

Natural Engineer

Version 4.4.2

Utilities

for Mainframes

## **Manual Order Number: NEE442-080MFR**

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Readers' comments are welcomed. Comments may be addressed to the Documentation Department at the address on the back cover. Internet users may send comments to the following e-mail address:

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# ABOUT THIS MANUAL

## Purpose of this manual

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This manual contains the Utilities for Natural Engineer.

It describes the various utility options available within Natural Engineer, which include:

- Automating the execution of Natural Engineer processes using the Task Scheduler option.
- Review maintenance changes within objects using the Change Management Tracking option.
- Convert Natural Reporting mode objects into Natural Structured mode objects using the Mode Conversion option.

## Target Audience

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The target audience for this manual is intended to be any User of Natural Engineer at any level of experience.

## Typographical Conventions used in this manual

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The following conventions are used throughout this manual:

|                                   |   |
|-----------------------------------|---|
| <b>UPPERCASE<br/>TIMES</b>        | Commands, statements, names of programs and utilities referred to in text paragraphs appear in normal (Times) uppercase.  |
| <b>UPPERCASE BOLD<br/>COURIER</b> | In illustrations or examples of commands, items in uppercase bold courier must be typed in as they appear.  |
| < >                               | Items in angled brackets are placeholders for user-supplied information. For example, if asked to enter <file number>, you must type the number of the required file. |
| <u>Underlined</u>                 | Underlined parts of text are hyperlinks to other parts within the online source manual. This manual was written in MS-Word 97 using the "hyperlink" feature.          |

The following symbols are used for instructions:

|    |   |
|----|---|
| ⇒  | Marks the beginning of an instruction set.                    |
| □  | Indicates that the instruction set consists of a single step. |
| 1. | Indicates the first of a number of steps.                     |

## How this manual is organized

---

This manual is organized to reflect all the Utilities options of Natural Engineer in the following chapters:

| <b>Chapter</b> | <b>Contents</b>   |
|----------------|---|
| 1              | Describes the Task Scheduler option, which provides the facility to automate the execution of the various Environment, Analysis and Modification options. This provides the facility to execute long-running batch tasks in an unattended mode to minimize the impact on machine and human resources. |
| 2              | Describes the Change Management Tracking (CMT) option, which provides the facility to review audit trail records of changes applied to individual objects within Natural Engineer.  |
| 3              | Describes the Mode Conversion option, which provides the facility to convert Natural Reporting mode objects into Natural Structured mode objects.   |

## **Natural Engineer Utilities**

# **Terminology**

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It is assumed that you are familiar with general Natural and mainframe terminology, as well as the terms and concepts relating to Microsoft Windows operating systems. This section explains some terms that are specific to the Natural Engineer product.

## **Analysis**

The Analysis process of Natural Engineer searches application data within the Natural Engineer Repository, according to specified Search Criteria and generates reports on the search results.

## **Application**

An Application is a library or group of related libraries, which define a complete Application. In Natural Engineer, the Application can have a one-to-one relationship with a single library of the same name, or a library of a different name, as well as related steplibs. The Application refers to all the source code from these libraries, which Natural Engineer loads into the Repository.

## **Browser**

An Internet Browser such as Microsoft Internet Explorer or Netscape.

## **Category**

Categories in Natural Engineer specify whether and how a Modification is applied to the Natural code. Valid categories are: Automatic change, Manual change, Reject the default Modification, No change to the data item, and the data item is in Generated Code.

A category is further broken down according to type of change (for example: Keyword, Literal, Data Item, Database Access, Definition).

## **Consistency**

An option in the Analysis process that causes Natural Engineer to trace an Impact through the code, using left and right argument resolution to identify further code impacted by the code found.

## **Environment**

The Environment process is the means by which Natural Engineer generates a structured view of the application code in the Natural Engineer Repository. This provides application analysis reports and inventory information on the application and is used as the basis for Impact Analysis.

## **Exception**

An Exception is an Item identified as impacted that does not require a Modification. Where there are a few similar Exception Items, they can be treated as Exceptions, and rejected in the Modification review process. Where there are many similar (therefore not Exceptions), consideration should be given to changing the Search Criteria so they are not identified as impacted in the first place.

