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The Improved Performance Research Integration Tool (IMPRINT) was developed for the Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED). This manual describes the professional version of IMPRINT, named IMPRINT Pro. IMPRINT Pro is government-owned and consists of a set of automated aids to assist analysts in conducting human performance analyses. IMPRINT Pro provides the means for estimating manpower, personnel, and training (MPT) requirements and constraints for new weapon systems very early in the acquisition process.

Some of the key features of IMPRINT Pro are:

- Includes extensive MPT data libraries on existing weapon systems
- Estimates operator and maintainer manpower requirements at the system, unit and force levels
- Provides task-based analyses that predict changes in performance as a function of changes in personnel characteristics
- Predicts performance effects of environmental stressors and sustainment training frequency
- Estimates crew workload
- Contains mission simulation models that aggregate task performance

ARL HRED distributes IMPRINT Pro. For more information about IMPRINT Pro or to obtain a copy of IMPRINT Pro, please contact imprint-info@arl.army.mil.
What’s New in this Manual

The following list describes new features and enhancements to look for in this version of IMPRINT Pro:

- **Database-less installation**: this version of IMPRINT Pro is database-less, resulting in easier installation, updating and uninstallation of the application. Because data is stored as separate .xml files rather than inside a database, analyses are quicker and easier to import, export and backup and require less space on your system overall.

- **MMF Mission Builder**: this separate application allows you to create the basic framework of a mission (tasks, functions, goals, operators) in an external application. This application is geared towards MMF users and uses the MMF terminology. It can, however, be used to create a generic IMPRINT Pro (i.e., non-MMF) mission as well.

- **Task Sequence Chart**: The Task Sequence Chart displays all task activity that occurred during a model run in the form of a Gantt chart.

- **Mission Time Drivers chart**: This chart displays a subset of information contained by the Task Sequence Chart, specifically those tasks which contribute to the critical path of the mission and Task Sequence Chart. All task data displays in a Gantt chart format.

- **Task Network Exporting**: export your entire task network to Microsoft Excel as a table.

- **Remote and Local Server Setup**: share analysis files between one or more machines over a common network.

- **Disable Reports Option**: temporarily disable reports to bypass post-processing time. By disabling the reports the simulation clock time and duration of the model run may be immediately viewed in the output window once the model run completes.

- **Personnel Forecast Report (previously Personnel Attributes)**: For every operator in your analysis having a unique specialty, the Personnel Forecast Report displays the number of people of that specialty who will be available over the course of the next five years. Estimates are broken down by E-level (E3, E4...E9).
Specialty Utilization Report (for Operations, Maintenance and Forces): For users who regularly use the Army Military-Civilian Cost System (AMCOS) to estimate the cost of using a fixed number of military personnel for a specific number of years, the Specialty Utilization Report is designed to provide you information about the utilization of all the specialties in your model run which may then be used as a basis for the data you enter into AMCOS.

Network Workload Monitors: in addition to the Animator window, workload monitoring may now be done directly in the Network Diagram window by adding workload monitors as desired. The workload totals displayed by the monitors update as the simulation progresses.

Charts: chart the values of variables at run-time. Variables can be plotted against other variables.

Custom Training Moderators: Now besides adding your own custom stressors to your model, you can also add custom training to impact task performance.

Revised Workload Strategies: the previous workload strategies of E and F (reallocation of new task and reallocation of ongoing task to contingency operator) has now been combined to a new strategy E. This strategy has been enhanced by a new dropdown list which now not only allows you to choose either the new task or an ongoing task to get reallocated but among all ongoing tasks, namely by highest priority, lowest priority, highest difficulty, lowest difficulty and by how recently the task was added relative to other tasks.

About this Manual

The IMPRINT Pro User Guide contains the following volumes, chapters, and glossaries:

Volume 1—IMPRINT Pro Basic Procedures

Chapter 1 Introduction

This chapter contains an overview of IMPRINT Pro, lists the contents of the guide, explains how to use the online help feature, and outlines the conventions used in documentation.
Chapter 2 Installing IMPRINT Pro
This chapter describes system requirements and how to install and start IMPRINT Pro.

Chapter 3 Understanding IMPRINT Pro Analyses
This chapter describes the various elements of a IMPRINT Pro analysis. Sections are arranged around conducting analyses of system missions and equipment. This chapter includes descriptions of the IMPRINT Pro interfaces, data collection, and analysis features. The chapter concludes with a general discussion of the steps involved in creating, debugging, and running IMPRINT Pro analyses.

Chapter 4 Understanding the IMPRINT Pro Window
This chapter presents an overview of the components of the IMPRINT Pro window and how to move, resize, hide, display, close, and dock the window panes.

Chapter 5 IMPRINT Pro Menu Structure
This chapter describes the elements of the IMPRINT Pro menu structure and identifies the capabilities and features available under each element.

Appendix A Technical Description of Stressor Implementation
This appendix contains a discussion of the Evaluation of Human Performance under Diverse Conditions using Modeling Technology.

Appendix B Human Performance Micromodels
This appendix contains a list of micromodels available in IMPRINT Pro.

Appendix C
This appendix describes the impact of Training and Personnel Characteristics on taxons.

Appendix D
This appendix outlines the steps required to set up your machine to use Local Server and Remote Server functionality within IMPRINT Pro.
Appendix E

This appendix lists the differences in functionality between IMPRINT 7 and IMPRINT Pro.

Glossary

The glossary contains a listing of the terms used in IMPRINT Pro.

**Volume 2 – Developing Analyses in IMPRINT Pro**

Chapter 1 Basic Procedures

This chapter describes how to create, open, and save analyses, export and import analyses and results, and search for text.

Chapter 2 Understanding the IMPRINT Pro Window

This chapter presents an overview of the components of the IMPRINT Pro window and how to move, resize, hide, display, close, and dock the window panes.

Chapter 3 Overview of Analyses

This chapter describes the elements of an IMPRINT Pro Analyses, including Warfighter, Missions, Equipment, and User Stressor.

Chapter 4 Warfighters Data

This chapter describes how to enter the data needed to describe the warfighters that will operate, maintain, supply and support the system.

Chapter 5 Mission Analysis

This chapter describes the IMPRINT Pro Mission module and is divided into several parts, described below.

Subchapter 5.1 Mission Network Diagram

This subchapter describes how to create a mission model network diagram that describes the system mission.

Subchapter 5.2 Working With Missions

This chapter describes the parameters for mission model components:
tasks, networks, comments, groups, variables, functions, events, and snapshots. It also describes how to establish performance parameters for the tasks, including time, accuracy, and workload.

**Subchapter 5.3 Running the Mission**
This chapter describes the settings that control model execution, including speed options. How to check a model for syntax and logic errors is also discussed.

**Subchapter 5.4 Mission and Personnel Reports**
This chapter describes methods used to analyze the model data and how to create charts displaying the values of variables during execution. How to export and open trace, queue, snapshot and task data files is also discussed.

**Chapter 6 Equipment Analysis**
This chapter describes the IMPRINT Pro Equipment analysis capability and is divided into several parts, described below.

**Subchapter 6.1 Equipment Data**
This subchapter describes how to enter the data needed to describe the system equipment, so that IMPRINT Pro can assess maintainability and availability of the system.

**Subchapter 6.2 Scenarios**
This chapter describes the parameters for operational scenarios: segments, maintainer manning, and sparing.

**Subchapter 6.3 Running the Equipment Scenario**
This chapter describes the settings that control model execution, including speed options.

**Subchapter 6.4 Analyzing Equipment Results**
This chapter describes methods used to analyze the results data and how to create charts displaying the values of variables during execution.

**Chapter 7 Custom Performance Moderators**
This chapter describes how users can create their own performance
moderator equations (stressor and training algorithms) that can be used to affect task time and/or accuracy.

**Chapter 8 Force Data**
This chapter describes how to predict the manpower needed to perform the routine work done by a force unit. Similar to the Define Equipment module in IMPRINT Pro, the Force Data module operates using a stochastic model which relies on various inputs you provide.

**Chapter 9 Plugins**
This chapter describes how developers can create their own plugins to extend the runtime functionality of the IMPRINT Pro simulator.

**Glossary**
The glossary contains a listing of the terms used in IMPRINT Pro.

**Appendix A Technical Description of Stressor Implementation**
This appendix contains a discussion of the evaluation of human performance under diverse conditions using modeling technology.

**Appendix B Human Performance Micromodels**
This appendix contains a list of micromodels available in IMPRINT Pro.

**Volume 3—IMPRINT Pro Syntax Reference Manual**

**Chapter 1 Introduction**
This chapter contains an overview of IMPRINT Pro, lists the contents of the guide, explains how to use the online help feature, and outlines the conventions used in documentation.

**Chapter 2 Expressions**
This chapter explains the constants, variables, functions, comments, operators, statements, and loops used to create IMPRINT Pro expressions.

**Chapter 3 Built-in Macros**
This chapter discusses built-in IMPRINT Pro functions, including Model,
Chapter 4 Probability Distributions
This chapter discusses the twenty probability distributions that are available in IMPRINT Pro.

Appendix
This appendix contains a list of syntax errors and fixes.

Glossary
The glossary contains a listing of the terms used in IMPRINT Pro.

Using Online Help
IMPRINT Pro contains extensive online Help to assist you as you work. To display help contents, select Help from the Help menu.

Document Conventions
IMPRINT Pro documentation uses the following terms and typographical conventions:

- File names, variables, and program code are shown in this **typeface**.
- Labeled buttons, menu commands, and menu options are in bold. For example, Click **OK** to close the dialog box.
- Information that the user needs to enter is in Arial Italic. For example, enter **BO90001** in the text box.

Displaying Version Information
You can view version information for IMPRINT Pro. You may want to know
the version number when you are requesting technical support.

**To display version information:**

1. From the **Help** menu, select **About**.

   The About IMPRINT Pro dialog box information displays. The version number of the software is indicated.

2. To close the dialog box, click the ✗ in the upper right corner.
Technical Support

You can e-mail any questions you have regarding IMPRINT Pro to the following address:

imprint-info@arl.army.mil
Chapter 2: Installing IMPRINT Pro

This chapter presents the instructions for installing IMPRINT Pro. In this chapter, you will learn the following:

- Before you install IMPRINT Pro: what you need to know and what you should have on hand
- System Requirements for installing and running IMPRINT Pro
- How to install IMPRINT Pro
- How to start IMPRINT Pro

Before you install IMPRINT Pro

What you should know

If IMPRINT 7 is already installed on your machine, there is no need to remove it. Your IMPRINT 7 data and program executables are preserved during the IMPRINT Pro installation. It is, however, recommended that you export analyses prior to performing this installation.

If an older version of IMPRINT Pro is already installed on your machine, you may choose to install this updated version update using this same installer. By performing this update, a new version of IMPRINT Pro (version 3.0) installs on your machine while the older version also remains on your machine. This installation, however, remains separate from any previous installation of IMPRINT Pro on the system. This version, unlike previous versions of IMPRINT Pro, does not rely on the Microsoft SQL Server Database and therefore does not alter any existing files which are used by the pre-existing version of IMPRINT Pro. The first time the program is executed, however, all previously-existing analyses in the older version of IMPRINT Pro are scanned and copied into your new IMPRINT Pro 3.0 analysis tree. All analyses are then saved as Imprint Pro Analyses (.ipa) files in your system’s Documents and Settings...\Application Data\Alion Science and Technology - MA&D Operation\IMPRINT Pro\Data folder; all analyses exported from this new version are still exported as .xml-based IMPRINT Pro (.pro) files to the location of your choosing.

While data from your previous version is preserved during the update, it is recommended you export analyses prior to performing this update.
An electronic copy of the IMPRINT Pro user guide automatically installs with this update and is available in the Help menu. PDF copies of the user guide may also be found in the IMPRINT Pro/Documentation directory.

What you should have

Before you install IMPRINT Pro, check that you have the following items:

- IMPRINT Pro Installation CD

OR

- IMPRINT Pro installation files from download

System Requirements

All systems on which this version of IMPRINT Pro will be installed should be done so only by either an administrator or other user account having administrative privileges.

Hardware Requirements

The recommended hardware requirements to run IMPRINT Pro are the following:

- 1.5 GHz - Intel Pentium-class processor
- 512 megabytes (MB) of RAM (1 GB recommended)
- 1 gigabyte (GB) free hard disk space (additional space recommended as needed)
- 1280x1024 or higher-resolution display with 32-bit color quality
- Microsoft mouse or compatible pointing device
- CD-ROM

Software Requirements

Prior to running this installation of IMPRINT Pro, it is recommended that your system be updated with all available Microsoft Windows updates. The following are minimum operating system requirements:
Windows XP: Service Pack 2

Windows Vista

All systems on which IMPRINT Pro is to be installed are required to have the following components installed beforehand; these components are available through the IMPRINT Pro installation wizard or from files included with your IMPRINT Pro installation CD or download:

1. **Windows Installer 3.1**

   Windows Installer is part the Windows Operating System, but your system's current version may be out of date. The IMPRINT Pro setup will display an error and abort if this is the case. In most cases, you can determine if Windows Installer 3.1 is installed via Start → Settings → Control Panel → Add/Remove Program. Windows Installer 3.1 is available through the following link:


2. **Microsoft .NET Framework version 3.5 Redistributable Package**

   If the installation detects that the Microsoft .NET Framework 3.5 is not already installed, you will be prompted to install it. This item may be installed from the files included with your IMPRINT Pro installation CD or download. Please keep in mind that it may take several minutes to install.

---

**Installing IMPRINT Pro for the First Time**

For user accounts expected to run IMPRINT Pro with Administrative, Standard or Restricted access, the following steps must be performed by the **system administrator** installing this software.

**To install IMPRINT Pro:**

1. Log into the system with **Administrative** privileges.
2. Insert the IMPRINT Pro CD into your CD-ROM drive. Open Windows explorer and navigate to the files on the CD.

   OR

Download and unzip the IMPRINT Pro installation.

The files included in your installation are based upon the version of IMPRINT Pro currently distributed by ARL.

✓ Note:
   For more information on obtaining a copy of IMPRINT Pro contact imprint-info@arl.army.mil.

3. Navigate to the file called Setup.exe. Double-click this file to launch the IMPRINT Pro installation wizard which will guide you through the installation.

4. Follow the instructions that display on the screen to complete the installation process. You may install IMPRINT Pro using all default settings in this wizard.

   By default, IMPRINT Pro installs to the following directory:
   C:\Program Files\IMPRINT Pro 3.0

✓ Note:
   The folder indicated above is the default installation folder for IMPRINT Pro. You may choose to install this item to a location other than the default.

5. Once the installation is complete, exit the installation wizard and reboot.

6. Launch the IMPRINT Pro application.

   Upon starting IMPRINT Pro 3.0, you might be prompted to install the Microsoft .NET 3.5 Service Pack 1 framework. This framework is a free package available through Microsoft.com and is required for running IMPRINT Pro 3.0. If you are prompted, proceed to download and install this package. Once finished, reboot your machine, and then re-launch the IMPRINT Pro application.

7. By starting IMPRINT Pro the following folder(s) are created in Application Data directory belonging to the user account under which IMPRINT Pro is launched:

   Windows XP:
Chapter 2: Installing IMPRINT Pro

C:\Documents and Settings\[user]\Application Data\Alion Science and Technology - MA&D Operation\IMPRINT Pro\Data

Windows Vista:
C:\\Users\[username\\AppData\Roaming\Aion Science and Technology - MA&D Operation\IMPRINT Pro\Data

These folders store all IMPRINT Pro analyses in-progress (.ipa files) post import/creation and prior to export. They also contain the directory file (.ipd file) which keeps track of the analyses and folders in your application. In the event IMPRINT Pro 3.0 is later uninstalled through the IMPRINT Pro installation wizard or through the Control Panel, the Data directory(ies) above and all files they contain remain unless manually deleted. By re-installing IMPRINT Pro 3.0, you may resume access to and use of these analysis files as before.

For individual Vista machines having multiple user accounts: each account having its own unique login on the same local machine will have its own unique set of analysis files (.ipa and .ipd files) for IMPRINT Pro 3.0. locally on that machine.

You are now ready to use IMPRINT Pro.

Updating from version 0.0.8.43 and later

For any system already having a version of IMPRINT Pro (8.43a or later) installed, you may run the “Update” option in this installation to install this latest version of IMPRINT Pro.

To first determine your currently installed version,

1. Start up the IMPRINT Pro application.

2. Click the Help menu option located at the top of the IMPRINT Pro window.

3. Select the About option. Look for the version number in the window which appears.
Updating from versions prior to 0.0.8.43

In the rare case that an older version of IMPRINT Pro (older than 8.43a) is installed on your system, this older version must first be removed before installing this version of IMPRINT Pro. To do this, go to Start --> Settings --> Control Panel --> Add/Remove Programs and choose the option to remove IMPRINT Pro. (Do not, however, remove the MySQL application or any of its folders or files as they are also required to run IMPRINT 7 and IMPRINT Standard.)

Starting IMPRINT Pro

To start IMPRINT Pro:

1. Click the Start button, and then point to Programs.

2. Select IMPRINT Pro, and then select the IMPRINT Pro icon and program name. You can alternatively double-click the IMPRINT Pro icon on the desktop.

IMPRINT Pro opens.

Note:
After installing IMPRINT Pro and its supporting applications, you may start to add and import analyses to work on as desired. Before beginning any analysis work in IMPRINT Pro, however, we recommend that you first check your settings for your local server where your analyses will be saved. You may also optionally set your system up to work with a remote server in order to access files from a networked computer running the same version of IMPRINT Pro. For more information on setting up the Local Server and Remote Server Environments see “Local Server Environment vs. Remote Server Environment” on page 179.

Monitor Resolution Issues

For IMPRINT Pro users who have monitors which default to 120 dpi, you may notice an issue where many labels and text fields appear cut off. For example, on the task workload demand interface, the interfaces of the resource-interface pairs might appear completely cut off.

You may choose from one of the following three options:
✿ Leave your monitor's resolution at 120 dpi; this will result in labels appearing cut off.

✿ Change your monitor's resolution to 96 dpi and keep the resolution high; this will result in small text.

✿ Change your monitor's resolution to 96 dpi and change the resolution to be lower; this will result in larger text and smaller working windows, in terms of usability.
Chapter 3: Understanding IMPRINT Pro Analyses

This chapter presents an overview of IMPRINT Pro analyses. Sections discuss the components of IMPRINT Pro, including how to define Warfighters, Missions, Equipment, and User Stressor elements. The chapter concludes with a general discussion of the steps involved in creating, debugging, and running an IMPRINT Pro analysis.

Warfighters Module

The Warfighters module helps you estimate the type of people that will be available to operate and maintain the system you intend to model for the manpower, personnel and training (MPT) analysis.

This module lets you select Military Operational Specialties that are likely to be available, probably from a predecessor system, to operate and maintain the new system. It then permits you to see a profile of these specialties for the current year with estimates on their personnel characteristics.

Questions That Can be Answered in the Warfighters Module

- What types of people are currently in a specialty?
- What types of soldiers (in terms of personnel characteristics such as gender, education, etc.) may be available to operate, maintain, and support a system?
- What number of the soldiers in this specialty are Test Score Category IV?
- How many people of this specialty are high school graduates?
Elements of the Warfighters Module

The only element of the Warfighters module is the Warfighter. A Warfighter is any person or automated device that operates, maintains, supplies or supports military equipment; Warfighters are categorized as such (Operators, Maintainers and Supply and Support Personnel) as they are added to an analysis under the Warfighters node in the tree. Each Warfighter is described, at minimum, by a three-character specialty designation, for example 11B or 67U. Once the desired Warfighters have been added to your analysis, you may determine the Warfighter profile by running the Personnel Attributes report available through the Reports menu.

Mission Module

IMPRINT Pro allows you to analyze a new weapon system by helping you build models of each mission that the weapon system will be capable of accomplishing. Since it is typically easier to describe the mission by breaking it into smaller “sub” functions than trying to describe the mission as a whole, you build these models by breaking down the mission into a network of functions. Each of the functions is then further broken down into a network consisting of other functions and tasks.

Then, by executing the mission model simulation, you can study the range of results that occur in the mission. A description of the variability of each element can be obtained for further analysis.

IMPRINT Pro performs the simulation analysis based on how long you tell it to perform each task in the mission. In addition, with each task, you estimate accuracy levels and assign workload values that reflect the amount of effort the warfighter will have to expend to perform the task. During the simulation, IMPRINT Pro predicts task performance and calculates how much workload each warfighter was experiencing throughout the mission. In this way, you determine whether the warfighters were overloaded, and if so, how changes can be made to reduce the workload to an acceptable level.

At the completion of the simulation IMPRINT Pro can compare the minimum acceptable mission performance time and accuracy to the predicted performance. This will determine whether the mission met its performance requirements.
Questions That Can be Answered in the Mission Module

- How much effort must a Warfighter expend to perform a task?
- What is the amount of workload a Warfighter will experience throughout the mission?
- Are any Warfighters overloaded?
- Was the minimum performance time and accuracy of the mission completed as predicted?
- Were the performance requirements of the mission met?
- How will our new weapon system perform?

Elements of the Mission Module

The central element of Missions module is the task network. The task network encompasses the following elements:

- **Warfighters** who represent the operators performing the tasks in your model.
- **Tasks** which represent the steps in the process or “mission” you are attempting to model.
- **Task Attributes** that specify the parameters associated with each task, including warfighter assignment, time, accuracy, and workload.
- **Functions** which contain sub-networks of tasks.
- **Paths** which connect the functions and tasks in your model so as to direct the flow of entities running through your model when it is executed.
- **Goals** which represent events external to the network modeled but which can have an impact on your mission when they fire.
- **RI Pairs**, or resources and interfaces used by each operator in the mission.
- **Macros** that return values or perform procedures when they are called in tasks.
- **Variables** you define to represent changeable system states or characteristics, with values that change as tasks begin and end or scenario events occur.

- **Snapshots** that collect the values of particular variables when triggered by conditions that you specify.

- **External Events** that you schedule to occur at specific clock times to change the values of variables.

- **Charts** that display the values of selected variables at run-time.

- **Cultural Templates** that allows for the creation of a template to define the cultural and country differences that might cause people to react differently in a situation.

- **Plugins** that communicate with other applications.

These elements and their interrelationships are shown in the following diagram. The diagram does not show a logical flow of model execution, but illustrates the general relationships between the aspects of a model.
Chapter 3: Understanding IMPRINT Pro Analyses

Warfighters

Warfighters define a crew for your model. In an operational mission, Warfighters comprise Operators in your analysis who perform the tasks in your operations model. For each Warfighter you add, you can choose a specialty appropriate to the task the Warfighter will be assigned.

For each operator in the mission, you may additionally set a "default" flag to indicate that Warfighter's role in the system as well as a workload threshold and workload management strategy to help model realistic operator actions under conditions of work overload. Lastly, you may designate the operator as an automated device if the task is to be performed by a machine.

Tasks

A task represents the most basic building block in the mission you are modeling.
Task Attributes

Every task you add to your network can be defined by the following seven attributes:

- **Time and Accuracy** - the length of time this task usually takes and the likelihood this task will fail.
- **Effects** - the circumstances which must occur before, during and after the firing of this task.
- **Failure** - the consequences as a result of this task failing.
- **Crew** - the operators who will be performing the task.
- **Taxons** - the categorization used to describe the workload composition of your task in a way that can be understood by performance moderators.
- **Paths** - the decision logic describing the conditions under which each of the individual paths leaving a task are taken.
- **Workload Demand** - value(s) indicating the relative demand on an operator performing a task.

The execution time for each task varies within the parameters you supply (usually distribution type, mean time, and standard deviation). Additionally, as each task executes it can alter the state of the system with expressions called “effects.” Effects are executed either at the beginning or at the end of a task. For example, the beginning effect of a machine task might decrease the number of available machines by one while the ending effect would increase the number by one.

Each task can also check the state of the system before it executes and delay execution until a certain condition, called a release condition, is met. For example, assume you define a variable named `Workers` that tracks the number of available operators. If you have a task that requires an operator to perform it, the condition `Workers > 0` must be true for the task to execute.

Functions

Functions are the primary organizing items of the mission network and represent groups (or networks) of tasks. Functions do not have performance estimates of their own. Rather, they only encapsulate tasks.
**Paths**

After adding the functions and tasks to your network to describe the different steps in your model, you must add the paths between them to direct the flow of your model. When you execute a model, an entity starts at the task you designate as the starting point. The entity then travels along the paths(s), executing each task it encounters. When more than one path leaves a task, the decision on which path to take will be determined by the value set in the task’s decision node. Decision nodes are automatically added to a task by IMPRINT Pro and display in the network diagram as a diamond-shape on the end of a task node. Each contains a letter inside of it (S, T, P, or M) indicating the branching logic the entity should follow.

