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Risk Assessment Tools

Frederic C. Gray
Joanne Marshall-Mies
Horizons Technology, Inc.
3990 Ruffin Road
San Diego, CA 92123-1826

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13. ABSTRACT *(Maximum 200 words)*

A number of computer-based risk assessment tools were enhanced or created to provide increased access to risk assessment instruments and information. Primary tools include the Performance Information Management System (PIMS), Human Response Program database, and the Synthetic Task Authoring System (SYNTAS). Access was also provided to the Taxonomic Workstation (TWS) and Blueprint of the Battlefield. Specific risk assessment and performance degradation data was collected, analyzed, published in a series of reports, and integrated into the PIMS.

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SUMMARY

Risk assessment has traditionally been accomplished through a variety of means. Analysis of military tasks, environments, and requirements has provided insight into the cognitive components of work and has allowed the creation of models. Models, particularly sequential network models, have then been used to simulate the work tasks under varying conditions and performance levels to make estimates of the military effect of degradation of task components. Observation of soldiers in the field, coupled with administration of questionnaires, has provided estimates of the potential degradation of performance for a variety of factors, such as pain, overheating, and nausea commonly associated by battlefield weapons of mass destruction. Measurement of performance using standardized controlled tests have provided quantitative data to back up these estimates and has provided verification of the risk estimates. These tests, traditionally assembled into more generic performance assessment batteries, have progressed in recent years to computer-based simulations of work-related tasks.

This report describes efforts conducted under the Risk Assessment Tools contract design and develop a new tool, called the Synthetic Task Authoring System, for creating synthetic tasks or part-task simulators. It also describes efforts to improve, automate, correlate, and provide better access to a variety of tools.

The Risk Assessment Tools contract not only continued the important work done by DNA's Intermediate Dose Program but produced an extensible authoring tool, SYNTAS, for test instruments that will simplify the data gathering phase of subsequent work.

SYNTAS gives DNA:

- A practical way to estimate soldier performance decrements due to nuclear, chemical, biological, or conventional stresses
- An extensible platform for developing models, gaming scenarios, training systems, and assessment instruments with human performance included
- An exportable product to other agencies and services for similar uses.

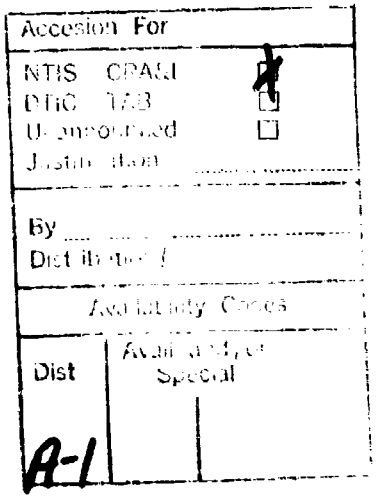
SYNTAS has been shown to be capable of producing quite complex part-task simulators. However, to date no organization has used SYNTAS for actual construction of research instruments. This is partially due to the very closed development and review community.

We recommend that efforts be made to promote SYNTAS outside the immediate development community and encourage its practical use.

The initial implementation of SYNTAS centers on two-dimensional simulations on a computer screen. This is adequate for a large range of tasks but stops short of SYNTAS' potential.

Logical extensions to SYNTAS can provide:

- **A means of modeling crew and team performance using multiple interconnected SYNTAS applications**
- **Increased fidelity through incorporation of video, high-quality sound, and techniques from virtual reality**
- **Through a linkage to Micro SAINT, authoring of SYNTAS applications based on Micro SAINT model, generation of performance data through the use of those applications, and feeding the results back into the Micro SAINT model for further refinement.**



PREFACE

This report provides a summary and overview of the Risk Assessment Tools contract. The contract, which ran from July 1990 to March 1994, contained a variety of efforts by individuals in four corporations: Horizons Technology, Inc.; NTI, Inc.; Pacific Sierra Research Corporation, and Georgetown University. Detail on the individual efforts is kept minimal here, and may be found in the many reports and manuals generated during the contract's progress.

The authors would especially like to acknowledge the contributions of Ms. Carol Oles and Mr. Mark Gianturco of Horizons Technology, Dr. Samuel (Major) Moise and Mr. Joe Campbell of NTI, Mr. George Anno and Dr. Gene McClellan of Pacific Sierra Research, and Dr. Gary Kay of Georgetown University.

In particular, HTI appreciates the support and guidance provided to the contract team by Dr. Fred Hegge of the Office of Military Performance Assessment Technology, U. S. Army Medical Research and Development Command, and Mr. Rob Kehlet of the Radiation and Policy Division, Defense Nuclear Agency.

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Conversion factors for U.S. Customary to metric (SI) units of measurement.

MULTIPLY → TO GET	BY	← TO GET DIVIDE
angstrom	1.000 000 X E-10	meters (m)
atmosphere (normal)	1.013 25 X E +2	kilo pascal (kPa)
bar	1.000 000 X E +2	kilo pascal (kPa)
barn	1.000 000 X E -28	meter^2 (m^2)
British thermal unit (thermochemical)	1.054 350 x E+3	joule (J)
calorie (thermochemical)	4.184 000	joule (J)
cal (thermochemical)/cm^2	4.184 000 X E -2	mega joule/m^2 (MJ/m^2)
curie	3.700 000 x E+1	*giga becquerel (GBq)
degree (angle)	1.745 329 x E-2	radian (rad)
degree Fahrenheit	$t_K = (t°f + 459.67)/1.8$	degree kelvin (K)
electron volt	1.602 19 X E -19	joule (J)
erg	1.000 000 X E -7	joule (J)
erg/second	1.000 000 X E -7	watt (W)
foot	3.048 000 X E -1	meter (m)
foot-pound-force	1.355 818	joule (J)
gallon (U.S. liquid)	3.785 412 X E -3	meter^3 (m^3)
inch	2.540 000 X E -2	meter (m)
jerk	1.000 000 X E +9	joule (J)
joule/kilogram (J/kg) radiation dose absorbed	1.000 000	Gray (Gy)
kilotons	4.183	terajoules
kip (1000 lbf)	4.448 222 X E +3	newton (N)
kip/inch^2 (ksi)	6.894 757 X E +3	kilo pascal (kPa)
ktap	1.000 000 X E +2	newton-second/m^2 (N-s/m^2)
micron	1.000 000 X E -6	meter (m)
mil	2.540 000 X E -5	meter (m)
mile (international)	1.609 344 X E +3	meter (m)
ounce	2.834 952 X E -2	kilogram (kg)
pound-force (lbs avoirdupois)	4.448 222	newton (N)
pound-force inch	1.129 848 X E -1	newton-meter (N·m)
pound-force/inch	1.751 268 X E +2	newton/meter (N/m)
pound-force/foot^2	4.788 026 X E -2	kilo pascal (kPa)
pound-force/inch^2 (psi)	6.894 757	kilo pascal (kPa)
pound-mass (lbm avoirdupois)	4.535 924 X E -1	kilogram (kg)
pound-mass-foot^2 (moment of inertia)	4.214 011 X E -2	kilogram -meter^2 (kg·m2)
pound-mass/foot^3	1.601 846 X E +1	kilogram/meter^3 (kg/m^3)
rad (radiation dose absorbed)	1.000 000 X E -2	**Gray (Gy)
roentgen	2.579 760 X E -4	coulomb/kilogram (C/kg)
shake	1.000 000 X E -8	second (s)
slug	1.459 390 X E +1	kilogram (kg)
torr (mm Hg, 0° C	1.333 22 X E -1	kilo pascal (kPa)

* The becquerel (Bq) is the SI unit of radioactivity; 1 Bq = 1 event/s.

** The Gray (GY) is the SI unit of absorbed radiation.

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SECTION 1

INTRODUCTION

This is the Final Report for Contract No. DNA001-90-C-0118, Risk Assessment Tools. This document describes:

- overall contract objectives and contract tasks;
- the steps designed to accomplish these objectives; and
- accomplishments through 31 March, 1994

1.1 CONTRACT BACKGROUND AND CONTEXT.

The Risk Assessment Tools contract was awarded to a team headed by Horizons Technology, Inc. (HTI) by the Defense Nuclear Agency (DNA) on 19 July 1990 for a period of 39 months. It was subsequently extended to 31 March, 1994.

Funding for the contract was provided jointly by the DNA and the U.S. Army Medical Research and Development Command (USAMRDC) Office of Military performance Assessment Technology (OMPAT). HTI and its subcontractors {Georgetown University (GTU); NTI, Inc. (NTI); and Pacific Sierra Research Corporation (PSR)} were responsible for carrying out research and development activities to meet contract requirements.

The Risk Assessment Tools contract was conducted within the framework of previous work done in the area of medical defense against chemical weapons by OMPAT, a USAMRDC activity, and in the area of human response within nuclear environments by the Radiation and Policy Division (RARP) of the DNA. Figure 1-1 presents an overview of the OMPAT risk assessment tools development program.

The OMPAT program's goal is to support military users with historical data and reports including estimates of human performance decrements. This information is derived from a number of research activities including:

- analysis of military work/tasks, conditions, and requirements;
- measurement of performance using standardized controlled tests;
- estimates of risk to military system performance;
- development of performance norms and standards;
- verification of system performance risk estimates using field exercises, simulations, and computer models; and
- archiving research reports, test results, and bibliographies.