## **Generated Code**

This is code which has been generated by a Natural code generator, such as Construct, and which is not normally modified directly in the Natural editor.

## **Impact**

An Impact is an instance of a Natural code Item; e.g., data item or statement (a “hit” scored by the Analysis process) that matches the defined Search Criteria used in the Analysis process.

## **Iteration**

An Iteration is one examination cycle of a field identified according to the specified Search Criteria. For example, one Iteration is reading the field right to left. Multiple Iterations are performed when the option of ‘Consistency’ or Multi Search is requested for Analysis, and Natural Engineer performs as many Iterations as necessary to exhaust all possibilities of expressing and tracing the field, and can be limited by a setting in the NATENG.INI file.

## **Library**

A single library of source code, which exists in the Natural system file.

## **Natural Engineer Utilities**

### **Modification**

A Modification is a change suggested or made to an object or data item resulting in the required compliance of that object or data item. Modifications in Natural Engineer are classified according to Category and Type.

### **Presentation Split Process**

The Presentation Split Process is a sub-function of the Object Builder function that removes screen I/O statements from current application objects and places them in generated subprograms.

### **Soft Link**

A Soft Link is where a link between two objects has been defined using an alphanumeric variable rather than a literal constant.

### **Technical Split Process**

The Technical Split Process is a sub-function of the Object Builder function that results in the encapsulation of each database access within the application, into a sub-program so that the application is separated into 'presentation and logic' and 'database access'.

### **Type**

The Type of Modification available, for example: Data Item, Keyword and Literal.

### **TLM**

Text Logic Members are used to contain the code required to support inclusion of common code into the application. An example of this is the code to include into an application before updating a database.

## Related Literature

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The complete set of Natural Engineer manuals consists of:

**1 Natural Engineer Concepts and Facilities (NEE442-006ALL)**

The Concepts and Facilities manual describes the many application systems problems and solutions offered by Natural Engineer, providing some guidelines and usage that can be applied to Natural applications.

**2 Natural Engineer Release Notes (NEE442-008ALL)**

The Release Notes describe all the information relating to the new features, upgrades to existing functions and documentation updates that have been applied to Natural Engineer.

**3 Natural Engineer Installation Guide (NEE442-010ALL)**

The Installation Guide provides information on how to install Natural Engineer on both PC and mainframe platforms.

**4 Natural Engineer Administration Guide (NEE442-040WIN)  
Natural Engineer Administration Guide (NEE442-040MFR)**

The Administration Guide provides information on all the various control settings available to control the usage of the different functions within Natural Engineer.

**5 Natural Engineer Application Management (NEE442-020WIN)  
Natural Engineer Application Management (NEE442-020MFR)**

The Application Management manual describes all the functions required to add Natural applications into the Repository.

**6 Natural Engineer Application Documentation (NEE442-022WIN)  
Natural Engineer Application Documentation (NEE442-022MFR)**

The Application Documentation manual describes all the available functions to document a Natural application within the Repository. These functions will help enhance / supplement any existing systems documentation such as BSD / CSD / Specifications etc.

**7 Natural Engineer Application Analysis and Modification (NEE442-023WIN)  
Natural Engineer Application Analysis and Modification (NEE442-023MFR)**

The Application Analysis and Modification manual describes all the available functions to carry out analysis of Natural applications; including basic keyword searches. The modification process is described and detailed to show how it can be applied to modify single selected objects within a Natural application, or the entire Natural application in one single execution.

## **Natural Engineer Utilities**

**8 Natural Engineer Application Restructuring (NEE442-024WIN)  
Natural Engineer Application Restructuring (NEE442-024MFR)**

The Application Restructuring manual describes the analysis and modification functionality required to carryout some of the more sophisticated functions such as Object Builder.

**9 Natural Engineer Utilities (NEE442-080WIN)  
Natural Engineer Utilities (NEE442-080MFR)**

The Utilities manual describes all the available utilities found within Natural Engineer and, when and how they should be used.

**10 Natural Engineer Reporting (NEE442-025ALL)**

The Reporting manual describes each of the reports available in detail, providing report layouts, how to trigger the report and when the report data becomes available. The various report-producing mediums within Natural Engineer are also described.

