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Planning the U.S. Aeronautics Technology Future

As of this writing, I counted six separately initiated exercises in the U.S. alone to plan the future direction of aeronautics R&D. I believe it would be of interest both to readers of and contributors to this Journal, to learn about some of these activities, and where they are taking us. I will limit my coverage to the topics of this Journal, although the planning activity is more extensive.

Before launching into the activities themselves, I would venture a guess as to why all the fuss about the future of aeronautics R&D. I maintain, as I detailed in last year's editorial, that aeronautics R&D activity—specifically of the type reported in this Journal—has not yielded significant gain for some time. Significant recent gains in aircraft performance and capability (e.g., stealth) have come from areas outside the scope of this Journal. Where are the breakthroughs in aerodynamics, structures, and subsystems? I am frequently asked, "Who are today's revolutionary innovators in these areas?" One answer could be that we have become a national community of specialists, strong contributors in their niche, but no one of which will discover or invent the modern equivalent of such major past breakthroughs as area ruling, supersonic flight, the helicopter, etc. Another question asked at these times (I asked it in last year's January Editorial) is, "Have we reached the knee of the curve in these aeronautics disciplines?" I would hope not, but as of yet I have received no challenge from Journal readers. I did propose then that multi-disciplinary "integration technology" and unsteady aerodynamics involving advanced vorticity management application were at least two of the remaining frontiers. Many papers have been received on the latter subject and will appear this year. Most address the fundamentals and must be transitioned into design application to bear fruit. This lack of innovation, demonstrated performance, capability, and cost reduction possibilities, etc., has not gone unnoticed by the Congress, the military departments, or the commercial sector. They wonder if the airplane has reached its terminal state of configuration and application maturity and if only minor refinements are to be expected in the future. Of course, the end of the Cold War has further impacted the R&D budget availability to support aeronautics R&D as well as all other R&D funded by DoD, thus fostering the intense interest in discovering the most important areas for aeronautics R&D support and how national resources can best be focused on them.

So we have recently seen the emergence of the DoD Technology Area Plans (TAPs) and associated Technology Development Approaches (TDAs) that focus cross-service planning. Of specific interest to this Journal is the *Air and Space Vehicles TAP* and associated TDAs. Here goals identified and prioritized by government/industry/academia Integrated Product Teams are laid out over the next 15 years. These goals focus (and will hopefully stabilize) national investment in military aircraft aerodynamic, flight control, structures, subsystems, maritime unique and integration technology for five families of fixed-wing aircraft and for rotorcraft. At the top of the fixed-wing list, for example, is "production cost at T1," a radical departure from classical "performance goals," which are not far behind, however, on the list. The process of identifying and directing the minimum set of specific national R&D programs toward achievement of these goals is now underway.

Another set of activities—independently initiated but fully harmonized with the DoD TAP/TDA process—stems from a review by the President's Office of Science and Technology Policy (OSTP) and the creation of a report by the National Science and Technology Council (NSTC) Coordinating Committee on Transportation Research and Development. The report from their Subcommittee on Aeronautics and aviation was prepared by the FAA, NASA, and DoD to support the Coordinating Committee generation of "Goals for a National Partnership in Aeronautics Research and Technology." The Subcommittee report delineates a set of goals for civil aeronautics, military aeronautics (fully aligned with TAP/TDA goals), and R&D infra-structure.

Still another major activity was started last year by the Air Force/Navy/Army-led Joint Aero Commanders Group. Group members also include Marines, Coast Guard, FAA, NASA, and ARPA. This activity is to prepare a three-volume Aviation S&T road map including the most comprehensive electronic database of aviation S&T programs among all JACG members ever developed. DoD programs show their connectivity to the aforementioned TAP/TDA goals and to warfighter needs. Fortunately this activity has been tied to the previously mentioned DoD TAP and NSTC activities.

Let me conclude this subject by mentioning yet another activity initiated this year by the Air Force Chief of Staff and the NASA Administrator to find areas for increased DoD/NASA cooperation. This includes space as well as aeronautics activities but covers all possible areas.

As the specific plans and goals of these activities become finalized and better known, I'll be asking contributors to address attainment of the goals through aggressive, challenging research—the best results of which will appear in these pages.

