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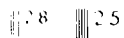
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**RADC-TR-81-308**  
Final Technical Report  
November 1981



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# NATIONAL SOFTWARE WORKS TOOL IMPLEMENTATION

IIT Research Institute

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FEB 03 1982

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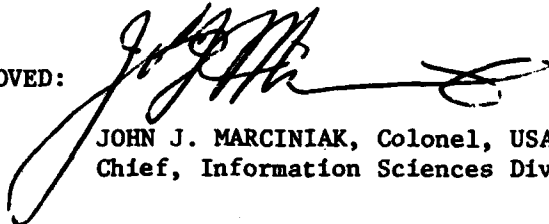
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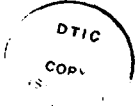
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## Section 0.0

### SUMMARY

#### Objective

The objective of this contract is to develop and apply guidelines, standards, and procedures for the selection, installation, and maintenance of software tools (computer programs) on the National Software Works (NSW), a network of computers which is a subset of the DoD-wide ARPANET system of computers. The purpose is to provide for more effective management, control, and utilization of the tools on the various computers which are part of the NSW.

#### Background

Since July 1974, KADC and ARPA have been engaged in a cooperative development program to apply the latest techniques in distributed data processing to reduce the high cost of software and improve its quality. This program, the National Software Works, provides convenient, uniform, access procedures to a large set of software development tools operating on multiple computers. In order to minimize the effects of tool transfer, each tool runs on its own computer (tool bearing host--TBH), and to minimize User training, all tools on all TBHs have a uniform access system and uniform file system. Thus, the user has easy access to a variety of software tools distributed across dissimilar TBHs on the ARPANET (a DoD network of computers), and can select and use those most appropriate for a given task. The tools include such things as text editors, file management systems, compilers, validators, debuggers, etc.

Many of the tools required by existing or potential Users are not part of the existing NSW capability, and procedures must be developed to incorporate them. Also, procedures must be developed to manage existing tools on the NSW. The function of the Tool Manager (TM) has been created to perform these tasks. The role of the TM is to support:

- (1) the NSW Policy Group (PG) in the classification, selection, installation, maintenance, and control of new and existing tools on the NSW,
- (2) the User in getting a needed tool installed on the NSW,
- (3) the Tool Vendor/Installer in facilitating the installation of the User-required tool on the NSW.

In order to accomplish the TM's role, the following tasks needed to be performed:

(1) Develop a "Tool Configuration and Quality Management Plan" to provide a framework for the classification, selection, installation, maintenance, and control of tools on the NSW.

(2) Expand upon the Plan by developing detailed guidelines, standards, and procedures for the classification, selection, installation, maintenance, and control of software tools on the NSW.

(3) Develop an on-line NSW Tool Library System to provide up-to-date tool status and tool usage information to the TM, NSW Users, and other members of the NSW community.

(4) Distribute all tool information identified in (1), (2), and (3), above, to NSW Operations (NSWOPS), for subsequent release to NSW Users and other members of the NSW community.

(5) Support PG in the coordination and processing of NSW tool requests.

(6) Support the User in getting a needed tool installed on the NSW, and the Vendor/Installer in facilitating the installation of a user-required tool on the NSW.

The purpose of this effort is to accomplish the above mentioned tasks by 30 June 1961.

#### Summary of Accomplishments

(1) The "Tool Configuration and Quality Management Plan" has been completed, delivered, accepted, and distributed to the NSW community.

(2) A "Tool Installation Guide," containing detailed guidelines, standards, and procedures for managing NSW software tools has been completed and delivered. Included in this document are tool validation procedures. The following has been accomplished in terms of initial implementation of the Guide:

(a) Procedures for interaction between NSW Operations and the Tool Manager in the software tool management process, e.g., handling of Software Trouble Reports (STRs), etc., have been established.

(b) Detailed tool installation procedures have been developed for one of the four NSW TBhs; i.e. UCLA/CCN.

(3) The NSW Tool Library System (TLS) has been delivered. The TLS was designed and implemented to meet the following criteria:

(a) The TLS is required to be available to NSW users and to contain up-to-date information on NSW tools. The TLS is installed as a tool under the NSW and currently contains tool data on eighteen current or proposed NSW tools.

(b) The TLS shall be in a form for convenient access to NSW users and 'Help' support shall be available to a user during TLS usage. The TLS is a menu driven system which guides the casual or sophisticated user through the retrieval process. Incorporated within the menu approach is an access to a 'help' feature which provides extensive support information to guide a user during a TLS usage session.

(4) The following has been done to support the NSW Policy Group:

(a) A survey was completed of software tools resident on the four NSW TBhs and two computers (RADC TOPS20 and UNIVAC 1108) being considered for NSW inclusion.

(b) An outline of an NSW Tool Repository was developed and presented to the NSW Working Group on the Air Force Logistics Command (AFLC) Technology Demonstration. Its purpose is to permit AFLC personnel to evaluate the utility of specific software tools with regard to the AFLC software support environment.

(c) Several briefings on the status of the TM contract were given to NSW contractors and to the NSW Working Group on the AFLC Technology Demonstration.

## Section 1.0

### INTRODUCTION

The objective of this eighteen month contracted effort is to develop guidelines, standards, and procedures for managing software tool resources within the National Software Works (NSW); and to install, or support the installation of, tools.

This effort represents the first step in the establishment and implementation of the function of a Tool Manager (TM) within the NSW Community. Background on the NSW and the need for, and functions of, a Tool Manager are adequately described in Section 0.0 (SUMMARY) of this report and will not be repeated here. The reader interested in learning more about the details and functions of the NSW, and the groups involved, is referred to the "NSW Management Plan" which was prepared by KADC/ISCP in February 1979.

Basically, the tasks to be done under this effort are as follows:

(1) Develop a "Tool Configuration and Quality Management Plan" to provide a framework for the classification, selection, installation, maintenance, and control of tools on the NSW.

(2) Expand upon the Plan by developing detailed guidelines, standards, and procedures for the classification, selection, installation, maintenance, and control of software tools on the NSW.

(3) Develop an on-line NSW Tool Library System to provide up-to-date tool status and tool usage information to the TM, NSW Users and other members of the NSW Community.

(4) Distribute all tool information identified in (1), (2), and (3) to NSW Operations (NSWOPS), for subsequent release to NSW users and other members of the NSW Community.

(5) Support PG in the coordination and processing of NSW tool requests.

(6) Support the User in getting a needed tool installed on the NSW, and the Vendor/Installer in facilitating the installation of User-required tool on the NSW.

The remaining sections of this report describe each of the tasks, in more detail, and the progress that has been made toward their accomplishment. The format of this report is geared to previously mentioned task structure as follows:

- o Section 2 -- Tool Configuration and Quality Management Plan.

- o Section 3 -- Tool Installation Guide and Tool Validation Procedures.
- o Section 4 -- National Software works Tool Library.
- o Section 5 -- Tool Support to NSW Policy Group.
- o Section 6 -- Preliminary Conclusions and Future work.
- o Section 7 -- Acronyms and Abbreviations
- o Section 8 -- References

## Section 2.0

### TOOL CONFIGURATION AND QUALITY MANAGEMENT PLAN

#### 2.1 INTRODUCTION

Task 1 of this contract is to develop a "Tool Configuration and Quality Management Plan" which shall address all aspects of Tool Management within the NSW consistent with the organizational framework of the NSW. The purpose of this Plan is to provide a framework for the classification, selection, installation, maintenance, and control of software tools on the National Software Works (NSW). These guidelines are the basis for the administration and operation of all NSW activities related to task management.

ITKI developed and submitted the original draft of this Plan in December 1979 for approval and the final draft in April 1980. The Plan has been approved and has been released for general distribution to the NSW community. Following is a very brief summary of the contents of the Plan. The total Plan is not repeated in this report because of its length (43 pages) and the fact that it is really a stand-alone document. The Plan is referenced in Section 8.0 for those readers who might require more detail.

#### 2.2 SUMMARY

The Plan is divided into two major sections. The Plan Summary Section outlines the key aspects of the Plan in terms of the functional responsibilities of the Tool Manager (TM) and the required interfaces with other NSW organizations during the individual tasks associated with the Tool Management process.

The Operational Procedures Section summarizes the functional requirements of the procedures for managing the tool resources of the NSW. Tool Management tasks discussed include:

- o Tool Classification--the methodology of assigning one of three classifications to tools; e.g. Class 1, Production Quality; Class 2, Proven but Unsupported; Class 3, Experimental
- o Tool Selection--definition of a process to match a user's need with an available tool.
- o Tool Installation and Acceptance--guidelines for acquisition, installation, and acceptance of tools on the NSW.
- o Tool Maintenance--rules for the TM's role in the tool maintenance (error correction, etc.) process.

- o Tool Design Change Procedure--guidelines on the TM's role when significant design changes are required for a tool.
- o New Tool Development--guidelines for new tool identification, evaluation, development, installation and acceptance.
- o Configuration Management--rules for identifying controlling, and verifying changes associated with NSW tools.
- o Administrative and Legal Issues--defines the basic administrative and legal factors that must be addressed among various NSW groups, Tool Vendors/Installers, and Tool Users.
- o Control and Costing Alternatives--identifies control parameters and costing elements which must be addressed.

The NSW Group Interaction Matrix (Figure 2-1) is included to indicate the interfaces necessary among the NSW Groups for each of the stages of a tool's evolution into the NSW.

	P	N	A	P	T	D	N	V	I	U
	G	S	C	D	M	M	H	E	N	S
		W	C	C		C	A	N	S	E
		O						D	T	R
		P						O	A	
		S						R	L	
									L	
									E	
									R	
Tool Classification	X				X					X
Tool Selection	X	X			X		X	X	X	
Tool Install & Accept	X	X	X	X	X	X	X	X	X	X
Tool Maintenance		X			X	X				X
Tool Design Change Proc	X	X	X	X	X			X	X	X
New Tool Development	X	X			X	X		X	X	X
Configuration Management	X	X			X			X	X	X
Admin & Legal Issues	X	X			X		X	X	X	X
Control & Costing	X	X			X		X	X		X

FIGURE 2-1 NSW GROUP INTERACTION MATRIX



## Section 3.0

### TOOL INSTALLATION GUIDE AND TOOL VALIDATION PROCEDURES

#### 3.1 INTRODUCTION

Task 2 of this contract is to develop detailed guidelines, standards and procedures for the selection, installation and maintenance, and control of tools within the NSW, and to develop test and validation procedures to ensure that tools being considered for installation meet the general guidelines and standards identified above.

ITRI developed and submitted a working draft of this Guide in December 1979 and the final draft for approval in July 80. This Guide has been approved and has been released for general distribution to the NSW community. Since the Guide is a rather voluminous document (125 pages), it will only be very briefly summarized in this report. The interested reader is referred to Section 8.0 for further details on how to obtain the Guide.