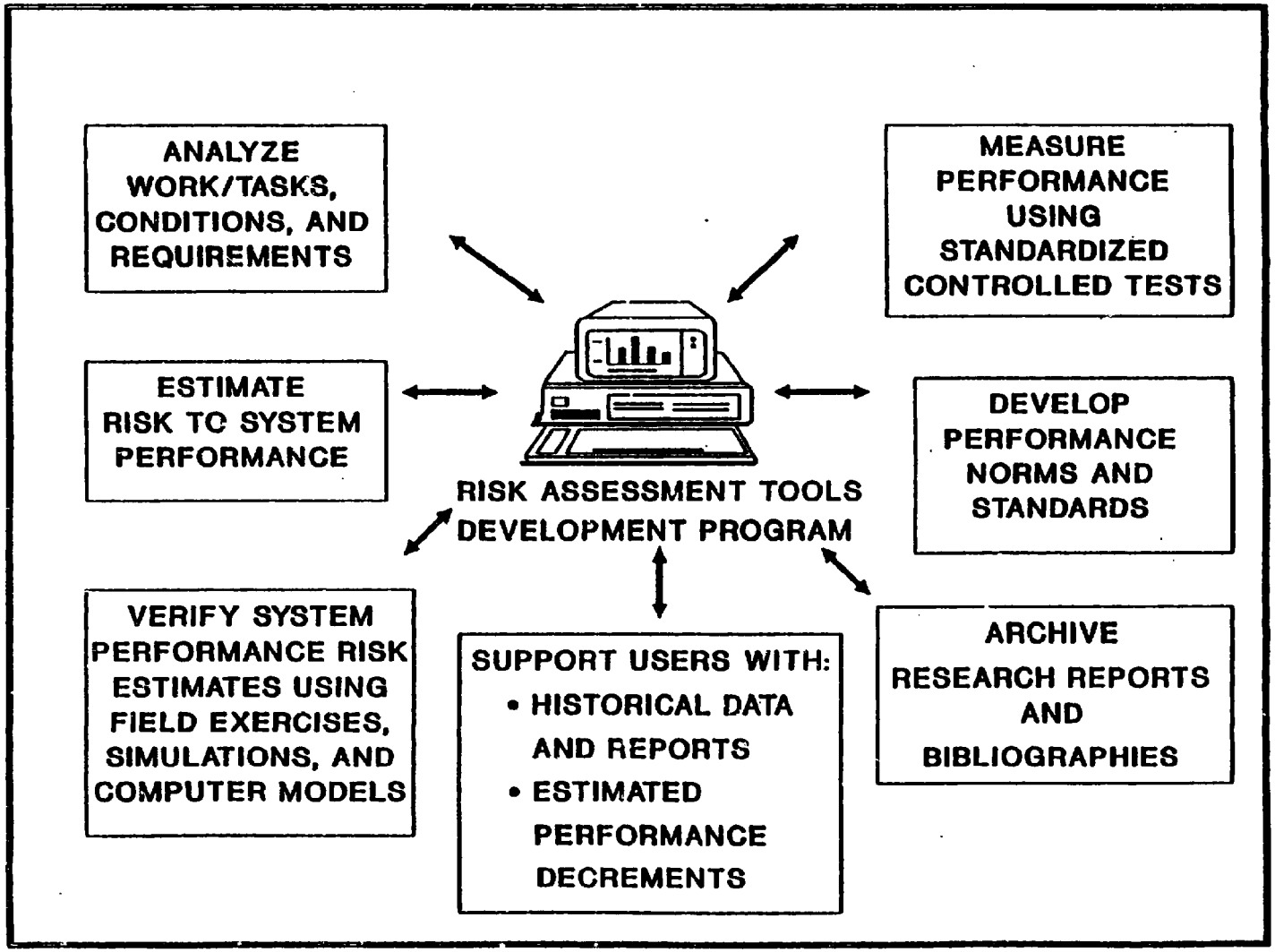

Figure 1-1. Program overview.

1.2 CONTRACT OBJECTIVES AND TASKS.

There were two major objectives for the Risk Assessment Tools contract:

(1) to consolidate efforts by the USAMRDC and the DNA to assess risks to personnel in nuclear, biological, and chemical (NBC) environments; and

(2) to place resulting products in the hands of decision makers responsible for operational issues on the integrated battlefield.

To accomplish these major contract objectives, HTI and its subcontractors performed the following technical tasks:

Task #1. Incorporate Human Response Performance (HRP) data into the OMPAT Performance Information Management System (PIMS);

Task #2. Expand the structured risk assessment database, i.e., the Taxonomic Work Station;

Task #3. Develop a Synthetic Task Authoring System (SYNTAS) to create part-task simulators;

Task #4. Identify and exercise models as a "test bed" for risk assessment tools;

Task #5. Integrate PC-based risk assessment tools; and

Task #6. Conduct conferences and user workshops.

1.3 SCHEDULING OF TASKS.

During FY90/91, the focus was on incorporating HRP data into the PIMS (Task #1), evaluating the Taxonomic Workstation software (Task #2), designing a tool to create part-task simulators (Task #3), and identifying and exercising models as a test bed for the risk assessment tools (Task #4). During FY92, the focus shifted to collecting human response data for incorporation into the PIMS (Task #1), developing a tool to create part-task simulators (Task #3), and initiating steps to integrate the PC-based risk assessment tools (Task #5). In the final year of the contract -- FY92/93, the focus was on incorporating the HRP data into the PIMS (Task #1), completing the tool for creating part-task simulators (Task #3), and integrating the tools (Task #5). Task #6, conducting conferences and user workshops, was a major emphasis in FY92 and continued in FY93 as products were delivered.

The progressive design of the Synthetic Task Authoring System had a major impact on the focus of the entire project. On initiation of the contract the intent of Task #3 was to revise and upgrade the software environment of the Unified Tri-service Cognitive Performance Assessment Battery (UTC-PAB), developed under a preceding contract. At the contract kick-off meeting in September 1990, the NTI representative, Dr. Moise, suggested an alternative approach, that of developing an extendible, modular, object-oriented authoring tool capable of producing software modules providing the functionality of the UTC-PAB. This approach was subsequently approved by OMPAT and DNA and adopted by the team.

The authoring tool, subsequently named the Synthetic Task Authoring System (SYNTAS) grew in scope as its design progressed and its potential was realized. Ultimately it became a computer-assisted software engineering (CASE) tool capable of producing a wide variety of assessment instruments. In addition, its increasing capabilities covered several of the components of other tasks in the contract. Therefore the increased scope of Task #3 was balanced by scaling back the scope of several of the other tasks, specifically Tasks #2 and #5.

1.4 ORGANIZATION OF THE REPORT.

This report contains six major sections, one for each of the six technical tasks identified. Within each task section, the most relevant tasks from the statement of work (SOW) are listed.

The reader should note that the six tasks in the revised structure are not numbered or presented in the same order as the SOW tasks; nonetheless, all eight SOW tasks are included in this plan under at least one of the six revised tasks. (For ease of creating an audit trail back to the SOW, the referenced SOW tasks continue to be numbered as they were in the SOW.)

Within each task section, the following information is provided:

- Relevant SOW Tasks: listing tasks from the original SOW that are covered by the task;
- Specific Objective(s): a statement of specific objectives related to the task;
- Steps to Accomplish Objectives: activities and steps used to accomplish the SOW objectives;
- Discussion and Task Evaluation: a brief chronology of the task evolution and related issues;
- Deliverables: a listing of research products and supporting documents delivered;
- Responsible Contractors: those contractors carrying out activities to meet task objectives.

SECTION 2

TASK #1 INCORPORATE HRP DATA INTO THE PIMS DATABASE

2.1 RELEVANT SOW TASKS.

The following tasks in the SOW were addressed by Task #1.

SOW Task 1. Collect data and develop performance norms

SOW Task 6. Develop and support the PIMS.

2.2 SPECIFIC OBJECTIVES.

The objectives of Task #1 were to collect and incorporate appropriate Human Response Program (HRP) documents and data into the PIMS database, and to design a tailored hierarchical structure for accessing and retrieving the PIMS HRP data.

2.3 STEPS TO ACCOMPLISH OBJECTIVES.

Step 1. HTI representatives met with OMPAT and DNA program managers to discuss and outline the structure of the PIMS. This overall structure is illustrated in Figure 2-1. The focus of Task #1 was on the PIMS text and associated numeric database information which includes ASCII input from books, reports, and bibliographies.

Step 2. Identify and catalogue HRP-related documents and data.

a. Catalogue HRP-related documents in the DNA library.

b. Identify and catalogue other HRP-related documents and data including:

- DNA contractor references/data
- DASAIC databases
- Other relevant databases

Step 3. Produce bibliography and database of HRP-related documents.

a. Compile initial draft bibliography and database of documents from DNA library.

b. Integrate other references into bibliography and database.

c. Establish an ongoing tracking system via NERAC to identify new HRP-related documents as they become available.

