Aircraft Engine Manufacturers

This report presents a methodology and planning factors for estimating manufacturing capacity for airplane and helicopter facilities. In the event additional capacity is required, the methodology can be applied to determine the required manufacturing area. It was not possible to include facilities for aircraft engines and all types of missiles, because of insufficient data available from the one missile and two aircraft engine manufacturers under BuAer cognizance. The methodology, however, is applicable to the Regulus and Matador missiles and to other missiles having airframes like those of airplanes. (Author).

The primary human activities that release carbon dioxide (CO_2) 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_2 emissions only make up approximately 2.0 to 2.5 percent of total global annual CO_2 emissions, research to reduce CO_2 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_2 emissions. Commercial Aircraft Propulsion and Energy Systems Research develops a national research agenda for reducing CO_2 emissions from commercial aviation. This report focuses on propulsion and energy technologies for reducing carbon emissions from large, commercial aircraftâ€" single-aisle and twin-aisle aircraft that carry 100 or more passengersâ€"because such aircraft account for more than 90 percent of global emissions from commercial aircraft. Moreover, while smaller aircraft also emit CO_2, they make only a minor contribution to global emissions, and many technologies that reduce CO_2 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_2 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.

Sakade challenges the narrative that the focus of British manufacturing went "from Empire to Europe" and argues rather that, following the Second World War, the key relationship was in fact trans-Atlantic. There is a commonly accepted belief that, during the twentieth century, British manufacturing declined irreparably, that Britain lost its industrial hegemony. But this is too simplistic. In fact, in the decades after 1945, Britain staked out a new role for itself as a key participant in a US-led process of globalisation. Far from becoming merely a European player, the UK actually managed to preserve a key share in a global market, and the British defence industry was, to a large extent, successfully rehabilitated. Sakade returns to the original scholarly parameters of the decline controversy, and especially questions around post-war decline in the fields of high technology and the national defence industrial base. Using the case of the strategically critical military and civil aircraft industry, he argues that British industry remained relatively robust. A valuable read for historians of British aviation and more widely of 20th century British Industry.

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 turbinesfrom 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 o

Engineers, inventors, and dreamers in the state of Michigan had been searching for the secret of heavier-than-air flight well before the Wright brothers' successful flights in 1903. In 1911, the first aircraft manufacturer opened for business in Michigan. During the 1920s and 1930s, the Detroit area was known as the "Aviation Capital of America." The All-American Aircraft Show, held annually in Detroit from 1928 to 1933, was the major showcase for introducing new airplanes to the aviation community. Major competitions, such as the Ford Air Tours (1925 to 1931) and the Cirrus Derby (1930), originated and ended at airports in Michigan. Michigan's aircraft manufacturers made major contributions to America's war efforts, building 1,500 Liberty planes during World War I and 8,685 B-24 bombers during World War II. In addition to those major manufacturers, a large number of individual designers and entrepreneurs toiled to build the ultimate airplane. Today the pioneering tradition lives on in the hundreds of individuals who design and build airplanes in their garage or basement.

This dissertation also contains a history of the aircraft engine industry and detailed information regarding the large commercial aircraft and aircraft engine manufacturers and their product lines.

The application of advanced control concepts to air breathing engines may yield significant improvements in aircraft/engine performance and operability. Screening studies of advanced control concepts for air breathing engines were conducted by three major domestic aircraft engine manufacturers to determine the potential impact of concepts on turbine engine performance and operability. The purpose of the studies was to identify concepts which offered high potential yet may incur high research and development risk. A target suite of proposed advanced control concepts was formulated and evaluated in a two phase study to quantify each concept's impact on desired engine characteristics. To aid in the evaluation specific aircraft/engine combinations were considered: a Military High Performance Fighter mission, a High Speed Civil Transport mission, and a Civil Tiltrotor mission. Each of the advanced control concepts considered in the study are defined and described. The concept potential impact on engine performance was determined. Relevant figures of merit on which to evaluate the concepts are determined. Finally, the concepts are ranked with respect to the target aircraft/engine missions. A final report describing the screening studies was prepared by each engine manufacturer. Volume 1 of these reports describes the studies performed by Pratt & Whitney. Ralph, J. A. Unspecified Center...