#### 3.2 SUMMARY

The purpose of the Tool Installation Guide is to provide implementation procedures, based upon the guidelines established in the "Tool Configuration and Quality Management Plan," for the administration and management of software tools on the National Software Works (NSW).

The Guide outlines procedures for the classification, selection, installation and acceptance, maintenance, configuration management, and test and validation of software tools on the NSW. It also addresses administrative and legal issues, and control and costing alternatives.

The Guide is intended for use not only by the NSW Tool Manager in performing the functions of administering and managing the software tools on the NSW, but also by other NSW groups who will be involved in one or more tasks of the tool management process. One of the purposes of the Guide is to identify the NSW groups involved in each task of the tool management process, and delineate their roles, responsibilities, and interfaces, (as viewed by the Tool Manager). It is recognized that the roles, responsibilities, and interfaces will probably change as the NSW system evolves.

The Guide is divided into two volumes. Volume I describes the operational procedures for tool classification, selection, installation and acceptance, maintenance, tool design change, new tool development, configuration management, and test and validation. Volume II describes administrative and legal considerations, and control and costing alternatives.

Appendices are provided to extend the procedures of the Guide to address those cases which require specifications that are TBH specific, or NSW and TBH

specific. The purpose of the appendices is to retain the stability of the Guide while allowing for dynamic updating as NSW and TBH configurations evolve. Current appendices include:

- o Tool Assessment Checklist

This checklist details items that a User might consider prior to acquiring a tool.

- o UCLA/CCN Tool Installation Procedures

This appendix describes the steps involved in the installation of a NSW candidate tool and UCLA/CCN from the viewpoint of the NSW host Administrator at UCLA/CCN.

- o Specimen Software License Agreement

This appendix is an example of a possible software licensing agreement that might be created and signed by a software vendor and a User.

- o Plan Summary

This appendix, extracted from the "Tool Configuration and Quality Management Plan," contains brief, general summaries of the roles and responsibilities of each of the NSW groups for each tool management task.

Initial implementation of the Guide has been accomplished in the following areas:

(a) Procedures for interaction between NSW Operations and the TM in the software tool management process, e.g. handling of STRs, etc., have been established.

(b) Detailed tool installation procedures have been developed for one of the four NSW TBHs; i.e. UCLA/CCN. (see appendices, above).

## Section 4.0

### NSW TOOL LIBRARY SYSTEM (TLS)

#### 4.1 INTRODUCTION

Task 3 of the NSW Tool Implementation Contract F30602-79-C-0239 was performed by Measurement Concept Corporation, Rome, NY, as subcontractor to IIT Research Institute. This task resulted in the establishment of an easily accessed and maintained repository of data concerning the characteristics and status of NSW tools. This data base (the NSW Tool Library) is maintained by the NSW Tool Manager (TM) and will be made available to NSW users via the Tool Library System (TLS) installed on the NSW. The TLS was designed to be straightforward and simple, requiring no user knowledge of computer systems. Figure 4-1 shows the user view of the Tool Library System.

The TLS was installed on the RADC-Multics honeywell-6180 as a stand alone system to allow evaluation prior to installation on the NSW. Since the TLS was designed to operate under the Multics operating system, advantage was taken of many tools available as part of the RADC-Multics facility.

These tools are provided by Multics and maintained by honeywell. Therefore, many problems inherent in maintaining a software system are eliminated by this approach. The tools utilized include: the Multics relational Data Store (MRDS) data base system; the Multics text formatter, compose, to format reports; and the Logical Inquiry and Update System (LINUS) to provide a powerful, user-oriented, interface to the MRDS system for the Tool Manager.

#### 4.2 SYSTEM COMPONENTS

The Tool Library System (TLS) is comprised of two separate components:

- o Query Component
- o Data Base Component

These are discussed in the following subsections. Section 4.3 discusses maintenance of both components.

##### 4.2.1 QUERY COMPONENT

The query interface is menu-driven to provide ease of use for the casual user. The user proceeds from the Top Menu down getting help or specifying a query type and override parameters to make a tailored retrieval. Override Parameters can be specified to limit default output using the "is", "contains", and "not" operators to retrieve only relevant information. The override parameters are "OR"ed together to construct the required request. When the user is satisfied with the override parameters and query type, the

retrieval can be initiated by selecting the "initiate" option from the menu. When the retrieval is complete, the user has the option of having the report written on his terminal, to an NSW file, or both.

#### 4.2.2 DATA BASE COMPONENT

The Tool Library System uses the MDRS relational data base management system. All information which is logically dependent on a particular data item with a unique value for each occurrence is a separate entity, or relation. A relation can be visualized as a table where the columns, or attributes, are the data items included in the relation (the key item and its logical dependents); and the rows, or tuples, are the separate instances populating the relation. Relationships between relations are represented by matching attributes, so that no relation is considered to be structurally the most appropriate model for an application (such as the NSW Tool Library, whose requirements may change as the NSW evolves). It should be emphasized that the design of the TLS system stresses ease of modification and independence between the software and the types of data stored, so that the latter can be expanded or changed to accommodate changing user needs.

The Tool Library data base contains information concerning the following tools:

BASIC-RM	FORTRAN-RM	HELP-RM
PLI-RM	COMPRESS-UC	DISPLAY-UC
FORTRAN-UC	ISOEDIT-UC	FTP-IC
MKLNOFF-IC	NETSTAT-IC	SOS-IC
SPELL-IC	BCPL-IE	DESCRIBE-IE
HOSTAT-IE	TECO-IE	XED-IE

Two dummy STR tuples were also entered to provide testing capability.

#### 4.3 MAINTENANCE

Maintenance is performed on the TLS components by the Tool Manager. Complete descriptions and examples of maintenance functions can be found in the TLS components Maintenance Manual. Figure 4-2 is a diagram of the actual layout of the Tool Library System.

##### 4.3.1 TOOL LIBRARY STRUCTURE

The Tool Library data base contains all of the actual data pertaining to NSW tools. Part of the responsibility of the TM is that of updating information in the data base to reflect the current status of the NSW. This update is performed through LINUS and, as long as no new relations are added to the data base, no reload is necessary. Figure 4-3 contains a complete specification of the Tool Library data base.

#### 4.3.2 QUERY STRUCTURE

Each query consists of the following: a program module; two tuples in the t1s data base, one under the <query> relation, and <query param> relation. Optionally, help can be provided for each query by making entires in the t1s-db under the <help> relation and a corresponding help file in the help directory. A Multics exec com (ec) is included in the TLS package which produces the query program module, with the following parameters:

- o the query name
- o the file name of a file containing the level 2 members of a PL/1 data structure to hold the retrieved data
- o the number of characters in the data structure

(An annotated example can be found in the TLS Maintenance Manual)

The exec com is executed from Multics command level to produce the query program module. To modify an existing query program module the same procedure is followed as above but the existing query name is passed to the exec com.

Tuples in the t1s-db data base are added, modified, or deleted using the LINUS store, modify, or delete command as shown in the TLS Maintenance Manual.

#### 4.3.3 HELP FILE STRUCTURE

Help files may be created or modified using any Multics text editor. Files may be deleted using the Multics delete command. (The Multics Programming Manual "Commands and Active Functions" contains more complete information on these procedures.)

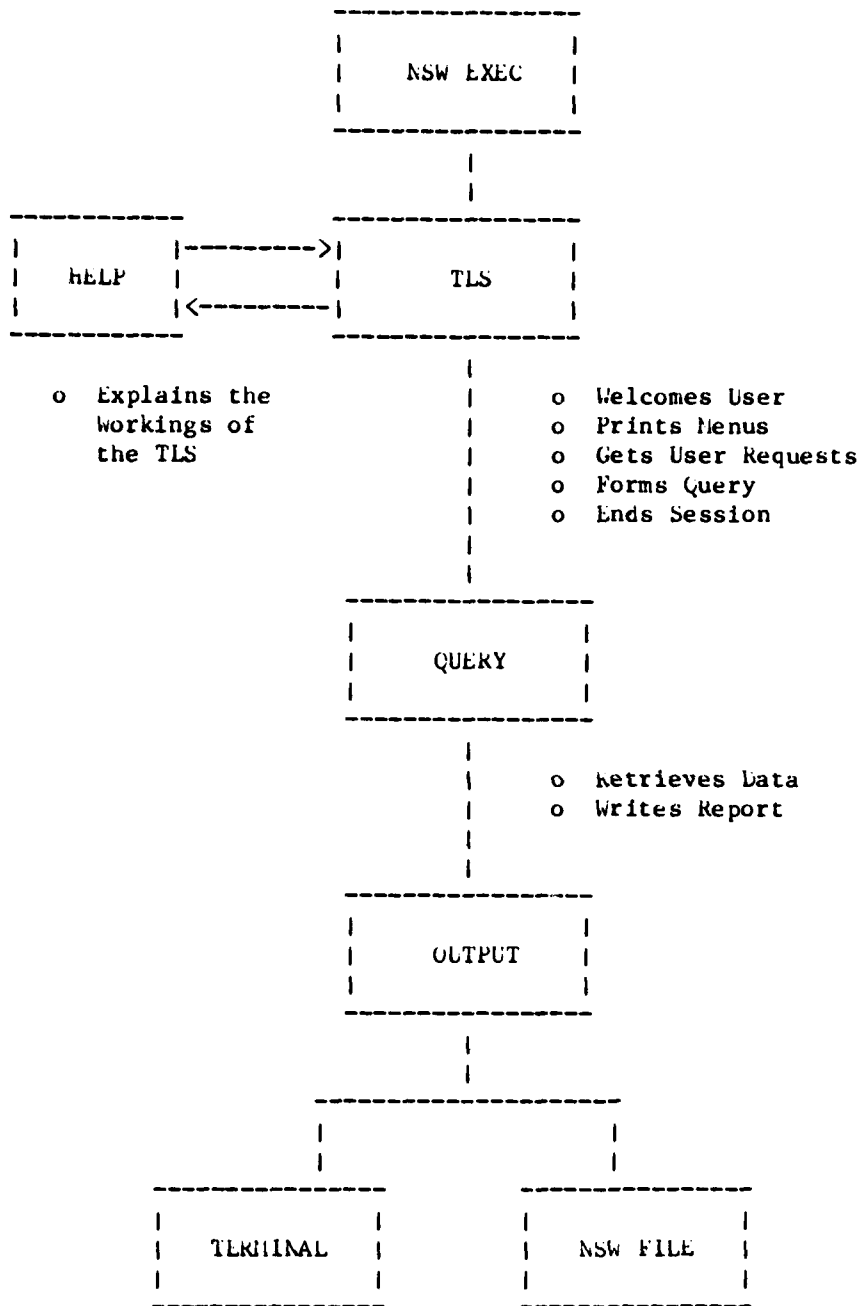


FIGURE 4-1 USER VIEW OF THE TLS

-----  
TLS CODE

-----  
TLS DB

-----  
|---| QUERY |  
-----

- o query\_name
- o query\_desc - Name of Query
- o default\_se - Default Selection Expression
- o date\_loaded
- o date\_updated

-----  
|---| QUERY PARAM |  
-----

- o query\_name
- o param - Parameter to be Specified  
when Selecting Overrides
- o tuple\_var - Variable Name Used in default\_se
- o date\_loaded
- o date\_updated

-----  
|---| HELP |  
-----

- o help\_name
- o help\_desc - Description of help File
- o help\_path - Pathname of help File
- o date\_loaded
- o date\_updated

-----  
|---| TOOL LIBRARY |  
-----

- o Contains all Tool Data  
(See Figure 4-3 for Spec)

-----  
|---| HELP |  
-----

- o help - Contains TLS Help Info
- o override - Contains Info on TLS Override Parameters
- o overview - Contains an Overview of the TLS
- o Various other help Files

FIGURE 4-2 TOOL LIBRARY SYSTEM DIAGRAM

This figure contains the complete specification of the Tool Library data base. Attributes marked with '\*' are key attributes. See the MRDS manual for further explanations. Key attributes are those that may be specified in an MRDS 'where' clause. When variable names are not self explanatory, additional information is provided under the 'FUNCTION' heading.