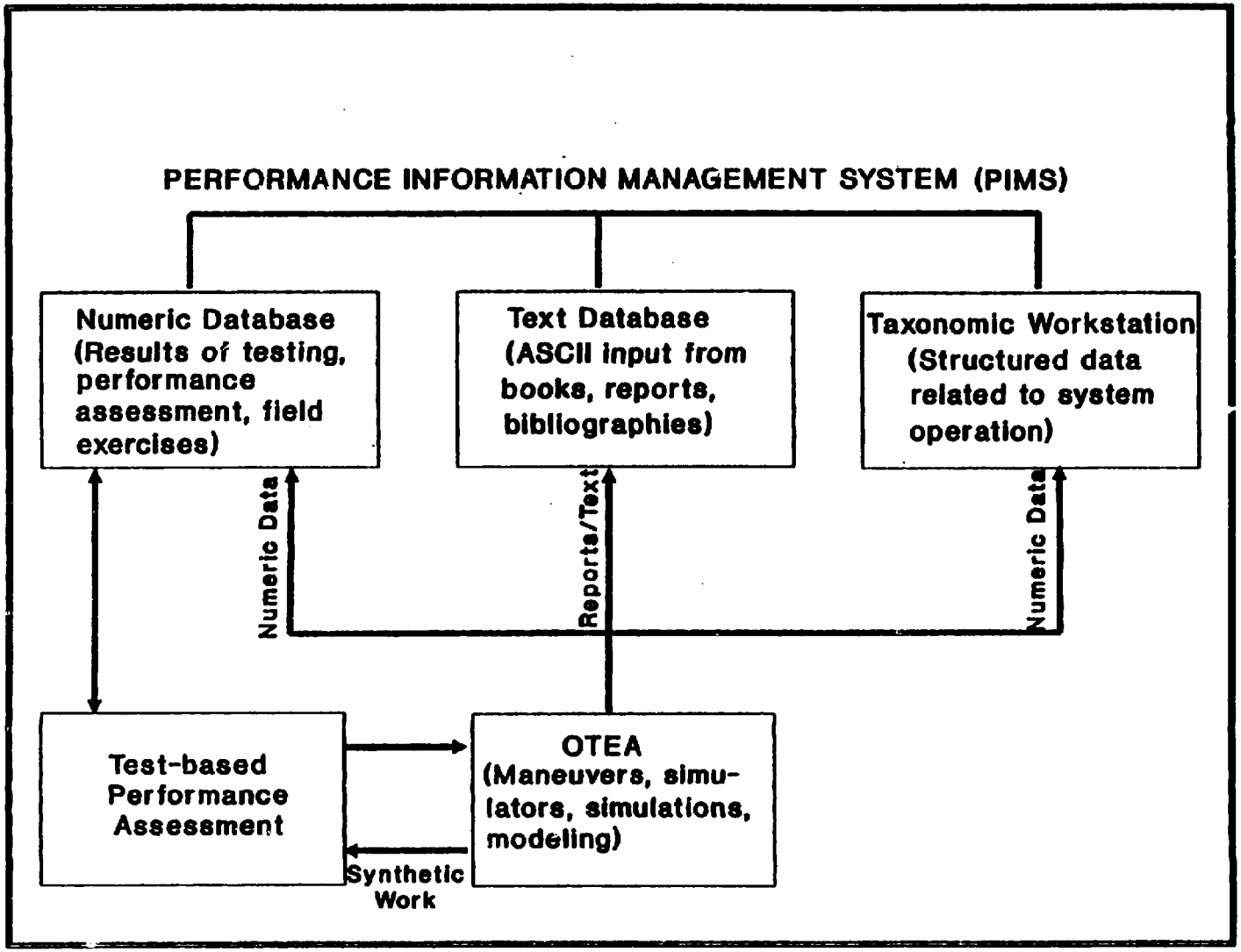

Figure 2-1. Overview of the performance information management system (PIMS) structure.

Step 4. Prioritize HRP documents for entry into the PIMS database including:

- DNA library documents
- Other contractor reports
- DASAIC references
- Other database references

Step 5 Scan selected HRP documents and incorporate them into the PIMS.

Step 6. Collect and evaluate HRP-related chemical and radiation data during the Close Combat Light (CCL) exercises at Fort Hunter-Liggett, California.

a. Design, pilot test, and revise questionnaires for collecting HRP-related chemical and radiation data.

b. Administer questionnaires to 11BRAVO and 13BRAVO subject matter experts.

c. Perform analyses of questionnaire data and determine coefficients for performance prediction algorithms.

d. Produce technical report, software data base, and computational algorithms for predictions of expected combat performance levels if exposed to degrading effects of nuclear radiation or chemical agents.

e. Integrate technical report, data base, and computational algorithms into PIMS.

Step 7 Organize the data in the PIMS database to include HRP data from DNA in addition to that provided by OMPAT.

Step 8. [Added during the contract] Collect and evaluate HRP-related crew time and motion data on M198 howitzer crews in MOPP4 during Marine Corps exercises at Aberdeen Proving Ground, Maryland.

2.4 DISCUSSION AND TASK EVOLUTION.

At initiation of the contract, a prototype PIMS was in operation at OMPAT. It utilized the document management product "Textware" and contained a substantial amount of information on Chemical Risk Assessment. Initial focus was to extend this system to include information from the nuclear risk assessment arena.

At first, HTI planned to capture selected data from DNA, scan it into the computer, perform optical character recognition on the resultant image, then organize the information and incorporate it into Textware.

In preparation for this effort, HTI conducted an analysis of hardware and software available for the task and recommended that DNA-RARP procure hardware (an IBM PC-compatible, 386-based PC; a Fujitsu scanner, a laser printer, an optical disk subsystem) and software (Textware with Images, OmniPage OCR software) to support data capture and integration.

Early in 1991, OMPAT determined that the Textware system was not adequate to use as the basis for the PIMS, and began converting the OMPAT PIMS to another product called HYPLUS.

Lengthy delays were experienced in the delivery of DNA's scanning hardware and software, and, once delivered, the scanning hardware and software presented a number of problems. While awaiting resolution of these problems, HTI developed tentative protocols for scanning, converting, and correcting documents. In addition, HTI conducted a comprehensive audit of material in the DNA HRP library, designed and implemented a database, and produced a complete on-line bibliography of materials.

Plans to use a DNA summer hire to scan/clean-up HRP documents were cancelled due to problems with the scanner. Instead, HTI began scanning several key HRP documents for inclusion into PIMS. In 1993, DNA awarded a new DASIAC contract which included the requirement to scan and archive portions of the DASIAC collection, which included many of the key documents in the HRP. In order to avoid duplication of effort and avoid incompatible systems, no further work scanning and archiving was done under the Risk Assessment Tools contract, with the understanding that key HRP documents would be scanned and archived at DASIAC and made available to RARP.

Two unforeseen opportunities arose for DNA/OMPAT to collect HRP-related, one at the CCL exercises at Fort Hunter-Liggett in California and another at Aberdeen Proving Ground, Maryland. These data would augment the DNA/IDP performance data for motorized Army combat personnel previously identified for incorporation into the PIMS database. In order to take advantage of these opportunities, Steps #5 and #6 (outlined above) were added to the Task #1 plan and several new products were added to the delivery schedule. The costs for these efforts were shared among several contracts managed by RARP.

Given these events, the scheduling and prioritization of Task #1 activities was revised. This resulted in a change of focus from scanning and database organization to the collection of valuable HRP-related data at Fort Hunter-Liggett and Aberdeen Proving Ground.

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Frederic C. Gray and Joanne Marshall-Mies

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Horizons Technology, Inc.
3990 Ruffin Road
San Diego, CA 92123-1826

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13. ABSTRACT *(Maximum 200 words)*

A number of computer-based risk assessment tools were enhanced or created to provide increased access to risk assessment instruments and information. Primary tools include the Performance Information Management System (PIMS), Human Response Program database, and the Synthetic Task Authoring System (SYNTAS). Access was also provided to the Taxonomic Workstation (TWS) and Blueprint of the Battlefield. Specific risk assessment and performance degradation data was collected, analyzed, published in a series of reports, and integrated into the PIMS.

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SUMMARY

Risk assessment has traditionally been accomplished through a variety of means. Analysis of military tasks, environments, and requirements has provided insight into the cognitive components of work and has allowed the creation of models. Models, particularly sequential network models, have then been used to simulate the work tasks under varying conditions and performance levels to make estimates of the military effect of degradation of task components. Observation of soldiers in the field, coupled with administration of questionnaires, has provided estimates of the potential degradation of performance for a variety of factors, such as pain, overheating, and nausea commonly associated by battlefield weapons of mass destruction. Measurement of performance using standardized controlled tests have provided quantitative data to back up these estimates and has provided verification of the risk estimates. These tests, traditionally assembled into more generic performance assessment batteries, have progressed in recent years to computer-based simulations of work-related tasks.

This report describes efforts conducted under the Risk Assessment Tools contract design and develop a new tool, called the Synthetic Task Authoring System, for creating synthetic tasks or part-task simulators. It also describes efforts to improve, automate, correlate, and provide better access to a variety of tools.

The Risk Assessment Tools contract not only continued the important work done by DNA's Intermediate Dose Program but produced an extensible authoring tool, SYNTAS, for test instruments that will simplify the data gathering phase of subsequent work.