IMPRINT Pro uses four different branching logic decision types: Single, Tactical, Probabilistic, or Multiple. Tasks with Single nodes indicate the entity flowing through has only a single path it can follow at that point in the network. Tasks with Multiple nodes cause an entity to split up into multiple entities so that all paths out of the task are followed; these entities must later rejoin. The paths that the entity follows can vary, however, if you include probabilistic or tactical routing decisions. In a probabilistic decision, you specify the probability of each following task, and IMPRINT Pro selects the path to follow randomly within these probabilities. In a tactical decision, you specify the system conditions under which each following path can be selected. You can define these conditions and probabilities using expressions, operators, and variables that represent the state of the system.

**Goals**

IMPRINT Pro allows you to model human performance in a goal-driven context. This capability allows you to specify individual goals, the tasks associated with these goals, the triggering conditions, and the interaction of goals with each other and with workload.

**RI Pairs**

IMPRINT Pro provides capabilities for you to predict and assess the workload involved in performing tasks. This capability is consistent with well-known and documented theories of workload prediction, including the Wickens Multiple Resource Theory (MRT).  

Seven default human resources are provided within IMPRINT Pro. They include Auditory, Cognitive, Fine Motor, Gross Motor, Speech, Tactile and Visual. You can add more resources to the list if you desire. Additionally, you can identify specific interface elements (that is, controls and displays) that the warfighters will interact with. If your system design is not yet mature enough for that level of detail, then you can accept the default interface named “Crewstation.”

**Macros**

IMPRINT Pro uses two types of macros: built-in macros, which are available to all missions, and custom macros, which you define for use within a particular mission. Both macro types work in a similar manner. You can include the macro's name or call the macro in any expression. When IMPRINT Pro encounters the macro, it executes the macro and returns a value that can be used in the expression.

Built-in macros include the following categories:

- Modeling macros, which perform actions such as starting or stopping tasks, and pausing or stopping model executions.
- Mathematical macros, which perform mathematical operations, such as calculating the minimum and maximum and trigonometric functions.
- Distribution macros, which generate random numbers for task execution according to a certain distribution.

Custom macros are particularly useful for calculations or procedures that you want to execute at more than one place in a model. For example, you might create a macro to calculate task time based on new research you have available. You would embed the new calculation in a custom macro, and then "call" that macro in the task mean time expression.

When macros are called in IMPRINT Pro, they are followed by parentheses, for example `CalculateTime()`. To return a value from a macro, the macro itself must be defined with a return value (for example, an “integer”).

**Variables**

Variables are an important element in any model because they keep track of the state of the system. Five system variables are automatically created for each IMPRINT Pro model. Additionally, you can define variables specific to each model.
The variables you define can keep track of whatever is appropriate for the model—how many items are processed, what the current temperature is, or whether a machine is on or off. Variables give different tasks, queues, and scenario events a way to interact with each other because they can evaluate and modify variable values.

Default system variables include the following:

- **Clock** records elapsed time (in simulation time units) since the beginning of model execution.
- **Distributions** allow access to all the model distributions. Distributions are used to determine task execution times.
- **Entity** includes all the entity variables.
- **Model** is used to control model actions, such as halt and pause.
- **Task** includes all data attached to each task in the network model.

**Snapshots**

Snapshots provide a way to collect values of variables at specified times during model execution. You can specify snapshots to be gathered at specific clock times (one-time or repeating), when a task begins or ends, when an entity enters or leaves a queue, or when a model run ends.

**External Events**

External events provide a way for you to cause events to occur at specific times during mission model execution. These can be one-time events, or events that repeat at regular intervals. External events are often used to change variable values, thereby changing the state of the model. For example, you might have a variable called `temperature` that would increase at 15-minute intervals during the day and decrease during the night. You could then make the times required for tasks such as warming up an engine be contingent upon the current temperature.

**Charts**

The Chart option allows you to display a plot of one mission variable against another. Since the value of your model's variables is determined at run-time, the points representing these variables' values are plotted on the chart at run time as the animation progresses.
Cultural Templates

In IMPRINT Pro, cultural modeling is defined as the application of cultural or country based influences on human behavior or performance within a human performance model. Given a situation with the same physical conditions and the same resources, people from different cultures or countries may react to the situation and apply their resources differently. A cultural difference exists when the “average” reaction of a population from one culture differs from that of another.

IMPRINT Pro allows users to create and save profiles, or templates, which define the relevant cultural parameters for each culture modeled and the values derived from cultural data that are assigned to those parameters. One or more templates can be defined by the user. At execution time, the user selects the template that is to be used.

The user selects the cultural parameters that are affected by a selected culture and assigns the appropriate values for those parameters based on the cultural data. IMPRINT Pro also allows the user to specify default values for each cultural parameter. The default value is used when cultural data for a parameter is not available.

Equipment Module

The Equipment module helps you estimate the maintenance manhours required to attain acceptable system availability. This module lets you enter parameters that control such items as the maintenance manpower pools, the spare availability, and the combat damage potential. These parameters, coupled with a mission schedule and the data describing the maintenance actions that your system may need are combined in a stochastic maintenance simulation.

Questions That Can be Answered in the Equipment Module

- How many people of each specialty do I need in order to meet the system availability requirement?
- Which pieces of equipment (that is, subsystems) are the high drivers for maintenance?
- How should each organizational level be staffed?
How sensitive is my maintenance manpower requirement to the failure rates of individual components?

**Elements of the Equipment Module**

The elements of the Equipment module include Subsystem and Scenarios.

- **Subsystem.** You will break your Equipment analysis down into Subsystems. A major subsystem is typically something like an engine, landing gear, or main gun. Next, you will decompose your subsystem into components. Components are the individual pieces of equipment that have repair tasks attached. You can enter or edit maintenance data for all repair tasks associated with the components.

- **Scenarios.** A Scenario is a configuration defining the set of conditions under which the components will be used. You can develop many scenario data sets for each system. For example, you might want to create one scenario for a thirty day run and another scenario that contains input parameters for a ten day run. When you have selected a scenario, you can add mission segment data for that scenario. You can add, duplicate, and delete scenarios.

This interface contains the list of scenarios available for your maintenance analysis. In order to view more information about a scenario, highlight it and double-click. This will let you edit and review the scenario parameters.

**Force Module**

The objective of the Force Analysis module is to help predict the manpower needed to perform the routine and unplanned work done by a force unit. Similar to the Define Equipment module in IMPRINT Pro, the Force Analysis module operates using a stochastic model which relies on various inputs you provide.

**Questions answered by the Force Module**

- What is the elapsed time for my planned and unplanned activities?
What is the cumulative amount of time an activity was performed over the course of the entire model run?

What was the status of an unplanned activity during the model run?

How many unplanned activities failed because the minimum number of Leaders, Sub-Leaders and Members required for this unplanned activity could not be met?

Elements of the Force Module

Force Analysis Data consists of the following items:

- **Force Units.** A Force Unit is a group of individuals who perform activities according to a schedule.

- **Schedule.** A Schedule is a pre-defined sequence of activities, planned and unplanned, over a specific amount of time.

- **Planned Activity.** A planned activity is a routine task. Examples may include guard duty, hygiene, eating and sleeping.

- **Unplanned Activity.** An unplanned activity is an activity which interrupts a normal schedule. Examples may include fire and emergency.

- **Activities Trump Matrix.** The Activity Trump Matrix is used to set task priority within a schedule for when any two activities overlap.

- **Jobs.** Jobs are general tasks, or occupations, which makes up a force unit. A job is defined by a name, specialty, rank and role. Examples may include Tank Driver, Navigator and Analyst.

Custom Moderators

IMPRINT Pro user can create custom moderator equations, or more specifically custom stressors and custom training moderators, that can be used to affect task time or accuracy. Identify the moderator (for example, “vibration”), then enter algorithms that link levels of the moderator to performance impacts by taxon. This is a way to embed your own experimental findings into an IMPRINT Pro model.
Chapter 3: Understanding IMPRINT Pro Analyses

Plugins

IMPRINT Pro contains a powerful plugin interface that allows developers to extend the runtime functionality of the simulator. This API provides extensibility and flexibility that far exceed the External Model Call functionality of IMPRINT 7, yet is much easier to create, debug and use.

Using plugins in a model is simply a matter of calling a method defined on a plugin object, passing to it those values desired, and using the result (if any). This can be done from any code window in the program, for example the Effects, Release Conditions, or Expressions windows.

Any public method defined in the plugin class will be available to all analyses in IMPRINT Pro. Any use of a plugin method will be checked for type compatibility by the Syntax Checker; programmers are immediately alerted to problems with the plugin code through text displayed in the Output window.

How to Create an Analysis

This section presents an overview of the analysis process and provides some tips and pertinent questions to help make sure you are on the right track at each step. It also emphasizes the early steps to perform before you begin building an analysis in IMPRINT Pro.

While the steps in this list are numbered, keep in mind that the analysis process is iterative. You may go back and forth between various steps in the process as new ideas occur to you, and you may go through several revisions of the analysis before you reach a final version. There is no one correct sequence that you need to follow.

In general, however, you develop an analysis through the following process:

- **Determine the questions you want to answer.**

  Before you start building an analysis, be sure to think about what it is you are trying to determine. If you try to model the entire weapon system when all you really need to do is determine how many maintainers with a specific specialty you need to repair the diesel engine when it breaks, you will expend a lot of extra effort. Build the analysis to answer your questions,
rather than thinking of the questions after you build it. We recommend that you think of your analysis as though it were an experiment, by identifying dependent and independent variables. This will help make sure that your analysis is structured so that it will answer your question.

Determine the IMPRINT Pro modules that are best suited to your analysis needs. The “Questions that can be Answered” sections can help you identify the modules in IMPRINT Pro that will be most helpful to you.

❖ **Analyze the process you want to model.**

Once you know which IMPRINT Pro modules you will be using, you will know what data are necessary to support the analysis. If you choose the Mission module, you will need to be able to draw a diagram of the operational mission that you want to represent, and you will need to understand the flow of the mission thoroughly. Determine what tasks are involved in the process, the sequence in which they are performed, what resources they use, whether there are any restrictions on when they can be performed, and how they affect the overall system being analyzed. If you are using the Equipment module, you will need a list of the relevant subsystems and components in your system.

At this stage, we recommend that you proceed hierarchically. That is, begin by identifying high level elements of your system, and only decompose them if they impact the analysis you are performing.

❖ **Enter data.**

As you determine what tasks and components are involved in your analysis, you also need to specify the data elements (as described in the relevant sections above). Examples of these elements are how long each task requires to execute and how the times for each task are distributed. IMPRINT Pro has capabilities to help you with these estimates, both through the libraries of Army data included in the tool, and through the calculators embedded within the tool (for example, micro-models, unit converters).

❖ **Define the variables and system changes.**
These elements of your analysis will probably align with the dependent and independent variables you identified in the first step. These elements help ensure that the analysis is properly parameterized so that you can exercise it with a minimum of changes to the data set itself. At this step in the process, you should also consider whether there are any other system characteristics you should represent with variables. Have you represented all environmental changes in the system that might affect task performance? Have you included all important counts and measurements that change as the simulation progresses? Have you included all the quantities that you want to use as input to or output from the system?

- **Check for errors.**

  IMPRINT Pro includes a built-in syntax checker and error checking routines that automatically searches the analysis to ensure that you have entered the data needed to conduct your analysis. Also, if you are using the Mission module, IMPRINT Pro searches your mission for errors in syntax. Any detected errors are displayed so that you can correct the problem.

- **Run and debug the analysis.**

  After you start the analysis execution, IMPRINT Pro has several different built-in tools that you can use to help you locate any logic errors in the analysis. If you are using the Mission module, you will see a symbolic animation of your mission network as the simulation progresses so that you can check to be sure the flow is logical.

- **Analyze the data.**

  You can examine all the results of an IMPRINT Pro analysis by accessing the Reports menu. Tables, charts and graphs are automatically generated to help you visualize the results. As you analyze the data, you will start to answer the questions you originally asked—and you may discover more questions that lead you to further development of the analysis.
Chapter 4: Understanding the IMPRINT Pro Window

IMPRINT Pro uses a modified form of the MDI (Multiple Document Interface) made available by Microsoft .NET Framework. MDI provides a parent container window that contains several other different window panes. This configuration allows you to reposition windows into logical working groups and to temporarily hide windows that you are not using. The IMPRINT Pro window is highly configurable, and changes to these configurations are preserved until the next time they are modified.

In this chapter, we describe methods you can use to navigate through the IMPRINT Pro interface, and customize the layout so that it meets your model needs and user preferences.

IMPRINT Pro Window Overview

The default configuration for the IMPRINT Pro window consists of a container window with a title bar, menu bar, tool bar, and status bar. Within this container, the following elements exist as separate window panes: Analysis Tree, Windows, Network Diagram, Properties Window, Palette, Event Queue, Output, and Variable Watches.

Note:
Many of the windows are blank until you open an analysis. To open an analysis, right-click in the Analysis Tree, select Add Analysis or Add Analysis from Library, and select the desired analysis from the dialog box that displays.

You can move, resize, hide, and dock all of the windows. You may want to use different configurations during different stages of model development.

The following illustration shows the components of the IMPRINT Pro window. Each of these components is described in greater detail in the remaining sections of this chapter.
IMPRINT Pro Window Components

This section describes the window components in the main IMPRINT Pro window. For details on resizing, moving, hiding, and docking the windows, see “Manipulating Windows” on page 50.

Title Bar

The title bar displays at the very top of the IMPRINT Pro window and contains the name and version of the currently open analysis.

Menu Bar

The menu bar displays below the title bar at the top of the IMPRINT Pro window and contains the File, Edit, View, Reports, Tools, Utilities, and Help menus. After opening your mission, the expanded menu will display the additional options of Moderators and Execution.
Chapter 4: Understanding the IMPRINT Pro Window

- **File.** The File menu includes the following basic commands: New Local Folder, New Analysis, Import Analysis, Library Analysis, Import Maintenance Data, Save Analysis, Save As, Close Analysis, Close All Except Current Analysis, Print Diagram and Exit.

- **Edit.** The Edit menu includes basic edit commands such as Undo, Redo, Cut, Copy, Paste, Copy Diagram as Image, Clear Output and Preferences.

- **View.** The View menu contains commands to zoom the display, display different windows, and reset the screen layout.

- **Moderators.** The Moderators menu (available only when a mission is selected) includes commands for mapping workload or maintenance tasks to taxons, setting Performance Moderators and reviewing the affects of those moderators on task times and accuracies.

- **Execution.** The Execution menu includes commands for controlling execution, such as Begin, Pause, Step, Halt and Abort Simulation. It also includes Check for Errors, an option to run a syntax check on your model, and Settings, an option to adjust model execution settings (execution speed, number of runs, simulation speed and more).

- **Reports.** The Reports menu includes options for generating detailed reports which display the results of your model run. Options include Operations Results, Maintenance Results, Force Results, Personnel Attributes and Cross Analysis. All reports display in a Microsoft Excel format.

- **Tools.** The Tools menu includes commands to display additional tools which may be helpful when configuring your model’s tasks. Tool options include Accuracy Calculator, Micromodels, Syntax Helper, and Unit Conversions windows.

- **Utilities.** The Utilities menu includes commands for enabling Display Trace, Network Animation and Update Comment Variables. Commands for controlling the network nodes in the diagram (Alignment, Snap to Grid) also appear in this menu. You may also view the entire model in a table format using the Export Network to Excel option.

- **Help.** The Help menu contains the About command to display version information and the Help command to open online help.
Tool Bar

The IMPRINT Pro tool bar displays below the menu bar and provides quick access to commonly used commands. Each command displays as a button on the tool bar which may be clicked to access the command. Options include: Save Analysis, Copy, Cut, Paste, Undo, Redo, Check for Errors, Begin Simulation, Pause Simulation, Step Simulation, Halt Simulation, Simulation Speed, Custom Layout 1, Custom Layout 2 and Custom Layout 3.

The tool bar also includes options for the Accuracy Calculator, Micromodels, Syntax Helper, and Unit Conversions tools.

As you move the pointer over each button, a tooltip displays the corresponding command name and the associated shortcut key, if available.

Windows

The IMPRINT Pro windows are all items in the IMPRINT Pro interface other than the Title Bar, Menu Bar and Tool Bar. These windows are used for selecting application options, entering data or displaying data.

Windows Pane

The Windows pane contains a list of all windows available for display in IMPRINT Pro. Similar to the Tool Bar, the Windows Pane is intended to provide quick access to commonly viewed windows through icons which may be clicked to access the desired window(s). Available windows include the Analysis Tree, Animator, Event Queue, Network Diagram, Output, Palette, Properties, Search, and Variable Watches.

In the default configuration, the Windows Pane displays on the left side of the IMPRINT Pro container window.

Windows are described in the following sections.
**Analysis Tree Window**

The Analysis Tree window displays a hierarchical list of the analyses, automatically sorted by name. Listed under each individual analysis are the Warfighters, Missions, Equipment, Custom Performance Moderators and Forces nodes.

To expand a node in the tree view, click the plus sign “+” adjacent to the item. To collapse a node, click the minus “-” sign adjacent to the item.

To select an item in the tree, left-click the item with the mouse. To select multiple items in a row, click the first and last items in the desired subset while holding down the **shift** key. Multiple items which are not grouped together may be selected simultaneously by clicking each item while holding down the **control** key.

**Palette Window**

The Palette displays the tools used to construct the network diagram. These tools consist of network node objects made to represent the six optional items you may add to your network diagram: tasks, functions, scheduled functions, goals, comments and workload monitors. To add one of these items to the network diagram, click the item in the Palette window and drag it onto the network diagram window. You can then enter its defining parameters in the Properties window.
**Network Diagram Window**

The Network Diagram displays the graphical depiction of the task network developed under the Mission module. Use this window in conjunction with the Palette to construct the task network diagram and view the mission model execution.

**Animator**

The Animator window displays a two dimensional graphical depiction of your model as it executes. The data displayed in the Animator window depends on the model type you choose to run:

- **Operations model.** The Animator window displays workload data for crew members in your operational mission.
Maintenance model. The Animator window displays queue data, combat data, reliability and availability data and maintenance summary data for your maintenance scenario.
To add animation to your model run:

1. Go to the Windows option under the View menu, and select the Animator option to add the display window to your current layout.

2. In the Settings option under the Execution menu, check the Animation On check box on the Execution Settings dialog.

The animation displays the next time you run your model scenario.
Properties Window

The Properties window displays the properties of the model item selected in the network diagram, such as a function, task, or goal. It also displays the properties of items that you select in the tree view such as variables, macros, scenario events, and snapshots. The properties that display in the Properties window also display in the dialog box for the associated item.

The Properties window functions like any folder list. To expand an item, click the adjacent plus “+” sign. To collapse an item, click the adjacent minus “−” sign.

Some of the fields in the Properties window have an associated drop-down list box. To display the list box, click in the text box, and a drop-down arrow displays. Click the arrow, and a selection list appears. A detailed description of any selected item automatically displays at the bottom of the Properties window.

Output Window

The Output window displays the trace of the execution which consists of all actions that just finished occurring in the model run. The clock times for beginning effects, ending effects, and scenario events are listed. Application errors, plugin loading errors, and the start and end of a simulation are also included. Any syntax errors are indicated and you can use them for debugging purposes. You can save the information in the Output window to a file or to the Windows clipboard and clear the information in the window before running a new simulation.
Variable Watches Window

The Variable Watches window displays the values of variables during model execution. You select the variables that you want to display by creating a watch for the variable. The variable name, value, and type display. For variables designated as arrays, indices display in the Index(es) field.

To add a Variable Watch:

1. Click the Variable Watches tab in the lower right-hand corner of the IMPRINT Pro window.

2. Click the Add Watch button.

   A new variable watch line appears in the Variable Watches window.

3. Under the Variable column, click the cell containing the variable name - a drop-down arrow appears. Click the drop-down arrow to access a list of variables in your mission. Select the variable whose values you wish to view.

4. Run the model.

   The variable type and values display in the cells to the right and continue to update as the model runs.
Chapter 4: Understanding the IMPRINT Pro Window

Event Queue Window

The Event Queue window displays the list of events as they occur during model execution. These include the execution of tasks and scheduled events. You create the scheduled events for the simulation. Scheduled events can be one-time events or they can repeat at regular intervals. The group, ID, tag, and time, and type of event displays.

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Event Description</th>
<th>Group</th>
<th>Tag</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning Effect</td>
<td>12_7 Loader Receives Communication</td>
<td>0</td>
<td>0</td>
<td>4288.34223</td>
</tr>
<tr>
<td>Beginning Effect</td>
<td>12_8 Driver Receives Communication</td>
<td>0</td>
<td>0</td>
<td>4288.34223</td>
</tr>
<tr>
<td>Waiting Without Queue</td>
<td>Trigger Parser (9999)</td>
<td>0</td>
<td>9999</td>
<td>0</td>
</tr>
<tr>
<td>Waiting Without Queue</td>
<td>goaest11 (9990)</td>
<td>0</td>
<td>9990</td>
<td>0</td>
</tr>
<tr>
<td>Waiting Without Queue</td>
<td>s_999 End</td>
<td>0</td>
<td>0</td>
<td>3916.40112</td>
</tr>
<tr>
<td>Ending Effect</td>
<td>12_5 TC Transmits Communication</td>
<td>0</td>
<td>0</td>
<td>4292.39844</td>
</tr>
<tr>
<td>Ending Effect</td>
<td>12_6 Gunner Receives Communication</td>
<td>0</td>
<td>0</td>
<td>4292.591</td>
</tr>
<tr>
<td>Beginning Effect</td>
<td>11_0 Start</td>
<td>0</td>
<td>0</td>
<td>4302.5083</td>
</tr>
</tbody>
</table>

Beginning effects are highlighted in navy, ending effects are in green, suspended beginning effects are in blue, and suspended ending effects are in lime. Evaluate queue is in fuchsia, leaving queue is in purple, and waiting without queue is in red. And finally, scenario events are in yellow, and snapshots are in maroon.

Search and Replace

The Search and Replace window allows you to locate a string of text in the model. You may then choose to replace select instances of that string with a new string you specify. You can search open analyses, closed analyses or any combination thereof. Within the analyses you choose to select, you can search either the currently-open model (e.g., operations model) or all models (e.g., operations model, equipment model and force model) within those analyses.

Depending on the models types you choose to search, you will then be presented with a list of components to refine your search parameters. The following fields may be searched for the model types listed:

- **Operations model**: Warfighters, Stressors, Goals, Functions, Tasks, RI Pairs, resources, Interfaces, Macros, Variables, Snapshots, External Events and Cultural Templates.
- **Maintenance model**: Warfighters, Stressors, Subsystems, Components, Repair Tasks, Scenarios and Segments.

- **Force model**: Warfighters, Stressors, Force Units, Schedules, Jobs, Planned Activities and Unplanned Activities.

**To search for text:**

1. Open the Search and Replace window.

2. In the **What to Search** field, check the boxes corresponding to the types of analyses you wish to include in your search. You may choose **Closed Analyses**, **Open analyses** and/or **Current Analysis**. If you choose the Current Analysis option, you can choose to search only the currently-opened model by checking the **Current Model Only** box below. Otherwise, you may leave the box unchecked to search all models in the current analysis.

   The **Look In** field below displays the options available based on the items you checked.

3. In the **Look In** field, check the boxes corresponding to the components within the selected analyses you wish to include in your search.

4. If you wish to locate only those instances whose case matches what you have typed in the **Find** field, check the **Match Case** box at the bottom of the window.

5. Click the **Find** button at the bottom of the window.

   All instances of the text string appear on the right side of the window in the following two fields:

   - **Replaceable**. All instances found in this field may be replaced with new text you specify in the Replace With field.
   
   - **Not Replaceable**. All instances found in this field are non-editable.

---

**Note:**

If you are searching for text with the **Close Analyses** box checked, several instances of your text could appear in the **Not Replaceable** field. In some cases you may make these instances replaceable by first opening (expanding) the analysis in the tree corresponding to this instance and then clicking the **Find** button again; all replaceable instances of this text string within the selected analysis will now appear in the **Replaceable** field.
**To replace text:**

1. In the **Replaceable** items field, check the boxe(s) of the instance(s) where you wish to replace text. For each listing a **Found in Object** line and a line number message will appear. When you check one box, both with automatically be selected.

   If you wish to choose all found instances, click the **Check All** button at the bottom of the window. To de-select any or all checked items, click the **Check None** button at the bottom of the window.

2. In the **Replace With** field on the left side of the window enter a replacement text string.

3. In the lower right-hand corner of the screen click the **Replace Checked** button to replace text in all selected instances with your new text string.

