

## Henry McDonald

### Education

*D. Sc.* Engineering, University of Glasgow (Scotland) 1965

*B. Sc.* Aeronautical Engineering, *with Honors*, University of Glasgow (Scotland) 1960

### Employment

*Director*, Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering, University of Tennessee at Chattanooga, 2005-present

*Distinguished Professor, Chair of Excellence in Engineering*, University of Tennessee at Chattanooga, 2002-present

*Interim Vice President of Research*, University of Tennessee System, June – December 2003

*Center Director*, NASA Ames Research Center, Moffett Field, California, 1996-2002

*Professor of Computational Engineering*, Mississippi State University, Starkville, Mississippi, 1997-2002

*Professor of Mechanical Engineering and Assistant Director, Computational Sciences*, Pennsylvania State University Applied Research Laboratory, University Park, Pennsylvania, 1991-1997

*Founder, President and Chief Executive Officer*, Scientific Research Associates, Inc., Glastonbury, Connecticut, 1976-1992

*Co-Founder*, Advanced Pulmonary Technologies, Inc., Glastonbury, Connecticut, 1988-1992

*Professor in Residence, Mechanical Engineering*, University of Connecticut, Storrs, Connecticut, 1985-1989

*Chief, Gas Dynamics Section*, United Technologies Research Center, East Hartford, Connecticut, 1972-1976

*Supervisor, Theoretical Gas Dynamics Group*, United Technologies Research Center, East Hartford, Connecticut, 1968-1972

*Research Engineer, Theoretical Gas Dynamics Group*, United Technologies Research Center, East Hartford, Connecticut, 1965-1968

*Engineer, Aerodynamics Department*, British Aircraft Corporation, Warton, England 1960-1965

### Academic Specialties

Supercomputing

Information Technology

Artificial Intelligence Applications

Computational Fluid Dynamics

Bio/Information Nanotechnologies

### Courses and Lectures

#### Invited Named Lectures:

Polytechnic University of Hong Kong Distinguished Lecture Series (1997)

The Shoda Memorial lecture, Glasgow, Scotland (1999)

The Quick-Goethert Memorial Lecture, Aachen, Germany, 2002

The Tom Davis Memorial Lecture, Cincinnati, Ohio

#### Short Courses/Continuing Education Courses:

Undergraduate, graduate, and postgraduate courses in Brussels, Belgium; Taipei, Taiwan; Tokyo, Japan; San Jose, California; Los Angeles, California; and Ames, Iowa.

Lecturer, ASME International Gas Turbine Institute Course on Turbomachinery

#### Seminars/Presentations (partial listing):

University of Glasgow

University of London/Imperial College

University of Waterloo, Canada

State University of New York, Buffalo  
California State University, Long Beach  
Massachusetts Institute of Technology  
Iowa State University  
Arizona State University  
Pennsylvania State University  
NASA Ames Research Center  
NASA Langley Research Center  
NASA Marshall Space Flight Center

## **Honors and Awards**

American Institute of Aeronautics and Astronautics, Honorary Fellow, 2008  
Royal Academy of Engineering, Fellow, 2003  
National Academy of Engineering, 2001  
NASA Distinguished Service Medal, 2001  
NASA Outstanding Leadership Medal, 1997, 2000  
NASA Group Achievement Award, Shuttle Independent Assessment Team, 2001  
Honorary Doctor of Engineering Degree, University of Glasgow, 1997  
Small Business of the Year Award for High Technology, State of Connecticut, 1989  
Connecticut Academy of Science & Engineering, 1990  
Honorary Member, American Society of Mechanical Engineers, 2001