A second subject, also likely to be taking us into the future, is the resurgence of interest in Unmanned Air Vehicles (UAVs). The military services have now fully embraced the concept of UAVs to perform a range of missions formerly conducted with conventionally piloted aircraft. As of this writing, the Air Force is initiating a top-level study to determine the future utility of such vehicles beyond classical reconnaissance and cruise missile type roles. ARPA is also contributing to the emergence of radical designs already in service use. NASA is developing several concepts for Earth and air monitoring. My reason for mentioning this important new direction in aeronautics is to encourage significant contributions directed at the unique technology application concepts and issues that UAV designers and planners will need in the years ahead.

On a different matter, I received a letter recently from the chairman of one of the AIAA Technical Committees that serves as a source of many excellent articles. His concern was with the lengthy process and long time to publication. He suggested we might create a "fast track" priority publication process for papers nominated by that TC for Best Paper Award. I certainly have no problem with this idea, since it will help assure that the best papers in a given discipline appear in a timely manner. Many of the factors delaying publication can be quickly traced back to the lack of attention given by some authors to the "Information for Contributors" found on the inside back cover of any issue of the Journal. When authors follow these guidelines, reviewers have little problem reading and annotating text, tables, and figures, the compositors can decipher mathematics, readers will be able to locate references, etc. Preprints should be reformatted to comply with the standards given in the "Information for Contributors" before they are submitted for Journal publication.

I would like to complete this year's editorial with some well deserved recognition of both the volunteer and professional staff. Beginning with the volunteers, my dedicated staff of Associate Editors appears as the 1996 team following this editorial. They know how to help you transform your excellent manuscripts into archival quality papers.

The International Board of Editors continues to be alert to outstanding material from their respective countries and serves to help authors develop good manuscripts. Bellur Nagabhushan, one of my Associate Editors, serves as the Associate for the International Board of Editors. Send him your good ideas on attracting international papers in the subject areas of interest to you.

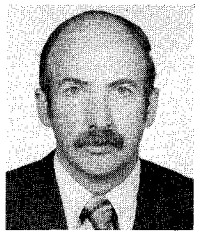
The Editorial Advisory Board was formed in 1993 to represent those AIAA Technical Committees most active in areas within the Journal scope. They encourage publication of good meetings papers in this Journal. I will begin placing their best paper award nominees on a fast track to assure that the best material is published with minimum delay.

The names of last year's Reviewers also appear in this issue. They provide the critical reviews that result in the maximum possible time value of the papers that are accepted. They also provide valuable input to authors of declined papers regarding rebuttal suggestions or future submissions. *JA* would not exist but for the dedicated, insightful work of these Reviewers.

Now for the professional staff. Norma Brennan, AIAA Publications, ably directs all Journal activity in AIAA. Yet she has time to provide encouragement, answer numerous questions, and provide inspiration to me and my Associate Editors. Jacqueline Dupree served as our Managing Editor. To say she personifies enthusiasm is certainly an understatement. Her innovation and impatience with the status quo have earned her a promotion to Production Editor for a variety of AIAA products, not just the journals. Jason Peak has been of great help in guiding the Associate Editors to avoid delays and cost impacts due to re-work. He has recently taken on the Managing Editor duties of the Journal.

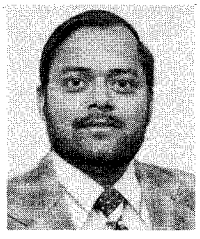
Thomas M. Weeks
Editor-in-Chief

Editor-in-Chief

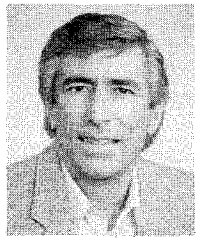


THOMAS M. WEEKS completed his degree work at Syracuse University, Department of Mechanical and Aerospace Engineering, in 1965. He entered active commissioned service that year, assigned to the Air Force Flight Dynamics Lab at Wright–Patterson AFB, Ohio. His initial work was in the area of electrogasdynamics at the nearly completed 50 MW facility. In 1968, he separated from the Air Force but remained at the same location working as a civilian. He was assigned in 1972 to the Analysis Group attached to the Aeromechanics Staff working on transonic wind tunnel wall interference. In 1976, he became Technical Manager of the External Aerodynamics Group of the Aerodynamics and Airframe Branch. He then served as deputy and acting manager of the X-29 Advanced Technology Development Program. He is currently Chief of Technology Strategy in the Flight Dynamics Directorate of Air Force Wright Aeronautical Laboratory. Dr. Weeks is an Associate Fellow of AIAA.