   All instances selected are replaced with your new text.
Status Bar

The status bar displays at the bottom of the IMPRINT Pro window. Any execution-related messages, such as the clock time and the run number, display on the right side of the status bar.

| Total Runs: 15 | Run Number: | Random Seed: 9 | Clock: 6700.031 |

Window Configurations

IMPRINT Pro provides three customizable window configurations or views, Custom Layout 1, Custom Layout 2, and Custom Layout 3. These views default to the layouts described in the following list.
Custom Layout 1 displays the default configuration of the Windows, Analysis Tree, Network Diagram, Properties, and Output windows. Tabs at the bottom of the windows display including Palette, Variable Watches, Event Queue, and Search.

Custom Layout 2 displays the default configuration of the Network Diagram, Analysis Tree, and the Output window. Tabs at the bottom of the windows display including Palette, Properties, Variable Watches, Event Queue, and Search. The Analysis Tree displays to the right.
Custom Layout 3 displays the Network Diagram, Analysis Tree, and Properties with tabs Output and Search. The Analysis Tree displays to the left.

The Reset Screen layout capability on the view menu enables you to return to these defaults at any time. For more information on how to move windows around, see “Manipulating Windows” on page 50.

Manipulating Windows

Any window in IMPRINT Pro that has a title bar is considered a Tool window, for example the Analysis Tree window. A tool window can be floating, docked, hidden, displayed in a vertical or horizontal tabbed format, and they have the auto-hide property.

Floating Windows

When a window is floating, you can move it around as a separate window that floats on top of the other windows. You can move a floating window outside of the main IMPRINT Pro window.

To float a window:

1. Right-click the title of the window, such as Analysis Tree or Properties.
2. Select **Floating** from the menu that displays so that a check mark appears adjacent to the Floating item.

The window appears as a separate window.

**Making Windows Dockable**

When a window is dockable, you can move it with the mouse so that it snaps to the closest side of the IMPRINT Pro window.

*To make a window dockable:*

1. Right-click the title of the window, such as Analysis Tree or Properties.
2. Select **Dockable** from the menu that displays so that a check mark displays adjacent to the dockable item.

**Docking Windows**

Once you set a window to be dockable, you can dock it to any of the sides of the main IMPRINT Pro window.

*To dock a window:*

1. Drag the window toward an edge of the IMPRINT Pro window to the location you want.

   As you drag the outline of the dockable window, four blue orientation docking symbols appear, each at the outer edge of the IMPRINT Pro application window. By dragging the outlined window over one of these symbols, the window will become docked along that edge of the application window. Also, shown is a separate docking orientation key within the window over which the window outline is currently hovering. If you wish to set your window down in any part of this location, simply drag your mouse to the edge of the symbol corresponding to the edge of the window where you want your window docked.

2. Release the mouse button.

   When you dock a window over an existing window, both windows now exist in the same space, but only one can be viewable at a time. The user can then choose what window to view by clicking that window’s corresponding tab (located at the bottom of the window region.)
Displaying Tab Groups

You can display tabbed windows adjacent to each other so that they can be viewed at the same time.

To display a tab group:

1. Right-click the title of any tab in a tool window.

2. To display the tab in a horizontal format, select New Horizontal. To display the tab in a vertical format, select New Vertical Tab.
The window rearranges to the selected format.

Repeat the previous step for any of the other windows as desired.
Hiding Windows

Hiding a window completely removes the window from the display and frees up more working space. Hiding a window is the same as closing the window.

To hide a window:

1. Right-click the title of the window, such as Analysis Tree or Properties.
2. Select Hide from the menu that displays. You can alternatively click the in the upper right corner of the window.

   The window is removed from the display.

Redisplaying Hidden Windows

Once a window is hidden, you can redisplay it using the View menu.

To redisplay a hidden window:

1. From the View menu, select Windows.
2. Select the window.

   The window redisplay in the last position it occupied.

   You can also redisplay a window using the Windows tab. For details, see “Windows Pane” on page 38.
Auto-Hiding Windows

Auto-Hide minimizes a window and places a tab with the window name on the closest edge of the IMPRINT Pro window.

To enable Auto-Hide:

1. Right-click the title of the window, such as Analysis Tree or Properties.
2. Select Auto-Hide from the menu that displays.

You can alternatively click the push pin icon on the title bar of the window. The icon points to the left when Auto-Hide is enabled and down when Auto-Hide is disabled.

When you move the mouse and the focus to another window, the window in auto-hide mode minimizes, and a tab displays on the edge of the IMPRINT Pro window with its name.

Displaying Windows in Auto-Hide Mode

Windows in Auto-Hide mode display as tabs along the edge of the IMPRINT Pro main window. Each tab displays the name of the window it represents.
To display a window in Auto-Hide mode:

Move the cursor over the window tab.

The window slides back into view and is ready for use. When you click the mouse off the window, the window loses focus and automatically slides back to the tab on the edge of the main window.

Disabling Auto-Hide Mode

Disabling Auto-Hide mode returns the window to its previous position.

To disable Auto-Hide mode:

1. Move the cursor over the tab for the window so that the window redispays.

2. Right-click the window title and select Auto-Hide so that the check mark adjacent to it is cleared.

You can alternatively click the push pin icon on the title bar of the window. The icon points in a downward direction when auto hide is disabled.

Moving Windows

To move any window:

Click and drag the title bar of the window to the new location while holding down the left mouse button.

Resizing Windows

To resize any window:

Move the cursor over the border of a window until the cursor changes into a double-headed arrow.

Press the left mouse button and move the border to the new location.
Changing the Active Window

To make a window active:

1. Click anywhere in the window.
2. If the window is not currently displayed, do the following:

   From the View menu, select Windows, and then select the window you want to make active.

Closing Windows

To close a window:

Click the in the upper right corner of the window or tab. You can alternatively right-click the title of the window and select Hide from the menu that displays.
Chapter 5: IMPRINT Pro Menu Structure

This chapter provides a detailed description of the menu items available in IMPRINT Pro. It is organized in the same order as the IMPRINT Pro menu items themselves, proceeding from left to right, top to bottom, beginning with the items on the File menu, and concluding with the items on the Help menu.

The menu bar displays below the title bar at the top of the IMPRINT Pro window and contains the File, Edit, View, Reports, Tools, Utilities and Help menu headings. Once a mission is opened, the menu bar expands to include Moderators and Execution menu headings.

File Menu

The File menu has the following commands:

- New Local Folder
- New Analysis
- Import Analysis
- Library Analysis
- New Analysis From Imported Data
- Save Analysis
- Save As
- Close Current Analysis
- Close All Except Current Analysis
- Print
- Exit
New Local Folder

In the Local Server directory of the Analysis Tree you can organize analyses into folders, much like you organize files into folders on your computer, by adding folders to the Analysis Tree.

To add a folder to the Analysis Tree:

From the File menu, click New Local Folder.

A new folder is added to the Analysis Tree under the Local Server node. You can rename the new folder with a double-click on the folder. Enter a new name in the Properties window.

Analyses folders may also be added to the tree by right-mouse clicking anywhere in the Analysis tree and selecting the option New Local Folder.

Once the new folder displays, you can cut or copy any analysis from an existing folder and paste it to the new folder. The cut analysis will display in red in the Analysis tree until pasted into the new folder.

New Analysis

You can add a new analysis to any existing folder in the analysis tree.

To add a new analysis:

1. From the File menu, select New Analysis.

2. In the submenu which appears to the right, select the folder in the Local Server directory where you wish to add the new analysis.

   The corresponding folder in the Analysis Tree automatically expands to display your newly added analysis.

New analyses may also be added to the tree by right-mouse clicking any folder in the Analysis tree and selecting the option New Analysis.

Import Analysis

You can import an analysis into any existing folder in the analysis tree.
To import an analysis:
1. From the File menu, select Import Analysis.
2. In the submenu which appears to the right, select the folder in the Local Server directory where you wish to add the imported analysis.

   The corresponding folder in the Analysis Tree automatically expands to display your imported analysis.

Imported analyses may also be added to the tree by right-mouse clicking any folder in the Analysis tree and selecting the option Import Analysis.

Library Analysis

You can add a library analysis into any existing folder in the analysis tree.

To add a library analysis:
1. From the File menu, select Library Analysis.
2. In the submenu which appears to the right, select the folder in the Local Server directory where you wish to add the library analysis.

   The corresponding folder in the Analysis Tree automatically expands to display your added library analysis.

Library analyses may also be added to the tree by right-mouse clicking any folder in the Analysis tree and selecting the option Library Analysis.

New Analysis From Imported Data

You can create a new analysis from an imported data file. Supported data file formats include the following:

Operations:
- MMF Data (.mmf files)

Maintenance
- Maintenance Spreadsheet (.maintPro files)
- Maintenance LSA File (.txt files)
These options are available through the **File** menu under the **New Analysis From Imported Data** submenu.

---

**Note:**
The option to import maintenance data into an analysis is available only to the user having the lock on the analysis. For more information on locking and unlocking analyses see *IMPRINT Pro User Guide Volume 1 - Basic Procedures, Chapter 1: Basic Procedures, Understanding the Analysis Environment, Locking and Unlocking Analyses*.  

---

# New Analysis from MMF Data

Operational Mission data created in the **IMPRINT Pro MMF Mission Builder** application may be imported into IMPRTIN Pro as the start of a new analysis.

**To import MMF data as a new analysis:**

1. Open IMPRTIN Pro.

2. From the **File** menu, select the **New Analysis from Imported Data** option.

3. From the submenu that appears, select the **From MMF Data** option.

4. From the submenu that appears, select **Local Server**.

5. From the submenu that appears, select the folder in which the new analysis should appear.

   A browse dialog appears.

6. From the browse dialog, select the MMF data file (.mmf file) to import, and then click the **Open** button.

   The data imports, and a message appears, indicating if the import was successful or unsuccessful.

7. Click **Ok**.

8. The Analysis Tree displays the new analysis with the imported data.

---

**Note:**
MMF data may also be imported into an existing IMPRTIN Pro analysis. This option, however, is not available through the **File menu** option and is only available through the IMPRTIN Pro analysis tree.
To import MMF Data into an existing analysis:

1. Open up the IMPRINT Pro Analysis Tree.

2. Locate the analysis into which the MMF data file will be imported.

3. Right-mouse click the desired analysis, and then select the Import Data option from the submenu that appears.

4. Select MMF Data from the submenu that appears.

   A browse dialog appears.

5. From the browse dialog, select the MMF data file (.mmf file) to import, and then click the Open button.

   The data imports, and a message appears, indicating if the import was successful or unsuccessful.

6. Click Ok.

7. The Analysis Tree displays the imported data under the selected analysis.

New Analysis from Maintenance Spreadsheet

For maintenance data which does not conform to an LSA template format, IMPRINT Pro includes a spreadsheet template into which your own maintenance data may be entered using Microsoft Excel. Once the data is entered, it may be saved to a file that can then be imported into an IMPRINT Pro as the start of a new maintenance analysis using the New Analysis from Imported Data option from the File menu.

Alternatively, you may import maintenance spreadsheet data into an existing analysis, although this option is only available through the Analysis Tree and not through the File menu.

Before importing maintenance spreadsheet data, the data must first be created using the IMPRINT Pro Maintenance Template.

To create maintenance data using the IMPRINT Pro Maintenance
Template:

1. Locate the maintainance task template file, ImportIMPRINT.xlt, included with your installation of IMPRINT Pro. This file is located in the C:\Program Files\IMPRINT Pro\Templates directory by default.

Note:
You may be prompted by Excel that macros are currently disabled on your system. In order to use the maintenance task template, you must choose to enable your macros before proceeding with the next step.

2. Enter the Subsystem and Component information in the columns provided. This information is required by the template for each row of data entered. You may copy data from a separate tab-delimited or comma-delimited file, provided the data is ordered to match the rows and columns in the template, and provided the number of cells copied matches the number of cells for pasting.

3. In the remaining columns, enter data as required. Some data fields require you choose from a drop-down list (e.g., Usage Type). To access the list, simply click the cell, and then click the drop-down arrow which appears – a list of choices appears. Click any listed option to select it. Note: Subsystem ID and Component ID fields are optional and will display only in reports.

4. Any invalid entry entered into the template appear in red. Entries may be invalid due to too many characters in Subsystem or Component names, invalid characters (slashes, commas and colons) or entries that are not included in the list of expected values where drop-down lists are in place. All invalid data must be corrected before the template can be exported.

5. Click the Create Data Import File button at the top of the template.

A dialog box appears, prompting you for a name and location to which your data export file is to be saved. If desired, click the Browse button to locate and select a new folder to which the file should be exported. Enter a name in the File name field. All exported template data automatically saves to a .maintPro ("maintenance import - IMPRINT Pro") file format.

Note:
Note: a duplicate maintenance entry is any entry that has the same Subsystem-Component-Action-Type combination as an existing entry; before your maintenance data is exported for use by the IMPRINT Maintenance module, the template application checks for and eliminates all duplicate entries.
To import Maintenance Spreadsheet data as a new analysis:

1. Open IMPRINT Pro.

2. From the File menu, select the New Analysis from Imported Data option.

3. From the submenu that appears, select the From Maintenance Spreadsheet option.

4. From the submenu that appears, select Local Server.

5. From the submenu that appears, select the folder in which the new analysis should appear.

A browse dialog appears.

6. From the browse dialog, browse to the place in your directory structure where you have stored the desired maintenance template data file, and then select the template data file (.maintPro) to import.

7. Click the Open button.

Once you have selected the file to import, IMPRINT Pro automatically detects the format of your file and proceeds to import the data into the equipment side of your analysis. If IMPRINT identifies any duplicate record, it will keep the duplicate but append a unique numeric identifier to it (e.g., "[1]") or ") in order to ensure that all component names are unique. If IMPRINT identifies duplicate records that have different specialties, the records will be kept in your data set.

The subsystems and components added to IMPRINT Pro are case sensitive. If an imported maintenance task data set contains identical subsystem and component names as those already existing in the analysis, the duplicates will be stripped during the import and any original data entered in the analysis through IMPRINT Pro will not be overwritten by the imported data. All data unique to the subsystem and/or component which is not included in the original data in the analysis, however, will be added in from the Maintenance Task Template import file upon import.

8. Review and edit the imported data as desired. You will find your data under the "Define Equipment" option or under the “Options” menu “Review Task Data” menu item, “Maintenance” selection.
To import Maintenance Spreadsheet data into an existing analysis:

1. Open IMPRINT Pro.

2. In the Analysis Tree open/expand the desired analysis into which LSA maintenance data will be imported.

3. Right-mouse click the analysis.
   
   A shortcut menu appears.

4. From the shortcut menu, select the **Import Data** option.

5. From the submenu that appears, select the **Maintenance Template Data** option.
   
   A browse dialog appears.

6. From the browse dialog, browse to the place in your directory structure where you have stored the desired data file, and then select the template file (.maintPro file) to import. Then, click the **Open** button.

   Once you have selected the file to import, IMPRINT Pro automatically detects the format of your file and proceeds to import the data into the equipment side of your analysis. If IMPRINT identifies any duplicate record, it will keep the duplicate but append a unique numeric identifier to it (e.g., "[1]" or "[2]") in order to ensure that all component names are unique. If IMPRINT identifies duplicate records that have different specialties, the records will be kept in your data set.

   The subsystems and components added to IMPRINT Pro are case sensitive. If an imported maintenance task data set contains identical subsystem and component names as those already existing in the analysis, the duplicates will be stripped during the import and any original data entered in the analysis through IMPRINT Pro will not be overwritten by the imported data. All data unique to the subsystem and/or component which is not included in the original data in the analysis, however, will be added in from the Maintenance Task Template import file upon import.

7. Review and edit the imported data as desired. You will find your data under the “Define Equipment” option or under the “Options” menu “Review Task Data” menu item, “Maintenance” selection.
New Analysis from Maintenance LSA File

IMPRINT Pro provides the option for importing Logistics Systems Analysis (LSA) Reports as the start of a new analysis using the **New Analysis from Imported Data** option from the **File** menu. These reports, usually containing maintenance data broken out by subsystem and component, import into the **Maintenance** side of your analysis under the **Equipment** node.

Alternatively, you may import maintenance LSA data into an **existing** analysis, although this option is only available through the Analysis Tree and not through the File menu.

IMPRINT accepts three different LSA formats. These include 750-16, 1388-2A and 1388-2B formats. The first two formats accept the data from the “02” report. The 1388-2B format accepts data from the “01” report. These are standard formats.

Before you import an LSA file, some preparation must be conducted. First, make sure your data are in ASCII text files. Most likely, you will receive your LSA report in a Word document. If this is the case, follow the steps below before attempting to import the data.

**To prepare an LSA file for import into IMPRINT Pro:**

1. Open the file in Microsoft Word.
2. Select the entire file, and change the font to Times New Roman, and the size to 6 point. This should remove the wrap-around from your data records. You do not need to make any other modifications to the file.
3. Save the file as a text file, with line breaks. Make sure the extension is *.txt.*

**To import LSA Maintenance data as a new analysis:**

1. Open IMPRINT Pro.
2. From the **File** menu, select the **New Analysis from Imported Data** option.
3. From the submenu that appears, select the **From Maintenance LSA File** option.
4. From the submenu that appears, select **Local Server**.
5. From the submenu that appears, select the folder in which the new analysis should appear.

A browse dialog appears.

6. From the browse dialog, browse to the place in your directory structure where you have stored the *.txt file, and then select the LSA data file (.txt file) to import. Then, click the **Open** button.

The data imports, and a message appears, indicating if the import was successful or unsuccessful.

7. **Click Ok.**

Once you have selected the file to import, IMPRINT Pro automatically detects the format of your file and proceeds to import the data into the equipment side of your analysis. If IMPRINT identifies any duplicate record, it will keep the duplicate but append a unique numeric identifier to it (e.g., “[1]” or “[2]”) in order to ensure that all component names are unique. If IMPRINT identifies duplicate records that have different specialties, the records will be kept in your data set.

Review and edit the imported data as desired. You will find your data under the “Define Equipment” option or under the “Options” menu “Review Task Data” menu item, “Maintenance” selection.

**To import LSA Maintenance data into an existing analysis:**

1. **Open IMPRINT Pro.**

2. In the Analysis Tree open/expand the desired analysis into which LSA maintenance data will be imported.

3. **Right-mouse click the analysis.**

   A shortcut menu appears.

4. **From the shortcut menu, selec the Import Data option.**

5. **From the submenu that appears, select the **Maintenance LSA Data** option.**

   A browse dialog appears.
6. From the browse dialog, browse to the place in your directory structure where you have stored the *.txt file, and then select the LSA data file (.txt file) to import. Then, click the Open button.

Once you have selected the file to import, IMPRINT Pro automatically detects the format of your file and proceeds to import the data into the equipment side of your analysis. If IMPRINT identifies any duplicate record, it will keep the duplicate but append a unique numeric identifier to it (e.g., “[1]” or “[2]”) in order to ensure that all component names are unique. If IMPRINT identifies duplicate records that have different specialties, the records will be kept in your data set.

Review and edit the imported data as desired. You will find your data under the “Define Equipment” option or under the “Options” menu “Review Task Data” menu item, “Maintenance” selection.

Save Analysis

We recommend that you save your analysis often!

To save the changes you have made to your analysis:

1. Select the analysis in the tree that you wish to save by clicking it.

2. From the File menu, click Save Analysis.

Your analysis saves to the name and version which display in the Analysis tree and Properties window.

✓ Note:
   Each time you run an operational mission or a maintenance scenario, your analysis automatically saves to the database just prior to the model run.

Save As

To save your analysis under a new name:

1. From the File menu, click Save As to enter a new analysis name and/or version.

2. In the Save Analysis As dialog box which appears, enter in the new name and/or version to which your analysis should be saved.
3. Click the **Ok** button.

   The new analysis name and/or version appears in the analysis tree and properties window.

   **Note:**
   The **Ok** button is disabled until the default name and/or version in the dialog box is changed.

---

**Close Current Analysis**

The Close Current Analysis option collapses the currently-selected analysis in the Analysis Tree and empties the IMPRINT Pro display windows.

**To close the current analysis:**

From the **File** menu, click **Close Current Analysis**.

Prior to the analysis closing, you will be asked if you wish to save the analysis. Upon selecting **Yes**, the analysis saves and closes. Upon selecting **No**, the analysis closes without saving.

---

**Close All Except Current Analysis**

The **Close All Except Current Analysis** option closes all analyses in the Analysis Tree except for the currently-selected analysis.
To close all analyses except the current analysis:

From the File menu, click Close All Except Current Analysis.

For each analysis which must be closed, you will be asked if you wish to save the analysis prior to closing it. Upon selecting Yes, these analyses save and close. Upon selecting No, these analyses close without saving. The currently-selected analysis remains open.

Print

The Print option allows you to print the network diagram in three different ways:

- **Entire Network.** Print the entire network diagram.
- **Selected.** Print only the currently-selected nodes and paths in the network diagram.
- **Visible.** Print only the portion of the network diagram which is currently visible in the Network Diagram window.

For details on printing, see Chapter 4, “Mission Analyses,” in Volume 2 of the IMPRINTPRO User Guide.

To print a network diagram selection:

1. Click the Network Diagram, or else select the components from the network diagram you wish to print.
2. From the File menu, select Print...

   The Print Network dialog box displays.
3. Choose a print option by clicking the drop-down arrow and selecting an option from the list.

A Print Preview window appears.

4. Modify the preview and print settings as required, and then click the Print icon to print your network diagram selection.

*Note:* Users with Adobe Acrobat installed on their systems may print to PDF provided this option displays in the list of available printers (see the Printers option under the Page Setup window.)
Exit

To close IMPRINT Pro:

From the File menu click Exit. Alternatively, click the \x in the upper right corner of the window.

Edit Menu

The Edit menu has the following menu items:

- Undo
- Redo
- Cut
- Copy
- Paste
- Copy Diagram as Image
- Clear Output
- Preferences

Undo

The Undo feature in IMPRINT Pro allows you to undo the last action performed in the IMPRINT Pro interface. This feature may be used on any action which adds or deletes data from the IMPRINT Pro database. Examples include the following:

- Adding and deleting nodes from the tree or network.
- Renaming nodes.
- Adding or deleting data from the properties of any node.

A separate Undo history is kept for each individual analysis in the Analysis Tree. For each analysis, the Undo action may be used as many times as there are actions which can be undone.
The Undo feature may not be used to reverse the following actions:

- Saving analyses.
- Deleting analyses from the tree.
- Deleting folders from the tree which contain analyses.
- Running a model.
- Reconfiguring a change made to the window layout.

**To undo an action:**

1. Confirm the analysis whose last action you wish to undo is selected in the Analysis Tree.

2. Click the **Undo** button in the IMPRINT Pro tool bar. Alternatively, you may select the **Undo** option from the **Edit** menu.

   The last action in the selected analysis is reversed.

**Redo**

The Redo feature in IMPRINT Pro allows you to reverse a change made by the **Undo** command. A separate Redo history is kept for each individual analysis in the Analysis Tree. For each analysis, the Redo action may be used as many times as there are actions which have been undone.

**To redo an action:**

1. Confirm the analysis whose last action you wish to redo is selected in the Analysis Tree.

2. Click the **Redo** button in the IMPRINT Pro tool bar. Alternatively, you may select the **Redo** option from the **Edit** menu.

   The last action undone in the selected analysis is redone.

**Cut**

You can cut text and objects using the **Cut** command. Cutting places the text or object on the clipboard where it may then be pasted elsewhere in the analysis or in another application. Once the item is pasted, it is removed from its original location.
**To cut text or an object:**

1. Select the text or object to cut.
2. From the Edit menu, click **Cut**.

You may alternatively right-click the item to be cut and select **Cut** from the shortcut menu.

The cut item is copied to the clipboard. You can now paste this item elsewhere in IMPRINT Pro or in another application.

**Copy**

You can copy selected text or an object to the Windows clipboard. Copying an object copies all of the object’s properties. Once the text or object is on the clipboard, you can use the **Paste** command to insert it elsewhere in the analysis or into another application.

**To copy text or an object:**

1. Select the text or object to copy.
2. From the Edit menu, click **Copy**. You can alternatively right-click the mouse and click **Copy**.

The item is copied to the clipboard.

**Paste**

You can paste items copied to the clipboard with the **Paste** command. If the clipboard is empty, or if the current clipboard item is not in a format appropriate for the current location, the Paste command appears dimmed so that you cannot select it. You cannot use the Paste command to replace a network that is currently displayed or any network above it.

**To paste text or an object do one of the following:**

1. Click the destination of the item to be pasted, for example if choosing to paste a copied task from one function to another, click the destination function.
2. From the Edit menu, click Paste.