SYNTAS gives DNA:

- A practical way to estimate soldier performance decrements due to nuclear, chemical, biological, or conventional stresses
- An extensible platform for developing models, gaming scenarios, training systems, and assessment instruments with human performance included
- An exportable product to other agencies and services for similar uses.

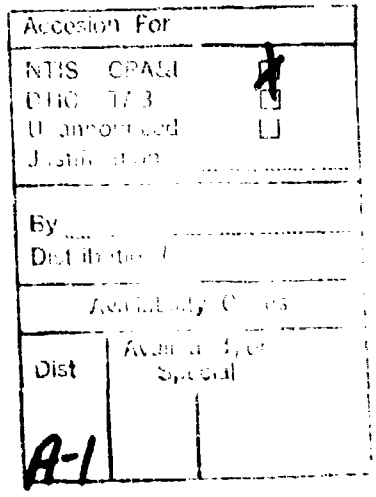
SYNTAS has been shown to be capable of producing quite complex part-task simulators. However, to date no organization has used SYNTAS for actual construction of research instruments. This is partially due to the very closed development and review community.

We recommend that efforts be made to promote SYNTAS outside the immediate development community and encourage its practical use.

The initial implementation of SYNTAS centers on two-dimensional simulations on a computer screen. This is adequate for a large range of tasks but stops short of SYNTAS' potential.

Logical extensions to SYNTAS can provide:

- A means of modeling crew and team performance using multiple interconnected SYNTAS applications
- Increased fidelity through incorporation of video, high-quality sound, and techniques from virtual reality
- Through a linkage to Micro SAINT, authoring of SYNTAS applications based on Micro SAINT model, generation of performance data through the use of those applications, and feeding the results back into the Micro SAINT model for further refinement.



PREFACE

This report provides a summary and overview of the Risk Assessment Tools contract. The contract, which ran from July 1990 to March 1994, contained a variety of efforts by individuals in four corporations: Horizons Technology, Inc.; NTI, Inc.; Pacific Sierra Research Corporation, and Georgetown University. Detail on the individual efforts is kept minimal here, and may be found in the many reports and manuals generated during the contract's progress.

The authors would especially like to acknowledge the contributions of Ms. Carol Oles and Mr. Mark Gianturco of Horizons Technology, Dr. Samuel (Major) Moise and Mr. Joe Campbell of NTI, Mr. George Anno and Dr. Gene McClellan of Pacific Sierra Research, and Dr. Gary Kay of Georgetown University.

In particular, HTI appreciates the support and guidance provided to the contract team by Dr. Fred Hegge of the Office of Military Performance Assessment Technology, U. S. Army Medical Research and Development Command, and Mr. Rob Kehlet of the Radiation and Policy Division, Defense Nuclear Agency.

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CONVERSION TABLE

Conversion factors for U.S. Customary to metric (SI) units of measurement.

MULTIPLY → TO GET	BY	← DIVIDE
angstrom	1.000 000 X E-10	meters (m)
atmosphere (normal)	1.013 25 X E +2	kilo pascal (kPa)
bar	1.000 000 X E +2	kilo pascal (kPa)
barn	1.000 000 X E -28	meter^2 (m^2)
British thermal unit (thermochemical)	1.054 350 x E+3	joule (J)
calorie (thermochemical)	4.184 000	joule (J)
cal (thermochemical)/cm^2	4.184 000 X E -2	mega joule/m^2 (MJ/m^2)
curie	3.700 000 x E+1	*giga becquerel (GBq)
degree (angle)	1.745 329 x E-2	radian (rad)
degree Fahrenheit	t_k = (t°f + 459.67)/1.8	degree kelvin (K)
electron volt	1.602 19 X E -19	joule (J)
erg	1.000 000 X E -7	joule (J)
erg/second	1.000 000 X E -7	watt (W)
foot	3.048 000 X E -1	meter (m)
foot-pound-force	1.355 818	joule (J)
gallon (U.S. liquid)	3.785 412 X E -3	meter^3 (m^3)
inch	2.540 000 X E -2	meter (m)
jerk	1.000 000 X E +9	joule (J)
joule/kilogram (J/kg) radiation dose absorbed	1.000 000	Gray (Gy)
kilotons	4.183	terajoules
kip (1000 lbf)	4.448 222 X E +3	newton (N)
kip/inch^2 (ksi)	6.894 757 X E +3	kilo pascal (kPa)
ktap	1.000 000 X E +2	newton-second/m^2 (N-s/m^2)
micron	1.000 000 X E -6	meter (m)
mil	2.540 000 X E -5	meter (m)
mile (international)	1.609 344 X E +3	meter (m)
ounce	2.834 952 X E -2	kilogram (kg)
pound-force (lbs avoirdupois)	4.448 222	newton (N)
pound-force inch	1.129 848 X E -1	newton-meter (N·m)
pound-force/inch	1.751 268 X E +2	newton/meter (N/m)
pound-force/foot^2	4.788 026 X E -2	kilo pascal (kPa)
pound-force/inch^2 (psi)	6.894 757	kilo pascal (kPa)
pound-mass (lbm, avoirdupois)	4.535 924 X E -1	kilogram (kg)
pound-mass-foot^2 (moment of inertia)	4.214 011 X E -2	kilogram -meter^2 (kg·m2)
pound-mass/foot^3	1.601 846 X E +1	kilogram/meter^3 (kg/m^3)
rad (radiation dose absorbed)	1.000 000 X E -2	**Gray (Gy)
roentgen	2.579 760 X E -4	coulomb/kilogram (C/kg)
shake	1.000 000 X E -8	second (s)
slug	1.459 390 X E +1	kilogram (kg)
torr (mm Hg, 0° C	1.333 22 X E -1	kilo pascal (kPa)

* The becquerel (Bq) is the SI unit of radioactivity; 1 Bq = 1 event/s.

** The Gray (GY) is the SI unit of absorbed radiation.

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SECTION 1

INTRODUCTION

This is the Final Report for Contract No. DNA001-90-C-0118, Risk Assessment Tools. This document describes:

- overall contract objectives and contract tasks;
- the steps designed to accomplish these objectives; and
- accomplishments through 31 March, 1994

1.1 CONTRACT BACKGROUND AND CONTEXT.

The Risk Assessment Tools contract was awarded to a team headed by Horizons Technology, Inc. (HTI) by the Defense Nuclear Agency (DNA) on 19 July 1990 for a period of 39 months. It was subsequently extended to 31 March, 1994.

Funding for the contract was provided jointly by the DNA and the U.S. Army Medical Research and Development Command (USAMRDC) Office of Military performance Assessment Technology (OMPAT). HTI and its subcontractors {Georgetown University (GTU); NTI, Inc. (NTI); and Pacific Sierra Research Corporation (PSR)} were responsible for carrying out research and development activities to meet contract requirements.

The Risk Assessment Tools contract was conducted within the framework of previous work done in the area of medical defense against chemical weapons by OMPAT, a USAMRDC activity, and in the area of human response within nuclear environments by the Radiation and Policy Division (RARP) of the DNA. Figure 1-1 presents an overview of the OMPAT risk assessment tools development program.

The OMPAT program's goal is to support military users with historical data and reports including estimates of human performance decrements. This information is derived from a number of research activities including:

- analysis of military work/tasks, conditions, and requirements;
- measurement of performance using standardized controlled tests;
- estimates of risk to military system performance;
- development of performance norms and standards;
- verification of system performance risk estimates using field exercises, simulations, and computer models; and
- archiving research reports, test results, and bibliographies.

