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Literature Review For Intelligent Simulated Forces

University of Central Florida Institute for Simulation and Training

INSTITUTE FOR SIMULATION AND TRAINING

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Literature Review for Intelligent Simulated Forces

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Orlando FL 32826

University of Central Florida
Division of Sponsored Research

iST

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PREPARED FOR:

U.S. ARMY PROJECT MANAGER FOR TRAINING DEVICES

12350 RESEARCH PARKWAY
ORLANDO, FLORIDA 32826-3276

RESEARCH AND DEVELOPMENT
FOR
INTELLIGENT SIMULATED FORCES

CONTRACT N61339-89-C-0044

LITERATURE REVIEW
FOR
INTELLIGENT SIMULATED FORCES

OCTOBER 1989

PREPARED BY:

INSTITUTE FOR SIMULATION AND TRAINING
UNIVERSITY OF CENTRAL FLORIDA
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ORLANDO, FL 32826

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INTELLIGENT SIMULATED FORCES
LITERATURE REVIEW

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to document the results of a literature search/information survey performed in the area of intelligent simulated forces. This information search was undertaken to assess the effectiveness and resource requirements of current intelligent simulated forces efforts, and to provide guidance for future enhancements.

1.2 Statement of the Problem

There is a need for a semi-automated opposing force offering a variable user interface that can accomodate controllers with different levels of expertise. Such an environment would most likely require the use of artificial intelligence and expert system techniques. This literature review investigated not only simulated forces design paradigms, but also traditional and artificially intelligent hardware and software strategies.

2.0 INVESTIGATION METHODOLOGY

2.1 Procedures

Relevant information was garnered by investigating existing documentation, interviewing experts, and visiting the sites of ongoing efforts.

2.1.1 Existing Documentation

2.1.1.1 Publications

An on-line search was performed, which originally resulted in more than three hundred (300) articles. A copy of the results are included in Appendix A. A review of the

titles led to the request for sixty-eight (68) abstracts. A copy of the abstracts is located in Appendix B.

Articles and abstracts were gleaned from magazines, journals, and conference and symposium proceedings. Some of the proceedings represented include those from Interservice/Industry Training Systems Conferences, the Florida Artificial Intelligence Research Symposium, the Annual AI Systems in Government Conference, and the Summer Simulation Conference. Documentation published by both Perceptronics and BBN for SIMNET was also encompassed in the literature review. A bibliography of this material may be found in Appendix C.

Copies of the books, papers, and articles deemed relevant were acquired from several sources, and placed on file in the IST library. All material contained in the IST library is available for review upon request. Additionally, IST library information has been shared with the PM TRADE data base on a limited basis. A copy of the titles and IST library file numbers of articles of relevance to the simulated forces effort is contained in Appendix D.

2.1.1.2 Commerce Business Daily Postings

The Commerce Business Daily publications for the months of January 1989 through July 1989 were reviewed for postings that related to intelligent simulated forces. Twenty-six (26) postings were considered relevant. Among the sponsoring organizations were the Rome Air Development Center, the Naval Underwater Systems Center, Kirtland Air Force Base, the Defense Nuclear Agency, and the Naval Training Systems Center. These organizations posted an interest in funding work in the area of intelligent simulated forces; the respondent firms were not investigated in the course of this literature search. The results of this review are included in Appendix E.

2.1.2 Interviewing Experts

Experts working in the simulated forces field were queried by members of the IST staff. Reports delineating the results of these interviews were included in the monthly status reports already delivered. Additional copies are attached in Appendix F.

2.1.3 Site Visits

Multiple vendor sites were visited. Trip reports describing the information garnered were included in the status reports submitted monthly. Copies are included in Appendix G.

3.0 SUMMARY

This Intelligent Simulated Forces literature search was undertaken to evaluate current intelligent simulated forces efforts, and ascertain possible future trends and areas of augmentation. The effort included locating and acquiring the data, and entering it into the IST library. Access to all literature located in the IST library is available upon request.

APPENDIX A

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Welcome to DIALOG
Dialog level 21.02.9B

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Logon file001 04oct89 09:56:59
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     >>>     Announcements last updated 29sep89         <<<

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   the information industry, there will be no charge, except
   telecommunications costs, for up to $500 worth of searches
   (per password) of PAIS INTERNATIONAL (File 49) during the
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File   1:ERIC - 66-89/AUG.

      Set  Items  Description
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       04oct89 09:57:19 User201554 Session B26.1
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      $0.12  Tymnet
      $0.42  Estimated cost this search
      $0.42  Estimated total session cost   0.010 Hrs.

File   6:NTIS - 64-89/ISS20
         (COPR. 1989 NTIS)

