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13. ABSTRACT (Maximum 200 words)

Two activities were pursued under this grant. The first was a visitor program to conduct research on numerical algorithms for MIMD computers. The program is summarized in the following attachments. Attachment A - List of Researchers Supported; Attachment B - List of Reports Completed; and Attachment C - Reports. The second activity was a workshop on the Control of fluid Dynamic Systems held on March 28-29, 1989. The workshop is summarized in attachments. Attachment D - Workshop Summary; and Attachment E - List of Workshiup Participants.

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THE DEVELOPMENT AND EVALUATION OF NUMERICAL ALGORITHMS FOR MIMD COMPUTERS

Final Report for Grant No. AFOSR-88-0117

Covering the period

February 1, 1988 through January 31, 1990

Submitted by:

Robert G. Voigt

INSTITUTE FOR COMPUTER APPLICATIONS

IN SCIENCE AND ENGINEERING

Operated by the

UNIVERSITIES SPACE RESEARCH ASSOCIATION

at

NASA LANGLEY RESEARCH CENTER

Hampton, Virginia 23665

Two activities were pursued under this grant. The first was a visitor program to conduct research on numerical algorithms for MIMD computers. The program is summarized in the following attachments.

Attachment A - List of Researchers Supported

Attachment B - List of Reports Completed

Attachment C - Reports

The second activity was a workshop on the Control of Fluid Dynamic Systems held on March 28-29, 1989. The workshop is summarized in attachments.

Attachment D - Workshop Summary

Attachment E - List of Workshop Participants

Attachment A

List of Researchers Supported

Loyce Adams - University of Washington

Mark Jones - Duke University

David Keyes - Yale University

Charles Koelbel - Purdue University

Richard Littlefield - University of Washington

Piyush Mehrotra - Purdue University

David Nicol - College of William and Mary

Merrell Patrick - Duke University

Terrence Pratt - University of Virginia

Joel Saltz - Yale University

Paul Saylor - University of Illinois

Attachment B

List of Reports Completed

NAS1-18605, AFOSR 88-0117

Nicol, David M.: *Parallel discrete-event simulation of FCFS stochasticqueueing networks.* ICASE Report No. 88-29, May 24, 1988, 22 pages. Proceedings of SIGPLAN PPEALS Symposium, New Haven, CT, July 1988, pp. 124-137.

NAS1-18107, AFOSR 88-0117

Keyes, David E.: *Domain decomposition methods for the parallel computation of reacting flows.* ICASE Report No. 88-52, September 15, 1988, 25 pages. Computer Physics Communications, Vol. 53, 1989, pp. 181-200.

NAS1-18107, NAS1-18605, AFOSR 88-0117

Nicol, D. M., D. R. Shier, R. K. Kincaid, and D. S. Richards: *A multistage linear array assignment problem.* ICASE Report No. 88-57, November 21, 1988, 33 pages. To appear in Operations Research.

NAS1-18107, AFOSR 88-0117

Saltz, Joel H., Ravi Mirchandaney, and Doug Baxter: *Run-Time parallelization and scheduling of loops.* ICASE Report No. 88-70, January 3, 1989, 34 pages. Proceedings of the First Symposium on Parallel Algorithms and Architectures, Santa Fe, NM, 1989.

NAS1-18107, NAS1-18605, AFOSR-88-0117, 6/87 to 10/88

Jones, Mark T.; Merrell L. Patrick and Robert G. Voigt: *A language comparison for scientific computing on MIMD architectures.* ICASE Report No. 89-6, January 24, 1989, 39 pages. Proceedings of the IFIP Working Conference on Aspects of Computation on Asynchronous Parallel Processors.

NAS1-18605, AFOSR-88-0117, November 1988 to April 1989

Jones, Mark T. and Merrell L. Patrick: *Bunch-Kaufman factorization for real symmetric indefinite banded matrices.* ICASE Report 89-37, May 20, 1989, 13 pages.

NAS1-18107, NAS1-18605, task 7, AFOSR-88-0117, June 1987 to November 1988
Naik, Vijay K. and Merrell L. Patrick: *Data traffic reduction schemes for cholesky factorization on asynchronous multiprocessor systems.* ICASE Report No. 89-40, June 1, 1989, 29 pages. Proceedings of ACM 1989 International Conference on Supercomputing, June 5-9, 1989, Crete, Greece.

NAS1-18605, AFOSR-88-0117
Jones, Mark T. and Merrell L. Patrick: *The use of Lanczos's method to solve the large generalized symmetric definite eigenvalue problem.* ICASE Report No. 89-69, September 26, 1989, 49 pages.

NAS1-18107, NAS1-18605, AFOSR-88-0117, T/11, w/o 10
Nicol, David M., and Joel H. Saltz: *An analysis of scatter decomposition.* ICASE Report No. 90-4, January 3, 1990, 20 pages. Submitted to IEEE Trans. on Computers.

NAS1-18107, NAS1-18605; AFOSR-88-0117, w/o 22
Jones, Mark T. and Merrell L. Patrick: *Factoring symmetric indefinite matrices on high-performance architectures.* ICASE Report No. 90-8, January 9, 1990, 15 pages.

Attachment C

Reports

Complete reports are available if requested.

Attachment D

Summary of Workshop on Control/Fluid Dynamics Systems

WORKSHOP ON CONTROL OF FLUID DYNAMIC SYSTEMS

There is a growing belief that developments in fluid dynamics, control theory and the computational sciences make it feasible to consider opportunities in the active control of fluid phenomena such as the transition to turbulence. Many problems still lie beyond present understanding and capability, but it seems appropriate to mount a research activity geared at exposing those problems on which some progress might be made and at illuminating those areas that require further development. To this end, ICASE organized a workshop held at the Radisson Hotel in Hampton, Virginia on March 28-29, 1988.

The participants of the workshop are listed in Appendix A and the Agenda is given in Appendix B. The initial lecture, given by J. McMichael, presented some areas of fluid dynamics that would benefit from active control. Three additional lectures were given presenting overviews of the state of the art in computational fluid dynamics, control of distributed parameter systems and the mathematical theory of the Navier-Stokes equations. Presentation material from these lectures is included in Appendix C.

Following discussion, three problems were identified for closer study: controlling the boundary between two fluids to enhance mixing, flutter suppression, and tangential blowing across a delta wing to affect leading edge separation. Workshop attendees were divided into three groups. Each group was asked to consider one of the problems and to lead a discussion when the workshop reconvened as a whole. Presentation material for these discussions is contained in Appendix D.

Attachment E

List of Workshop Participants

LIST OF ATTENDEES -
WORKSHOP ON CONTROL OF FLUID DYNAMIC SYSTEMS
March 28-29, 1988

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