RELATION NAME	ATTRIBUTE	FUNCTION	CHAR
tool		Describes NSW tool	
	nsw_tool_id*		20
	nsw_tool_version	NSW version number	20
	tool_long_name		40
	vendor_tool_version	Actual version number	20
	arpa_host_id		20
	tool_class	NSW tool class 1 - production class 2 - proven class 3 - experimental	1
	tool_name		20
	tool_type	Tool category and function	20
	tool_lang	Source code language	
	dmc_resp_org	Development and maintenance	80
	tsc_resp_org	Tool support contractor	80
	tool_kit		20
	load_size		20
	storage_rqmts	Requirements for object code	20
	proc_mode		12
	tool_behavior		500
	tool_restrict		50
	date_loaded		6
	date_updated		6
help		1000	
abstract		Contains abstract of an NSW tool	
	nsw_tool_id*		20
	abstr_desc	Abstract of tool	1000
	date_of_abstract		6
	date_loaded		6
date_updated		5	
host		Describes an NSW host	
	arpa_host_id*		20
	arpa_host_addr	Arpanet host number	20
	nsw_host_id		2
	tbh_addr	Addr of tool bearin host (street, city, state)	200
	host_opsys		20
	host_config		20
date_loaded		6	

FIGURE 4-3 TOOL LIBRARY DATA BASE SPECIFICATION



documentation	date_updated		6
	NSW_tool_id*		20
	document*	Addr of NSW document	50
	date_loaded		6
	date_updated		6
reference	NSW_tool_id*		20
	ref_manual*	Title and where to obtain	225
	date_loaded		6
	date_updated		6
keywords	keyword*		20
	NSW_tool_id*		20
	date_loaded		6
	date_updated		6
str		Describes software trouble report	
	str_no*	STR id number	5
	NSW_tool_id		20
	str_title		80
	str_abstract		1000
	date_submitted		6
	date_cancelled		6
	str_resolution		500
	expected_solution_available		150
	date_loaded		6
	date_updated		6
	related_tools	NSW_tool_1*	related tool 1
NSW_tool_2*		related tool 2	20
date_loaded			6
date_updated			6

FIGURE 4-3 TOOL LIBRARY SYSTEM SPECIFICATION (CONT)

## Section 5.0

### NSW POLICY GROUP SUPPORT

#### 5.1 INTRODUCTION

Task 5 consists of providing support to the Policy Group and coordinating with other NSW groups. This section of the report provides a summary of these activities which consisted of:

- o surveying tool availability
- o providing assistance to the AFLC/NSW working Group and developing the the Tool Repository Scenario

#### 5.2 NSW TOOLS

As a part of the Tool Manager function, IITRI performed a survey of Tools resident on the four Tool Bearing Hosts of the NSW and of the two computer systems (RADC TOPS20 and UNIVAC 1108) which are being considered for NSW inclusion. (During this contract the UNIVAC computer was dropped from consideration as a near-term NSW host.)

The Tool list produced is segmented by host computer system and further subdivided into three sections:

- o Tools on the TBH which are part of the NSW.
- o Tools on the TBH which are available to TBH Users but not available to the NSW.
- o Tools which are computer vendor supplied but are not currently included on the TBH site, but which might be considered for later implementation and potential NSW use.

The list of tools is included in its entirety in Appendix A of this report. Figure 5-1 contains a summary of the list in terms of the number of NSW tools identified and the number of TBH tools identified, exclusive of the NSW tools. In this Figure, the TBH codes are:

R2	TOPS20 at RADC
KN	MULTICS 6180 at RADC
IC	DEC20 at USC-ISIC
IE	DEC20 at USC-ISIE

UC IBH3033 at UCLA-CCN

UN UNIVAC

In compiling the list, an attempt was made to identify the agency responsible for supporting a tool if a User were to encounter a problem. Two areas were identified where support is provided:

- o TBh - this column identifies who supports the tools on the host computer.
- o NSW - this column identifies who supports the tool and its interface to the NSW.

The tools were also categorized into ten major types. The number of tools per type is illustrated in Figure 5-2.

A preliminary search was also made of the Software Tool Directory produced by the Software Management Consultants. Over 400 potential candidates that may be applicable to the needs of the Air Logistics Centers were identified. A subset of this list was produced for the four TBHs as examples of what tools exist. The list is contained in Appendix B of this report and includes a preliminary categorization of the tool products as production, proven (may be supported or unsupported, but do not meet the requirements set by NSW for documentation, testing, etc.), and experimental.

### 5.3 AFLC/NSW WORKING GROUP

A joint NSW technology demonstration plan was created to formulate an approach for using the NSW to support AFLC applications in the FY81-85 time frame. An NSW Working Group was established to plan, execute, implement, and control the NSW Technology Demonstration(s). The membership of this working group, stated in the 20 March 1980 Charter, is composed of the following:

Organization	Designated Representative
AFLC/LOLC	Capt. Bill Riski
WR-ALC/MNECV	Palmer Craig
CC-ALC/MNECO	Nike Parrish
EN-ALC/MNECF	Van Johnson
AFSC/XRF	Major Al Kopp
RADC/ISCP	Pat Baskinger
RADC/ISCP	Leon McDowell

Representatives from the NSW community were designated to provide technical assistance to the working group and consist of:

NSW responsibility	Representative	Organization
Integration Contractor	Charles Muntz	NCA
Operations Office	Doug Payne	GSC
Tool Manager	John Dobmeier	IITRI
Analysis Group	Rick Schantz	BBN

Three application scenarios were defined to be used to demonstrate NSW technology in a manner relevant to the operational needs of the ALC's. At the Third NSW Working Group Meeting held in April 1980, presentations were made on four application scenarios for the demonstrations. A ranking was determined for the scenarios and are listed below, according to the following priority:

- (1) Configuration/Project Management
- (2) Emulation
- (3) Tool Repository

IITRI was assigned the responsibility for the development of the Tool Repository Scenario. A paper detailing this scenario is contained in Appendix C of this report.

The objective of the Tool Repository Scenario is to describe an environment that can be used by AFLC software engineers and managers to evaluate the utility of new software tool technology for the support of current and future embedded computer systems. This environment will consist of a repository of tools accessible through the NSW as well as resources and services to assist AFLC personnel in evaluating the usefulness and applicability of software tool technology. Services to support the evaluation include a library of tool information, assistance in the design and implementation of evaluation procedures, and training in the use and evaluation of software tools.

The purpose of the NSW software tool repository will be to serve as a mechanism for AFLC to evaluate the utility of specific software tools in regard to the AFLC software support environment. Based upon the results of a tool's evaluation, AFLC may determine that it would be beneficial to install a tool for further detailed evaluation or production use.

In order to accomplish this evaluation, AFLC users will need to access and use a variety of tools through the NSW. Information concerning the availability of tools will be required to assist AFLC in selecting candidate tools for the evaluation. Information concerning evaluation methodologies will be necessary to aid AFLC in formulating and implementing a cost-effective evaluation methodology, and training in tool use will be necessary to assure that the features and applications of the evaluated tools are understood by the AFLC evaluators.

All of these resources will serve to assist AFLC in determining the utility of tool technology. By using these resources and the NSW-resident software tools, AFLC will be able to determine the software tools most

applicable and effective in the accomplishment of its mission. With this information and experience, the procurement, installation and use of software tools for AFLC software support environments will be able to be undertaken by AFLC with a high degree of confidence.

The NSW Software Tool Repository should not be viewed as a support environment, per se. Rather, it should be viewed as an aid to AFLC in evaluating potential tools for possible inclusion in software support environments within AFLC. As such, the Tool Repository could serve as a powerful tool in the design and development of software support environments.

IITRI staff attended the Third NSW Working Group Meeting held at Sacramento ALC, McClellan AFB, California on 15-17 April 1980 and the Fourth Working Group Meeting held 11-13 June 1980 at RADC/ISCP, Griffiss AFB, N.Y. The objectives of these meetings were to review the status of the technology demonstration plans and to determine future direction. At both of these meetings, IITRI briefed members of the Working Group on the status of the Tool Manager function and presented an outline of the Tool Repository Scenario.

TBH CODE	# NSW TOOLS	# TBH TOOLS
UC	23	73
IC	20	171
IE	17	130
RI	11	47
	--	---
	TOTAL 71	TOTAL 421
TBH CODE (Planned)	# NSW TOOLS	# TBH TOOLS
RZ	15	64
UR	TO BE DETERMINED	TO BE DETERMINED

FIGURE 5-1 TOOL SURVEY RESULTS

CATEGORY	NSW	TBH
Compilers, Assemblers, Inter.	20	76
Compiler Utilities (debuggers, loaders, xref, etc.)	10	60
File Utilities (sorts, comparators, copy, etc.)	14	79
Mail Utilities	0	20
Editors	8	22
Text Editor Utilities (runoff, renumber, spelling, etc.)	9	24
Simulators, Emulators	5	9
Application Programs (stat, graphics, math.)	0	66
NSW and ARPANET Ngmt Tools	6	6
DBMS	0	5

FIGURE 5-2 NSW AND TBH TOOLS BY TYPE

## Section 6.0

### CONCLUSIONS

The primary purpose of this contract was to define, and begin implementating, the role of the NSW Tool Manager (TM), a new "player" in the NSW community. As envisioned, the role of the TM is to develop and apply guidelines, standards, and procedures for managing software tool resources within the National Software Works; and to support the installation of tools.

Luring this contract the role of the TM was defined and documented. Also, the interfaces and/or communication links with other NSW organizations involved in the tool management process were established.