This book commemorates Wichita's role as Air Capital of the World. It takes readers from the early birds and barnstormers to the pioneers and entrepreneurs who established dozens of aircraft and associated factories in the 1920s. The story continues with the founding of Cessna, Beechcraft and Stearman (which became Boeing Wichita, then Spirit AeroSystems) and the massive build-up during World War II. Robust post-war growth got another boost when Bill Lear came to town and launched the business jet revolution with his Learjet. Today Wichita remains at the center of global aviation design and manufacturing with Textron Aviation, Spirit AeroSystems, Bombardier Learjet, Airbus and many dozens of smaller aviation manufacturers, suppliers and support organizations.What made Wichita the Air Capital? Flat prairies resembled one enormous landing field. Southwesterly winds added extra thrust to get and stay aloft. Farming and small manufacturing provided a legion of imaginative, industrious problem-solvers. Local boosters latched onto and promoted anything that flew. The city's central location provided an ideal refueling stop for coast-to-coast airmail routes. And oil generated a class of savvy, starry-eyed entrepreneurs who both used aircraft and had money to invest. Wichita brought it all together. The people. The promise. The planes.On Sept. 2, 1911, Albin Longren became the first person to build and fly an airplane in Kansas. His pusher-type biplane lifted off from a hayfield with a four-gallon gas tank and "flight instruments" that consisted of a pocket watch and barometer. The first plane built in Wichita rolled out of production in 1917, when Clyde Cessna assembled his Comet. Wichita's first commercial aircraft, the Swallow, came from the E.M. Laird Airplane Co. in 1920. By 1928, Wichita was general aviation's manufacturing grand central, producing 120 airplanes a week - a quarter of all U.S. output. A Chamber of Commerce Air Capital logo contest celebrated the city's 16 aircraft manufacturers, six aircraft engine factories, 11 airports and dozen flying schools. Wichita produces more airplanes - almost 300,000 to date - and offers more skilled aviation workers than any other city. Aviation forms Wichita's heritage and future.

The application of advanced control concepts to airbreathing engines may yield significant improvements in aircraft/engine performance and operability. Screening studies of advanced control concepts for airbreathing engines were conducted by three major domestic aircraft engine manufacturers to determine the potential impact of concepts on turbine engine performance and operability. The purpose of the studies was to identify concepts which offered high potential yet may incur high research and development risk. A target suite of proposed advanced control concepts was formulated and evaluated in a two-phase study to quantify each concept's impact on desired engine characteristics. To aid in the evaluation specific aircraft/engine combinations were considered: a Military High Performance Fighter mission, a High Speed Civil Transport mission, and a Civil Tiltrotor mission. Each of the advanced control concepts considered in the study are defined and described. The concept potential impact on engine performance was determined. Relevant figures of merit on which to evaluate the concepts are determined. Finally, the concepts are ranked with respect to the target aircraft/engine missions. A final report describing the screening studies was prepared by each engine manufacturer. Volume 3 of these reports describes the studies performed by the Allison Gas Turbine Division. Bough, R. M. Unspecified Center NAS3-25459; RTOP 505-62-41...

This report provides a summary and analysis of original data from seven major US aircraft engine manufacturers over a time period 1960-75. Analysis of large and small engine production, surge capacity, costs, productivity, and industry structure was made and compared with historical trends and the use of econometric models. Emphasis was placed on the lead times, shortages, and roles of subcontractors, component availability, and materials. (Author).

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.