You may alternatively right-click the destination of the item to be pasted and select Paste from the shortcut menu.

The pasted text or object displays. For objects on the network diagram, the pasted object is on top of the copied object. IMPRINT Pro automatically assigns a new ID to the item, but the name is the same as the copied item.

For a node in the network diagram, select the node, and use the mouse to move it to the new location.

Copy Diagram as Image

You can copy an entire network diagram to the Windows clipboard and paste the copy into another application. Only the graphical depiction of the network is copied. You cannot paste the diagram into IMPRINT Pro.

To copy a network diagram:

1. Select the Network Diagram whose image is to be copied.

2. From the Edit menu, click Copy Diagram as Image.

You may alternatively right-click in the network diagram and select Copy Diagram as Image from the shortcut menu.

The network diagram is copied to the clipboard. You can now paste the contents into another application.

Clear Output

You can clear or remove the existing results in the Output window using the Clear Output command. The Output window clears itself prior to the beginning of each model run you initiate. If you want to save the results for a single simulation, be sure to save the results prior to clearing the window or beginning another model run.
To clear the Output window:

From the Edit menu, click Clear Output.

Alternatively you may right-click inside the Output window and choose the Clear Output option.

The Output window clears.

Preferences

Use this menu item to alter your settings for Specialty type; Time Display format; Temperature Scale; Task, Function and Goal shapes and colors; and Maintenance Org Levels. These settings, also known as “preferences”, are saved at the analysis level.

To change your IMPRINT Pro settings:

1. Select the mission in the Analysis Tree whose settings you wish to change.

2. From the Edit menu, click Preferences.

A Preferences dialog window appears.

3. Click the tab corresponding to the preference item you wish to change.

Alter preferences in the tab as desired, and then click Ok to save.
Specialty

The Specialty tab allows you to choose the military branch whose list of specialties you wish to select from when selecting warfighter operators, maintainers and supply/support personnel.

To set a specialty:

1. Select the mission in the Analysis Tree whose specialty type you wish to set.
2. From the Edit menu, click Preferences.
   
   A Preferences dialog window appears.
3. Click the Specialty tab.
4. Click the radio button of the specialty you wish to set. Options include Army, Navy, Air Force, Marine Corps and Joint (all branches).
5. Click the OK button.

   All specialty lists in IMPRINT Pro are filtered according to the selected specialty type.

Time

The time option allows you to choose the time display format you wish to use when entering data in the IMPRINT Pro and when viewing data in the IMPRINT Pro reports. You may use different format types among the Operations, Maintenance and Forces parts of your analysis. Options include HH:MM:SS.mm, Hours, Minutes and Seconds for the Operations and Maintenance modules and Hours, Minutes and HH:MM for the Forces module.

To set a time format:

1. Select the mission in the Analysis Tree whose time format you wish to set.
2. From the Edit menu, click Preferences.
   
   A Preferences dialog window appears.
3. Click the Time tab.
4. Choose the display and/or report category(ies) whose time format you wish to change.

5. Below it, click the radio button of the time format you wish to set for that category.

6. Click the OK button.

   All IMPRINT Pro interfaces and reports update to display time in the selected formats.

**Temperature**

The Temperature option allows you to specify the temperature scale you wish to use when selecting temperature stressors from the Performance Moderators dialog.

*To set a temperature format:*

1. Select the mission in the Analysis Tree whose temperature format you wish to set.

2. From the Edit menu, click Preferences.

   A Preferences dialog window appears.

3. Click the Temperature tab.

4. Choose the temperature scale you wish to use by clicking the corresponding radio button. Options include Celsius and Fahrenheit.

5. Click the OK button.

   All options for temperature in the Performance Moderator Stressors dialog display temperature in the selected scale.

**Shapes and Colors**

The Shapes and Colors option allows you to set the shapes, sizing and colors of the nodes used in your network diagram (Operational missions only). These settings are applied to tasks, functions, goals and comments.

*To edit the shape of a node:*

1. Select the mission in the Analysis Tree containing the nodes whose shape(s) you wish to modify.
2. From the **Edit** menu, click **Preferences**. A **Preferences** dialog window appears.

3. Click the **Shapes and Colors** tab.

4. From the **Select Node Type** drop-down box, click the arrow on the right-hand side of the box to view a list of nodes from which to choose.

5. Select the node you wish to edit by clicking it in the list.

   The tab updates to display all default settings for the selected node.


7. Select a shape by clicking it.

   The tab updates to display all default settings for the newly selected node.

8. Click the **OK** button.

   All corresponding nodes in your network diagram update to display the selected shape.

   **To edit the size of a node:**

   1. Select the mission in the Analysis Tree whose nodes you wish to resize.
2. From the **Edit** menu, click **Preferences**.

   A **Preferences** dialog window appears.

3. Click the **Shapes and Colors** tab.

4. From the **Select Node Type** drop-down box, click the arrow on the right-hand side of the box to view a list of nodes from which to choose.

5. Select the node you wish to edit by clicking it in the list.

   The tab updates to display all default settings for the selected node.

6. Next to the **Size** box, click the drop-down box for a list of size options. Options include:

   - **Fit to Text**. All corresponding nodes in the network diagram resize automatically to display the full node name.

   - **Resizable**. All corresponding nodes in the network diagram remain their original size until modified. You may modify the size of the node by clicking and dragging the green handles which appear when the node is selected in the network diagram. Only one node resizes at a time using this method.

7. Click the **OK** button in the **Preferences** window.

   All corresponding nodes in your network diagram update to use the selected size preference.

*To edit the color of a node:*

1. Select the mission in the Analysis Tree whose color you wish to customize.

2. From the **Edit** menu, click **Preferences**.

   A **Preferences** dialog window appears.

3. Click the **Shapes and Colors** tab.

4. From the **Select Node Type** drop-down box, click the arrow on the right-hand side of the box to view a list of nodes from which to choose.

5. Select the node you wish to edit by clicking it in the list.

   The tab updates to display all default settings for the selected node.
6. Next to the Color box, click the drop-down arrow for a list of selectable colors. Select a new color from the palette which displays.

OR

Click the More Colors... button to customize your own node color. In the Select Color dialog which appears, choose your new color by selecting from the list on the left, by using the RBGA sliders at the bottom of the dialog or by clicking the location of the approximate desired color on the color wheel. Once the box at the bottom of the Select Color dialog displays your desired color, click the OK button.

7. Click the OK button in the Preferences dialog.

All corresponding nodes in your network diagram update to display the selected color.

Maintenance Org Levels

The Maintenance Org Levels option allows you to customize the names of the three org levels used in repair task data in your equipment analysis. Regardless of the names you choose for your Org levels, level 1 may only be performed “on” equipment while level 3 may only be performed “off” equipment; level 2 may be performed either “on” or “off” equipment. Default names for Org levels 1, 2 and 3 are Org, DS and GS, respectively.

To edit a Maintenance Org Level:

1. Select the mission in the Analysis Tree whose Maintenance Org Levels you wish to customize.

2. From the Edit menu, click Preferences.

   A Preferences dialog window appears.

3. Click the Maintenance Org Level tab.

4. Choose the level whose name you wish to change, and then type in the new name in the box to the right.

5. Click the OK button.

   The modified org level names appear in the Org Level drop-down box in the Repair Task dialogs and in the Maintenance reports.
View Menu

The View menu contains the following commands:

- Diagram Zoom
- Windows
- Layout

Diagram Zoom

Use the Zoom feature of IMPRINT Pro to view a specific part of the diagram in detail or broaden the diagram view.

*To zoom the network diagram:*

1. From the View menu, click Diagram Zoom.
2. Select the magnification level. Magnification levels vary from 25% to 800%.

   The Network Diagram grows/shrinks accordingly inside the Network Diagram window.

   Alternatively you may zoom the Network Diagram by holding the Control key down while rolling the mouse wheel. Large network diagrams may be panned by holding down the Shift key while rolling the mouse wheel. The Network Diagram window must first be selected before these options are enabled.

Windows

Use this menu to display any IMPRINT Pro window that is currently hidden or closed. For more details on individual windows, see “Windows” on page 38.

*To view a window:*

1. From the View menu, click Windows.

   A submenu displaying all viewable windows appears.
2. Click the window you wish to view.

The selected window comes into view in the IMPRINT Pro interface.

- **Analysis Tree.** Select Analysis Tree to view a hierarchical list of the analyses.

- **Animator.** Select the Animator window to view a two-dimensional animation of the model executing (maintenance model only).

- **Event Queue.** Select Event Queue to display the list of events as they occur during model execution. These include the execution of tasks and scheduled events.

- **Network Diagram.** Select Network Diagram to view the graphical depiction of the task network developed under the Mission module.

- **Output.** Select Output to view the trace of the execution, which consists of the actions that occur when you run the model.

- **Palette.** Select Palette to view the tools you use to construct a network diagram.

- **Properties.** Select Properties to view a window that displays the properties of the model item selected in the network diagram, such as function, task, or goal. It also displays the properties of items that you select in the tree view such as variables, macros, scenario events, charts, and snapshots.
Search and Replace. Select Search and Replace to locate a string of text in the model and to optionally replace select instances of that string with a new string you specify.

Variable Watches. Select Variable Watches to monitor the values of variables as a model executes. Viewing the values of variables in the model can be an excellent tool for debugging.

Windows. Select Windows to view a list of all windows you can display in IMPRINT Pro. This window is intended to be a shortcut to quickly open other display windows by simply clicking their corresponding icons and is identical in functionality to the View - Windows menu option.

Layout

IMPRINT Pro allows you to modify your window configurations as desired and to save up to three specific layouts. The Layout menu contains commands to reset the screen layout to one of these configurations:

- Custom Layout 1
- Custom Layout 2
- Custom Layout 3

Each layout represents the last-known configuration of the windows when the layout was last chosen in the IMPRINT Pro environment.

To change the screen layout:
1. Click the View menu.
2. Click the layout you wish to restore.

The IMPRINT Pro windows display in the new layout.

The Layout menu also includes the command Reset Screen Layout. This option allows you to restore the layout you have modified to the original default version of the layout included with IMPRINT Pro.

To reset the screen layout:
1. Click the View menu.
2. Click the **Reset Screen Layout** option.

The layout restores to the original default IMPRINT Pro configuration for that specific custom layout number.

For more information on customizable default configurations please refer to “Window Configurations” on page 48.

**Moderators Menu**

Below this menu you will find IMPRINT Pro’s capability to apply taxons, Personnel, Training and Stressor settings to tasks for Operational or Maintenance models.

- Map Workload to Taxons
- Map Maintenance Tasks to Taxons
- Settings
- Results

**Map Workload to Taxons**

Taxons provide a method for you to describe the composition of your task. Taxons are used in IMPRINT Pro to adjust estimated task times and accuracies when you apply Personnel Characteristics, Training Frequency or Stressor adjustments.

If you do not want to enter taxons, but you have already entered workload assignments you can use the Map Workloads to Taxons capability.

**To map workload to taxons:**

Click **Map Workload to Taxons** from below the **Moderators** menu.

View the summary of the effects of the command in the Output window.

IMPRINT Pro automatically maps taxon weights to the repair tasks in a maintenance scenario. The Map maintenance Tasks to Taxons dialog allows you to modify the mapping of taxons and taxon values for maintenance tasks. You can return to the default values set by IMPRINT Pro by clicking on the Reload Defaults button at the bottom of the dialog.
Modifying the taxons is only one part of using them. Taxons work in conjunction with stressors assigned to repair task types to impact calculated repair task times.

Example: In the Maintenance Task Taxon Mappings dialog, show below, the repair task called “Adjust and Repair” involves some fine motor discrete action. On the stressor by taxon table on page 95 you can see that the stressor “COLD” affects the task time of a task involving a fine motor discrete action. Applying this stressor will impact the repair task time because of the nature of the task.

Map Maintenance Tasks to Taxons

To **map maintenance tasks to taxons**:

1. Click **Map Maintenance Tasks to Taxons** below the **Moderators** menu.

The Map Maintenance Tasks to Taxons dialog displays.

2. Do one or more of the following:
   - Adjust taxons by clicking the drop down arrow to the right of the Taxon box, and then select a taxon from the list that displays.
Adjust taxon weight by clicking in the Taxon Weight box, and then type a new value.

Return to default values by clicking the **Reload Defaults** button.

---

**Note:**
To see the impact of taxons on the task times, you need to remember to set stressors on the “Stressors” dialog in the Moderators menu, and check the PTS Adjustments box in the Executions Settings menu before you run the model.

---

**Settings**

You can set Personnel Characteristics, Training Frequency, and Stressors (PTS) values under this IMPRINT Pro option for tasks in both Operational and Maintenance models. We recommend that you apply these attributes in the same order as how they are presented in the menu items and the interface (that is, Personnel, then Training, then Stressors). This is because the algorithms within IMPRINT Pro that make use of this information are order-dependent. Personnel Characteristics, the first set of Performance moderators, describe the attributes with which the Warfighter who will man your system will arrive. Next, the training for this Warfighter must be defined, and its effects will vary according to the Personnel attributes you just set. Finally, when the Warfighter actually performs the tasks, he or she will be subjected to environmental stressors. The impact of these stressors will also be dependent on moderators set before it.

In all of these effects, IMPRINT Pro calculates the impact of PTS variable change on the estimated task performance (time and accuracy). The amount of impact is reported to you. If you then execute the maintenance or operations model with the PTS Adjustments option checked, these “moderated” performance times and accuracies will be used by the model. If you do not check the PTS Adjustments option, then the model will execute with the original task time and accuracy estimates that you entered under the Mission interfaces.

Specific technical information regarding the precise algorithms that are used in this module, as well as the source of these algorithms can be found in Adkins and Dahl (1993) and in a paper included in Appendix A of the IMPRINT Pro User’s Guide.
Personnel Characteristics

The Personnel Characteristics option allows you to change the Armed Services Vocational Aptitude Battery (ASVAB) composite score and the cutoff score for any specialty performing tasks in your model. The ASVAB is a battery of tests administered to enlistees prior to entering the military services, the scores of which are used by IMPRINT Pro to describe the personnel characteristics of Warfighters. By changing the ASVAB composite and cutoff scores, you are, in effect, changing the specialty. This is because you have redefined the minimum requirements of that specialty when it is selected to perform tasks. By selecting higher score minimums in these categories, your selected specialty might be more difficult to find. However, a specialty having higher scores might perform the task better than the same specialty having lower score minimums.

To edit the Personnel Characteristics settings:

1. From the Moderators menu, select the Settings... option.
2. In the submenu which appears, select the Personnel... option.
   
   The Personnel Characteristics dialog box appears.
3. At the top of the dialog box, select the tab corresponding to the list of Warfighters whose characteristics you wish to view and edit. Options include Mission and Maintenance. Choose the Mission tab if you wish to modify ASVAB Composite and Cutoff values for operators; choose the Maintenance tab to modify the same for maintainers in your analysis.
4. For either tab you select, a list all warfighters displays. Warfighters are sorted by Specialty and name. Accompanying each Warfighter listed is a default **ASVAB Composite** and **ASVAB Cutoff** score. Change the desired composite or cutoff values as follows:

To change the **Composite** value, insert the cursor in the box whose value you wish to change, and then choose a value from the drop-down list provided.

To change the **Cutoff** value, insert the cursor in the box whose value you wish to change, and then type in the desired value.

Alternatively, you may copy and paste values to and from Microsoft Excel provided the values shared are within the expected ranges for that category.

---

**Note:**

If you go back to the Task information (either under Equipment or Mission) and change the Specialty assignment, IMPRINT Pro will connect the baseline performance time and accuracy estimates you make to that Specialty. The only way to "simulate" a new Specialty assignment and the impact it will have on task performance is through reassigning the ASVAB composite and cutoff on these screens.

---

**Mission Tab**

- **Specialty.** A 3-letter designation for a particular military job within the Armed Forces.

- **Warfighter.** A person or automatic device that operates, maintains, supplies or supports military equipment.

- **ASVAB Composite.** This option allows you to change the Armed Services Vocational Aptitude Battery (ASVAB) composite for the Specialty performing the tasks. The ASVAB itself consists of 10 subtests from which "composites" are constructed by combining two or more of the subtests. The current ASVAB
composite used to select people for the Specialty (for example, CO, EL, GM, etc.) is shown initially in the dialog box. You can select another ASVAB composite to be used from a drop down menu that will appear when you click the drop down control.

When choosing an ASVAB composite cutoff score, you should realize that a higher cutoff score will generally result in better performance within the Specialty. However, there will be fewer people available that can attain the higher cutoff score.

- **ASVAB Cutoff.** This option allows you to change the Armed Services Vocational Aptitude Battery (ASVAB) composite cutoff score for the Specialty performing the tasks. The current ASVAB cutoff score used to select people for the Specialty is shown initially in the dialog box. You can edit this value by selecting a different cutoff value from the drop down menu that will appear by clicking on that control. Higher cutoff scores will normally result in better performance but will cause fewer people to be available for the Specialty.

---

✔ **Note:**

To review the effect your selected composite and cutoff scores will have on your tasks, click **Results** from the Settings option on the Moderators menu to see a report summarizing the impact that your choice has had on task Accuracy, Time, and the Probability of achieving the minimum acceptable accuracy.

---

**Maintenance Tab**

- **Specialty.** A 3-letter designation for a particular military job within the Armed Forces.

- **ASVAB Composite.** This option allows you to change the Armed Services Vocational Aptitude Battery (ASVAB) composite for the Specialty performing the maintenance tasks.

- **ASVAB Cutoff.** This option allows you to change the Armed Services Vocational Aptitude Battery (ASVAB) composite cutoff score for the Specialty performing the tasks.
Training

This option allows you to review and edit training frequencies that will applied to tasks. One of five training levels can be assigned to a task. You should choose the training level which best describes how often operators or maintainers will perform the task. Performance of the task could be part of a training exercise or actual job performance. In general, the more frequently an individual practices or performs a task, the more accurately they will perform it. In addition, an increase in training frequency normally will decrease the time required to perform the task.

If you are trying to improve task performance to meet accuracy or time requirements, increasing training frequency is one possible alternative. An increase in training frequency, however, will often require additional resources (for example, an increase in the frequency with which warfighters zero the sights of their weapons will require more ammunition).

**To edit the Training settings:**

1. From the **Moderators** menu, select the **Settings...** option.

2. In the submenu which appears, select the **Training...** option.

A dialog box appears, displaying a list all warfighters in your model by Specialty and Warfighter name. Accompanying each listing is a training frequency.
3. To change the **New Frequency** value, insert the cursor in the box whose value you wish to change, and then choose a value from the drop-down list provided.

Alternatively, you may copy and paste values to and from Microsoft Excel provided the values shared are within the expected ranges for that category.

---

✔ **Note:**

If you do not assign sustainment training frequencies to tasks, the average (that is once a month) will be assigned automatically.

---

It is important to note that any training frequency changes that you make may alter the stored accuracy, time, and/or probability values that IMPRINT Pro has for that particular task or Specialty, within your analysis. If you make training frequency changes, IMPRINT Pro will produce a “Delta” Report that will show you how task performance has been changed. When this “Delta” Report is produced, you should save the contents of this report (by selecting the data in the report using your mouse, and then pressing “Ctrl” for copy, going to Excel and pressing “Ctrl” for paste) in order to maintain a record of your changes. This record is important because you can make further changes in other places in IMPRINT Pro. As these changes add up, it can be difficult, if not impossible, to regain your initial values. You should save any subsequent “Delta” Reports as well.

**Stressors**

This option allows you to apply stressors to mission and maintenance tasks. Five different stressors can be applied to tasks. They include the following:

- **Cold.** This option allows you to change the temperature and wind speed for the environment in which individuals are performing operator and maintainer tasks.

- **Heat.** This option allows you to change the temperature and humidity for the environment in which individuals are performing operator and maintainer tasks.

- **Noise.** This option allows you to change the decibel level at the ear and the distance between communicators for the environment in which individuals are performing operator and maintainer tasks.
❖ MOPP Levels. Mission Oriented Protective Posture (MOPP gear for individual nuclear, biological, and chemical defense affects the time that it takes to complete tasks. MOPP level 0 has a degradation factor of 1 that correlates to “no degradation.” Degradation factors are applied as multipliers against the time that it takes to complete a task in BDUs. The most degraded performance is under MOPP 4 for fine motor discrete tasks and for oral communication tasks that take 1.7 times as long to perform.

❖ Sleepless Hours. This option allows you to change the number of hours since sleep last occurred for individuals who are performing operator and maintainer tasks.

❖ Whole Body Vibration. This option allows you to factor vibration into your model, which is likely to be encountered in the situation of sea state or in a vehicle driving along a bumpy road. The parameters for vibration are Frequency (HZ) and Magnitude (m/s^2). The Whole Body Vibration stressor represents vibration for the z-axis (vertical) component only.

Several stressors include both a primary and a secondary component to set:

<table>
<thead>
<tr>
<th>Stressor</th>
<th>Primary Component</th>
<th>Secondary Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold</td>
<td>Temperature (degrees)</td>
<td>Wind (knots)</td>
</tr>
<tr>
<td>Heat</td>
<td>Temperature (degrees)</td>
<td>Humidity (%)</td>
</tr>
<tr>
<td>Noise</td>
<td>Distance (feet)</td>
<td>Decibels</td>
</tr>
<tr>
<td>Whole Body Vibration</td>
<td>Frequency (Hz)</td>
<td>Magnitude (m/s^2)</td>
</tr>
</tbody>
</table>

For these three stressors, primary stressor component values must be set before the secondary stressor component fields become available for editing. Secondary stressor components may not be applied by themselves.

Stressors may be reviewed and changed for each individual task one at a time, or for an entire group of tasks all at once. Depending upon the specifics of the task and Specialty, adding stressors may decrease task accuracy and/or increase the time it takes to complete the task.

In order to see the effects of stressors you should apply them one at a time. Once you have finished applying a stressor, it is recorded for that particular Task or Specialty and can be referred to or edited later.
It is important to note that any stressors that you apply may alter the stored accuracy, time, and/or probability values that IMPRINT Pro has for that particular task or Specialty, within your model. If you apply stressors, IMPRINT Pro will produce a “Delta” Report that will show you how task performance has been changed. When this “Delta” Report is produced, you should save the contents of this report (by selecting the data in the report using your mouse, and then pressing “Ctrl” for copy, going to Excel and pressing “Ctrl” for paste) in order to maintain a record of your changes. This record is important because you can make further changes in other places of IMPRINT Pro. As these changes add up, it can be difficult, if not impossible to regain your initial values. You should save any subsequent “Delta” Reports as well.

The following table indicates the impact of stressors by taxon.

<table>
<thead>
<tr>
<th>TAXON</th>
<th>MOPP</th>
<th>Heat</th>
<th>Cold</th>
<th>Noise</th>
<th>Sleepless Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>T</td>
<td>A</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numerical</td>
<td></td>
<td>A</td>
<td></td>
<td>TA</td>
<td></td>
</tr>
<tr>
<td>Cognitive</td>
<td></td>
<td>A</td>
<td></td>
<td>TA</td>
<td></td>
</tr>
<tr>
<td>Fine Motor Discrete</td>
<td>T</td>
<td>A</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Motor Continuous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Motor Light</td>
<td>T</td>
<td></td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Motor Heavy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication (Read &amp; Write)</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication (Oral)</td>
<td>T</td>
<td>A</td>
<td></td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

T = Affects task time  
A = Affects task accuracy  
TA = Affects both
If you apply more than one stressor to the same task, then a power function is applied. This means that the most severe stressor will have full effect, and the others have less. More information regarding the relevant calculations can be found in the HARDMAN III Final Report (Adkins and Dahl, 1993).

**To edit the Stressor settings:**

1. From the **Moderators** menu, select the **Settings...** option.

2. In the submenu which appears, select the **Stressors...** option.

   A dialog box appears, displaying a list all tasks in your model.

3. To change a stressor setting, insert the cursor in the box whose value you wish to change, and then choose a value from the drop-down list provided. For stressors having both a primary component and a secondary component set the primary component first, after which the secondary component may be set. Secondary components may not be applied by themselves.

   Alternatively, you may copy and paste values to and from Microsoft Excel provided the values shared are within the expected ranges for that category.

**Results**

Use the **Results...** option to review any impact on task performance as a result of applying Personnel Characteristics, Training, or Stressor moderators to either a Mission or Maintenance model.

**To view the impact of PTS settings on your tasks:**

1. From the **Moderators** menu, select the **Results...** option.

   A dialog box displays, listing all tasks and their respective PTS settings.

2. On the right-hand side of the dialog box are three check boxes: Personnel Characteristics, Training and Stressors. Check the boxes of the moderators you wish to apply to your tasks.
3. Click **Apply** on the PTS Results dialog.