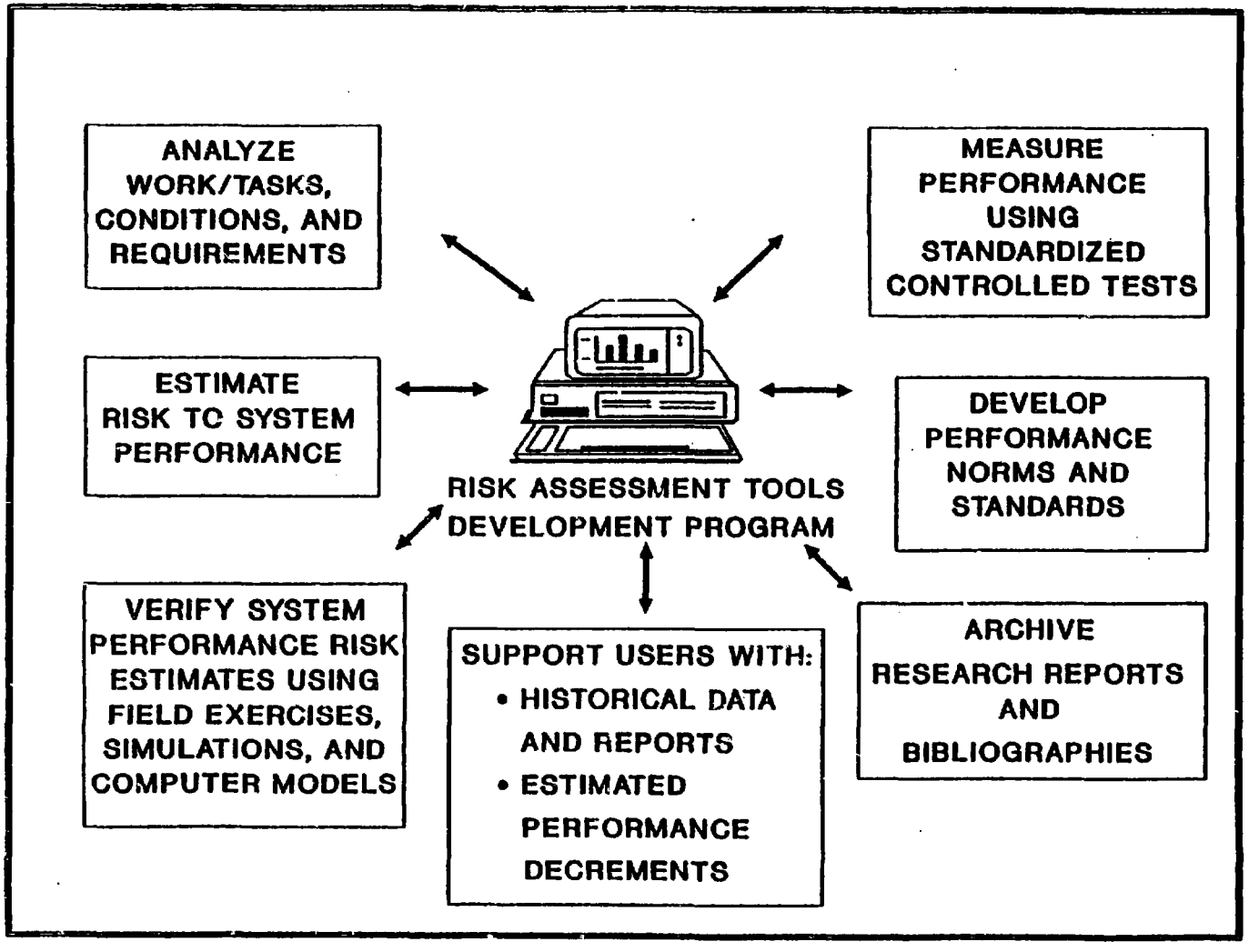

Figure 1-1. Program overview.

1.2 CONTRACT OBJECTIVES AND TASKS.

There were two major objectives for the Risk Assessment Tools contract:

(1) to consolidate efforts by the USAMRDC and the DNA to assess risks to personnel in nuclear, biological, and chemical (NBC) environments; and

(2) to place resulting products in the hands of decision makers responsible for operational issues on the integrated battlefield.

To accomplish these major contract objectives, HTI and its subcontractors performed the following technical tasks:

Task #1. Incorporate Human Response Performance (HRP) data into the OMPAT Performance Information Management System (PIMS);

Task #2. Expand the structured risk assessment database, i.e., the Taxonomic Work Station;

Task #3. Develop a Synthetic Task Authoring System (SYNTAS) to create part-task simulators;

Task #4. Identify and exercise models as a "test bed" for risk assessment tools;

Task #5. Integrate PC-based risk assessment tools; and

Task #6. Conduct conferences and user workshops.

1.3 SCHEDULING OF TASKS.

During FY90/91, the focus was on incorporating HRP data into the PIMS (Task #1), evaluating the Taxonomic Workstation software (Task #2), designing a tool to create part-task simulators (Task #3), and identifying and exercising models as a test bed for the risk assessment tools (Task #4). During FY92, the focus shifted to collecting human response data for incorporation into the PIMS (Task #1), developing a tool to create part-task simulators (Task #3), and initiating steps to integrate the PC-based risk assessment tools (Task #5). In the final year of the contract -- FY92/93, the focus was on incorporating the HRP data into the PIMS (Task #1), completing the tool for creating part-task simulators (Task #3), and integrating the tools (Task #5). Task #6, conducting conferences and user workshops, was a major emphasis in FY92 and continued in FY93 as products were delivered.

The progressive design of the Synthetic Task Authoring System had a major impact on the focus of the entire project. On initiation of the contract the intent of Task #3 was to revise and upgrade the software environment of the Unified Tri-service Cognitive Performance Assessment Battery (UTC-PAB), developed under a preceding contract. At the contract kick-off meeting in September 1990, the NTI representative, Dr. Moise, suggested an alternative approach, that of developing an extendible, modular, object-oriented authoring tool capable of producing software modules providing the functionality of the UTC-PAB. This approach was subsequently approved by OMPAT and DNA and adopted by the team.

The authoring tool, subsequently named the Synthetic Task Authoring System (SYNTAS) grew in scope as its design progressed and its potential was realized. Ultimately it became a computer-assisted software engineering (CASE) tool capable of producing a wide variety of assessment instruments. In addition, its increasing capabilities covered several of the components of other tasks in the contract. Therefore the increased scope of Task #3 was balanced by scaling back the scope of several of the other tasks, specifically Tasks #2 and #5.

1.4 ORGANIZATION OF THE REPORT.

This report contains six major sections, one for each of the six technical tasks identified. Within each task section, the most relevant tasks from the statement of work (SOW) are listed.

The reader should note that the six tasks in the revised structure are not numbered or presented in the same order as the SOW tasks; nonetheless, all eight SOW tasks are included in this plan under at least one of the six revised tasks. (For ease of creating an audit trail back to the SOW, the referenced SOW tasks continue to be numbered as they were in the SOW.)

Within each task section, the following information is provided:

- Relevant SOW Tasks: listing tasks from the original SOW that are covered by the task;
- Specific Objective(s): a statement of specific objectives related to the task;
- Steps to Accomplish Objectives: activities and steps used to accomplish the SOW objectives;
- Discussion and Task Evaluation: a brief chronology of the task evolution and related issues;
- Deliverables: a listing of research products and supporting documents delivered;
- Responsible Contractors: those contractors carrying out activities to meet task objectives.

SECTION 2

TASK #1 INCORPORATE HRP DATA INTO THE PIMS DATABASE

2.1 RELEVANT SOW TASKS.

The following tasks in the SOW were addressed by Task #1.

SOW Task 1. Collect data and develop performance norms

SOW Task 6. Develop and support the PIMS.

2.2 SPECIFIC OBJECTIVES.

The objectives of Task #1 were to collect and incorporate appropriate Human Response Program (HRP) documents and data into the PIMS database, and to design a tailored hierarchical structure for accessing and retrieving the PIMS HRP data.

2.3 STEPS TO ACCOMPLISH OBJECTIVES.

Step 1. HTI representatives met with OMPAT and DNA program managers to discuss and outline the structure of the PIMS. This overall structure is illustrated in Figure 2-1. The focus of Task #1 was on the PIMS text and associated numeric database information which includes ASCII input from books, reports, and bibliographies.

Step 2. Identify and catalogue HRP-related documents and data.

a. Catalogue HRP-related documents in the DNA library.

b. Identify and catalogue other HRP-related documents and data including:

- DNA contractor references/data
- DASAIC databases
- Other relevant databases

Step 3. Produce bibliography and database of HRP-related documents.

a. Compile initial draft bibliography and database of documents from DNA library.

b. Integrate other references into bibliography and database.

c. Establish an ongoing tracking system via NERAC to identify new HRP-related documents as they become available.