Airpower is not widely understood. Even though it has come to play an increasingly important role in both peace and war, the basic concepts that define and govern airpower remain obscure to many people, even to professional military officers. This fact is largely due to fundamental differences of opinion as to whether or not the aircraft has altered the strategies of war or merely its tactics. If the former, then one can see airpower as a revolutionary leap along the continuum of war; but if the latter, then airpower is simply another weapon that joins the arsenal along with the rifle, machine gun, tank, submarine, and radio. This book implicitly assumes that airpower has brought about a revolution in war. It has altered virtually all aspects of war: how it is fought, by whom, against whom, and with what weapons. Flowing from those factors have been changes in training, organization, administration, command and control (C 2), and doctrine. War has been fundamentally transformed by the advent of the airplane. Billy Mitchell defined airpower as “the ability to do something in the air. It consists of transporting all sorts of things by aircraft from one place to another.”1 Two British air marshals, Michael Armitage and Tony Mason, more recently wrote that airpower is “the ability to project military force by or from a platform in the third dimension above the surface of the earth.”2 In truth, both definitions, though separated in time by almost six decades, say much the same thing. Interestingly, however, most observers go on to note that airpower includes far more than air vehicles; it encompasses the personnel, organization , and infrastructure that are essential for the air vehicles to function. On a broader scale, it includes not only military forces but also the aviation industry, including airline companies and aircraft/engine manufacturers. On an even broader plane, airpower includes ideas—ideas on how it should be employed. Even before the aeroplane was invented, people speculated—theorized—on how it could be used in war. The purpose of this book is to trace the evolution of airpower theory from the earliest days of powered flight to the present, concluding with a chapter that speculates on the future of military space applications.3 Attempting to find the origins of airpower theory, trace it, expose it, and then examine and explain it, is no easy task. Perhaps because airpower's history is short—all of it can be contained in a single lifetime—it lacks first-rate narrative and analytical treatments in many areas. As a result, library shelves are crammed with books about the aerodynamics of flight, technical eulogies to specific aircraft, and boys' adventure stories. Less copious are good books on airpower history or biography. For example, after nearly five decades, we still do not have an adequate account of American airpower in the Southwest Pacific theater during World War II, or the role of George Kenney, perhaps the best operationallevel air commander of the war. Similarly, we need a biography of one of the most brilliant thinkers and planners in US Air Force history; the only airman ever to serve as Supreme Allied Commander Europe, and the third youngest general in American history—Lauris Norstad. Nor do we have a complete, official history of airpower's employment in the war in Southeast Asia. Much needs to be done to fill such gaps.

Pratt & Whitney was at one time the dominant player in commercial aircraft engines, only to lose market leadership to GE and CFM International over the past two decades. After an extended 20 year period of research and development on a new architecture that proved fruitful, P&W is poised for a market share rebound through the introduction of innovative, game changing technology.

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

Directory of U.S. Aircraft Engine ManufacturersDefunct Aircraft Engine Manufacturers of the United StatesAllison Aircraft Engines, Curtiss Aircraft Engines, Wright Aircraft Engines, Allison V-171University-Press.org

Most countries aspire to have a civil aircraft industry, but even in the best of times, success at civil aircraft manufacturing is difficult. Technological barriers, governments, and geopolitical considerations are only the beginning of the challenges faced by those aspiring to join the industry. In fact, only four companies in the world (Airbus, Boeing, Bombardier, and Embraer) have mastered manufacturing the extremely complex machines that are civil aircraft. In Entering the Civil Aircraft Industry: Business Realities at the Technological Frontier, Dr. Dean Roberts provides an insider’s perspective of this fascinating, multifaceted, and challenging industry using his more than thirty years of experience and interest in all aspects of the field. Using in-depth case studies, he examines the interplay of industrial policy, high technology, globalization, and business strategy on the field of civil jet aircraft manufacturing, seeking out the reasons for policy successes—and failures.

This document presents the results of an FAA investigation to determine the effects of using de-icing, as opposed to anti-icing, in aircraft turbine engine inlets. A literature search was conducted. Ice protection equipment technology was assessed. This report describes the icing/de-icing process, discusses de-ice system operation and performance and ice detector characteristics, and presents a method for determining the effects of the de- icing process on the turbine engine and its associated induction system. Keywords: Aircraft icing, De-icing systems, Ice detectors, Anti-icing. (MJM).