**11 Natural Engineer Batch Processing [Mainframes] (NEE442-026MFR)**

The Batch Processing manual describes the various batch jobs (JCL) and their functionality.

**12 Natural Engineer WebStar (NWS442-020ALL)**

The WebStar manual describes the concepts and facilities, installation and configuration options, how to web enable a Natural application and how to create and execute Natural Short Transactions using the Natural Engineer add-on component WebStar.

**13 Natural Engineer WebStar Release Notes (NWS442-008ALL)**

The Release Notes describe all the information relating to the new features, upgrades to existing functions and documentation updates that have been applied to the Natural Engineer add-on component WebStar.

**14 Natural Engineer Messages and Codes (NEE442-060ALL)**

The Messages and Codes manual describes the various messages and codes produced by Natural Engineer.

# TASK SCHEDULER

## Chapter Overview

---

This chapter describes the Task Scheduler option within Natural Engineer, which is used to manage and execute automatically Natural Engineer Environment, Impact and Modification tasks. These tasks will execute in unattended batch mode.

The topics covered in this chapter are:

1. [Task Scheduler Overview](#)
2. [Task Scheduler Summary Screen](#)
3. [Task Details Screen](#)
4. [Task Scheduler Initiator Batch Job](#)

## Task Scheduler Overview

---

The Task Scheduler option allows you to specify tasks to be executed at a specified date and time. These tasks may be scheduled to run with a frequency of once, daily, weekly or monthly and may also have dependencies on other defined tasks to allow a series of tasks to run in a controlled sequence.

Once the task or tasks have been specified, they are ready for execution and will be triggered by the Task Scheduler Initiator batch job. This must be invoked in order for the tasks to be released for execution (if their individual specifications have been attained).

Each task execution will have a history log entry available showing the execution events for that task. Any tasks that have experienced problems during execution will be highlighted with a status of 'Error' in the Task Scheduler Summary screen.

### Using the Task Scheduler

The Task Scheduler allows long executing tasks for individual applications to be scheduled to run overnight or at weekends, in order that the normal working day is less disrupted waiting on these tasks to complete.

For example: If an extract and load of a very large application is required, where the extract and load processes are likely to take several hours each to complete, then a task can be scheduled to start executing at the end of the normal working day (i.e., overnight). The task can then be reviewed the next working day.

### Using the Frequency Task option

A frequency can be set for any tasks that are to be repeated many times. This means a task need only be specified the once, but with the appropriate frequency set, it will execute each time it is initiated via the Task Scheduler.

For example: Natural Engineer is being used to maintain an application where various modifications are being applied using the modification options of Natural Engineer. The application has been specified within Natural Engineer to apply all the modifications to the base application library. To maintain integrity of the modified application on the Repository, the Extract Source Code function with Synchronize Source Code option activated requires running once a week. A task would be set up with the correct details specified to run Extract Source Code with a frequency of 'Weekly' set.

## Using the Dependency Task option

Task dependencies can be specified, so that tasks are only initiated provided the previous task has completed.

For example: Task 0001 is specified to run an Extract Source Code function for an application. A second task, 0002, is specified to run the Load Repository function for the same application with a dependency of task 0001 set. When the initiator is run, task 0002 will not execute until task 0001 has completed.

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## Natural Engineer Utilities

### Task Scheduler Summary Screen

---

The Task Scheduler Summary screen is accessed by selecting option ‘T’ (Task Scheduler) from the Utilities Menu screen.

The Task Scheduler Summary screen utilizes left and right screen scrolling to show the complete information for each task. When the screen is positioned to the left, all the task execution information is displayed. When the screen is scrolled to the right, all the task function information is displayed.