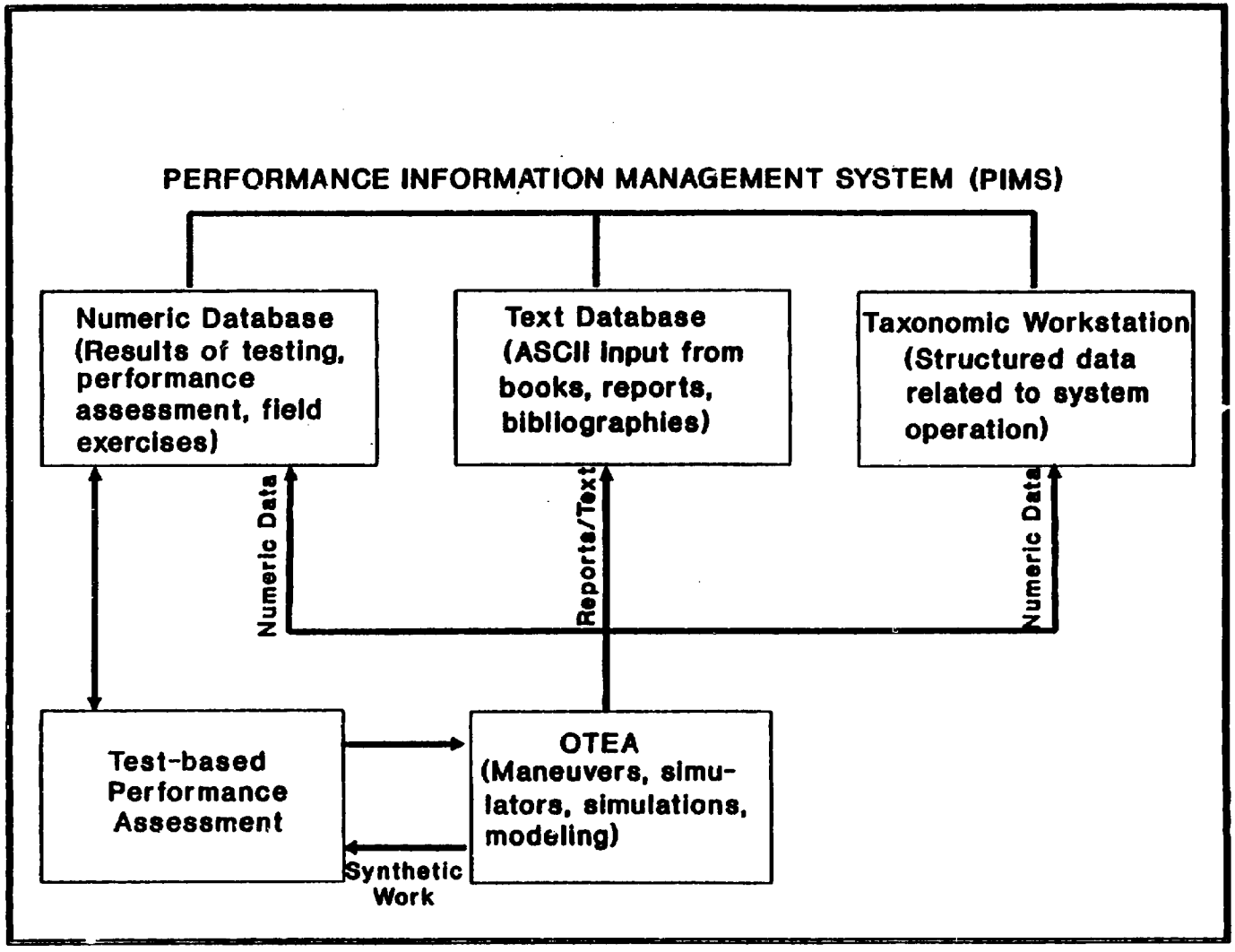

Figure 2-1. Overview of the performance information management system (PIMS) structure.

Step 4. Prioritize HRP documents for entry into the PIMS database including:

- DNA library documents
- Other contractor reports
- DASAIC references
- Other database references

Step 5 Scan selected HRP documents and incorporate them into the PIMS.

Step 6. Collect and evaluate HRP-related chemical and radiation data during the Close Combat Light (CCL) exercises at Fort Hunter-Liggett, California.

a. Design, pilot test, and revise questionnaires for collecting HRP-related chemical and radiation data.

b. Administer questionnaires to 11BRAVO and 13BRAVO subject matter experts.

c. Perform analyses of questionnaire data and determine coefficients for performance prediction algorithms.

d. Produce technical report, software data base, and computational algorithms for predictions of expected combat performance levels if exposed to degrading effects of nuclear radiation or chemical agents.

e. Integrate technical report, data base, and computational algorithms into PIMS.

Step 7 Organize the data in the PIMS database to include HRP data from DNA in addition to that provided by OMPAT.

Step 8. [Added during the contract] Collect and evaluate HRP-related crew time and motion data on M198 howitzer crews in MOPP4 during Marine Corps exercises at Aberdeen Proving Ground, Maryland.

2.4 DISCUSSION AND TASK EVOLUTION.

At initiation of the contract, a prototype PIMS was in operation at OMPAT. It utilized the document management product "Textware" and contained a substantial amount of information on Chemical Risk Assessment. Initial focus was to extend this system to include information from the nuclear risk assessment arena.

At first, HTI planned to capture selected data from DNA, scan it into the computer, perform optical character recognition on the resultant image, then organize the information and incorporate it into Textware.

In preparation for this effort, HTI conducted an analysis of hardware and software available for the task and recommended that DNA-RARP procure hardware (an IBM PC-compatible, 386-based PC; a Fujitsu scanner, a laser printer, an optical disk subsystem) and software (Textware with Images, OmniPage OCR software) to support data capture and integration.

Early in 1991, OMPAT determined that the Textware system was not adequate to use as the basis for the PIMS, and began converting the OMPAT PIMS to another product called HYPLUS.

Lengthy delays were experienced in the delivery of DNA's scanning hardware and software, and, once delivered, the scanning hardware and software presented a number of problems. While awaiting resolution of these problems, HTI developed tentative protocols for scanning, converting, and correcting documents. In addition, HTI conducted a comprehensive audit of material in the DNA HRP library, designed and implemented a database, and produced a complete on-line bibliography of materials.

Plans to use a DNA summer hire to scan/clean-up HRP documents were cancelled due to problems with the scanner. Instead, HTI began scanning several key HRP documents for inclusion into PIMS. In 1993, DNA awarded a new DASIAC contract which included the requirement to scan and archive portions of the DASIAC collection, which included many of the key documents in the HRP. In order to avoid duplication of effort and avoid incompatible systems, no further work scanning and archiving was done under the Risk Assessment Tools contract, with the understanding that key HRP documents would be scanned and archived at DASIAC and made available to RARP.

Two unforeseen opportunities arose for DNA/OMPAT to collect HRP-related, one at the CCL exercises at Fort Hunter-Liggett in California and another at Aberdeen Proving Ground, Maryland. These data would augment the DNA/IDP performance data for motorized Army combat personnel previously identified for incorporation into the PIMS database. In order to take advantage of these opportunities, Steps #5 and #6 (outlined above) were added to the Task #1 plan and several new products were added to the delivery schedule. The costs for these efforts were shared among several contracts managed by RARP.

Given these events, the scheduling and prioritization of Task #1 activities was revised. This resulted in a change of focus from scanning and database organization to the collection of valuable HRP-related data at Fort Hunter-Liggett and Aberdeen Proving Ground.

While the exercises provided an unparalleled opportunity to augment the DNA Intermediate Dose Performance (IDP) database, specific data collection activities were not originally budgeted. Therefore, it was decided that Steps #5 and #7 - scanning documents and organizing the HRP data within the PIMS database - be accomplished outside of the Risk Assessment Tools contract. Such activities were not time-critical and could be carried out by DNA and OMPAT support staff and at DASIAC as time and resources allowed.

2.5 DELIVERABLES.

Documents and products delivered under Task #1 were:

Listing and Prioritization of DNA HRP Documents.

HTI-TR-419-004. February 1991.

IDP performance data representing regression parameter and data fit statistics for individual crew members of the four ground combat crews (files related to DNA-TR-85-52 and DNA-TR-88-173). February 1991. (These data were developed by PSR under previous contracts and provided for use in the PIMS database.)

dBase Software Listing and Categorizing of DNA HRP Documents. HTI-SW-419-001. March 1991.

Example Organization and Structure of Selected DNA HRP Documents Using the PIMS HYPLUS Hypertext Software. March 1991.

NERAC and DASAIC Literature Searches Related to the Effects of Radiation on Human Performance and the Development of Synthetic Work Tasks. March 1991.

Software for PSR PEAB Version 1.0. May 1991. (This software was developed by PSR under a previous DNA contract and provided for review by the Risk Assessment Tools contract staff.)

The AQUAFHL Program Questionnaires and Raw Data. June 1992.

AQUAFHL Task Performance Regression Relationships. September 1992.

AQUAFHL Performance Data (3D Dose X Time). 12 November 1992; updated 22 January 1993.

Task Time Data Collection for M198 Howitzer. November 1993. (Funded under a separate DNA contract to PSR and provided for use in the PIMS database.)

AQUAFHL technical report, software data base, and computational algorithms for predictions of expected combat performance levels under degrading effects of nuclear radiation or chemical agents.

The Effect of MOPP4 on M198 Howitzer Crew Performance, Volume 1 - Emplacement and Displacement Times and Rates of Fire, 1 November 1993.

2.6 RESPONSIBLE CONTRACTORS.

HTI provided management support, PIMS technical support, database design and data collection. PSR designed and administered questionnaires in field settings and generated reports.

SECTION 3

TASK #2 - EXPAND THE STRUCTURED RISK ASSESSMENT DATABASE

3.1 RELEVANT SOW TASKS.

SOW Task 2. Increase risk identification capabilities

3.2 SPECIFIC OBJECTIVE.

The objective of Task #2 was to extend the existing Taxonomic Work Station (TWS) database to include HRP-related data and updated taxonomies.

3.3 STEPS TO ACCOMPLISH OBJECTIVES.

Step 1. Update existing TWS Version 1.0 taxonomies and data including:

- Blueprint of the Battlefield
- Human Factors Parameters
- Conditions Taxonomy
- Mission/Task Inventory

Step 2. Input SAIC HRP database into the TWS Version 1.0.

Step 3. Exercise the existing TWS software to gain familiarity and to evaluate its status.

- Determine for which versions of Advanced Revelation the existing TWS will and will not work.
- Determine the level of effort required to upgrade the revised TWS Version 1.0 to the U.S. Army Research Institute (ARI) TWS Version 1.1 and to future TWS Versions 2.0 or higher.

3.4 DISCUSSION AND TASK EVOLUTION.

The TWS effort was originally scheduled to start in late FY91 and continue throughout FY92; instead, Task #2 efforts were postponed. This revised plan allowed HTI and its subcontractors to function within budget constraints, to accommodate delays in receiving the Advanced Revelation software, and to respond to other project task priorities.

Since the current TWS software runs under Advanced Revelation Version 1.0, a decision was made at the IPR #2 to initially update existing TWS taxonomies and to input the SAIC HRP database (Steps 1 and 2) using TWS Version 1.0.