      Set  Items  Description
      ---  -----  -----------
? s parallel(w)programming? or distributed(w)processing?
            17357  PARALLEL
            46534  PROGRAMMING?
              174  PARALLEL(W)PROGRAMMING?
            11575  DISTRIBUTED
           109155  PROCESSING?
              617  DISTRIBUTED(W)PROCESSING?
      S1            787      PARALLEL(W)PROGRAMMING?   OR
DISTRIBUTED(W)PROCESSING?
? s s1 and py=1986:1989
              787  S1
           182147  PY=1986 : PY=1989
      S2      337  S1 AND PY=1986:1989
```

? t /6/all

2/6/1
1407258 DE89012297/XAB
Structured Command History for UNIX Using a Parallel Distributed Processing Model
(Thesis (M.S.))
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A05/MF A01

2/6/2
1406419 AD-A209 401/9/XAB
International Conference on Vector and Parallel Computing (2nd)
NTIS Prices: PC A03/MF A01

2/6/3
1406150 AD-A209 132/0/XAB
Parallel Vision Algorithms
(Annual technical rept. no. 2, 1 Oct 87-28 Dec 88)
NTIS Prices: PC A05/MF A01

2/6/4
1405739 PB89-866917/XAB
Computer Networks: Data Communication Architecture and Development.
January 1975-July 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database)

(Rept. for Jan 75-Jul 89)
NTIS Prices: PC N01/MF N01

2/6/5
1405071 N89-23373/8/XAB
Decentralization of Databases and the Communication between Them
NTIS Prices: (Order as N89-23362/1, PC A06/MF A01)

2/6/6
1405007 N89-23183/1/XAB
Specifying Real-Time Systems with Interval Logic
(Final Report)
NTIS Prices: PC A05/MF A01

2/6/7
1405004 N89-23073/4/XAB
Implementing Nested Conditional Statements in SIMD (Single Instruction Multiple Data) Machines
(Final Report)
NTIS Prices: PC A03/MF A01

2/6/8
1403583 AD-A208 271/7/XAB

Parallel Vision Algorithms
(Annual technical rept. no. 1, 1 Oct 86-30 Sep 87)
NTIS Prices: PC A04/MF A01

2/6/9
1403124 N89-22358/0/XAB
DeMAID: A Design Manager's Aide for Intelligent Decomposition User's Guide
NTIS Prices: PC A03/MF A01

2/6/10
1402924 ED-303 177
Technology Options for Libraries. ERIC Digest
Available from ERIC Document Reproduction Service (Computer Microfilm
International Corporation), 3900 Wheeler Ave., Alexandria, VA 22304-5110.
NTIS Prices: Not available NTIS

2/6/11
1400748 PB89-184360/XAB
Methodology for the Design of Comtinuous-Dataflow Synchronous Systems (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/12
1400638 N89-21542/0/XAB
Parallel Solution of Sparse One-Dimensional Dynamic Programming Problems (Final Report)
NTIS Prices: PC A03/MF A01

2/6/13
1400633 N89-21537/0/XAB
Language Comparison for Scientific Computing on MIMD Architectures (Final Report)
NTIS Prices: PC A03/MF A01

2/6/14
1399531 AD-A207 609/9/XAB
Implementation Indices (1975-1979). Volume 1
(Technical rept.)
NTIS Prices: PC A08/MF A01

2/6/15
1399489 AD-A207 567/9/XAB
Real-Time Signal Processing Data Acquisition Subsystem
(Journal article)
NTIS Prices: PC A03/MF A01

2/6/16
1398122 N89-20638/7/XAB
Run-Time Scheduling and Execution of Loops on Message Passing Machines (Final Report)
NTIS Prices: PC A03/MF A01

2/6/17
1398121 N89-20637/9/XAB
Optimal Feedback Control Infinite Dimensional Parabolic Evolution Systems: Approximation Techniques
(Final Report)
NTIS Prices: PC A04/MF A01

2/6/18
1396042 AD-A206 657/9/XAB
Lexical Analysis on a Moderately Sized Multiprocessor
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/19
1395831 TIB/B89-80939/XAB
Graphenalgorithmen fuer MIMD-Rechner. (Graph algorithms for MIMD (Multiple-Instruction-Stream, Multiple Data Stream) processors)
(Diploma Thesis)
NTIS Prices: PC E11

2/6/20
1395803 TIB/B89-80904/XAB
Fairness in parallel programs: The transformational approach

NTIS Prices: PC E09

2/6/21
1394837 N89-19830/3/XAB
Artificial Intelligent Decision Support for Low-Cost Launch Vehicle Integrated Mission Operations
NTIS Prices: (Order as N89-19817/0, PC A22/MF A01)

2/6/22
1394836 N89-19829/5/XAB
CIRCA 2000 Operations Criteria
NTIS Prices: (Order as N89-19817/0, PC A22/MF A01)

2/6/23
1393513 DE88015374/XAB
Automated COBOL Code Generation for SNAP-I (Shipboard Nontactical ADP Program) CAI (Computer Aided Instruction) Development and Maintenance
Procedures
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A09/MF A01

2/6/24
1393174 AD-A206 371/7/XAB
Heuristics for Cooperative Problem Solving
(Final rept.)
NTIS Prices: PC A04/MF A01

2/6/25
1391131 N89-18601/9/XAB
Study of Communication Options in a Distributed Data Handling System and Survey of Advanced Man Machine Communication Schemes, Work Package 2.1 and 2.2 (Final Report)
NTIS Prices: PC A04/MF A01

2/6/26
1391044 N89-18479/0/XAB
Task Interactions in Distributed Machines of Embedded Computer Systems
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/27
1391041 N89-18476/6/XAB
Definitions and Requirements for Distributed Real-Time Systems NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/28
1391023 N89-18458/4/XAB
Debugging Distributed Ada Avionics Software
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/29
1391020 N89-18455/0/XAB
Embedding Formal Methods in SAFRA
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/30
1391019 N89-18454/3/XAB
Avionics Systems Engineering and Its Relationship to Mission Software Development
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/31
1391014 N89-18449/3/XAB
Software Productivity through Ada Engines
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/32
1389945 DE89001134/XAB
PCP (Parallel C Preprocessor): A Parallel Extension of C That Is 99% Fat Free
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/33
1388857 AD-A205 406/2/XAB
Three Short Papers on Language and Connectionism (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/34
1387880 N89-12255/0/XAB
Study of the Deveopment of On-Board Distributed Software Systems Using Ada
NTIS Prices: PC A04/MF A01

2/6/35
1387870 N89-12222/0/XAB
Support Architecture for Reliable Distributed Computing Systems.
Semiannual Status Report, June 9, 1987-June 8, 1988
NTIS Prices: PC A03/MF A01

2/6/36
1385855 N89-18098/8/XAB
CO-OP Method: A Method for Compositional Derivation of Canonical Testers (M.S. Thesis)
NTIS Prices: PC A05/MF A01

2/6/37
1385854 N89-18097/0/XAB
High Level Synchronization Services of OSI (Open Systems Interconnection): Commitment, Concurrency and Recovery
NTIS Prices: PC A03/MF A01

2/6/38
1383265 N89-17422/1/XAB
Parallel Gaussian Elimination of a Block Tridiagonal Matrix Using Multiple Microcomputers
NTIS Prices: PC A03/MF A01

2/6/39
1381250 AD-A204 126/7/XAB
QLISP for Parallel Processors
(Final rept. 15 Jul 86-31 Jul 88)
NTIS Prices: PC A02/MF A01

2/6/40
1380067 N89-16371/1/XAB
Database Management Capability for Ada
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/41
1380049 N89-16353/9/XAB
Using Ada to Implement the Operations Management System in a Community of Experts
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/42
1380043 N89-16347/1/XAB
Comparing Host and Target Environments for Distributed Ada Programs

NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/43
1380038 N89-16342/2/XAB
Implementing Distributed Ada for Real-Time Applications (Abstract Only)
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/44
1380035 N89-16339/8/XAB
Ada Implementation for Fault Detection, Isolation and Reconfiguration Using a Fault-Tolerant Processor
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/45
1380033 N89-16337/2/XAB
Lessons Learned in Creating Spacecraft Computer Systems: Implications for Using Ada (R) for the Space Station
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/46
1380032 N89-16336/4/XAB
Transparent Ada Rendezvous in a Fault Tolerant Distributed System
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/47
1380027 N89-16331/5/XAB
Some Design Constraints Required for the Assembly of Software Components: The Incorporation of Atomic Abstract Types into Generically Structured Abstract Types
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/48
1380010 N89-16314/1/XAB
Impact of Common APSE (Ada Program Support Environment) Interface Set Specifications on Space Station Information Systems
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/49
1379992 N89-16296/0/XAB
Distributable APSE (Ada Program Support Environment)
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/50
1379991 N89-16295/2/XAB
Distributing Program Entities in Ada
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/51
1379989 N89-16293/7/XAB
Distributed Ada: Methodology, Notation and Tools
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/52
1379988 N89-16292/9/XAB
Distributed Programming Environment for Ada
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/53
1379980 N89-16284/6/XAB
Testability of Ada Programs
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/54
1379975 N89-16279/6/XAB
First International Conference on Ada (R) Programming Language Applications for the NASA (National Aeronautics and Space Administration) Space Station, Volume 1
NTIS Prices: PC A18/MF A01

2/6/55
1379928 N89-15972/7/XAB
Transportation Node Space Station Conceptual Design
NTIS Prices: PC A10/MF A01

2/6/56
1379661 DE89005619/XAB
Floating Point Engine for Lattice Gauge Calculations
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NTIS Prices: PC A02/MF A01

2/6/57
1378569 AD-A203 982/4/XAB
Performance Evaluation of Parallel Algorithms and Architectures in Concurrent Multiprocessor Systems
(Final rept. Jan-Sep 87)
NTIS Prices: PC A03/MF A01

2/6/58
1377891 TIB/B89-80016/XAB
Einsatz des OCCAM/Transputerkonzepts als busloses Multiprozessorsystem fuer einen digitalen Regler. (Application of the OCCAM/transputer conception as busless multiprocessor system in a digital controller)
NTIS Prices: PC E09

2/6/59
1377085 N89-15601/2/XAB
Very Large Area Network (VLAN) Knowledge-Base Applied to Space Communication Problems
NTIS Prices: (Order as N89-15549/3, PC A21/MF A01)

2/6/60
1373911 AD-A203 087/2/XAB

Virtual Time Machine
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/61
1372087 N89-14946/2/XAB
Resident Database Interfaces to the DAVID System, a Heterogeneous Distributed Database Management System
(Final Report)
NTIS Prices: PC A03/MF A01

2/6/62
1372001 N89-14695/5/XAB
Analysis of FDDI Synchronous Traffic Delays
NTIS Prices: PC A03/MF A01

2/6/63
1369604 PB89-150296/XAB
Distributed-Feedback Laser-Diode Module with an Optical Isolator for Multigigabit Optical Transmission
Included in Mitsubishi Denki Giho, v62 n10 p77-80 1988.
NTIS Prices: (Order as PB89-150221, PC E05/MF A01)

2/6/64
1369597 PB89-150221/XAB
Mitsubishi Denki Giho, Vol. 62, No. 10, 1988
NTIS Prices: PC E05/MF A01

2/6/65
1369112 N89-13991/9/XAB
Strategy for Reducing Turnaround Time in Design Optimization Using a Distributed Computer System
NTIS Prices: PC A02/MF A01

2/6/66
1369107 N89-13975/2/XAB
Using Data Tagging to Improve the Performance of Kanerva's Sparse Distributed Memory
NTIS Prices: PC A03/MF A01

2/6/67
1368737 N89-12938/1/XAB
Automatic Control of a Multi-Channel Millimeter Wave Radiometer NTIS Prices: (Order as N89-12936/5, PC A99/MF E04)

2/6/68
1365726 N89-13214/6/XAB
Two Alternate Proofs of Wang's Lune Formula for Sparse Distributed Memory and an Integral Approximation
NTIS Prices: PC A03/MF A01

2/6/69
1365721 N89-13173/4/XAB

European Seminar on Neural Computing
NTIS Prices: PC A03/MF A01

2/6/70
1364167 AD-A201 042/9/XAB
Operating Environment for the Jellybean Machine (Memorandum rept.)
NTIS Prices: PC A08/MF A01

2/6/71
1361012 N89-11438/3/XAB
Sopmcr: An Operating System for the Multiprocessor for Communication Networks
NTIS Prices: PC A12/MF A01

2/6/72
1361011 N89-11429/2/XAB
Parallelizing Recursive Programs
NTIS Prices: PC A03/MF A01

2/6/73
1360975 N89-11287/4/XAB
CSM (Computational Structural Mechanics) Testbed Software System: A Development Environment for Structural Analysis Methods on the NAS (Numerical Aerodynamic Simulator) Cray-2
NTIS Prices: PC A03/MF A01

2/6/74
1360264 DE88016468/XAB
BLAZE Family of Languages: Programming Environments for Shared and Distributed Memory Architectures
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NTIS Prices: PC A03/MF A01

2/6/75
1358578 PB89-116859/XAB
Langage Modulaire de Specifications de Programmes Paralleles et Sa Compilation (These) (Modular Language of Parallel Program Specifications and Its Compilation)
NTIS Prices: PC E10/MF E10

2/6/76
1358316 N89-10216/4/XAB
High Speed Fiber Optics Local Area Networks: Design and Implementation. Final Report, January 1, 1984-December 31, 1987
NTIS Prices: PC A02/MF A01

2/6/77
1358248 N89-10096/0/XAB
Advanced Data Management Design for Autonomous Telerobotic Systems in Space Using Spaceborne Symbolic

Processors
NTIS Prices: (Order as N89-10063/0, PC A99/MF E04)

2/6/78
1358229 N89-10077/0/XAB
Hierarchically Distributed Architecture for Fault Isolation Expert Systems on the Space Station
NTIS Prices: (Order as N89-10063/0, PC A99/MF E04)

2/6/79
1356758 PB89-122394/XAB
GRAMPS (General Real-Time Asynchronous Multiprocessor System) Operating System: User's Guide
NTIS Prices: PC A03/MF A01

2/6/80
1356433 PB89-116388/XAB
Platinum Jubilee Conference on Systems and Signal Processing. Held at Bangalore, India on December 11-13, 1986
NTIS Prices: PC E15/MF A01

2/6/81
1356360 PB89-115349/XAB
Languages and Methods for the Interface I1
NTIS Prices: PC E03/MF E03

2/6/82
1356357 PB89-115315/XAB
ESPRIT SPAN Project: A Kernel System for Integrating Parallel Symbolic and Numeric Processing (Technical rept.)
NTIS Prices: PC E05/MF E05

2/6/83
1356037 N88-30350/8/XAB
Parallel and Distributed Computation for Fault-Tolerant Object Recognition
NTIS Prices: (Order as N88-30330/0, PC A19/MF A01)

2/6/84
1356011 N88-30321/9/XAB
Performance Analysis of FDDI (Fiber Distributed Data Interface)
NTIS Prices: PC A03/MF A01

2/6/85
1355342 NTN88-0747
Bibliography on Multiprocessors and Distributed Processing: This computerized data base yields citations, indexes, and cross-references (NTIS Tech Note)
FOR ADDITIONAL INFORMATION: Contact: COSMIC 112 Barrow Hall, University of Georgia, Athens, GA 30602; (404) 542-3265. Refer to ARC-11568/TN.
NTIS Prices: Not available NTIS

2/6/86
1354072 AD-A199 271/8/XAB
United States Air Force Program Office Guide to Ada (4th Edition)
NTIS Prices: PC A05/MF A01

2/6/87
1353917 PB89-851109/XAB
Microcomputer Hardware Standards: Extended Industry Standard Architecture (EISA). January 1983-November 1988 (Citations from The Computer Database) (Rept. for Jan 83-Nov 88)
NTIS Prices: PC N01/MF N01

2/6/88
1353023 N88-29425/1/XAB
Networking and AI (Artificial Intelligence) Systems: Requirements and Benefits (Abstract Only)
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/89
1353013 N88-29415/2/XAB
Design Consideration in Constructing High Performance Embedded Knowledge-Based Systems (KBS)
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/90
1353009 N88-29411/1/XAB
Expert System for a Distributed Real-Time Trainer
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/91
1352989 N88-29391/5/XAB
AI (Artificial Intelligence) and Simulation: What Can They Learn from Each Other
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/92
1352984 N88-29386/5/XAB
Distributed Cooperating Processes in a Mobile Robot Control System
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/93
1352969 N88-29371/7/XAB
Intelligent Test Integration System
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/94
1352226 DE88013609/XAB
Tools to Aid in the Analysis of Memory Access Patterns for Fortran Programs: LAPACK Working Note No. 6
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/95
1348416 AD-A198 201/6/XAB
Information Processing Research (Final rept. Jan 85-Sep 87)
NTIS Prices: PC A10/MF A01

2/6/96
1347904 PB88-253299/XAB
Data Management for Integrated Control Systems
Included in Fuji Electric Jnl., v61 n6 p414-418 1988.
NTIS Prices: (Order as PB88-253281, PC E04/MF A01)

2/6/97
1347313 PB88-245196/XAB
Database Snapshots: A Mechanism for Replication of Data in Distributed Databases
NTIS Prices: PC E08/MF E08

2/6/98
1345026 AD-A197 197/7/XAB
Parallel Debugging Using Graphical Views (Technical rept.)

NTIS Prices: PC A03/MF A01

2/6/99
1344933 AD-A197 103/5/XAB
Voyeur: Graphical Views of Parallel Programs (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/100
1344931 AD-A197 101/9/XAB
Experiences with POKER
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Programming: Progress Report, September 1, 1986-August 31, 1987
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Support Architecture for Reliable Distributed Computing Systems. Interim Report, November 9, 1983-December 3, 1985
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Network Protocols: Proceedings of the Joint IBM (International Business Machines)/University of Newcastle upon Tyne Seminar Held in the University Computing Laboratory, September 3-6, 1985
NTIS Prices: PC E12/MF E12

2/6/238
1276525 N87-27444/5/XAB
Automated Problem Scheduling and Reduction of Synchronization Delay Effects (Final rept.)
NTIS Prices: PC A03/MF A01

2/6/239
1276515 N87-27433/8/XAB
Detection of Faults and Software Reliability Analysis. Annual Report, July 1, 1985-June 30, 1987 (Progress rept.)
NTIS Prices: PC A02/MF A01

2/6/240
1276514 N87-27432/0/XAB
Implementation and Use of ADA on Distributed Systems with High Reliability Requirements. Semiannual Report, March 5, 1982-February 14, 1988 (Progress rept.)
NTIS Prices: PC A03/MF A01

2/6/241
1276511 N87-27425/4/XAB
Parallel Software Support for Computational Structural Mechanics. Semiannual Report, December 1, 1986-May 31, 1987
NTIS Prices: PC A02/MF A01

2/6/242
1276506 N87-27420/5/XAB
Parallel Simulated Annealing Algorithm for Standard Cell

Placement on a Hypercube Computer
NTIS Prices: PC A05/MF A01

2/6/243
1276504 N87-27418/9/XAB
Implementation and Use of ADA on Distributed Systems with High Reliability Requirements. Semiannual Report, March 5, 1982-December 31, 1986
NTIS Prices: PC A06/MF A01

2/6/244
1276064 N87-26555/9/XAB
Experience in Highly Parallel Processing Using DAP (Distributed Array Processor)
NTIS Prices: (Order as N87-26531 PC A13/MF A01)

2/6/245
1274820 AD-A183 946/3/XAB
Data Multiplex System (DMS) - Aspects of Fleet Introduction
NTIS Prices: PC A02/MF A01

2/6/246
1274207 PB87-867149/XAB
Distributed Data Base Management Systems. October 1984-September 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database)
(Rept. for Oct 84-Sep 87)
NTIS Prices: PC N01/MF N01

2/6/247
1273956 PB87-219937/XAB
Replicated Distributed Processing
(Technical rept. series)
NTIS Prices: PC E03/MF E03

2/6/248
1273786 PB87-217592/XAB
Distributed Computer System for Factory Automation
Included in Mitsubishi Denki Giho, v61 n4 p17-20 1987.
NTIS Prices: (Order as PB87-217584, PC E05/MF A01)

2/6/249
1273334 N87-26581/5/XAB
Comparison Between Sparsely Distributed Memory and Hopfield-Type Neural Network Models
NTIS Prices: PC A03/MF A01

2/6/250
1273332 N87-26577/3/XAB
EOS: A Project to Investigate the Design and Construction of Real-Time Distributed Embedded Operating Systems. Mid-Year Report, 1987
NTIS Prices: PC A11/MF A01

2/6/251
1273331 N87-26576/5/XAB
Parallel Discrete Event Simulation: A Shared Memory Approach

NTIS Prices: PC A03/MF A01

2/6/252
1273329 N87-26574/0/XAB
PISCES 2 Users Manual
NTIS Prices: PC A03/MF A01

2/6/253
1273328 N87-26573/2/XAB
PISCES 2 Parallel Programming Environment (Final rept.)
NTIS Prices: PC A02/MF A01

2/6/254
1273325 N87-26568/2/XAB
Network Protocols for Real-Time Applications
NTIS Prices: PC A02/MF A01

2/6/255
1273324 N87-26567/4/XAB
Two Demonstrators and a Simulator for a Sparse, Distributed Memory
NTIS Prices: PC A02/MF A01

2/6/256
1273314 N87-26520/3/XAB
Force User's Manual (Revised)
NTIS Prices: PC A03/MF A01

2/6/257
1273312 N87-26518/7/XAB
Parallel Algorithm for Channel Routing on a Hypercube
NTIS Prices: PC A02/MF A01

2/6/258
1272530 DE87010147/XAB
Performance of Three Hypercubes
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NTIS Prices: PC A02/MF A01

2/6/259
1271733 AD-A183 216/1/XAB
Methodologies for Concurrent Programming
(Final rept. for 1 Mar 86-28 Feb 87)
NTIS Prices: PC A02/MF A01

2/6/260
1271456 AD-A182 935/7/XAB
Parallel and Distributed Computing

(Final rept. 1 Jun 85-30 Nov 86)
NTIS Prices: PC A02/MF A01

2/6/261
1270513 PB87-200960/XAB
Bus-Type Home Control System Using Coaxial Cables
Included in National Technical Report (Matsushita Electric Industrial Company), v32 n6 p37-44 Dec 86.
NTIS Prices: (Order as PB87-200945, PC E07/MF E01)

2/6/262
1270383 N87-25890/1/XAB
Integration of Communications and Tracking Data Processing Simulation for Space Station
NTIS Prices: (Order as N87-25884 PC A13/MF A01)

2/6/263
1269083 AD-A182 557/9/XAB
Mediation and Automatization
(Technical rept. for period ending Dec 86)
NTIS Prices: PC A02/MF A01

2/6/264
1269040 AD-A182 513/2/XAB
CRONUS, A Distributed Operating System: CRONUS DOS Implementation (Final rept. Oct 84-Jan 86)
NTIS Prices: PC A04/MF A01

2/6/265
1267878 N87-24949/6/XAB
New Technology Impacts on Future Avionics Architectures
NTIS Prices: (Order as N87-24940 PC A07/MF A01)

2/6/266
1266715 DE87008558/XAB
Parallel Solution of Triangular Systems on Distributed-Memory Multiprocessors
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NTIS Prices: PC A03/MF A01

2/6/267
1265970 AD-A182 240/2/XAB
Exact Performance Analysis of Two Distributed Processes with One Synchronization Point (Technical rept.)

NTIS Prices: PC A03/MF A01

2/6/268
1265948 AD-A182 216/2/XAB
Distributed Sensor Networks (Semiannual technical summary rept. 1 Apr-30 Sep 86)
NTIS Prices: PC A03/MF A01

2/6/269
1265911 AD-A182 178/4/XAB
Data Replication in Nested Transaction Systems (Technical rept.)
NTIS Prices: PC A05/MF A01

2/6/270
1265909 AD-A182 176/8/XAB
Remote Pipes and Procedures for Efficient Distributed Communication (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/271
1265908 AD-A182 175/0/XAB
Correctness of Orphan Elimination Algorithms (Master's thesis)
NTIS Prices: PC A03/MF A01

2/6/272
1265037 PB87-180857
Programming the Parallel Processor (Final rept.)
Pub. in The Role of Language in Problem Solving 2, p321-333 1987. NTIS Prices: Not available NTIS

2/6/273
1264037 DE87008229/XAB
Effect of Distributed Computing Technology on Wide Area Network Capacity Requirements Portions of this document are illegible in microfiche products.
NTIS Prices: PC A02/MF A01

2/6/274
1262291 PB87-196010/XAB
Graph Model for Efficient Reachability Analysis of Description Languages, Series B, Number 34 (Research rept.)
NTIS Prices: PC E03/MF E01

2/6/275
1259984 AD-A180 847/6/XAB
ParLance: A Para-Functional Programming Environment for Parallel and Distributed Computing (Research rept.)
NTIS Prices: PC A03/MF A01

2/6/276
1254966 DE87003740/XAB
Numerical Computation on Massively Parallel Hypercubes
NTIS Prices: PC A02/MF A01

2/6/277
1254677 AD-A179 958/4/XAB
Debugging Parallel Programs with Instant Replay
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/278
1254622 AD-A179 902/2/XAB
Debugging Parallel Programs with Instant Replay (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/279
1254235 PB87-860052/XAB
Distributed Data Processing. October 1985-May 1987 (Citations from the NTIS Database) (Rept. for Oct 85-May 87)

NTIS Prices: PC N01/MF N01

2/6/280
1254234 PB87-860045/XAB
Distributed Data Processing. November 1981-September 1985 (Citations from the NTIS Database) (Rept. for Nov 81-Sep 85)

NTIS Prices: PC N01/MF N01

2/6/281
1252186 AD-A179 407/2/XAB
Experiment in Knowledge-Based Signal Understanding Using Parallel Architectures (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/282
1250889 N87-19932/9/XAB
Computer Sciences and Data Systems. Volume 2
NTIS Prices: PC A15/MF A01

2/6/283
1250888 N87-19931/1/XAB
Computer Sciences and Data Systems, Volume 1
NTIS Prices: PC A16/MF A01

2/6/284
1249337 PB87-858429/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-April 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 75-Apr 87)
NTIS Prices: PC N01/MF N01

2/6/285
1248435 N87-19022/9/XAB
Distributed Computer System Enhances Productivity for SRB (Solid Rocket Booster) Joint Optimization
NTIS Prices: PC A02/MF A01

2/6/286
1248419 N87-18988/2/XAB
Concurrent Extensions to the Fortran Language for Parallel Programming of Computational Fluid Dynamics Algorithms

NTIS Prices: PC A03/MF A01

2/6/287
1247784 DE87004030/XAB
Advanced Distributed Processing with Focus and PC/Focus: Planning Considerations and Phased Implementation
NTIS Prices: PC A03/MF A01

2/6/288
1247084 AD-A178 975/9/XAB
Durra: A Task-Level Description Language Preliminary Reference Manual (Final rept.)
NTIS Prices: PC A03/MF A01

2/6/289
1243898 DE86014102/XAB
Performance Evaluation of the HEP, ELXSI and CRAY X-MP Parallel Processors on Hydrocode Test Problems
NTIS Prices: PC A02/MF A01

2/6/290
1242319 N87-17441/3/XAB
Comparison of Five Benchmarks
NTIS Prices: PC A02/MF A01

2/6/291
1241827 N87-16851/4/XAB
Distributed Data Acquisition System for Aeronautics Test Facilities
NTIS Prices: PC A02/MF A01

2/6/292
1239787 AD-A176 907/4/XAB
Naval C(3) Distributed Tactical Decision Making
(Quarterly rept. 1 Oct-31 Dec 86)
NTIS Prices: PC A03/MF A01

2/6/293
1239707 AD-A176 827/4/XAB
Survey of Fault Tolerant Computer Security and Computer Safety (Final technical rept. Apr 85-Apr 86)
NTIS Prices: PC A10/MF A01

2/6/294
1239234 N87-16656/7/XAB
Database Interfaces on NASA's (National Aeronautics and Space Administration's) Heterogeneous Distributed Database System (Semiannual rept)
NTIS Prices: PC A03/MF A01

2/6/295
1239221 N87-16528/8/XAB
Overview of Database Projects
(Semiannual status rept)

NTIS Prices: PC A10/MF A01

2/6/296
1235417 AD-A176 258/2/XAB
Development of Real-Time Speech Recognition
(Final technical rept. 3 Jun 85-2 Dec 86)
NTIS Prices: PC A02/MF A01

2/6/297
1234157 N87-14914/2/XAB
Placement d'UN Reseau de Processus Communicants Decrit en FP2 sur Une Structure de Grille en Vue d'Une Implantation Parallele de Ce Langage (Location of the Communication Process Network Described in FP2 on a Graph Structure in Order to Implement the Parallel Processing of That Language)
NTIS Prices: PC A05/MF A01

2/6/298
1234151 N87-14907/6/XAB
Aspecten van Het Amsterdams Multiprocessor Prolog Systeem (Aspects of the Amsterdam Multiprocessor Prolog System)
NTIS Prices: PC A02/MF A01

2/6/299
1229732 DE86015570/XAB
Portable Environment for Developing Parallel Fortran Programs
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NTIS Prices: PC A02/MF A01

2/6/300
1227996 N87-12270/1/XAB
ELAND: An Expert System for the Configuration of Local Area Networks Applications
NTIS Prices: PC A03/MF A01

2/6/301
1227995 N87-12265/1/XAB
Implementation and Use of Ada on Distributed Systems with High Reliability Requirements
(Progress rept. 5 Mar 82-31 Dec 86)
NTIS Prices: PC A04/MF A01

2/6/302
1227984 N87-12247/9/XAB
Parallel Scheduling of Recursively Defined Arrays (Final rept)
NTIS Prices: PC A03/MF A01

2/6/303
1227974 N87-12169/5/XAB
Application of a Sparse, Distributed Memory to

the Detection, Identification and Manipulation of Physical Objects. Semiannual Status Report October 1985-March 1986
NTIS Prices: PC A02/MF A01

2/6/304
1227329 DE86014770/XAB
Data Management of a Multilaboratory Field Program Using Distributed Processing Portions of this document are illegible in microfiche products.
NTIS Prices: PC A02/MF A01

2/6/305
1227052 AD-A174 506/6/XAB
Cooperative Intelligence for Remotely Piloted Vehicle Fleet Control. Analysis and Simulation (Interim rept.)
NTIS Prices: PC A04/MF A01

2/6/306
1227032 AD-A174 486/1/XAB
Assessment of the Computer Science Activities of the Office of Naval Research
NTIS Prices: PC A03/MF A01

2/6/307
1226827 AD-A174 276/6/XAB
Processor Renaming in Asynchronous Environments (Technical rept.)
NTIS Prices: PC A02/MF A01

2/6/308
1225747 N87-11510/1/XAB
EOS (Embedded Operating Systems): A Project to Investigate the Design and Construction of Real-Time Distributed Embedded Operating Systems
NTIS Prices: PC A10/MF A01

2/6/309
1225308 AD-A173 989/5/XAB
Serial Order: A Parallel Distributed Processing Approach (Technical rept. Jun 85-Mar 86)
NTIS Prices: PC A04/MF A01

2/6/310
1223941 DE86014683/XAB
Unified Approach to Parallel Computation: Performance Evaluation and Architecturally Independent Parallel Programming. Progress Report, September 1, 1985-August 31, 1986
NTIS Prices: PC A02/MF A01

2/6/311
1223263 AD-A173 283/3/XAB
Applying Activation Theory for Modeling Task Interference

in Dual-Task Situations (Final rept. Mar 85-Jun 86)
NTIS Prices: PC A02/MF A01

2/6/312
1223009 AD-A173 028/2/XAB
Information Processing Research (Final rept. Jan 81-Dec 84)
NTIS Prices: PC A07/MF A01

2/6/313
1222214 N86-33032/1/XAB
First 3 Years of Operation of RIACS (Research Institute for Advanced Computer Science) (1983-1985) (Final rept)
NTIS Prices: PC A02/MF A01

2/6/314
1220744 N86-32112/2/XAB
Multiple Grid Problems on Concurrent-Processing Computers
NTIS Prices: PC A06/MF A01

2/6/315
1219350 AD-A172 224/8/XAB
Distributed Control in Computer Networks and Cross-Sections of Colored Multidimensional Bodies (Interim research rept.)
NTIS Prices: PC A02/MF A01

2/6/316
1219323 AD-A172 196/8/XAB
RAMBOT (Restructuring Associative Memory Based on Training): A Connectionist Expert System That Learns by Example
(Technical rept. Oct 85-Apr 86)
NTIS Prices: PC A03/MF A01

2/6/317
1219099 PB86-877123/XAB
DECNET: Digital Equipment Corporation Network Architecture. 1976-October 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database)

(Rept. for 1976-Oct 86)
NTIS Prices: PC N01/MF N01

2/6/318
1219057 PB86-876687/XAB
IBM System 370. 1975-October 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Oct 86)
NTIS Prices: PC N01/MF N01

2/6/319
1218318 N86-31261/8/XAB
Optimal Partitioning of Random Programs Across Two

Processors
(Final rept)
NTIS Prices: PC A03/MF A01

2/6/320
1217862 DE86013517/XAB
Denelcor HEP Multiprocessor Simulator
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NTIS Prices: PC A02/MF A01

2/6/321
1216029 N86-30380/7/XAB
Force on the Flex: Global Parallelism and Portability
(Final rept)
NTIS Prices: PC A02/MF A01

2/6/322
1216028 N86-30379/9/XAB
Dynamic Remapping of Parallel Computations with Varying Resource Demands (Final rept)
NTIS Prices: PC A04/MF A01

2/6/323
1215030 PB86-875507/XAB
Distributed Data Base Management Systems. October 1984-September 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database)
(Rept. for Oct 84-Sep 86)
NTIS Prices: PC N01/MF N01

2/6/324
1214437 N86-29562/3/XAB
UCLA Design Diversity Experiment (DEDIX) System: A Distributed Testbed for Multiple-Version Software
NTIS Prices: PC A02/MF A01

2/6/325
1214435 N86-29551/6/XAB
Statistical Methodologies for the Control of Dynamic Remapping (Final rept)
NTIS Prices: PC A03/MF A01

2/6/326
1214434 N86-29550/8/XAB
Approximate Algorithms for Partitioning and Assignment Problems NTIS Prices: PC A03/MF A01

2/6/327
1210685 AD-A169 981/8/XAB
High Performance Parallel Computing
(Final rept. 1 Feb 84-31 Jan 85)
NTIS Prices: PC A02/MF A01

2/6/328
1201386 N86-25142/8/XAB
Implementation and Use of Ada on Distributed Systems with High Reliability Requirements (Annual rept)
NTIS Prices: PC A05/MF A01

2/6/329
1199173 PB86-870466/XAB
Micro-Mainframe Links: Forecasts and Markets. 1983-June 1986 (Citations from The Computer Database) (Rept. for 1983-Jun 86)
