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INNOVATIVE SCIENCE and TECHNOLOGY DIRECTORATE

Current Grant Number: N00014-91-J-4063
Project Title: Communications Networks in Stressed Environments
Final Report - Period Covered: 1 Jan. 1991 - 31 Dec. 1993
S&T Agent: DR. RABINDER MADAN Agency: ONR
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Secondary Investigator: T.G. Robertazzi

Project Classification: Unclassified

Project Summary:

Communications techniques and performance models are devised for communications networks in which mobile platforms, volatile traffic patterns, and interference are significant features. The main focus is on network organization and control configurations that support communications among semi-autonomous mobile platforms. Example platforms can support data gathering sensors and communications equipment aboard guided or maneuverable space vehicles, satellites, aircraft, ships or ground vehicles or persons. Network configurations with limited and/or shared communications resources are considered. Analytical models are devised to characterize major performance issues. Matters of concern include maintaining network connectivity with mobile platforms that have active communications links, methods for allocating communications resources to gateways, dynamic assignment of resources and access rights. Topics investigated have included: acquisition of spread spectrum signals, low-delay channel access protocols, call hand-off schemes, telecommunications traffic performance of mobile networks, computation vs. communication considerations, high speed packet switching, and aspects of self-organizing communications networks. A new framework has been developed that is based on the notion of multi-dimensional birth-death processes and which permits formulation of analytically tractable models for mobile communication networks that incorporate a considerable amount of physical complexity. The result is that teletraffic performance characteristics for many systems and alternative schemes can be numerically computed (rather than simulated by brute force Monte-Carlo type techniques). The results of the research provide increased understanding of effective techniques for rapid, reliable and ubiquitous communications among mobile users. Extensive publications of the work have been presented in the technical literature. A patent application has been filed. Some of the techniques have been incorporated in existing or developing systems.

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The Research Foundation
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February 3, 1994

Dr. Rabinder N. Madan
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Office of Naval Research
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Arlington, VA 22217-5000

RE: N0001491J4063

Dear Dr. Madan:

Enclosed please find three copies of Dr. Stephen Rappaport's final report for the above-referenced document. The four remaining copies have been distributed in accord with the contract's instructions.

Sincerely,

Katherine L. MacCormack
Associate for Sponsored Programs

KLM:rb
enc.

cc: Administrative Contracting Officer (1)
Director, Naval Research Laboratory (1)
Defense Technical Information Center (2) ✓
Dr. S. Rappaport
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CUMULATIVE LIST OF PUBLICATIONS AND PATENTS

The publications listed below acknowledge support by SDIO/IST or BMDO/IST funding under ONR Grant No. N00014-91-J-4063 or its predecessor, ONR Contract No. N00014-85-K-0610 during the period Jan. 1, 1991 to Dec. 31, 1993. (List prepared January 19, 1994).

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A.A. Lazar and T.G. Robertazzi, "Markovian Petri Net Protocols with Product Form Solution", Performance Evaluation, Vol. 12, 1991, pp. 67-77.

S. Bataineh and T.G. Robertazzi, "Bus Oriented Load Sharing for a Network of Sensor Driven Processors", special issue on Distributed Sensor Networks of the IEEE Transactions on Systems, Man and Cybernetics, Sept. 1991, Vol. 21, no.5, pp. 1202-1205.

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S.S. Rappaport and H. Jiang, "CBWL: A New Channel Assignment and Sharing Method for Cellular Communication Systems," (Patent filed February 1, 1993.)

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S.S. Rappaport, "Modeling the Hand-Off Problem in Personal Communications Networks," Proc. IEEE Vehicular Technology Conference, VTC '91, St. Louis, May 1991, pp. 517-523.

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H-Y. Huang and T.G. Robertazzi, "Performance Evaluation of the Manhattan Street Network with Input Buffers", Proceedings of the IEEE International Conference on Communications '92, Chicago, Ill, June 1992, pp. 202-206.

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H. Jiang and S.S. Rappaport, "CBWL: A New Channel Assignment and Sharing Method for Cellular Communication Systems," CEAS Technical Report No. 651, January 7, 1993, College of Engineering and Applied Sciences, State University of New York, Stony Brook, NY 11794.

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