Prior to the present contract award, ARI began to revise the TWS to upgrade it to Version 1.1 using Advanced Revelation Version 1.1. Because of this change in existing software, ARI had already addressed the concerns of Task #2, Steps 1 - 3. ARI also had recently developed an automated Blueprint of the Battlefield (updated AUTOBOB or BOBCAT, Version 2.0) which was released during FY92. Both of these actions affected the Risk Assessment Tools contract priorities by eliminating the need to implement the various taxonomies into the TWS. Because of the availability of the revised Version 1.1 TWS and the Version 2.0 BOBCAT for use by DNA, OMPAT and other government clients, it was agreed at IPR #3 that Task #2 activities be dropped from the Risk Assessment Tools contract. Such a decision would prevent duplication of effort across government agencies and provide additional funds for higher priority contract activities.

In place of the revised TWS, HTI agreed to acquire and deliver to DNA and OMPAT copies of TWS version 1.1 and the updated Automated Blueprint of the Battlefield.

3.5 DELIVERABLES.

Products and supporting documents delivered under Task #2 included

Taxonomic Work Station Version 1.1, March 1993 (Provided by the Army Research Institute)

Blueprint of the Battlefield, Version 2.0 (Provided by the Army Research Institute)

3.6 RESPONSIBLE CONTRACTORS.

This task was accomplished by HTI, with most input from outside the contract by ARI.

SECTION 4

TASK #3 - DEVELOP A TOOL TO CREATE PART-SIMULATORS

4.1 RELEVANT SOW TASKS.

SOW Task 5. Revise UTC-PAB software to include creation of utilities and enhancements.

4.2 SPECIFIC OBJECTIVES.

The objective of Task #3 was to design and develop a software system (referred to as the Synthetic Task Authoring System or SYNTAS) that can:

- create, develop, and implement part-task simulators and synthetic work tasks for measuring human performance on military tasks;
- reflect sequential network modeling concepts and the nodal structure and interrelationships of military tasks; and
- be capable, modular, extensible, and maintainable.

4.3 STEPS TO ACCOMPLISH OBJECTIVES.

Step 1. Develop proposal for updating the UTC-PAB to meet the objectives stated above.

Step 2. Develop SYNTAS functional specifications and demonstration user interface. This included functional design of the software, evaluation of software tools, hardware and software requirements, cost estimates, and a proposed development schedule.

Step 3. Develop SYNTAS system specification and concept demonstration to provide a detailed definition of SYNTAS functionality and an illustration of how a synthetic task can be implemented. This would serve as a basis for system testing and acceptance.

Step 4. Develop SYNTAS software specifications.

Step 5. Program, test and document SYNTAS software according to software specifications.

a. Develop draft SYNTAS user interface and designer's guide.

b. Define criterion test.

c. Develop and test SYNTAS Alpha Version 1.

- Alpha Authoring System software and designer's guide.
- Alpha Real-Time System software and User's Guide.
- Alpha Integrated Authoring and Runtime System software and designer's guide.
- Alpha Integrated Authoring, Runtime, and Real-Time System software and Designer's Guide.
- Interact with and respond to inquiries/feedback from the Alpha Test Group, releasing periodic updates to the software and documentation.

d. Develop and test SYNTAS Beta Version 1

- Integrated SYNTAS Authoring and Runtime System software and designer's guide.
- Integrated SYNTAS Authoring, Runtime, and Real-Time System software and designer's guide.
- Interact with and respond to inquiries/feedback from the Beta Test Group, releasing periodic updates to the software and documentation.

f. Develop final SYNTAS Version 1 software, technical software documentation, and user guide.

4.4 DISCUSSION AND TASK EVOLUTION.

Initially, this task centered on updating and revising the existing UTC-PAB software. At the initial project planning meeting held at HTI in September 1990, NTI recommended changing this task to produce an authoring system capable of creating the components of the UTC-PAB while addressing a number of compatibility and performance issues. This approach was subsequently approved by DNA and OMPAT.

During the first year of the contract, NTI conducted a detailed study of technical approaches, evaluated computer-assisted software tools and candidate programming languages, and recommended to the planning group that an object-oriented authoring system based on a graphical user interface be implemented under Microsoft Windows using the Actor programming language. Subsequently, NTI developed a functional specification and software specification for SYNTAS.

Development of SYNTAS software began in the second year of the contract. Limitations in the Windows task scheduling system (specifically its inability to perform deterministic, preemptive scheduling of tasks) coupled with the need for millisecond accuracy in the test instruments produced caused a splitting of the software development into two parts -- an Authoring System implemented in Actor

to execute under Microsoft Windows, and a Real-time System implemented in C and executed under MS-DOS. The development of the Authoring System was begun by HTI while the development of the Real-Time system was begun by NTI.

As development proceeded, design of the Real-time system proved to be quite difficult, stretching the capabilities of the PC and MS-DOS. At a technical review meeting held in San Antonio in February 1992, it was decided that the user interface, the interface with the Authoring System, and other non-Real-time components such as file I/O would be developed by HTI, leaving NTI to focus on the real time scheduling component, subsequently called the Real-Time Kernel. HTI's component was initially called the Utility code.

As HTI developed this utility component, it became necessary to test it. The HTI programmer produced a non-real-time version of the system to use in testing, which eventually became a product in its own right, called the Runtime System. The Runtime system combined the Utility component with a simplified, non-real-time scheduler. When the real-time kernel was completed, it was also combined with the Utility component to produce the Real-time System.

Due to the commonalty of the Utility component, models produced by the Authoring System would run on either the Runtime or Real-Time system without modification. The Runtime System offered some advantages: it would run under MS Windows and thus could be used to test Authoring System output without leaving Windows, and it could handle large, slow operations such as display of large bitmap files without causing the frame overruns that would stop the Real-Time System. Its disadvantage was, of course, its non-real-time nature, i. e. there was no guarantee that models run on the Runtime System would adhere to real-time timing and scheduling standards.

Similarly, the Authoring System evolved throughout the course of the contact. Initially it was to be based on a flow-chart metaphor, and would take advantage of a sample application shipped with Actor that implemented much of the graphical procedures for flow charts. Flow charts, however, had two liabilities. First, programming with flow charts is not less difficult than programming itself; all it does is substitute pictures for structured phrases. Secondly, the task models to be implemented under SYNTAS were not expressed as flow charts, but rather as sequential network diagrams, a metaphor similar mathematically to PERT charts. Consequently, the overall design of the Authoring System moved from flow charts to sequential network modeling.

The sequential network model, while sufficient for expressing the components and relationships among task components, is not sufficiently powerful to use as a general purpose programming paradigm. Through the design process, the HTI analysts and programmers added an event-driven engine to the network model, producing a new programming system capable of expressing complicated models without the need for traditional programming statements. SYNTAS truly became a

tool designed for the non-programmer, allowing those in other disciplines such as cognitive psychology to leverage their own expertise and efficiently implement part-task simulators and test instruments without becoming programmers.

As the SYNTAS design evolved, a number of issues related to the integration of other Risk Assessment Tools were incorporated into the SYNTAS design. For example, sequential network modeling structures and concepts were designed as an integral part of SYNTAS. This concept was originally scheduled for investigation under Task #4, Modeling, and under Task #5, Integration of Risk Assessment Tools. Issues related to Task #6, Technology Transfer and User Workshops, were incorporated into the Task #3 effort as well. In another example, a software demonstration of the SYNTAS Authoring and Runtime System was presented at the Second Annual Technology Transfer Meeting in December 1992. Also, the SYNTAS Alpha and Beta versions were released to the Alpha and Beta Test Groups for review and comment. These groups covered a wide range of users from the Army, Air Force, NASA, and universities. These types of activities have created interest and acceptance among potential users.

4.5 DELIVERABLES.

Documents/products delivered to date under Task #3 follow:

Preliminary Proposal for Modification of UTC-PAB Software. HTI-TR-419-001. October 1990.

Functional Specifications for SYNTAS. HTI-TR-419-002. Draft, November 1990; Final, January 1991.

Demonstration Software of SYNTAS User Interface. January 1991.

Draft SYNTAS System Specification and Concept Demonstration.

HTI-TR-419-005. March 1991.

Draft SYNTAS System Software Specifications. August 1991.

Demonstration SYNTAS Configuration System and User Interface software. 30 January 1992.

Demonstration SYNTAS Real-Time System software. 30 January 1992.

Draft SYNTAS (Version 0.5) User Interface software. 16 April 1992.

Draft SYNTAS (Version 0.5) Designer's Guide. HTI-419-SW-GUIDE1. 16 April 1992.

Draft SYNTAS (Version 0.55) User Interface software. 28 May 1992.

Draft SYNTAS (Version 0.55) Designer's Guide. HTI-419-SW-GUIDE/0.55. 28 May 1992.

Modified demonstration model and subtask software for SYNTAS Version 0.55. 8 June 1992.

Draft User's Guide, SYNTAS Real-Time System, Alpha Version 1.0, HTI-419-SW-RT/GUIDE/1.0. December 1992.

Alpha SYNTAS Integrated Authoring and Runtime System Version 1.0 software and User Guide. HTI-419-SW-GUIDE/1.0. 14 January 1993.

Training materials and conduct of SYNTAS Alpha Test Group Training. 14-15 January 1993.

Alpha SYNTAS Integrated Authoring and Runtime System, 4 February 1992.