The following Figure 1-1 illustrates the Task Scheduler Summary screen displaying the task execution information.

```

- Task Scheduler Summary -

Task User      Date          Time  Freq  Depn  Status  Application
- 0040 XGSLXX   09/09/2001  14:29           Complete HOSPITAL
- 0041 XGSLXX   09/09/2001  14:35           Missed   HOSPITAL
- 0042 XGSLXX   10/09/2001  22:00 Week           PAYROLL

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help           Exit  Add           Prev Next           W<  W>  Main
```

**Figure 1-1 Task Scheduler Summary screen displaying task execution information**

The following Figure 1-2 illustrates the Task Scheduler Summary screen displaying the task function information.

```

- Task Scheduler Summary -

Task User      Date      Application Function Grp Function Name      Ver
- 0001 XGSLXX  09/09/2001 NEEDOCN   Environment  Extract Source Code
- 0002 XGSLXX  09/09/2001 NEEDOCN   Environment  Load Repository
- 0003 XGSLXX  10/09/2001 PAYROLL   Analysis     Impact Execution   01

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help      Exit Add      Prev Next      W<  W>  Main

```

Figure 1-2 Task Scheduler Summary screen displaying task function information

| SCREEN ITEMS  | DESCRIPTION  |
|---------------|--|
| <b>Select</b> | Select task to perform various task administration options. Valid selections are:<br>'V' View task details.<br>'U' Update task details.<br>'R' Reset task.<br>'D' Delete task.<br>'L' View task log. Invokes the Task Log screen.<br>'S' Suspend task. |
| <b>Task</b>   | The task id that has been assigned for the task. This is an internally generated sequential number starting from 0001. Deleted task numbers are reused.  |
| <b>User</b>   | The user id of the person that added the task.   |
| <b>Date</b>   | The task execution start date specified in the Task Details screen.  |

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## Natural Engineer Utilities

| SCREEN ITEMS        | DESCRIPTION  |
|---------------------|--|
| <b>Time</b>         | The task execution start time specified in the Task Details screen.  |
| <b>Freq</b>         | The task frequency. This controls the amount of executions for the task. The following frequencies are available:<br>‘O’ Task will execute once only.<br>‘D’ Task will execute daily at the same time based on the original date and time specified.<br>‘W’ Task will execute weekly at the same time based on the original date and time specified.<br>‘M’ Task will execute monthly at the same time based on the original date and time specified.  |
| <b>Depn</b>         | The task's dependency on other scheduled tasks. This will contain the task id of the task that needs to complete before this task will execute.  |
| <b>Status</b>       | The task status. The following are available:<br>‘ ‘ Task is waiting for the specified start date and time, i.e., a date and time have been set in the future.<br><b>Missed</b> Task has missed the specified date and time and is ready for execution the next time the Initiator is invoked.<br><b>Error</b> Task has experienced an error during execution.<br><b>Complete</b> Task has completed successfully.<br><b>In Progress</b> Task is currently executing.<br><b>Suspended</b> Task has been suspended and will not be released for execution until the Release option is used from the context menu. |
| <b>Application</b>  | The name of the application being used by the task.  |
| <b>Function Grp</b> | The main function area being used by the task. The function groups available are:<br><ul style="list-style-type: none"> <li>▪ <b>Environment</b></li> <li>▪ <b>Analysis</b></li> <li>▪ <b>Modification</b></li> </ul>  |

| SCREEN ITEMS         | DESCRIPTION   |
|----------------------|---|
| <b>Function Name</b> | <p>The name of the sub-function within the main function. The sub-functions available are:</p> <p>For the function group Environment:</p> <ul style="list-style-type: none"> <li>▪ <b>Extract Source Code</b></li> <li>▪ <b>Load Repository</b></li> <li>▪ <b>Extract &amp; Load</b></li> <li>▪ <b>Extract, Load &amp; Impact</b></li> <li>▪ <b>Environment Bulk Reports</b></li> </ul> <p>For the function group Analysis:</p> <ul style="list-style-type: none"> <li>▪ <b>Impact Execution</b></li> <li>▪ <b>Impact Bulk Reports</b></li> </ul> <p>For the function group Modification:</p> <ul style="list-style-type: none"> <li>▪ <b>Modify All</b></li> <li>▪ <b>Modification Bulk Reports</b></li> </ul> |
| <b>Ver</b>           | <p>The impact version number being used by the task. This is only applicable to function names: Impact Execution and Modify All. All other tasks will show '00'.</p>  |

| PFKEYS      | DESCRIPTION   |
|-------------|---|
| <b>PF1</b>  | Activates the help function.                                  |
| <b>PF3</b>  | Exit from the current function and return to previous screen. |
| <b>PF4</b>  | Add new Task. Invokes the Task Details screen.                |
| <b>PF7</b>  | Displays previous page.                                       |
| <b>PF8</b>  | Displays next page.   |
| <b>PF10</b> | Scrolls screen display to the left.                           |
| <b>PF11</b> | Scrolls screen display to the right.                          |
| <b>PF12</b> | Returns to the Natural Engineer Main Menu.                    |

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## Natural Engineer Utilities

### Task Scheduler Task Log Screen

The Task Log screen is displayed when a task is selected using option 'L' from the Task Scheduler Summary screen.