## **Advisory Boards and Panels, Academic Appointments**

Air Force Scientific Advisory Board, 2008  
Chair of Excellence in Engineering, University of Tennessee at Chattanooga, 2002-present  
NASA Senior Management Council, 1996–2002  
Chair, Review of the Aerodynamics Issues on the V-22 Osprey, 2001  
Chair, Space Shuttle Independent Assessment Team, 2000  
Governor's Committee on High Technology, State of Connecticut  
Advisory Committee, Department of Aeronautical Engineering, Stanford University  
Advisory Committee for Faculty of Engineering, University of California at Davis  
Special Review of the Titan IV Test Failure, U.S. Air Force/Martin Marietta, 1991  
Advisory Group on Cold Flow Testing, NASA Marshall Flight Center, 1987-1991  
Review Panel on Challenger AFT Field Joint CFD Predictions, NASA/Morton Thiokol, 1987  
Special Review Panel on Blade Cracking in the SSME Turbine, NASA/Rocketdyne, 1986-1987  
Visiting Faculty Member, Department of Mechanical Engineering, Hong Kong Polytechnic University  
Visiting Faculty Member, Department of Mechanical Engineering, Imperial College, University of London  
Engineering Research Center Advisory Board, Mississippi State University, 1996-2000  
External Examiner, Department of Mechanical Engineering, University of Waterloo, Canada, 1986  
Chair, Advisory Panel on Computational Continuum Dynamics, U.S. Army Ballistics Research Laboratory, 1979  
Advisory Committee on Computational Fluid Dynamics of Turbomachinery, NASA Lewis Research Center, 1978  
Senior Research Fellow, University of Glasgow, Scotland, 1975–1976  
Tenure Review Committee, Department of Engineering, State University of New York, 1974

## **Professional Associations**

Royal Academy of Engineering, Fellow, 2003  
National Academy of Engineering, Peer Committee, Aerospace Engineering, 2003-Present  
American Institute of Aeronautics and Astronautics, Fellow, Associate Technical Editor, AIAA Journal, 1981-1984  
American Society of Mechanical Engineers, Fellow  
Royal Aeronautical Society (UK), Fellow  
Governors Advisory Council for High Technology, State of Connecticut, 1989–1990  
Connecticut Innovations (a wholly owned State of Connecticut Corporation for funding high technology), Board of Directors

## Reviewer

ASME Journal of Engineering  
ASME Journal of Gas Turbines and Power,  
ASME Journal of Fluids Engineering  
ASME Journal of Heat Transfer  
AIAA Journal  
AIAA Journal of Propulsion and Power  
Journal of Computational Physics  
Journal of Fluid Mechanics  
International Journal of Heat and Mass Transfer  
The Aeronautical Quarterly  
National Science Foundation  
Department of Energy  
Army Research Office  
NASA  
Strategic Defense Initiative, Office of Innovative Science and Technology

## Publications

### Book Chapters

1. Henry McDonald, "Observations on the Columbia Accident," *Organization at the Limit, Lessons from the Columbia Disaster*, Edited by W. H. Starbuck and M. Farjoun, Blackwell Publishing, pp. 336-346, 2005.
2. McDonald, H. and Briley, W.R.: A Survey of Some Recent Work on Interacted Boundary Layer Theory for Flow with Separation: *Numerical and Physical Aspects of Aerodynamic Flows II*, Edited by T. Cebeci, Springer Verlag, New York, pp. 141-162, 1984.
3. McDonald, H. and Briley, W.R.: Some Observations on Numerical Solution of the Three Dimensional Navier Stokes Equations: *Numerical and Physical Aspects of Aerodynamic Flows*, Edited by T. Cebeci, Springer Verlag, New York, pp. 99-120, 1982.
4. McDonald, H., Shamroth, S.J. and Briley, W.R.: Transonic Flows with Viscous Effects. Transonic, Shock, and Multidimensional Flows: *Advances in Scientific Computing*, Academic Press, Inc., 1982.
5. McDonald, H., "Combustion modeling in two and three dimensions – Some numerical considerations." *Progress in Energy and Combustion Science*, Vol 5, No. 2, (1979) pp. 97-122.