Two key documents were developed and delivered which describe in detail the role of the TM in the tool management process. The first is the "Tool Configuration and Quality Management Plan," which provides a framework for the classification, selection, installation, maintenance, and control of tools on the NSW. It also defines the interactions required between the TM and other NSW organizations during each of the previously mentioned stages of tool management. The second document, the "Tool Installation Guide," is an expansion of the Plan and contains detailed guidelines, standards, and procedures for managing each of the stages of a tool's evolution into the NSW e.g. classification, selection, installation, maintenance, etc. Included in the Guide are detailed tool validation procedures.

Although the Plan and the Guide are summarized in this report, they are not included in their entirety because: 1) of their size (Plan - 43 pages, Guide - 125 pages); and, 2) it is felt that they are stand-alone, working documents which should be implemented within the NSW community. The reader interested in obtaining these documents is referred to Section 8.0 of this report.

Another task performed under this contract is the development of an on-line NSW Tool Library System (TLS) to provide up-to-date tool status and tool usage information to the TM and other members of the NSW community, as appropriate. This data base will be used and maintained by the TM, and is available to NSW Users, as well as other members of the NSW community involved in the tool management process. The TLS is completed and on-line to the NSW community.

With all of the tasks of this contract completed and the TM function fully implemented, there is available an orderly, unified approach and mechanism for the classification, selection, installation, maintenance, and control of software tools on the NSW. The benefits to be derived from the implementation of the TM function are:



- (1) NSW Users are provided with up-to-date, on-line information on all tools.
- (2) Tool Users have confidence that their tool usage will not be impaired by ad-hoc changes
- (3) Appropriate NSW organizations, e.g. Vendor/Installers, PG, will have available a detailed set of guidelines and procedures for each stage of a tool's evolution into the NSW.
- (4) The PG has a supporting arm, the TM, in the tool management process.

## Section 7.0

### ACRONYMS AND ABBREVIATIONS

ACC	Architecture Control Contractor
AFLC	Air Force Logistics Command
DBA	Data Base Administrator
DMC	Development and Maintenance Contractor
MONSTR	A program to monitor software trouble reporting
MKDS	MULTICS Relational Data Store
NHA	NSW Host Administrator
NST	NSW Standard Transaction
NSW	National Software Works
NSWIC	National Software Works Information Center
NSWOPS	National Software Works Operations
PDC	Product Development Contractor
PG	Policy Group
PM	Program Manager, Chief of NSW Policy Group
STR	Software Trouble Report
TBH	Tool Bearing Host
TLI	NSW Tool Library Interface Subsystem
TLM	NSW Tool Library Maintenance Subsystem
TLQ	NSW Tool Library Query Subsystem
TLRPG	NSW Tool Library Report Generator Subsystem
TLS	NSW Tool Library System
TM	NSW Tool Manager

Section 8.0

REFERENCES

1. "Tool Configuration and Quality Management Plan," RADC/ISCP, Griffiss AFB, N.Y. 13441, May 1980.
2. "Tool Installation Guide," RADC/ISCP, Griffiss AFB, N.Y. 13441, July 1980.
3. Feinler, E. and Sjoberg, A., "NSW Bibliography and Contract Listing," NSWIC, SkI International, Menlo Park, CA 94025, December 1979.
4. Gale, Ross, "NSW Documentation Summary," GSG Inc., 51 Main Street, Salem N.H. 03079, February 1980.
5. "NSW Management Plan," RADC/ISCP, Griffiss AFB, N.Y. 13441, February 1979.
6. Gilb, Tom, Software Metrics, Winthrop Publishers, Inc., 1977
7. Reifer, D.J. and Trattner, S., "A Glossary of Software Tools and Techniques," COMPUTER, July 1977, pp. 52-60.
8. Tkw Systems and Space Group, "NSW Feasibility Study," RADC-TR-78-23, February 1978. (A052996)
9. McCabe, T.J., "A Complexity Measure," IEEE Transactions on Software Engineering, vol. SE-2, pp. 308-320, December 1976.
10. McCall, J.A. et al, Factors in Software Quality, Concepts and Definitions of Software Quality, RADC-TR-77-369, November 1977. Vol I (A049014) and Vol II (A049015)
11. Bernard, D., "Management Issues in Cooperative Computing," ACM Computing Surveys, March 1979, pp. 3-17.

## APPENDIX A

### TOOLS RESIDENT ON NSW TBHS

The following list contains a survey of Tools resident on the four Tool Bearing Hosts of the NSW and of the RADC TOPS20 computer system which is being considered for NSW inclusion. The list is segmented by host computer system and further subdivided into three sections: 1) Tools on the TBH which are part of the NSW, 2) Tools on the TBH which are available to TBH Users but not the NSW, and 3) Tools which are computer vendor supplied but are not currently included on the TBH site but which might be considered for later implementation and potential NSW use.

The codes used in the following list and their explanations are:

Host codes are:

R2	TOPS20 AT RADC
RM	MULTICS 6180 AT RADC
IC	DEC10 AT USC-ISIC
IE	DEC10 AT USC-ISIE
UC	IBM3033 AT UCLA-CCN

In compiling the following list, an attempt has been made to identify the agency responsible for supporting a tool if a User were to encounter a problem. Two areas have been identified where support is provided: 1) TBH - this column identifies who supports the tools on the host computer and 2) NSW - this column identifies who supports the tool and its interface to the NSW. If the creator of the list was unable to find the information because of time constraints, the column is left blank. Also, in the case of entries which were too long, abbreviations were used. These abbreviations have been expanded at the end of this appendix.

HOST	TOOL NAME	TOOL TYPE	SUPPORT	
			TBH	NSW

NSW TOOLS

UC	MACRO20	BATCH ASSEMBLER	NOSC	CCN
UC	ASM80	COMPILER	INTEL	CCN
UC	CMS2M	BATCH COMPILER	UNIVAC	CCN
UC	PLI	BATCH COMPILER	IBM	CCN
UC	PLM80	BATCH 8080 CROSS COMPILER	INTEL	CCN
UC	SPPCOBOL	BATCH COMPILER	RADC	CCN
UC	COBOL	BATCH COMPILER	IBM	CCN
UC	FORTTRAN	BATCH COMPILER	IBM	CCN
UC	PLICOMP	BATCH COMPILER	IBM	CCN
UC	TSO EDIT	EDITOR	IBM	CCN
UC	PLILINK	BATCH LINKER	IBM	CCN
UC	PLIBGO	BATCH RUN	IBM	CCN
UC	GETC	LIBRARY UTILITY	CCN	CCN
UC	GETP	LIBRARY UTILITY	CCN	CCN
UC	PUTP	LIBRARY UTILITY	CCN	CCN
UC	PUTC	LIBRARY UTILITY	CCN	CCN
UC	COMPRESS	LIBRARY UTILITY	CCN	CCN
UC	LIBMAINT	LIBRARY UTILITY	CCN	CCN
UC	MERGELIB	LIBRARY UTILITY	CCN	CCN
UC	CREATEC	LIBRARY UTILITY	CCN	CCN
UC	CREATEL	LIBRARY UTILITY	CCN	CCN
UC	CREATEP	LIBRARY UTILITY	CCN	CCN
UC	DISPLAY	FILE UTILITY	CCN	CCN

TBH TOOLS

UC	IMS	DBMS	IBM	
UC	MARK IV	DBMS	INFORMATICS	
UC	ASSEMBLER F	ASSEMBLER	IBM	
UC	ASSEMBLER G	ASSEMBLER	WATERLOO U	
UC	ASSEMBLER H	ASSEMBLER	IBM	
UC	SPASM	SINGLE-PASS ASSEMBLER	STANFORD U	
UC	ASSIST	ASSEMBLER	PENN STATE	
UC	WATBOL	ASSEMBLER	WATERLOO U	
UC	ALGOL	COMPILER	IBM	
UC	ALGOLW	COMPLIER	STANFORD U	
UC	CALGOL	COMPILER	UCLA	
UC	FORTTRAN G	COMPILER	IBM	
UC	FORTTRAN H	COMPILER	IBM	
UC	LISP 360	INTERPRETER/COMPILER	UNSUPPORTED	
UC	PLI F	COMPILER	IBM	
UC	PLI OPTIMIZER	COMPILER	IBM	

UC	PLC	COMPILER	CORNELL
UC	SNOBOL4	COMPILER	
UC	WATFIV	IV COMPILER	WATERLOO U
UC	PASCAL 8000	COBOL COMPILER	TOKYO U
UC	APL*PLUS	COMPILER	STSC
UC	MIX	LANGUAGE	CCN
UC	PL 360	LANGUAGE	STANFORD U
UC	FLECS	STRUCTURED PROG	
UC	MORTTRAN	STRUCTURED PROG	STANFORD U
UC	ALTRAN	ALG SYMBOLIC MANIPULATOR	BELL LABS
UC	SIMSCRIPT II.5	SIMULATION LANGUAGE	CACI
UC	DYNAMO	SIMULATION	MIT
UC	GPSS	DISCRETE SIMULATION	IBM
UC	ENPORT	SIMUL SYS	
UC	GASPIV	SIMUL SYS	
UC	GPSSV	SIMUL SYS	
UC	SSL4	SIMUL SYS	
UC	WYLBUR	EDITOR	OLB
UC	FMS	TEXT FORMATTING	CCN
UC	RPG	REPORT GENERATOR	IBM
UC	APPTEK	GRAPHICS	
UC	BMD	STAT ANAL PROGRAM	UCLA
UC	CALFORM	GRAPHICS	HARVARD
UC	CSMP	SYSTEM MODELING	IBM
UC	DATA TEXT	STAT ANALYSIS	
UC	ECAP	CIRCUIT ANALYSIS	IBM
UC	ESP	ANALYSIS	
UC	IMSL	MATH STAT SUBR PACKAGE	
UC	MPS360	LINEAR PROG SYS	IBM
UC	NASTRAN	STRUCTURAL ANALYSIS	NASA
UC	OSIRIS III	STAT PACKAGE	U OF MICHIGAN
UC	PLOT 10	PLOT PKG	TEKTRONIX
UC	REDUCE	ALGEBRAIC MANI	UNIV UTAH
UC	SAP IV	STRUCT ANAL PROGRAM	BERKELEY
UC	SORT	IBM SORT/MERGE	IBM
UC	SOUPAC	STAT PKG	U OF ILLINOIS
UC	SPEAKEASY	BATCH LANG NUMER CAL	ANL
UC	SPICE	CIRCUIT ANALYSIS	BERKELEY
UC	SPSS	STAT ANAL	SPSS INC
UC	SUPERMAP	SYNAGRAPHIC MAPPING	HARVARD
UC	SYMAP	3-D SURFACE PLOTTING	HARVARD
UC	SYMVU	3-D SURFACE PLOTTING	
UC	TAYLOR	ALG SYMB MANI	CAMBRIDGE
UC	TS OLMS	MATH SYSTEM	CCN
UC	ESP/TSP	STAT PKG	
UC	MINITAB	STAT PKG	
UC	MULTIV	STAT PKG	
UC	NT-SYS	STAT PKG	
UC	SAS	STAT PKG	
UC	SSA	STAT PKG	
UC	EISPAC	MATH SYS	
UC	FUNPACK	MATH SYS	