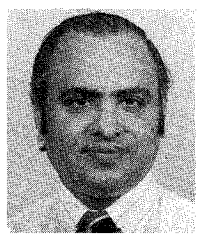
Associate Editors



RAMESH K. AGARWAL is currently the Bloomfield Distinguished Professor and Chairperson of the Department of Aerospace Engineering at Wichita State University in Wichita, Kansas. From 1978 to 1994, he was with McDonnell Douglas Aerospace in St. Louis where he was a McDonnell Douglas Fellow. He received a B.S. in Mechanical Engineering from the Indian Institute of Technology, Kharapur, India, in 1968; an M.S. in Aeronautical Engineering from the University of Minnesota in 1969; and a Ph.D. in Aeronautical Sciences from Stanford University in 1975. Dr. Agarwal has worked in all aspects of CFD, namely, grid generation, adaptive and multigrid methods, solution of nonlinear potential, Euler, and Navier-Stokes equations, viscous-inviscid interactions, boundary-layer flows, and turbulence modeling. He has also worked in other areas of computational aerosciences such as computational aero-acoustics, computational electromagnetics, parallel processing, and CFD-based expert systems. The author of over 100 articles and papers, Dr. Agarwal has been an Affiliate Professor of Mechanical Engineering at Washington University, St. Louis, since 1986. He is a Fellow of the AIAA; and has served on its Fluid Dynamics Technical Committee from 1986 to 1989, and on the AIAA Multidisciplinary Optimization Committee from 1991 to 1992. He is also an AIAA Distinguished Lecturer for 1994 to 1995.



MARTIN E. BEYERS is currently Head of the Aircraft Aerodynamics Group, Applied Aerodynamics Laboratory, at the National Research Council of Canada. Before joining the NRC in 1979 he was Head of the Flight Mechanics Division of NIAST, CSIR, South Africa. He received his Ph.D. from the University of the Witwatersrand, Johannesburg, in 1978. Dr. Beyers has served on the AIAA Technical Committees on Atmospheric Flight Mechanics and Applied Aerodynamics. He was a member of AGARD FDP Working Group 11 and technical editor of its final report. He is presently a coordinator of AGARD FDP Working Group 16, and Canadian National Leader on HTP-5, the TTCP panel on Manoeuvring Aerodynamics. He has conducted extensive research on high-alpha unsteady aerodynamics and free-flight dynamics, introducing a number of new wind-tunnel dynamic testing concepts, and recently initiated research projects on maneuvering aerodynamics, dynamic ground effects, and aerodynamics of contaminated wings. He is a Fellow of the Canadian Aeronautics and Space Institute, Fellow of the South African Institute of Aerospace Engineering, and the author of over 70 articles and papers.

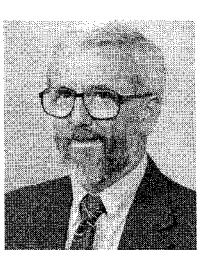


INDERJIT CHOPRA is a Professor of Aerospace Engineering and Director for the Center for Rotorcraft Education and Research at the University of Maryland. He received a B.Sc. in Engineering from Punjab Engineering College, Chandigarh, India, in 1965; an M.E. from Indian Institute of Science, Bangalore, India, in 1968; and a Sc.D. from the Massachusetts Institute of Technology in 1977. He worked at the National Aeronautical Laboratory in Bangalore from 1966 to 1974. His research there included aeroelastic wind tunnel testing of scaled models of airplanes and launch vehicles. At MIT, he worked on aeroelastic analysis of wind turbine rotors for his doctoral dissertation. In 1977, he joined NASA Ames/Stanford University Joint Institute of Aeronautics and Acoustics, where he researched aeroelastic analysis of advanced rotor systems and dynamic testing of full-scale helicopters in the NASA Ames 40 x 80 ft wind tunnel. In 1981, he joined the University of Maryland. He has been working on problems related to helicopter dynamics, including aeromechanical stability, smart structures applications, active vibration control, structural health monitoring, composite blade modeling, and aeroelastic optimization. An author of over 120 articles and papers, Dr. Chopra was also an Associate Editor of the *Journal of the American Helicopter Society* and a member of the editorial advisory board of *Vertica, The International Journal of Rotorcraft and Powered Lift Aircraft*. He is a Fellow of AIAA.