### Journal Articles

1. Briley, W.R. and McDonald, H.: An Overview and Generalization of Implicit Navier-Stokes Algorithms and Approximate Factorization. *Computers and Fluids*, 30, pp. 807-828, 2001.
2. Thompson, B.E., Senald, J., Vafidis, C., Whitelaw, J.H., McDonald, H., "Flow in a model of the Space Shuttle Main Engine main injector bowl," *AIAA Journal of Spacecraft and Rockets*, vol. 29, (Mar-Apr 1992), p. 247-252.
3. Liu, N.S., Shamroth, S.J., McDonald, H., "Reciprocal interactions of hairpin-shaped vortices and a boundary layer," *AIAA Journal*, vol. 29, (May 1992), p. 720-727.
4. Govindan, T.R., Briley, W.R., McDonald, H., "General three-dimensional viscous primary/secondary flow analysis," *AIAA Journal*, vol. 29, (March 1991), p. 361-370.
5. Sabnis, J.S., Gibeling, H.J., McDonald, H., "Navier-Stokes analysis of solid propellant rocket motor internal flows," *Journal of Propulsion and Power*, Vol. 5, (Nov-Dec 1989), pp. 657-664.
6. Briley, W. R., and McDonald, H.: Three Dimensional Viscous Flows with Large Secondary Velocity. *Journal of Fluid Mechanics*, **144**: 47-77, 1984.
7. J. P. Kreskovsky, Briley, W.R. and McDonald, H.: Investigation of Mixing in a Turbofan Exhaust Duct, Part I: Analysis and Computational Procedure. *AIAA Journal*, **22**(3): 374-382, 1984.
8. S. J. Shamroth, McDonald, H. and Briley, W. R.: Prediction of Cascade Flow Fields Using the Averaged Navier Stokes Equations. *Journal of Engineering for Gas Turbines and Power*, **106**: 383-390, 1984.
9. Briley, W.R., McDonald, H., Shamroth, S.J., "A low Mach number Euler formulation and application to time-iterative LBI schemes (Linearized Block Implicit)." *AIAA Journal*, Vol. 21, (Oct. 1983), pp. 1467-1469.
10. Briley, W.R., McDonald, H., "On the structure and use of linearized block implicit schemes." *Journal of Computational Physics*, Vol. 34, (Jan 1980), pp. 54-73.
11. Briley, W.R., McDonald, H., "Solution of the multidimensional compressible Navier-Stokes equations by a generalized implicit method." *Journal of Computational Physics*, Vol. 24, (Aug. 1977), pp. 372-397.

12. McDonald, H., Briley, W.R. "Three-dimensional supersonic flow of a viscous or inviscid gas." *Journal of Computational Physics*, Vol. 19, (Oct. 1975), pp. 150-178.
13. Briley, W.R. and McDonald, H.: Numerical Prediction of Incompressible Separation Bubbles. *Journal of Fluid Mechanics*, **69**(4): 631-656, 1975.
14. Shamroth, S.J., McDonald, H., "Application of a transitional boundary-layer in the low hypersonic Mach number regime." *International Journal of Heat and Mass Transfer*, Vol. 18 (Nov. 1975), pp. 1277-1284.
15. McDonald, H., Kreskovsky, J.P., "Effect of free stream turbulence on the turbulent boundary layer." *International Journal of Heat and Mass Transfer*, Vol. 17, (Jul. 1974), pp. 705-716.
16. McDonald, H., Fish, R.W., "Practical calculations of transitional boundary layers." *International Journal of Heat and Mass Transfer*, Vol. 16, (Sept. 1973) pp. 1729-1744.
17. Shamroth, S.J., McDonald, H., "Application of a time-independent boundary-layer analysis to the problem of dynamic stall." *ASME, Transactions Journal of Applied Mechanics*, Vol. 39 (Sept. 1972), pp. 823-825.
18. Shamroth, S.J., McDonald, H., "A new solution of the turbulent near-wake recompression problem. (Crocco-Lee theory extension to flow behavior prediction for two dimensional supersonic turbulent near wake behind bluff body during recompression)." *Aeronautical Quarterly*, Vol. 23, (May 1972), pp. 121-130.
19. McDonald, H., Shamroth, S.J., "An analysis and application of the time-dependent turbulent boundary-layer equations (Two dimensional compressible turbulent boundary layer with time dependent mean velocity and density fields, deriving momentum and kinetic energy integral equations)." *AIAA Journal*, Vol. 9 (Aug. 1971), pp. 1553-1560.
20. McDonald H., "Linear stress distribution and the turbulent boundary-layer equations of motion." *Physics of Fluids*, Vol. 12, (Nov. 1969), pp. 2241-2247.
21. McDonald, H., "The departure from equilibrium of turbulent boundary layers." *Aeronautical Quarterly*, Vol. 19, (Feb. 1968), pp. 1-19.
22. Maise, G., McDonald, H., "Mixing length and kinematic eddy viscosity in a compressible boundary layer." *AIAA Journal*, Vol. 6 (Jan. 1968), pp. 73-80.
23. McDonald, H., "Turbulent shear layer re-attachment with special emphasis on the base pressure problem." *Aeronautical Quarterly*, Vol. 15, (Aug. 1964), pp. 247-280.