UC	HARWELL	MATH SYS	
UC	SSP	MATH SYS	
UC	ETABS	STRUC ANAL	
UC	FLUSH	STRUC ANAL	
UC	NONSAP	STRUC ANAL	
UC	USER FTP	NETWORK FILE TRANSFER	CCN
UC	READMAIL	MSG SYS	CCN

NSW TOOLS

IC	MACRO	ASSEMBLER	DEC	BBN
IC	MACRO20	ASSEMBLER		
IC	EMLOAD	PRIM EMULATOR	ISI	BBN
IC	JIGSAW	PRIM EMULATOR	ISI	BBN
IC	PRIM	PRIM EMULATOR	ISI	BBN
IC	U1050	PRIM EMULATOR	ISI	BBN
IC	UKY20	PRIM EMULATOR	ISI	BBN
IC	SOS	EDITOR	DEC	BBN
IC	TECO	EDITOR	BBN	BBN
IC	XED	EDITOR	ISI	BBN
IC	MRUNOFF	TEXT FORMATTER	BBN	BBN
IC	BDDT	DEBUGGER	BBN	BBN
IC	IDDT	DEBUGGER	BBN	BBN
IC	LINKER	LINKER	DEC	BBN
IC	FTP	FILE TRANSFER PRGRM	DEC	BBN
IC	HOSTAT	ARPA UTILITY	BBN	BBN
IC	NETSTAT	ARPA UTILITY	BBN	BBN
IC	SPELLDICT	SPELLING DICTIONARY	BBN	BBN
IC	DESCRIBE	NSW HELP	BBN	BBN
IC	SPELL	SPELLING CORRECTOR	BBN	BBN

TBH TOOLS

IC	CALENDAR	SIMPLE DMS		
IC	FAIL	ASSEMBLER		
IC	GPM	ASSEMBLER		
IC	MACN11	ASSEMBLER		
IC	MIDAS	ASSEMBLER		
IC	PAL10	ASSEMBLER		
IC	PAL11X	ASSEMBLER		
IC	ALGOL	COMPILER		
IC	BASIC	COMPILER		
IC	BLISS	COMPILER		
IC	COBOL	COMPILER		
IC	FORTRAN	COMPILER		
IC	BCPL	COMPILER		
IC	F40	OLD FORTRAN COMPILER		
IC	FASBOL	SNOBOL RELATED		
IC	AID	INTERP LANG		
IC	L10	LANGUAGE		
IC	LISP	LANGUAGE		
IC	RLISP	LISP		
IC	PPL	LANGUAGAE		
IC	REDUCE	LANGUAGE		
IC	SAIL	LANGUAGE		
IC	SNOBOL	LANGUAGE		
IC	UCILSP	LISP LANG		



IC	MIDAS	LANGUAGAE
IC	LIBSIM	SIMULA LIB
IC	SIMULA	LANGUAGE
IC	BEDIT	EDITOR
IC	BXED	EDITOR
IC	FED	CAM EDITOR
IC	NETED	EDITOR
IC	POET	EDITOR
IC	BH	EDITOR
IC	HTECO	HP TECO
IC	DNLS	NLS FOR DISPLAYS
IC	NLS	DOC PREPARER
IC	RUNOFF	TEXT FORMATTER
IC	RUNOUT	DOC SYS
IC	SCRIBE	DOC FORMATTER
IC	TNLS	TERMINAL NLS
IC	XNLS	EXPER NLS
IC	COBDDT	COBOL DEBUGGER
IC	FORDDT	FORTRAN DEBUG
IC	SDDT	DEBUGGER
IC	UDDT	DEBUGGER
IC	LINK10	DEC 1FO LINK/LOADER
IC	LINK11	PDP 11 LINK/LOADER
IC	LOADER	LINK/LOADER
IC	LNKX11	LOADER FOR 11 CODE
IC	TENLDR	LOADER
IC	TENLOAD	LOADER
IC	CREF	CROSS-REF GEN
IC	GLOB	GLOBA SYM CREF
IC	JOB DAT	REL SYM FILE
IC	FLOW	FORT FLOWCHART
IC	DFTP	DATA COMP UTILITY
IC	COPYM	FILE UTILITY
IC	DELVER	FILE UTILITY
IC	DROP	FILE UTILITY
IC	DUMPER	FILE UTILITY
IC	FILCOM	FILE UTILITY
IC	FILECK	FILE UTILITY
IC	FILEX	FILE UTILITY
IC	FRKCOM	FILE UTILITY
IC	FUDGE2	REL FILE UTILITY
IC	IMGPTP	FILE UTILITY
IC	PIP	FILE UTILITY
IC	RUNFIL	CMD FILE UTILITY
IC	TYPBIN	FILE UTILITY
IC	FILES	FILES UTILITY
IC	11COPY	PDP-11 COPY UTILITY
IC	BCDTAP	TAPE UTILITY
IC	BSYS	TAPE UTILITY
IC	CAM	SRC UPDATE
IC	DTACOPY	TAPE UTILITY
IC	EBCTAP	TAPE UTILITY

IC	MTACPY	TAPE UTILITY
IC	TAPCNV	TAPE UTILITY
IC	TAPRD	TAPE UTILITY
IC	FORLIB	FORT LIB
IC	LIB40	FORTRAN LIB
IC	LIBOL	COBOL LIB
IC	STRLIB	?
IC	LIBRARY	LIBRARY
IC	2COL	2 COLUMNS OUTPUT
IC	ASNDEV	DEVICE UTILITY
IC	BCPLB2	BCPL UTILITY
IC	CCL	SYS UTILITY
IC	CHKPNT	ACCT UTILITY
IC	CML	?
IC	DCOPY	DIABLO UTILITY
IC	DSKAG	?
IC	DX	?
IC	ECAP	CIRCUIT ANALYZER
IC	EXTRACT	?
IC	FLIST	FORT UTILITY
IC	FOROTS	FORT RUN SYS
IC	GROUP	SYS UTILITY
IC	GRPSTS	SYS UTILITY
IC	GRPUSR	SYS UTILITY
IC	HELPER	?
IC	HP	HP TERMINAL UTILITY
IC	IMP40	?
IC	ISAM	?
IC	IVER	?
IC	LD	SYSTAT
IC	LOGOS	?
IC	LOWTSA	?
IC	LP	SYS UTIL FOR L P
IC	MAXIM SAV 100	SYS UTILITY
IC	MULTI	MULTI FORK EXEC
IC	NOUTPRC	?
IC	PA1050	SYS UTILITY
IC	PCSAMP	SYS UTILITY
IC	QXPAND	MACRO UTILITY
IC	RECORD	PSEUDO TERMINAL
IC	RENBR	RENUMBER UTILITY
IC	RENUM	RENUMBER UTILITY
IC	RJS	REMOTE JOB SERVICE
IC	RNAMF	?
IC	RESEXEC	RESOURCE SHARING EXEC
IC	SECURE	TERMINAL UTILITY
IC	SELOTS	?
IC	NTELNET	NEW TELNET
IC	SENDPRINT	?
IC	SORT	SORT PKG
IC	SPSOTS	STAT PKG
IC	SPSS	STAT PKG

IC	SRCCOM	SRC COMPARE UTILITY	
IC	SSP	?	
IC	STENEX	TENEX JSYS	
IC	SUBMIT	BATCH SUPPORT	
IC	TALK	TERMINAL UTILITY	
IC	TELL	SYS PREFORMANCE UTILITY	
IC	TELNET	SYS COMM	
IC	TIPCOPY	ARPA UTILITY	
IC	TIPLINES	ARPA UTILITY	
IC	TIPSTAT	ARPA UTILITY	
IC	TSET	NLS UTILITY	
IC	TSO	?	
IC	TTYTST	TERMINAL TEST	
IC	TYPREL	REL UTILITY	
IC	WATCH	SYS UTILITY	
IC	WHAT	SYS PERF UTILITY	
IC	WHO	SYSTAT	
IC	XGP	XEROX GRAPH UTILITY	
IC	XLP	XEROX GRAPH UTILITY	
IC	ZCONFER	?	
IC	ASTATUS	?	
IC	DO	RUNFIL CMD UTILITY	
IC	FIND	?	
IC	GFIN	?	
IC	HP2600	HP UTILITY	
IC	HP35	HP UTILITY	
IC	HP42	HP UTILITY	
IC	HPCAL	HP UTILITY	
IC	HPEN	HP UTILITY	
IC	SEND	?	
IC	SETLCL	HP UTILITY	
IC	SETTRN	HP UTILITY	
IC	WHOIS	SRI NAME SERVER	SRI
IC	BANANARD	OLD MSG SYS	
IC	HERMES	MAIL SYS	
IC	MAILBOX	MAIL SYS	
IC	MAILER	MAIL SYS	
IC	MAILSYS	MAIL SYS	
IC	MSG	NLS MSG SYS	
IC	NETMAIL	MAIL SYS	
IC	RD	MAIL DMS	
IC	READMAIL	MAIL SYS	
IC	SNDMSG	MAIL SYS	

NSW TOOLS

IE	MACRO	ASSEMBLER	DEC	BBN
IE	BCPL	COMPILER	BBN	BBN
IE	SOS	EDITOR	DEC	BBN
IE	TECO	EDITOR	BBN	BBN
IE	XED	EDITOR	ISI	BBN
IE	MRUNOFF	DOC SYS	BBN	BBN
IE	BDDT	DEBUGGER	BBN	BBN
IE	IDDT	DEBUGGER	BBN	BBN
IE	FTP	FILE TRANSER PRGRM	BBN	BBN
IE	LINKER	LINKER	DEC	BBN
IE	HOSTAT	ARPA UTILITY	BBN	BBN
IE	NETSTAT	ARPA UTILITY	BBN	BBN
IE	SPELL	SPELLING CORRECTOR	BBN	BBN
IE	DESCRIBE	NSW HELP	BBN	BBN
IE	CONCORDANCE	CREF FOR BCPL	BBN	BBN
IE	ECL	LANGUAGE	HARVARD	BBN
IE	PSAVE	BCPL UTILITY	BBN	BBN