NTIS Prices: PC N01/MF N01

2/6/330
1198619 N86-24347/4/XAB
Performance Tradeoffs in Static and Dynamic Load Balancing Strategies (Final rept)
NTIS Prices: PC A02/MF A01

2/6/331
1196115 N86-23319/4/XAB
Display System Software for the Integration of an Adage 3000 Programmable Display Generator into the Solid Modeling Package C.a.D. Software (Contractor rept., 26 Sep 84-31 Mar 86)
NTIS Prices: PC A08/MF A01

2/6/332
1195222 DE86007645/XAB
Environments for Prototyping Parallel Algorithms
NTIS Prices: PC A02/MF A01

2/6/333
1193603 N86-21516/7/XAB
Three-Dimensional Boundary Layer Analysis Program Blay and Its Application
NTIS Prices: PC A02/MF A01

2/6/334
1192839 DE86007309/XAB
Forward Spectrometers at the SSC
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NTIS Prices: PC A02/MF A01

2/6/335
1191949 PB86-866829/XAB
Distributed Information Systems. 1975-April 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Apr 86)
NTIS Prices: PC N01/MF N01

2/6/336

1184451 AD-A164 897/1/XAB
Semi-Applicative Programming. Examples of Context Free Recognizers (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/337
1183966 PB86-862703/XAB
Computer Networks: Data Communication Architecture and Development. 1975-March 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Mar 86)
NTIS Prices: PC N01/MF N01
? t 1387880/7;t 1387870/7;t 1381250/7;t 1380043/7;t 1380010/7;t 1379988/7;t 1377085/7

APPENDIX B

1387880/7
1387880 N89-12255/0/XAB
Study of the Development of On-Board Distributed Software Systems Using Ada
Porcherlabreuille, B. ; Dellatorre, A.
CISI Ingenierie, Toulouse (France).
Corp. Source Codes: 093451000; CP773641
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: ESA-CR(P)-2651; ETN-88-93247
May 88 71p
Languages: English
Journal Announcement: GRAI8906; STAR2703
Prepared in Cooperation with Carlo Gavazzi Controls S.p.a., Milan, Italy.
NTIS Prices: PC A04/MF A01
Country of Publication: France
Contract No.: ESA-6572/85-NL-PP

Use of Ada technology for the design and implementation of large distributed systems in the context of the Columbus space station program was assessed by developing in Ada a prototype of an on-board data management system (DMS). Results and lessons learned by applying a virtual node approach together with hierarchical object oriented design contribute to a better understanding and management of the use of Ada technology. This approach provides the definition of a development framework very well adapted to the Columbus DMS context. By defining applications and services software as Ada virtual nodes it is possible to design the whole system as a single Ada program, structured according to the architecture adopted for DMS. The applications could be developed in parallel on geographically distributed sites and be validated individually using this initial model and the corresponding interface specification. The final integration process could concentrate on the operational validation of the system in distributed configuration (the functional validation in centralized configuration being obtained at the end of the first phase). The efficient implementation of this method requires support tools for: checking the rules imposed by the virtual node approach; and scanning virtual node specifications (Ada packages) in order to generate a surrogate software layer to provide syntactically transparent communication between virtual nodes located on distinct physical processors.

1387870/7
1387870 N89-12222/0/XAB
Support Architecture for Reliable Distributed Computing Systems. Semiannual Status Report, June 9, 1987-June 8, 1988
Dasgupta, P. ; LeBlanc, R. J.

Georgia Inst. of Tech., Atlanta.
Corp. Source Codes: 010263000; GW167534
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: NAS 1.26:183235; NASA-CR-183235
30 Sep 88   36p
Languages: English
Journal Announcement: GRAI8906; STAR2703
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAG1-430
The Clouds project is well underway to its goal of building a unified distributed operating system supporting the object model. The operating system design uses the object concept of structuring software at all levels of the system. The basic operating system was developed and work is under progress to build a usable system.

1381250/7
1381250 AD-A204 126/7/XAB
QLISP for Parallel Processors
(Final rept. 15 Jul 86-31 Jul 88)
McCarthy, J.
Stanford Univ., CA. Dept. of Computer Science.
Corp. Source Codes: 009225004; 094120
Jan 89   4p
Languages: English
Journal Announcement: GRAI8912
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: N00039-84-C-0211; ARPA Order-5826
The goal of the Qlisp project at Stanford is to gain experience with the shared-memory, queue-based approach to parallel Lisp, by implementing the Qlisp language on an actual multiprocessor, and by developing a symbolic algebra system as a testbed application. The experiments performed on the simulator included: 1. Algorithms for sorting and basic data structure manipulation for polynomials. 2. Partitioning and scheduling methods for parallel programming. 3. Parallelizing the production rule system OPS5. Computer programs. (jes)

1380043/7
1380043 N89-16347/1/XAB
Comparing Host and Target Environments for Distributed Ada Programs
Paulk, M. C.
System Development Corp., Huntsville, AL.
Corp. Source Codes: 030459000; S8792091
Sponsor: National Aeronautics and Space Administration, Washington, DC.
1986   10p
Languages: English
Journal Announcement: GRAI8911; STAR2708

In NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 2 10 p.
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)
Country of Publication: United States
The Ada programming language provides a means of specifying logical concurrency by using multitasking. Extending the Ada multitasking concurrency mechanism into a physically concurrent distributed environment which imposes its own requirements can lead to incompatibilities. These problems are discussed. Using distributed Ada for a target system may be appropriate, but when using the Ada language in a host environment, a multiprocessing model may be more suitable than retargeting an Ada compiler for the distributed environment. The tradeoffs between multitasking on distributed targets and multiprocessing on distributed hosts are discussed. Comparisons of the multitasking and multiprocessing models indicate different areas of application.

1380010/7
1380010 N89-16314/1/XAB
Impact of Common APSE (Ada Program Support Environment) Interface Set Specifications on Space Station Information Systems
Diaz-Herrera, J. L. ; Sibley, E. H.
George Mason Univ., Fairfax, VA.
Corp. Source Codes: 063190000; GV714519
Sponsor: National Aeronautics and Space Administration, Washington, DC.
1986 11p
Languages: English
Journal Announcement: GRAI8911; STAR2708
In NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 11 p.
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)
Country of Publication: United States
Certain types of software facilities are needed in a Space Station Information Systems Environment; the Common APSE (Ada Program Support Environment) Interface Set (CAIS) was proposed as a means of satisfying them. The reasonableness of this is discussed by examining the current CAIS, considering the changes due to the latest Requirements and Criteria (RAC) document, and postulating the effects on the CAIS 2.0. Finally, a few additional comments are made on the problems inherent in the Ada language itself, especially on its deficiencies when used for implementing large distributed processing and data base applications.

1379988/7
1379988 N89-16292/9/XAB
Distributed Programming Environment for Ada
Brennan, P. ; McDonnell, T. ; McFarland, G. ; Timmins, L.

J. ; Litke, J.
D.
Grumman Data Systems Corp., Woodbury, NY.
Corp. Source Codes: 093982000; G7180425
Sponsor: National Aeronautics and Space Administration, Washington, DC.
1986 11p
Languages: English
Journal Announcement: GRAI8911; STAR2708
In NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 11 p.
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)
Country of Publication: United States
Despite considerable commercial exploitation of fault tolerance systems, significant and difficult research problems remain in such areas as fault detection and correction. A research project is described which constructs a distributed computing test bed for loosely coupled computers. The project is constructing a tool kit to support research into distributed control algorithms, including a distributed Ada compiler, distributed debugger, test harnesses, and environment monitors. The Ada compiler is being written in Ada and will implement distributed computing at the subsystem level. The design goal is to provide a variety of control mechanics for distributed programming while retaining total transparency at the code level.

1377085/7
1377085 N89-15601/2/XAB
Very Large Area Network (VLAN) Knowledge-Base Applied to Space Communication Problems
Zander, C. S.
Colorado State Univ., Fort Collins.
Corp. Source Codes: 006665000; CU102466
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Oct 88 9p
Languages: English
Journal Announcement: GRAI8910; STAR2707
In NASA, Marshall Space Flight Center, Fourth Conference on Artificial Intelligence for Space Applications p 401-409.
NTIS Prices: (Order as N89-15549/3, PC A21/MF A01)
Country of Publication: United States
This paper first describes a hierarchical model for very large area networks (VLAN). Space communication problems whose solution could profit by the model are discussed and then an enhanced version of this model incorporating the knowledge needed for the missile detection-destruction problem is presented. A satellite network or VLAN is a network which includes at least one satellite. Due to the complexity, a compromise between fully centralized and fully distributed network management has been adopted. Network nodes are assigned to a physically

localized group, called a partition. Partitions consist of groups of cell nodes with one cell node acting as the organizer or master, called the Group Master (GM). Coordinating the group masters is a Partition Master (PM). Knowledge is also distributed hierarchically existing in at least two nodes. Each satellite node has a back-up earth node. Knowledge must be distributed in such a way so as to minimize information loss when a node fails. Thus the model is hierarchical both physically and informationally.

? t 1372001/7;t 1369604/7;t 1369112/7;t 1365721/7;t 1361012/7;t 1351011/7

1372001/7
1372001 N89-14695/5/XAB
Analysis of FDDI Synchronous Traffic Delays
Johnson, M. J.
National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Corp. Source Codes: 019045001; NC473657
Report No.: NAS 1.26:183223; RIACS-TR-88.3; NASA-CR-183223
Jan 88 21p
Languages: English
Journal Announcement: GRAI8909; STAR2706
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NCC2-387
The Fiber Distributed Data Interface (FDDI) high-speed token-ring protocol provides support for two classes of service: synchronous, to support applications which require deterministic access to the channel, and asynchronous, to support applications which do not have such stringent response-time requirements. The purpose of this paper is to determine how
to set ring parameters to support synchronous traffic most efficiently. Both theoretical results and results obtained from a simulation study are presented.

1369604/7
1369604 PB89-150296/XAB
Distributed-Feedback Laser-Diode Module with an Optical Isolator for Multigigabit Optical Transmission
Yamashita, J. ; Nakamura, T. ; Suganuma, R. ; Ito, S. ; Kakimito, S.
Mitsubishi Electric Corp., Tokyo (Japan).
Corp. Source Codes: 076350000
c1988 3p
Languages: Japanese
Journal Announcement: GRAI8908
Text in Japanese.
Included in Mitsubishi Denki Giho, v62 n10 p77-80 1988.
NTIS Prices: (Order as PB89-150221, PC E05/MF A01)
Country of Publication: Japan
The module, which has a thermoelectric cooler, has

the following advantages: a smooth frequency response up to 5GHz, relative intensity noise less than -145dB/Hz, side-model suppression ratio better than 35dB during high-bit-rate modulation, high output-power stability (< or = 0.2dB) over a wide 0 approx. 60 degrees C operating-temperature range, and efficient cooling.

1369112/7
1369112 N89-13991/9/XAB
Strategy for Reducing Turnaround Time in Design Optimization Using a Distributed Computer System
Young, K. C. ; Padula, S. L. ; Rogers, J. L.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.15:101519; NASA-TM-101519
Oct 88 10p
Languages: English
Journal Announcement: GRAI8908; STAR2705
Presented at the Asme Design Technology Conferences-the Design Automation Conference, Kissimmee, Fla., 25-28 Sep. 1988.
NTIS Prices: PC A02/MF A01
Country of Publication: United States

There is a need to explore methods for reducing lengthly computer turnaround or clock time associated with engineering design problems. Different strategies can be employed to reduce this turnaround time. One strategy is to run validated analysis software on a network of existing smaller computers so that portions of the computation can be done in parallel. This paper focuses on the implementation of this method using two types of problems. The first type is a traditional structural design optimization problem, which is characterized by a simple data flow and a complicated analysis. The second type of problem uses an existing computer program designed to study multilevel optimization techniques. This problem is characterized by complicated data flow and a simple analysis. The paper shows that distributed computing can be a viable means for reducing computational turnaround time for engineering design problems that lend themselves to decomposition. Parallel computing can be accomplished with a minimal cost in terms of hardware and software.

1365721/7
1365721 N89-13173/4/XAB
European Seminar on Neural Computing
Zomzely-Neurath, C.
Office of Naval Research, London (England).
Corp. Source Codes: 021603000; OH736806
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: ONRL-8-010-C
31 Aug 88 38p

Languages: English   Document Type: Conference proceeding
Journal Announcement: GRAI8907; STAR2704
Seminar Held in London, United Kingdom, Feb. 1988.
NTIS Prices: PC A03/MF A01
Country of Publication: Other
Topics range from neural systems and models through languages and architectures to the respective European and American perspectives on neurocomputing.

1361012/7
1361012 N89-11438/3/XAB
Sopmcr: An Operating System for the Multiprocessor for Communication Networks
Martins, E. ; Ambrosio, A. M. ; Oshiro, S. K.
Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
Corp. Source Codes: 058511000; IO601891
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: INPE-4675-NTE/284
Aug 88 270p
Languages: Portuguese
Journal Announcement: GRAI8905; STAR2702
In Portuguese; English Summary.
NTIS Prices: PC A12/MF A01
Country of Publication: Brazil
This work presents a distributed system developed at INPE, designed for the Multiprocessor for Network Communications (MCR). The system supports execution of application processes by request from other processes or external events. These processes communicate with each other by asynchronously exchanging messages; the use of a logical entity called channel permits the interprocess communications, independently of where the processes are being executed. The MCR was designed to bepart of a packet-switching communications subnetwork node, among other applications; therefore the system must support the implementation of the lower layers of a communications protocol (layers 2 and 3 in the ISO/OSI architecture).

1351011/7
1351011 TIB/B88-81947/XAB
Nichtnukleare Energieforschung in der Bundesrepublik Deutschland. Bilanz und Ausblick. (Non-nuclear energy research in the Federal Republic of Germany. Balance and outlook)
Nitsch, J.
Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.). Inst. fuer Technische Physik.
Corp. Source Codes: 062740003
Report No.: DFVLR-ITP/IB-441/463-83
Jun 83 83p
Languages: German

Journal Announcement: GRAI8901
In German,
NTIS Prices: PC E09
Country of Publication: Germany, Federal Republic of

After taking a look at the present situation of energy supply in the Federal Republic of Germany the book reports on the non-nuclear energy research of 1972-1982. The topic is divided into following main points: 1) Criteria of supporting technologies; 2) A comprehensive look at the support programs and the classification of the individual areas; 3) The program 'non-nuclear energy systems'; 4) The partial program 'rational utilization of energy in the spheres of application and secondary energy'; 5) The partial program 'new energy sources';and 6) The partial program 'coal and other fossil energy sources'. (UA). (Copyright (c) 1988 by FIZ. Citation no. 88:081947.)

? t 1360264/7;t 1358316/7;t 1344931/7;t 1344375/7;t 1342170/7;t 1341664/7;t 1341275/7

1360264/7
1360264 DE88016468/XAB
BLAZE Family of Languages: Programming Environments for Shared and Distributed Memory Architectures
Mehrotra, P. ; Van Rosendale, J.
Argonne National Lab., IL. Mathematics and Computer Science Div. Corp. Source Codes: 001960004; 9502076
Sponsor: Department of Energy, Washington, DC.
Report No.: ANL/MCS-TM-108
Jun 88 15p
Languages: English
Journal Announcement: GRAI8905; NSA1300
Portions of this document are illegible in microfiche products. NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: W-31109-ENG-38

Designing software environments for parallel computers is a central issue in parallel computing research. This paper discusses this issue and the alternate approaches to resolving it which are being studied. We also look at the way in which the type of parallel architecture constrains the design of the programming environments. Shared memory multiprocessors provide the most freedom in the design of effective programming environments, but are more costly than nonshared memory architectures of comparable power. After this general discussion, we describe two new parallel programming languages, BLAZE 2 and KALI. The first of these, BLAZE 2, is a high level language for shared memory multiprocessors. The second, KALI, is a moderately high-level language for distributed memory architectures. We conclude with a brief discussion of the differences between these two languages, which are a consequence of the difference between shared and non-shared memory

multiprocessors. 13 refs., 3 figs. (ERA citation 13:052904)

1358316/7
1358316 N89-10216/4/XAB
High Speed Fiber Optics Local Area Networks: Design and Implementation. Final Report, January 1, 1984-December 31, 1987
Tobagi, F. A.
Stanford Univ., CA.
Corp. Source Codes: 009225000; S0380476
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: NAS 1.26:182432; NASA-CR-182432
29 Sep 88 9p
Languages: English
Journal Announcement: GRAI8904; STAR2701
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: NAG2-292
The design of high speed local area networks (HSLAN) for communication among distributed devices requires solving problems in three areas: (1) the network medium and its topology; (2) the medium access control; and (3) the network interface. Considerable progress has been made in all areas. Accomplishments are divided into two groups according to their theoretical or experimental nature. A brief summary is given in Section 2, including references to papers which appeared in the literature, as well as to Ph.D. dissertations and technical reports published at Stanford University.

1344931/7
1344931 AD-A197 101/9/XAB
Experiences with POKER
Notkin, D. ; Socha, D. ; Snyder, L. ; Bailey, M. L. ; Forstall, B.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Apr 88 12p
Languages: English
Journal Announcement: GRAI8824
Sponsored in part by Grant AFOSR-88-0023.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; NSF-CCR84-16878
Experience from over five years of building nonshared memory parallel programs using the Poker Parallel Programming Environment has positioned us to evaluate our approach to defining and developing parallel programs. This paper presents the more significant results of our evaluation of Poker. The evaluation is driving our next effort in parallel programming environment; many of the results should be sufficiently general to apply to other related efforts. Keywords:

Algorithms; Programming language. (kr)

1344375/7
1344375 PB88-242144/XAB
Programming Languages for Distributed Systems
Bal, H. E. ; Steiner, J. G. ; Tanenbaum, A. S.
Vrije Univ., Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
Corp. Source Codes: 019507011;
Sponsor: Mathematisch Centrum, Amsterdam (Netherlands).
Report No.: IR-147
Feb 88 84p
Languages: English
Journal Announcement: GRAI8823
Prepared in cooperation with Mathematisch Centrum, Amsterdam (Netherlands).
NTIS Prices: PC E04/MF A01
Country of Publication: Netherlands
The paper presents a survey of recent research in programming distributed systems, with the emphasis on new programming languages specifically designed for this purpose. Short descriptions are given of 20 languages. In addition, a comprehensive bibliography provides over 250 references to more
than 100 languages for distributed programming.

1342170/7
1342170 AD-A196 931/0/XAB
Parallel Programming Paradigms (Doctoral thesis)
Nelson, P. A.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Report No.: TR-87-07-02
Jul 87 142p
Languages: English Document Type: Thesis
Journal Announcement: GRAI8823
Sponsored in part by Grant NSF-DCR84-16878.
NTIS Prices: PC A07/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; N00014-85-K-0328
Paradigms for the development of sequential algorithms, such as divide-and-conquer and the greedy method, are well known. Paradigms for the development of parallel algorithms, especially algorithms for non-shared memory MIMD machines, are not well known. These paradigms are important, not only as tools for the development of new algorithms, but also because algorithms using the same paradigm often have common properties that can be exploited by operations such as contraction. This dissertation identifies four primary paradigms used by non-shared memory MIMD algorithms. They are compute-aggregate-broadcast, divide-and-conquer, pipelining, and reduction. Compute-aggregate-broadcast is used, for example, in numerical approximation algorithms like

the conjugate gradient iterations. Three variations of the compute-aggregate-broadcast paradigm are studied. Divide-and-conquer is shown to be applicable to parallel algorithms. The relationship between divide-and-conquer algorithms and the n-cube is studied. Systolic techniques are known to be broadly applicable for the development of MIMD algorithms. Systolic algorithms are shown to be members of the more general pipelining paradigm. Finally, the reduction paradigm is briefly studied. The contraction problem, the problem arising when an algorithm requires more processors than are available on the execution machine, is studied. Special attention is given to common solutions to the contraction problem in each paradigm. (KR)

1341664/7
1341664 AD-A196 419/6/XAB
Poker (4.1): A Programmer's Reference Guide (Technical rept.)
Snyder, L.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Report No.: TR-83-03-03
Apr 88 97p
Languages: English
Journal Announcement: GRAI8823
NTIS Prices: PC A05/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; NSF-CCR84-16878

This document gives a succinct description of the facilities available with the Poker Parallel Programming Environment. The emphasis is on what is available rather than how to achieve particular results. Although the sections are self-contained, so that they may be referred to independently, there are a few things you should know: 1) Poker uses interactive graphics. The graphics are described in Section 2; the interaction is described in Section 3; 2) The usual programming language notion of a 'source program' as a monolithic piece of symbolic text has been replaced in Poker by a database. The way to create, view, and change the database is described in Section 4; 3) Object programs (the 'compiled database') are executed or emulated by Poker and snapshots of the execution can be continuously displayed; 4) Poker supports a variety of CHiP architectures; the current one can be displayed or changed using the CHiP Parameters facility; Section 7; 5) The back page of this document gives a summary of the commands; and 6) Other versions of Poker exists; consult Appendix B for your particular system. (kr)

1341275/7
1341275 PB88-868625/XAB
DECNET: Digital Equipment Corporation Network Architecture. January 1976-September 1988 (Citations from the INSPEC: Information Services for the Physics and

Engineering Communities Database) (Rept. for Jan 76-Sep 88)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Sep 88 63p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8822
Supersedes PB87-867958.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning the network architecture DECNET provided by the Digital Equipment Corporation. Topics include hardware and software for implementing communications between different computer operating systems. DECNET's ability to create resource sharing, communications networks, and distributed computing is examined by employing specialized protocol layers which serve the functions of network control, data access control, interprogram communications, and automatic error detection and retransmission. Applications for medical information systems, chemical laboratories, electronic mail systems, and industrial process control are presented. (This updated bibliography contains 126 citations, 40 of which are new entries to the previous edition.)
? t 1356758/7;t 1356357/7;t 1356011/7;t 1353023/7;t 1353013/7;t 1353009/7;t 1352984/7

1356758/7
1356758 PB89-122394/XAB
GRAMPS (General Real-Time Asynchronous Multiprocessor System) Operating System: User's Guide
Mansbach, P. ; Shneier, M.
National Bureau of Standards, Gaithersburg, MD.
Corp. Source Codes: 081914000;
Sponsor: Philips Labs., Briarcliff Manor, NY.
Report No.: NBSIR-88/3776
Sep 88 43p
Languages: English
Journal Announcement: GRAI8903
Prepared in cooperation with Philips Labs., Briarcliff Manor, NY. NTIS Prices: PC A03/MF A01
Country of Publication: United States
The guide describes the GRAMPS real-time multiprocessor operating system from an applications viewpoint. It presents the information needed to use GRAMPS in implementing distributed processing applications. Additional information needed by an administrator to set up and maintain a specific application appears in the Administrator's Guide.

1356357/7
1356357 PB89-115315/XAB
ESPRIT SPAN Project: A Kernel System for Integrating Parallel Symbolic and Numeric Processing (Technical rept.)
Refenes, A. N. ; McCabe, S. C. ; Treleaven, P. C.

University Coll., London (England). Dept. of Computer Science.
Corp. Source Codes: 019989026
Report No.: UCL-CS-TR-149
May 88 30p
Languages: English
Journal Announcement: GRAI8903
NTIS Prices: PC E05/MF E05
Country of Publication: United Kingdom

Within ESPRIT, Europe's $3 billion Information Technology research program, projects are developing next generation parallel computers. Each project is undertaken by a consortium of companies and universities. One such consortium (SPAN) is investigating the integration of numeric and symbolic processing involving research at the applications, language, and architecture levels. The core of the SPAN project consists of a Kernel System which connects languages and applications to a range of parallel computer architectures. The Kernel System comprises a Target Machine Language and its corresponding Virtual Machine. The paper describes the design of the SPAN Target Machine Language and its Virtual Machine. The Target Machine Language is a procedural programming language providing explicit constructs to facilitate parallel execution of programs and primitive n-ary list operations to support array and list-processing in a uniform way.

1356011/7
1356011 N88-30321/9/XAB
Performance Analysis of FDDI (Fiber Distributed Data Interface) Johnson, M. J.
National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Corp. Source Codes: 019045001; NC473657
Report No.: NAS 1.26:183206; RIACS-TR-88.11; NASA-CR-183206
Apr 88 20p
Languages: English
Journal Announcement: GRAI8903; STAR2624
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NCC2-387

The Fiber Distributed Data Interface (FDDI) is an emerging ANSI and ISO standard for a 100 megabit per second fiber optic token ring. The performance of the FDDI media access control protocol is analyzed using a simulation developed at NASA Ames. Both analyses using standard measures of performance (including average delay for asynchronous traffic, channel utilization, and transmission queue length) and analyses of characteristics of ring behavior which can be attributed to constraints imposed by the
timed token protocol on token holding time (including bounded token rotation time, support for synchronous traffic, and fairness of channel access for nodes transmitting asynchronous traffic) are included.

1353023/7
1353023 N88-29425/1/XAB
Networking and AI (Artificial Intelligence) Systems: Requirements and Benefits (Abstract Only)
Gold Hill Computers, Inc., Cambridge, MA.
Corp. Source Codes: 092849000; G1146597
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Aug 88 2p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In NASA, Marshall Space Flight Center, Second Conference on Artificial Intelligence for Space Applications p 623-624.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States

The price performance benefits of network systems is well documented. The ability to share expensive resources sold timesharing for mainframes, department clusters of minicomputers, and now local area networks of workstations and servers. In the process, other fundamental system requirements emerged. These have now been generalized with open system requirements for hardware, software, applications and tools. The ability to interconnect a variety of vendor products has led to a specification of interfaces that allow new techniques to extend existing systems for new and exciting applications. As an example of the message passing system, local area networks provide a testbed for many of the issues addressed by future concurrent architectures: synchronization, load balancing, fault tolerance and scalability. Gold Hill has been working with a number of vendors on distributed architectures that range from a network of workstations to a hypercube of microprocessors with distributed memory. Results from early applications are promising both for performance and scalability.

1353013/7
1353013 N88-29415/2/XAB
Design Consideration in Constructing High Performance Embedded Knowledge-Based Systems (KBS)
Dalton, S. D. ; Daley, P. C.
Martin Marietta Aerospace, Denver, CO. Denver Div.
Corp. Source Codes: 100103001; MI411300
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Aug 88 6p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In NASA, Marshall Space Flight Center, Second Conference on Artificial Intelligence for Space Applications p 591-596.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States