The high fuel prices of recent years have caused the operating cost of the airlines to soar. In an effort to bring down the fuel consumption, the major aircraft engine manufacturers are now taking a fresh look at open rotors for the propulsion of future airliners. Open rotors, also known as propfans or unducted fans, can offer up to 30 per cent improvement in efficiency compared to high bypass engines of 1980 vintage currently in use in most civilian aircraft. NASA Langley researchers have contributed significantly to the development of aeroacoustic technology of open rotors. This report discusses the current noise prediction technology at Langley and reviews the input data requirements, strengths and limitations of each method as well as the associated problems in need of attention by the researchers. We present a brief history of research on the aeroacoustics of rotating blade machinery at Langley Research Center. We then discuss the available noise prediction codes for open rotors developed at NASA Langley and their capabilities. In particular, we present the two useful formulations used for the computation of noise from subsonic and supersonic surfaces. Here we discuss the open rotor noise prediction codes ASSPIN and one based on Ffowcs Williams-Hawkings equation with penetrable data surface (FW - Hpds). The scattering of sound from surfaces near the rotor are calculated using the fast scattering code (FSC) which is also discussed in this report. Plans for further improvements of these codes are given. Farassat, Fereidoun Langley Research Center WBS:561581.02.08.07.18.03

Aircraft Financing and Leasing: Tools for Success in Aircraft Acquisition and Management provides researchers, industry professionals and students with a thorough overview of the skills necessary for navigating this dynamic field. The book details the industry’s foundational concepts, including aviation law and regulation, airline credit analysis, maintenance reserves, insurance, transaction cost modeling, risk management tools, such as fuel hedging, and the art of lease negotiations. Different types of aircraft are explored, highlighting their purposes, as well as when and why airline operators choose specific models over others. In addition, the book also covers important factors, such as maintenance reserve development, modeling financial returns for leased aircraft, and appraising aircraft values. Most chapters feature detailed case studies, applying concepts to actual industry circumstances. Users will find this an ideal resource for practitioners or as an outstanding reference for senior undergraduate and graduate students. Presents the foundations of aircraft leasing and financing, including aviation law and regulation, airline credit analysis, maintenance reserves, insurance, transaction cost modeling, and more Provides an overview of the different types of aircraft, their purposes, and when and why operators choose specific models over others Offers a blend of academic and professional views, making it suitable for both student and practitioner Serves as an aircraft finance and leasing reference for those starting their careers, as well as for legal, investment, and other professionals

From the pioneering glider flights of Otto Lilienthal (1891) to the advanced avionics of today’s Airbus passenger jets, aeronautical research in Germany has been at the forefront of the birth and advancement of aeronautics. On the occasion of the centennial commemoration of the Wright Brother’s first powered flight (December 1903), this English-language edition of Aeronautical Research in Germany recounts and celebrates the considerable contributions made in Germany to the invention and ongoing development of aircraft. Featuring hundreds of historic photos and non-technical language, this comprehensive and scholarly account will interest historians, engineers, and, also, all serious airplane devotees. Through individual contributions by 35 aeronautical experts, it covers in fascinating detail the milestones of the first 100 years of aeronautical research in Germany, within the broader context of the scientific, political, and industrial milieus. This richly illustrated and authoritative volume constitutes a most timely and substantial overview of the crucial contributions to the foundation and advancement of aeronautics made by German scientists and engineers.

This procedure is designed to provide for the aircraft, engine, turbosupercharger manufacturers, and other interested groups a guide for instrumenting, testing, and presenting the over-all characteristics of any engine-turbosupercharger installation.

The Navy methodology for predicting gas turbine engine production cost is developed from engine material content. This methodology is shown to be applicable to the principal engine manufacturers. Keywords include: Engine Cost, Gas Turbine.