The Task Log screen will show history details of activity for the selected task.

The following Figure 1-3 illustrates the Task Scheduler Task Log screen.

```
          - Task Scheduling - Task Log
                    Task Id: 0001
09/09/2001 17:01:12 - Extract HOSPITAL - Started
09/09/2001 17:01:14 - Extract HOSPITAL - Completed

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help           Exit                Prev Next                W<  W>    Main
```

Figure 1-3 Task Scheduler Task log screen

| <b>SCREEN ITEMS</b>     | <b>DESCRIPTION</b>              |
|-------------------------|---------------------------------|
| <b>Task Log Entries</b> | Each line details a task event. |

| <b>PFKEYS</b> | <b>DESCRIPTION</b>  |
|---------------|---|
| <b>PF1</b>    | Activates the help function.                                  |
| <b>PF3</b>    | Exit from the current function and return to previous screen. |
| <b>PF7</b>    | Displays previous page.                                       |
| <b>PF8</b>    | Displays next page.   |
| <b>PF10</b>   | Scrolls screen display to the left.                           |
| <b>PF11</b>   | Scrolls screen display to the right.                          |
| <b>PF12</b>   | Returns to the Natural Engineer Main Menu.                    |

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## Natural Engineer Utilities

### Task Details Screen

---

The Task Details screen is where each task can be specified and added to the Task Scheduler. This screen is also used to update or view the details for a task.

The Task Details screen can be invoked by using 'PF4' (Add) from the Task Scheduler Summary screen, by selecting a task using selection options 'U' (to update task) or 'V' (to view task) from the Task Scheduler Summary screen.

The following Figure 1-4 illustrates the Task Scheduler Task Details screen.

```

- Task Details -

Task Id: 0004

Start Date: 09 / 09 / 2001 (DD/MM/YYYY)
Time: 14 : 55 (HH:MM)

Job Id: XGSLXX04 Job Class: _
Dependency: _____ Frequency: _

Application:
Function Group:
Function:

Comments:
_____

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help      Exit      Save Appl Pref Func Vers ECrt ICrt Main
```

Figure 1-4 Task Scheduler Task Details screen

| SCREEN ITEMS          | DESCRIPTION  |
|-----------------------|--|
| <b>Start Date</b>     | The date the task is to execute using date DD/MM/YYYY format. The default date will be the current date when the Task Details screen was invoked.  |
| <b>Start Time</b>     | The time the task is to execute using time HH:MM format. The default time will be the current time when the Task Details screen was invoked.   |
| <b>Job Id</b>         | The Job name. This defaults to the first 4 characters of the logon id plus the task id.  |
| <b>Job Class</b>      | The Job Class to be used during execution.   |
| <b>Dependency</b>     | Select a task id on which this task is to be dependent. Task ids available will be the current tasks available in the Task Scheduler Summary screen.   |
| <b>Frequency</b>      | The task frequency. This controls the amount of executions for the task. The following frequencies are available:<br><p>‘O’ Task will execute once only.</p> <p>‘D’ Task will execute daily at the same time based on the original date and time specified.</p> <p>‘W’ Task will execute weekly at the same time based on the original date and time specified.</p> <p>‘M’ Task will execute monthly at the same time based on the original date and time specified.</p> |
| <b>Application</b>    | The name of the application that this task is to reference.  |
| <b>Function Group</b> | The main function area being used by the task. The function groups available are: <ul style="list-style-type: none"> <li>▪ <b>Environment</b></li> <li>▪ <b>Analysis</b></li> <li>▪ <b>Modification</b></li> </ul>   |