As the hardware trends for artificial intelligence (AI)

involve more and more complexity, the process of optimizing the computer system design for a particular problem will also increase in complexity. Space applications of knowledge based systems (KBS) will often require an ability to perform both numerically intensive vector computations and real time symbolic computations. Although parallel machines can theoretically achieve the speeds necessary for most of these problems, if the application itself is not highly parallel, the machine's power cannot be utilized. A scheme is presented which will provide the computer systems engineer with a tool for analyzing machines with various configurations of array, symbolic, scaler, and multiprocessors. High speed networks and interconnections make customized, distributed, intelligent systems feasible for the application of AI in space. The method presented can be used to optimize such AI system configurations and to make comparisons between existing computer systems. It is an open question whether or not, for a given mission requirement, a
suitable computer system design can be constructed for any amount of money.

1353009/7
1353009 N88-29411/1/XAB
Expert System for a Distributed Real-Time Trainer
Purinton, S. C. ; Wang, C. K.
National Aeronautics and Space Administration, Huntsville, AL. George C.
Marshall Space Flight Center.
Corp. Source Codes: 019043002; ND736801
Aug 88 9p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In Its Second Conference on Artificial Intelligence for Space Applications p 545-554.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States
The problem addressed by this expert system concerns the expansion of capability of a Real Time Trainer for the Spacelab flight crew. As requirements for more models or fidelity are placed upon the system, expansion is necessary. The simulator can be expanded using a larger processor or by going to a distributed system and expand by adding additional processors. The distributed system is preferable because it is more economical and can be expanded in a more incremental manner. An expert system was developed to evaluate modeling and timing capability within a real time training simulator. The expert system is based upon a distributed configuration. Components of the modeled system are control tasks, network tasks, emulator tasks, processors, displays, and a network. The distributed module expert system (DMES) allows the configuring of processors, tasks,
display use, keyboard use, and selection of alternate methods

to update the data buffer. Modules can be defined with execution occurring in a specific processor on a network. The system consists of a knowledge front end editor to interactively generate or update the knowledge base, an inference engine, a display module, and a recording module.

1352984/7
1352984 N88-29386/5/XAB
Distributed Cooperating Processes in a Mobile Robot Control System
Skillman, T. L.
Boeing Co., Seattle, WA.
Corp. Source Codes: 004210000; BR564481
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Aug 88 12p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In NASA, Marshall Space Flight Center, Second Conference on Artificial Intelligence for Space Applications p 325-336.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States

A mobile inspection robot has been proposed for the NASA Space Station. It will be a free flying autonomous vehicle that will leave a berthing unit to accomplish a variety of inspection tasks around the Space Station, and then return to its berth to recharge, refuel, and transfer information. The Flying Eye robot will receive voice communication to change its attitude, move at a constant velocity, and move to a predefined location along a self generated path. This mobile robot control system requires integration of traditional command and control techniques with a number of AI technologies. Speech recognition, natural language understanding, task and path planning, sensory abstraction and pattern recognition are all required for successful implementation. The interface between the traditional numeric control techniques and the symbolic processing to the AI technologies must be developed, and a distributed computing approach will be needed to meet the real time computing requirements. To study the integration of the elements of this project, a novel mobile robot control architecture and simulation based on the blackboard architecture was developed. The control system operation and structure is discussed.

? t 1339013/7;t 1337246/7;t 1332983/7;t 1332768/7;t 1332523/7;t 1332050/7;t 1331894/7;t 1331892/7

1339013/7
1339013 AD-A195 520/2/XAB
TAC-1: A Knowledge-Based Air Force Tactical Battle Management Testbed (Interim rept. Oct 86-Sep 87)

Nugent, R. O. ; Tucker, R. W.
MITRE Corp., McLean, VA.
Corp. Source Codes: 045505000; 402364
Sponsor: Rome Air Development Center, Griffiss AFB, NY.
Report No.: RADC-TR-88-10
Jan 88 78p
Languages: English
Journal Announcement: GRAI8822
NTIS Prices: PC A05/MF A01
Country of Publication: United States
Contract No.: F19628-87-C-0001; 5581; 27

This report describes the framework for, and a demonstration vehicle of, a knowledge-based testbed for integrating multiple artificial intelligence systems into a distributed processing network for purposes for evaluation and exploitation. TAC-1 is a version of the testbed applied to the domain of Air Force tactical battle management. The domain-independent framework includes a centralized control subnet, including a message router and a common protocol language for message passing among component systems. A Common Database and a Common Knowledge Base are essential components of the testbed. The Router directs data queries to the Common Database (one of the hosted systems) and, through the use of a Common Knowledge Base, directs service requests to the systems which can handle them. Keywords: Knowledge based systems, Distributed artificial intelligence, Cooperating knowledge based systems, Knowledge based tactical battle management. (sdw)

1337246/7
1337246 AD-A195 395/9/XAB

ACCESS: A Communicating and Cooperating Expert Systems System
(Final rept. 30 Jun 87-31 Jan 88)
Cottman, B. H. ; Paslay, R. C.
Symbiotics, Inc., Caambridge, MA.
Corp. Source Codes: 092500000; 419151
31 Jan 88 112p
Languages: English
Journal Announcement: GRAI8821
NTIS Prices: PC A06/MF A01
Country of Publication: United States
Contract No.: DAAB10-87-C-0053

The primary focus of Phase I was to prototype a development environment, ACCESS, for A Communicating and Cooperating Expert Systems System. More generally, this work explored the question of what capabilities were needed in a development environment for embedding distributed knowledge-based systems applications on personal computer or work-station class platforms. The stated goal of the Phase I research and development effort was to investigate and implement a software environment for the realization of cooperating knowledge sources on personal computers. This system was to be Lisp based, distributed processing was to be facilitated

by message passing using TCP/IP, control was to be accomplished by meta-level objects and a variety of features were to be provided to aid developers in building such systems. Underlying these goals was the assumption that the tools needed to support such an effort, mainly Common Lisp, Portable Common Loops and TCP/IP, were adequate to do so. During the course of this work Symbiotics found several short-comings in these software tools and identified a need for higher level tools to facilitate distributed processing development. This report documents that work and the results of the Phase I effort.

1332983/7
1332983 N88-23083/4/XAB
Strategies for Concurrent Processing of Complex Algorithms in Data Driven Architectures
Stoughton, J. W. ; Mielke, R. R.
Old Dominion Univ., Norfolk, VA.
Corp. Source Codes: 045163000; OS853217
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: NAS 1.26:181657; NASA-CR-181657
Feb 88 73p
Languages: English
Journal Announcement: GRAI8819; STAR2616
NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: NAG1-683
Research directed at developing a graph theoretical model for describing data and control flow associated with the execution of large grained algorithms in a special distributed computer environment is presented. This model is identified by the acronym ATAMM which represents Algorithms To Architecture Mapping Model. The purpose of such a model is to provide a basis for establishing rules for relating an algorithm to its execution in a multiprocessor environment. Specifications derived from the model lead directly to the description of a data flow architecture which is a consequence of the inherent behavior of the data and control flow described by the model. The purpose of the ATAMM based architecture is to provide an analytical basis for performance evaluation. The ATAMM model and architecture specifications are demonstrated on a prototype system for concept validation.

1332768/7
1332768 DE88008019/XAB
Graphical Multiprocessing Analysis Tool (GMAT)
Seager, M. K. ; Campbell, S. ; Sikora, S. ; Strout, R. ; Zosel, M.
Lawrence Livermore National Lab., CA.
Corp. Source Codes: 068147000; 9513035
Sponsor: Department of Energy, Washington, DC.
Report No.: UCID-21348; ISCR-87-2

Mar 88 47p
Languages: English
Journal Announcement: GRAI8819; NSA1300
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: W-7405-ENG-48

The design and debugging of parallel programs is a difficult task due to the complex synchronization and data scoping issues involved to aid the programmer in parallel code development we have developed two methodologies for the graphical display of execution of parallel codes. The Graphical Multiprocessing Analysis Tools (GMAT) consist of stategraph, which represents an inheritance tree of task states, and timeliness, which represents task as flowing sequence of events. Information about the code can be displayed as the application runs (dynamic mode) or played back with time under user control (static mode). This document discusses the design and user interface issues involved in developing the parallel application display GMAT family. Also, we present an introductory user's guide for both tools. 4 figs. (ERA citation 13:032031)

1332523/7
1332523 AD-A194 128/5/XAB

Cauldrons: An Abstraction for Concurrent Problems Solving. Revision (Memorandum rept.)

Haase, K.
Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

Corp. Source Codes: 001450241; 407483
Report No.: AI-M-673
Sep 86 45p
Languages: English
Journal Announcement: GRAI8819
Revision of report dated Dec 82.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-79-C-0260

The abstractions we have for serial programming are powerful: concepts like data types, variable binding, generalized operators, the subroutine. We do not yet have the same sort of powerful abstractions for distributed computation, but I believe that the place to look for them is the same place that we found many of our abstractions for serial computation--in our own minds. This research extends a tradition of distributed theories of mind into the implementation of a distributed problem solver. In this problem solver a number of ideas from Minsky's Society of Mind are implemented and are found to provide powerful abstractions for the programming of distributed systems. These abstractions are the cauldron, a mechanism for instantiating reasoning contexts, the frame, a way of modularly describing those contexts and the goal-mode, a mechanism for bringing a particular context to bear

on a specific task. The implementation of both these abstractions and the distributed problem solver in which they run is described, accompanied by examples of their application to various domains.

1332050/7
1332050 AD-A193 648/3/XAB
Combined And-Or Parallel Execution of Logic Programs
Gupta, G. ; Jayaraman, B.
North Carolina Univ. at Chapel Hill. Dept. of Computer Science. Corp. Source Codes: 045592060; 409668
Report No.: TR88-012
Mar 88 23p
Languages: English
Journal Announcement: GRAI8819
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0680; NSF-DCR86-03609

A number of approaches have recently been proposed for the parallel execution of logic programming languages, but most of them deal with either or-parallelism or and-parallelism but not both. This paper describes a high-level design for efficiently supporting both and-parallelism and or-parallelism. Our approach is based on the binding arrays method for or-parallelism and the RAP method for and-parallelism. Extensions to the binding-arrays method are proposed in order to achieve constant access-time to variables in the presence of and-parallelism. The RAP (Restricted And-Parallelism) method becomes simplified because backtracking is unnecessary in the presence of or-parallelism. The author's approach has the added effect of eliminating redundant computations when goals exhibit both and-and or-parallelism. The paper first briefly describes the basic issues in pure and-parallelism and or-parallelism, states desirable criteria for their implementation (with respect to variable access, task creation and switching), and then describes the combined and-or implementation.

1331894/7
1331894 AD-A193 465/2/XAB
Programming Language Concepts for Multiprocessors (Interim rept.)
Jordan, H. F.
Colorado Univ. at Boulder. Computer Systems Design Group.
Corp. Source Codes: 068646038; 418831
Report No.: CSDG-87-4; ECE-TR-87-1-3
Sep 87 14p
Languages: English
Journal Announcement: GRAI8819
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0204

It is currently possible to build multiprocessor

systems which will support the tightly coupled activity of hundreds to thousands of different instruction streams, or processes. This can be done by coupling many monoprocessors, or a smaller number of pipelined multiprocessors, through a high concurrency switching network. The switching network may be couple processors to memory modules, resulting in a shared memory multiprocessor system, or it may couple processor/memory pairs, resulting in a distributed memory system. The need to direct the activity of very many processes simultaneously places qualitatively different demands on a programming language than the direction of a single process. In spite of the different requirements, most languages for multiprocessors have been simple extensions of conventional, single stream programming languages. The extensions are often implemented by way of subroutine calls and have little impact on the basic structure of the language. This paper attempts to examine the underlying conceptual structure of parallel languages for large scale multiprocessors on the basis of an existing language for shared memory multiprocessors, known as the FORCE, and to extend the concepts in this language to distributed memory systems.

1331892/7

1331892 AD-A193 463/7/XAB

Force. (Parallel Programming Language)

(Interim rept.)

Jordan, H.

Colorado Univ. at Boulder. Computer Systems Design Group.

Corp. Source Codes: 068646038; 418831

Report No.: CSDG-87-1; ECE-TR-87-1-1

Jan 87 44p

Languages: English

Journal Announcement: GRAI8819

Sponsored in part by grants NAG-1-640, NAS1-17070.

NTIS Prices: PC A03/MF A01

Country of Publication: United States

Contract No.: N00014-86-K-0204; AFOSR-85-1089

The FORCE is a parallel programming language and methodology based on the shared memory multiprocessor model of computation. It is an extension to Fortran which allows a user to write a parallel program that is independent of the number of processes executing it and in which the management of processes is suppressed. Multiple instruction streams are managed as a group by operations that synchronize them and allocate work. The system is implemented on several machines as a macro preprocessor which expands FORCE programs into Fortran code for the host system.

? t 1331037/7;t 1329890/7;t 1329055/7;t 1328670/7;t 1326261/7;t 1321106/7;t 1320158/7

1331037/7
1331037 PB88-203997/XAB
Distributed Application Programming with Extended Prolog (Distribuerad Applikationsprogrammering med Utvidgad Prolog)
Stroemberg, D.
Foersvarets Forskningsanstalt, Stockholm (Sweden).
Corp. Source Codes: 063330000
Report No.: FOA-B-30121-3.3
Jan 88 31p
Languages: English
Journal Announcement: GRAI8818
NTIS Prices: PC E03/MF A01
Country of Publication: Sweden
Many tasks in office oriented environments engage several experts and office workers. The increasing use of workstation based tools for such tasks calls for simpler and more appropriate ways to specify program distribution and user communication. The authors propose a facility to specify such task sharing. The main point in the approach is the localization term, which is an extension to a Prolog-like language. This allows us to describe a multi-user application as one unified program instead of as a set of distributed single-user programs.

1329890/7
1329890 AD-A193 297/9/XAB
Poker on the Cosmic Cube: The First Retargetable Parallel Programming Language and Environment (Technical rept.)
Snyder, L. ; Socha, D.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Report No.: TR-86-02-05
Jun 86 17p
Languages: English
Journal Announcement: GRAI8818
Sponsored in part by Contract N00014-85-K-0328.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; NSF-DCR84-16878
This paper describes a technique for retargetting Poker, the first complete parallel programming environment, to new parallel architectures. The specifics are illustrated by describing the retarget of Poker to CalTech's Cosmic Cube. Poker requires only three features from the target architecture: MIMD operation, message passing inter-process communication, and a sequential language (e.g. C) for the processor elements. In return Poker gives the new architecture a complete parallel programming environment which will compile Poker parallel programs without modification, into efficient object code for the new architecture.

1329055/7

1329055 PB88-201769/XAB
Optimal Database Allocation in Distributed Computer Network Systems
Inamoto, A.
Mitsubishi Electric Corp., Tokyo (Japan).
Corp. Source Codes: 076350000
c1987 4p
Languages: Japanese
Journal Announcement: GRAI8817
Text in Japanese.
Included in Mitsubishi Denki Giho, v61 n12 p26-29 1987.
NTIS Prices: (Order as PB88-201751, PC E04/MF A01)
Country of Publication: Japan
The report concerns optimal database allocation and optimal location of processors in the distributed processing networks used for sales and product distribution management systems. The problems are formulated, and a mathematical methodology for solving these problems is presented. To minimize the system expense, the methodology is used to analyze the hardware cost of the distributed processors, the cost of the magnetic disk drive for database storage, the cost of communications over a packet switching network, and the cost of leased lines.

1328670/7
1328670 N88-21688/2/XAB
Distributed Operating Systems: An Overview
Aksit, M.
Technische Univ. Twente, Enschede (Netherlands). Dept. of Computer Science.
Corp. Source Codes: 090700004; TJ309982
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: INF-87-29; ETN-88-91830
Oct 87 26p
Languages: English
Journal Announcement: GRAI8817; STAR2614
NTIS Prices: PC A03/MF A01
Country of Publication: Netherlands
Layered systems, operating systems, and distributed computer systems are defined. The differences between parallel and distributed processing are identified. Existing distributed operating systems are listed. Distributed operating system design issues are summarized.

1326261/7
1326261 PB88-865043/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-May 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 75-May 88)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Jun 88 147p

Languages: English Document Type: Bibliography
Journal Announcement: GRAI8816
Supersedes PB87-858429.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning architecture and development of computer networks for data communication systems. Data network design, operation, performance analysis, reliability, security, maintenance and evolution are discussed. Techniques of packet switched and distributed data communication networks are presented. Applications of data communication technology are included. (This updated bibliography contains 345 citations, 22 of which are new entries to the previous edition.)

1321106/7
1321106 AD-A190 956/3/XAB
UNIX Based Programming Tools for Locally Distributed Network Applications (Master's thesis)
Frank, W. C.
Naval Postgraduate School, Monterey, CA.
Corp. Source Codes: 019895000; 251450
Dec 87 105p
Languages: English Document Type: Thesis
Journal Announcement: GRAI8815
NTIS Prices: PC A06/MF A01
Country of Publication: United States
The Graphics and Video Laboratory of the Department of Computer Science has a growing need for easy to use programming tools in support of distributed processing applications. The most pressing need is for software on three UNIX-based workstations connected via Ethernet. The remote interprocess communication tools that UNIX provides for using Ethernet are effective but complicated to learn. This requires researchers to spends
much of their time becoming proficient with them instead of concentrating on the distributed application at hand. This work presents the design and implementation of several programming tools that allow programmers to establish and experiment with distributed programs in the graphics laboratory environment. The tools allow a higher level of abstraction for remote interprocess communications and establish a straightforward method for implementing distributed programs. Additionally, they support code reuseability with software templates and are modularized to be both understandable and changeable. Recommendations are made for future research and management efforts that have been highlighted by these new tools.

1320158/7
1320158 N88-19147/3/XAB
Distributed Computation of Graphics Primitives on a Transputer Network

Ellis, G. K.
National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Corp. Source Codes: 019039001; ND315753
Report No.: NAS 1.15:100814; ICOMP-88-3; NASA-TM-100814
1988 7p
Languages: English
Journal Announcement: GRAI8814; STAR2611
Prepared for Presentation at the Summer Computer Simulation Conference, Seattle, Wash., 25-28 Jul. 1988; Sponsored in Part by the Society for Computer Simulation.
NTIS Prices: PC A02/MF A01
Country of Publication: United States
A method is developed for distributing the computation of graphics primitives on a parallel processing network. Off-the-shelf transputer boards are used to perform the graphics transformations and scan-conversion tasks that would normally be assigned to a single transputer based display processor. Each node in the network performs a single graphics primitive
computation. Frequently requested tasks can be duplicated on several nodes. The results indicate that the current distribution of commands on the graphics network shows a performance degradation when compared to the graphics display board alone. A change to more computation per node for every communication (perform more complex tasks on each node) may cause the desired increase in throughput.

? t 1314371/7;t 1314308/7;t 1312882/7;t 1312569/7;t 1306589/7;t 1306289/7;t 1302419/7

1314371/7
1314371 N88-17312/5/XAB
Systeme de Programmation Parallele Occam/Ada (Occam/Ada Parallel Programming System) (Doctoral thesis)
Nekkache, M.
Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
Lab. d'Informatique Appliquee.
Corp. Source Codes: 067950006; II354902
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: ISAL-IDI1-87-11; ETN-88-91630
1987 133p
Languages: French Document Type: Thesis
Journal Announcement: GRAI8812; STAR2609
In French; English Summary.
NTIS Prices: PC A07/MF A01
Country of Publication: France
A programming tool to specify and develop real time applications in Ada language is presented. The Occam system was chosen as a basis and translated into Ada language. Programming is regarded as a scheduling activity

rather than a sequencing one. The problems involved included splitting systems in smaller parallel systems, synchronizing of the components, and mutual exclusion of shared variables. Application experience indicates that Occam may be considered a language for specification and development in Ada.

1314308/7

1314308 N88-17230/9/XAB

Task Allocation in a Distributed Computing System

Seward, W. D.

Air Force Inst. of Tech., Wright-Patterson AFB, OH. Dept. of Electrical and Computer Engineering.

Corp. Source Codes: 000805001; AI174479

Sponsor: National Aeronautics and Space Administration, Washington, DC.

Oct 87 9p

Languages: English

Journal Announcement: GRAI8812; STAR2609

In NASA. Lyndon B. Johnson Space Center, Houston, Texas,First Annual Workshop on Space Operations Automation and Robotics (SOAR 87), p173-181.

NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

Country of Publication: United States

A conceptual framework is examined for task allocation in distributed systems. Application and computing system parameters critical to task allocation decision processes are discussed. Task allocation techniques are addressed which focus on achieving a balance in the load distribution among the system's processors. Equalization of computing load among the processing elements is the goal. Examples of system performance are presented for specific applications. Both static and dynamic allocation of tasks are considered and system performance is evaluated using different task allocation methodologies.

1312882/7

1312882 AD-A189 569/7/XAB

Why We Can't Program Multiprocessors the Way We're Trying to Do It Now (Technical rept.)

Baldwin, D.

Rochester Univ., NY. Dept. of Computer Science.

Corp. Source Codes: 010090065; 410386

Report No.: TR-224

Aug 87 36p

Languages: English

Journal Announcement: GRAI8812

Sponsored in part by Grant NSF-DCR83-20136.

NTIS Prices: PC A03/MF A01

Country of Publication: United States

Contract No.: DACA76-85-C-0001; NSF-DMC86-13489

Parallel computation is an area in which software technology lags considerably behind hardware technology. The need for parallel computing in a number of applications (e.g., scientific computing, machine vision, artificial

intelligence) is unquestioned, and computers with hundreds of processors are now readily available (for instance, the Butterfly or the
many derivatives of the Cosmic Cube). However, these machines are programmed in essentially the same way as existing sequential machines. The best available parallel programming languages are variants of standard sequential languages, with extensions to let the programmer explicitly divide a program into tasks and pass information between those tasks. Although designers of these languages claim that they are no harder to use
than conventional sequential ones, programmers still face the problem of figuring out how to partition their application into tasks in addition to the usual problem of translating it into a program. An appealing alternative is to leave partitioning of programs to compilers. By hiding partitioning problems from programmers, this approach should make
multi-processor computers easier to program than they are now. Unfortunately efforts to develop parallelizing compilers have so far been rather unsuccessful.

1312569/7
1312569 AD-A189 245/4/XAB
Interface between Object-Oriented Systems (Technical rept.)
Crowl, L. A.
Rochester Univ., NY. Dept. of Computer Science.
Corp. Source Codes: 010090065; 410386
Report No.: TR-211
Apr 87 23p
Languages: English
Journal Announcement: GRAI8812
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: DACA76-85-C-0001; NSF-DCR83-20136
The Chrysalis operating system for the Butterfly Parallel Processor presents an object-oriented programming environment based on shared memory. However, because of Chrysalis's low level orientation and its use of type-unsafe features of the C programming language, programs using the environment are difficult to program and highly error-prone. Using C as the primary programming language for the Butterfly does not fully realize the
benefit of Chrysalis's object orientation. An object-oriented programming language is natural candidate for improving the Chrysalis environment. The C ++ programming language provides a number of advantages in developing such an interface. This paper reports the successes and problems encountered in the development of Chrysalis ++, a C ++ interface to Chrysalis ++ uncovered many strengths and weakness in C ++. Some apply to C
++ in general, others apply only to its adaptation

to a parallel programming environment. It is important to note that C++ is a sequential language; it is use in a parallel programming environment is therefore outside the bounds of its design.

1306589/7
1306589 AD-A188 142/4/XAB
Implementing Dynamic Arrays: A Challenge for High-Performance Machines
Mago, G. ; Partain, W.
North Carolina Univ. at Chapel Hill. Dept. of Computer Science. Corp. Source Codes: 045592060; 409668
1986 3p
Languages: English
Journal Announcement: GRAI8810
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: DAAL03-86-G-0050
There is an increasing need for high-performance AI machines. What is unusual about AI is that its programs are typically dynamic in the way their execution unfolds and in the data structures they use. AI therefore needs machines that are late-binding. Multiprocessors are often held out as the answer to AI's computing requirements. However, most success with
multiprocessing has come from exploiting numerical computations' basic data structure-the static array (as in FORTRAN). A static array's structure does not change, so its elements (and the processing on them) may be readily distributed. In AI, the ability to change and manipulate the structure of data is paramount; hence, the pre-eminence of the LISP list. Unfortunately, the traditional pointer-based list has serious drawbacks for distributed processing. The dynamic array is a data structure that allows random access to its elements (like static arrays) yet whose structure-size and dimensions-can be easily changed, i.e., bound and re-bound at run-time. It combines the flexibility that AI requires with the potential for high performance through parallel operation. A machine's implementation of
dynamic arrays gives a good insight into its potential usefulness for AI applications. Therefore, the authors outline the implementation of dynamic arrays on a machine that we are developing.

1306289/7
1306289 AD-A187 824/8/XAB
Performance Measurements of Distributed Simulation Strategies
(Technical rept.)
Fujimoto, R. M.
Utah Univ., Salt Lake City. Dept. of Computer Science.
Corp. Source Codes: 016669107; 404949
Report No.: UUCS-87-026

1987 29p
Languages: English
Journal Announcement: GRAI8810
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-87-K-0184; NSF-DCR85-04826