Beta SYNTAS Integrated software and Designer's Guide, June 1993

SYNTAS software, Version 1.0, technical documentation, and designer's guide, August 1993

RTCONFIG software and users manual, August 1993

SCRAMBLE software and users manual, August 1993

EXPAND software and users manual, August 1993

4.6 RESPONSIBLE CONTRACTORS.

The responsible contractors for the development of SYNTAS were HTI and NTI. HTI provided overall program management; designed, coded, tested, and documented the SYNTAS Authoring System, the Runtime System, and that portion of the Real-Time System which is common to both Runtime and Real-Time Systems (e.g., user interface, graphics, input/output). NTI provided initial design of the system; authored the functional specification; and designed, coded, and tested the Real-Time Kernel used in the Real-Time system. GTU reviewed the draft functional specification and software specification and served as SYNTAS alpha and beta testers.

SECTION 5

TASK #4 - IDENTIFY AND EXERCISE MODELS AS A TEST BED FOR THE RISK ASSESSMENT TOOLS

5.1 RELEVANT SOW TASKS.

SOW Task 3. Expand risk quantification capabilities

5.2 SPECIFIC OBJECTIVES.

The objective of Task #4 was to identify, refine, and exercise models as a "test bed" for the emerging risk assessment technologies.

5.3 STEPS TO ACCOMPLISH OBJECTIVES.

Step 1. Identify and evaluate existing task sequencing models and data for use as a "test bed" for risk assessment tools. This includes a review and analysis of models and data related to the following systems:

- M1 Abrams Tank
- M60A3 Tank
- UH-60 Blackhawk Helicopter
- AH-1 Cobra Helicopter
- AH-64 Apache Helicopter

Step 2. Select 2 - 3 models and scenarios as "test bed" for the risk assessment tools, specifying the models and scenarios located, level of task specification, mean task times and variances, available performance degradation data, model users, and implementation codes.

5.4 DISCUSSION AND TASK EVOLUTION.

Task #4 activities (i.e., Steps 1 and 2) were completed as planned. In addition, PSR participated in the CCL exercises at Fort Hunter-Liggett and MOPP4 exercises at Aberdeen proving Ground to gather HRP-related chemical, radiation, and heat stress data in a field setting. The data gathered provided input to the Task #4 effort.

A number of different potential models emerged over the course of the contract as a potential test bed for the risk assessment tools. Initially, the Task #4 effort focused on the M60A3 Tank as a test bed. More recent CCL and Aberdeen data collection efforts have focused on infantrymen and artillery men.

In the near future, there is a need to re-evaluate and confirm the previous selection of a single test bed for future efforts.

5.5 DELIVERABLES.

Documents/products delivered under Task #4 include:

An Assessment of Selected Crew Models as a Test Bed for Risk Assessment Tools. HTI-TR-419-004. June 1991.

WAA/HARDMAN III Micro SAINT models in Windows format (provided by MicroAnalysis & Design). 12 November 1992.

DNA Task Specific Micro SAINT models in Windows format (provided by MicroAnalysis & Design). 12 November 1992.

Micro SAINT models in DOS format (provided by MicroAnalysis & Design). January 1993.

5.6 RESPONSIBLE CONTRACTORS.

Responsible Contractors for this task were HTI, PSR, and GTU. HTI provided overall program management. PSR identified, evaluated, and documented existing task models and data as a test bed for the risk assessment tools. GTU reviewed and provided feedback on the written assessment report and test bed model selection.

SECTION 6

TASK #5 - INTEGRATE PC-BASED RISK ASSESSMENT TOOLS

6.1 RELEVANT SOW TASKS.

SOW Task 4. Link SYNTAS, risk identification, and risk quantification capabilities

SOW Task 7. Develop a PC-based computational aide for an integrated NBC environmental methodology

6.2 SPECIFIC OBJECTIVES.

The objectives of Task #5 were to integrate the PC-based risk assessment tools, i.e., SYNTAS, TWS, PIMS, and Micro SAINT; and to encourage different user populations, e.g., testers, modelers, and system engineers, to consider a more integrated approach which involves using the full range of risk assessment tools.

6.3 STEPS TO ACCOMPLISH OBJECTIVES.

Step 1. Identify the needs of system users in addressing questions within an NBC battlefield environment.

a. Work with DNA and OMPAT to identify potential users of the risk assessment tools.

b. Conduct user discussions to ascertain the types of questions that they are asking or would like to have answered concerning performance degradation of military personnel in NBC environments.

Step 2. Design approaches for interfacing between SYNTAS, TWS, PIMS, and Micro SAINT. Alternative approaches might involve the following:

a. Exploring alternative taxonomic structures as a means of interfacing the tools, such as

- literature on synthetic work tasks, part-task simulators, and sequential network modeling existing TWS taxonomies
- activities being conducted by OMPAT and DNA (e.g., results of the Perez analysis)

b. Creating new TWS task structures using information from the selected models, for linking this information into Micro SAINT, and for later storing output from Micro SAINT.

c. Using Micro SAINT output to help develop specifications for the design of part-task simulators within SYNTAS.

d. Developing part-task simulators using SYNTAS.

e. Mapping synthetic task data back into the TWS and into Micro SAINT.

Step 3. Develop an aide for integrating PC-based risk assessment tools.

6.4 DISCUSSION AND TASK EVOLUTION.

Task #5 overlapped considerably with other project tasks, (in particular Tasks #1, #3, #4, and #6) and a number of activities related to these other tasks dealt with interface issues. These activities included:

- collecting HRP-related data in field exercises and via questionnaires for inclusion in PIMS, the primary OMPAT interface tool (Task #1);
- gathering key DNA HRP-related documents for inclusion in the PIMS data base (Task #1);
- incorporating sequential network modeling and Petri modeling concepts/structures into the SYNTAS design structure (Task #3);
- interacting with the Alpha Group to identify user needs/concerns (Task #3);
- developing materials and participating in activities to promote the SYNTAS creating a better understanding of user needs and expanding the potential user base to simulation and training specialists (Task #6); and
- reviewing existing task sequencing models and data as a test bed for risk assessment tools (Task #4);
- developing materials and conducting training and presentations on the design of SYNTAS models (Tasks #3 and #6).

These activities integrated concepts from task analysis and sequential network and other modeling techniques with the design of performance assessment instruments. Because of these numerous activities, it was decided at IPR #3 that the requirements of this task had been met and that the deliverables would be reduced to a software Risk Assessments Tools Introduction and a SYNTAS demonstration, which was to be implemented in SYNTAS itself.

6.5 DELIVERABLES.

Documents and products delivered under Task #5 include:

SYNTAS DEMO, Version 1.0, a SYNTAS application demonstrating the design of models using SYNTAS, December 1993

6.6 RESPONSIBLE CONTRACTORS.

Responsible Contractor for this task was HTI.

SECTION 7

TASK #6 - CONDUCT TECHNOLOGY TRANSFER CONFERENCES AND USER WORKSHOPS

7.1 RELEVANT SOW TASKS.

SOW Task 8. Coordinate and conduct user workshops.

7.2 SPECIFIC OBJECTIVES.

The objectives of Task #6 were to communicate the value of the risk assessment tools in addressing performance degradation questions related to military performance in an NBC environment, to transfer OMPAT/DNA risk assessment technology to military users, and to train users in this technology.

7.3 STEPS TO ACCOMPLISH OBJECTIVES.

Step 1. Work with DNA and OMPAT to identify and determine the needs of potential users of the risk assessment tools.

Step 2. Set-up, coordinate, host, conduct, and document the results of annual DNA/OMPAT Technology Transfer Meetings.

a. Assist DNA in planning and conducting the Second Annual DNA Technology Transfer Meeting.

b. Participate in Third Annual DNA Technology Transfer Meeting

Step 3. Develop and conduct workshops to train clients in the use of OMPAT/DNA risk assessment technology.

7.4 DISCUSSION AND TASK EVOLUTION.

Each of the risk assessment tools individually may have several different types of users. For example, there are at least three audiences involved in performance assessment:

(1) designers of performance assessment instruments and synthetic work tasks;

(2) test administrators; and

(3) test subjects.

In addition, audiences include designers and users of training and simulation tools. Each of these audiences has particular needs which must be considered when designing user guides, meeting agenda, content, format, etc.

As SYNTAS was being developed, it became evident that there are a number of training issues that go well beyond the scope of the immediate contract. Future training needs include, but are not limited to, the use of sequential network modeling concepts in test design and the development of more integrated approaches to performance measurement.

7.5 DELIVERABLES.

Supporting documents/products produced under Task #6 include:

DNA 2ND Annual Technology Transfer Meeting. 3 - 5 December 1991.

"Joint OMPAT/DNA Risk Assessment Program." Presentation at DNA 2nd Annual Technology Transfer Meeting. December 1991.

"Synthetic Task Authoring System (SYNTAS)." Presentation at DNA 2nd Annual Technology Transfer Meeting. December 1991.

Demonstrations of SYNTAS Authoring System and resultant synthetic tasks at the 2nd Annual DNA Technology Transfer Meeting. December 1992.

Training Session for SYNTAS Alpha Test Group. 14-15 January 1993.

7.6 RESPONSIBLE CONTRACTORS.

Responsible Contractors for this task included HTI, PSR, NTI, and GTU.

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