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| <b>SCREEN ITEMS</b>  | <b>DESCRIPTION</b>  |
|----------------------|---|
| <b>Function Name</b> | <p>The name of the sub-function within the main function. The sub-functions available are:</p> <p>For the function group Environment:</p> <ul style="list-style-type: none"><li>▪ <b>Extract Source Code</b></li><li>▪ <b>Load Repository</b></li><li>▪ <b>Extract &amp; Load</b></li><li>▪ <b>Extract, Load &amp; Impact</b></li><li>▪ <b>Environment Bulk Reports</b></li></ul> <p>For the function group Analysis:</p> <ul style="list-style-type: none"><li>▪ <b>Impact Execution</b></li><li>▪ <b>Impact Bulk Reports</b></li></ul> <p>For the function group Modification:</p> <ul style="list-style-type: none"><li>▪ <b>Modify All</b></li><li>▪ <b>Modification Bulk Reports</b></li></ul> |
| <b>Comments</b>      | <p>Up to 72 characters of text can be entered to serve as a comment for the task. These are treated as information only.</p>  |

| <b>PFKEYS</b> | <b>DESCRIPTION</b>  |
|---------------|---|
| <b>PF1</b>    | Activates the help function.  |
| <b>PF3</b>    | Exit from the current function and return to previous screen.   |
| <b>PF5</b>    | Saves the Task details specified and return back to the Task Scheduler Summary screen.  |
| <b>PF6</b>    | Invokes the Select an Application screen. An existing application can be selected or a new application name input.  |
| <b>PF7</b>    | Invokes the Application Preferences screen. Application Preferences can be specified and saved for the selected application.  |
| <b>PF8</b>    | <p>Invokes a series of pop-up windows to select first the Function Group and then the Function Name to be used for the task.</p> <p>The Function Groups available are:</p> <ul style="list-style-type: none"><li>▪ <b>Environment</b></li><li>▪ <b>Analysis</b></li><li>▪ <b>Modification</b></li></ul> <p>The Function Names available are:</p> <p>For the function group Environment:</p> <ul style="list-style-type: none"><li>▪ <b>Extract Source Code</b></li><li>▪ <b>Load Repository</b></li><li>▪ <b>Extract &amp; Load</b></li><li>▪ <b>Extract, Load &amp; Impact</b></li><li>▪ <b>Environment Bulk Reports</b></li></ul> <p>For the function group Analysis:</p> <ul style="list-style-type: none"><li>▪ <b>Impact Execution</b></li><li>▪ <b>Impact Bulk Reports</b></li></ul> <p>For the function group Modification:</p> <ul style="list-style-type: none"><li>▪ <b>Modify All</b></li><li>▪ <b>Modification Bulk Reports</b></li></ul> |

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## Natural Engineer Utilities

| <b>PFKEYS</b> | <b>DESCRIPTION</b>   |
|---------------|--|
| <b>PF9</b>    | <p>Invokes the Impact Version screen. A new version can be created or an existing version selected. This option is only available for the following function names:</p> <ul style="list-style-type: none"><li>▪ <b>Extract, Load &amp; Impact</b></li><li>▪ <b>Impact Execution</b></li><li>▪ <b>Impact Bulk Reports</b></li><li>▪ <b>Modify All</b></li><li>▪ <b>Modification Bulk Reports</b></li></ul> <p><i>Note: The impact versions available are the same as for the application when using the Impact Version option from the Impact Analysis Menu screen.</i></p> |
| <b>PF10</b>   | <p>Invokes the Extract Selection Criteria screen. Extract selection criteria can be specified and saved.</p> <p><i>Note: The criteria specified here are only relevant to the task for which they have been defined. The task criteria are independent of the main application extract selection criteria defined using the Extract Selection Criteria option from the Environment Menu screen.</i></p>  |
| <b>PF11</b>   | <p>Invokes the Impact Search Criteria Summary screen. Search criteria can be specified here and saved for the current version.</p> <p><i>Note: The impact search criteria available are the same as for the application when using the Impact Search Criteria option from the Impact Analysis Menu screen.</i></p>   |
| <b>PF12</b>   | <p>Returns to the Natural Engineer Main Menu.</p>  |

## Task Scheduler Initiator Batch Job

---

The Task Scheduler tasks are initiated using the Task Scheduler Initiator Batch Job: TASKSCH. This needs to be invoked before any scheduled tasks will be executed.