Once you “Apply” your choices, you will see a report summarizing the new performance estimates and a “Delta” column that includes the impact your changes have had on the MOST RECENT values for task accuracy, time, and the probability of achieving the minimum acceptable accuracy. Each time you press “Apply,” the performance estimates will be a combined calculation based on all PTS settings so far, and the Delta values will show the amount of change from the immediately preceding “Apply” button click. If you wish to “Unapply” your choices, you must go back to the combo boxes where the settings were changed, adjust them so that they are in the N/A or 0 levels, and “Apply” these values again.

✔ **Note:**
If you click Apply and do not see any adjustments, it may be that you have not assigned any taxons to your tasks.

✔ **Note:**
In an Operations Model, only those tasks whose distribution types require mean time and standard deviation as parameters support the ability to apply PTS calculations.

✔ **Note:**
To have the PTS-adjusted task times and accuracies take effect during your model run, you must check the PTS Adjustments check box on the Execution Settings dialog before running your model.

---

**Execution Menu**

Once you have created a mission and defined mission parameters, you are ready to check your model for errors. The Execution menu includes the Check for Errors option which scans the model for incorrect syntax and reports errors in the Output window. This option may be used prior to running your model or for debugging your model once it has run.

The Execution Menu also contains several options to control model execution. Options include Begin Simulation, Pause Simulation, Step Simulation, Halt Simulation, and Abort Simulation. You may also change the speed of model execution using the Simulation Speed option.
Through an additional Settings option you can choose to apply PTS moderators, Perfect Accuracy, Workload Strategies and Cultural Modeling adjustments to the model and then specify the random number seed and number of runs for which the model should be executed.

The Execution menu has the following commands:

- Check for Errors
- Begin Simulation
- Pause Simulation
- Step Simulation
- Halt Simulation
- Abort Simulation
- Simulation Speed
- Settings

**Check for Errors**

The Check for Errors option should be used before executing a model and for debugging the model afterwards. For details, see “Checking for Syntax Errors” in IMPRINT Pro, Volume 2.

*To check for syntax errors:*

1. From the Execution menu, click Check for Errors. Alternatively, you may use the shortcut keys Ctrl+Shift+G.

   Any detected errors display in the Output window.
2. To open the dialog box where the error occurs, double-click the error.

IMPRINT Pro generally indicates the nature of the problem in the error message, such as "unrecognized word" for a misspelled or undeclared variable or function, or "semicolon expected at end" for a missing semi-colon.

Common problems include typographical errors in an expression, omitting a semi-colon, forgetting to define a variable or using the wrong case for a variable name. Because IMPRINT Pro distinguishes between upper and lower case letters, name, NAME, and Name are considered to be different and unique variables.

A detailed description of commonly encountered errors and methods to correct them is available in the IMPRINT Pro User’s Guide, Volume III, Appendix: Checking for Errors.

**Begin Simulation**

*To start or resume model execution:*

From the **Execution** menu, click **Begin Simulation**. Alternatively, you may use the shortcut keys **Ctrl+G**.

The model executes (or resumes execution if previously paused).

![Tick symbol]

**Note:**
Each time you run an operational mission or a maintenance scenario, your analysis automatically saves to the database just prior to the model run.

**Pause Simulation**

*To pause model execution:*

1. From the **Execution** menu, click **Pause Simulation**. Alternatively, you may use the shortcut keys **Ctrl+P**.

   The model pauses executing.

2. When ready to resume model execution, click **Begin Simulation** on the **Execution** menu.
**Step Simulation**

*To step through model execution:*

1. From the **Execution** menu, click **Step Simulation**. Alternatively, you may use shortcut keys **Ctrl+T**.
   - IMPRINT Pro executes the next event and then pauses.

2. Click **Step Simulation** again.
   - IMPRINT Pro executes the next event and then pauses.

3. To resume continuous execution, click **Begin Simulation**.

   **Note:**
   - Each time you run an operational mission or a maintenance scenario, your analysis automatically saves to the database just prior to the model run. This includes initiating a model run using the **Step Simulation** command.

**Halt Simulation**

Use the Halt Simulation any time you wish to stop your model run. Halting the model allows any ongoing Beginning Effects, Ending Effects, timed Snapshots and/or External Events to complete before the model run stops, allowing the model to end gracefully. In the event your model encounters an infinite loop in any of these types of events and therefore cannot end, choose the Abort Simulation option from the menu instead to end your model run.

*To stop model execution:*

   From the **Execution** menu, click **Halt Simulation**. Alternatively, you may use the shortcut keys **Ctrl+H**.

   The current execution stops.

   **Note:**
   - If you click **Begin Simulation** after you have halted an execution, a new run starts.
Abort Simulation

The Abort Simulation option should be used to end a model run only in the event the Halt Simulation option does not work, such as in the case of an infinite loop.

To abort model execution:

From the Execution menu, click Abort Simulation. Alternatively, you may use the shortcut keys Ctrl+Shift+Y.

The current execution aborts.

Simulation Speed

The Simulation Speed option controls the speed of real time mission simulation.

To set a simulation speed:

1. From the Execution menu, click Simulation Speed.

   A list of speeds appear.

2. Select a speed. Optional speeds include 25%, 50%, 100%, 200%, 400%, or 800%; each execution speed is twice as fast as the speed listed above it.

Settings

The Settings option allows access to execution settings for Operational or Maintenance models.

To access model execution settings:

From the Executions menu click the Settings option.

A new dialog box appears in the main IMPRINT Pro window, displaying options for model execution.
Edit Execution Settings

Before running an Operational Mission model or a Maintenance Scenario model, you may wish to edit the execution settings for the model run.

✓ Note:
Upon saving any mission or scenario, the current execution settings saved as part of it.

To edit execution settings:

1. From the Execution menu, click the Settings item.

   The Execution Settings dialog box displays.

   ![Execution Settings Dialog Box]

   The type of model currently loaded and selected in the Analysis tree (Operations, Maintenance or Force model) determines the type of settings to appear in this window. For example, if you currently have an operational mission selected in the Analysis tree, the Execution Settings window is automatically set to display the Operations Model execution settings. To view Maintenance Model execution settings, click the radio button beside the Maintenance Model option.

2. Edit the execution parameters.

   Model execution parameters are described in the following section.
Operations Model Parameters

The Operations model settings box contains the following editable execution parameters for the currently loaded mission listed in the top of the window:

- **Number of times to Run the mission.** This number determines how many times the model must run each time a simulation run starts from the beginning. If the number is greater than one, the execution times, paths of execution, and other probabilistic events are likely to be different for each run. If you run the model multiple times with the PTS Adjustments, Perfect Accuracy, Workload Strategies and Cultural Modeling options enabled, the data from these options will also appear in the results files along with data from all consecutive runs.

- **Random Number Seed.** The random number seed is the number used to generate random numbers for calculating task execution times and taking probabilistic paths through the network. The random number seed is a number between approximately -2 billion and +2 billion (inclusive). The same seed always produces the same set of random numbers in the same order, and thus the same results.

- **PTS Adjustments.** You may select “PTS Adjustments” to use the adjusted times and accuracies that were the result of the combined applied Personnel Characteristics, Training Frequencies and Stressors on the Calculators→Performance Moderators menu.

- **Perfect Accuracy.** Use this option to run the model with perfect accuracy (i.e., no task ever fails.) This method is sometimes useful when debugging your mission model.

- **Workload Strategies.** Check the Workload Strategies check box to implement Workload parameters set on the Warfighter dialog.
Animation On. Check the Animation On check box to view an animated representation of ongoing operator workload. In order to view the animation during your model run, you must first open the Animator window by selecting it from the View menu under the Windows submenu.

Note:
For best animation viewing results, enable the Display Trace option located on the Utilities menu before running your model. Viewing performance may also be improved by choosing a reduced Simulation Speed, available through the Execution menu and on the Tool bar.

Cultural Modeling. Check the Cultural Modeling check box and choose a Cultural template you created to apply pre-set conditions to your model that are known to be found in a particular cultural environment.

Maintenance Model Parameters

The Maintenance model settings box contains the following editable execution parameters for the currently loaded scenario listed in the top of the window:

- **Length of Run.** Select the number of days over which to execute your model.
Random number seed. Contains the number used to generate random numbers for calculating task execution times and taking probabilistic paths through the network. The random number seed is a number between approximately -2 billion and +2 billion (inclusive). The same seed always produces the same set of random numbers in the same order, and thus the same results.

Number of Systems. Select the number of systems to run. The number of systems defaults to one.

PTS Adjustments. Select “PTS Adjustments” to use the task times and accuracies that were adjusted as a result of the combined applied Personnel Characteristics, Training Frequencies and Stressors on the Calculators→Performance Moderators menu.

Crew Limits On. This check box lets you run the scenario in an unconstrained mode, regardless of the entries you make on the Maintenance Crew dialog. This means that IMPRINT Pro will ignore the shift manning on Equipment–Scenario–Maintenance Crew spreadsheet.

Animation On. This option enables the Animator window to display an animated version of a scenario and its corresponding maintenance data as it runs.

Note:
For best animation viewing results, enable the Display Trace option located on the Utilities menu before running your model. Viewing performance may also be improved by choosing a reduced Simulation Speed, available through the Execution menu and on the Tool bar.
Force Model

The Force model settings box contains the following editable execution parameters for the currently loaded force unit listed in the top of the window:

- **Length of Run.** Select the number of days over which to execute your model.

- **Random number seed.** Contains the number used to generate random numbers for calculating task execution times and taking probabilistic paths through the network. The random number seed is a number between approximately -2 billion and +2 billion (inclusive). The same seed always produces the same set of random numbers in the same order, and thus the same results.
Reports Menu

On completion of a model run, IMPRINT Pro can create reports pertaining to an Operations model, Maintenance Model, Force Model, Personnel Attributes and Cross-model Analysis.

*To review one or more of the reports:*

1. Click the **Reports** menu.

A secondary menu will display from which you can select the type of report to be reviewed:

- Operations Results
- Maintenance Results
- Force Results
- Personnel Attributes
- Cross Analysis Report

When you make this menu selection, you will be presented with an additional interface displaying all available reports for the type of report selected.
2. Select the report options you want.

3. Click **OK**.

IMPRINT Pro creates a new Microsoft Excel workbook that contains a separate worksheet for each selected report and graph.

A sample report workbook is shown in the following figure.

Each report can be accessed by clicking on its corresponding tab at the bottom of the workbook. Any selected report can be printed by selecting the “Print icon” in the Tool Bar.

### Sample Report

#### Operational Results Reports

Several reports are available after an Operations Model (Mission) has completed.

To **display operational results reports:**

1. From the **Reports** menu, click **Operational Results**.

   A dialog box displays, showing all selectable reports.
2. Check the reports you want to see, and then click the OK button.

3. If the Specialty Usage report is selected or if the Check All button is pressed, the Assign Grade Levels dialog displays, prompting you to select grade levels (E1-E9) for each of the Operators in your model.

For each listed operator, select a corresponding grade level from the drop-down list under the Grade column, and then click the OK button.
4. If the **Workload Graph** is checked, the **Workload Over Time** dialog box displays, prompting you for the range of time over which workload should be graphed.

Enter the desired **Start Time** and **End Time** for the range of data you wish to graph, and then click the **OK** button.

5. If the Operator Workload Detail report is checked, click the **Group** or **Ungroup** radio button to group or ungroup the data by simulation clock time.
Chapter 5: IMPRINT Pro Menu Structure

6. Click **OK**.

Excel launches, and all selected reports appear in an Excel workbook format.

![Excel workbook screenshot]

**Operation Model Reports**

Select the report you want to view by clicking the corresponding tab at the bottom of the workbook. For more information on Operational Results Reports see *IMPRINT Pro User Guide Volume 2 - Developing Analyses, Chapter 4: Mission and Personnel Reports*.

**Maintenance Results Reports**

*To create maintenance model reports:*

1. Select **Maintenance Results** from the **Reports** menu.

   When you make this menu selection, a new dialog box will appear, prompting you to first select the reports you wish to generate for that scenario.

2. Choose each report you wish to view by clicking its check box to the left.

3. Click **OK**.
The selected Maintenance reports display.

Select the report you want to view by clicking the corresponding tab at the bottom of the workbook. For more information on Maintenance Results Reports see *IMPRINT Pro User Guide Volume 2 - Developing Analyses, Chapter 5: Maintenance Model Results Reports*.

**Force Model Reports**

After running the force model for the desired force unit, you can view the results of your model run using the Reports option.
To view force analysis reports:

1. From the **Reports** menu, select **Force Model Results**.

   A dialog box appears, showing all available reports for your model run.

2. Select the check boxes of the reports you want to view, and then click the **Ok** button.

   ![Force Reports dialog box](image)

Microsoft Excel launches, and the reports you selected appear as separate sheets in a workbook. Click the tab at the bottom of the workbook corresponding to the report you want to view.

![Sample Force Report](image)

For more information on Maintenance Results Reports see *IMPRINT Pro User Guide Volume 2 - Developing Analyses, Chapter 8: Viewing Force Analysis Reports*. 
Personnel Forecast Report

For every operator in your analysis having a unique specialty, the Personnel Forecast Report displays the number of people of that specialty who will be available over the course of the next five years. Estimates are broken down by E-level (E3, E4...E9).

To create a Personnel Forecast Report:

1. From the Reports menu, click Personnel Forecast.

   The Personnel Forecast report dialog box displays.

   ![Personnel Forecast Report Dialog Box]

2. In the Personnel Forecast report dialog, check the boxes corresponding to the data you wish to view. Available options are:

   • **Personnel Forecast**: this report displays forecast data for all unique specialties in your list of operators in a single report. For every year forecasted, the report breaks down the number of forecasted personnel for that specialty by E-level (E3, E4...E9). Data are presented in a tabular format.

   • **Personnel Forecast Graphs**: for each unique specialty in your list of Operators, a new graph report is create, displaying that specialty’s forecast data in the form of a three-dimensional bar chart. For every year forecasted, the report breaks down the number of forecasted personnel for that specialty by E-level (E3, E4...E9).

3. Click OK.

   Microsoft Excel launches, and the reports display.
In the example below, the report is run for five different helicopter repairman specialties: 15M, 15R, 15S, 15T and 15U. The generated report displays estimates on how many personnel of each specialty category will be available through the year 2012.

**Note:**
In the example below, IMPRINT Pro omits the 15M specialty due to the unavailability of data for this specialty.

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</tbody>
</table>

**Personnel Forecast Report**

The Personnel graphs display the same information in the form of a bar chart:
Cross Analysis Report

The Cross Analysis Report allows you to display the results of one or more missions (or scenarios) side-by-side and compare their summary data.

To run the Cross Analysis Report:

1. Run the missions in your models that you wish to compare.

2. From the Reports menu, select Cross Analysis Report.

   A report selection dialog appears:
3. If you wish to compare Mission runs, click the **Operations Model** radio button.

   A list of all missions run in the current session of IMPRINT Pro appear.

4. Check the box for each mission you wish to include in your comparison.

5. Click **OK**.

   Excel launches, and the Cross Analysis report appears.

   ![Cross Analysis Report - Operations Model](image)

   Summary data for all selected missions displays.
6. For comparison of equipment scenarios, click the **Maintenance Model** radio button.

![Cross Analysis Report Dialog - Maintenance Model](image)

7. Check the box for each scenario you wish to include in your comparison.

8. Click **OK**.

Excel launches, and the Cross Analysis report displays.
Summary data for all selected scenarios display.

**Disable Reports**

The Disable Reports option allows you to run your model as normal, but it disables the post-processing step performed by IMPRINT afterwards. The post-processing step is required for compiling all data from the model run in a format which can be used and displayed by the reports. By choosing to disable this option, you may perform back to back runs of your model without having to wait for post-processing in between. You may not, however, view any report data until reports are once again enabled and the model is re-run.
Tools Menu

The Tools menu includes the following features:

- Accuracy Calculator
- Micromodels
- Syntax Helper
- Unit Conversions

Accuracy Calculator

In IMPRINT Pro, the likelihood that a task will be performed accurately is determined by an estimated mean and standard deviation that work together with the accuracy measure (for example, “percent steps correct”). When the model runs, IMPRINT Pro pulls a number from a normal distribution created with the mean and standard deviation you enter. This is compared to the accuracy standard to determine whether the task succeeded or failed its accuracy on each occurrence. If the number pulled is higher than the accuracy standard and the accuracy measure determines that higher equates with more accurate (e.g., percent steps correct), then the task is considered a success.

For example, you might say that on the average when performing this task the operators get 90 percent of the steps correct, or for another tasks they are within 10 mils of the correct azimuth. Under the first option, you will also specify the standard deviation, which is a measure of the worst and best the task is likely to be performed. An easy rule of thumb for specifying the standard deviation is to compute the difference between the worst and best performance and divide it by 6. For example, if the worst performance is 40% steps correct and the best is 100%, then an estimate for the standard deviation would be 10% ((100 - 40)/6) = 10).

We realize that it is often difficult for users to think of accuracy in these terms, and that it is often easier to think of it in terms of the probability of success. To accommodate this fact, we have provided a calculator that you can use to calculate the probability of success from the information you have entered. When you select the Accuracy Calculator, IMPRINT Pro uses your accuracy mean and accuracy standard deviation, as well as the accuracy standard to calculate the probability of success. This is actually
calculated using standard statistical procedures that compute the area under a Normal statistical curve. IMPRINT Pro is also careful to evaluate your accuracy measure to determine whether “bigger values” are better (for example, percent steps correct), or “smaller values” are better (for example, mils from desired). For more information, please refer to a statistics textbook.

We have also provided access the Accuracy Calculator dialog box that lets you enter three of the four data elements that are needed to specify accuracy (that is, accuracy standard, accuracy mean, accuracy standard deviation, and probability of success), and it will calculate and display the fourth data item. In addition, it will draw the normal distribution and show the area under the curve that is used to calculate the probability of success.

To use the Accuracy Calculator:

1. In the Network Diagram or the Analysis tree, select a task for which accuracy will be calculated.

✓ Note:
By choosing a task first before opening the Accuracy Calculator window, the Accuracy Calculator window, once opened, will then automatically provide an option for applying your calculated value to this selected task.
2. From the **Tools** menu click **Accuracy Calculator**.

   The Accuracy Calculator window appears.

3. Choose a description of measure from the **Measure** drop-down list which best describes accuracy for your task.

4. Click the radio button of the value you wish to calculate. Values include Accuracy Requirement, Probability of Success, Mean Accuracy and Standard Deviation.

5. Enter values in the remaining three fields.

6. Click the **Calculate** button next to the choice you selected.

   Your calculated value appears in the adjacent field.

7. Click the **Apply to Selected Task** button if you wish to replace your task’s existing value with the newly calculated value.

**Micromodels**

Select Micromodels to access a set of micromodels of human performance that have been gathered from psychological research literature. Many of these micromodels are just constant values, for example the Eye Movement Time (target is in the field) micromodel which has an algorithm value of 0.1 which translates into a 2.00 second adjustment in the mean task time. Other micromodels include prompts for you to enter pertinent data, for example the Hand Movement micromodel which requires entering a distance to target and target size.
To apply a Micromodel:

1. From the Tools menu click Micromodels.

   The Micromodels window appears.

2. In the Micromodel Name field click the drop-down arrow to display a list of available micromodels. Click the desired micromodel to select it.

   The micromodel name displays in the Micromodel Name field, and its algorithm and reference display in the fields below.
3. Enter the necessary parameters in the P1 - P4 fields if required by the selected micromodel.

4. Click the **Calculate** button.

   The Calculated Adjustment appears below.

5. Select the manner in which the adjustment should be applied to your current mean task time by clicking the radio button next to your choice. The Calculated Adjustment may be added to, subtracted from or replace the current mean task time. By default, the option **None** is selected.

   By clicking the radio button of your selection, the modified mean task time (as it would be if you applied this adjustment) appears in the Adjusted Mean Time field.

6. Click the **Apply to Task** button to replace the current mean task time with the Adjusted Mean Time

### Syntax Helper

The Syntax helper is an interactive tool that helps you see the acceptable syntax for any expressions you might enter in IMPRINT Pro. Use the syntax help if you are uncertain of the format of any expression. You can copy and paste the sample code from the helper into your beginning effects, ending effects or advanced mean time expressions and then modify the generic expressions to suit the needs of your model. Use the sample code for more guidance.

A detailed description of syntax is available in the IMPRINT Pro User's Guide, Volume III.

**To use the Syntax Helper:**

1. From the **Tools** menu click **Syntax Helper**.

   The Syntax Helper window appears.

2. In the list on the left, click the desired code example under the Loops section or the Conditional Statements section. For example, click the “Do” listing to see sample code for a do-while expression.

   Sample code appears in the window on the right. You may copy and paste code from this window into any code window in IMPRINT Pro.
3. Replace all parts of your pasted code containing “<expression>” with code that achieves your goal.

Unit Conversions

The Unit Conversions tool is a calculator which converts a value in a particular unit of measure to its equivalent value in a different unit of measure.

To use the Unit Conversion tool:

1. From the Tools menu click Unit Conversions.

   The Unit Conversions window appears.

2. Click the Time tab or Distance tab, depending on the type of units you wish to convert.

3. Enter the value to be converted in the Original Value field.

4. Select the desired “from” and “to” units by clicking the drop-down arrows in each field and selecting the desired units from the lists provided.

   The Result field automatically updates with the converted value.
Utilities Menu

The Utilities menu has the following commands:

- Display Trace
- Network Animation
- Update Comment Variable
- Alignment
- Enable Snap to Grid
- Export Task Network To Excel

Display Trace

The Output window displays the actions that occur when you run the model. This output is called the trace data. The following information displays:

- Clock values for beginning effects
- Clock values for ending effects
- Clock values for scenario events
- Syntax errors
✈ Whether the plugins (such as Animator .dlls) are successfully loaded when IMPRINT Pro is started

✈ When a run or simulation begins and ends

✈ Application errors

**To display trace data in the Output window:**

From the **Utilities** menu, click **Display Trace** to enable this option.

A check mark displays next to this option in the Utilities menu to indicate the option is enabled.

The next time you run the model simulation, trace information displays in the Output window.
To disable trace data in the Output window:

From the Utilities menu, click Display Trace to clear the check mark adjacent to this option.

The next time you run the model simulation, trace information does not display in the Output window. The only information that displays is the simulation clock value, run number and duration of simulation.

**Note:**

When you disable the display of trace data, you cannot enable network animation, charts, event queue, or comment variables to display.

To clear the Output window:

From the Edit menu, click Clear Output.

The Output window clears.
Network Animation

When you execute an IMPRINT Pro mission model, you can view the model execution as it occurs using network animation. When you enable network animation, you can watch entities move through the network diagram. When an entity is in a task or function, the task or function highlights in blue as beginning effect of that task (or any subtask belonging to the function) is evaluated. The number of entities in a task or queue are indicated by numbers above that display above the task or queue. Disabling network animation speeds model execution.

✓ Note:
   You must enable the display of trace data before you can enable the display of network animation.

To enable the display of network animation:

   From the Utilities menu, click Network Animation.

   A check mark displays next to this option in the Utilities menu to indicate the option is enabled.

   The next time you run the model simulation, network animation displays in the Task Network window.
To disable the display of network animation:

From the Utilities menu, click Network Animation so that the check mark adjacent to the label Network Animation clears.

The next time you run the model simulation, network animation does not display in the Task Network window.

Update Comment Variable

You can select variables to display on the task network diagram during model execution in Comment boxes. Once you add a comment box and select the variables for display, you can enable or disable the update of these variables during model execution. To maximize execution speed, disable the update of Comment variables to display.

To update Comment variables during model execution:

From the Utilities menu, click Update Comment Variables.

A check mark displays next to this option in the Utilities menu to indicate the option is enabled.

The next time you run the model simulation, any variables selected for display in Comments dynamically update as the model executes.
To disable the update of Comment variables during model execution:

From the Utilities menu, click Update Comment Variables so that the check mark adjacent to the label Update Comment Variables clears.

The next time you run the model simulation, any variables selected for display in Comments do not update.

Alignment

You can align network objects with one another along a vertical line or along a horizontal line. You can also center objects vertically or horizontally. IMPRINT Pro aligns the objects with the leftmost, rightmost, highest, or lowest object.

To align network objects:

1. Using your left mouse button, select the objects to align by dragging a box around them. Alternatively, you can press the Shift or Ctrl key and click the items with the mouse.

   The selected items appear highlighted in blue.