Although many distributed simulation strategies have been developed, to data, little empirical data is available to evaluate their performance. A multiprocessor-based, distributed simulation testbed is described that was designed to facilitate controlled experimentation with distributed simulation algorithms. Using this testbed, the performance of simulation strategies using deadlock avoidance and deadlock detection and recovery techniques was examined under various synthetic workloads. The distributed simulators were compared with a uniprocessor-based event list implementation. Results of a series of experiments are reported that demonstrate that message population and the degree to which processes can look ahead in simulated time play critical roles in the performance of distributed simulators using these algorithms. An avalanche phenomenon was observed in the deadlock detection and recovery simulators as message population was increased, and was found to be a necessary condition for achieving good performance. It is demonstrated that these distributed simulation algorithms can provide significant speedups over sequential event list implementations for some workloads, even in the presence of only a moderate amount of parallelism and many feedback loops. However, a moderate to high degree of parallelism was not sufficient to guarantee good performance for all workloads that were tested.

1302419/7
1302419 N88-13886/2/XAB

Introduction to Local Area Network Design on Ariane 5 and Future Launchers

Durand, Y. ; Pic, J.
Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).

Corp. Source Codes: 071736000; SQ445108
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: SNIAS-872-422-102; ETN-88-91203
17 Jan 86 11p
Languages: English
Journal Announcement: GRAI8808; STAR2605
NTIS Prices: PC A03/MF A01
Country of Publication: France

The impact of real time local area networks (LAN) on launchers is discussed. Communication needs of a launch vehicle that call for distributed processing techniques are reviewed. The design drivers of the system are identified. A method to ensure the fulfillment of design

goals, i.e., to benefit from the potentials of real time LAN is outlined.
? t 1297257/7;t 1291911/7;t 1291909/7;t 1285013/7

1297257/7
1297257 N88-12287/4/XAB
Mapping a Battlefield Simulation onto Message-Passing Parallel Architectures (Final rept.)
Nicol, D. M.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178396; ICASE-87-51; NASA-CR-178396
Oct 87 18p
Languages: English
Journal Announcement: GRAI8806; STAR2603
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-18107
Perhaps the most critical problem in distributed simulation is that of mapping: without an effective mapping of workload to processors the speedup potential of parallel processing cannot be realized. Mapping a simulation onto a message-passing architecture is especially difficult when the computational workload dynamically changes as a function of time and space; this is exactly the situation faced by battlefield simulations. This paper studies an approach where the simulated battlefield domain is first partitioned into many regions of equal size; typically there are more regions than processors. The regions are then assigned to processors; a processor is responsible for performing all simulation activity associated with the regions. The assignment algorithm is quite simple and attempts to balance load by exploiting locality of workload intensity. The performance
of this technique is studied on a simple battlefield simulation implemented on the Flex/32 multiprocessor. Measurements show that the proposed method achieves reasonable processor efficiencies. Furthermore, the method shows promise for use in dynamic remapping of the simulation.

1291911/7
1291911 N88-11402/0/XAB
Report from the MPP (Massively Parallel Processor) Working Group to the NASA (National Aeronautics and Space Administration) Associate Administrator for Space Science and Applications. Technical Memorandum
Report, October 1, 1985-September 30, 1986
Fischer, J. R. ; Grosch, C. ; McAnulty, M. ; ODonnell, J. ; Storey, O.
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
Corp. Source Codes: 013129001; NC999967

Report No.: NAS 1.15:87819; REPT-87B0265;s jPT]5B;C Kj&h'oY 87 64p
Languages: English
Journal Announcement: GRAI8804; STAR2602
NTIS Prices: PC A04/MF A01
Country of Publication: United States
NASA's Office of Space Science and Applications (OSSA) gave a select group of scientists the opportunity to test and implement their computational algorithms on the Massively Parallel Processor (MPP) located at Goddard Space Flight Center, beginning in late 1985. One year later, the Working Group presented its report, which addressed the following: algorithms, programming languages, architecture, programming environments, the way theory relates, and performance measured. The findings point to a number of demonstrated computational techniques for which the MPP architecture is ideally suited. For example, besides executing much faster on the MPP than on conventional computers, systolic VLSI simulation (where distances are short), lattice simulation, neural network simulation, and image problems were found to be easier to program on the MPP's architecture than on a CYBER 205 or even a VAX. The report also makes technical recommendations covering all aspects of MPP use, and recommendations concerning the future of the MPP and machines based on similar architectures, expansion of the Working Group, and study of the role of future parallel processors for space station, EOS, and the Great Observatories era.

1291909/7
1291909 N88-11398/0/XAB
Cache-Based Error Recovery for Shared Memory Multiprocessor Systems
Wu, K. ; Fuchs, W. K. ; Patel, J. H.
Illinois Univ. at Urbana-Champaign.
Corp. Source Codes: 034597000; IB655059
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: NAS 1.26:181470; NASA-CR-181470
20 Nov 87 21p
Languages: English
Journal Announcement: GRAI8804; STAR2602
Sponsored in cooperation with Texas Instruments, Inc. and Digital Equipment Corp. Presented at FTCS 18, Tokyo, Japan, June 27-30, 1987.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAG1-613
The problem of recovering from processor failures in shared memory multiprocessor systems is examined. A cache-based checkpointing scheme is developed utilizing a checkpointing algorithm which guarantees that a consistent global state is always maintained. Processes can recover from errors due to a faulty processor by restarting from

the consistent saved computation state. There are no difficulties with checkpoint propagation in that when a process p takes a checkpoint, no other process is forced to join p in the checkpoint. The recovery algorithm allows only those processes encountering errors to perform rollback recovery while other unaffected processes on fault free processors continue normal execution.
The checkpointing recovery schemes are shown to be easily integrated into standard bus-based cache coherence protocols. An analytical model is used to estimate the checkpointing frequency and the performance degradation incurred by the checkpointing scheme during normal execution.

1285013/7
1285013 AD-A184 969/4/XAB
Test and Evaluation of the Transputer in a Multi-Transputer System (Master's thesis)
Filho, J. V.
Naval Postgraduate School, Monterey, CA.
Corp. Source Codes: 019895000; 251450
Jun 87 200p
Languages: English Document Type: Thesis
Journal Announcement: GRAI8802
NTIS Prices: PC A09/MF A01
Country of Publication: United States
The purpose of this thesis is to start the evaluation of the Transputer, a 32 bit microprocessor on a chip, to verify its potentials and limitations for real time applications, in distributed systems. The evaluation concentrates on the four physical communication links, and its advertised capability to operate in parallel with the main processor (CPU), each one
of them at rate of 10 mbit/sec in each direction. It also presents to the reader an introduction to the machine itself, to the Occam Programming Language, a description of the environment at the Naval Postgraduate School (NPS), and suggests to the novice a learning sequence. The evaluation programs and other example programs presented in this thesis were implemented using the Occam Programming Language (Proto-Occam) in either
the Occam Programming System (OPS) or the Transputer Development System (TDS), both resident on the VAX 11/780 computer under the VMS Operating System (VAX/VMS).
? t 1277155/7;t 1276980/7;t 1273325/7;t 1269040/7;t 1267878/7;t 1264037/7;t 1254966/7

1277155/7
1277155 PB87-867958/XAB
DECNET: Digital Equipment Corporation Network Architecture. January 1976-September 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 76-Sep 87)

National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Oct 87 44p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8723
Supersedes PB86-877123.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning the network architecture DECNET provided by the Digital Equipment Corporation. Topics include hardware and software for implementing communications between different computer operating systems. DECNET's ability to create resource sharing, communications networks, and distributed computing is examined by employing specialized protocol layers which serve the functions of network control, data access control, interprogram communications, and automatic error detection and retransmission. Applications for medical information systems, chemical laboratories, electronic mail systems, and industrial process control are presented. (This updated bibliography contains 86 citations, 28 of which are new entries to the previous edition.)

1276980/7
1276980 PB87-226098/XAB
Network Protocols: Proceedings of the Joint IBM (International Business Machines)/University of Newcastle upon Tyne Seminar Held in the University Computing Laboratory, September 3-6, 1985
Randell, B.
Newcastle upon Tyne Univ. (England). Computing Lab.
Corp. Source Codes: 020410010
c1986 279p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8723
NTIS Prices: PC E12/MF E12
Country of Publication: United Kingdom
Contents: The performance of LAN protocols; Open systems interconnection communication architecture; Realization of open systems; Electronic messaging; Another look at computer communication protocols; Computerized commerce; High layer protocol standardization for distributed processing; IBM logical unit type 6.2--An overview; Verifying a protocol algebraically
using CCS; Communication architectures for distributed systems; The state of the art in testing protocol implementations; Notes on automated protocol analysis; Standardization for open systems; On protocol engineering.

1273325/7
1273325 N87-26568/2/XAB
Network Protocols for Real-Time Applications
Johnson, M. J.
National Aeronautics and Space Administration, Moffett

Field, CA. Ames Research Center.
Corp. Source Codes: 019045001; NC473657
Report No.: NAS 1.26:180977; RIACS-TR-87.15; NASA-CR-180977
May 87 17p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8722; STAR2520
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: NCC2-387

The Fiber Distributed Data Interface (FDDI) and the SAE AE-9B High Speed Ring Bus (HSRB) are emerging standards for high-performance token ring local area networks. FDDI was designed to be a general-purpose high-performance network. HSRB was designed specifically for military real-time applications. A workshop was conducted at NASA Ames Research Center in January, 1987 to compare and contrast these protocols with respect to their ability to support real-time applications. This report summarizes workshop presentations and includes an independent comparison of the two protocols. A conclusion reached at the workshop was that current protocols for the upper layers of the Open Systems Interconnection (OSI) network model are inadequate for real-time applications.

1269040/7
1269040 AD-A182 513/2/XAB
CRONUS, A Distributed Operating System: CRONUS DOS Implementation (Final rept. Oct 84-Jan 86)
Schantz, R. ; Schroder, K. ; Barrow, M. ; Bono, G. ; Dean, M.
Bolt Beranek and Newman, Inc., Cambridge, MA.
Corp. Source Codes: 004246000; 060100
Sponsor: Rome Air Development Center, Griffiss AFB, NY.
Report No.: BBN-6183; RADC-TR-86-183
Dec 86 70p
Languages: English
Journal Announcement: GRAI8721
NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: F30602-84-C-0171; 2530; 01

This is the final report for the second contract phase for development of the CRONUS Project. CRONUS is the name given to the distributed operating system (DOS) and system architecture for distributed application development environment being designed and implemented by BBN Laboratories for the Air Force Rome Air Development Center (RADC). The project was begun in 1981. The CRONUS distributed operating system is intended to promote resources which are shared. Its major purpose is to provide a coherent and integrated system based on clusters of interconnected heterogeneous computers to support the development and use of distributed applications. Distributed applications range from simple programs that merely require convenient reference to remote data, to collections of

complex subsystems tailored to take advantage of a distributed architecture. One of the main contributions of CRONUS is a unifying architecture and model for developing these distributed applications; as well as support for a number of
system-provided functions which are common to many applications.

1267878/7
1267878 N87-24949/6/XAB
New Technology Impacts on Future Avionics Architectures
Mejzak, R. S.
Naval Air Development Center, Warminster, PA.
Corp. Source Codes: 032381000; NO000154
Sponsor: National Aeronautics and Space Administration, Washington, DC.
c1987 7p
Languages: English
Journal Announcement: GRAI8720; STAR2518
In AGARD Advanced Computer Aids in the Planning and Execution of Air Warfare and Ground Strike Operations, 7p.
NTIS Prices: (Order as N87-24940 PC A07/MF A01)
Country of Publication: United States
An interpretation of avionics architecture is provided with respect to system components, organization, and design factors. Initially, general avionics architecture characteristics are addressed followed by discussions on emerging technologies and their impact on advanced systems. Information handling requirements are projected for future tactical aircraft. In addition, advanced avionics architecture design consideration and technical issues are addressed relative to achieving improved performance, reliability, survivability, flexibility, and low life cycle cost.

1264037/7
1264037 DE87008229/XAB
Effect of Distributed Computing Technology on Wide Area Network Capacity Requirements
Hall, D. ; Johnston, W. ; Hutchinson, M. ; Rosenblum, M. ; Robertson, D.
Lawrence Berkeley Lab., CA.
Corp. Source Codes: 086929000; 9513034
Sponsor: Department of Energy, Washington, DC.
Report No.: LBL-22948; CONF-870277-1
Feb 87 12p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8719; NSA1200
Federal Coordinating Council on science, engineering and technology, San Diego, CA, USA, 17 Feb 1987.
Portions of this document are illegible in microfiche products. NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: AC03-76SF00098

This report identifies a need to increase wide area network capacity by as much as three orders of magnitude over the next ten years. These increases are necessary to support new distributed computing products. Such products increase productivity, but are currently available only on local area networks. There is no technical reason for limiting these products to tightly constrained geographical areas, however. They can operate perfectly well over any terrestrial distance provided sufficient bandwidth is available. Such bandwidth is available today with fiber optics. To quantify capacity requirements, network traffic generated by this newer technology is compared with traditional traffic in a local network environment. An extrapolation to wide area networks is made. Speculation about the long term future of distributed computing technology and its effect on network capacity requirements is offered. It is argued that an increase of network capacity by one order of magnitude is sufficient to accommodate new distributed computing technology on existing wide area networks. Two orders of magnitude are needed to accommodate a fully integrated distributed system such as interactive graphics. Three orders of magnitude are needed to accommodate increases in hardware speed anticipated in the next five to ten years. Availability of highly integrated, nationwide distributed computing service would significantly increase the competitive edge of the United States in science and computing. (ERA citation 12:028235)

1254966/7
1254966 DE87003740/XAB
Numerical Computation on Massively Parallel Hypercubes
McBryan, O. A.
Los Alamos National Lab., NM.
Corp. Source Codes: 072735000; 9512470
Sponsor: Department of Energy, Washington, DC.
Report No.: LA-UR-86-4218; CONF-8609173-9
1986 20p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8716; NSA0000
Conference on hypercube multiprocessors, Knoxville, TN, USA, 29 Sep 1986.
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: AC02-76ER03077; W-7405-ENG-36

We describe numerical computations on the Connection Machine, a massively parallel hypercube architecture with 65,536 single-bit processors and 32 Mbytes of memory. A parallel extension of COMMON LISP, provides access to the processors and network. The rich software environment is further enhanced by a powerful virtual processor capability, which extends the degree of fine-grained parallelism beyond 1,000,000. We briefly describe the hardware and indicate the principal features of the parallel programming environment. We then present

implementations of SOR, multigrid and pre-conditioned conjugate gradient algorithms for solving partial differential equations on the Connection Machine. Despite the lack of floating point hardware, computation rates above 100 megaflops have been achieved in PDE solution. Virtual processors prove to be a real advantage,
easing the effort of software development while improving system performance significantly. The software development effort is also facilitated by the fact that hypercube communications prove to be fast and essentially independent of distance. 29 refs., 4 figs.
? t 1249337/7;t 1247084/7;t 1227996/7;t 1227984/7;t 1218318/7;t 1216028/7;t 1214434/7

1249337/7
1249337 PB87-858429/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-April 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 75-Apr 87)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Apr 87 135p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8713
Supersedes PB86-862703.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning architecture and development of computer networks for data communication systems. Data network design, operation, performance analysis, reliability, security, maintenance and evolution are discussed. Techniques of packet switched and distributed data communication networks are presented. Applications of data communication technology are included. (This updated bibliography contains 323 citations, 37 of which are new entries to the previous edition.)

1247084/7
1247084 AD-A178 975/9/XAB
Durra: A Task-Level Description Language Preliminary Reference Manual (Final rept.)
Barbacci, M. R. ; Wing, J. M.
Carnegie-Mellon Univ., Pittsburg, PA. Software Engineering Inst. Corp. Source Codes: 005343014; 416208
Sponsor: Electronic Systems Div., Hanscom AFB, MA.
Report No.: CMU/SEI-86-TR-3; ESD-TR-86-207
Dec 86 49p
Languages: English
Journal Announcement: GRAI8713
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: F33615-84-K-1520; ARPA Order-4976

Durra is a language designed to support the development of large-grained parallel programming applications. This document is a preliminary reference manual for the syntax and semantics of the language. We are using the term description language rather than programming language to emphasize that a task-level application description is not translated into object code of some kind of executable machine language. Rather, it is to be understood as a description of the structure and behavior of a logical machine, that will be synthesized into resource allocation and scheduling directives. These directives are to be interpreted by a combination of software, firmware, and hardware in a heterogeneous machine. Although our ultimate goal is to design and implement a task-level description language that can be used for different machines and for varying applications, our first pass is influenced by both a specific architecture and by a specific application, the Autonomous Land Vehicle (ALV), and more specifically, the perception components of the ALV. We assume there is a cross-bar switch, intelligent buffers on the switch sockets, and a scheduler that can communicate with all processors, buffers, and I/O devices.

1227996/7
1227996 N87-12270/1/XAB
ELAND: An Expert System for the Configuration of Local Area Networks Applications
Tanca, L. ; Ceri, S.
Politecnico di Milano (Italy).
Corp. Source Codes: 016875000; PX565076
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: REPT-86-008; ETN-86-97941
1986 30p
Languages: English
Journal Announcement: GRAI8705; STAR2503
NTIS Prices: PC A03/MF A01
Country of Publication: Italy

A rule-based expert system for configuring Local Area Networks (LAN) and for designing distributed database applications over them is described. The system includes a general-purpose inference machine for solving synthesis problems, based on two separed modules: the Tree Traversal and the Matcher. The former performs a recursive descent on a tree-structured solution space and generates a description of requirements that the final solution should posses; the latter matches these requirements to existing commercial products. The inference machine and its concrete application to the design and configuration of LAN information systems are described.

1227984/7
1227984 N87-12247/9/XAB
Parallel Scheduling of Recursively Defined Arrays

(Final rept)
Myers, T. J. ; Gokhale, M. B.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178195; ICASE-86-66; NASA-CR-178195
Oct 86 26p
Languages: English
Journal Announcement: GRAI8705; STAR2503
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-18107; UDRF-LTR860114

A new method of automatic generation of concurrent programs which constructs arrays defined by sets of recursive equations is described. It is assumed that the time of computation of an array element is a linear combination of its indices, and integer programming is used to seek a succession of hyperplanes along which array elements can be computed
concurrently. The method can be used to schedule equations involving variable length dependency vectors and mutually recursive arrays. Portions of the work reported here have been implemented in the PS automatic program generation system.

1218318/7
1218318 N86-31261/8/XAB
Optimal Partitioning of Random Programs Across Two Processors
(Final rept)
Nicol, D. M.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178159; ICASE-86-53; NASA-CR-178159
Aug 86 27p
Languages: English
Journal Announcement: GRAI8626; STAR2422
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-18107

The optimal partitioning of random distributed programs is discussed. It is concluded that the optimal partitioning of a homogeneous random program over a homogeneous distributed system either assigns all modules to a single processor, or distributes the modules as evenly as possible among all processors. The analysis rests heavily on the approximation which equates the expected maximum of a set of independent random variables with the set's maximum expectation. The results are strengthened by providing an approximation-free proof of this result for two processors under general conditions on the module execution time distribution. It is also shown that use of this approximation causes two of the previous central results to be

false.

1216028/7
1216028 N86-30379/9/XAB
Dynamic Remapping of Parallel Computations with Varying Resource Demands (Final rept)
Nicol, D. M. ; Saltz, J. H.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178150; ICASE-86-45; NASA-CR-178150
Jul 86 56p
Languages: English
Journal Announcement: GRAI8625; STAR2421
NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: NAS1-17070; NAS1-18107
A large class of computational problems is characterized by frequent synchronization, and computational requirements which change as a function of time. When such a problem must be solved on a message passing multiprocessor machine, the combination of these characteristics lead to system performance which decreases in time. Performance can be improved with periodic redistribution of computational load; however, redistribution can exact a sometimes large delay cost. We study the issue of deciding when to invoke a global load remapping mechanism. Such a decision policy must effectively weigh the costs of remapping against the performance benefits. We treat this problem by constructing two analytic models which exhibit stochastically decreasing performance. One model is quite tractable; we are able to describe the optimal remapping algorithm, and the optimal decision policy governing when to invoke that algorithm. However, computational complexity prohibits the use of the optimal remapping decision policy. We
then study the performance of a general remapping policy on both analytic models. This policy attempts to minimize a statistic W(n) which measures the system degradation (including the cost of remapping) per computation step over a period of n steps. We show that as a function of time, the expected value of W(n) has at most one minimum, and that when this minimum exists it defines the optimal fixed-interval remapping policy. Our decision policy appeals to this result by remapping when it estimates that W(n) is minimized. Our performance data suggests that this policy effectively finds the natural frequency of remapping. We also use the analytic models to express the relationship between performance and remapping cost, number of processors, and the computation's stochastic activity.

1214434/7
1214434 N86-29550/8/XAB
Approximate Algorithms for Partitioning and Assignment

Problems Iqbal, M. A.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178130; ICASE-86-40; NASA-CR-178130
Jun 86 31p
Languages: English
Journal Announcement: GRAI8624; STAR2420
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-17070; NAS1-18107
The problem of optimally assigning the modules of a parallel/pipelined program over the processors of a multiple computer system under certain restrictions on the interconnection structure of the program as well as the multiple computer system was considered. For a variety of such programs it is possible to find linear time if a partition of the program exists in which the load on any processor is within a certain bound. This method, when combined with a binary search over a finite range, provides an approximate solution to the partitioning problem. The specific problems considered were: a chain structured parallel program over a chain-like computer system, multiple chain-like programs over a host-satellite system,
and a tree structured parallel program over a host-satellite system. For a problem with m modules and n processors, the complexity of the algorithm is no worse than O(mnlog(W sub T/epsilon)), where W sub T is the cost of assigning all modules to one processor, and epsilon the desired accuracy.

? t 1183966/7

1183966/7
1183966 PB86-862703/XAB
Computer Networks: Data Communication Architecture and Development. 1975-March 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Mar 86)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Apr 86 210p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8611
Supersedes PB85-859098.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning architecture and development of computer networks for data communication systems. Data network design, operation, performance analysis, reliability, security, maintenance, and evolution are discussed. Techniques of packet switched and distributed data communication networks are presented. Applications of data communication technology are included.

(This updated bibli
ography contains 286 citations, 32 of which are new entries to the previous edition.)

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APPENDIX C

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Literature Search

Prepared by

Institute for Simulation and Training
University of Central Florida

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APPENDIX D

TITLE	FILE #
"The Promise of Interactive Networking: New Levels of Training and Research Readiness in Peacetime" SIMULATION	F - 01
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"Object Oriented Systems Design with Logical CPU's" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING	F - 03
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"A Flexible Expert System Architecture for Tactical Trainers" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY	F - 18
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THE DIVISION 86 TANK COMPANY SOP COORDINATING DRAFT	F - 26

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TITLE "The Promise of Interactive Networking: New Levels of Training and Research Readiness in Peacetime" SIMULATION AND TRAINING RESEARCH SYMPOSIUM ON INTERACTTIVE NETWORKED SIMULATION FOR TRAINING

AUTHOR(S) EARL A. ALLUISI

PUBLISHER

DATE OF PUBLICATION APRIL 26, 1989

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TITLE "Wargaming: Applications of Human Performance Models to System Design and Military Training" RESEARCH STUDY GROUP 9 WORKSHOP

AUTHOR(S) EARL A. ALLUISI

PUBLISHER

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TITLE "Object Oriented Systems Design with Logical CPU's" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE

AUTHOR(S) MICHAEL ASH

PUBLISHER

DATE OF PUBLICATION NOVEMBER 29 - DECEMBER 1, 1988

PAGE NUMBER 41 - 53

FILE # F - 03

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Battle Command Integration Program Initiated" C2MUG BULLETIN Vol. VIII, No. 2

AUTHOR(S)

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TITLE BATTLE SIMULATION SOFTWARE SURVEY

AUTHOR(S)

PUBLISHER PMTRADE NAVAL TRANING CENTER
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FILE # F - 05

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Control and Inferencing Paradigms for an Intelligent Simulation Training System" PROCEEDINGS OF THE FIRST FLORIDA ARTIFICIAL INTELLIGENCE RESEARCH SYMPOSIUM

AUTHOR(S) JOHN E. BIEGEL
MURAT DRAMAN
GAJANANA NADOLI
GEORGE H. BROOKS

PUBLISHER
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TITLE CAPABILITIES OF THE INTELLIGENT INFORMATION SYSTEMS DIVISION

AUTHOR(S)

PUBLISHER PERCEPTRONICS

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SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Push Button War: The Base for Command and Staff Training" ARMY TRAINER

AUTHOR(S) DAVID B. CHAPPELL

PUBLISHER

DATE OF PUBLICATION WINTER 1988

PAGE NUMBER 44 +

FILE # F - 08

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "RiC--Integrating Rules into C for Near Real-Time Applications" PROCEEDINGS OF THE FIRST FLORIDA ARTIFICIAL INTELLIGENCE RESEARCH SYMPOSIUM

