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**Final Report
Grant No. NAG-1-1529**

RESEARCH IN PARALLEL COMPUTING

Submitted to:

**National Aeronautics and Space Administration
Langley Research Center
ACD, Mail Stop 125
Hampton, VA 23681-0001**

Attention: Dr. Jules J. Lambiotte

Submitted by:

**James M. Ortega
Charles Henderson Professor**

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**DEPARTMENT OF COMPUTER SCIENCE
SCHOOL OF ENGINEERING AND APPLIED SCIENCE
UNIVERSITY OF VIRGINIA
CHARLOTTESVILLE, VA 22903-2442**

This is the final report on NASA Grant NAG-1-1529. This grant has been supporting a PhD student in Computer Science, Michael DeLong. Mr. DeLong has now completed his dissertation and all other requirements for the PhD and will accept a postdoctoral fellowship at Los Alamos National Laboratory in February, 1997.

The research of this project concerned the investigation of the suitability of the SOR iteration as a preconditioner for the GMRES method for solving large sparse nonsymmetric systems of linear equations. Preliminary results on a serial computer (RS 6000) showed that SOR was indeed a good preconditioner, at least for the convection-diffusion equations used in this study. This was in contradiction to various statements that had appeared in the literature, questioning the suitability of SOR as a preconditioner. These experiments using a serial computer were described more completely in previous semi-annual reports as well as in [1].

The second phase of this project was to develop parallel codes for the Intel Paragon at NASA-Langley and the Center for Advanced Computing Research at Caltech, and the IBM SP-2 at NASA-Langley and NASA-Ames. Highly parallel codes were developed. Indeed, an unexpected result was the superlinear speedup in some cases due to better cache utilization as the problem sizes and number of processors increased. Preliminary results on these parallel experiments were given in [2] and final results in [3] and [4].

References

- [1] M. DeLong and J. Ortega, SOR as a Preconditioner, *Applied Numerical Mathematics* 18, pp. 431-440, 1995.
- [2] M. DeLong and J. Ortega, SOR as a Parallel Preconditioner. In L. Adams and J. Nazareth, editors, *Linear and Nonlinear Conjugate Gradient-Related Methods*, pp. 143-148, SIAM, 1996.
- [3] M. DeLong, SOR as a Preconditioner, PhD Thesis, University of Virginia, 1997.
- [4] M. DeLong and J. Ortega, SOR as a Parallel Preconditioner II, submitted to *Applied Numerical Mathematics*.

DISTRIBUTION LIST

- 1 - 3 Dr. Jules J. Lambiotte
 NASA Langley Research Center
 ACS, Mail Stop 125
 Hampton, VA 23681-0001
 (804) 864-5794
- 4 Dr. Joseph S. Murray
 NASA Langley Research Center
 Acquisition Division, Mail Stop 126
 Hampton, VA 23681-0001
 (804) 864-7709
- 5 - 6 NASA Scientific & Technical Information Facility
 P. O. Box 8757
 Baltimore/Washington International Airport
 Baltimore, MD 21240
- 7 -8 M. Rodeffer, Clark Hall
- 9 - 10 J. M. Ortega
- * SEAS Postaward Research Administration
- 11 SEAS Preaward Research Administration

*Cover letter

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