#### **Conference Papers and Proceedings**

1. McDonald, H., and Whitfield, D.L., "Self-Propelled Maneuvering Underwater Vehicles," Twenty-First Symposium on Naval Hydrodynamics, Trondheim, Norway, June 24-28, 1996.
2. DeJong, F.J., Sabnis, J.S., Buggeln, R.C., McDonald, H., "Hypersonic flow calculations with a hybrid Navier-Stokes/Monte Carlo method," AIAA paper 90-1691. AIAA/ASME 5<sup>th</sup> Thermophysics and Heat Transfer Conference, Seattle, WA, (June 18-20, 1990), p. 15.
3. Liu, N.S., Shamroth, S.J., McDonald, H., "Reciprocal interactions of hairpin-shaped vortices and a boundary layer," AIAA Paper No. 90-0017, AIAA, 28<sup>th</sup> Aerospace Sciences Meeting, Reno, NV, (Jan 8-11, 1990), p. 11.
4. Thompson, B.E., Senaldi, J., Vafidis, C., Whitelaw, J.H., McDonald, H., "Flow in a model of the SSME main injector bowl," Scientific Research Associates Report No. SE254832; Proceedings of the 1<sup>st</sup> Canadian Symposium of Aerodynamics, Ottawa, Canada, (Dec 1989), Canadian Aeronautics and Space Institute, 1989, p. 30-1 to 30-22
5. Sabnis, J.S., Madabhushi, R.K., Gibeling, H.J., McDonald, H., "On the use of k-epsilon turbulence model for computation of solid rocket internal flows," AIAA Paper No. 89-2558, AIAA/ASME/SAE/ASEE 25<sup>th</sup> Joint Propulsion Conference, Monterey, CA (July 10-13, 1989), p. 12.
6. Briley, W.R., Buggeln, R.C., McDonald, H., "Solution of the incompressible Navier-Stokes equations using artificial compressibility methods." Proceedings of the 11<sup>th</sup> International Conference on Numerical Methods in Fluid Dynamics, Berlin and New York, Springer-Verlag (1989), pp. 156-160.
7. Roscoe, D.V., Buggeln, R.C., Foster, J.A., McDonald, H., "A numerical investigation of fluid flow for disk pumping applications." Proceedings of the ASME Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, Netherlands, (June 88) p. 10.
8. Govindan, T.R., McDonald, H., "Computation of tip and corner region flows." AGARD Computation of Three-Dimensional Boundary Layers Including Separation, (Feb. 87) p. 20.
9. Sabnis, J.S., Gibeling, H.J., McDonald, H., "Navier-Stokes analysis of two- and three-dimensional flow field in solid rocket motors with segment joints." AIAA/SAE/ASME/ASEE, 23<sup>rd</sup> Joint Propulsion Conference, San Diego, CA (Jul. 1987), p. 11.