2. From the Utilities menu, click Alignment.

3. Select one of the following:
   • To align the left sides, click Align Left. Objects are aligned with the leftmost object.
   • To align the right sides, click Align Right. Objects are aligned with the rightmost object.
   • To align the tops, click Align Top. Objects are aligned with the highest object.
   • To align the bottoms, click Align Bottom. Objects are aligned with the lowest object.
   • To align the objects on the same horizontal line, click Center Horizontally. Objects are aligned on a horizontal line that is midpoint between the highest and lowest object.
   • To align the objects on the same vertical line, click Center Vertically. Objects are aligned on a vertical line that is midpoint between the leftmost and rightmost object.
Enable Snap to Grid

The Snap to Grid option allows objects in the network diagram to snap to the invisible grid as they are moved. By using the grid, tasks and functions align easily as you move them in your network diagram thus keeping the network diagram appearance more orderly.

To enable snap to grid:

From the Utilities menu, click Enable Snap to Grid.

The Snap to Grid feature is enabled, and a check mark displays adjacent to the Snap to Grid option in the Utilities menu. Objects on the network diagram snap to the invisible grid as they are moved.

To disable snap to grid:

From the Utilities menu, click Enable Snap to Grid.

The Snap to Grid feature is disabled, and the check mark adjacent to Snap to Grid item is removed. As you move objects on the network diagram, they move in a continuous line.

Export Task Network To Excel

The Export Task Network to Excel option exports all task network information from the selected mission to an Excel report which may be shared and understood by non-IMPRINT users. The report displays a listing of all network nodes in your selected mission model and includes information on how they connect to the other nodes in the network. Exported items include tasks, functions and goals.

To export the task network to Excel:

1. From the Utilities menu, click Export Network to Excel.

   A Save As dialog appears.

2. Using the drop-down option next to the Save In field, navigate to the folder in which you wish to save your exported data.

3. In the File Name field, type in the desired name of your exported data file.
4. Click the **Save** button.

All task network data exports to an Excel report.

**To view exported task network data**

1. Browse to the location of the exported network task data file on your system.
2. Double-click the file.

Excel launches, and the task network data report displays.

For each node listed in the report, the following information displays:

- **Object Type.** The type of object in the network diagram. Types include: **NetworkTask**, **NetworkFunction**, **NetworkGoal**, **StartTask** and **EndTask**.
- **ID.** The IMPRINT ID of the listed object. The ID displays as either “Root” for any object added to the root level of the network or as a string value indicating its placement within the subnetwork of another function or goal in the network. For more information on IMPRINT object identification, see “Network Object Identification” in Volume 2: Developing Analyses.
❖ **Parent.** The IMPRINT ID of the listed node’s parent object. The ID displays as either “Root” for any object added to the root level of the network or as a string value indicating its placement within the subnetwork of another function or goal in the network. For more information on IMPRINT object identification, see “Network Object Identification” in Volume 2: Developing Analyses.

❖ **Name.** The listed object’s name.

❖ **Paths.** The IMPRINT IDs of all other nodes to which this node connects in the network.

❖ **Decision Type.** The decision type set in the listed node’s path type field. Path types include **Single, Multiple, Tactical** and **Probabilistic**.

### Help Menu

The Help menu has the following commands:

❖ **Help**

❖ **About**

### Help

The Help command launches an electronic copy of the IMPRINT Pro User Manual. You may browse the available help topics or search by key words to locate a specific help topic.

**To open online help:**

From the Help menu, click Help.

A new window displaying the contents of the IMPRINT Pro user manual appears. This window contains the following three tabs:

❖ **Contents.** Navigate the listed topics by expanding the categories on the left side of the window. Single-click any topic in this list to display its contents in the right side of the window.
Index. Type a keyword or letter to bring up all Index listings starting with that word or letter. Click the topic in the listings below which most closely matches the topic of interest to display its contents in the right side of the window.

Search. Type a keyword or letter in the search field, and then click the List Topics button to bring up a list of topics starting with the keyword or letter you entered. Click the topic in the listings below which most closely matches the topic of interest to display its contents in the right side of the window.

About

The About command displays version information for your installation of IMPRINT Pro. This information may be helpful in tracking down any issues or “bugs” in this version.

To display version information:

From the Help menu, click About.

A window containing version information appears.
Accuracy Measure
Accuracy Measure is a unit corresponding to the nature of how your task’s accuracy is measured. This unit helps IMPRINT Pro to determine whether your task is more or less accurate when the number pulled from the accuracy distribution is greater or less than the requirement you set. For example, assume that your Accuracy Measure is set to Percent Steps Correct and your Accuracy Requirement is set to 80. If the number pulled from the Accuracy distribution is 85, then IMPRINT Pro will consider this accuracy value to be a success since 85% is better than 80% in the context of Percentage of Steps Correct. If, however, you intend choose the unit of Measure Feet from Desired, IMPRINT Pro will consider this accuracy value of 85 to be a failure since 85 is less accurate that 80 in the context of Feet from Desired.

Accuracy Requirement
The Accuracy Requirement is the minimum acceptable accuracy for a task in order for it to be considered a success.

Accuracy Standard Deviation
The Accuracy Standard Deviation specifies how tightly all the various values in the distribution are clustered around the Mean Accuracy value.

Activities Trump Matrix
A matrix used to set task priority within a Force Unit schedule for when any two activities overlap.

Analysis Description
A brief description of the analysis found in the Properties window. The Analysis Description is optional.

Analysis Name
The Analysis Name can be 20 characters long and can include spaces and symbols. When an analysis is added, IMPRINT Pro automatically generates an analysis name that the user may edit in the Properties window. However, when an analysis is saved, the user will need to enter a name in the dialog provided.
**Analysis Version**

The Analysis Version can be 20 characters long and can include spaces and symbols. When an analysis is added, IMPRINT Pro automatically generates an analysis version that the user may edit in the Properties window. When an analysis is saved, the user will need to enter a version number in the dialog provided.

**Array**

An ordered set of variable values that are indexed to a single variable name. An array can be a one-dimensional list, a two-dimensional table of rows and columns, or a multi-dimensional array.

**Beginning Effect**

An expression used to change the values of variables in the model as a result of a task starting.

**Clock**

System variable that records elapsed time in simulation time units since the beginning of model execution. The Clock variable can be used in any expression in a model.

**Contingency Operators**

One or more contingency operators may be selected for each task. During the task reallocation process, a contingency operators will be considered if workload overload occurs during mission execution.

**Crew Ratio**

Crew Ratio is the average number of crews available for each new system in the unit. In some cases where systems are required to operate continuously there may be multiple crews for each system.

**Criterion**

This value is the percentage of time that this task, function or mission must meet both its time requirement and its accuracy requirement simultaneously in order to be considered successful.
Decision Node
A diamond-shaped object on a network diagram containing one of the following letters: P, M, or T—representing a Probabilistic, Multiple, or Tactical decision.

Decision Type
The Decision Type determines which path(s) an entity may follow when exiting a node which branches out along multiple paths. Tasks with a decision type of Multiple will follow all paths every time; tasks with a decision type of Probabilistic are likely to follow the path(s) in proportion to the percentages you set for each path; tasks with a decision type of Tactical will follow only those paths whose conditions evaluate to True; tasks with a decision type of Single will only ever follow one path.

Distribution
The range of all possible values which can be assigned to a task’s time value and the probability that those values will be chosen at random.

Effect
An expression that executes as a result of task activity during model execution. Tasks can have beginning, and ending effects. You can use these effects to change variable values and thus represent the system changes that occur as a result of the task activity.

Ending Effect
An expression used to change the values of variables in the model because of a task ending.

Entity
A conceptual object that travels through a task network and indicates by its location when each task is executing or waiting to execute. The entity may represent a physical object, such as a part being built on a production line. It may also represent a person performing the tasks. Or, the entity may simply trace the sequence of tasks and not correspond to anything physical. During model execution, entities can be represented by symbols or numbers that travel through the network diagram. Entities are identified by corresponding values of their entity attributes.
**Entity.Duration**

An Entity attribute that records the time each entity spends in the current task.

**Entity.Tag**

An Entity attribute that records the identity of each entity when there are multiple entities traveling through a network. Once an entity has an Entity.Tag value, the value stays with the entity through the remainder of model execution.

**Estimated Task Accuracy**

Use Task Mean Accuracy and Accuracy Standard Deviation under this section of the TimeAcc tab to specify an average value for how accurately a particular task is likely to be performed. For example, you might say that on the average when performing this task the operators get 90 percent of the steps correct or for another tasks they are within 10 mils of the correct azimuth. Under the first option, you will also specify the standard deviation, which in some sense is a measure of the worst and best the task is likely to be performed. An easy rule of thumb for specifying the standard deviation is to compute the difference between the worst and best performance and divide it by 6. For example, if the worst performance is 40% steps correct and the best is 100%, then an estimate for the standard deviation would be 10% \(((100 - 40)/6) = 10\). Under this option you will define what is acceptable performance by specifying an accuracy standard. For example, you may say that any error greater 5 mils causes firing inaccuracies that are unacceptable. With the information above, the model then computes the probability of the task performance being at or above the standard and compares a selected random number to determine if task was performed accurately.

**Estimated Task Time**

The Estimated Task Time is the amount of time a task will take to execute as calculated by IMPRINT Pro. This time will vary each time the task is executed. To calculate this time, IMPRINT Pro starts with an initial task time which can either be represented as a value (entered in the Value field in the format of HH:MM:SS.mm) or as a time expression (entered in the Expression field and evaluated to seconds). Next, IMPRINT Pro pairs this initial time with a statistical distribution type. This distribution determines the possible values your task time could take relative to your initial value. When IMPRINT Pro runs, a random number is generated and is used to pull a number from the distribution you have specified. This number
becomes the Estimated Task Time for that occurrence of the task. Note: of
the available 20 distribution types, IMPRINT Pro uses, by default, the
Normal distribution which uses Mean and Standard Deviation to predict a
task performance time. Depending on the distribution type you choose to
use, different and/or additional parameters such as Shape, Probability of
Success, Maximum, Minimum and Scale, might also be required.

**Event**
Something that is scheduled to happen during a simulation at a specific
clock time. Some events are expressions that you schedule to occur at
specific times—these are called scenario events. All other events are
scheduled, such as the finish times for currently executing tasks, as the
model is running. You can watch events being scheduled by displaying the
Event Queue window.

**Event Queue**
Events that are scheduled to happen during model execution are placed in
an Event Queue. As each event occurs, it is removed from the top of the
queue. These events are displayed in the Event Queue window.

**Expression**
A calculation, formula, macro, or statement that supplies a value or
performs an operation. Expressions can contain combinations of numerical
values (constants or variables), macros, mathematical and logical
operators, and logical statements.

**Force Unit**
A Force Unit is a group of individuals, defined by jobs, who perform a
variety of activities according to schedules.

**Function**
A network that is inside another network. In a model, all networks are
functions except for the top network (level 1). You can create a function by
dragging a function object to the Network Diagram from the Palette. Select
the function with the pointer to open its diagram. Function diagram are
drawn in the same way as the main network diagram. Functions usually
also contains tasks.
**Function Criterion**

Function Criterion is a percentage that determines how often the function must meet its Function Time Requirement to be considered a success. Enter a value between 0 and 100, inclusive.

**Function Time Requirement**

The Time Requirement is the slowest performance time that can be tolerated and have the function still be considered a success. When IMPRINT Pro executes your mission model, the performance time that is predicted by the aggregation of all tasks in this function will be compared to this standard to ensure that your design can meet the function level time requirement. The format for this entry (as with all other time values) is HH:MM:SS.mm. To enter a time requirement of 30 minutes, 15 seconds enter 00:30:15.00. Notice that you can enter hundredths of a second after the decimal point.

**Job**

The occupation held by one or more members of the Force Unit. Each job is defined by a name, specialty, rank and role. Examples may include Tank Driver, Navigator and Analyst.

**Length of run**

The number of days of operations that the IMPRINT Pro maintenance model will simulate. If you define mission segments for more days than are entered here, the model will not execute any segments that go beyond this value. This value defaults to 1.00.
Macro
One or more mathematical or logical expressions that are assigned a single name and return a single value. When a macro name is encountered in an expression in a model, the model executes the expressions included in the macro and returns a value. IMPRINT Pro contains model, mathematical, and distribution macros for your use, or you can define and save your own macros with the model.

Maximum Number of Systems
This value is the maximum number of systems that would be assigned to your segment if available.

Mean Accuracy
The Mean Accuracy is the estimate of the most likely, or average, accuracy value for a task.

Mean Time Expression
The Mean Time represents the average number of seconds required to execute a task. You can either enter a mean time value (00:00:30) or you can enter an expression (clock<=30 then 10 else 15). Each expression is delimited by semicolons. In building the expression you can use any of the algebraic or logical operators including the following: (&, |, >, <, :=, ==, +, -, *, and /), and you can use if-then-else statements. The assignment operator is :=. The equivalence operator is ==.

Minimum Number of Systems
This value is the minimum number of systems that must be ready to begin the segment prior to the cancellation time in order to prevent all departure groups from being canceled.

Mission Accuracy Criterion
The Mission Accuracy Criterion is a percentage that determines how often the mission must complete without abort to be considered a success. Aborts are caused when a task fails and the consequence of failure is mission abort Values can range from 0 to 100.

Mission Criterion
The Mission Criterion is the percentage that represents how often the mission must meet both its time and accuracy standards at the same time. Values can range from 0 to 100.
**Mission Description**

The Mission Description is a fairly long text field that you can use to describe the mission you intend to model. The description is limited to 255 characters. All printable text characters are allowed.

**Mission Name**

The Mission Name is a brief text label that you will use to uniquely identify your system's mission. The mission name is limited to 60 characters. All printable text characters are allowed, including spaces.

**Mission Time Criterion**

The Mission Time Criterion is a percentage that determines how often the mission must meet its Mission Time Requirement to be considered a success. Values can range from 0 to 100.

**Mission Time Requirement**

The Time Requirement is the slowest performance time that can be tolerated and have the mission still be considered a success. When IMPRINT Pro executes your mission model, the performance time that is predicted by aggregating your individual tasks will be compared to this standard to ensure that your design can meet the mission level time standard. The format for this entry (as with all other time values) is HH:MM:SS.mm. So, to enter a time requirement of 30 minutes, 15 seconds enter 00:30:15.00. Notice that you can enter hundredths of a second after the decimal point.

**MMH/System**

Annual MMHs/system (ORG, DS, & GS levels) are the total number of annual maintenance manhour (by maintenance level) required to maintain one new system in that unit.

**New Systems**

This is the number of new systems that will be fielded in the unit.

**Network**

A sequential relationship of jobs (tasks and functions) that simulate a system, activity, or process. You create the network by drawing a network diagram, and you use variables to simulate the effects of the tasks on other tasks and on the system.
**Network Diagram**
A graphical depiction of a model network showing the sequence of tasks and functions, and the possible paths through the network. You draw the network diagram using the objects on the Palette.

**Number of times to run the mission**
If you would like to run a model more than once, you can enter that number in this field. If you have a relatively short scenario (in days), you may want to run the model several times in order to be confident that the data you get from all of the runs is representative. One short run may, by chance, produce data that are not very typical. Running a model for a long period of time (for example, 90 days) will also improve the probability that the results are typical. IMPRINT Pro will automatically begin each run with a new random number seed. This value defaults to 1.

**Number Per Departure Group**
This value controls the number of systems per group (sometimes referred to as a “flag”) that are sent out on this segment.

**OP Tempo**
Annual OP Tempo is the usage per year that the new system is expected to accrue in the type and size unit listed.

**Overall Workload**
The sum of all single task demand values and all conflict values (inter-channel and intra-channel) of all ongoing tasks that an operator is currently performing at a given instant of time (see Operator Workload Summary and Detail reports.)

**Path**
A sequential connection between two nodes (tasks or functions), drawn by dragging the mouse cursor from one node (source) to another (destination). The conditions under which the path is taken is specified in the Paths tab of the source node.
**Planned Activity**
A planned activity is an activity comprising part of a Force Unit schedule, which has a designated start time and will last until the next scheduled activity is set to occur. Examples may include “guard duty,” “hygiene,” “eating” and “sleeping.”

**Primary Operator**
The Primary Operator is the Specialty and crew position that will be assigned to perform the task.

**Probability of Success**
The Probability of Success is the likelihood that a task will succeed each time it is executed. This number can either be manually entered or can be calculated as a result of entering values for the remaining three fields upon which it is dependent, namely the Mean Accuracy, Accuracy Standard Deviation and the Accuracy Requirement.

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**Random Number Seed**
A number between approximately -2 billion and +2 billion used to generate random numbers for calculating task execution times and taking probabilistic paths through the network. You supply the random number seed when you define the Execution settings for a model.

**Rank**
An official position or standing in the armed forces. This information is used to help define the jobs in a force unit. Ranks include E1-E3 (Private and Private First Class), E4 (Specialist or Corporal), E5 (Sergeant), E6 (Staff Sergeant), E7 (Sergeant First Class), and E8-E9 (Master Sergeant, First Sergeant, Sergeant Major, Command Sergeant Major and Sergeant Major of the Army).

**Release Condition**
An expression that is evaluated to determine whether or not a task can execute. A task can execute only when the value of the release condition is nonzero or true. You supply the release condition when you define the task. The default release condition is always “true”.
**Repeating Segments**
A Repeating Segment is one in which IMPRINT Pro’s maintenance model will attempt to send more systems out to perform this segment every so often. You can identify the frequency of the segment (for example, “repeats every four hours”).

**Replacement Systems**
The number of old systems that will be replaced in a unit.

**Resource-Interface Channels**
Resource-Interface Channels are formed by pairing the human resources with the interfaces (for example, visual/heads up display, motor/control stick). All workload is assigned to a task by setting individual single task demand values for each resource-interface channel used to perform that task.

**Role**
The level of participation that a job (an occupation held by one or more members of the Force Unit, such as a driver or gunner) will have in an unplanned activity if one requiring such a level occurs. Roles include Leader, Sub-Leader and Member.

**Run number**
The current run number in cases where there are multiple runs. The run number can be accessed through the expression `Model.RunNumber`.

**Scenario Description**
The scenario description is a free text field that you can use to document your analysis. It is limited to 255 characters.

**Scenario Name**
This is the name of your maintenance scenario. You can have many maintenance scenarios for each system.

**Seed**
Random number seed used to run a model. The random number seed generates a set of random numbers that are used to calculate task execution times and probabilistic paths taken through the network. The random number seed can be set in the Execution dialog box. For multiple runs of a model, the variable `Model.RandomSeed` contains the random seed used to generate the particular run.
**Segment Cancellation Time**

This is the number of hours that the simulation will wait for the minimum number of systems to be available before canceling the segment. For example, if the minimum number of systems for this segment is six and there are only four available at the scheduled start of the segment then the segment must wait. If there is a value of “01:00:00.00” in this field, then if the minimum number of systems do not become available within one hour of the scheduled start, the segment will be canceled. The default value for this item is 00:00:00.00. This means that the minimum number of systems must be available at the start time of this segment in order for the segment to begin. Be very careful that your cancellation is not after the segment would be attempting to repeat.

**Segment Duration Time**

This value indicates the number of operational hours for this segment. This value is used to schedule the return of the systems from operations and the beginning of the maintenance window. Additionally, this time is used to determine usage for the equipment on which failures are triggered by time.

**Segment Priority**

When more than one segment has been defined to occur at the same time, the segments must compete for available systems. In this box, you can enter a priority number for each segment. Available systems will be allocated to higher priority segments first.

**Segment Repeat Mean Time**

If you have checked the Repeating box for your segment, you will be able to enter a time in the Segment Repeat Time box. The value in this box controls the frequency (in hours) with which the simulation will attempt to repeat this segment. If you will enter the number 4 in this box, it will indicate that you want this segment to repeat every four hours. In other words, this segment will try to start again every four hours throughout the simulation. If you wanted this segment to repeat only twice, you could do this by defining two separate but identical segments with one starting four hours after the first.

**Segment Start Day**

The Segment Start Day and the Segment Start time work together to identify the start time of this segment. This value defaults to 1. If you were to leave the default values in both of these boxes, this mission would begin at time 0 on day 1.
**Segment Start Time**
The time entered in the Segment Start Time box indicates the time the segment is to begin. This value defaults to 00:00:00.00.

**Shift Data**
Enter the maintenance shift length in clock hours and the number of shifts per day. The product of the two numbers must be less than or equal to 24. The number of shifts will determine the number of shift columns in the Maintenance Crew spreadsheet.

**Shift Length**
The length of shift in hours.

**Shifts per day**
The number of shifts per day.

**Snapshot**
An option that records the values of specified variables at particular points during model execution—for example, when a task starts or ends, at the end of a run, or at specific clock times. When you run a model for which you have defined snapshots, the values are recorded, and results may be viewed in the Snapshots report.

**Specialty**
Specialty is a designation for a particular military job within the Armed Forces referenced by a 3-letter designation. For example, a Scout helicopter repairer is designated 67S. This option enables you to select people of appropriate specialties for task assignments.

**Spinner Task**
A task with a path that goes back to itself. Spinner tasks are used to generate multiple entities to travel through the network.

**Subsystem Equipment Group Name**
The subsystem type indicates the operational units (Armament, Mobility, and Other) that are used to describe the usage for that subsystem.
**Subsystem**

A subsystem is one of several smaller elements comprising a system, for example, an engine is a subsystem that is part of a system called “Tank”. Each Subsystem is going to be one of three types (Armament, Mobility, and Other) and must be uniquely named. Subsystem type indicates the operational units that are used to accrue the usage for that subsystem. Usage for an Armament subsystem is described as the number of rounds that have been fired from that subsystem. Usage for components in a Mobility system is described in terms of the distance that the system has traveled. Subsystems with a type of “Other” use operational time as the usage measure.

**Task**

Tasks are the basic building blocks of a model. A task is defined by timing information, execution constraints (or release conditions), effects of the task on the system, and routing information concerning following tasks and functions. Each time a task executes, the execution time is randomly calculated within the time distribution parameters you supply. You can create a task using the Palette and Network Diagram or through the Analysis Tree. To define a task simply double-click the task in the tree or in the network, and enter its information in the Task Properties window.

**Task Accuracy Probability**

As an alternative to specifying a task’s Accuracy Mean, Standard Deviation and Accuracy Standard data and relying upon IMPRINT Pro to calculate its Probability of Success, you can instead directly enter this value by (as a percentage) in the Probability of Success field. When the task runs, the value entered here is compared with a random number to determine if the task was performed accurately.

**Task Criterion**

The percentage of time that the task must meet its time and accuracy standards in the same simulated occurrence in order to considered a success.

**Task Mean Accuracy**

The average value for how accurately a particular task is likely to be performed.
**Task Name**
This text box displays the name of the task for which you are displaying or entering information.

**Task Priority**
On the Effects tab, task priorities are used to execute priority-based workload management strategies. The priorities range from 1 (very low) to 5 (very high). New tasks are assigned a priority level of 3 (medium). To change a priority level for a task, double click on a task to open the task parameter window, click in the Task priority field of the task and enter a priority value between 1 and 5, or click on the drop box in the task priority field and select a priority from the list.

**Task Standard Deviation**
A measure that tells you how closely all the various task times calculated by IMPRINT Pro are clustered around the mean task time. In general, one standard deviation away from the task mean time in either direction (greater than or less than the mean) accounts for somewhere around 68 percent of all computed task times. Two standard deviations away from the mean account for roughly 95 percent of the computed task times. And three standard deviations account for about 99 percent of the computed task times. By specifying the Task Standard Deviation for your task, you are helping IMPRINT Pro to determine how widely varied (or unvaried) the distribution of all your different calculated task times will be.

**Task Time Requirement**
The Time Requirement is the slowest performance time that can be tolerated and have the task still be considered a success. When IMPRINT Pro executes your mission model, the Distribution along with parameters Mean and Standard Deviation are used to choose a specific task time for each occurrence of each task. These times are then accumulated throughout the model run and compared to the time standard in order to report the percentage of successes for each task. To enter the time requirement, use the mouse to position the cursor in the time requirement box.

**Time Between Departures**
The value in the Time Between Departures field denotes the amount of time that must lapse between any two consecutive group departures for a given segment. This value is in hours and can be entered in the HH:MM:SS.mm format to include hundredths of hours.
**Time Format**

Time data entered in the IMPRINT Pro interfaces or viewed in the IMPRINT Pro reports can be displayed in one of several different formats, such as hours, minutes, seconds and HH:MM:SS.mm. Time formats may be changed in the Time tab through the Preferences option under the View menu.

**Time Requirement**

The Time Requirement is the maximum acceptable performance time for a task.

**Unplanned Activity**

A unplanned activity is an activity which can interrupt the normal planned activities comprising a Force Unit schedule, Unplanned activities are defined by a probable start time, duration and the number of people required to address them. Examples may include “fire” and “emergency”.