AUTHOR(S) LINFU CHENG

PUBLISHER

DATE OF PUBLICATION MAY 4 - 6, 1988

PAGE NUMBER 202 - 207

FILE # F - 09

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Chet" COMPUTERIZED BATTLE SIMULATION (COMBAT SIM) SYSTEMS DESCRIPTION

AUTHOR(S) ERNEST L. CHILDS

PUBLISHER PERCEPTRONICS

DATE OF PUBLICATION MARCH 1987

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SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE COMBAT SIM INFORMATION BRIEFING

AUTHOR(S)

PUBLISHER PERCEPTRONIICS

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SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE COMBAT-SIM COMPUTERIZED BATTLE SIMULATION

AUTHOR(S)

PUBLISHER PERCEPTRONICS

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SUBJECT	SEMI-AUTOMATED OPPOSING FORCES
TITLE	THE CONMOD SIMULATION
AUTHOR(S)	
PUBLISHER	CONFLICT SIMULATION LABORATORY
DATE OF PUBLICATION	
PAGE NUMBER	13
FILE #	F - 13

SUBJECT	SEMI-AUTOMATED OPPOSING FORCES
TITLE	RESEARCHERS CHANNEL AI ACTIVITIES TOWARD REAL-WORLD APPLICATIONS
AUTHOR(S)	
PUBLISHER	AVIATION WEEK & SPACE TECHNOLOGY
DATE OF PUBLICATION	FEBRUARY 17, 1986
PAGE NUMBER	40 - 94
FILE #	F - 14

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Data Collection and Analysis: The Keys for Interactive Training for Combat Readiness" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE

AUTHOR(S) RICHARD E. GARVEY
THOMAS RADGOWSKI

PUBLISHER
DATE OF PUBLICATION NOVEMBER 29 - DECEMBER 1, 1988
PAGE NUMBER 572 - 576
FILE # F - 15

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Training Systems R&D Program: Progress and Challenges" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE

AUTHOR(S) RONALD HOFER
HALIM OZKAPTAN
J. PETER KINCAID

PUBLISHER
DATE OF PUBLICATION NOVEMBER 30 - DECEMBER 2, 1987
PAGE NUMBER 32 - 41
FILE # F - 16

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Parallel Computing: a Cost-effective Way to Achieve Real-Time Simulators and Trainers" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE

AUTHOR(S) WALTER J. KARPLUS
ALAN ROGERS

PUBLISHER
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PAGE NUMBER 6
FILE # F - 17

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "A Flexible Expert System Architecture for Tactical Trainers" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE

AUTHOR(S) DANIEL I. KATCHER

PUBLISHER
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PAGE NUMBER 482 - 487
FILE # F - 18

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Developement and Evaluation of Artificial Intelligence Techniques for Tactical Decision Support Systems" PROCEEDINGS OF THE ANNUAL AI ASYSTEMS IN GOVERNMENT CONFERENCE

AUTHOR(S) KEVIN J. LEHNERT
MICHAEL SULLIVAN
EDITORS:
H. JAMES ANTONISSE
JOHN W. BENOIT
BARRY G. SILVERMAN

PUBLISHER

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FILE # F - 19

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Evaluation of Planning Paradigms in the Cactus Testbed" PROCEEDINGS OF THE 1988 SUMMER SIMULATION CONFERENCE

AUTHOR(S) KEVIN LEHNERT
EDITORS:
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SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE PERCNET

AUTHOR(S) A. MADNI
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PUBLISHER PERCEPTRONICS INC.
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SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Knowledge-Based Simulation: An Approach to Intelligent Opponent Modeling for Training Tactical Decision Making" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE

AUTHOR(S) AZAD M. MADNI
ROBERT AHLERS
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PUBLISHER
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PAGE NUMBER 179 - 183
FILE # F - 22

SUBJECT	SEMI-AUTOMATED OPPOSING FORCES
TITLE	"Long-Haul Networking of Simulators" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE
AUTHOR(S)	DUNCAN C. MILLER ARTHUR R. POPE ROLLAND M. WALTERS
PUBLISHER	
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SUBJECT	SEMI-AUTOMATED OPPOSING FORCES
TITLE	CONSTRAINTS AS A SPECIFICATION MECHANISM FOR AUTOMATED OPPPOSING FORCES IN NETWORKED SIMULATORS
AUTHOR(S)	MICHAEL J. MOSHELL CHARLES E. HUGHES MIKEL D. PETTY
PUBLISHER	
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SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "What is Artificial reality? Wear a Computer and See" NEW YORK TIMES

AUTHOR(S) ANDREW POLLACK

PUBLISHER NEW YORK TIMES
DATE OF PUBLICATION APRIL 10, 1989
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FILE # F - 25

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE THE DIVISION 86 TANK COMPANY SOP COORDINATING DRAFT

AUTHOR(S)

PUBLISHER UNITED STATES ARMY ARMOR SCHOOL
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FILE # F - 26

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

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AUTHOR(S)

PUBLISHER UNITED STATES ARMY ARMOR SCHOOL

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FILE # F - 27

SUBJECT SEMI-AUTOMATED OPPOSING FORCES

TITLE "Warfighting With SIMNET--A Report From the Front" PROCEEDINGS OF THE INTERSERVICE/INDUSTRY TRAINING SYSTEM CONFERENCE

AUTHOR(S) JACK A. THORPE

PUBLISHER

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FILE # F - 28

SUBJECT	SEMI-AUTOMATED OPPOSING FORCES
TITLE	INPUT AND INSTRUCTION PARADIGMS FOR AN INTELLIGENT SIMULATION TRAINING SYSTEM
AUTHOR(S)	DR. JOHN E. BIEGEL MS. LESLIE D. INTERRANTE MS. JENIFER M. SARGEANT MS. CHERYL E. BAGSHAW MS. CAMILLE M. DIXON DR. GEORGE H. BROOKS DR JOSE A. SEPULVEDA
PUBLISHER	UNIVERSITY O CENTRAL FLORIDA
DATE OF PUBLICATION	MAY 4 , 1988
PAGE NUMBER	250 - 252
FILE #	F - 29

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SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE PERFORMANCE EVALUATION OF THE COMPUTER NETWORK DYNAMIC TABLE ALOGORITHM

AUTHOR(S) C. A. NIZNIK

PUBLISHER IEEE TRANSACTIONS ON COMPUTERS

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SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE INTEGRATED SERVICE DIGITAL NETWORKS: MARKET ASPECTS JANUARY 1983 - AUGUST 1988

AUTHOR(S) VARIOUS

PUBLISHER CITATIONS FROM THE COMP. DATA BASE

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FILE # B - 02

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE COMPUTING ON AN ANONYMOUS RING

AUTHOR(S) H. ATTIYA
M. SNIR
M.K. WARMUTH

PUBLISHER JOURNAL OF ASSN. COMPUT. MACHINERY
DATE OF PUBLICATION OCT. 1988
PAGE NUMBER 845 - 875
FILE # B - 03

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE A GRAPH MATCHING APPROACH TO OPTIMAL TASK ASSIGNMENT IN DISTRIBUTED COMPUTING SYSTEMS USING A MINIMAX CRITERION

AUTHOR(S) WEN-HSIANG TSAI
CHIEN-CHUNG SHEN

PUBLISHER IEEE TRANSACTIONS ON COMPUTERS
DATE OF PUBLICATION MAR. 1985
PAGE NUMBER 197 - 203
FILE # B - 04

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	NETWORKS AND DISTRIBUTED COMPUTATION: CONCEPTS, TOOLS, AND ALGORITHMS
AUTHOR(S)	MICHEL RAYNAL
PUBLISHER	MIT PRESS, CAMBRIDGE, MASS.
DATE OF PUBLICATION	1988
PAGE NUMBER	166
FILE #	B - 05

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	EFFICIENT COMPUTATION OF OPTIMAL ASSIGNMENTS FOR DISTRIBUTED TASKS
AUTHOR(S)	J. B. SINCLAIR
PUBLISHER	JOURNAL OF PARALLEL AND
DATE OF PUBLICATION	1987 VOL 4
PAGE NUMBER	342 - 362
FILE #	B - 06

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	MODELING OF COMPUTER COMMUNICATION SYSTEMS
AUTHOR(S)	ISRAEL MITRANI
PUBLISHER	CAMBRIDGE UNIV. PRESS, NY
DATE OF PUBLICATION	1987
PAGE NUMBER	192
FILE #	B - 07

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	HANDBOOK OF COMPUTER COMMUNICATION STANDARDS THE OPEN SYSTEMS INTERCONNECTION (OSI) MODEL AND OSI RELATED STANDARDS VOLUME 1
AUTHOR(S)	WILLIAM STALLINGS
PUBLISHER	HOWARD & SAMS PUBLISHING
DATE OF PUBLICATION	1988 VOL 3
PAGE NUMBER	206
FILE #	B - 08

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE DATA AND COMPUTER COMMUNICATIONS

AUTHOR(S) WILLIAM STALLINGS

PUBLISHER MACMILLAN PUBLISHING COMPANY

DATE OF PUBLICATION 1988 VOL 2

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FILE # B - 09

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE GATEWAYS COMBINE WITH STANDARDS TO BROADEN INTERCONNECTIVITY OPTIONS FOR DISSIMILIAR DEVICES

AUTHOR(S) M. EDWARDS

PUBLISHER COMMUNICATION NEWS

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PAGE NUMBER 44 - 49

FILE # B - 10

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	SUPPORTING EXISTING TOOLS IN DISTRIBUTED PROCESSING SYSTEMS: THE CONVERSION PROBLEM
AUTHOR(S)	SANDRA A. MARMAK HONG-CHIH KOU DILIP SONI
PUBLISHER	DISTRIBUTED COMPUTING SYSTEMS
DATE OF PUBLICATION	1982
PAGE NUMBER	847 - 853
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SUBJECT	MODELING OF COMPUTER COMMUNICATIN SYSTEMS
TITLE	A NEW GATEWAY
AUTHOR(S)	CARL GEIGER
PUBLISHER	DATAMATION
DATE OF PUBLICATION	OCT.1 , 1988
PAGE NUMBER	4
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SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE THE EVOLUTION OF ARPANET

AUTHOR(S) BRAD SCHULTZ

PUBLISHER DATAMATION

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PAGE NUMBER 71 - 74

FILE # B - 13

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE COMMUNICATION ASPECTS OF ANSA

AUTHOR(S) A. HERBERT

PUBLISHER COMPUTER STANDARDS AND INTERFACE

DATE OF PUBLICATION 1988 VOL 8 # 1

PAGE NUMBER 49 - 56

FILE # B - 14

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	PERFORMANCE MODELS OF TOKEN RING LOCAL AREA NETWORKS
AUTHOR(S)	ROBERT BERRY K. MANI CHANDY
PUBLISHER	ACM
DATE OF PUBLICATION	1983
PAGE NUMBER	266 - 274
FILE #	B - 15

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	ETHERNET: DISTRIBUTED PACKET SWITCHING FOR LOCAL COMPUTER NETWORKS
AUTHOR(S)	ROBERT M. METCALFE DAVID R. BOGGS
PUBLISHER	ASSOCIATION FOR COMPUTING
DATE OF PUBLICATION	1976
PAGE NUMBER	395 - 403
FILE #	B - 16

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE COMPUTER NETWORKS "A CARRIER SENSE MULTIPLE ACCESS PROTOCOL FOR LOCAL NETWORKS"

AUTHOR(S) SIMON S. LAM

PUBLISHER NORTH-HOLLAND PUBLISHING CO.

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FILE # B - 17

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE COMPUTER NETWORKS "PERFORMANCE ANALYSIS OF CARRIER SENSE MULTIPLE ACCESS WITH COLLISION DETECTION

AUTHOR(S) FOUAD A. TOBAGI
V. BRUCE HUNT

PUBLISHER NORTH-HOLLAND PUBLISHING CO.

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FILE # B - 18

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE SIMULATION OF ETHERNET PERFORMANCE BASED ON SINGLE SERVER AND SINGLE QUEUE MODEL

AUTHOR(S) KANTI PRASAD
ASHWANI SINGHAL

PUBLISHER IEEE SIMULATION CONFERENCE ON

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PAGE NUMBER 74 - 85

FILE # B - 19

SUBJECT MODELING OF COMPUTER COMMUNICATION NETWORKS

TITLE PROGRAMMING CONNECTIONIST ARCHITECTURES

AUTHOR(S) MARK A. JONES

PUBLISHER AT&T TECHINICAL JOURNAL

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FILE # B - 20

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE ROUTING WITH PACKET DUPLICATION AND ELIMINATION IN COMPUTER NETWORKS

AUTHOR(S) ARIEL ORDA
RAPHAEL ROM

PUBLISHER IEEE TRANSACTIONS ON

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PAGE NUMBER 860 - 866

FILE # B - 21

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE NETWORK ACCESS PROTOCOLS FOR REAL-TIME DISTRIBUTED SYSTEMS

AUTHOR(S) ASOK RAY

PUBLISHER IEEE TRANSACTIONS ON INDUSTRY

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PAGE NUMBER 897 - 904

FILE # B - 22

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE MEASURED PERFORMANCE OF AN ETERNET LOCAL NETWORK

AUTHOR(S) JOHN F. SHOCH
JON A. HUPP

PUBLISHER COMMUNICATIONS OF THE ACM
DATE OF PUBLICATION DEC 1980 VOL 23 #12
PAGE NUMBER 711 - 720
FILE # B - 23

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE PERFORMANCE CHARACTERISTICS OF 2 ETHERNETS: AN EXPERIMENTAL STUDY

AUTHOR(S) TIMOTHY A. GONSALVES

PUBLISHER ACM
DATE OF PUBLICATION 1985
PAGE NUMBER 78 - 86
FILE # B - 24

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	A TASK ALLOCATION MODEL FOR DISTRIBUTED COMPUTING SYSTEMS
AUTHOR(S)	PERNG-YI RICHARD MA EDWARD Y. S. LEE MASAHIRO TSUCHIYA
PUBLISHER	IEEE TRANSACTIONS ON COMPUTERS
DATE OF PUBLICATION	JAN 1982 VOL C-31 #1
PAGE NUMBER	41 - 46
FILE #	B - 25

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	PEER-TO-PEER PROTOCOL FACILITIES REAL-TIME COMMUNICATION
AUTHOR(S)	DEIF N. ATALLAH
PUBLISHER	EDN
DATE OF PUBLICATION	AUG 18, 1988
PAGE NUMBER	179 - 186
FILE #	B - 26

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE ROUTING WITH PACKET DUPLICATION AND ELIMINATION IN COMPUTER NETWORKS

AUTHOR(S) ARIEL ORDA
RAPHAEL ROM

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FILE # B - 27

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE NETWORKED SIMULATORS: USING MODELS AND EXPERIENCED FOR DESIGN

AUTHOR(S) GORDON ANDERSON
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SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE PLANNING THE DESIGN OF TRAINING FOR A STATE-WIDE DATA COMMUNICATIONS NETWORK

AUTHOR(S) CANDACE M. ZACHER

PUBLISHER EDRS

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PAGE NUMBER 1 - 9

FILE # B - 29

SUBJECT MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE RECENT DEVELOPMENTS IN INTERNATIONAL STANDARDS FOR INFORMATION TECHNOLOGY

AUTHOR(S) BRYAN WOOD

PUBLISHER NETWORKING TECHNOLOGY AND

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FILE # B - 30

SUBJECT MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE PROGRESS AND PRACTICE IN CONFORMANCE TESTING AND CERTIFICATION

AUTHOR(S) DR. JEREMY TURFF

PUBLISHER NETWORKING TECHNOLOGY AND

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FILE # B - 31

SUBJECT MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE RECENT PROGRESS IN PROFILES FOR OSI

AUTHOR(S) RICHARD LLOYD

PUBLISHER NETWORKING TECHNOLOGY AND

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PAGE NUMBER 21-29

FILE # B - 32

SUBJECT	MODELING OF COMPUTER COMMUNICATIONS SYSTEMS
TITLE	BOUNDING THE MAXIMUM SIZE OF A PACKET RADIO NETWORK
AUTHOR(S)	CRAIG C. PROHAZKA
PUBLISHER	IEEE TRANSACTIONS ON COMPUTERS
DATE OF PUBLICATION	OCT. 1988
PAGE NUMBER	1184-1190
FILE #	B - 33

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	A MONITORING SYSTEM FOR AN ETHERNET INSTALLATION
AUTHOR(S)	MICHELLE S. LEUNER JOSEPH L. HAMMOND
PUBLISHER	PROCEEDINGS: SOUTHEASTERN
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FILE #	B - 34

SUBJECT MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE AN EFFICIENT METHOD FOR SIMULATING TOKEN RING BUS ACCESS PROTOCOLS

AUTHOR(S) D. PANCHMATIA
J.L. HAMMOND
W. TIPPER

PUBLISHER PROCEEDINGS: SOUTHEASTERN
DATE OF PUBLICATION 1988
PAGE NUMBER 165-169
FILE # B - 35

SUBJECT MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE SHIPNET: A REAL-TIME LOCAL AREA NETWORK FOR SHIPS

AUTHOR(S) ROBERT SIMONCIC
ALFRED C. WEAVER
BRENDAN G. CAIN
M. ALEXANDER COLVIN

PUBLISHER UNIVERSITY OF VIRGINIA
DATE OF PUBLICATION 6 JUNE, 1988
PAGE NUMBER TR-88-15
FILE # B - 36

SUBJECT MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE XTP/PE OVERVIEW

AUTHOR(S) GREG CHESSON

PUBLISHER SILICON GRAPHICS

DATE OF PUBLICATION INFORMATION NOT AVAILABLE

PAGE NUMBER 292 - 296

FILE # B - 37

SUBJECT MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE INTEGRATION VOICE/DATA SWITCHING

AUTHOR(S) THOMAS M. CHEN
DAVID G. MESSERSCHMITT

PUBLISHER IEEE COMMUNICATIONS MAGAZINE

DATE OF PUBLICATION JUNE 1988

PAGE NUMBER 16 - 26

FILE # B - 38

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE MILITARY STANDARD
COMMON LONG HAUL AND TACTICAL
COMMUNICATION SYSTEM TECHNICAL
STANDARDS

AUTHOR(S) NONE

PUBLISHER DEPARTMENT OF DEFENSE

DATE OF PUBLICATION 15 NOVEMBER, 1972

PAGE NUMBER 186

FILE # B - 39

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE VERY LARGE AREA NETWORKS (VLAN)
KNOWLEDGE-BASE APPLIED TO SPACE
COMMUNICATION PROBLEMS

AUTHOR(S) CAROL S. ZANDER

PUBLISHER DEPT. COMPUTER SCIENCE COLORADO

DATE OF PUBLICATION OCTOBER 1988

PAGE NUMBER 401 - 409

FILE # B - 40

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	EUROPEAN SEMINAR ON NEURAL COMPUTING
AUTHOR(S)	CLAIRE ZOMZELY-NEURATH
PUBLISHER	US OFFICE OF NAVAL RESEARCH,
DATE OF PUBLICATION	31 AUGUST 1988
PAGE NUMBER	35
FILE #	B - 41

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	THE FORCE
AUTHOR(S)	HARRY JORDAN
PUBLISHER	NTIS - COMPUTER SYSTEMS DESIGN
DATE OF PUBLICATION	JANUARY 1987
PAGE NUMBER	42
FILE #	B - 42

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	POKER ON THE COSMIC CUBE: THE FIRST RETARGETABLE PARALLEL PROGRAMMING LANGUAGE AND ENVIRONMENT
AUTHOR(S)	LAWRENCE SNYDER DAVID SOCHA
PUBLISHER	NTIS - UNIVERSITY OF WASHINGTON
DATE OF PUBLICATION	JUNE 1986
PAGE NUMBER	15
FILE #	B - 43

SUBJECT	MODELING OF COMPUTER COMMMUNICATION SYSTEMS
TITLE	EXPERIENCES WITH POKER
AUTHOR(S)	DAVID NOTKIN D. SOCHA L. SNYDER M. BAILEY B. FORSTALL K. GATES R. GREENLAW W. GRISWOLD T. HOLMAN R. KORRY G. LASSWELL R. MITCHELL P. NELSON
PUBLISHER	NTIS - UNIVERSITY OF WASHINGTON
DATE OF PUBLICATION	APRIL 1988
PAGE NUMBER	11
FILE #	B - 44

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE CRONUS, A DISTRIBUTED OPERATING SYSTEM: CRONUS DOS IMPLEMENTATIONS

AUTHOR(S) R. SCHANTZ, K. SCHRODER, M. BARROW, G. BONO, M. DEAN, R. GURWITZ, K. LAM, K. LEBOWITZ, S. LIPSON, P. NEVES, R. SANDS

PUBLISHER NTIS - ROME AIR DEVELOPEMENT

DATE OF PUBLICATION OCT. 31, 1988

PAGE NUMBER 55

FILE # B - 45

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE NUMERICAL COMPUTATIONS ON MASSIVELY PARRALLEL HYPERCUBES

AUTHOR(S) OLIVER A. McBRYAN

PUBLISHER NTIS - LOS ALAMOS NATIONAL

DATE OF PUBLICATION OCT. 1, 1986

PAGE NUMBER 18

FILE # B - 46

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE CACHE BASED ERROR RECOVERY FOR SHARED MEMORY MULTIPROCESSOR SYSTEMS

AUTHOR(S) KUN-LUNG WU
KENT FUCHS
JANAK H. PATEL

PUBLISHER NTIS - COMPUTER SYSTEMS GROUP

DATE OF PUBLICATION JUNE 27-30, 1987

PAGE NUMBER 21

FILE # B - 47

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE POKER 4.1: A PROGRAMMER'S REFERENCE GUIDE

AUTHOR(S) LAWRENCE SNYDER

PUBLISHER NTIS - UNIVERSITY OF WASHINGTON

DATE OF PUBLICATION APRIL 1988

PAGE NUMBER 94

FILE # B - 48

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	NETWORK PROTOCOLS: PROCEEDINGS OF THE JOINT IBM/UNIVERSITY OF NEWCASTLE UPON TYNE SEMINAR HELD IN THE UNIVERSITY COMPUTER LABATORY
AUTHOR(S)	EDITED BY B. RAYNDELL
PUBLISHER	NTIS
DATE OF PUBLICATION	NOV. 9, 1987
PAGE NUMBER	273
FILE #	B - 49

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	TAC - 1: KNOWLEDGE BASED AIRFORCE TACTICAL BATTLE MANAGEMENT TESTBED
AUTHOR(S)	RICHARD O. NUGENT RICHARD W. TUCKER
PUBLISHER	THE MITRE CORPORATION
DATE OF PUBLICATION	JAN. 1988
PAGE NUMBER	84
FILE #	B - 50

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: PARALLEL PROGRAMMING PARADIGMS

AUTHOR(S): PHILIP ARNE NELSON

PUBLISHER: NTIS - UNIVERSITY OF WASHINGTON

DATE OF PUBLICATION: JULY 1987

PAGE NUMBER: 132

FILE #: B - 51

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: APPROXIMATE ALGORITHMS FOR PARTITIONING AND ASSIGNMENT PROBLEMS

AUTHOR(S): M. ASHRAF IQBAL

PUBLISHER: NASA LANGLEY RESEARCH CENTER

DATE OF PUBLICATION: JUNE 1986

PAGE NUMBER: 30

FILE #: B - 52

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE CITATIONS FROM THE INFORMATION SERVICES FOR THE PHYSICS AND ENGINEERING COMMUNITIES INSPEC DATABASE
COMPUTER NETWORKS: DATA COMMUNICATION ARCHITECTURE AND

AUTHOR(S)

PUBLISHER NTIS

DATE OF PUBLICATION 1988

PAGE NUMBER 130

FILE # B - 53

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE CITATIONS FROM THE INFORMATION SERVICES FOR THE PHYSICS AND ENGINEERING COMMUNITIES INSPEC DATABASE
DECNET: DIGITAL EQUIPMENT CORPORATION NETWORK ARCHITECTURE

AUTHOR(S)

PUBLISHER NTIS

DATE OF PUBLICATION SEPT 1988

PAGE NUMBER 62

FILE # B - 54

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	EUROPEAN SEMINAR ON NEURAL COMPUTING
AUTHOR(S)	CLAIRE ZOMZELY-NEURATH
PUBLISHER	OFFICE OF NAVAL RESEARCH
DATE OF PUBLICATION	AUG. 31, 1988
PAGE NUMBER	38 (presently on microfiche)
FILE #	B - 55

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	OPTIMAL PARTITIONING OF RANDOM PROGRAMS ACROSS TWO PROCESSORS
AUTHOR(S)	D. M. NICOL
PUBLISHER	LANGLEY RESEARCH CENTER
DATE OF PUBLICATION	AUG. 1986
PAGE NUMBER	27 (presently on microfiche)
FILE #	B - 56

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE AN EXPERT SYSTEM FOR THE CONFIGURATION OF LOCAL AREA NETWORKS APPLICATIONS

AUTHOR(S) L. TANCA
S. CERI

PUBLISHER POLYTECHNICAL OF MILANO
DATE OF PUBLICATION 1986
PAGE NUMBER 30 (presently on microfiche)
FILE # B - 57

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE MAPPING A BATTLEFIELD SIMULATION ONTO MESSAGE-PASSING PARALLEL ARCHITECTURES

AUTHOR(S) D.M. NICOL

PUBLISHER NASA LANGELY RESEARCH CENTER
DATE OF PUBLICATION OCT. 1987
PAGE NUMBER 18 (presently on microfiche)
FILE # B - 58

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE ANALYSIS OF FDDI SYNCHRONOUS TRAFFIC DELAYS

AUTHOR(S) MARJORY J. JOHNSON

PUBLISHER NASA

DATE OF PUBLICATION JAN. 1988

PAGE NUMBER 21 (presently on microfiche)

FILE # B - 59

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE THE EFFECT OF DISTRIBUTED COMPUTING TECHNOLOGY ON WIDE AREA NETWORK CAPACITY REQUIREMENTS

AUTHOR(S) DENNIS HALL
WILLIAM JOHNSTON
MARGE HUTCHINSON
MENDEL ROSENBLUM
DAVID ROBERTSON

PUBLISHER NTIS - LAWRENCE BERKELEY LABATORY

DATE OF PUBLICATION FEB. 1987

PAGE NUMBER 10

FILE # B - 60

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	THE BLAZE FAMILY OF LANGUAGES: PROGRAMMING ENVIRONMENTS FOR SHARED AND DISTRIBUTED MEMORY ARCHITECTURES
AUTHOR(S)	PIYUSH MEHROTRA JOHN VAN ROSENDALE
PUBLISHER	NTIS - ARGONNE NATIONAL LABATORY
DATE OF PUBLICATION	JUNE 1988
PAGE NUMBER	13
FILE #	B - 61

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	EFFICIENT PARALLEL ARCHITECTURE FOR HIGHLY COUPLED REAL-TIME LINEAR SYSTEM APPLICATIONS
AUTHOR(S)	CHESTER C. CARROLL ABDOLLAH HOMAIFAR SOUMAVO BARUA
PUBLISHER	BUREAU OF ENGINEERING RESEARCH THE
DATE OF PUBLICATION	JANUARY 1988
PAGE NUMBER	85
FILE #	B - 62

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	ESTIMATION AND IDENTIFICATION OF NONLINEAR DYNAMIC SYSTEMS
AUTHOR(S)	D. JOSEPH MOOK
PUBLISHER	AIAA JOURNAL
DATE OF PUBLICATION	JULY 1989
PAGE NUMBER	968 - 974
FILE #	B - 63

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	SIMULATION NETWORKING PROTOCOL ALTERNATIVES
AUTHOR(S)	DR. MICHAEL GEORGIOPOULOS
PUBLISHER	IST
DATE OF PUBLICATION	1 AUGUST 1988 THRU 31 JULY 1989
PAGE NUMBER	78
FILE #	B - 64

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	PROGRAMMING LANGUAGES FOR DISTRIBUTED SYSTEMS
AUTHOR(S)	H. E. BAL J. G. STEINER A. S. TANENBAUM
PUBLISHER	NTIS - VRIJE UNIVERSITY, AMSTERDAM
DATE OF PUBLICATION	FEB. 1988
PAGE NUMBER	84
FILE #	B - 65

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	WHY WE CAN'T PROGRAM MULTIPROCESSORS THE WAY WE'RE TRYING TO DO IT NOW
AUTHOR(S)	DOUG BALDWIN
PUBLISHER	NTIS - DEPT. OF COMPUTER SCIENCE
DATE OF PUBLICATION	AUGUST 1987
PAGE NUMBER	33
FILE #	B - 66

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	IMPLEMENTING DYNAMIC ARRAYS: A CHALLENGE FOR HIGH-PERFORMANCE MACHINES
AUTHOR(S)	GYULA MAGO' WILL PARTAIN
PUBLISHER	NTIS - DEPT. OF COMPUTER SCIENCE
DATE OF PUBLICATION	NOV. 23 1987
PAGE NUMBER	491 - 493
FILE #	B - 67

SUBJECT	MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE	UNIX BASED PROGRAMMING TOOLS FOR LOCALLY DISTRIBUTED NETWORK APPLICATIONS
AUTHOR(S)	WILLIAM C. FRANK
PUBLISHER	NTIS - NAVAL POSTGRADUATE SCHOOL
DATE OF PUBLICATION	DECEMBER 1987
PAGE NUMBER	105
FILE #	B - 68

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE HANDBOOK OF COMPUTER COMMUNICATIONS STANDARDS LOCAL NETWORK STANDARDS VOLUME 2

AUTHOR(S) WILLIAM STALLINGS

PUBLISHER HOWARD W. SAMS & COMPANY

DATE OF PUBLICATION 1988 BOOK

PAGE NUMBER 244

FILE # B - 69

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE HANDBOOK OF COMPUTER COMMUNICATIONS STANDARDS DEPARTMENT OF DEFENSE (DOD) PROTOCOL STANDARDS VOLUME 3

AUTHOR(S) WILLIAM STALLINGS

PUBLISHER MACMILLAN PUBLISHING

DATE OF PUBLICATION 1988

PAGE NUMBER 240

FILE # B - 70

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE HIGH SPEED FIBER OPTICS LOCAL AREA NETWORKS: DESIGN AND IMPLEMENTATION

AUTHOR(S) F. A. TOBAQI

PUBLISHER STANFORD UNIVERSITY

DATE OF PUBLICATION SEPTEMBER 29, 1988

PAGE NUMBER 9 (presently on microfiche)

FILE # B - 71

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE AN INTERFACE BETWEEN OBJECT ORIENTED SYSTEMS

AUTHOR(S) LAWRENCE A. CROWL

PUBLISHER UNIVERSITY OF ROCHESTER COMPUTER

DATE OF PUBLICATION APRIL 1987

PAGE NUMBER 20

FILE # B - 72

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE DISTRIBUTED OPERATING SYSTEMS: AN OVERVIEW

AUTHOR(S) MEHMET AKSIT

PUBLISHER TECHNICAL UNIVERSITY OF TWENTE

DATE OF PUBLICATION OCTOBER 1987

PAGE NUMBER 23

FILE # B - 73

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE DISTRIBUTED COMPUTATION OF GRAPHICS PRIMATIVES ON A TRANSPUTER NETWORK

AUTHOR(S) G. K. ELLIS

PUBLISHER NASA

DATE OF PUBLICATION 1988

PAGE NUMBER 7

FILE # B - 74

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE PERFORMANCE ANALYSIS OF FDDI

AUTHOR(S) M. J. JOHNSON

PUBLISHER NASA

DATE OF PUBLICATION APRIL 1988

PAGE NUMBER 18

FILE # B - 75

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE NETWORK PROTOCOLS FOR REAL TIME APPLICATIONS

AUTHOR(S) M. J. JOHNSON

PUBLISHER NASA, AMES RESEARCH CENTER

DATE OF PUBLICATION MAY 1987

PAGE NUMBER 17 (presently on microfiche)

FILE # B - 76

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE TEST AND EVALUATION OF THE TRANSPUTER IN A MULTI-TRANSPUTER SYSTEM

AUTHOR(S) JOSE VANNI FILHO

PUBLISHER NAVAL POSTGRADUATE SCHOOL

DATE OF PUBLICATION JUNE 1987

PAGE NUMBER 201

FILE # B - 77

APPENDIX E

Institute of Simulation and Training
Intelligent Simulated Forces Review
Commerce Business Daily
Summary of Postings of Interest

Date Posted	Sponsoring Organization	Title	Objective	Notice/Closing/Response Date	Contact
12 Jan 89	Rome Air Development Center Page 2	Object Oriented Battlefield Simulation Development	Design and Build a scenario-generation capability and implement a ground force on force model compatible with current simulation.	RFP 10 days from publication of notice	Technical POC-- Craig Anken RADC/COES 315-330-4833 CPM Non-technical inquiries-- Joseph Christofaro RADC/PKRZ 315-330-3204
17 Jan 89	Space and Naval Warfare Systems Command p. 45	Next Generation Computer Resources Program	Select or define a set of industrially based standards leading to a family of real-time distributed operating system standards for the NGCR Program.	First Meeting March 89	CDR Richard Barbour SPAWAR 324B 202-692-9207 Patricia Oberndorf NADC 7031 215-441-2737
18 Jan 89	Naval Underwater Systems Center p. 2	Quantitius Evaluations of Simulated Engagements through use of SIM II	Perform analyses/evaluations, validate accuracy and identify strengths and weaknesses	3 Apr 89	Ned D'Gomes 203-440-4617
19 Jan 89	AFCMD/PKRA Kirtland AFB p 1	Battlefield Simulation Support	Theater level, man-in-the-loop battlefield simulation for an assessment of the utility of joint surveillance target attack radar system (STARS).	23 Mar 89	Eileen M. Murer AFCMD/PKRA 505-844-8514

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20 Jan 89	Rome Air Development Center p 3	Correction: Real-Time Battlefield Sim			Elaine M. Newman 315-330-3844 Glen C. Fye 315-330-3175
23 Jan 89	Naval Underwater Systems Center p 5	Encapsulated harpoon Weapon system Computer Based Simulation Models		10 Mar 89	Neg C. Lyons
23 Jan 89	AFDW Contr Office Andrews AFB p 4	C-3I Model Support and Data Base Development	Specific tasks shall include: modelling of current strategic issues, data base development to support real time analysis in response to quick turn around issues, model documentation and validative and graphics software		Carol Smith, Contr Specialist Jack E. Bynare. Contr. Officer 301-981-2437
25 Jan 89	Rome Air DC p 1	Distributed Situation Development	Develop a high level design of an ES that will support an automated situation assessment capability, the prediction of enemy courses of action, and the dynamic proactive tasking of friendly forces.		Capt David S. Blocker, Contr. Specialist 315-330-2203 Lt Glenn Fye, program Mgr 315-330-3175
31 Jan 89	CO, NRL, p. 2	Battle Management System	requirement for a battle management systems project in support of four areas	RFP closing 35 days after issuance	Anna Beckett. Contr. Specialist. Code 2210.AB 202-767-3003

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27 Feb 89	Rome Air DC, p. 1	Database/Knowledge Base System Interface	Extend database functionality to perform event subevent inferences using knowledge representation		POC P McCabe 315-330-2171 Contr. Officer L. Reed 315-33[illegible]
13 Feb 89	Rome Air Dev Center, p 2	Enemy Structure Modeling	Design a data base for storage and analysis of enemy situational activities based on tables of equipment doctrine, tactics, and deployment to support R&D efforts.		John C. Corbin Contr. Specialist 315-330-38[illegible] James Papagni Program Mgr 315-330-3175
9 Feb 89	DCA Center for Control and Command p 32	DCA Demonstration and Technology Survey Program	Technology survey and demonstration of mapping systems is planned	10 days after notice	Anne Fradel DCA/C-S/A510 703-[illegible]
13 Feb 89	Space and Naval warfare systems Command p 58	Next Generation Computer Resources Operating System Development	one of several joint Navy/Industry groups to define hardware/software standards	10 Mar 89	CDR Barbour, SPAWAR 324A, 202-692-92[illegible]
17 Feb 89	Directorate of Contracting, Contracting Div. USAFE, Ft. Belvoir, For ARI, Ft Knox, p. 2	Research Support for Soldier Training and Performance Issues	Six Task Areas--third is developing prototype simulation software for table top simulators and developing prototype hardware/software for soldier-in-the-loop networked simulators.	Sol available on 3 Apr 89	Gloria J Laws 703-[illegible]-6301 [illegible] Contr. Offcr Wm E. Campbell Jr. 703-[illegible]

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21 Feb 89 AFCMD/PKRA Kirtland AFB	Modeling and Simulation Support	Contract to provide computer modeling and simulation in support of the Air Force Operational Test and Evaluation Center	RFP issued on 28 Feb 89, closed 28 Mar 89.	Contr. Off Tacia 505-844-4117
6 Apr 89 Defense Nuclear Agency p. 1	Battlefield information and Targeting System	One of the tasks is to demonstrate the capability of the system to collect, monitor, and analyze statistics that would demonstrate the value of interfaces developed.		Tim Sherer 202-325-6626
10 Apr 89 Naval Training Systems Center, p. 1	BAA--Experimental Developmental, Basic and Applied Research Work Opportunities at the office of PM TRADE and ARI.	General in, nature, this BAA includes Engagement Simulationuntil and Instrumentation, Simulation Networking, Battle Simulation, Embedded Training, etc	Remains open superceded.	PM TRADE PCO: Stan Goodman 407-380-8165 ARI PCO Dr. Bruce Knerr 407-380-4387
10 Apr 89 Naval Air DC p. 3	Develop and Maintain Tactical Environment Simulation and Scoring Software	Requirement includes developing real-time and faster than real time digital weapon system simulations to support air to air, air to surface, surface to air and surface to surface weapons training for training systems supported by the Naval Air Development Center.	Due 31 May 89	Contr. Off. John Stabilito 215-441-2683