TBH TOOLS

IE	FAIL	ASSEMBLER
IE	GPM	ASSEMBLER
IE	MACN11	ASSEMBLER (PDP-11)
IE	ALGOL	COMPILER
IE	BASIC	COMPILER
IE	BLISS	COMPILER
IE	COBOL	COMPILR
IE	FORTRA	COMPILER
IE	PASCAL	COMPILER
IE	BASOTS	BASIC PLUS2
IE	FASBOL	SNOBOL RELATED
IE	SIMULA	LANGUAGE
IE	AID	INTERP LANG
IE	L10	LANG (NLS)
IE	LISP	LANGUAGE
IE	PPL	LANGUAGE
IE	SNOBOL	LANGUAGE
IE	MIDAS	LANGUAGAE
IE	SAIL	LANGUAGE
IF	BEDIT	EDITOR
IE	BXED	EDITOR
IE	EMACS	EDITOR
IE	FED	EDITOR FOR CAM
IE	POET	EDITOR
IE	TV	CRT EDITOR
IE	BH	EDITOR

IE	HTECO	HP TECO
IE	NLS	EDITOR
IE	DNLS	NLS FOR DISPLAYS
IE	RUNOFF	TEXT FORMATTER
IE	RUNOUT	DOC SYS
IE	SCRIBE	DOC FORMATTER
IE	TNLS	NLS FOR TERMINALS
IE	COBDDT	COBOL DEBUG
IE	FORDDT	FORT DEBUGGER
IE	PSDDT	PASCAL DEBUGGER
IE	LINK10	DEC 10 LINK/LOAD
IE	LINK11	PDP 11 LINK/LOAD
IE	11COPY	PDP-11 COPY UTILITY
IE	BSYS	TAPE UTILITY
IE	CNVRT	SRC CONVER UTIL
IE	DELVER	FILE UTILILTY
IE	DUMPER	FILE UTILITY
IE	PIP	FILE UTILITY
IE	RENFIL	CMD FILE UTILITY
IE	SRCCOM	SRC COMPARE UTILITY
IE	TIPCOPY	NET FILE COPY
IE	DO	RUNFIL CMD UTILITY
IE	FORLIB	FORT LIB
IE	LIBOL	COBOL LIB
IE	LIBSIM	SIMULA LIB
IE	SIMLIB	SIMULA LIB
IE	PASLIB	PASCAL LIB
IE	2COL	2 COLUMN OUTPUT UTILITY
IE	CAM	SOURCE UPDATER
IE	CML	?
IE	CSORT	?
IE	DCOPY	DIABLO UTILTY
IE	DFTP	DATA COMPUTER UTILITY
IE	DNTIME	?
IE	DSKAGE	?
IE	ECAP	CIRCUIT ANALYZER
IE	FIGURE	?
IE	FOROTS	FORT RUN SYS
IE	FRKCOM	FILE UTILITY
IE	GRPSTS	SYS UTIL
IE	IVER	?
IE	JOBDAT	SYM FILE FOR REL
IE	LD	SYSTAT
IE	LPTSPL	?
IE	MACSIM	?
IE	MONSYM	?
IE	PA1050	SYS COBOL UTILITY
IE	PIX8	LP UTILITY
IE	QXPAND	MACRO UTILITY
IE	RENBR	RENUMBER UTILITY
IE	RENUM	RENUMBER UTILITY
IE	RJS	REMOTE JOB SRVC

IE	RSEXEC	RESOURE SHARE EXEC
IE	SCAN	?
IE	SELOTS	?
IE	SLEEP	?
IE	SPSS	STAT PKG
IE	SSP	?
IE	STENEX	TENEX SYSTEMERR
IE	SYSERR	SYS UTILITY
IE	TAGS	?
IE	TECPUR	?
IE	TELNET	SYS COMM
IE	TSET	NLS UTILITY
IE	TTYTST	TERMINAL TEST
IE	TYPBIN	BINARY UTILITY
IE	TYPREL	REL UTILITY
IE	ULIST	?
IE	WHAT	SYS PERF UTILITY
IE	WHO	SYSTAT
IE	XGP	XEROX GRAPHICS UTILITY
IE	XLP	XEROX UTILITY
IE	ASTATUS	?
IE	CLEAN	?
IE	FINE	?
IE	GFIND	?
IE	HP2600	HP UTILITY
IE	HP35	HP UTILITY
IE	HP42	HP UTILITY
IE	HPCAL	HP UTILITY
IE	HPEM	HP UTILITY
IE	MM	?
IE	PHOTO	?
IE	SETLCL	HP UTILITY
IE	SETTRN	HP UTILITY
IE	BANANARD	OLD MAIL
IE	BBOARD	MSG UTILITY
IE	HERMES	MAIL
IE	MAIL	MAIL SYS
IE	MAILBOX	MAIL SYS
IE	MAILER	MAIL SYS
IE	MAILSTAT	MAIL SYS
IE	MSG	MAIL SYS
IE	MSGNLS	NLS MAIL SYS
IE	NTELNET	NEW TELNET
IE	OTELNET	OLD TELNET
IE	RD	MAIL SYS
IE	RDMAIL	MAIL SYS
IE	SNCMSG	MAIL SYS
IE	SEND	MSG SYS
IE	WHOIS	SRI NAMESERVER
IE	HELP	SYS INFO
IE	HELPER	?
IE	SPELLDICT	SPELLING DICTIONARY

NSW TOOLS

RM	ALM	ASSEMBLER	HIS	HIS
RM	PDL	COMPILER	CFG	HIS
RM	PL1	COMPILER	HIS	HIS
RM	BASIC	COMPILER	HIS	HIS
RM	PDL	COMPILER	HIS	HIS
RM	FORTRAN	COMPILER	HIS	HIS
RM	QEDX	EDITOR	HIS	HIS
RM	RUNOFF	DOC FORMATTER	HIS	HIS
RM	RUN	RUNS MULTICS OBJ SEG	HIS	HIS
RM	HELP	USER SYSTEM AID	HIS	HIS
RM	SPELL	SPELL CORRECTER	HIS	HIS

TBH TOOLS

RM	CONSISTENT-SYSTEM	MIS	RCI	
RM	DIANA	MIS-ANALYSIS	RCI	
RM	DISCOURSE	GEOGRAPHIC MIS	RCI	
RM	JANUS	RELATIONAL DMS	RCI	
RM	LINUS	MRDS FRONT END	HIS	
RM	LISTER	SIMPLE DMS	HIS	
RM	MIDS	DBMS	HIS	
RM	MRDS	RELATIONAL DBMS	HIS	
RM	META	CROSS-ASSEMBLER		
RM	ALGOL	COMPILER	HIS	
RM	BCPL	COMPILER	UNSUPPORTED	
RM	COBOL	COMPILER	HIS	
RM	JOCIT	JOVIAL COMPILER	RADC	
RM	JOVIAL	COMPILER	RADC	
RM	XPL	COMPILER	UNSUPPORTED	
RM	PASCAL	COMPILER	UNSUPPORTED	
RM	APL	LANGUAGE	HIS	
RM	LISP	LIST PROC LANG	UNSUPPORTED	
RM	SNOBOL	LANGUAGE	UNSUPPORTED	
RM	GASP	SIMULATOR	HIS	
RM	GPSS	GENERAL PURPOSE SIMUL SYS	HIS	
RM	EDM	EDITOR	HIS	
RM	EMACS	WORD PROC SYS	UNSUPPORTED	
RM	FAST	EDITOR&RUN FORT&BASIC	HIS	
RM	NETED	EDITOR		
RM	TECO	EDITOR	HIS	
RM	TED	EDITOR	UNSUPPORTED	
RM	MRPG	REPORT GENERATOR	HIS	
RM	WORDPRO	WORD PROC TOOLS	HIS	
RM	DEBUG	DEBUGGER	HIS	
RM	PROBE	DEBUGGER	HIS	
RM	MATHPAC	MATH PKG	HIS	

RM	SORT/MERGE	FILE UTILITY	HIS
RM	SPEEDTYPE	USER INPUT SYS	HIS
RM	UTILITY	GCOS UTILITY	HIS
RM	BMD	STAT PKG	HIS
RM	CADSAT	DESIGN & SPEC ANAL	
RM	CALC	CALCULATOR PRGRM	HIS
RM	GCOS	GCOS EMULATOR	HIS
RM	M-Graphics	MULTICS GRAPHICS PKG	HIS
RM	NET HOST STATUS	ARPA UTILITY	HIS
RM	OLPARS	PATTERN RECOGNITION SYS	RADC
RM	ORACLE	RELIABILITY SYSTEM	RADC
RM	PLOT10	TEKTRONIX GRAPHICS PKG	TEK
RM	WAVES	SEE OLPARS	RADC
RM	MAIL	MSG SYS	HIS
RM	USER TELNET	SYS COMM	HIS



The following two systems (TOPS20 at RADC and the UNIVAC 1100 series) are not part of the current NSW configuration, but are under consideration for inclusion into the NSW.

NSW TOOLS (under consideration)

R2	MACRO	ASSEMBLER	DEC
R2	BCPL	COMPILER	BBN
R2	SOS	EDITOR	UNSUPPORTED
R2	TECO	EDITOR	UNSUPPORTED
R2	XED	EDITOR	UNSUPPORTED
R2	MRUNOFF	REPORT GENERATOR	UNSUPPORTED
R2	BDDT	DEBUGGER	
R2	IDDT	DEBUGGER	UNSUPPORTED
R2	LINKER	LINKER	UNSUPPORTED
R2	FTP	FILE TRANSFER	DEC
R2	SRCCOM	SOURCE FILE COMPARE	UNSUPPORTED
R2	DESCRIBE	NSW HELPER	UNSUPPORTED
R2	HOSTAT	ARPA HOST STAT	UNSUPPORTED
R2	SPELL	SPELLING AID	UNSUPPORTED
R2	MS	MAIL UTILITY	DEC

TBH TOOLS

R2	FAIL	ASSEMBLER	UNSUPPORTED
R2	MIDAS	ASSEMBLER	UNSUPPORTED
R2	BLIS10	COMPILER	DEC
R2	FORTRAN	COMPILER	DEC
R2	LISP	COMPILER	UNSUPPORTED
R2	PASCAL	COMPILER	UNSUPPORTED
R2	APL	LANGUAGE	DEC
R2	FLECS	STRUCT FORT PREPROCESSOR	
R2	EDIT	EDITOR	DEC
R2	TV	EDITOR	DEC
R2	BEDIT	EDITOR	
R2	ZTECO	EDITOR	UNSUPPORTED
R2	RUNOFF	REPORT GENERATOR	DEC
R2	FRODDT	FORTRAN DEBUGGER	DEC
R2	SDDT	SYSTEM DEBUGGER	
R2	DDT	DEBUGGER	DEC
R2	UDDT	USER DEBUGGER	
R2	CREF	CROSS-REF GENERATOR	DEC
R2	FORFLO	FORTRAN FLOWCHARTER	UNSUPPORTED
R2	GLOB	GLOBAL SYMB UTILITY	UNSUPPORTED
R2	LINK	LINKER	DEC
R2	LINKJ	JOVIAL LINKER	
R2	FORLIB	FORTRAN RUN LIBRARY	DEC
R2	FILCOM	FILE UTILITY	DEC
R2	FILDDT	FILE UTILITY	DEC
R2	DUMPER	FILE UTILITY	DEC
R2	CHANGE	MAG TAPE UTILITY	UNSUPPORTED
R2	CLNUP	SYS UTILITY	UNSUPPORTED
R2	CNVRT	MAG TAPE UTILITY	UNSUPPORTED
R2	CVTALL	MAG TAPE UTILITY	UNSUPPORTED
R2	DUMP20	FILE UTILITY	
R2	FRKCOM	BIN FILE COMPARE UTILITY	

