He “walks” readers through the essential understanding and skills required to conceive, develop, build and even test-fly their own personal light airplane. Basic mathematics, essential aerodynamics and stress analysis are just a few of the chapters of this fascinating book. Heintz even provides a sample design to help would-be designers take their first step towards imagining and creating their own wings. Truly a beginner's guide to everything you need to know in order to achieve that age-old dream: To fly on your own wings!

From the early machines to today's sophisticated aircraft, stability and control have always been crucial considerations. In this second edition, Abzug and Larrabee again forge through the history of aviation technologies to present an informal history of the personalities and the events, the art and the science of airplane stability and control. The book includes never-before-available impressions of those active in the field, from pre-Wright brothers airplane and glider builders through to contemporary aircraft designers. Arranged thematically, the book deals with early developments, research centers, the effects of power on stability and control, the discovery of inertial coupling, the challenge of stealth aerodynamics, a look toward the future, and much more. It is profusely illustrated with photographs and figures, and includes brief biographies of noted stability and control figures along with a core bibliography. Professionals, students, and aviation enthusiasts alike will appreciate this readable history of airplane stability

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and control.

This textbook for advanced students focuses on industry design practice rather than theoretical definitions. Covers configuration layout, payload considerations, aerodynamics, propulsion, structure and loads, weights, stability, and control, performance, and cost analysis. Annotation copyright Book

The pilot's guide to aeronautics and the complex forces of flight Flight Theory and Aerodynamics is the essential pilot's guide to the physics of flight, designed specifically for those with limited engineering experience. From the basics of forces and vectors to craft-specific applications, this book explains the mechanics behind the pilot's everyday operational tasks. The discussion focuses on the concepts themselves, using only enough algebra and trigonometry to illustrate key concepts without getting bogged down in complex calculations, and then delves into the specific applications for jets, propeller crafts, and helicopters. This updated third edition includes new chapters on Flight Environment, Aircraft Structures, and UAS-UAV Flight Theory, with updated craft examples, component photos, and diagrams throughout. FAA-aligned questions and regulatory references help reinforce important concepts, and additional worked problems provide clarification on complex topics. Modern flight control systems are becoming more complex and more varied between aircrafts, making it essential for pilots to understand the aerodynamics of flight before they ever step into a cockpit. This book provides clear explanations and flight-specific examples of the physics every pilot must know. Review the basic physics of flight Understand the applications to specific types of aircraft Learn why takeoff and landing entail special considerations Examine the force concepts behind stability and control As a pilot, your job is to balance the effects of design, weight, load factors, and gravity during flight maneuvers, stalls, high- or low-speed flight, takeoff and landing, and more. As aircraft grow more complex and the controls become more involved, an intuitive grasp of the physics of flight is your most valuable tool for operational safety. Flight Theory and Aerodynamics is the essential resource every pilot needs for a clear understanding of the forces they control.

Find the right answer the first time with this useful handbook of preliminary aircraft design. Written by an engineer with close to 20 years of design experience, General Aviation Aircraft Design: Applied Methods and Procedures provides the practicing engineer with a versatile handbook that serves as the first source for finding answers to realistic aircraft design questions. The book is structured in an "equation/derivation/solved example" format for easy access to content. Readers will find it a valuable guide to topics such as sizing of horizontal and vertical tails to minimize drag, sizing of lifting surfaces to ensure proper dynamic stability, numerical performance methods, and common faults and fixes in aircraft design. In most cases, numerical examples involve actual aircraft specs. Concepts are visually depicted by a number of useful black-and-white figures, photos, and graphs (with full-color images included in the eBook only).



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Broad and deep in coverage, it is intended for practicing engineers, aerospace engineering students, mathematically astute amateur aircraft designers, and anyone interested in aircraft design. Organized by articles and structured in an "equation/derivation/solved example" format for easy access to the content you need Numerical examples involve actual aircraft specs Contains high-interest topics not found in other texts, including sizing of horizontal and vertical tails to minimize drag, sizing of lifting surfaces to ensure proper dynamic stability, numerical performance methods, and common faults and fixes in aircraft design Provides a unique safety-oriented design checklist based on industry experience Discusses advantages and disadvantages of using computational tools during the design process Features detailed summaries of design options detailing the pros and cons of each aerodynamic solution Includes three case studies showing applications to business jets, general aviation aircraft, and UAVs Numerous high-quality graphics clearly illustrate the book's concepts (note: images are full-color in eBook only)

Prepared at the request of NASA, Aeronautical Technologies for the Twenty-First Century presents steps to help prevent the erosion of U.S. dominance in the global aeronautics market. The book recommends the immediate expansion of research on advanced aircraft that travel at subsonic speeds and research on designs that will meet expected future demands for supersonic and short-haul aircraft, including helicopters, commuter aircraft, "tiltrotor," and other advanced vehicle designs. These recommendations are intended to address the needs of improved aircraft performance, greater capacity to handle passengers and cargo, lower cost and increased convenience of air travel, greater aircraft and air traffic management system safety, and reduced environmental impacts.

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