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17 Apr 89	Contracts Directorate, Marine Corps Logistics Base Albany GA, p 2	Research and Development Effort in Support the Defense Training and Performance Data Center, Orlando FL	Identify, collect, and develop inventory, capability, statistical performance and cost data related to military training conducted on weapons training ranges in tactical or administrative training areas or in training facilities.	Issue date 24 Apr 89	Sandra Walker Code 909, 912-439-6741 Contr Offficer Donald L. Sutton Code 909 912-439-6741
27 Apr 89	US Army MedicalResearch Acquisition Activity p 2	Laboratory Measurement of Biomechanical Response to Whole-Body Vibration in Army Vehicles	Simulate actual rides in Army tactical vehicles	Sol scheduled to be issued on 15 May 89; due on 29 Jun 89	George Brown 301-695-2804
28 Apr 89	Commander Naval Ocean systems Center p 1	Support for Simulation Hardware Design and Software Development for project EXCEL Advanced Hybrid Simulator	Include in the scope are requirements analysis, trade studies, system specification, system design, hardware specification, de4sign, and documentation, hardware fabrication and assembly, software specification, design, development, and documentation, system verificaiton and validation, system configuration management, maintenance of simulation support system hardware and software and project management support.		RW Esaias 619-553-4515, Negotiator is JC Norris 619-553-4331

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3 May 89	Kirtland Contracting Center, p. 2	Computer Hardware and Software Operations, Maintenance and Simulation Development	Primary purpose is to simulate at the execution level the Air Defense functions of detection, tracking, identification, weapons allocation, engagement, weapons control, and kill assessment.		Technical contact Maj Mason 505-84[illegible]-0883
4 May 89	US Army Missile command Directorate for procurement & Production, Redstone Arsenal AL p 1	ASC Environmental Modeling for Missile Lsimulation and Technology Development	Performance of environmental modeling for missile simulation and technology developoment support services	due 25 May 89	Shirley Jackson Contr Specialist 205-876-8761 Harold Smith Contr Officer 20[illegible]-87[illegible]-7325
16 May 89	Rome Air Development Center p 3	Ground Attack Fighter MDL Software (GAFMS II)	Develop a new Ground Attack fighter MDL Software program to provide Foreign Technology at Wright Patterson AFB OH, the capability to simulate and conduct syst effectiveness studies on air ground attack tactical fighter missions and est acft capabilities and performance for various missions in a hostile environment.		POC Nancy McCann 315-330-[illegible] Contr Spec James Maier 315-33[illegible]-[illegible]

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15 May 89	AFDW [illegible] Andrews AFB [illegible]	TAC Thunder Simulation Model.	Include in-house support for minor changes, debugging, assistance in study and wargame preparation and execution, documentation, training and installation, user group administration and configuration control.	23 Jun 89	POC Carol Smith Contr Specialist Jack Eynane Contr Officer 301-981-2437
2 Jun 89	Defense Supp... Service the Pentagon	USACAA Wargame & Political/Military (P/M) Game Assistance	For on-call assistance in conducting theater level wargaming on behalf of the US Army Concepts Analysis Agency using computer simulations		Harry W. Shatto 202-695-2563 Edna M. Clark 202-695-2564

APPENDIX F

DATE: July 14, 1989

TO: M. Companion, B, Goldiez

FROM: T. Clarke

SUBJ: E-Mail with Mike SUllivan of Texas Instruments

In place of a trip to Texas Instruments which is not practical in the immediate future, I initiated an Arpanet E-mail conversation with Mike Sullivan of TI with regard to the implementation issues of putting their SARGE intelligent command and control system into a SIMNET SAFOR.

SARGE runs under TI's CACTUS simulation environment. CACTUS uses a hexagonal terrain data base. Sullivan indicates that they have in the past converted DTED databases to CACTUS so that converting the SIMNET terrain data base should be no problem.

SARGE now is implemented on Mac II hosted TI microExplorer in Lisp. Sullivan says that SARGE is for the most part Common Lisp compatible, but that parts use the Flavors object-oriented extensions. Thus porting to another Common Lisp platform would involve converting that portion of the code to CLOS (Common Lisp Object System). Also the user interfaces make use of the Mac II host graphics environment and Explorer window system. Thus another host would require complete rework of the user interface.

In order to use SARGE as part of a SIMNET SAFOR it would thus be necessary to add a MacII/microExplorer to the testbed. Since SARGE is under continual development there is also little in the way of documentation available, the best way to transfer it to IST would be to fund a visit to IST by TI personnel (or vice versa). Mike Sullivan thinks that incorporating SARGE into SIMNET should be doable.

Using this opportunity to mount a philosophical soap-box, it seems that the Command anc Control portion of the SAFOR testbed is driven by the availility of software. TI's SARGE requires a microExplorer/MacII, Lawrence Livermore's ConMod requires a microVAX/Tektronix.

Rather than choose a SAFOR Command and Control software package now, it would pe possible to acquire the hardware to host both SARGE and ConMod. The hardware costs are relatively minor compared to the savings in project labor. Project personnel would be assigned to establish a SIMNET interface protocol so that the two Command and Control packages could access a common SIMNET interface.

The strengths, weaknesses, computational requirements of these packages could then be evaluated as part of the SIMNET SAFOR. Any other packages that can be adapted to the SAFOR protocol (BBN, Perceptronics?) could also be hosted and evaluated.

Organizationally, it would be best to assign an individual to each the care and feeding of each Command and Control package. SARGE's skilled Lisper and ConMod's Ada-adept are not likely to be the same individual.

CONFERENCE REPORT

DATES: April 26 & 27 **NAME:** Michael Companion
Thomas Clarke

LOCATION: Orlando, Fl.

CONFERENCE: Interactive Networked Simulation for Training

SPONSOR: Institute for Simulation and Training/UCF

During the IST Simulation Symposium, the BBN Semi-automated Opposing Forces Software was discussed with Dr. Duncan Miller of BBN. Dr. Miller stated that the BBN OpFor software was not stable and would be unsuitable as the basis of a benchmark for the IST work. The software was undergoing extensive revision in light of performance limitations discovered during the March '89 Simnet exercise. Dr. Miller went on to discuss the OpFor software in more detail.

The BBN OpFor software runs on a multi-mode BBN Butterfly computer linked to several Symbolics workstations. In addition to handling Simnet interface, the Butterfly is programmed in C to handle the numerically intensive terrain-following, dead-reckoning, and trajectory-calculation tasks for the simulated vehicles in the opposing forces. The Symbolics workstations are "just that"; that is they are used to provide a user-friendly interface to the operators of the simulated forces. There appears to be very little expert system or rule-based software in the workstations.

The major performance bottleneck uncovered during the Simnet exercise was in the communication links within the OpFor software. Apparently the OpFor software is structured after a Command and Control model. Each simulated vehicle communicates reports, sightings, events etc., to the operator of the OpFor through the workstation. There is apparently no intelligence included for combining reports so that the reporting traffic is reduced. With the high density of vehicles that occurred during the exercise, the OpFor overloaded and missed frame updates.

Another remark by Dr. Miller indicated that the OpFor software was terrain dependent. This is a given, since the simulated vehicles have to follow terrain, allow for terrain in line-of-sight calculations and the like. However, Dr. Miller's remarks seemed to imply additional dependence, perhaps caused by having to hand optimize the software for a particular set of terrain.

In view of these considerations, the BBN OpFor package is not suitable for this research. It appears to be an unfinished product which applies only to a specialized terrain data base. It is interesting to note that BBN's partitioning of tasks, numerically intensive to Butterfly, human interface to Symbolics workstation, is similar to the kind of task partition that will be investigated with the test bed.

Another interesting conversation was had with Chuck Benton of TSI who has a DARPA SBIR grant to look at low-cost applications of transputers to Simnet. His experience may come be useful.

A possible source of benchmark software was identified in Betty Armistead of Simulation Technologies Inc. She is involved with the DWS (Distributed Wargaming Systems) project which is charge with being ultimately compatible with Simnet. Most interesting is that the software she used is considered GFE.

APPENDIX G

TRIP REPORT

NAME: M. Companion
DATES: June 30, 1989
LOCATION: SPARTA, Inc., Huntsville Ala.

CONTACTS: Dr. G. Hassin, J. Watson, R. REynolds, C. Case and A. Jones.

I travelled to Huntsville to visit Sparta, Inc to discuss two topic areas. The first area was to explore and discuss a statement of work Sparta to develop a transputer based intervisibility model to support the Simulated Forces Project. The second area was to discuss Sparta's capabilities and ongoing/past efforts in the area of force-on-force simulation.

Sparta had reviewed the draft SOW and develop an estimate of the time and cost to develop a transputer based intervisibility model. The intent of this task is to explore the transputer requirements for the testbed and develop a baseline intervisibility model for the simulated forces model. We discuss the assumptions that Sparta had made in deriving their resource estimates and concluded that they had interpreted several task to be more detailed and formal than we intended. After agreeing to the basic output that was desired it would appear that it is possible to accomplish the transputer based intervisibility model within the targeted level of resources.

Sparta provided a detailed briefing of their force-on-force simulation capabilities. The have been involved in a number of efforts force a wide variety of customers. Their primary thrust has been in the area of simulating laser threats within the battlefield simulation. They are beginning some work for DARPA on laser threats for the SIMNET. The attached pages summarize their force-on-force simulation experience and the SIMNET force-on-force related activity.

One of the simulation models that Sparta has been developed is extremely relevant is AWSIM. This effort has been sponsored by MICOM, AMSAA and LABCOM. It is a computer simulation of close combat for combined arms armys. It utilizes digitized terrain, smoke/artillery dust effects and simulates up to battalion/regiment size scenarios. This model/simulation should be looked into in more depth for potential input to our effort. More detail is provided in the attachment.

It looks like Sparta is one of the companies that we will want to bid on the larger support effort to the simulated forces program. I have added to the statement of work we are discussing 20 hours to support front end analysis.

Attached is a hard copy of the Sparta force-on-force briefing.

SPARTA, INC.

AA001

CAPABILITIES/EXPERIENCE IN FORCE-ON-FORCE SIMULATION

30 June 1989

SPARTA, Inc.
4901 Corporate Drive
Huntsville, AL 35805-6201
(205) 837-5200

DED0689-02/Front

REPRESENTATIVE SPARTA FORCE-ON-FORCE SIMULATIONS

SPARTA, INC.

NAME	APPLICATION	DEVELOPER	TO BE PRESENTED
AWSIM	CLOSE COMBAT & AIR DEFENSE, ESP. WITH DEW	SPARTA (FOR MICOM, AMSAA, LABCOM)	√
DIDSIM	SDI	SPARTA	√
TMDSIM	ARMY SDI (NATO)	SPARTA	√
ADEM	BLUE AIR VS RED AIR DEFENSE	VARIOUS	√
CARMONETTE	CLOSE COMBAT	CAA/TRAC	
ADAGE CAMPAIGN	BLUE AIR DEFENSE	AMSAA	√
ARMY BM/C^3 EV	ARMY BM/C^3 DEMO	TRW/SPARTA	
AIR FORCE BM/C^3 EV	AF BM/C^3 DEMO	SPARTA	

AREAS OF SIMULATION EXPERTISE

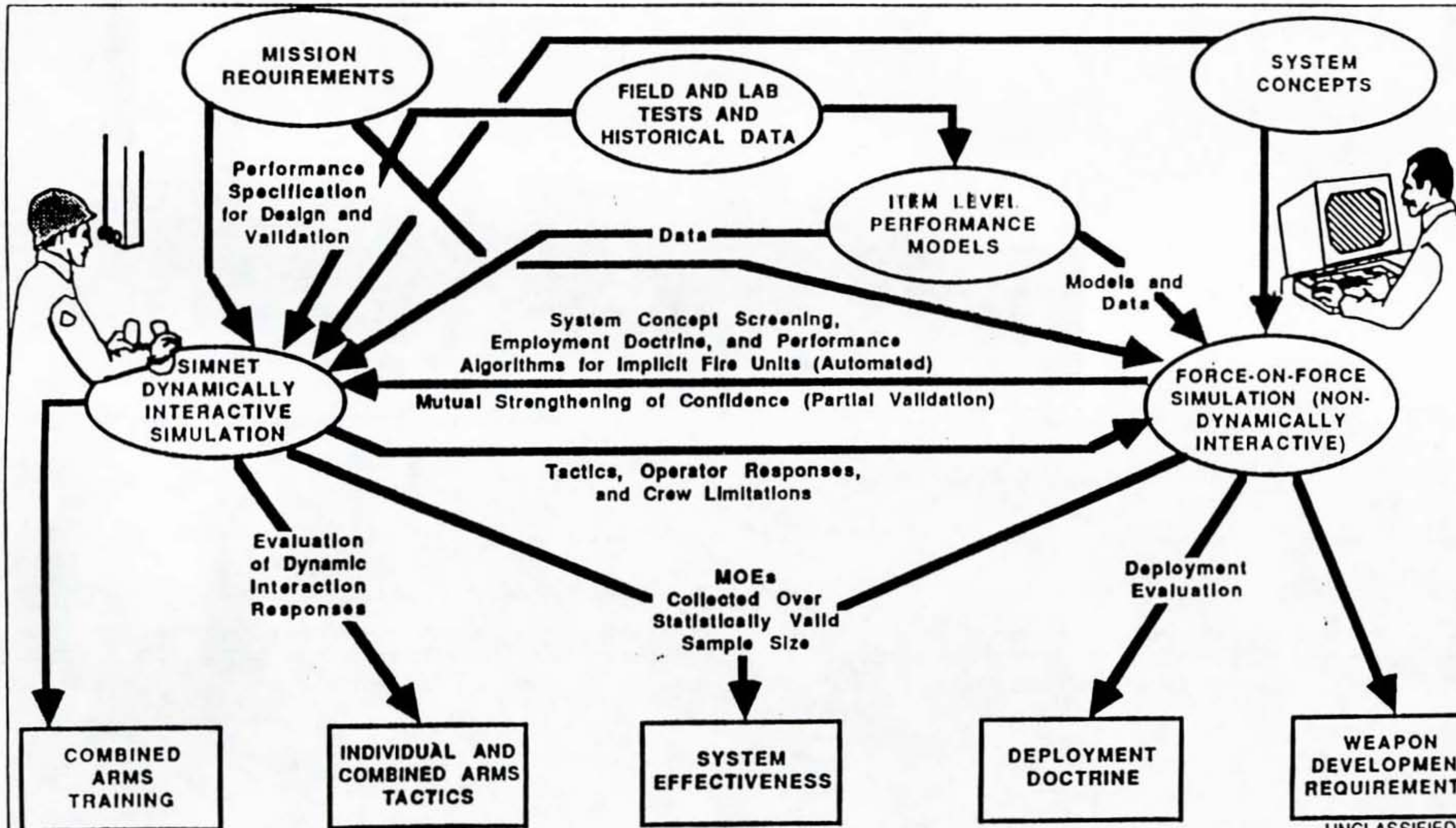
SPARTA, INC.

- MODEL DEVELOPMENT
  - PHENOMENOLOGY MODELS
  - LARGE SCALE SIMULATION
- SCENARIO DEVELOPMENT
- TARGET RESPONSE ANALYSIS
- ANALYSIS USING SIMULATION TOOLS
  - ITEM-LEVEL
  - FORCE-ON-FORCE
- REQUIREMENTS DEVELOPMENT
- CONVENTIONAL AND DEW SYSTEMS
- WEIGHT AND VOLUME SIZING
- FIELD TEST SUPPORT
  - PLANNING SUPPORT
  - RESULTS ANALYSIS/MODELING

UNCLASSIFIED

SIMNET AND FORCE-ON-FORCE SIMULATION (U)

SPARTA, INC.



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0589-034/01

UNCLASSIFIED

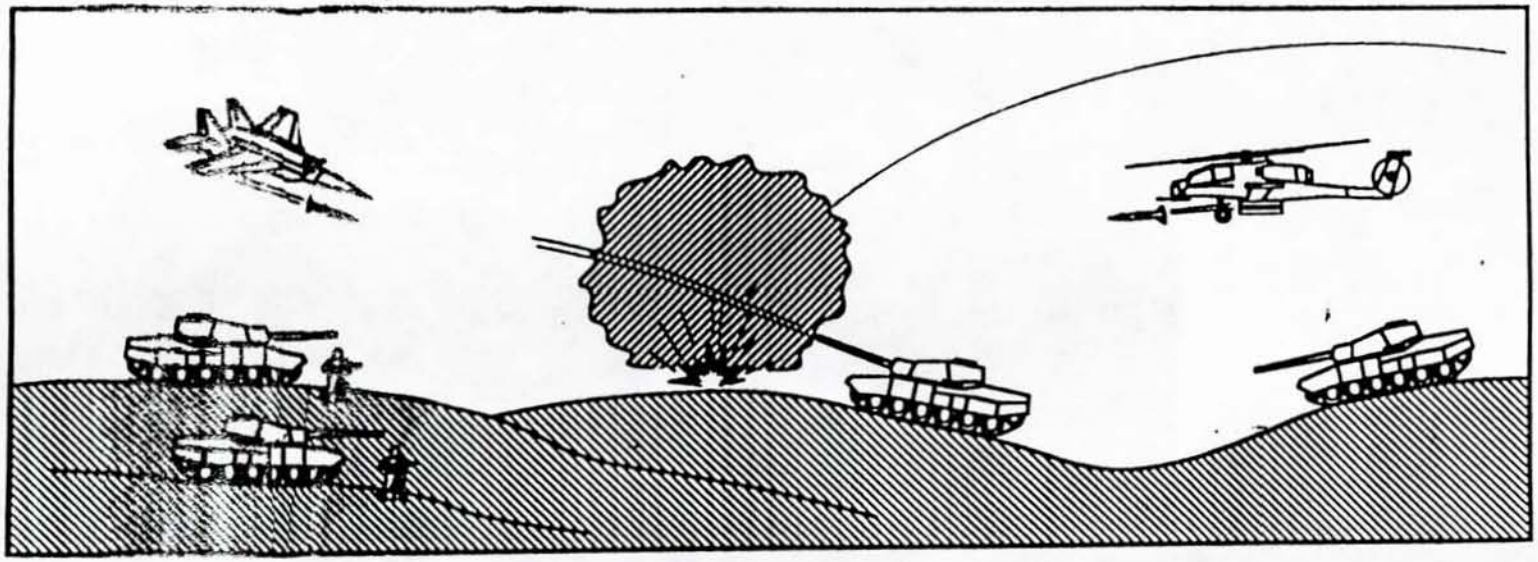
SPARTA SIMNET SUPPORT TO DARPA

SPARTA, INC.

- LASER/BIO-EFFECTS MODELING IN SIMNET
  - LASER MODELS AND DATA
  - BIO-EFFECTS MODELS AND DATA
  - AUTOMATED SIMULATION OF THREAT RESPONSE TO LASER IRRADIATION
  - AUTOMATED SIMULATION OF THREAT LASER TACTICS
- SIMNET PERFORMANCE VALIDATION
  - COMPARISONS OF SIMNET OPERATOR PERFORMANCE TO TEST DATA AND MODEL PREDICTIONS (E.G., ACQUISITION CAPABILITY)
  - RECOMMENDED IMPROVEMENTS
- FORCE-ON-FORCE SIMULATION SUPPORT
  - RESULTS COMPARISON WITH SIMNET
  - FIELD TEST REVIEW
  - SCENARIO ANALYSIS
- ANALYSIS OF SIMNET EXERCISES
  - LASER AND BIO-EFFECTS MODELS CHECK OUT
  - ACQUISITION OF DATA FOR AUTOMATED THREAT
  - PRELIMINARY CONCEPT ASSESSMENT

WHAT IS AWSIM 89?

SPARTA, INC.



- **COMPUTER SIMULATION OF CLOSE COMBAT**
  - COMBINED ARMS: ARMOR, INFANTRY, AIRCRAFT, AD, ARTILLERY
  - DIGITIZED TERRAIN
  - SMOKE/ARTILLERY DUST EFFECTS
  - SIMULATES UP TO BATTALION/REGIMENT SCENARIO
- **EVALUATES BATTLEFIELD UTILITY OF WEAPONS**
  - FUNCTIONAL MODELS: MANEUVER, SEARCH, ACQUISITION, ENGAGEMENT
  - DETAILED LASER WEAPON MODEL

0489-036/02

AWSIM DESIGN PHILOSOPHY

SPARTA, INC.

MODELING PHILOSOPHY

STOCHASTIC →
- PROB. DIST. SAMPLED BY MONTE CARLO TECHNIQUE
- MANY REPLICATIONS YIELD OUTCOME DISTRIBUTION

EVENT-SEQUENCED →
- EVENTS OCCUR INSTANTANEOUSLY
- CLOCK JUMPS FROM EVENT TO EVENT
- CONTINUOUS PROCESSES MODELED IN FIXED TIME STEPS

COMPUTER CODE PHILOSOPHY

- STANDARD FORTRAN 77 → TRANSPORTABILITY
- SOPHISTICATED SUPPORT SOFTWARE
  - DYNAMIC MEMORY ALLOCATION
  - INTERACTIVE DATABASE EDITOR
  - EVENT PROCESSING AND LIST PROCESSING ROUTINES
- STRUCTURED PROGRAMMING
  - MODULARITY AND TOP-DOWN FLOW
  - USE OF MNEMONICS AND NAMING CONVENTIONS
- LOGICALLY PARTITIONED DATA STRUCTURE

USE OF EXISTING MODELS IN AWSIM (U)

SPARTA, INC.

- APPROACHES/ALGORITHMS FROM CARMONETTE
  - TERRAIN REPRESENTATION AND LINE-OF-SIGHT DETERMINATION
  - VEHICLE MOVEMENT
  - ARMOR/ANTI-ARMOR WEAPON EFFECTS
- EOSAEL87 ⟹ NATURAL ATMOSPHERE, SMOKE, AND DUST
- CCNVEO/AMSAA PASSIVE TARGET ACQUISITION CODE
- LELAWS ⟹ LASER WEAPON EFFECTS
- PHI ⟹ LASER ACTIVE DETECTION PERFORMANCE
- INCURSION ⟹ AIR DEFENSE WEAPON EFFECTS

UNCLASSIFIED

0589-050/02

ARMY INTERACTION IN AWSIM DEVELOPMENT AND REVIEW

SPARTA, INC.

- SIMULATION/MODELING REVIEWS DURING DEVELOPMENT
  - AMSAA
  - TRAC/WSMR
  - USAIS
  - LABCOM
  - CECOM
  - CACDA
  - MICOM
  - VAL
  - CCNVEO
- SUBSTANTIAL MODELING GUIDANCE FROM AMSAA
  - AIR DEFENSE
  - INFANTRY WEAPONS
  - ARTILLERY EFFECTS
  - LASER WEAPON EFFECTS
- CODE INSTALLED ON GOVERNMENT COMPUTERS
  - AMSAA (VAX AND CRAY)
  - MICOM (VAX)
  - LABCOM (VAX)
- APPROVED FOR DE WEAPON ANALYSIS BY MULTI-AGENCY ARMY DE MODELING COMMITTEE (CHAIRED BY LABCOM) IN AUGUST 1987
- RECOMMENDED BY DUSA-OR IN EARLY 1989 FOR VALIDATION

0489-036/05

SPARTA, INC.

SCENARIOS AVAILABLE

- EUROPEAN MECHANIZED INFANTRY DEFENSE (DAZER SCENARIO)
  - CLOSE RANGE ARMORED/DISMOUNTED ASSAULT BY TWO COMPANIES ON A DISMOUNTED U.S. PLATOON
  - FULLY OPERATIONAL
  - EXERCISED IN SEVERAL STUDIES
- TRADOC HIGH RESOLUTION SCENARIO #1
  - INTENSE ARMOR BATTLE BETWEEN U.S. ARMOR BATTALION AND SOVIET MOTORIZED RIFLE REGIMENT
  - FULLY OPERATIONAL
  - EXERCISED IN UNCONVENTIONAL BEAM WEAPON STUDY

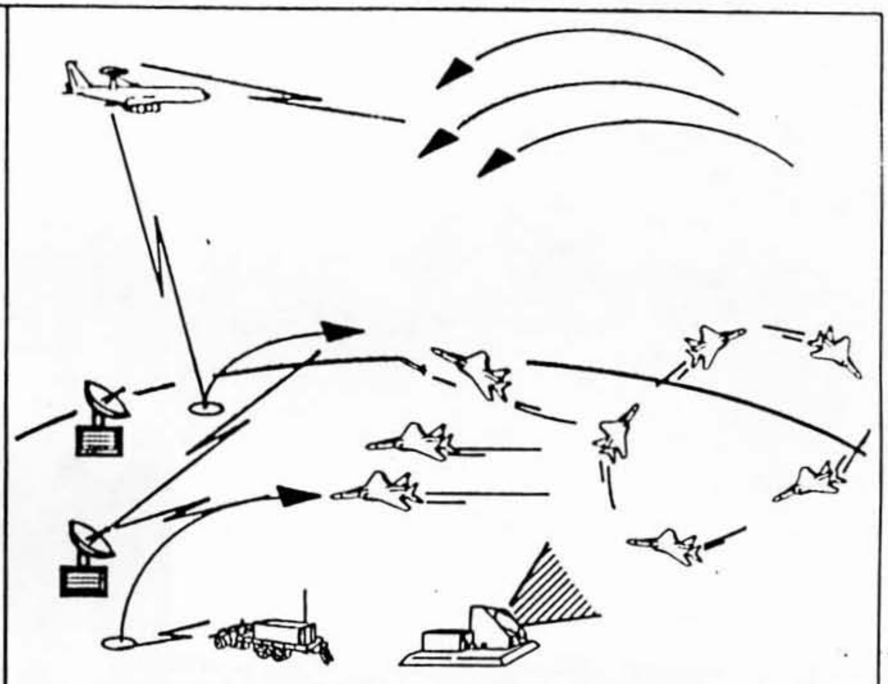
SUMMARY

SPARTA, INC.

- **AWSIM89**
  - A HIGH RESOLUTION, QUICK RESPONSE SIMULATION
  - A FLEXIBLE, SOPHISTICATED FORCE EFFECTIVENESS ANALYSIS TOOL
  - RESPECTED WITHIN THE ARMY ANALYSIS COMMUNITY

THEATER MISSILE DEFENSE SIMULATION (TMDSIM)

- THEATER-LEVEL, EVENT-BASED SIMULATION OF EXTENDED AIR DEFENSE
- ONE-SIDED (RED-ON-BLUE OR BLUE-ON-RED)
- EMPHASIS ON ACTIVE DEFENSE OPERATIONS AND BATTLE MANAGEMENT/COMMAND/CONTROL
- INPUT DATA-DRIVEN TO REPRESENT MULTIPLE TYPES OF SENSORS, WEAPONS, BM/C^3 ELEMENTS
- DEVELOPED FOR EVALUATION OF CANDIDATE ARCHITECTURES IN THEATER MISSILE DEFENSE ARCHITECTURE STUDIES (TMDAS)
- EXTENDED IN COMMAND/CONTROL AND SURVEILLANCE TO SUPPORT NATO AGARD AAS-29 STUDY



	THREAT	ASSETS	SURVEILLANCE	COMMAND, CONTROL, COMMUNICATIONS	WEAPONS
Model Characteristics, Parameters	- Trajectories/Waypoints - Attack Timing - Warhead Lethality - Reliability - RF/IR Signatures - ECM Power/Band/FOV	- Types, Numbers - Location (Lat/Lon) - Vulnerability - Value/Priority - C^2 Subordination	- Types, Locations - Orientation - Scan Rate - Field-of-View - RF Sensitivity - ECM Resistance	- Tactical OPS Concept - Rules Of Engagement - Types, Locations - Key Functions - Processing Times - Message Transfer - Times	- Types, Locations - Flyout (Range/Time) - Pssk, Reliability - Engagement Constraints - Firing Rate Constraints
Options	- Fighters, Bombers - Tactical Air-to-Surface Missiles - Tactical Ballistic Missiles - Anti-Radiation Homing Missiles - Cruise Missiles - Standoff Jammers	- Airbases - SAM Sites - SSM Sites - Bai/Interdiction - Surveillance Sensors - Command/Control Nodes - Logistics	- Airborne, Ground Based, Space Based - Radar, Optical - Active, Passive - Over-the-Horizon Radar	- BOC/FU - SAMOC - SFP, RPC - ACC - AOCC - CAOC - WOC - MNC/MSC/PSC	- Ground Based Airborne - Missiles, Guns, DEW - Active, Semiactive, Command Homing - Firing Doctrines

0589-025/04

TMDSIM COMPUTER/USER ASPECTS

SPARTA, INC.

- FORTRAN 77 LANGUAGE
- DISCRETE EVENT SIMULATION FRAMEWORK
  - SPARTA PROPRIETARY CODE
  - 30 EVENT "CHAINS," ~ 100 TOTAL SUB-EVENTS
  - 50,000 EVENT QUEUE TYPICAL
- CONVEX C-1 VECTOR PROCESSING COMPUTER (10 TO 60 MIB)
- 5 TO 10 CPU HOURS RUN TIME FOR 2 HOUR BATTLE
- 60 MB CORE MEMORY, ~ 10 MB DISK
- ~ 35,000 LINES OF CODE
- BUILT OVER 3 YEAR PERIOD (IOC 1987)
- DOCUMENTATION - USER'S MANUAL ONLY (NOT CURRENT)
- PRE-POST PROCESSORS
  - THREAT GENERATION
  - OUTPUT FILES - STATISTICS, AGGREGATES, TIME HISTORIES

- DIDSIM -
A HIERARCHY OF MODELS

FORCE-ON-FORCE (DIDSIM)

DEFENSE TIERS (ASATSIM, SBDEWSIM, MIDSIM, HEDSIM)

ENGAGEMENT MODELS

- END-TO-END DETAILED SIMULATIONS OF:
  - PRECOMMIT FUNCTIONS (ALERT, SURVEILLANCE, DISCRIMINATE, TRACK)
  - POSTCOMMIT FUNCTIONS (IN-FLIGHT GUIDANCE, TERMINAL GUIDANCE, KILL)
  - BATTLE MANAGEMENT/C^3

THREAT MODELS

- ALLOCATION OF THREAT FOR
  - NATIONAL TARGETS
  - HARDENED MILITARY TARGETS
  - ADAPTIVE DEFENSES
  - CLUSTERED DEFENSES
- DETAILED FUNCTIONAL MODELS OF THREAT (E.G., FLYOUT, PBV, RV SIGNATURES)

FUNCTIONAL SIMULATION

- SENSOR DISCRIMINATION
- SENSOR TRACK PERFORMANCE
- ENDGAME PERFORMANCE
- WEAPON KILL (LASER, PARTICLE BEAMS, KILL VEHICLES, INTERCEPTORS)

DIDSIM OUTPUTS

- EFFECTIVENESS AND FUNCTIONAL LOADING OF EACH DEFENSE TIER
  - OBJECTS KILLED
  - OBJECTS LEAKED
  - WEAPONS EXHAUSTED
  - WEAPONS WASTED
  - SURVIVORS

VS

- ATTACK LAYDOWNS
- TARGET HARDNESS
- SENSOR LOCATIONS AND PERFORMANCE
- WEAPON LOCATIONS AND PERFORMANCE
- BATTLE MANAGEMENT STRATEGIES
- COMMUNICATION EFFECTIVENESS

- GRAPHICS DISPLAY OF SELECTED SYSTEM FUNCTIONS AND KEY TECHNICAL PARAMETERS DURING FULL SYSTEM SIMULATION OR FOR SPECIFIC CONDITIONS

ADEM

AIR DEFENSE EFFECTIVENESS MODEL

ADEM SIMULATION

EFFECTIVENESS AND SURVIVABILITY SIMULATION

TIME INTEGRATED MONTE CARLO

BLUE AIRCRAFT
vs.
RED AIR DEFENSE

MANY-ON-MANY
(20 AC vs. 500 THREATS)

DETAILED COMPONENT MODELS

PROGRAMABLE, REACTIVE AIRCRAFT

5 DOF SAMS

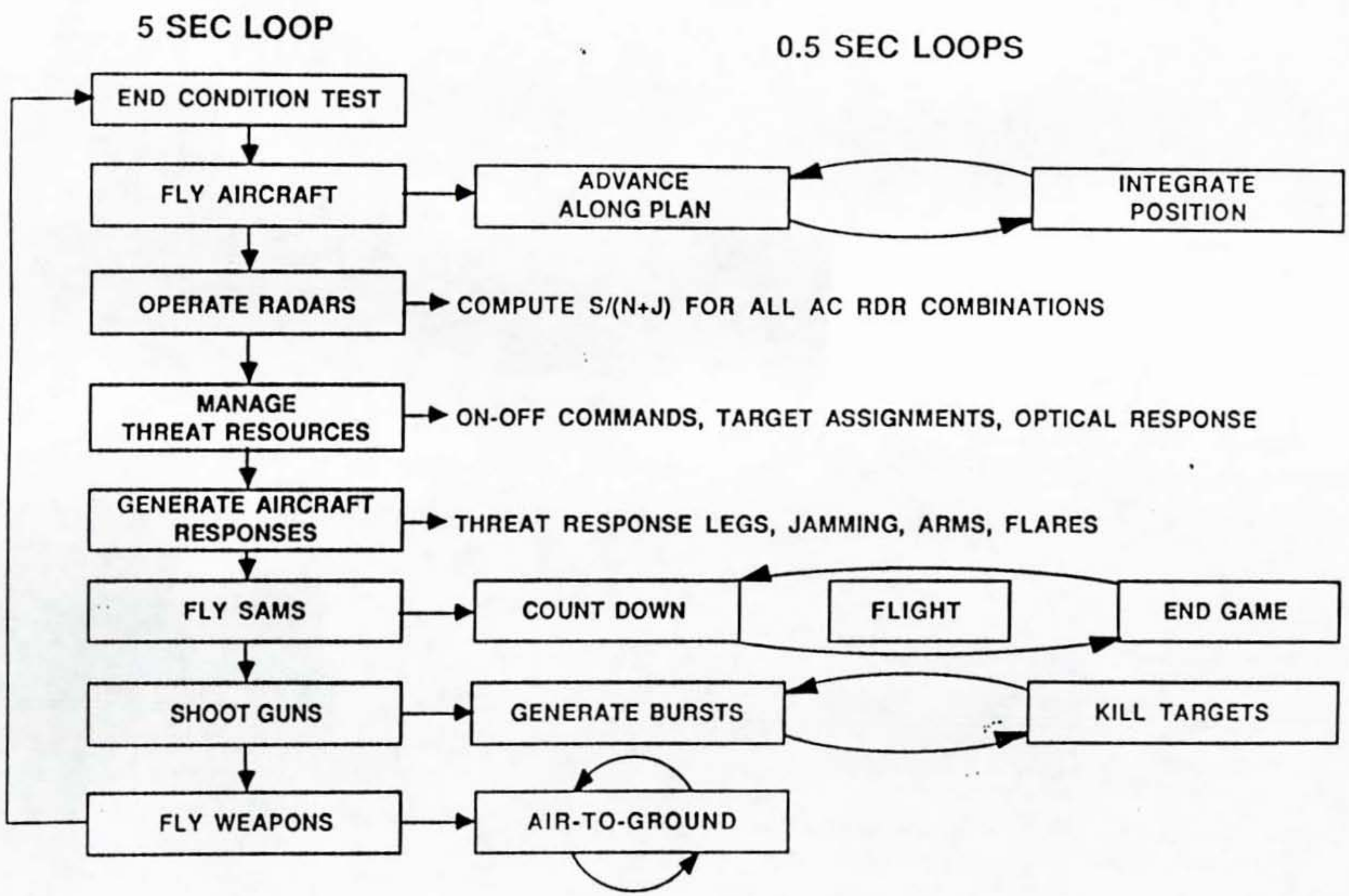
BURST-BY-BURST GUNS

RADAR, CCC NETWORK

ASE

ADEM
AIR DEFENSE EFFECTIVENESS MODEL

ADEM INTEGRATION LOOP



ADAGE

SPARTA, INC.

AIR DEFENSE AIR-TO-GROUND ENGAGEMENT SIMULATION

- DEVELOPED BY AMSAA
- DESIGNED TO STUDY THE EFFECTIVENESS OF MIXES OF GROUND BASED WEAPONS IN PROVIDING AIR DEFENSE TO A DIVISION
- USED FOR
  - DIVAD GUN COEA
  - SHORAD/MANPAD STUDY
  - FADEW/AIR DEFENSE STUDY
  - SGT YORK COEA

INCURSION MODEL

SYSTEM SPECIFIC ONE-ON-ONE ENGAGEMENT MODEL

- MONTE CARLO
- SYSTEM FUNCTIONS
- THREAT FLIGHT PATH
- FLY-BY AND VICINITY OF TARGET MODES
- PROVIDES AIR DEFENSE EFFECTIVENESS TO CAMPAIGN

CAMPAIGN MODEL

TOTAL DIVISION LEVEL BATTLE WITH ALL AD SYSTEMS PLAYED FOR SEVERAL DAYS

- EXPECTED VALUE MODEL
- OPTIMIZED RED RAIDS
- AIR/AIR AND GROUND/GROUND BATTLE CONSIDERED
- REPAIR AND REFURB CONSIDERED

INCURSION/VA MODEL HIGHLIGHTS

- LOW ENERGY LASER PROPAGATION MODEL (LELAWS) OPERATED OFF-LINE TO FEED INCURSION
- EXPLICIT MODEL OF PILOT FOV ORIENTATION THROUGHOUT FLIGHT PROFILE
- FIRE CONTROL DOCTRINE
- MULTIPLE TYPES OF KILL
  - DAZZLE
  - NEGATION
- RELATIVE FREQUENCY WITH WHICH A DAZZLE OR NEGATION FOR USE IN CAMPAIGN

1188-038/06

Ada SOFTWARE DEVELOPMENT SUPPORTING CAPABILITIES

SPARTA, INC.

- DEVELOPED ALL MAJOR DOCUMENTS FOR Ada APPLICATIONS REQUIRED BY DoD-STD 2167 AND DoD-STD 2167A
  - OPERATIONAL CONCEPT DESCRIPTIONS
  - SYSTEM AND SEGMENT SPECIFICATIONS
  - SOFTWARE REQUIREMENTS SPECIFICATIONS
  - SOFTWARE DEVELOPMENT PLANS
  - SOFTWARE TOP-LEVEL AND DETAILED DESIGN DOCUMENTS
  - SYSTEM INTERFACE SPECIFICATIONS
  - SOFTWARE USER'S MANUAL
- ESTABLISHED SOFTWARE QUALITY CONTROL FUNCTION
- ESTABLISHED SOFTWARE CONFIGURATION MANAGEMENT FUNCTION
- ESTABLISHED SOFTWARE TEST AND EVALUATION FUNCTION

TRIP REPORT
JUNE 25-27, 1989
BRIAN GOLDIEZ
PITTSBURGH, PA & AKRON, OH

PITTSBURGH, PA

PURPOSE: Visit the Software Engineering Institute (SEI) at Carnegie-Mellon University

INDIVIDUALS CONTACTED: Dr. Mario Barbacci, Senior Member of the Technical Staff

DISCUSSION: The primary of this trip was to find out more about a software development environment called Durra. Several other activities of the SEI were also discussed which could be beneficial to the training and simulation community. The SEI is a Federally Funded Research and Development Center (FFRDC). They are funded by DARPA and chartered to do research work for the DoD.

Durra is a software development environment for heterogeneous computing systems. IST's interest in such a programming environment is dictated by trends toward the use of microprocessors and/or distributed computing architectures in training devices. Programming in environments where several different computing architectures are employed is not a straightforward matter. Systems issues related to timing of synchronous tasks, memory usage, communication, control, programming, etc. are not immediately apparent in heterogenous environments. In addition, dynamic allocation of computing resources is normally not a feature considered in training devices.

Durra provides a development to develop software in heterogeneous environments. Its applicability to training devices is not clear, due to host computers used, timing, monitoring features, and control structures which would have to be developed for specific training applications. IST, though, will be receiving and installing Durra in our lab to address these issues. Initial applications will be with respect to our Networking and Intelligent Semi-Automated Opposing Forces tasks on the BAA. These two tasks represent loosely coupled and tightly coupled computer systems, respectively. IST will be the first sight to experiment with Durra.

Other activities at the SEI could be extremely appropriate to training. The SEI has developed training software using AI and the new Digital Video Interactive (DVI) chip technology being developed by Intel and IBM. This technology could be appropriate to Embedded Training, the classroom of the future, and other training technologies which could benefit from an on screen graphics capability. The SEI is also doing Object Oriented Design of simulation software modules. They have developed an OOD for a flight simulator engine module in Ada. Although this module operates correctly, it does not execute in realtime nor do I believe it is responsive to external interrupts typical of a realtime operating system. However, further insight into Ada development environments at the SEI could be useful to IST.

AKRON, OH

PURPOSE: Visit Loral Corporation to get information on multi-spectral data base

INDIVIDUALS CONTACTED:
James Horton, Manager of Business Development
George Snyder, Manager of Radar Image Generator
Andy Jansen, Engineering Manager HOT SHOT products

DISCUSSION: IST had expressed interest in data base generation and correlation techniques to Loral at several previous meetings. This visit was to review Loral capabilities in the data base generation and correlation area. Loral (formerly Goodyear Aerospace) has been involved in data base generation and correlation for over 40 years. This work had been primarily applied to weapon system application. The F-15 WST program, though, required radar generation capabilities which were not available. Loral has developed a radar simulator with correlation to actual terrain and the other sensors (several E-O sensors) on the F-15 aircraft. In additioon, Loral makes several products for the DMA and Army (in support of Pershing II) which can generate and correlate sensor data with actual terrain rapidly. These products could potentially be applied to training devices.

Loral has also developed a part task trainer known as the HOT SHOT. This product simulates an F-15 or F-16 aircraft. Many of the training features of this device were explained and demonstrated. This device appears to offer training capability in some of the target engagement tasks of the design basis aircraft.

DATE: July 13, 1989

TO: M. Companion, B, Goldiez, E. Smart

FROM: T. Clarke

SUBJ: Trip Report of Visit to Perceptronics and LLNL

On June 28 and 29 Ernie Smart and I traveled to Perceptronics and Lawrence Livermore National Laboratory. Ernie traveled in support of the Army IQC and I traveled to gather information for the SAFOR project. In what follows I will discuss the results of the trip primarily from the SAFOR viewpoint as I believe Ernie has covered the business and IQC aspects of the trip in his report.

Perceptronics

At Perceptronics we met with Azad Madni, Phil Handley and Michael Fielding. Madni is the Division Manager of AI and Man-Machine Systems at Perceptronics. Fielding is a Division manager of same, and Handley is a Product line manager for simulation systems.

The discusion at Perceptronics centered on their COMBAT-SIM battle simulation system. This system is based on either PC/AT or MicroVAX computers. Visuals are provided by a videodisc player.

COMBAT-SIM is designed to simulate the military command environment to train commanders. It has no intelligence at echelons below the user interface level. Because of its lack of intelligence, and dependence of canned images, COMBAT-SIM would have little utility in SAFOR.

There was also some discussion with Madni of a proposal that Perceptronics was submitting to IST "Context Template-Driven SAFOR Modeling and Simulation". I was able to examine this proposal in detail after the trip. It proposes research designed to produce a design for a SAFOR using the template AI technique. Since the proposal is for design, not implementation, and since implemented SAFOR command and control systems are available from Texas Instruments (see companion report) and from Lawrence Livermore (see below), this proposal should not be considered as part of the IST SAFOR effort.

Lawrence Livermore National Laboratory
Conflict Simulation Laboratory

At LLNL's CSL we met with Dr. Ralph Toms and Arnold S. Warshawsky. Toms and Warshawsky are the principal scientists in CSL. The LLNL management structure is such that CSL has only two line positions. Other positions are staffed by military personnel and by personnel borrowed from other parts of LLNL.

The mission of CSL is to simulate conflict in order to evaluate the utility of the weapons developed at LLNL. The emphasis at CSL is thus a bit different from battle simulations developed for training purposes. CSL simulations include extensive logging and analysis capability. The emphasis is on making it easy for the operator to control the simulation, not on accurately modelling the military command environment. The learning curve for CSL simulations is reported to be very short. Nevertheless, some CSL simulations have found use in training.

The nost mature simulation product of CSL is Janus (the Roman god, not an acronym). Janus is a "classic" battle simulation with players sitting at graphics control stations and interacting through the simulated battle. It has no internal intelligence for simulated echelon levels not explicitly controlled by players. Janus is written in FORTRAN, is hosted on a VAX/VMS and used Tektronix 4225 terminals as display stations. Because of its lack of intelligence, Janus will probably be of little use in SAFOR.

The CSL product that may be of use in the SAFOR project is ConMod. As the attachment indicates, ConMod explicitly models the military command and control hierarchy. Echelons below the user level have intelligence needed to develop Operation and Task Orders for lower echelons, to Coordinate with parallel echelons, and to submit Status reports to higher echelons. Like Janus ConMod has an easy to learn graphic user interface.

Significantly, ConMod seperates modeling the physical world of actual force-on-force conflict, from the cognitive world of military command and control. This explicit separation should facilitate using ConMod as the intelligent command and control interface to a SIMNET SAFOR. The model or simulation of the physical conflict would be replaced by an interface to the SIMNET environment. ConMod appears to be a data driven system, so that customizing the force structure for the SIMNET SAFOR should be just a matter of creating the appropriate data files.

ConMod iw written in Ada and runs on a VAX/VMS and uses a Tektronix 4225 for interface. Since ConMod should be available at nominal cost, it would seem wise to insure that the testbed has the capability of hosting ConMod. Ada is allegedly portable between machines so that one of the 80386 hosts should be able to run ConMod. There are always nagging machine dependent incompatibilites however, so that it might be easier to procure a MicroVax host. No decision has to be made now as the IST Networking Lab is procuring a VaxStation with Ada so that the various possibilities can be explored. The graphic interface depends on the availability of Tektronix hardware, so that a Tek 4225 needs to be procured to insure ConMod compatability.

The ConMod Simulation