10. Sabnis, J.S., Gibeling, H.J., McDonald, H., "A combined Eulerian-Lagrangian analysis for computation of two-phase flows." AIAA Paper 87-1419, AIAA 19<sup>th</sup> Fluid Dynamics, and Lasers Conference, Honolulu, HI (Jun. 1987), p. 10.
11. Kim, Y.N., Buggeln, R.C., McDonald, H., "Numerical analysis of some supersonic viscous flows related to inlet and nozzle systems." AIAA Paper 86-1597, AIAA/ASME/SAE/ASEE 22<sup>nd</sup> Joint Propulsion Conference, Huntsville, AL (June 1986), p. 13.
12. Brondum, D.C., Bennett, J.C., Weinberg, B.C., McDonald, H., "Numerical and experimental investigation of nonswirling and swirling confined jets." AIAA 24<sup>th</sup> Aerospace Sciences Meeting, Reno, NV, (Jan. 1986), p. 15.
13. Buggeln R.C., Briley, W.R., Shamroth, S.J. and McDonald, H.: Solution of the Three Dimensional Navier Stokes Equations for Turbine Flows. 1st World Congress on Computational Mechanics (Univ. Texas, Austin TX), 1986.
14. Liu, N.S., Shamroth, S.J., McDonald, H., "On hairpin vortices as model of wall turbulence structure." Proceedings of the 5<sup>th</sup> Symposium on Turbulent Shear Flows, University Park, PA. (1985) p. 2.1-2.6.
15. Weinberg, B.C., Yang, R.J., McDonald, H., Shamroth, S.J., "Calculations of two and three-dimensional transonic cascade flow fields using the Navier-Stokes equation." ASME paper 85-GT-66, ASME 30<sup>th</sup> International Gas Turbine Conference and Exhibit, Houston, TX, (Mar 1985) p. 10.
16. Roscoe, D.V., Gibeling, H.J., McDonald, H., Shamroth, S.J., "Development of a Navier-Stokes analysis to investigate the mechanism of shock/wave boundary layer interactions." AIAA 3<sup>rd</sup> Symposium on Numerical and Physical Aspects of Aerodynamic Flows, Long Beach, CA (Jan. 1985), p.p. 4-15 – 4-23.
17. Briley, W.R., Buggeln, R.C., McDonald, H., "Solution of the three-dimensional Navier-Stokes equations for a steady laminar horseshoe vortex flow." Proceedings of the AIAA 7<sup>th</sup> Computational Fluid Dynamics Conference, Cincinnati, OH (July 1985), pp. 299-312.
18. Lin, S.J., Briley, W.R., McDonald, H., "Numerical study of three-dimensional viscous flows with system rotation." AIAA 18<sup>th</sup> Fluid Dynamics and Plasmadynamics and Lasers Conference, Cincinnati, OH (Jul. 1985), p. 13.
19. Sabnis J.S., Gibeling, H.J., McDonald, H., "Calculation of solid propellant rocket motor internal flow field using an implicit Navier-Stokes procedure." AIAA 18<sup>th</sup> Fluid Dynamics and Plasmadynamics and Lasers Conference, Cincinnati, OH (Jul. 1985), p. 7.
20. Weinberg, B.C., McDonald, H., Shamroth, S.J., "A solution procedure for two- and three-dimensional unsteady viscous flows." AIAA 23<sup>rd</sup> Aerospace Sciences Meeting, Reno, NV (Jan. 1985), p. 15.
21. Sabnis, J.S., Gibeling, H.J., McDonald, H., "Internal fluid mechanism of solid propellant rocket motors. " Proceedings of 21<sup>st</sup> JANNAF Combustion Meeting, (Oct 1984) Vol. 1 p.p. 195-205
22. Briley, W.R. and McDonald, H.: Three Dimensional Viscous Flows with Large Secondary Velocity. *ASME Symposium on Computation of Internal Flows: Methods and Applications* (New Orleans, LA), 1984.
23. Liu, N.S., Shamroth, S.J., McDonald, H., "Numerical solution of the Navier-Stokes equations for compressible turbulent two/three dimensional flows in the terminal shock region of an inlet/diffuser." AIAA Paper 83-1892, AIAA 6<sup>th</sup> Computational Fluid Dynamics Conference, Danvers, MA (Jul. 1983), pp. 61-71. 45.
24. Levy, R., Briley, W.R. and McDonald, H.: Viscous Primary/Secondary Flow Analysis for Use with Nonorthogonal Coordinates, *AIAA Paper No. 83 0556* (21st Aerospace Sciences Meeting, Reno, NV), 1983.
25. Shamroth, S.J., McDonald, H. and Briley, W.R.: Application of a Navier Stokes Analysis to Transonic Cascade Flow Fields. *ASME Paper 82 GT 235*, 1982.
26. Kreskovsky, J.P., Briley, W.R, McDonald, H., "Analysis and computation of three-dimensional flow in strongly curved ducts." ASME Winter Annual Meeting, Washington, D.C., (Nov 1981) (A82-29001 13-02); American Society of Mechanical Engineers, (1981) pp. 129-140.
27. R. Levy, H. McDonald and W. R. Briley: A Three Dimensional Turbulent Compressible Subsonic Duct Flow Analysis for Use with Constructed Coordinate Systems. *AIAA Paper No. 80 1398*, AIAA 13th Fluid and Plasma Dynamics Conference (Snowmass, CO), 1980.
28. Briley, W.R., McDonald, H., "Computation of three-dimensional horseshoe vortex flow using the Navier Stokes equations." 7<sup>th</sup> International Conference on Numerical Methods in Fluid Dynamics, Stanford and Moffett Field, CA (Jun. 1980). Published Berlin and New York, Springer-Verlag (1981) pp. 91-98.
29. Buggeln, R.C., Briley, W.R., McDonald, H., "Solution of the Navier-Stokes equations for three-dimensional turbulent flow with viscous sublayer resolution." AIAA paper 81-1023, Proceedings of the AIAA 5th Computational Fluid Dynamics Conference, Palo Alto, CA, June 1981. Collection of Technical Papers (1981), pp. 247-256.

