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14. ABSTRACT
The goal of this award was to enhance the capabilities of the Department of Applied Mathematics and Statistics (AMS) at the University of California, Santa Cruz (UCSC) to conduct research and research-related education in areas of relevance to ARL/DoD, with a special focus on biomathematics. This objective was achieved by expanding the capabilities of our GRAPE computing cluster by adding additional nodes and improving the networking infrastructure of the cluster by installing a high-speed Infiniband switch for the network.

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High Performance Computing; Infiniband

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Report Title

Final Report: DURIP: High Performance Computing in Biomathematics Applications

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Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received Paper

TOTAL:

Number of Manuscripts:

Books

Received Book

TOTAL:

Received	Book Chapter

TOTAL:

Patents Submitted

Patents Awarded

Awards

Graduate Students

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Post Doctorates

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Faculty Supported

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields:..... 0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME

Total Number:

Names of other research staff

NAME	PERCENT_SUPPORTED

FTE Equivalent:

Total Number:

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

The monies from this award were invested in the acquisition of the following equipment:

- 1 Infiniband 36QSFP Switch.
- 21 QSFP Networking cards.
- 13 QSFP+ 56Gb/s Passive Copper Cables (3.3 ft).
- 13 QSFP+ 56Gb/s Passive Copper Cables (10 ft).
- 4 Dell PowerEdge R820 servers (including extended warranty).
- 5 Dell PowerEdge R420 servers (including extended warranty).

We acquired a larger number of network cards and cables than servers in order to make all GRAPE nodes (both new and old) Infiniband-compatible. All equipment was installed on the main UCSC campus (Room BE250 of the Baskin Engineering building).

The award benefited a number of research and research-related education activities at AMS. The equipment played a key role in the work performed under three grants involving PI Rodriguez:

- Dynamic Network Modeling: Estimation and Optimal Design of Interventions, 2010-2013, funded by DARPA.
- Using Estimations of Entropy to Optimize Complex Human Dynamic Networks Under Stress, 2012-2013, funded by DARPA.
- ATD: A Novel Statistical Framework for Sensor Fusion, 2013-2017, funded by NSF and DTRA.

Although the DURIP award that is the subject of this report did not generate any direct product besides the infrastructure described above, the projects it directly supported led to 12 papers in refereed journals and conference proceedings. Other researchers with DOD support that benefited from access to the cluster included Prof. Qi Gong and Prof. Marc Mangel.

From an educational point of view, the expansion of the cluster allowed the development of new graduate courses in entitled “An Introduction to High Performance Computing” (AMS-250, see https://courses.soe.ucsc.edu/courses/ams250/), as well as a number of independent studies on the use of high-performance for Bayesian Computational methods.

Technology Transfer