The Conflict Model (ConMod) is an automated, high-resolution, large-scale, AirLand Battle simulation at the corps level with the capability to model echelons-above-the-corps. It is designed as an analytic tool to enable the user to examine activities of a military conflict involving air and ground forces engaged in deep, rear, and close combat. It simulates selected aspects of combat, combat support, and combat service support, covering a geographical extent of hundreds of kilometers, with a time period of days. ConMod is primarily intended for evaluating existing and proposed combat systems, tactics, and doctrine in order to provide timely evaluation and recommendations to policy makers. While designed as an analytic tool, ConMod is also adaptable to research, operational support, and training purposes.

Founded on control system theory, ConMod takes an object-oriented approach to the modeling of military systems. Generic military objects with scenario dependent links form military organization hierarchies and command and control networks. Planning may be automated below a selectable organizational level. The model uses high resolution physics for the simulation of movement, acquisition, engagement, and communication. Physics calculations are based on the engineering data for individual item systems.

Using 3D digitized terrain, typically on a 250-meter grid, the model has a comprehensive system support environment. ConMod is written in the Ada programming language under the VAX/VMS operating system and is currently under further development on computer systems of the VAX 8000 class. Currently, its high-resolution, color graphics user interface runs on Tektronix 4120/4225 series workstations.

CONMOD DESIGN CONCEPTS

ConMod emphasizes five significant features in its conceptual design. These are: (1) command and control (C2) representation based on control system theory, (2) separation of the cognitive aspects of the simulation from the physical aspects, (3) cause and effect audit trail, (4) discrete event simulation, and (5) extensible model architecture. The rationale for these features stems from ConMod's objectives. Each of these will be discussed in turn, bearing in mind that the aim of this or any simulation is to represent those characteristics of the system that are pertinent to the problem under study.

Theoretical Background

For automated command and control, a control theory approach to organizations provides a theoretical foundation. In this structure, the cognitive aspects of the problem, namely, command and control, can be viewed separately from the physical aspects. Each military entity is viewed as a generic object residing in a control system, receiving and sending signals which effect its state or alter the states of other objects. The signals become the generic events of a discrete event simulation. Objects are, therefore, related not to other objects but to the actions they are effected by and cause. Within this overall organizational framework, the control agent is modeled using a theory of management.

Cognitive Plane and Physical Plane Separation

The organizations interact on two separate but related planes: the cognitive plane and the physical plane. Each independent organization has its own cognitive plane, but it shares a physical plane with all other independent organizations. Thus, there is a single physical plane but a cognitive plane for each of the opposing forces.

This separation of the problem recognizes two distinct types of modeling effort. The physical plane deals with physical processes such as sensing, moving, engaging, and communicating. The cognitive plane emphasizes the management processes; planning, directing, controlling, coordinating and reporting

Cause and Effect Audit Trail

In a model whose purpose is analysis, the ability to identify cause and effect is vital. In the ConMod design, a mechanistic viewpoint is imposed whereby all effects have a known cause and all effects are calculable. This is achieved by requiring two entities: objects and actions. When two objects interact through an action, there are also two events: the cause event and the effect event.

Discrete Event Simulation

The need for a cause and effect audit trail combined with the need to examine individual item systems leads to a discrete event simulation. ConMod is conceived as an event driven, variable resolution model. The simulation proceeds through the execution of scheduled (queued) events. One event is either an object initiating an action (cause event) or an object being acted upon (effect event).

Since ConMod resolves events down to selected item systems on digitized 3-D terrain, it becomes possible to use actual locations for determining range and range-dependent variables, such as the probability of hit and probability of kill (Ph and Pk). This allows cause and effect to be established using the actual locations and actual times for discrete events, particularly sensing and engaging. These low-level events are modeled stochastically.

Extensible Model Architecture

Constant change is the norm of the military world. In order to accommodate the future changes in weapons systems, organizations, operations, tactics, and doctrine, ConMod adopted an object-oriented development method. Since a clear distinction is made between cognitive and physical processes, future extensions that utilize knowledge based system concepts can be facilitated.

COMMAND AND CONTROL SIMULATION CHARACTERISTICS

In this section, the important simulation features relating to command and control are further developed. First the control system and organizational theory are applied to combat simulation. Then the cognitive/physical separation is described. Next military organizations are shown as they fit into the structure, and their management functions are described.

Control System Theory

A system can be defined as a group of objects interacting with each other through well defined actions and behaving as a unified whole with respect to the system's environment.

A control system is composed of two subsystems: (1) a controller and (2) a producer. The controller attempts to control the producer's behavior in the presence of environmental interactions.

A metacontrol system is a special kind of control system. Metacontrol is the control of a controller. This has the effect of distributing or stacking control through various levels, as is commonly done in organizations.

An organization behaves as a control system. It attempts to control its producers in the presence of interactions with the physical environment. An organization is the union of a management metacontrol system and a production control system.

A hierarchical organization has a layering of management metacontrollers in its management metacontrol system in order to provide the desired span of control of a number of specialized production control systems. Typical organizational structures may be constructed by combining features from a centralized structure and a decentralized structure. In the centralized organization, high level managers may exert control down several levels, including control of production controllers, while in the decentralized organization, high level management controllers only control other management controllers.

Cognitive and Physical Separation

As described previously under design concepts, the C2 system in ConMod is separated from the physical combat processes. In the model, this is expressed in terms of planes–two cognitive planes, one for each opposing side in the conflict; and one physical plane, for the interaction of forces. In terms of organizational theory, the C2 system is the management metacontroller, and the force system is the production control system.

The C2 system is composed of cognitive objects related by cognitive actions. It lies entirely in the cognitive plane of its respective side. The configuration of a C2 system may be customized to reflect a particular hierarchical organizational structure.

The force system is composed of active and passive physical objects. Active physical objects include such things as single weapon systems, tactical groupings (aircraft flights, tank platoons, etc.), command posts, logistics centers, and communications centers. Passive physical objects include such things as unissued supplies, unissued equipment, unassigned personnel, and barriers. The force system may interact with the C2 system through the management actions;

planning, directing, controlling, coordinating, and reporting. The force system also interacts with the common environment system and may cause physical actions which affect objects in the common environment.

Common environment objects lie in the physical plane. They include terrain, vegetation, hydrographic features, and cultural features, as well as weather, radiation, and chemical contamination

It should be noted that the interaction between two opposing sides occurs only in the common physical plane. There is no direct connection between cognitive planes. Thus, ConMod excludes what might be termed political processes, such as direct negotiations between the cognitive parts of opposing sides. Blue has no way of directly manipulating Red's cognitive processes. This implies, for example, that if Blue wants to deceive Red, it has to manipulate objects or events in the physical plane that Red might misinterpret.

Generic Objects in Military Organization Hierarchies

The extensibility objective of ConMod's development requires a conceptual architecture and software design which will allow for continuous expansion of the number and kinds of military functionalities represented. It is recognized that the partitioning of military activities into functional areas is largely doctrinal. Military entities typically perform tasks in more than one functional area. In consideration of differing organizational doctrine on both sides as well as to allow for future developments, the discussion of military entities is in generic terms.

ConMod must be able to model a wide variety of military forces and organizations. Because of the differences in doctrine, size, organization, procedures, and equipment between scenarios that can be modeled, ConMod uses a number of generic objects whose characteristics are specified by the analyst to represent real world decision making groups or fighting objects. ConMod also allows the analyst to specify lines of command and communication so that he can assemble these customized objects into a military structure that represents the real world structure of whatever force is being modeled. This modeling approach is called object-oriented.

The object-oriented approach satisfies the need for flexibility and extensibility. An analyst examines the military forces and weapon systems of interest and chooses a generic modeling object that best performs the operational functions required at each of the real world command organizations or by each of the fighting units. After selecting the appropriate generic objects, the analyst must customize them by specifying a data base of characteristics that direct their performance during the simulation. For example, if the analyst wants to model a U.S. M1A1 tank platoon, he would choose a generic Close Combat Unit (CCUN) and specify the speed, range, firepower, vulnerability, etc. of M1A1 tanks. After establishing the appropriate characteristics, the analyst specifies the chain of command that ties subordinates and superiors together as well as communications links that allow coordination within the chain of command or with organizations in other command structures.

In ConMod each object is a finite state machine. The state of each object at any time during the simulation depends on: (1) its characteristics specified at the beginning of the simulation, (2) the actions of other objects on it, (3) its actions on other objects. The actions on a cognitive object by other cognitive objects in the C2 system are: (1) directives it receives from its superiors through the command lines, (2) coordinations it receives through communication links, (3) reports it receives from subordinates. If the object is a physical object in the force system, its state is not only influenced by the directives it receives from superiors, and coordinations it receives through communication links but also by the environment, by what its sensors detect, and by the result of any combat action.

Objects within the force system of each side are tactical groupings appropriate to the resolution of the simulation. Some examples are artillery batteries, command posts, and aircraft flights. Active force system objects are capable of performing specialized tasks in the physical plane. One way to express this specialization is to consider that each force system object has its own specific language. For example, artillery batteries use a language that is distinct from that used by aircraft flights. The language specific activities performed in the C2 system are represented by what may be termed authority centers.

The cognitive authority centers are mapped into real world military objects. The mapping allows flexibility in designating, for any particular force structure, who performs a specific cognitive activity. By closely relating these objects to real world entities, such as command posts, their behavioral characteristics can be demonstrated.

Two types of authority centers have been included in the ConMod concept: (1) control authorities at the lowest level, and (2) mission authorities at higher levels. These are shown in Figure 1.

A control authority exercises tactical control over a group of specialized force system objects. Some examples are Artillery Control Authorities (ARTYCA), Close Combat Control Authorities (CCCA), and Air Defense Control Authorities (ADCA). Control authorities receive an operation order from a superior and attempt to execute the order by issuing detailed tasking to assigned force system objects. Control authorities report their status to their superior and may request support for their operation through coordination channels when authorized.

Mission authorities exercise operational control over subordinate forces. They receive a broad directive which includes allotments of forces and resources. The language of mission authorities reflects the types of operations their subordinate control authorities can execute. Mission authorities may also control other mission authorities of the same type. This is indicated in Figures 2 and 3. Examples are Force Mission Authorities (FMA), Ground Mission Authorities (GMA), and Air Mission Authorities (AMA). Mission authorities issue mission directives and operation orders to their subordinates. They may request support for their mission through coordination channels when authorized.

Management Processes for Command and Control Objects

Each C2 object is a management entity capable of performing five processes: (1) planning, (2) directing, (3) controlling, (4) reporting, and (5) coordinating. Management processes must be customized for a particular C2 object; however, the data flow between processes is generic to all C2 objects.

Key to the management process is the local data maintained by each C2 object: (1) the plan, (2) the perceived situation, and (3) policy data. The plan may be either the result of an automated planning process or, for those objects in a manual planning mode, a manually prepared plan. Plans conform to constraints imposed by a superior on its subordinate through a directive. The perceived situation is updated from information received through feedback and coordination. The perceived situation has three aspects: (1) environmental perception, (2) threat perception, and (3) friendly perception. The environmental perception includes current knowledge of objects in the common environment. Threat perception includes current knowledge of objects in the opposing organization's force, fused to the appropriate level for planning. The friendly perception includes current knowledge of other objects in the same organization, including immediate subordinates. Policy data is characteristic data used by the management processes. Policy data contains information with doctrinal and procedural implications.

CONMOD COMMAND AND CONTROL THEORY

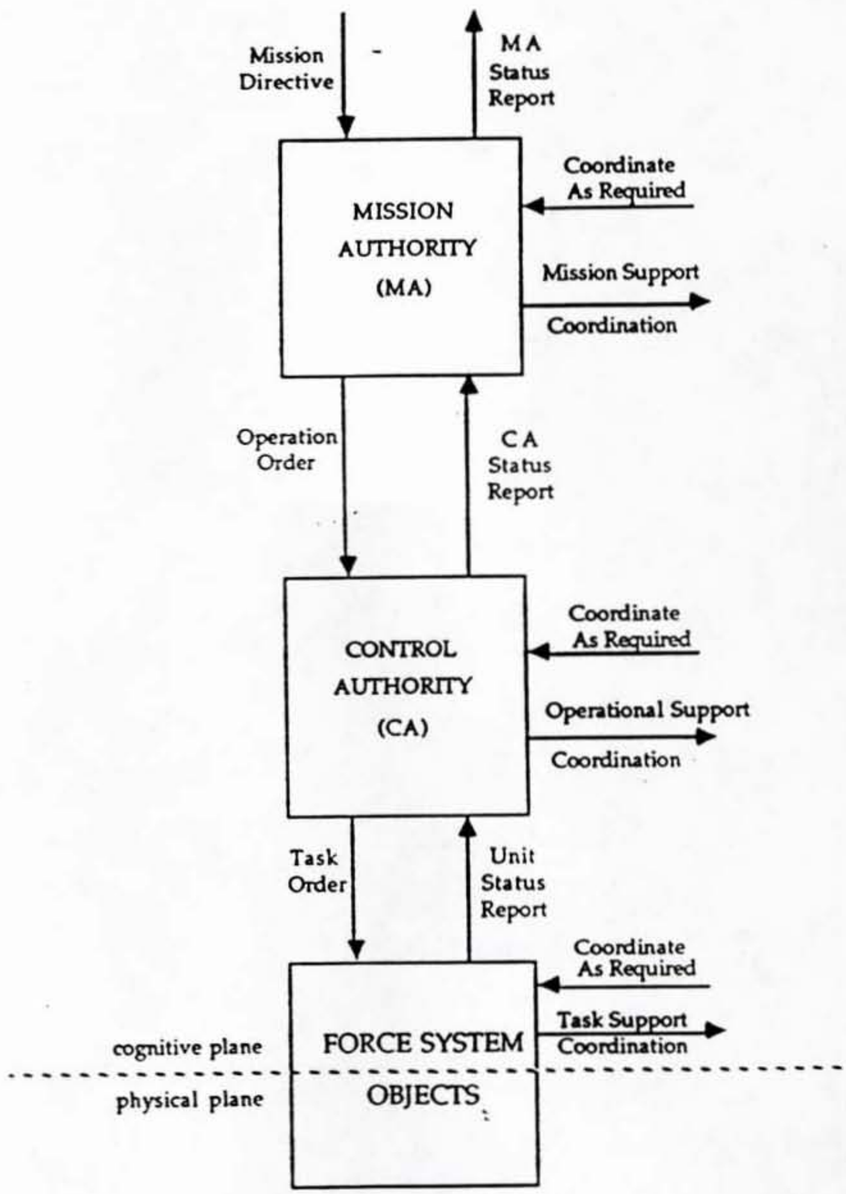
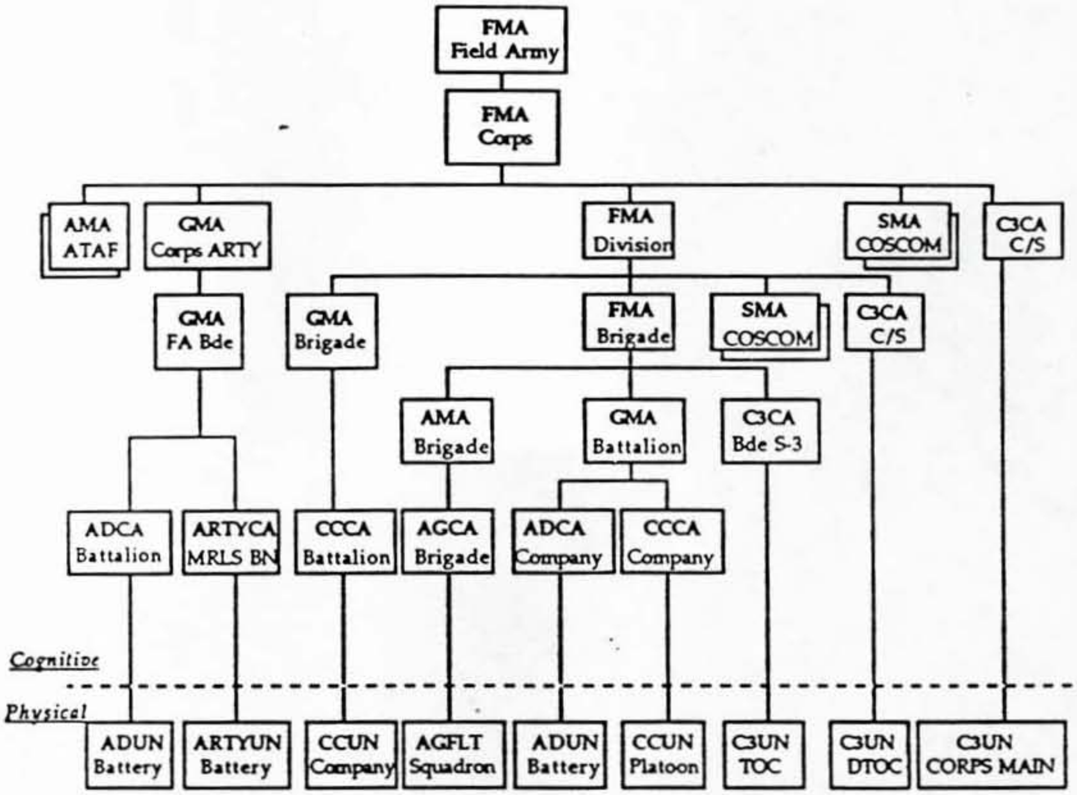


Figure 1.

One possible arrangement of
GROUND COMPONENT COMMAND AND CONTROL



In this diagram, the generic military objects (FMAs, GMAs,...) depict various levels of command. Modeling the simulation with generic objects results in the same generic object representing different levels of military activity. For example, depending on the level of abstraction, FMAs and GMAs occur at various echelons of command.

Figure 2.

One possible arrangement of
AIR COMPONENT COMMAND AND CONTROL

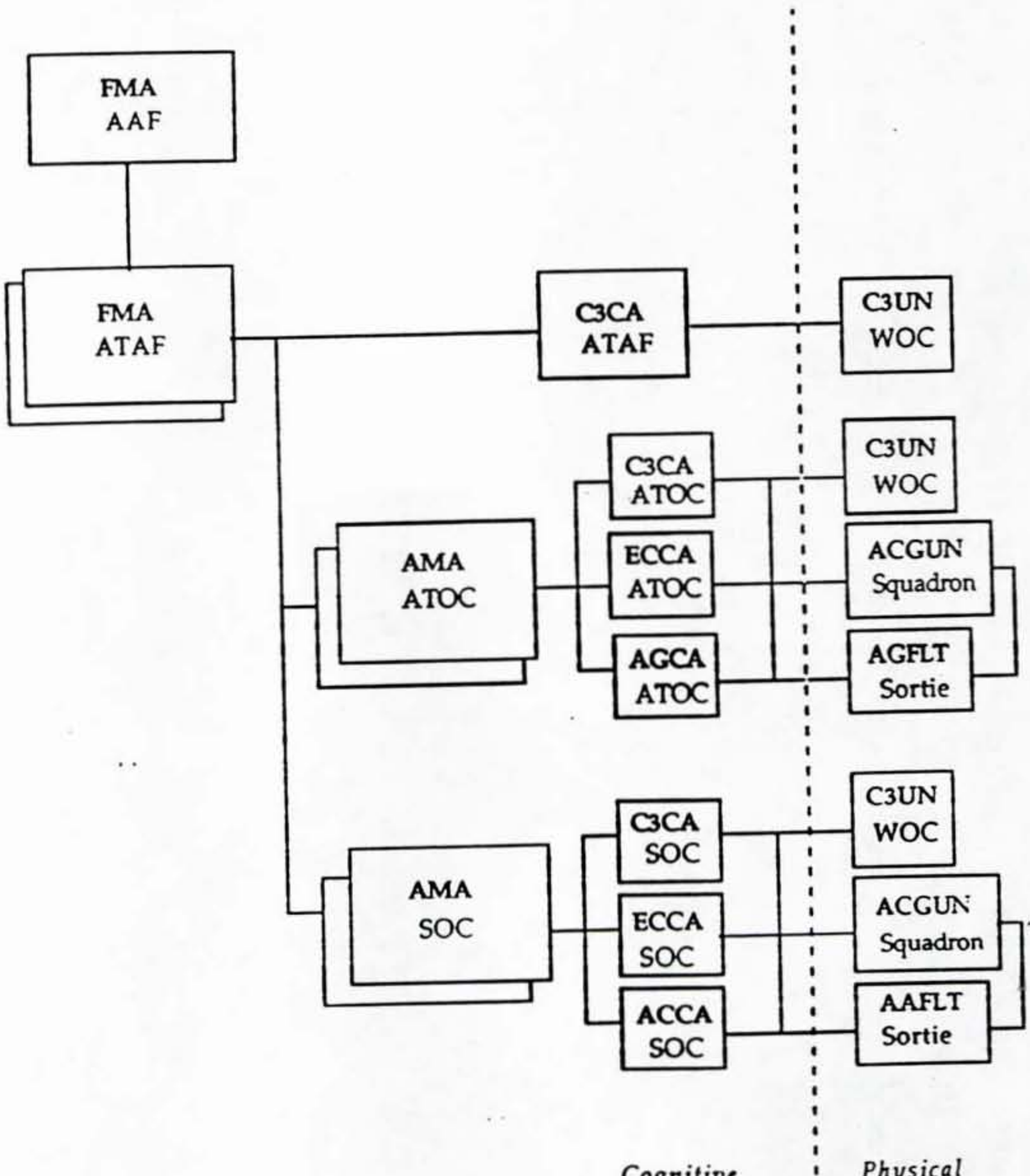


Figure 3.

OBJECTS

Objects are the significant military entities in the simulation whose state changes are recorded in the simulation history for analysis purposes. Listed below are the objects that represent the cognitive authority centers and the physical force objects.

Mission Authorities:

Force Mission Authority	(FMA)
Ground Mission Authority	(GMA)
Air Mission Authority	(AMA)

Control Authorities:

Command, Control, and Communication:

C3 Control Authority	(C3CA)

Ground Combat:

Close Combat Control Authority	(CCCA)
Artillery Control Authority	(ARTYCA)
Military Intelligence Control Authority	(MICA)
Electronic Warfare Control Authority	(EWCA)
Air Defense Control Authority	(ADCA)

Air Combat:

Air to Ground Control Authority	(AGCA)
Air to Air Control Authority	(AACA)
Reconnaissance Control Authority	(RCCA)
Resource Management Control Authority	(RMCA)

Force Objects

Command, Control and Communication:

C3 Unit	(C3UN)

Ground Combat:

Close Combat Unit	(CCUN)
Artillery Unit	(ARTYUN)
Fire Support Target Generator	(FSTG)
Military Intelligence Unit	(MIUN)
Electronic Warfare Unit	(EWUN)
Air Defense Unit	(ADUN)
Air Defense Target Generator	(ADTG)

Air Combat:

Air to Ground Flight	(AGFLT)
Air to Air Flight	(AAFLT)
Aircraft Generation Unit	(ACGUN)

Force Mission Authority (FMA)

The FMA is the combined arms manager. It provides the campaign guidance and operational control of assigned FMA's, GMA's, AMA's, and C3CA's. The FMA receives a Mission Directive and graphic control measures from a superior FMA or the analyst/planner. The FMA then: analyzes its environment, threat and friendly situation; develops its plan; coordinates as required; and issues the appropriate FMA Mission Directives, GMA Mission Directives, AMA Mission Directives, and C3CA Operations Orders with associated graphic control measures. It receives the status reports of assigned FMA's, GMA's, AMA's and C3CA's and issues its own status report to its superior FMA.

The FMA is the cognitive activity which plans and provides high level force integration command and control. It does not provide detailed air and ground directives to its subordinate FMAs, GMAs, AMAs andC3CAs. It provides only the commander's intent in terms of a broad directive and the allotment of major forces and resources in support of a main effort or campaign.

A scenario example of an FMA is a US Corps.

Ground Mission Authority (GMA)

The GMA provides campaign guidance to subordinate GMA's and operational control of assigned CCCA's, ARTYCA's, and C3CA's. The GMA receives a Mission Directive and graphic control measures from its controlling GMA or FMA. The GMA then: analyzes its environment, threat, and friendly situation; coordinates as required; develops its plan; and issues GMA Mission Directives, CCCA Operations Orders, ARTYCA Operations Orders, and C3CA Operations Orders. It assesses the ground campaign through information received from the status reports of subordinate GMA's, CCCA's, and ARTYCA's. The GMA provides operational control of its C3 infrastructure through subordinate C3CA's.

A scenario example of a GMA is a US Armored Battalion.

Air Mission Authority (AMA)

The AMA provides campaign guidance to subordinate AMA's and operational control of assigned AGCA's, AACA's, RMCA's, and C3CA's. It receives an AMA Mission Directive and issues AMA Mission Directives and subordinate CA Operations Orders. It assesses air campaigns through information received from the status reports of subordinate AMA's. It assesses air to ground and air to air operations through information received from CA status reports. The AMA may coordinate with other mission authorities when authorized. It provides operational control of its C3 infrastructure through a subordinate C3CA.

A scenario example of an AMA is an Allied Tactical Air Force.

Command, Control and Communication Control Authority (C3CA)

A C3CA is assigned to a mission authority to provide tactical controlof the C3UN's which comprise the mission authority's C3 infrastructure. The C3CA receives a C3CA Operations Order from a mission authority and composes tasking orders for its assigned C3UN's. The C3CA receives coordinations and issues C3CA Operation Support Coordinations. These coordinations are the means by which messages are passed from cognitive objects for transmission by a physical C3UN.

A scenario example of a C3CA is a US TAC Command Post.

Close Combat Control Authority (CCCA)

The CCCA provides tactical control of assigned CCUNs. The CCCA receives an Operations Order and graphic control measures from a GMA. The CCCA then: analyzes its environment, threat, and friendly situation; develops its plan; coordinates as required; and issues CCUN Task Orders and graphic control measures. It receives the status reports of assigned CCUNs and issues its own status report to its GMA. It is the cognitive activity which plans and controls the execution of a close combat operation. The CCCA does not provide support to other agencies but does have other agencies supporting it. Supporting agents may be Air Ground Flights (AGFLT's), Artillery Units (ARTYUN's), Fire Support Target Generator's (FSTG's), or Artillery Control Authorities (ARTYCA's).

A scenario example of a CCCA is a US Mechanized Battalion.

Air Ground Control Authority (AGCA)

The AGCA provides tactical control of assigned Air Ground Flights (AGFLTs). The AGCA receives an operations order including graphic control measures from an Air Mission Authority (AMA). The AGCA creates a plan and implements the plan by issuing AGFLT Task Order and coordinating with others as required. It receives the status reports of its subordinates and issues a status report to its superior AMA. It is the cognitive activity which controls the execution of air to ground operations to include: Battlefield Air Interdiction (BAI), Close Air Support (CAS), Air Interdiction (AI), and Offensive Counter Air (OCA).

A scenario example of an AGCA is a US Tactical Air Control Center (TACC).

Command, Control and Communciation Unit (C3UN)

The C3UN is the force system object which provides a physical signature representing command posts, communications posts, and sensor posts. It may serve as a physical host unit for mission authorities and contro authorities. It is tactically controlled by a C3CA.

A scenario example of a C3UN is an E-3A Airborne Warning and Control System (AWACS) aircraft.

Close Combat Unit (CCUN)

The CCUN is the force system object which provides for physical execution of close combat tasks. The CCUN is normally a grouping of individual homogeneous items systems, but can be an individual item system. Moving and sensing are performing from a single location within the unit template, with capabilities determined from the aggregate of its individual item system properties and template. The CCUN selects which item systems will engage, and engagement is performed at item system resolution. It is tactically controlled by a CCCA.

A scenario example of a CCUN is a US Tank Company.

Air Ground Flight (AGFLT)

The AGFLT is the force system object that provides for the physical execution of an air to ground attack mission. The AGFLT is normally a flight or grouping of aircraft item systems although it can consist of a single item. Moving, sensing and engaging are all performed using the flight as the object. The AGFLT is launched and recovered by an Aircraft Generation Unit (ACGUN) and is tactically controlled by an AGCA.

A scenario example of a AGFLT is a flight of four F-16s.

For more information on the ConMod Project, contact:

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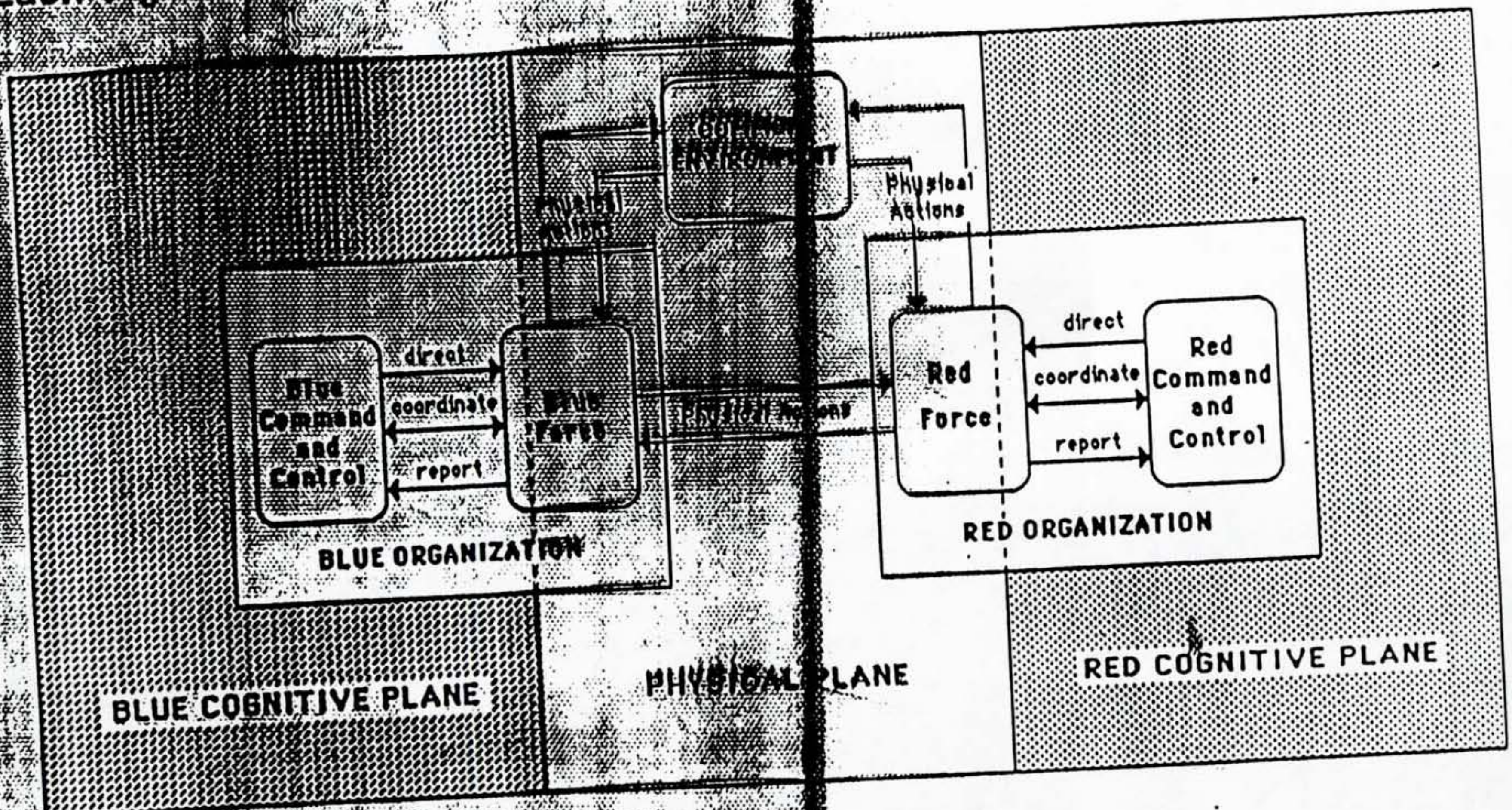
Conflicting Organizations

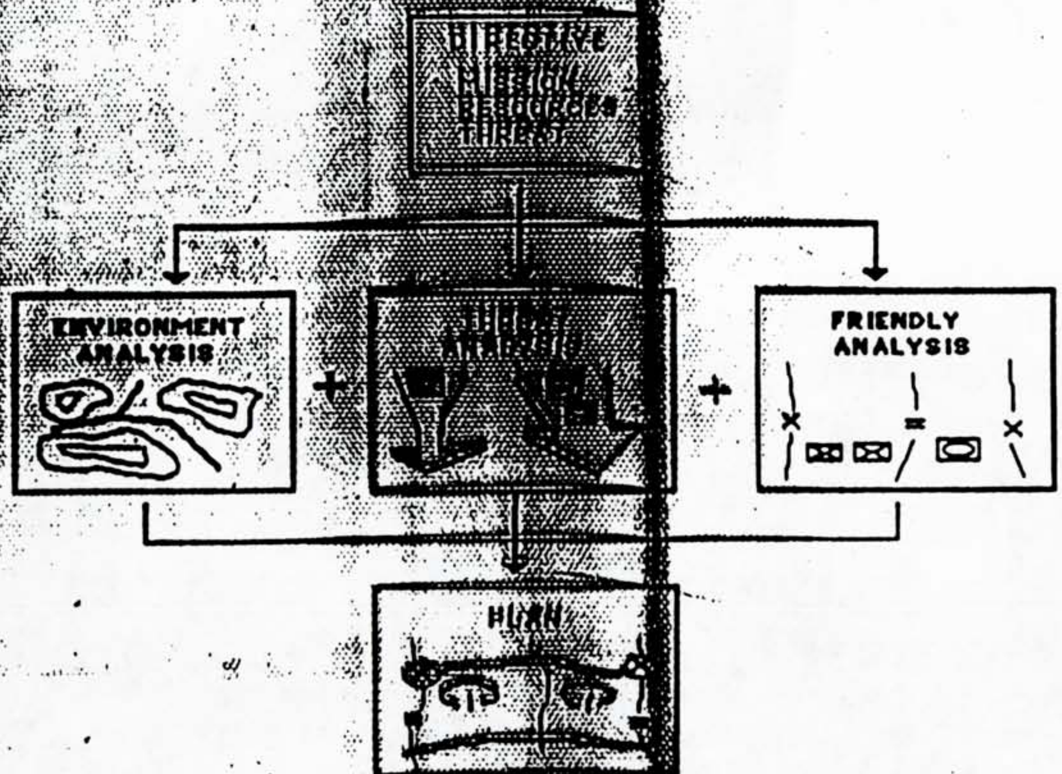
Each organization performs distinctively cognitive and physical activities.



Planning

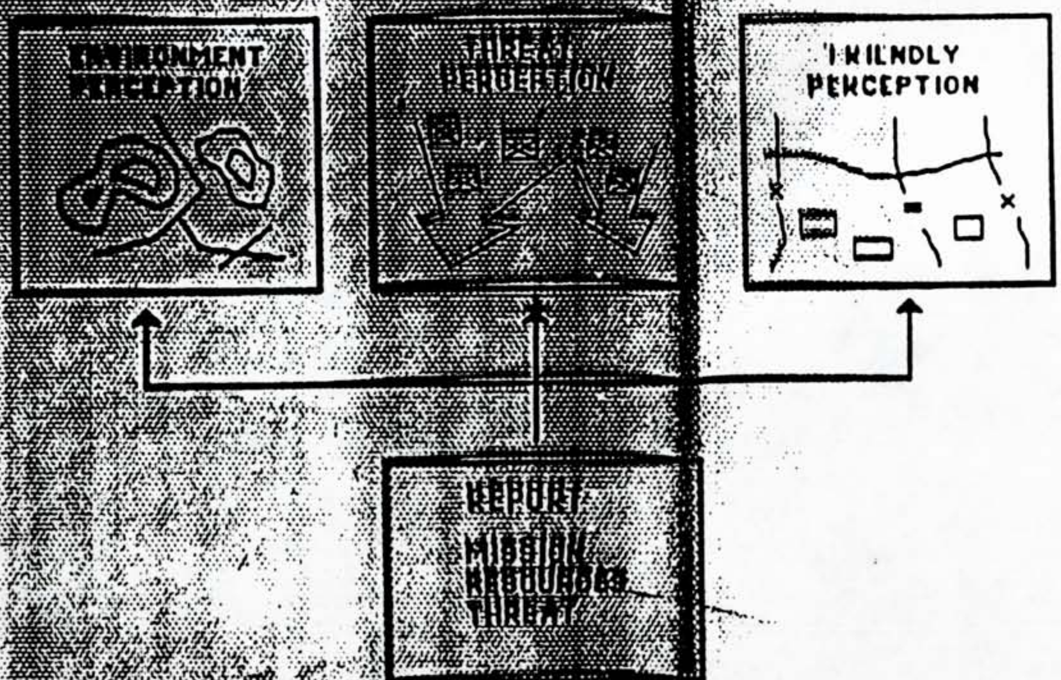
The planning activity creates a plan which meets the requirements of the directive and tasks each subordinate in accordance with its capabilities.

The planning activity follows a METT-T (mission, enemy, troops, terrain, time) methodology appropriate to the function of the planner.

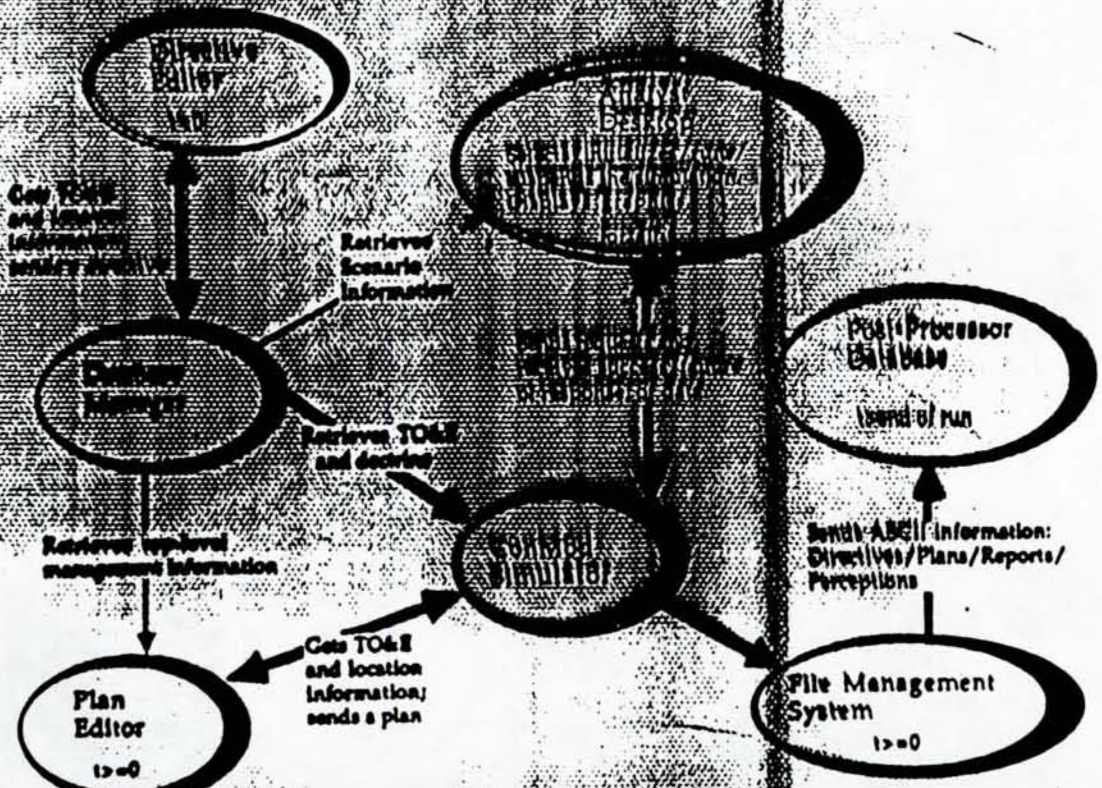


Reporting

The reporting activity consolidates subordinate status reports to maintain current perceptions.



ConMod's Design Allows for Distributed Processing



TRIP REPORT

NAME: E. Smart
DATES: May 1989
LOCATION: Ft. Leavenworth, BDM, Montery CA., Perceptronics, Los Angeles

Several locations were visited during this trip. The trip was taken in support of the PM TRADE IQC. During the trip issues related to simulated forces were pursued with the intent of paving the way for follow up visits by technical people on the simulated forces project.

BDM and Perceptronics are both involved in work related to simulated forces. Invitations for follow-up visits to both locations were received.

A number of contacts related to the simulated forces effort were made at Ft. Leavenworth. Initial discussions were held with Mr. Herb Westmoreland of the Battle Command Training Program Office, Lt. Col. John Strand of the Future Battle Laboratory and Mr. Bernard of the Combined Arms Training Activity (CATA). The Future Battle Laboratory is the primary contact for the seamless simulation issues which we will need to address. At the CATA, which is responsible for battle simulation hardware requirements, a demonstration of a prototype PC-based data logger was viewed. The prototype development was sponsored by Ft. Knox. This low cost alternative data logger appears suited to our needs.

TRIP REPORT

NAME: T. Clarke
DATES: May 10, 1989
LOCATION: SPARTA, Inc., Huntsville Ala.

On May 10 I met travelled to Huntsville to visit SPARTA Inc. SPARTA desires to use transputers on the SIMNET and had contacted DARPA who referred them to PM TRADE who referred them to IST. I decided to visit them under the RISC HiTech grant to investigate, and see whether there might be any possibility of collaboration.

I met with James Watson, head of SPARTA's Advanced Data Processing Laboratory in Huntsville, and was introduced to Bill Fiorentino who manages the Development Engineering Operations. Dave Auld, an Inmos sales engineer, drove over from Atlanta.

Sparta has developed their XP (Xpandable Parallel) coprocessing system under sponsorship of Rome Air Defense Center and NASA. The XP consists of AT bus expansion chassis containing Inmos T800 transputer cards interfaced to an AT host. The demonstrated the XP running an SDI battle simulation using 22 processors and also executing finite element structural analysis (NASTRAN) using 32 processors. The NASTRAN code was ported from FORTRAN to the Occam language used in the XP using a SPARTA developed FORTRAN to Occam translater. Jim Watson said that arrangements could be made for IST to use this translator to translate the NTSC flight simulator benchmark. SPARTA is also a beta site for transputer Ada and would work with us on Ada applications.

SPARTA's desire is to use their transputer expertise together with hardware support from Inmos to develop a transputer based visual system for use on SIMNET/C^2T^2. Dave Auld's back of the envelope calculations indicate that 256 T212 (16 bit) transputers could meet C^2T^2 CIG requirements for less than $100K. They are probably a little late for this round of C^2T^2 but their system would be a very intriguing SIMNET CIG.

Inmos has a university grant program that would pay for the CIG hardware at IST. Jim Watson indicates that he needs about $50K to cover expenses of doing work at IST.

I think we should pursue the IST/SPARTA/Inmos collaboration. I was very impressed with SPARTA's transputer expertise and this is a very good opportunity to learn a lot about this technology rapidly. For a fairly small sum we can leverage a lot of hardware and software expertise. As the attached white paper details, the SPARTA/Inmos technology will also have applications in OpFor as well as the visual area. The SPARTA/Inmos CIG is a RISC simulator application so a few $K from the RISC HiTech would be very appropriate (maybe SPARTA will open an Orlando office.) The remainder could come from some combination of visual and DARPA OpFor funds.

Note that SPARTA is a small business and they are willing to cone to Orlando for discussions.

TRIP REPORT

NAME: M. Companion
DATES: May 18, 1989
LOCATION: CCI (Consultant's Choice Inc.), Roswell GA.

While on personal business in Atlanta, I scheduled a visit to Consultant's Choice Inc. (CCI) in Roswell, GA. This visit was arranged subsequent to discussions with IIM (Integrated Inference Machines) who develop LISP based coprocessors boxes for AT class machines. They indicated that CCI was developing a neural network based battle simulation that ran on their machine. At CCI I met with Paul Lampru, Senior Project Manager responsible for their intelligent systems work.

CCI is a small business that is a spin-off from Georgia Tech Research Institute. Their initial area of endeavor was in the intelligence area and they are still heavily involved in that area. The primary areas that we discussed were in the areas of battle simulation and terrain data bases.

The project that CCI is working on with IIM is the development of a battlefield situation assessment simulation based on nested neural nets. They are heavily involved in systems which integrate both symbolic (rule-based) processes and neural nets. They are one of the few people that we have found to have actual experience in multi-architecture software systems for battle simulation. This expertise is directly applicable to some of our initial concepts for the testbed.

They are also heavily involved in the development of tactical terrain data bases for the Army based on object oriented programming which has direct application to our simulated forces activities.

They identified several potential areas where they might be considered for technical support to the program.

1. Object oriented programming for terrain and transfer into the IIM machine.
2. Providing tactical synthetic terrain data.
3. The development of neural networks, their application and integration with other software simulations.
4. Conversion of programs from sequential to transputer architectures.

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