ROBERT E. DUFFY is currently president of RED Associates, a recently formed research and consulting firm. A former member of the faculty of the Department of Mechanical Engineering, Aeronautical Engineering, and Mechanics at Rensselaer Polytechnic Institute, he was for a number of years the chairman of the aeronautical engineering academic program. He is the author of over 50 published papers and research reports in the areas of applied aerodynamics, flight mechanics, and experimental fluid dynamics. Dr. Duffy has served as a consultant to numerous governmental agencies, industrial concerns, and individuals. He is a past member of the Atmospheric Flight Mechanics technical committee and is an Associate Fellow of AIAA.

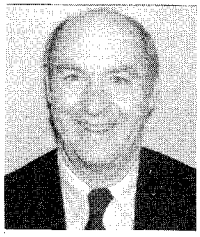
FRANKLIN E. EASTEP is a Professor, the Director of Aerospace Engineering, and the Associate Dean for Graduate Engineering at the University of Dayton. He received a B.S. from Ohio State University in 1958, an M.S. in Aeronautical Engineering from the Air Force Institute of Technology in 1963, and a Ph.D. in Aeronautics and Astronautics from Stanford University in 1968. Dr. Eastep has been teaching and conducting research within the technical areas of structural dynamics, aeroelasticity, and unsteady aerodynamics since 1968. During this period, he has been the principal thesis advisor for 15 doctoral students and over 35 master's students. He served on active duty with the U.S. Air Force for 20 years, retiring in 1978. Dr. Eastep is a member of the American Academy of Mechanics and an Associate Fellow of AIAA.

THOMAS N. FARRIS received his BSME from Rice University in 1982. His graduate education was at Northwestern University in Theoretical and Applied Mechanics leading to a Ph.D. in 1986 at which time he joined the School of Aeronautics and Astronautics of Purdue University, where he is now a Professor, teaching courses in tribology, structural analysis, plates and shells, finite elements, and elasticity. He spent the summer of 1991 on a Japan Society for the Promotion of Science Fellowship and the fall of 1991 as a sabbatical visitor to the Cambridge University Engineering Department. He has made contributions in using fracture mechanics to explain the material removal mechanism in the fine finishing of ceramic materials and various aspects of contact fatigue. These contributions led to support by NSF through a Presidential Young Investigator Award in 1990 and the ASME Burt L. Newkirk Award in 1992. His present research interests are in the areas of manufacturing processes including grinding, hard turning, superfinishing, and heat treatment as well as fretting fatigue of aging aircraft.

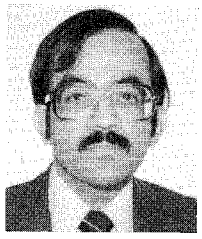


RONALD A. HESS received his B.S., M.S., and Ph.D. degrees in Aerospace Engineering from the University of Cincinnati in 1965, 1967, and 1970, respectively. After completing his doctoral work, he joined the faculty of the Department of Aeronautics at the Naval Postgraduate School in Monterey, California. In 1976, he joined the staff of the Flight Systems Research Division at NASA Ames Research Center. At NASA he conducted research in the areas of aircraft handling qualities, control/display analysis and design, and manual control. In 1982, he joined the faculty of the Department of Mechanical Engineering at the University of California, Davis, where he is currently a Professor in the Department of Mechanical, Aeronautical, and Materials Engineering. His current research interests lie in the areas of automatic and manual control of aircraft and in man/machine systems. Dr. Hess is an Associate Fellow of the AIAA, a member of the IEEE, Sigma Xi, and Tau Beta Pi, and is an Associate Editor of the *IEEE Transactions on Systems, Man, and Cybernetics*. He is a Vice-President of the IEEE Systems, Man, and Cybernetics Society and chairman of the Society's Manual Control Technical Committee. He is a member of the Technical Committee on Atmospheric Flight Mechanics of AIAA.