R2	MTCOPY	MAG TAPE UTILITY	UNSUPPORTED
R2	NOPERM	FILE UTILITY	UNSUPPORTED
R2	PHOTO	FILE UTILITY	UNSUPPORTED
R2	PIP	FILE UTILITY	DEC
R2	RUNFIL	CMD FILE UTILITY	UNSUPPORTED
R2	TAPDMP	TAPE UTILITY	UNSUPPORTED
R2	TCOPY	TAPE UTILITY	UNSUPPORTED
R2	ULTCMD	CMD PROCESSOR UTILITY	
R2	XSEARCH	FILE SEARCH UTILITY	UNSUPPORTED
R2	MAKLIB	LIBRARY UTILITY	DEC
R2	FUDGE2	LIB FILE UTILITY	UNSUPPORTED
R2	PA105Q	TOPS10 TO TOPS 20	DEC
R2	LD	SYSTAT	UNSUPPORTED
R2	MFEEXEC	MULTIFORKING EXEC	UNSUPPORTED
R2	AID	CALCULATOR PRGRM	UNSUPPORTED
R2	BASES	BASE 8 TO 10 CONVERTOR	UNSUPPORTED
R2	CNVLOW	UPPER CASE TO LOWER CNVRTR	UNSUPPORTED
R2	LWTOUP	LOWER CASE TO UPPER CNVRTR	
R2	TIMES	TIMES AT ARPA LOCATIONS	UNSUPPORTED
R2	HOSTS	ARPA UTILITY	UNSUPPORTED
R2	NETSTAT	ARPA UTILITY	DEC
R2	GUIDE	ON-LINE HELPER	UNSUPPORTED
R2	WHOIS	SRI NAMESERVER	SRI
R2	NTELNET	SYS COMMUNICATION	DEC
R2	SUSTEL	STANFORD TELNET	UNSUPPORTED
R2	TELNET	SYS COMMUNICATION	DEC
R2	MAIL	OLD MAIL UTILITY	DEC
R2	RDMAIL	OLD MAIL UTILITY	DEC
R2	TELNET	SYSTEM COMM	DEC
R2	OTELNET	OLD SYS COM UTILITY	DEC
R2	NMIALER	ARPA MAIL UTILITY	DEC
R2	SNDMSG	ARPA MAIL UTILITY	UNSUPPORTED

#### OTHER POTENTIAL TOOLS

R2	ALGOL	COMPILER	DEC
R2	BASIC	COMPILER	DEC
R2	COBOL-68	COMPILER	DEC
R2	DBMS	MIS	DEC
R2	IQL	INTERACTIVE QUERY LANG	DEC
R2	SORT/MERGE	SORT/MERGE	DEC

TBH TOOL

UN	CULL	CROSS-REF GENERATOR	UNIVAC
UN	DMS1100	DBMS	UNIVAC
UN	ED	EDITOR	UNIVAC
UN	FLAP	PRGM MONITOR	UNIVAC
UN	FLIT	DEBUGGER	UNIVAC
UN	HOST16	HOSTED SOFTWARE FOR UYK20	UNIVAC
UN	MAPPER	RELATIONAL DBMS	UNIVAC
UN	PMD	PRGM DIAGNOSTIC	UNIVAC
UN	SORT/MERGE	FILE UTILITY	UNIVAC

ANL	ARGONNE NATIONAL LABS	
BBN	BOLT BERANEK AND NEWMAN, INC	(DMC)
BERKELEY	UNIVERSITY OF CALIFORNIA AT BERKELEY	
CACI	CACI, INC	
CAMBRIDGE	CAMBRIDGE UNIVERSITY, ENGLAND	
CCN	UCLA, OFFICE OF ACADEMIC COMPUTING	(DMC)
CFG	CAINE FARBER AND GORDON	
MICHIGAN U	UNIVERSITY OF MICHIGAN	
NOSC	NAVAL OCEANS SYSTEMS CENTER	
OLB	ONLINE BUSINESS SYSTEMS	
RCI	RENAISSANCE COMPUTING INC	
SRI	STANFORD RESEARCH INTERNATIONAL	
STSC		
TOKYO	UNIVERSITY OF TOKYO, JAPAN	
WATERLOO	UNIVERSITY OF WATERLOO	

## APPENDIX B

### SAMPLE CANDIDATE TOOLS

A search of tool data bases for potential candidates for the AFLC demonstration has been made. Over 400 products applicable to the candidate TBHs were identified. Of course, many of these have limited applicability to the problems of the Air Logistics Centers involved. Therefore, the list of tools that follows for the four TBHs (UNIVAC 1108, IBM360, HONEYWELL 6180 and DEC20) should be treated as examples of what exists, and not all inclusive.

The search illustrates the problems that Users have when they don't have specific requirements. So many alternatives are available, that a logical selection cannot be made. That is where the TM guidelines could help. Identifying the specific needs would allow a search to narrow the candidates to the few candidates that have the potential to solve the User's tool needs. Possibly, NSW will have a data base of existing tools on-line so that future Users can implement their search in a structured manner.

The brief summaries that follow are based upon a cursory examination of tool information, results and documentation. No responsibility is taken for any mistakes made on our interpretation, and no endorsement of any of the products is implied. The tool products reported have been categorized as production, proven (may be supported or unsupported, but do not meet the requirements set by NSW for documentation, testing, etc.) and experimental.

AMPIC, IBM360, Logicon, Inc.

AMPIC is a program that structures, translates and symbolically executes other programs written in either higher order language or assembly code. EXPERIMENTAL.

ANSI FORTRAN Checker and Error Detector, UNIVAC1108, IBM360, H6180 and DEC20, SOFTOOL Inc.

This program checks FORTRAN programs to determine if they comply with the ANSI definition of FORTRAN (X3.9-1966).

AUTODOC, UNIVAC 1108, TRW-Houston.

AUTODOC automatically extracts and prints COMMON variable allocation and identification information. PROVEN.

AUTOFLOW, IBM360, Applied Data Research.

Autoflow generates program flowcharts from FORTRAN source. PROVEN.

Automated Test Data Generator, Univac 1108, NASA/JSC.

This system provides support to program testing at the unit level by identifying effective test case paths and the data constraints which must be satisfied to execute them. EXPERIMENTAL.

AUTORETEST, IBM360, TRW.

This system provides an automated comparison between selected old and new test parameters thereby allowing changes to have their test effects ascertained. PROVEN.

Automated Weapon Initialization Program, IBM360/370, General Dynamics

This system corrects a deficiency in the JOVIAL J3B-2 language by providing parallel initialization of J3B tables. PROVEN.

CADSAT, IBM 360/370, University of Michigan.

CADSAT describes requirements for information processing systems in machine processable form and provides for selective analysis of the requirements data base entered in the PSL language. PROVEN.

CALLREF, IBM360, TRW.

CALLREF processes object decks and creates a readable and useful cross-reference and calling tree printout for FORTRAN and BAL programs. PROVEN.

CCREF, UNIVAC 1108, TRW-Houston.

This program verifies the accuracy of COMMON data bases as it executes a given source tape. PROVEN.

Code Generator Generator Language, IBM360, College of William and Mary.

CGGL is a non-procedural language allowing the user to specify how a code tree is to be translated into machine code. EXPERIMENTAL

COMMENT, UNIVAC 1108, Jet Propulsion Laboratory.

This processor facilitates adding comments to any symbolic element. PROVEN.

COMPARE, UNIVAC 1108, Jet Propulsion Laboratory.

This program compares two files against each other and detects differences. PROVEN.

Critical Path Analysis Tool, UNIVAC 1108, Jet Propulsion Lab.

This system outputs an optimized PERT chart in the form of Gantt charts based upon WBS input data. PROVEN.

DAVE, UNIVAC 1108, University of Colorado.

DAVE performs data flow analysis of FORTRAN source. It detects such errors as dead variable definitions and uninitialized references. EXPERIMENTAL.

DECA, IBM360, Boeing Computer Services.

DECA provides designers with a consistent method for expressing and verifying their design. EXPERIMENTAL.

DEPCHT, UNIVAC 1108, TRW.

This program provides a quick and accurate subroutine cross-reference report. PROVEN.

DOCGEN, UNIVAC 1108 and IBM360, TRW-Houston.

This system selectively extracts program documentation from user source. PROVEN.

Dynamic Debugging Technique, UNIVAC 1108, Jet Propulsion Lab.

This debugger includes features like breakpoints, single step, assemble/disassemble and other useful routines. PROVEN.

EAVS, IBM360, General Research Corp.

EAVS is a system of tools for analyzing source programs written in either J3B-2 or FORTRAN. It is installed at Hill AFB and relies on measuring path coverage. EXPERIMENTAL - may be PROVEN.

FORTAN Automated Verification System, H6000, RADC.

This system analyzes and instruments FORTAN source and measures path coverage. PROVEN.

FORTAN Code Auditor, H6000, TRW.

This program enforces design, format, structural and other standards established a priori. PROVEN.

FORTAN INSTRUMENTER I, all, SOFTOOL, Inc.

This program automatically generates routine execution time profiles of FORTRAN programs. PROVEN.

FORREF, UNIVAC 1108, TRW.

FORREF provides the FORTRAN user with detailed cross-reference tables of selected FORTRAN symbolic elements. PROVEN.



IFTRAN, IBM360, General Research Corp.

This preprocessor structures FORTRAN code by extending the language to include needed constructs. PROVEN.

JIGSAW, IBM360 and UNIVAC 1110, TRW.

JIGSAW provides the capability to develop a structured JOVIAL J3 source program through the use of "structured" macro statements. PROVEN.

JOVIAL J73 Code Auditor.

This program collects language related utilization statistics and helps identify patterns. PROVEN.

JOVIAL J73 Cross Compiler, DEC20, Proprietary Software Systems.

This language front-end can be married to code generators for different code machines. PROVEN.

JOCIT, H6000, RADC.

This system can be used to generate JOVIAL/J3 compilers quickly and reliably. PROVEN.

JOVIAL Structured Design Diagrammer, H6180, Draper Labs.

This processor produces flow and invocation diagrams for JOVIAL J3 programs. PROVEN.

JPL Text Editor, UNIVAC 1108, Jet Propulsion Laboratory.

This program can be used to develop, edit and update UNIVAC formatted data files, tapes. PROVEN.