30. Shamroth, S.J., Gibeling, H.J., McDonald, H., "A Navier-Stokes solution for laminar and turbulent flow through a cascade of airfoils." Proceedings of the AIAA 13<sup>th</sup> Fluid and Plasma Dynamics Conference, Snowmass, CO, (Jul. 1980), p. 14.
31. Levy, R., McDonald, H., Briley, W.R., Kreskovsky, J.P., "A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems." AIAA paper 80-1398, AIAA 13<sup>th</sup> Fluid and Plasma Dynamics Conference, Snowmass, CO, (Jul. 1980), p. 10.
32. Buggeln, R.C., McDonald, H., Kreskovsky, J.P., Levy, R., "Computation of three-dimensional viscous supersonic flow in inlets." AIAA Paper 80-0194, AIAA 18<sup>th</sup> Aerospace Sciences Meeting, Pasadena, CA, (Jan 1980), p. 12.
33. McDonald, H., Briley, W.R., "Computational fluid dynamic aspects of internal flows." AIAA 79-1445, AIAA Computational Fluid Dynamics Conference, Williamsburg, VA, (Jul. 1979); Collection of Technical Papers (1979), P. 266-283.
34. Briley, W.R., McDonald, H., "Analysis and computation of viscous subsonic primary and secondary flows." AIAA 79-1453, AIAA Computational Fluid Dynamics Conference, Williamsburg, VA, (Jul. 1979), pp. 7-78
35. Levy R., McDonald, H., Briley, W.R., "Calculation of three-dimensional turbulent subsonic flow in transition ducts." Proceedings of 6<sup>th</sup> International Conference on Numerical Methods in Fluid Dynamics, Tiflis, GA (Jun. 1978), pp. 361-369.
36. Kreskovsky, J.P., Shamroth, S.J., McDonald, H., "Application of a general boundary layer analysis to turbulent boundary layers subjected to strong favorable pressure gradients." ASME paper 75-FE-16, ASME, Joint Fluids Engineering and Lubrication Conference, Minneapolis, MN, (May, 1975), p. 12.
37. Briley, W.R., McDonald, H., "Solution of the three-dimensional compressible Navier-Stokes equations by an implicit technique." Proceedings of 4<sup>th</sup> International Conference on Numerical Methods in Fluid Dynamics, New York, NY, (Jun. 1974), pp. 105-110.
38. McDonald, H., Fish, R. W., "Practical calculations of transitional boundary layers (finite difference procedure for computing behavior of two-dimensional boundary layers and turbulence model to predict location and extent of transition region." Published in AGARD Boundary Layer Effects in Turbomachines (Dec. 1972), pp. 29-53.
39. McDonald, H., "A new solution of the turbulent near-wake recompression problem (Two dimensional supersonic turbulent near wake saddle point singularity during recompression analyzed by including transverse momentum integral equation)." AIAA Paper 70-228, AIAA 8<sup>th</sup> Aerospace Sciences Meeting, New York, N.Y., (Jan. 1970) p. 12.
40. McDonald, H., "The effect of pressure gradient on the law of the wall in turbulent flow." *Journal of Fluid Mechanics*, Vol. 35, (Feb. 1969), pp. 311-336.
41. Camarata, F.J., McDonald, H., "An extended mixing length method for computing turbulent shear stress distribution required in calculating two dimensional incompressible turbulent boundary layer." Stanford University, Department of Mechanical Engineering, Thermosciences Div. (1969) p. 16; and Volume 1 – Methods, Predictions, Evaluation and Flow Structures (Aug. 1968), pp. 83-98.