To sustain in the vibrant field of civil aviation, the aircraft and engine manufacturers are in the pursuit of delivering efficient systems with the best economics. In umpteen scenarios of growing interest, engine maintenance cost due to scheduled maintenance is of importance. The current research is focused on estimation of the maintenance factors, such as severity and shop visit rate to study the operational scenarios and concurrent technologies. The severity, defined as relative engine damage is estimated by blending the aircraft performance, gas turbine performance, gas turbine design and life estimation methods towards transforming the thrust variation into life estimates, reflecting the severity on critical Life Limited Part (LLP) of an aircraft engine. The Shop Visit Rate (SVR) is predicted based on Exhaust Gas Temperature (EGT) margin consumption due to gas turbine performance degradation. The severity studies reveal that Hight Pressure Turbine (HPT) blade and disc are critical, depicting engine severity. Lower thrust engine severity is dominated by cyclic damage (low cycle fatigue) and large thrust engines by steady state damage (creep). The operational factors, take-off derate and Outside Air Temperature (OAT) have more sensitivity on severity of aircraft engines. The use of climb derate, reduces the damage on large thrust engines considerably, especially for three shaft engines. Cooling effectiveness and thermal barrier coating are important technological factors for reducing the severity level. The SVR prediction on lower and large thrust engines, depict the take-off EGT as a source for shop visits, governed by operational parameters such as takeoff derate, OAT, trip length and engine wash. The engine aging curves are represented as Weibull distribution based on severity and SVR. Severity estimation and shop visit prediction methodology, demonstrated through an integrated tool will serve as a decision making element for comparing competitive engines, operational strategies and engine technologies.

The Federal Aviation Administration (FAA) has been engaged in discussions with airframe and engine manufacturers concerning regulations that would apply to new technology fuel efficient "openrotor" engines. Existing regulations for the engines and airframe did not envision features of these engines that include eliminating the fan blade containment systems and including two rows of counter-rotating blades. Damage to the airframe from a failed blade could potentially be catastrophic. Therefore the feasibility of using aircraft fuselage shielding was investigated. In order to establish the feasibility of this shielding, a study was conducted to provide an estimate for the fuselage shielding weight required to provide protection from an open-rotor blade loss. This estimate was generated using a two-step procedure. First, a trajectory analysis was performed to determine the blade orientation and velocity at the point of impact with the fuselage. The trajectory analysis also showed that a blade dispersion angle of 3deg bounded the probable dispersion pattern and so was used for the weight estimate. Next, a finite element impact analysis was performed to determine the required shielding thickness to prevent fuselage penetration. The impact analysis was conducted using an FAA-provided composite blade geometry. The fuselage geometry was based on a medium-sized passenger composite airframe. In the analysis, both the blade and fuselage were assumed to be constructed from a T700S/PR520 triaxially-braided composite architecture. Sufficient test data on T700S/PR520 is available to enable reliable analysis, and also demonstrate its good impact resistance properties. This system was also used in modeling the surrogate blade. The estimated additional weight required for fuselage shielding for a wing- mounted counterrotating open-rotor blade is 236 lb per aircraft. This estimate is based on the shielding material serving the dual use of shielding and fuselage structure. If the shielding material is not used for dual purpose, and is only used for shielding, then the additional weight per aircraft is estimated to be 428 lb. This weight estimate is based upon a number of assumptions that would need to be revised when applying this concept to an actual airplane design. For example, the weight savings that will result when there is no fan blade containment system, manufacturing limitations which may increase the weight where variable thicknesses was assumed, engine placement on the wing versus aft fuselage, etc. Carney, Kelly and Pereira, Michael and Kohlman, Lee and Goldberg, Robert and Envia, Edmane and Lawrence, Charles and Roberts, Gary and Emmerling, William Glenn Research Center FUSELAGES; SHIELDING; AIRCRAFT DESIGN; FAN BLADES; TURBOFAN ENGINES; AIRFRAMES; WEIGHT MEASUREMENT; STRUCTURAL WEIGHT; COMPOSITE STRUCTURES; DYNAMIC STRUCTURAL ANALYSIS; WEIGHT (MASS); FINITE ELEMENT METHOD; BRAIDED COMPOSITES; PITCH (INCLINATION); AIRCRAFT SAFETY

Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 45. Chapters: Allison aircraft engines, Curtiss aircraft engines, Wright aircraft engines, Allison V-1710, Packard, Garrett AiResearch, Wright R-975, Wright R-790, Wright R-760, Wright R-3350 Duplex-Cyclone, Allison Engine Company, Curtiss OX-5, LeBlond Aircraft Engine Corporation, Wright R-540, Curtiss Aeroplane and Motor Company, Wright R-1820, Marquardt Corporation, Allison T40, Wright R-2600, Hall-Scott, Allison J33, Allison Model 250, Nelson Aircraft, Allison T56, Curtiss H-1640, Allison J35, Wright R-1300, Wright Aeronautical, Curtiss V-1570, Wright Company, Allison V-3420, Teledyne Turbine Engines, Kinner Airplane & Motor Corporation, Curtiss D-12, Lawrance Aero Engine Company, Wright J65, Curtiss K-12, Curtiss C-6, Allison TF41, Franklin Engine Company, Curtiss R-600, Allison T38, Westinghouse Aviation Gas Turbine Division, Wright R-2160, Aeromarine, Allison J71, Curtiss V-2, Fairchild Industries, Axelson, Curtiss OXX, Warner Aircraft Corporation, Curtiss A-2, Ranger/Fairchild Engines, Jacobs Aircraft Engine Company, Rolls-Royce J102, Reaction Motors. Excerpt: Packard was an American luxury-type automobile marque built by the Packard Motor Car Company of Detroit, Michigan, and later by the Studebaker-Packard Corporation of South Bend, Indiana. The first Packard automobiles were produced in 1899, and the last in 1958. Packard was founded by James Ward Packard (Lehigh University Class of 1884), his brother William Doud Packard and their partner, George Lewis Weiss, in the city of Warren, Ohio. James Ward Packard believed that they could build a better horseless carriage than the Winton cars owned by Weiss (an important Winton stockholder) and, being himself a mechanical engineer, had some ideas for improvement on the designs of current automobiles. The story goes: Packard was not completely satisfied with the Winton car...

It is the end of the Cold War. Defense markets begin to dwindle as the global community emerges into the new era of perestroika. Military engine manufacturers brace for the impact, and in a surge of survival instinct and shrewd business sense, one makes the transition into the commercial engine market and eventually surpasses the rest. Witness as GE Aircraft Engines moves from military markets to commercial ventures through the eyes of a 40-year company veteran. Robert Garvins enlightening history details the political and external forces affecting the engine industry and how GE avoided some of the problems posed by environmental politics. Much more than a memoir, "Starting Something Big" tracks GEs progress from the early 1950s to its present-day dominance in the global market. Interview accounts and anecdotes add personal flair to Garvins analysis of the long-term economic characteristics of the aircraft engine industry, including GEs contract with the U.S. Department of Commerce to help Russian aerospace engineers adapt and survive in civil markets. Youll learn, through Garvins experience, how to gain an edge in finding money for new programs, staying competitive in the production of commercial aircraft engines, and positioning your financial investorsand start something big of your own.

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).

An attempt is made to briefly review the aircraft engine bearing materials and to discuss some of the impact made from a cooperative and collaborative effort among parties involved, such as government agencies, academic communities, steel companies, research institutes, and users(aircraft engine manufacturers). NASA's impact on the GE bearing design and specifications has been mentioned as an example. Without this concentrated and coordinated effort, the success we are enjoying in current gas-turbine-engine technology would be impossible. This team approach is important and must be continued to advance technology, to achieve improved performance, and to achieve better efficiency and reliability.