HARRY H. HEYSON earned his B.Ae.E., cum laude, at the Polytechnic Institute of Brooklyn in 1949. He received his M.S. in Aeronautical Engineering from Virginia Polytechnic Institute in 1958. He joined the staff of NACA's Langley Laboratory in 1949. His research at NACA and NASA has resulted in 75 papers on the theoretical and experimental aspects of helicopters and V/STOL induced flowfields, ground effects, and wind tunnel wall effects, as well as on innovative new aircraft concepts. He is a frequent lecturer in university short courses and helicopter safety seminars. After a brief period as an Associate at the Hampton Division of Eagle Engineering, Mr. Heyson has established his own consulting practice specializing in helicopter and V/STOL aerodynamics and wind tunnel wall effects. Mr. Heyson is an Associate Fellow of AIAA and a member of the American Helicopter Association.



KENNETH J. HOLT retired from the McDonnell Douglas Corporation in 1990. He had been involved in flight test operations and marketing. He received his B.Sc. from Hampton University in Virginia and his M.B.A. from the University of Missouri, St. Louis. He served 20 years in the U.S. Air Force and retired as Lieutenant Colonel and a Command Pilot. His background is in fighters, having flown the F-86, F-100, F-4, F-15, and F-18, and also tours in the Air Training Command and Strategic Air Command. He joined McDonnell in 1973. There he flew production test flights and was the company's interface with the military and Federal Aviation Administration for test flights. He developed much of the flight test operating procedures for the F-18 and AV8B, and was the McDonnell flight operations consultant to the Government Aircraft Factory F-18 facility at Avalon, Australia. He retired from active flying in 1984. Mr. Holt served as chairman of the Aircraft Operations Technical Committee from 1985–87. He is a Member of AIAA.



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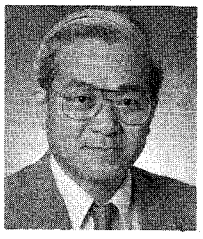
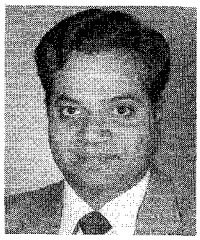


CHING F. LO is a Professor of Aerospace and Mechanical Engineering at the University of Tennessee Space Institute. He received his B.S. from National Taiwan University, Taipei, Taiwan, in 1959 and his M.S. and Ph.D. degrees from Cornell University in 1964 and 1967, respectively. He joined the research staff of Arnold Engineering Development Center at Arnold Air Force Base, Tennessee, in 1967. His research involved the development of aerodynamic ground test facilities and testing techniques including Reynolds number effects and wind tunnel wall interference technology for various types of wind tunnels from low speed V/STOL to transonic, supersonic speed and adaptive wall tunnel. He has been responsible for the application of Artificial Intelligence (AI) technology to wind tunnel facilities. As a senior research fellow at NASA in 1987, he initiated an AI application program for the operation of the NASA/ARC wind tunnel facilities in the Aerodynamics Division. He assumed his present position at the University of Tennessee in 1988. Dr. Lo's current interest concerns the development of AI/expert systems for wind tunnel facilities and Space Shuttle, engineering monitoring expert systems, neural network based systems for propulsion, and tunnel wall interference. He is a member of AIAA and a member of the American Association for Artificial Intelligence.



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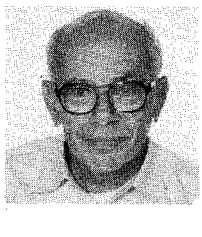

MURRAY TOBAK is a Senior Staff Scientist at NASA Ames Research Center. He has degrees from the University of California and Stanford University, and has been a Research Scientist at NACA–NASA Ames Research Center since 1948. He has specialized in theoretical studies of fluid and flight dynamics of high-speed aircraft and missiles. His studies have been aimed at identifying problems in nonlinear dynamics, flow stability, 3D separated flow, and vortex phenomena requiring basic research and new analytical and experimental tools for their solution. He is an Ames Associate Fellow and has received NASA's Exceptional Service Award.