## Reports

1. Govindan, T.R., DeJong, F.J., Briley, W.R., McDonald, H., "Rotating flow in radial turbomachinery, Scientific Research Associates, Report No. AD-A222885; SRA-R930011-F; ARO-22360.4-EG-S, (May 1990).
2. Briley, W.R., Govindan, T.R., and McDonald, H.: Efficient Navier Stokes Flow Prediction Algorithms, SRA Report R90 900068 F, 1990.
3. Liu, N.S., Shamroth, S.J., McDonald, H., "Reciprocal interactions of hairpin-shaped vortices and a boundary layer," Scientific Research Associates, Inc., Final Report, (Feb. 1, 1986 – Dec. 31, 1988).
4. Liu, N.S., Shamroth, S.J., McDonald, H., "Flow dynamics stimulation by hairpin-like vortices in initially laminar boundary layers." Published in Scientific Research Associates, Inc., Annual Report (Mar 1988).
5. Govindan, T.R., Briley, W.R., and Levy, R.: Computation of Flow Around Maneuvering Submerged Bodies. SRA Report R88 920029 F, 1988.
6. Buggeln, R. C., Briley, W.R., McDonald, H., Shamroth, S.J., Weinberg, B.C., "Two- and three-dimensional turbine blade row flow field simulations," Scientific Research Associates, Inc., SE254832. Published by NASA Lewis Research Center in Turbine Engine Hot Section Technology Report, (Oct. 1987) pp. 199-209.
7. Sabnis, J.S., Gibeling, E.J., McDonald, H., "Solid rocket motor aft field joint flow field analysis." Published in Scientific Research Associates, Inc., Final Report (Sept. 1987).
8. Chan, Y.T., Buggeln, R.C., McDonald, H., "Three-dimensional dynamic labyrinth seal analysis." Published in Scientific Research Associates, Inc., Final Report (Jan. 1987), p. 50.