**Variable**

An identifier which is used to represent a quantity which can vary in value. When a variable name is encountered in an expression, IMPRINT Pro substitutes in the current value of the variable and evaluates the expression. Variables are useful for representing changeable aspects of the system you are simulating. You can change the value of a variable through any expression in your model, for example, in a task effect or in a scenario event. For each IMPRINT Pro model, five system variables are automatically created including Clock, Distributions, Entity, Model, and Task. For more information about system variables see the “Variables” section in this manual.

**Warfighter**

A warfighter is any person or automated device that operates, maintains, supplies or supports military equipment.
Glossary

X

Y

Z
Appendix A: Technical Description of Stressor Implementation

Evaluation of Human Performance under Diverse Conditions via Modeling Technology

Dr. Laurel Allender, Ms. Lucia Salvi, Dr. David Promisel

U.S. Army Research Laboratory Human Research and Engineering Directorate

Aberdeen Proving Ground, Maryland, U.S.A

Streamlined system acquisition and resource constraints are realities of military test and evaluation today. However, the pressure of saving time and dollars cannot be permitted to eliminate the assessment of total system performance - that is, the soldier, the hardware, and the software. Assessing combined soldier-system performance is as critical as ever. To address the challenges of the future battlefield requirements documents being written for military systems today regularly require operation in cold and hot conditions; in nuclear, biological, and chemical (NBC) environments; and over extended time periods. More and more functions are required to be automated, which does not necessarily make the job easier but, more likely, changes the nature of the job, the crew size, the task allocation, and the skills and abilities needed to do the job. These kinds of system requirements generate soldier-system dynamics that will affect overall system performance and must be evaluated throughout the system acquisition, design, and ultimately, the test and evaluation process.

In addition to the time and cost-effectiveness considerations that are givens for test and evaluation, regulations governing human use and test participant safety must also be considered. It is simply not permitted to test systems under all of the actual conditions in which they are required to operate. Certain hazardous conditions, for example, NBC operations, must be approximated. It is being proposed here that modeling not only provides a reasonable alternative for the approximation of performance under diverse--even extreme--conditions, but it also can be accomplished within the time and cost constraints. Existing data can be used to extrapolate to other conditions. Once a baseline model is built, excursions are typically straightforward. Modeling can be used iteratively to evaluate different conditions or to conduct sensitivity analyses and comparisons.
Over and above the ways in which modeling technology helps to address the time, cost, and safety concerns of test and evaluation, it offers a logical and sound approach to estimating human performance. It is a task-analytic approach that lends itself to good documentation and the building of audit trails. It can be used to help quantify what are, all too often, largely subjective assessments. It can also compensate for, or be used to extend operational field data that come with certain innate limits such as uncontrollable extraneous variables, small sample size, and non-repeatability. Modeling too, has its limitations; however, in combination with more traditional test and evaluation methods, for example, in a model-test-model mode, it can provide valuable estimates of human performance under a wide variety of conditions.

The IMPRINT Tool

The U.S. Army Research Laboratory Human Research and Engineering Directorate has developed a modeling and analysis tool, the Improved Performance Research Integration Tool (IMPRINT). The IMPRINT tool grew out of common U.S. Air Force, Navy, and Army manpower, personnel, and training (MPT) concerns identified in the mid-1970's: How to estimate MPT constraints and requirements early in system acquisition and how to enter those considerations into the design and decision-making process. The U.S. Navy first developed the HARDMAN (Hardware vs. Manpower) Comparability Methodology (HCM). The Army then tailored the manual HCM, which became known as HARDMAN I, for application to a broad range of weapon systems and later developed an automated version, HARDMAN II. In HARDMAN I and II, however, there was no direct link between MPT and performance. To directly remedy this shortcoming, the U.S. Army began the development of a set of software analysis modules in the mid-80's (Kaplan, 1988). This set of modules was called HARDMAN III, and although the name was the same, it used a fundamentally different approach for addressing MPT concerns than previous methods. It provided an explicit link between MPT variables and soldier-system performance. IMPRINT, while being an improvement over HARDMAN III, for the purpose of the discussion here, is essentially HARDMAN III in the Windows™ environment.

The mechanism for the MPT-performance link is task network modeling provided by the commercially-available Micro Saint task network simulation modeling engine, PC software designed for describing and analyzing task networks. The modeling capability offered can be further characterized based on three distinctions (Law & Kelton, 1991): (1) static vs. dynamic, (2) deterministic vs. stochastic, and (3) continuous vs. discrete. A static model does not address system effects over time,
whereas a dynamic model represents a system as it changes with time. A deterministic model does not represent any probabilistic, or random, elements. A stochastic model does encompass random elements and produces output that contains random error. A discrete model refers to instances where the variables characterizing the system change instantaneously at separated points in time. A continuous model is the converse, with variables that change continuously with time. In some instances, systems can be treated as either discrete or continuous, depending on the objectives of the analysis.

Using these definitions then, IMPRINT can be described as a dynamic, stochastic, discrete event modeling tool. When certain assumptions hold, namely, that the system of interest can be adequately described by task activities and networked sequencing, that dynamic processes and random variability are of interest, and that any continuous tasks can be fairly transformed into discrete tasks, then IMPRINT is an appropriate tool to use to represent and analyze soldier-system performance.

The basic modeling capability in IMPRINT requires the decomposition of a system mission into functions which, in turn, are decomposed into tasks. The functions are linked together into a network describing the flow of events. The network can include various types of branching logic such as parallel branches, probabilistic branches, and repeating branches. Within each function, the tasks are sequenced using the same types of branching logic options. At the task level, estimates of task performance time and accuracy means and standard deviations are input along with the consequences of the failure to perform a task accurately enough. The failure consequence options are no effect, total mission abort, repetition of
that or some other task, or subsequent degradation of some other task. The data entered are assumed to be representative of performance under “typical” or baseline conditions. Also, standards of performance can be entered to provide benchmarks for performance adequacy at the mission, function, and task levels. A sample IMPRINT screen depicting a network of functions (containing tasks) is shown in Figure 1.

IMPRINT executes a mission model task-by-task by first drawing a task time from the distribution as defined by the mean and standard deviation input for each task. (IMPRINT assumes a default normal distribution although other distribution options are available). Then it calculates the probability of success for the task based on the accuracy inputs. Next it determines, for this instance, whether there is an accuracy failure. After checking for a given task, IMPRINT proceeds through the task and function networks in accord with the established branching logic and analyzes the output according to the standards. When the model execution is completed (which can be anywhere from 1 to 999 repetitions), reports of estimated performance at each of the three levels are generated along with the comparisons to the standards. Although any given model and its associated assumptions must be scrutinized, this approach is particularly useful for comparisons across systems or system conditions.
Environmental Stressors in IMPRINT

Along with the basic task network simulation modeling capability, the IMPRINT tool includes specific algorithms or look-up tables—environmental stressors—to assess performance under diverse conditions. Recall that the task performance data entered in the baseline model are assumed to represent performance under “typical” conditions. The embedded environmental stressors automatically adjust performance to account for the changes expected under different levels of the stressors. Currently, IMPRINT includes five environmental stressors: protective clothing (that is, Mission-Oriented Protective Posture or MOPP), heat, cold, noise, and hours since last sleep (see Figure 2). The application of a stressor will result in either less accurate task performance, longer times to complete the task, or both. Stressors may be applied to an individual task or to all the tasks assigned to a particular job or Military Occupational Specialty (Specialty) for the mission. When the model is re-run, the new, or “stressed,” task performance time and/or accuracy are used as the task estimates that are “rolled up” in the task, function, and mission reports and compared against the standards. Importantly, the results can also be compared with the baseline model predictions. (See Dynamics Research Corporation, & Micro Analysis & Design, 1993) for more complete documentation.)

<table>
<thead>
<tr>
<th>Stressors</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Task ID</td>
<td>Task</td>
<td>Worker</td>
<td>Specialty</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module START</td>
<td>1</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Module END</td>
<td>555</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Start</td>
<td>1,0</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Start</td>
<td>1,2</td>
<td>Driver</td>
<td>19K</td>
</tr>
<tr>
<td>Power Tank</td>
<td>1,3</td>
<td>Driver</td>
<td>19K</td>
</tr>
<tr>
<td>Minita Task</td>
<td>1,4</td>
<td>Driver</td>
<td>19K</td>
</tr>
<tr>
<td>Minita Forward</td>
<td>1,5</td>
<td>Driver</td>
<td>19K</td>
</tr>
<tr>
<td>Conduct Surveillance</td>
<td>1,6</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Conduct Surveillance</td>
<td>1,7</td>
<td>Gunner</td>
<td>19K</td>
</tr>
<tr>
<td>Conduct Surveillance</td>
<td>1,8</td>
<td>Loader</td>
<td>19K</td>
</tr>
<tr>
<td>End</td>
<td>1,995</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Start</td>
<td>2,0</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Default</td>
<td>2,1</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>End</td>
<td>2,995</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Start</td>
<td>3,0</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>Default</td>
<td>3,1</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
<tr>
<td>End</td>
<td>3,995</td>
<td>Tank Commander</td>
<td>19K</td>
</tr>
</tbody>
</table>
As a side note, IMPRINT also models the effects of two task performance shaping functions, based upon personnel characteristics and training frequency and recency. The personnel characteristics function uses both standardized Specialty entrance scores and the general Armed Forces Qualification Test (AFQT) scores. Different from the stressors, which only degrade performance, applying the performance shaping functions can result in either better or worse performance, depending on the level selected. For example, increasing the frequency of training results in improved performance, whereas decreasing the frequency lowers performance. IMPRINT also models the mental workload associated with task performance. Workload profiles can be developed for crew members, or, in the advanced mode, the interaction of workload and performance can be evaluated to include workload coping strategies and task-workload conflicts. Although these functions provide important analytic capabilities, the focus of the paper from this point is solely on the environmental stressors.

Before discussing each stressor in turn, it is important to note that not all tasks are affected in the same way or by the same stressor. To accommodate this, IMPRINT uses a task category weighting scheme. Nine categories or taxons used to describe a task (see Table A-1) (Fleishman & Quaintance, 1984). Category weights are assigned to each task so that the various stressor effects are likewise weighted. In this way, each task contributes only the appropriate amount of change to the “stressed” performance at the mission level. Every task can be categorized with as many as three taxons. For example, operating a tractor and semi-trailer may involve driving a vehicle that is classified as “fine motor continuous” and may involve giving or receiving instructions, which is classified as “communication (oral).” Additionally, weights, which must sum to 1.0, are used to describe the degree to which a particular task manifests a particular taxon. In the example cited, operating a tractor and semi-trailer task might be composed of .75 fine motor continuous and .25 communication (oral). Modification of the taxon weights also allows for the consideration of new technology. For example, an automatic reloading device could change a heavy lifting or gross motor heavy task to a fine motor discrete task where only the manipulation of controls is required.
# Table A-1: IMPRINT Taxons, Descriptions, and Task Examples

<table>
<thead>
<tr>
<th>Taxons</th>
<th>Definitions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>Requires using the eyes to identify or separate targets or objects</td>
<td>Seeing something move and then recognizing it as an enemy tank</td>
</tr>
<tr>
<td>Numerical</td>
<td>Requires performing arithmetical or mathematical calculations</td>
<td>Measuring an azimuth on a map with a protractor Estimating the distance between two points on a map</td>
</tr>
<tr>
<td>Cognitive (Problem Solving and Decision Making)</td>
<td>Requires processing information mentally and reaching a conclusion</td>
<td>Locating a fault in an electrical system after troubleshooting Selecting the best firing position for a machine gun</td>
</tr>
<tr>
<td>Fine Motor Discrete</td>
<td>Requires performing a set of distinct actions in a predetermined sequence mainly involving movement of the hands, arms, or feet with little physical effort</td>
<td>Assembly and disassembly of the M-16 rifle Starting the engine of a truck</td>
</tr>
<tr>
<td>Fine Motor Continuous</td>
<td>Requires uninterrupted performance of an action needed to keep a system on a desired path or in a specific location</td>
<td>Driving a vehicle Tracking a moving target</td>
</tr>
<tr>
<td>Gross Motor Heavy</td>
<td>Requires expending extensive physical effort or exertion to perform an action</td>
<td>Lifting an artillery round Loosening a very tight bolt with a wrench</td>
</tr>
</tbody>
</table>
Table A-2 details which task taxons are affected by which stressors in the current IMPRINT software. It also shows whether the task performance is degraded by time, accuracy, or both. Since degradation factors are processed as multipliers, the degradation factors affecting time will be greater than 1.0 to increase the performance time. On the other hand, the degradation factors affecting accuracy will be less than 1.0 to decrease the performance accuracy from the pre-existing accuracy level. The overall degradation resulting from a specified stressor is directly proportional to the weighting assigned to the affected taxon(s) comprising the task.

Table A-2: Listing of the IMPRINT Environmental Stressors and the Taxon Types Affected by Either Time or Accuracy or Both

<table>
<thead>
<tr>
<th>Taxons</th>
<th>Definitions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Motor Light</td>
<td>Requires moving the entire body (that is, not just the hands) to perform an action without expending extensive physical effort</td>
<td>Getting into a prone firing position</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evacuating a tank</td>
</tr>
<tr>
<td>Communication (Read and Write)</td>
<td>Requires either reading text or numbers that are written somewhere or writing text or numbers that can be read</td>
<td>Reading a preventive maintenance check list for a vehicle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Writing a letter home</td>
</tr>
<tr>
<td>Communication (Oral)</td>
<td>Requires either talking or listening to another person</td>
<td>Giving a situation report by radio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receiving a password from someone while on guard duty</td>
</tr>
</tbody>
</table>

Table A-2 details which task taxons are affected by which stressors in the current IMPRINT software. It also shows whether the task performance is degraded by time, accuracy, or both. Since degradation factors are processed as multipliers, the degradation factors affecting time will be greater than 1.0 to increase the performance time. On the other hand, the degradation factors affecting accuracy will be less than 1.0 to decrease the performance accuracy from the pre-existing accuracy level. The overall degradation resulting from a specified stressor is directly proportional to the weighting assigned to the affected taxon(s) comprising the task.

Table A-2: Listing of the IMPRINT Environmental Stressors and the Taxon Types Affected by Either Time or Accuracy or Both

<table>
<thead>
<tr>
<th>Taxon</th>
<th>MOPP</th>
<th>Heat</th>
<th>Cold</th>
<th>Noise</th>
<th>Sleepless Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>T</td>
<td>A</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numerical</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td>TA</td>
</tr>
<tr>
<td>Cognitive</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td>TA</td>
</tr>
</tbody>
</table>
Appendix A: Technical Description of Stressor Implementation

Table A-2: Listing of the IMPRINT Environmental Stressors and the Taxon Types Affected by Either Time or Accuracy or Both

<table>
<thead>
<tr>
<th>Taxon</th>
<th>MOPP</th>
<th>Heat</th>
<th>Cold</th>
<th>Noise</th>
<th>Sleepless Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Motor Discrete</td>
<td>T</td>
<td>A</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Motor Continuous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Motor Light Light</td>
<td>T</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Motor Heavy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication (Read &amp; Write)</td>
<td></td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication (Oral)</td>
<td>T</td>
<td>A</td>
<td>A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

where T = Affects task time only
A = Affects task accuracy only
TA= Affects task time and accuracy

**Effect of MOPP**

The effect of MOPP gear on task performance is modeled as a function of levels of MOPP gear and task taxon. As shown in the Table A-2, MOPP affects the time that it takes to complete tasks described by the visual, fine motor discrete, gross motor light, and communication (oral) taxons. The degradation factors were derived from a series of studies conducted by the former Ballistic Research Laboratory (Wick, 1988) where the measure of performance degradation for each task was the time difference between performing the task in Battle Dress Uniform (BDU) and performing it in MOPP 4. Each task was later described in terms of ten human ability codes. These codes were mapped to the IMPRINT taxons and the degradation factor for each taxon was computed as the average of the mapped degradation factors by human ability code. MOPP level 0 is equivalent to BDU and therefore has a degradation factor of 1 that
correlates to “no degradation.” Degradation factors are applied as multipliers against the time that it takes to complete a task in BDUs. The most degraded performance is under MOPP 4 for fine motor discrete tasks and for oral communication tasks that take 1.7 times as long to perform. (The entire set of matrices of degradation factors for the stressors is not provided here but is available from the author on request.)

**Effect of Heat**

IMPRINT models the effects of heat on task performance accuracy as a function of dry bulb temperature and relative humidity using degradation factors based on various published reports and documents. Research relating heat stress to inaccurate performance (for example, Ramsey & Morrissey, 1978) was referenced. The MIL-HDBK-759-A (1981) was used to determine the effective temperature for different combinations of dry bulb temperature and relative humidity. And, data on the average number of mistakes per manhour as a function of effective temperature from the Bioastronautics Data Book (1981) were included in the derivation of the heat degradation factors. The derived factors applied solely to sedentary type tasks. Thus, the taxons affected are visual, numerical, cognitive, fine motor discrete, communication (read and write), and communication (oral). No degradation in accuracy performance is seen until the temperature reaches approximately 113° F (or 45° C) and the humidity reaches approximately 50%. Performance falls to essentially zero when the temperature reaches approximately 130° F (or 55° C) and the humidity reaches approximately 80%.

**Effect of Cold**

Cold weather degradation factors affecting task time performance are modeled in IMPRINT as a function of ambient temperature and wind velocity. Two functional relationships were developed from a study (Teichner, 1958) that related wind chill to percentage of performance loss. One relationship was developed for visual reaction time, thus providing the data for the visual and fine motor discrete taxons; the other was developed for manual skills, providing the data for the gross motor light taxon. The degradation factors for cold are computed as the percent loss of performance as a function of wind chill, wind chill being a function of wind velocity and ambient temperature. Time effects range from a minimum of 1.03 times as long for temperatures of approximately 35° F (or 1° C) and a wind velocity of approximately 10 knots to a maximum of 1.70 times as long for temperatures of approximately -40° F (or -40° C) and a wind velocity of greater than 50 knots. Note that this degradation does not account for prolonged exposure to cold and wind.
**Effect of Noise**

The way in which IMPRINT models the effect of noise on task performance is based on the effectiveness of voice communications as a function of noise level and distance between the speaker and the listener. As shown in the Table A-2, the degradation that results from various noise levels affects the accuracy with which a task that requires oral communications between two or more people is performed. The effect of noise on task accuracy and the resultant degradation factors were derived from a graph in MIL-STD-1472C. Distances modeled range from 1 to greater than 20 feet and noise levels range from 50 to greater than 110 dB PSIL. Approximately midway through the ranges modeled, accuracy of performance essentially drops to zero, as might be expected.

**Effect of Sleepless Hours**

In IMPRINT, sleepless hours refers to extended operations or the lack of sleep. It is important to note that sleep deprivation is the only environmental stressor that causes degradation in both the time to perform a task and the accuracy with which it is performed. IMPRINT models the stress of continuous operations as a function of hours since last sleep. Ranges of hours since last sleep go from 24 hours to greater than 96. At the 96-hour range, time to perform tasks is essentially doubled and accuracy has dropped to zero. The factors included in IMPRINT were derived from a review of several studies (Belenky et al., 1987), which found that the only taxons that are affected by lack of sleep are numerical and cognitive. Of note, in contrast to cognitive performance, physical strength and endurance are relatively unaffected by lack of sleep and can be restored by simple rest.

**Multiple Taxons with Multiple Stressors**

Many combinations of multiple stressors and taxons are also implemented in IMPRINT. Table A-3 shows the possible combinations of stressors and the associated taxons. When two or more different stressors affect a task’s taxon in time or accuracy, the overall degradation is not just the sum of the individual degradations. In fact, the overall degradation is less than the sum of the individual degradations. As more stressors are added, they have less than the full effect on performance. Normally, the most severe stressor will have a full effect on performance. As additional stressors are added, they will have less and less impact on performance accuracy and time. This phenomenon is approximated with a power function (Harris 1985).
Table A-3: Possible Combinations of Stressors and Taxons Implemented in IMPRINT

<table>
<thead>
<tr>
<th>Stressors</th>
<th>Taxons</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOPP &amp; Heat</td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>Fine Motor Discrete</td>
</tr>
<tr>
<td></td>
<td>Communication (oral)</td>
</tr>
<tr>
<td>MOPP &amp; Cold</td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>Fine Motor Discrete</td>
</tr>
<tr>
<td></td>
<td>Gross Motor Light</td>
</tr>
<tr>
<td>MOPP &amp; Noise</td>
<td>Communication (oral)</td>
</tr>
<tr>
<td>Heat &amp; Noise</td>
<td>Communication (oral)</td>
</tr>
<tr>
<td>Heat &amp; Sleepless Hours</td>
<td>Numerical</td>
</tr>
<tr>
<td></td>
<td>Problem Solving</td>
</tr>
<tr>
<td>MOPP &amp; Heat &amp; Cold</td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>Fine Motor Discrete</td>
</tr>
<tr>
<td>MOPP &amp; Heat &amp; Noise</td>
<td>Communication (oral)</td>
</tr>
</tbody>
</table>

IMPRINT Verification, Validation, and Accreditation (VV&A)

HARDMAN III, the IMPRINT predecessor was subjected to a formal VV&A process, the first of its type in the U.S. Army. The first phase, which is applicable here, comprised the core task network modeling capability and the effects implemented as additions to or modifications of the task data—mental workload estimation and environmental degradation, personnel characteristics, and training. A review board of representative users, policy-makers, technical experts, and soldier proponents evaluated the
findings against eight criteria: configuration management, software verification, documentation, data input requirements, model granularity, validity of modeling techniques and embedded algorithms, output, and analysis timelines. All criteria were satisfied and formal accreditation was granted in January 1995 with only limited caveats (see Allender et. al, 1995).

Since the environmental stressors were transitioned to IMPRINT without modification, the basic VV&A transitioned as well. Of note, although this portion of the software was approved and the basic approach of degrading time and/or accuracy of performance on a task-by-task basis was supported, the consensus was that all the algorithms warrant updating and that new algorithms need to be developed to fill the voids. Referring to the Table A-2, and to the dates of some of the environmental stressor references, it is clear that there are substantial voids and that there is certainly new research that should be accounted for in this arena.

Examples of the Method for Test and Evaluation

One example of the implications of this modeling approach to the test and evaluation arena was reported by Allender, McAnulty, and Bierbaum (1992). They describe the application of the predecessor HARDMAN III software to the analysis of potential options for reducing turnaround time in an Apache Forward Arming and Refueling Point (FARP). Once the baseline was constructed, three options were compared: adding a new equipment component, adding personnel, and changing reloading tactics, that is full vs. half reload of one ammunition type. The level of effort involved in the evaluation of options was only a fraction of the baseline development costs and certainly only a fraction of comparable field trials. Since the modeling effort was conducted at the same time as the test planning was under way, the results were available to the test planners to help focus testing and to serve as a validation reference. They asserted that the results were appropriate to be used in interaction with testing, not as a substitute.

Another example is the work reported by McMahon, Spencer, and Thornton (1995). Within months of a final milestone review, an NBC reconnaissance system called the Fox had been given an “unacceptable” operational assessment at the completion of a large-scale field test. The central issue was that a four-seat vehicle had not been modified to fit the new three-person crew. The operator was forced to switch positions repeatedly in order to do the job, which caused safety problems and unacceptable performance. Coupled with modeling of proposed changes to
the equipment and display layout, two mission models were built: the baseline and the proposed re-design. The mission model predicted substantially reduced workload and improved performance. Subsequently, the system was retro-fitted for a limited, two-week test which validated the model predictions. From this example the time, cost, and even safety benefits of using modeling in conjunction with testing are quite evident.

Proposed Environmental Stressor Developments

The examples provided in the previous section are good evidence for the utility of modeling in the test and evaluation arena; however, a comprehensive application of the environmental stressors for test and evaluation has not been completed. This is clearly a priority. Also, the shortcomings, voids, and need for updates to the stressors are obvious.

At this time, the literature in this area is being re-surveyed in order to develop a prioritized list of stressor updates, enhancements, and additions. Criteria for the prioritization are user need and availability of generalized data. Several other organizations have also identified this type of work as critical and plans for leveraging and cooperation are under way. Work of note includes that being performed under the auspices of the United Kingdom Defence Evaluation Research Agency Centre for Human Sciences, the Integrated Performance Modeling Environment. The U.S. Defense Special Weapons Agency (formerly the Defense Nuclear Agency) has published work in this area also (for example, Anno, Dore, & Roth, 1996). Close at hand, the U.S. Army Research Laboratory Human Research and Engineering Directorate is currently investigating databases on various dimensions of psychological stress as related to performance for inclusion in IMPRINT.