LEXICON, UNIVAC 1108, JPL.

This program reads a sequence of symbolic elements and writes out definitions in alphabetic order to produce a dictionary of COMMON block variables. PROVEN.

LIBRARIAN, IBM360, Applied Data Research.

This source program management system has many library features that can be employed to manage the program production cycle. PROVEN.

MAGIC, DEC20, Western Electric.

A computer graphics package that allows the use of smart terminals with interactive graphics. PROVEN.

MEDSYS, IBM360, Martin Marietta Corp. - Denver.

MEDSYS consists of a family of low cost interactive subsystems for specifying and analyzing requirements and designs. EXPERIMENTAL.

METRAN, IBM360, McDonnell Douglas Astronautics Co.

This meta translator is a general purpose tool used to generate language translators. EXPERIMENTAL.

Microprocessor Cross Assembler and Simulators, DEC20, Microtec.

This macro cross assembler and simulator library is written in FORTRAN and is available for INTEL 8080, 8086 and 8008, TI9900, F8, Motorola 6800/6801 and Z80 micro support. PROVEN.

Microprocessor Software Engineering Facility, UNIX-based, SOFTECH.

This integrated collection of tools is available to provide a programming environment for support of microprocessor and micro-computer software development. PROVEN.

MINI-UNIX, DEC20, Western Electric.

A version of UNIX that provides interactive support for software development. PROVEN.

MORTAN2, IBM 360, The National Energy Software Center.

This macro processor provides capability to expand the FORTRAN language to support things like string manipulation. PROVEN.

NBS Analyzer, IBM360, National Bureau of Standards.

This analyzer provides both static and dynamic capabilities when it comes to analyzing FORTRAN programs. PROVEN.

Overlay Manager, IBM 360, Systems Research Corp.

This processor provides real-time overlay support for any DEC-RDOS system. PROVEN.

Program Design Language, IBM360 and UNIVAC1108, CFG Inc.

This pseudo language acts as an aid in designing and documenting a program. PRODUCTION.

Program Evaluator and Tester, UNIVAC 1108, McDonnell Douglas Astronautics Co.

This automated verification system instruments FORTRAN code and measures test coverage. PROVEN.

QUICKDRAW, IBM360, National Computer Analysis.

This program is a syntax analyzer that scans COBOL, BAL, PL1 and FORTRAN source and automatically produces flowcharts, diagnostics and series of related cross-references. PROVEN.

RADAR, DEC20, John Bell Computer Services LTD (England).

This program facilitates recovery from a failure by allowing rational restructuring of files. PROVEN.

RALCRTPH, IBM360, The National Energy Software Center.

This system maps requirements at all levels so that concordance, consistency, and completeness can be checked. PROVEN.

S-FORTRAN, IBM360, H6000, Univac 1108 and some DEC, CFG Inc.

This structured FORTRAN preprocessor extends the current language capabilities to support modern programming techniques. PROVEN.

Source Code Analyzer, DEC20, NASA Goddard Space Flight Center.

This program extracts quantitative information pertaining to FORTRAN, like number of source lines and number of comments. PROVEN.

Source Code Analyzer/Halstead, DEC20, NASA Goddard.

This program extends the Source Code Analyzer to generate various sets of complexity measures and Halstead parameters. EXPERIMENTAL.

Software Design and Documentation Language, UNIVAC 1108, Jet Propulsion Laboratory.

This pseudo-language formats design statements to provide a structured representation of the design, with indentation and flow lines. PROVEN.

SPEAR, IBM360, General Dynamics.

This is an integrated software support system with extensive tool capabilities for JOVIAL J73. PROVEN.

SYDIM, IBM360, General Dynamics.

SYDIM provides the capability to add, delete or modify common data area declarations and also documents the data in a language independent form. PROVEN.

Superscreen, DEC20, Numeri-Comp. Inc.

This interactive series of programs for RDOS provides FORTRAN programmers with complete flexibility to layout their CRTs. EXPERIMENTAL (new product).

Symbol Dictionary Program, UNIVAC 1108, Teledyne Brown Engineering.

This program provides extensive symbol cross-reference information. PROVEN.

System Resource Measurement Program, H6000, NASA/JSC.

This software monitor can be used for performance measurement and evaluation. PROVEN.

TRACER, DEC20, Information Processing Techniques Corp.

This interactive run-time debugger is useful for isolating and repairing FORTRAN faults. PROVEN.

Universal Flowcharter, IBM360, HOS Inc.

This system produces structured design diagrams and concordances for source programs written in FORTRAN. PROVEN.

## APPENDIX C

### NSW-BASED TOOL REPOSITORY FOR THE AFLC TECHNOLOGY DEMONSTRATION

#### Objective

The objective of this scenario is to describe an environment that can be used by AFLC software engineers and managers to evaluate the utility of new software tool technology for the support of current and future embedded computer systems. This environment will consist of a repository of tools accessible through the NSW, as well as resources and services to assist AFLC personnel in evaluating the usefulness and applicability of software tool technology. Services to support the evaluation include a library of tool information, assistance in the design and implementation of evaluation procedures, and training in the use and evaluation of software tools.

#### Scope

The purpose of the NSW Software Tool Repository will be to serve as a mechanism for AFLC to evaluate the utility of specific software tools in regard to the AFLC software support environment. Based upon the results of a tool's evaluation, AFLC may determine that it would be beneficial to install a tool for further detailed evaluation or production use.

In order to accomplish this evaluation, AFLC users will need to access and use a variety of tools through the NSW. Information concerning the availability of tools will be required to assist AFLC in selecting candidate tools for the evaluation. Information concerning evaluation methodologies will be necessary to aid AFLC in formulating and implementing a cost-effective evaluation methodology, and training in tool use will be necessary to assure that the features and applications of the evaluated tools are understood by the AFLC evaluators.

All of these resources will serve to assist AFLC in determining the utility of tool technology. By using these resources and the NSW-resident software tools, AFLC will be able to determine the software tools most applicable and effective in the accomplishment of their mission. With this information and experience, the procurement, installation and use of software tools for AFLC software support environments will be able to be undertaken by AFLC with a high degree of confidence.

The NSW Software Tool Repository should not be viewed as a support environment, per se. Rather, it should be viewed as an aid to AFLC in evaluating potential tools for possible inclusion in software support environments within AFLC. As such, the NSW Tool Repository could serve as a powerful tool in the design and development of software support environments.

## Background

Software tools serve as powerful aids in the design, development, test, and operation of computer software. They assist the analyst, programmer, and manager by automating certain functions throughout the software life cycle, and by providing additional information concerning the software that would not otherwise be available. Both of these features tend to increase programmer productivity and reduce total life cycle costs. As embedded computer systems become more complex and long-lived, the importance of increased programmer productivity and reduced life cycle costs will be paramount throughout AFLC.

Despite these apparent advantages, the use of software tools is not widespread. Among the reasons for their lack of use are:

- \* Management is often reluctant to forsake traditional methods.
- \* Management imposes tools when the intended user does not perceive the benefits of using a tool.
- \* There is a lack of confidence in the capabilities of the available tools to solve the problems.
- \* The use of tools is thought to be too expensive.
- \* Information concerning the availability and capabilities of tools is limited.
- \* Available equipment may not be adequate to support the tool.
- \* A well-defined methodology for the evaluation and use of tools is lacking.

These concerns can only be answered through an assessment of the utility of software tool technology. NSW can serve as a software tool repository for the assessment of this technology.

## Approach

The NSW Software Tool Repository can be viewed as a multi-layered set of resources structured to facilitate an orderly assessment of software tool technology. A schematic of the structure is shown in Figure C-1 and described below.

At the core of the repository, is the actual tool software as installed in the NSW. At the present time, the Software Tool Repository for the NSW consists of about 60 installed tools on four tool bearing host computers. The NSW Tool Manager is currently formulating a Tool Installation Guide to provide guidance and procedures for the installation and verification of tools within the NSW.

The next layer consists of training resources. The effective use and evaluation of a software tool is contingent, to a large extent, on a complete

understanding of the tool's operation and application as well as an understanding of the use of the NSW. Training resources help to provide the foundation for this requisite understanding.

If an evaluation is to be successful, it must follow a systematic methodology in its design and implementation. Ad hoc evaluations too often result in little meaningful data at their completion to risk such an unstructured approach. Evaluation information, which is the next outer layer in the tool repository structure, supplies the information for the construction of a useful evaluation methodology.

The outermost layer of the tool repository structure consists of general tool information such as the availability of tools in the NSW. A specific example of such information is the tool inventory currently being prepared by the NSW Tool Manager. This inventory lists NSW installed tools on the four tool bearing host computers as well as tools that are currently installed on the hosts, but not installed on the NSW. This tool information is required to select a tool, or set of tools, for evaluation.

In procedural terms, the evaluation of a tool proceeds from the outer layers of the structure into the inner layers. As the procedures approach the center, actions become more specific and build on the information and actions of the previous outer layers. Figure C-2 illustrates the procedure flow in relation to the tool repository structure. A description of those procedures is presented below.

Step one consists of the selection of a set of possible applications and the corresponding technical and administrative constraints. The AFLC environment and mission comprise the information base for the derivation of the possible applications.

The second step consists of selecting the appropriate tools for the evaluation. The major input to this decision comes from the tool information present in the Tool Repository, as well as the application scenarios describing the Ada, SMITE, and configuration management tools.

In the next step, an evaluation methodology that is both appropriate to the possible applications and the selected tools is designed and implemented. The evaluation information layer of the tool repository provides the information resource for this step of the evaluation process.

To make the most of the evaluation, the AFLC evaluators need to be trained in the features and use of the tool and the NSW. Available training resources such as manuals and tutorials supply the base for the attainment of proficiency in tool use and evaluation.

The final step, which corresponds to the innermost layer of the repository structure, consists of actually using the tool, gathering data pertinent to the evaluation, and evaluating the utility of the tool. NSW provides the tool software, operating system environment and computer hardware required to perform this step of the process.

Milestones

Establish training resources, evaluation information, and tool information.

Select initial set of possible applications.

Select candidate list of tools.

Perform evaluation in accordance with approach.

Refine approach and continue evaluating different tools and applications.



AFLC Environment

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Tool Information

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Evaluation Information

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Training Resources

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FIGURE C-1 NSW TOOL REPOSITORY

Repository	[Procedures]
AFLC Environment	[Derive possible applications]
-----	
Tool Information	[Select candidate tool(s)]
-----	
Evaluation Information	[Select evaluation methodology]
-----	
Training Resources	[Train Users in tool features and NSW]
-----	
NSW Tool Repository	[Use and evaluate tools]

FIGURE C-2 PROCEDURE FLOW IN RELATION TO THE TOOL REPOSITORY STRUCTURE

A decorative border with a repeating floral or scrollwork pattern surrounds the central text.

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**DE**