9. Liu, N.S., Shamroth, S.J., McDonald, H., "Flow dynamics stimulated by hairpin-like vortices in initially laminar boundary layers." Published in Scientific Research Associates, Inc., Annual Report, (Feb 1987), p. 22.
10. Buggeln, R.C., Briley, W.R., Shamroth, S.J., McDonald, H., "Turbine stator flow field simulations," Published by NASA Lewis Research Center in Turbine Engine Hot Section Technology Report (Oct. 1986), pp. 233-235.
11. Briley, W.R., Govindan, T.R., Levy, R., McDonald, H., "Numerical study of three-dimensional laminar and turbulent flows with system rotation." Published in Scientific Research Associates, Inc., Final Report (1986), p. 46.
12. Gibeling, H.J., Weinberg, B.C., Shamroth, S.J., McDonald, H., "Flow through a compressor state." Published in Scientific Research Associates, Inc., Final Report (Jun 1983 – May 1986), p. 55.
13. Buggeln, R.C., Kim, Y.N., McDonald, H., "Computation of multi-dimensional viscous supersonic flow." Published in Scientific Research Associates, Inc., Final Report, (Oct. 1986), p. 194.
14. Kim, Y.N., Buggeln, R.C., McDonald, H., "Computation of multi-dimensional viscous supersonic jet flow." Published in Scientific Research Associates, Inc., Final Report (Oct 1986), p. 128.
15. Yang, R.J., Weinberg, B.C., Shamroth, S.J., McDonald, H., "Numerical solutions of the Navier-Stokes equations for two- and three-dimensional turbine cascades with heat transfer." Published in General Motors Corp, Final Report (Jul. 1985), p. 160.
16. Weinberg, B.C., Yang, R.J., Shamroth, S.J., McDonald, H., "Calculation of two- and three-dimensional transonic cascade flow field using the Navier-Stokes equations." Published by NASA Lewis Research Center's Turbine Engine Hot Section Technology Report (Oct. 1984), p. 8.
17. Lui, N.S., Shamroth, S.J., McDonald, H., "Numerical simulation of unsteady three-dimensional turbulent structures in boundary layer flow." Published in Scientific Research Associates, Inc., Final Report (Nov. 1984 – May 1985), p. 45.
18. Weinberg, B.C., McDonald, H., "Influence of large-scale motion on turbulent transport for confined coaxial jets. Volume 2: Navier-Stokes calculation of swirling and nonswirling confined coaxial jets." Published in Scientific Research Associates, Inc., Final Report (Jan. 1986) p. 57.
19. Buggeln, R.C., Briley, W.R., McDonald, H., "Solution of the three-dimensional Navier Stokes Equations for a turbulent horseshoe vortex flow." Published in Scientific Research Associates, Inc. Final Report (Oct 1985 – Sept. 1986) p. 36.
20. Briley, W.R. and McDonald, H.: Accuracy and Iterative Convergence Rate of ADI Schemes for Scalar Convection, SRA Report R86 900050 F, 1986.
21. Kim, Y.N., Buggeln, R.C., McDonald H., "Development of a Navier-Stokes analysis for the flow in disk pumps." Published in Scientific Research Associates, Inc. Final Report (Sep. 1984 – Mar. 1985), p. 45.
22. Briley, W.R., McDonald, H., and Buggeln, R.C.: Observations on Three Dimensional Viscous Turbine Flow Analysis Methods, SRA Report R85 900029 F, 1985.
23. Briley, W. R., Buggeln, R.C., McDonald, H., "Solution of the three-dimensional Navier-Stokes equations for a steady laminar horseshoe vortex flow." Scientific Research Associates, Inc., Final Report (Jun 1982 – Jun. 1984), p. 43.
24. Shamroth, S.J., McDonald, H., Weinberg, B.C., Roscoe, D.V., "Development of a Navier-Stokes rotor and stator analysis." Scientific Research Associates, Inc., Annual Report, (Jun. 1984), p. 39.
25. Shamroth, S.J., Yang, R.J., McDonald, H., "Further development of a transonic cascade analysis, Scientific Research Associates, Inc., Final Report, (Aug. 1983), p. 49.
26. Gibeling, H.J., Briley, W.R., Kreskovsky, J.P., Shamroth, S.J., McDonald, H., "Computation of discrete slanted hole film cooling flow using the Navier-Stokes equations." Scientific Research Associates, Inc., Final Report (Sept. 1983), p. 63.
27. Lin, S.J., Kreskovsky, J.P., Briley, W.R., McDonald, H., "Further development of a method for computing three-dimensional subsonic viscous flows in turbofan lobe mixers." Scientific Research Associates, Inc., Final Report (Nov. 1983) p. 66.
28. Kreskovsky, J.P., Briley, W.R., McDonald, H., "Turbofan forced mixer-nozzle internal flowfield. Volume 3; A computer code for 3-D mixing in axisymmetric nozzles." Published in Scientific Research Associates, Inc., Final Report (Apr. 1982), Vol. 3, p. 129.
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