In conclusion, the IMPRINT tool offers a modeling technology for evaluating human performance under diverse conditions. Based on sound task analysis, network modeling, and environmental stressor degradation algorithms tailored to task type, assessments of performance under diverse conditions can be used to augment test and evaluation today. With continued development, the capability to perform these types of analyses will be further enhanced.
Acknowledgments

The contributions of the HARDMAN III and IMPRINT Verification and Validation Task Force, in particular Mr. Troy Kelley ARL HRED, were used in the preparation of this paper and are very much appreciated. The contributions of the IMPRINT contractors, Ms. Sue Archer and Ms. Patricia Kearns, Micro Analysis & Design and Mr. Rich Adkins, Dynamics Research Corporation were also relied upon heavily and likewise appreciated.

References


Appendix B: Human Performance Micromodels

IMPRINT Pro uses the following types of micromodels:

- Perceptual Micromodels
- Cognitive Micromodels
- Motor Micromodels
- Special Micromodels

Perceptual Micromodels

The following table contains the basic parameters for perceptual micromodels.

<table>
<thead>
<tr>
<th>Model</th>
<th>Value or Equation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye Movement Time (target</td>
<td>100 msec (travel time only)</td>
<td>Houtmans &amp; Sanders, 1984; Sanders &amp; Houtman, 1985</td>
</tr>
<tr>
<td>located in eye field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head Movement Time (target</td>
<td>200 msec (travel time only)</td>
<td>Houtmans &amp; Sanders, 1984; Sanders &amp; Houtman, 1985</td>
</tr>
<tr>
<td>located in head field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye Fixation Time</td>
<td>100 msec - 500 msec</td>
<td>Houtmans &amp; Sanders, 1984; Sanders &amp; Houtman, 1985</td>
</tr>
<tr>
<td>Search Time</td>
<td>((T_m + T_f)N) where N = number of fixations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(T_m = ) movement time (T_f = ) fixation time</td>
<td></td>
</tr>
</tbody>
</table>
Motor Micromodels

The following table contains the basic parameters for Motor micromodels.

<table>
<thead>
<tr>
<th>Model</th>
<th>Value or Equation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Parameters</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Hand Movement (Fitt's Law-Welford Variant) | $IM \log_2 [D/S + 0.5]$ where $T = Movement Time$  
$D = Distance$ between targets  
$S = Size$ of Targets  
$IM = Slope$ Constant = .1 sec/bit | Welford, 1968                  |
| **Hand Controls**                          |                                                                                    |                            |
| Pushbutton or Toggle                       | 400 msec                                                                           | Harris et al., 1988        |
| Rotary Dial                                | 730 msec                                                                           | Harris et al., 1988        |
| Cursor Movement with Trackball             | $IM * \log_2 (d/s + 0.5)$ where $IM = constant = 100$ msec/bit  
$d = cursor$ distance to be moved  
$s = display$ symbol width                | Harris et al., 1988, from Fitt's Law                                    |
| Cursor Movement with Mouse                 | $1.03 + .06 \log_2 (D/S + .5)$ sec  
$D = Distance$ to target  
$S = Size$ of target                  | Card et al., 1983              |
<table>
<thead>
<tr>
<th>Model</th>
<th>Value or Equation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor Movement with Joystick</td>
<td>KD + .100 log₂ (D/S + .5) sec where KD = intercept distance for distance D</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td></td>
<td>D = Distance moved</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S = Size of target</td>
<td></td>
</tr>
<tr>
<td>Cursor Movement with Step Keys</td>
<td>98 + .074 (Dₓ/Sₓ + Dᵧ/Sᵧ) sec, where Dₓ=Horizontal distance to target</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td></td>
<td>Dᵧ=Vertical distance to target</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sₓ=Size of a vertical step (default = .456 cm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sᵧ=Size of a horizontal step (default = .246 cm).</td>
<td></td>
</tr>
<tr>
<td>Cursor Movement using Text Keys</td>
<td>.66 + .209 Nₘᵢₙ sec. where .209 = Keystroke rate (in sec/keystroke) which approximates the typing rate for random words Nₘᵢₙ = minimum number of keystrokes</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Single Finger Keying Rate</td>
<td>.140 [ .060 = .200 ] sec</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Typing Rate</td>
<td>.209 sec/keystroke</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Walking Rate</td>
<td>0.19 sec/foot</td>
<td>Harris, 1988</td>
</tr>
<tr>
<td><strong>Speech</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Speech rate</strong></td>
<td>3.4 words/sec (large vocabulary)</td>
<td>McCormick, 1970</td>
</tr>
<tr>
<td></td>
<td>2.4 words/sec (small vocabulary)</td>
<td></td>
</tr>
</tbody>
</table>
The following table contains the basic parameters for cognitive micromodels.

<table>
<thead>
<tr>
<th>Model</th>
<th>Value or Equation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptual Process</td>
<td>$\tau_P = 100 \text{ msec}$</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Decision Process</td>
<td>$\tau_C = 70 \text{ msec}$</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Motor Process</td>
<td>$\tau_M = 70 \text{ msec}$</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Simple Reaction Times - On/Off Response</td>
<td>$\tau_P + \tau_C + \tau_M = 240 \text{ msec}$</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Simple Reaction Times - Physical Match</td>
<td>$\tau_P + 2\tau_C + \tau_M = 310 \text{ msec}$</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Simple Reaction Times - Name Match</td>
<td>$\tau_P + 3\tau_C + \tau_M = 380 \text{ msec}$</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Simple Reaction Times - Class Match</td>
<td>$\tau_P + 4\tau_C + \tau_M = 450 \text{ msec}$</td>
<td>Card et al., 1983</td>
</tr>
<tr>
<td>Choice Reaction Time</td>
<td>$K \times \log_2 (n+1)$ where $k$ is a constant representing simple RT and is set at 150 msec. $n$ is number of possible alternatives.</td>
<td>Hick’s Law as discussed in Card et al., 1983</td>
</tr>
<tr>
<td>Mental Rotation (Visualization)</td>
<td>$1 \text{ sec} + (R / 50^\circ \text{ per sec})$ where: $R =$ amount of rotation from initial perceived view to final visualized view (in degrees)</td>
<td>Shepherd and Metzler, 1971</td>
</tr>
</tbody>
</table>
# Special Micromodels

The following table contains the basic parameters for special micromodels.

<table>
<thead>
<tr>
<th>Model</th>
<th>Value or Equation</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Prioritization (that is, of targets) | \(.310[n(n+1) / 2] \) where: 
\( n = \) number of targets in a sector. 
This formula treats prioritization as a unidimensional [worth] pairwise comparison between all possible targets in a sector. | McCarthy and Plocher, 1990 |
| Terrain Association                | Two stage process: 
Stage 1. Reduce size of area of uncertainty: Time = 5 sec. 
(Performed once every time a completely new view is encountered.) 
Stage 2. Pinpoint own location 
Time = 2 sec. Per terrain matching attempt. (Four to seven matching attempts required to pinpoint own location. Other job activities are typically interspersed in between terrain matching attempts.) | Cross, Rugge, and Throndyke, 1982 |
Appendix C: Impact of Training and Personnel Characteristics on Taxons

The following tables describe the impact of Training Frequency and Personnel Characteristics on Taxons in IMPRINT Pro.

Table C-1 details which task taxons are affected by changes in ASVAB cutoff scores in the current IMPRINT software. It also shows whether the task performance is degraded by time, accuracy, or both. Since degradation factors are processed as multipliers, the degradation factors affecting time will be greater than 1.0 to increase the performance time. On the other hand, the degradation factors affecting accuracy will be less than 1.0 to decrease the performance accuracy from the pre-existing accuracy level. The overall degradation resulting from a specified cutoff score is directly proportional to the weighting assigned to the affected taxon(s) comprising the task.

Table C-2 details which task taxons are affected by changes in Training Frequency in the current IMPRINT software.

Table C-1: Listing of the IMPRINT Taxon Types Affected in Either Time or Accuracy or Both by changes in ASVAB scores

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Increase/Decrease of ASVAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>A</td>
</tr>
<tr>
<td>Numerical</td>
<td>T/A</td>
</tr>
<tr>
<td>Cognitive</td>
<td>T/A</td>
</tr>
<tr>
<td>Fine Motor Discrete</td>
<td>T/A</td>
</tr>
<tr>
<td>Fine Motor Continuous</td>
<td></td>
</tr>
<tr>
<td>Gross Motor Light</td>
<td>A</td>
</tr>
<tr>
<td>Gross Motor Heavy</td>
<td></td>
</tr>
<tr>
<td>Communication (Read &amp; Write)</td>
<td>T/A</td>
</tr>
<tr>
<td>Communication (Oral)</td>
<td>A</td>
</tr>
</tbody>
</table>
where T = Affects task time only
A = Affects task accuracy only
TA= Affects task time and accuracy

Table C-2: Listing of the IMPRINT Taxon Types Affected in Either Time or Accuracy or Both by Training Frequency.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Less than twice a year</th>
<th>Less than once a month</th>
<th>Once a month (default)</th>
<th>2 or 3 times a month</th>
<th>Once or more a week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numerical</td>
<td>T/A</td>
<td>T/A</td>
<td>T/A</td>
<td>T/A</td>
<td>T/A</td>
</tr>
<tr>
<td>Cognitive</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td>TA</td>
</tr>
<tr>
<td>Fine Motor Discrete</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Fine Motor Continuous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Motor Light</td>
<td>T</td>
<td></td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Motor Heavy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication (Read &amp; Write)</td>
<td>T/A</td>
<td>T/A</td>
<td>T/A</td>
<td>T/A</td>
<td>T/A</td>
</tr>
<tr>
<td>Communication (Oral)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

where T = Affects task time only
A = Affects task accuracy only
TA= Affects task time and accuracy
Appendix D: Local Server and Remote Server Setup

After installing IMPRINT Pro and its supporting applications, you may start to add and import analyses to work on as desired. Before beginning any analysis work in IMPRINT Pro, however, we recommend that you first check your settings for your local server where your analyses will be saved. You may also optionally set your system up to work with a remote server in order to access files from a networked computer running the same version of IMPRINT Pro. This section discusses the advantages of each server environment and the setup required.

Local Server Environment vs. Remote Server Environment

When loading, creating, modifying and saving analyses in IMPRINT Pro, you have the option of working with files which are local to your own machine (local server) or those which are located on a remote machine (remote server). Files which are local to your own machine may be accessed, loaded, run and saved without any special configuration, although there are settings available to you that you may choose to modify at a later point. Files which are accessed remotely may only be done so once a connection has been established with a remote server. This remote server may be another user’s machine or a literal server on a network which is accessible by several machines on the network.

Access to files via a remote server first requires creating a group on the remote machine which defines all IMPRINT Pro users who will have access to shared IMPRINT Pro files. If a group is not used, then access must be set up on the remote server for user accounts on an individual basis. Secondly, the group (or individual user accounts) must be given permission on the remote machine to access and modify remote files. Third, the local machine must be configured to connect to the remote server. For more information see “Step 1: Allowing Remote User Access on the Remote Server Machine” on page 182.
Once the setup is complete, you may access analyses for either of these servers through the IMPRINT Pro interface. Upon launching IMPRINT Pro, the server nodes immediately appear in the Analysis Tree as two folder nodes: **Local Server** and **Remote Server**. These nodes represent the local server directory and the remote server directory where you may access and store your analyses.

![Analysis Tree]

Because files in the remote server environment are shared between two or more users, IMPRINT Pro includes an option to lock any files you (as a local user or remote user) check out and wish to modify in order to guarantee that your modifications to the file can be saved back to the remote server database. For more information on locking files see “Viewing Analyses in the Local and Remote Servers” on page 189.

Once your remote server option is configured, you may select any unlocked analysis and do the following:

- View the analysis remotely (i.e., view the network diagram, view tasks)
- Run models from the analysis remotely
- Copy a remote analysis and paste it into your local directory
- Coping parts of the remote analysis (missions, tasks, etc.) and pasting these parts into an existing analysis or new analysis on your local machine
- Modify and save changes to the analysis (not to include cutting, deleting or updating any part of a remote analysis)
- Create new folders on the remote server
- Create new analyses on the remote server

The following actions are **prohibited** for a remote user accessing a remote server:

- Deleting an analysis on a remote server
- Cutting any part of an analysis on a remote server (i.e., cutting missions, tasks, etc.)
Updating any remote analysis to a newer version of IMPRINT Pro

Setting Up the Local Server Directory

The Local Server settings window available through the IMPRINT Pro interface displays the location where your IMPRINT Pro data is stored locally. This location is a fixed folder on your machine and cannot be modified.

To view the local connection setup from the local machine

1. Open IMPRINT Pro.
2. Locate the Local Server node in the Analysis Tree. Double-click this node.

The Local Server dialog displays the IMPRINT Pro Data Folder. The folder specified in this path is the location where all analyses in progress (IMPRINTProData.ipa files) and the IMPRINT Pro directory (IMPRINTProDirectory.ipd file) are stored. The local server defaults to the following path depending on your system’s operating system:

Windows XP:
C:\Documents and Settings\[user]\Application Data\Alion Science and Technology - MA&D Operation\IMPRINT Pro\Data

Windows Vista:
Setting Up the Remote Server Directory

Setting up the remote server directory requires three steps:

1. Defining a new group on the remote server to include all remote users who wish to access the remote server machine.

2. Configuring the remote server to allow a defined group of remote IMPRINT Pro users or individual users access to a shared folder.

3. Configuring the local machine to access the remote server.


The first step in setting up the remote server directory is to create a group on the remote machine to which all the remote users will belong. Privileges may then be assigned to the group as a whole, omitting the need to assign privileges to users on an individual basis. These privileges will allow any remote user who is set up to be part of the group to connect to the remote server and to access shared IMPRINT Pro analyses.

This setup, however, does not require that the user have sysadmin privileges to the machine.

Note:
Although the Delete permissions are required for the remote user login, they do not permit a remote user to delete remote server files.

For convenience, the permissions are assigned to the Group level in the steps below. You may, however, assign the same permissions on a per-login basis if you choose.

To define the remote user group on the remote server machine:
4. Right-mouse click the **My Computer** icon on your desktop and select **Manage**.

In the tree, select **Local Users and Groups**.

OR

From the **Start** key, select **Settings → Control Panel → User Accounts**.
In the dialog which appears click the **Advanced** tab, and then click the **Advanced** button under **Advanced User Management**.

The **Local Users and Groups** dialog appears.
5. Right-mouse click the **Groups** folder, and select **New Group** from the shortcut menu which appears.

![Image of Local Users and Groups window]

In the **New Group** dialog, provide a name and description for the new group.

6. Click the **Add** button.

From the **Select Users, Groups or Computers** dialog, specify the name of the user who will be connecting to this server remotely, and then click **OK**.

![Image of Select Users, Computers, or Groups dialog]

7. Click the **Create** button.

The new group appears in the Groups list in the **Computer Management** window (or **Local Users and Groups** window).
Step 2: Allowing Remote User Access to the IMPRINT Pro Database

Once the group is defined on the remote server machine and the user(s) are assigned to it, permissions must then be set for the common folder on the remote server to allow a remote user to read, write to and modify data in the database. This setup, however, does not require that the user have sysadmin privileges to the machine.

To allow remote user access to the IMPRINT Pro database:

1. Locate the folder on the remote server machine to serve as the common folder for all shared analyses. This folder should be the location where all analyses in progress (IMPRINTProData.ipa files) and the IMPRINT Pro directory (IMPRINTProDirectory.ipd file) are stored. The local server defaults to the following path depending on the operating system:

   **Windows XP:**
   
   C:\Documents and Settings\[user]\Application Data\Alion Science and Technology - MA&D Operation\IMPRINT Pro\Data

   **Windows Vista:**
   
   C:\Users\[user]\AppData\Roaming\Alion Science and Technology - MA&D Operation\IMPRINT Pro\Data

   **Note:**
   The default Local Server path is not changeable by users nor by administrators.
2. Set the folder’s permissions such that all users, either via a group or individually, have “Full Control”.

✓ Note:  
For Windows XP: although the Delete permissions are required for the remote user login, they do not permit a remote user to delete remote server files.

Step 3: Configuring the Local Machine to access the Remote Server

To configure the local machine to access the remote server

1. Open IMPRINT Pro on the Local machine.

2. In the Analysis Tree, double-click the Remote Server node.

   The Remote Server dialog displays.

3. Next to the IMPRINT Pro Data Folder field, click the Browse… button.

   The Browse For Folder dialog appears.

4. Browse to the designated shared IMPRINT Pro data folder. This remote server path must point to the location on the remote machine which contains all analyses in progress (IMPRINTProData.ipa files) and the IMPRINT Pro directory (IMPRINTProDirectory.ipd file). The default location of these files on the remote machine’s directory depends on the operating system:

   **Windows XP:**
   
   \( C:\Documents and Settings\{user\}\Application Data\Alion Science and Technology - MA&D Operation\IMPRINT Pro\Data.\)

   **Windows Vista:**
   
   \( C:\Users\{user\}\AppData\Roaming\Alion Science and Technology - MA&D Operation\IMPRINT Pro\Data.\)
5. Click the OK button

The path to the selected folder appears in the **IMPRINT Pro Data Folder** field. You are now ready to view/access analyses on the remote server through IMPRINT Pro. The path as it appears in the field may be abbreviated if the folder specified is already shared on your network.

If the path entered in the IMPRINT Pro Data Folder field is invalid, a message appears below the field, indicating the path is invalid.

In this case verify the machine name and path entered in the Remote Server dialog. Next, check with your network administrator to verify the correct privileges have been set for your login on the remote server machine. Finally, check to make sure the remote server machine is turned on.

**Viewing the Server Directories in the IMPRINT Pro Analysis Tree**

The highest level nodes in the Analysis Tree are the Local Server node and the Remote Server node. These nodes represent the local server directory and the remote server directory where you may access and store your analyses.
When starting up IMPRINT Pro, the Local and Remote server nodes immediately appear in the Analysis Tree.

### Viewing Analyses in the Local and Remote Servers

To view analyses in the local and remote server environments:

1. Click the plus “+” sign next to the Local Server and/or Remote Server node(s).

   A list of folders containing your analyses appears.

2. Click the plus “+” sign next to a folder.

   A list of analyses within the folder appears.
Locking and Unlocking Analyses

When using the remote server option in IMPRINT Pro, access to analyses is shared between two or more users. This provides the benefit of allowing several users access to the same analysis without having to export and import the analysis from machine to machine.

To prevent two or more users from accessing the same analysis at the same time and potentially overwriting each other's changes, you may first lock the analysis. The lock option allows you to open, modify, run and save the analysis as you choose while allowing other users limited privileges of viewing a copy of the analysis in its last saved state. When you have completed and saved your changes to the analysis, you may then unlock the analysis for other users to be able to access and modify your updated file as required.

**To lock an analysis:**

1. Right-click the desired analysis in the Analysis Tree.

From the shortcut menu that appears, select the **Lock Analysis** option.
2. The blue lock symbol appears next to the analysis name in the tree.

To unlock an analysis:

1. Right-click the desired locked analysis in the Analysis Tree.

   From the shortcut menu which appears, select the Unlock Analysis option.

   The blue lock symbol disappears from the analysis name in the tree, and the analysis is once again fully accessible by all other remote users.

   ✓ Note:
   Prior to unlocking the model, you will be prompted to save your analysis if your model has any changes which have not been saved.

   The following conditions should also be considered when locking and
unlocking analyses:

- If another user has a lock on the model, a message appears both before the model run and before attempting to run reports that reports are unavailable. This is because you do not have the lock thus you cannot save model run data to the database for the reports to be able to utilize.

- If you have the lock and choose to unlock the analysis, every time you run the model the analysis will be re-locked. This is because IMPRINT Pro needs to ensure that data from the model run can be saved to the database, which requires a lock.

- Closing the analysis (using the actual Close Analysis shortcut option to do this) will result in the lock being released.

- Collapsing the analysis in the tree does not result in the lock being released.
Appendix E: IMPRINT 7 to IMPRINT Pro Conversion

IMPRINT Pro is based on the IMPRINT 7 tool but has been completely redesigned to be faster, modular, and more powerful. The following list describes areas in IMPRINT Pro which have been significantly enhanced since IMPRINT 7:

- New docking interface allows you to place windows where they are most useful.
- Highly configurable windows that allow you to reposition windows into logical working groups and to temporarily hide windows that you are not using.
- Analysis Tree view that displays a list of all analyses.
- Task network palette that contains the tools you use to construct the task network.
- An Output window that displays the trace of execution, including the clock times for events, application errors, whether plugins were loaded successfully, the start and end of simulation, and any syntax errors.
- A Properties window for all the model items that displays a list of all the item properties. Properties can be changed directly in the Properties window or in the associated dialog box for any model item.
- Multiple charts that can be used to plot variable data as a function of the clock time or as a function of another variable.
- Enhanced functionality on the task network diagram, including Groups (collections of similar tasks that resemble a network and can be minimized) and Comments (the display of text or the values of variables during execution).
- Ability to export all model items in HTML format and all data files in .xml format.

IMPRINT 7 to IMPRINT Pro Conversion List

The following list describes the differences between IMPRINT 7 and
**IMPRINT Pro:**

<table>
<thead>
<tr>
<th><strong>IMPRINT 7</strong></th>
<th><strong>IMPRINT Pro</strong></th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
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**Installation**

- Installs to `C:\IMPRINT 7`
- Installs to `C:\Program Files\IMPRINT Pro`

**Database**

- Requires that MySQL 3.23.58 be installed prior to installing IMPRINT 7.
- Requires the latest version of MSDE (Microsoft Database Engine).
- Analyses stored as `.imp` folders in `C:\MySQL\Data`.
- Analyses stored in the MSDE database.

**Import and Export**

- Files in IMPRINT 7 export as `.xch` for use on other IMPRINT 7 systems and export to `.7XP` (xml file) for import into IMPRINT Pro.
- IMPRINT Pro imports `.7XP` from IMPRINT 7 and exports to `.pro` for use on other machines having Pro.

**Terminology**

- “MOS” Changed to “Specialty”
- “Crewmembers” Changed to “Warfighters”
## Appendix E: IMPRINT 7 to IMPRINT Pro Conversion

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<th>IMPRINT 7</th>
<th>IMPRINT Pro</th>
</tr>
</thead>
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<td><strong>Difference in Analysis Setup</strong></td>
<td></td>
</tr>
<tr>
<td>Operators are attached to a Mission.</td>
<td>Operators are attached to an Analysis (under the Warfighters node just below the Analysis level.)</td>
</tr>
<tr>
<td>Crewmembers are defined through the Mission page, and all appear under one list.</td>
<td>Warfighters (previously Crewmembers) are added through the Warfighters node and are separated into three distinct categories: Operators, Maintainers and Supply and Support Personnel. Only Operators have names associated with the chosen Specialty whereas Maintainers and Supply and Support Personnel are listed as Specialty only.</td>
</tr>
<tr>
<td>MOS types must be added prior to being available when defining Crewmembers.</td>
<td>Specialty types (previously MOS) may be defined at the time the Warfighter (previously Crewmember) is defined.</td>
</tr>
<tr>
<td>RI pairs are found only in Advanced models; see Options–Workload and Crewstation Parameters–Define Resource Interface Channels.</td>
<td>RI pairs available for all analyses; see RI pairs node under the Mission node for your mission.</td>
</tr>
<tr>
<td>Each task for each operator must have at least one RI pair attached to it; see Assign R/I Channels to Tasks.</td>
<td>RI pair assignments are optional for each task.</td>
</tr>
<tr>
<td>Access Demand values through Options–Workload and Crewstation Parameters–Assign Single Task Demand Values.</td>
<td>Double-click the Network node, click the Review Tasks tab, and then click the Task Demands option. This option is also available under the Workload Demand tab for any task.</td>
</tr>
<tr>
<td>Crewmembers defined and Assigned by Mission.</td>
<td>Warfighters (previously Crewmembers) now defined at the Analysis level; all Warfighters available to all missions within that analysis.</td>
</tr>
<tr>
<td>IMPRINT 7</td>
<td>IMPRINT Pro</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Data Loss</strong></td>
<td></td>
</tr>
<tr>
<td>RI pairs are assigned to each task, for each operator.</td>
<td>Pro only imports the RI pairs from the IMPRINT 7 model which were assigned to the lowest operator ID.</td>
</tr>
<tr>
<td>Two Crewmembers might share the same task having the same RI pair. Each might have a different demand value assigned for that task. For example, “Listen to Radio” might require an Auditory/Crewstation demand value of 5.00 by Driver and 3.00 by Navigator.</td>
<td>If Driver was created first, then the “Listen to Radio” task has a generic Auditory/Crewstation demand value of 5.00 regardless of Operator.</td>
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