The Task Scheduler Initiator Batch Job makes use of program: MFUAEP01. Once invoked, MFUAEP01 will interrogate the Repository looking for any tasks that are ready for execution, i.e., any tasks that have a date and time stamp which is less than or equal to the date and time when MFUAEP01 is executing.

For each scheduled task that has all its criteria satisfied, the relevant batch job for the scheduled task will be submitted.

*Note: The Task Scheduler Initiator Batch Job can be located as a member TASKSCH within dataset NEEvrs.JOBS supplied on the mainframe Natural Engineer installation tape. This contains sample JCL, which needs to be modified to meet local site standards.*

*In order to allow the scheduled tasks to execute, it is recommended that the TASKSCH job is entered into the sites automated operations scheduler to be executed at pre-determined times.*

*For more information on the Natural Engineer installation tape refer to Chapter 2 in the Natural Engineer Installation Guide.*



# CHANGE MANAGEMENT TRACKING (CMT)

## Chapter Overview

---

This chapter describes the Change Management Tracking (CMT) option available from the Utilities menu. The CMT option provides the facility to track changes that have been applied to objects within an application using Natural Engineer.

The following topics are covered:

1. [Change Management Tracking Overview](#)
2. [Change Management Tracking Reports Selection Screen](#)
3. [Change Management Tracking Example](#)

## Change Management Tracking Overview

---

The CMT option provides audit trail data per object within an application that has used Natural Engineer to administer maintenance changes.

Any updates applied by Natural Engineer to an application's objects generate audit trail records for the application on the Repository. These audit trail records contain the before and after images of updated code, a date and time stamp of when the updates were made and the User Id of the person making the update.

The audit trail records are accumulated per object, and are only deleted when the application is deleted from the Repository. This allows for complete tracking of updates for an application during its maintenance life cycle within Natural Engineer.

The audit trail records can be viewed as hardcopy reports from the batch job output file.

## CMT Reports Selection Screen

The CMT Reports Selection screen allows you to review audit trail records for individual or a range of objects within an application using hardcopy reports by submitting a batch job.

The CMT Reports Selection screen is accessed by selecting option 'M' (Change Management Tracking) from the Utilities Menu screen.

The following Figure 2-1 illustrates the CMT Reports Selection screen.

```

Change Management Tracking      Application: HOSPITAL
Reports Selection              Version: 01

Object:      _____ to _____
or All Objects: N

All Versions:  N

Date Operator:  __ Date:  __ __ ____ (dd mm yyyy)
                To:  __ __ ____ (dd mm yyyy)

User Id:      _____

Sort Order:   1  Timestamp - Asc

Object Types:  GLASNHMP3C4      (PF2 to set)

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help  Types Exit          Sub  Vers                               Main

```

Figure 2-1 CMT Reports Selection screen

| SCREEN ITEMS        | DESCRIPTION   |
|---------------------|---|
| <b>Object</b>       | Allows you to select an individual or range of objects to report on. For Example: if XX021P01 is entered, then only audit trail records for XX021P01 will be reported.  |
| <b>All Objects</b>  | If selected, then all the objects with audit trail records within the current application will be reported. Valid selections are:<br>'N' Single object or range of objects.<br>'Y' All objects  |
| <b>All Versions</b> | If selected, will report on all the versions for each object within the application. Valid selections are:<br>'N' Reports on current selected version only.<br>'Y' Reports on all versions.   |
| <b>Date</b>         | Allows you to specify date ranges resulting in audit trail records matching the date range being reported only.<br><b>Date Operator</b> The operator used to qualify the date range specified. Valid operators are:<br><b>GT – greater than.</b><br><b>LT – less than.</b><br><b>EQ – equal to.</b><br><b>From Date</b> Start from date using format DDMMYYYYY.<br><b>To Date</b> End at date using format DDMMYYYYY. |
| <b>User Id</b>      | Allows you to specify a User Id, which will result in audit trail records for the specified user being reported only. This input is case dependent.<br>For Example:<br>'xx209' will only report a User Id of 'xx209' and not 'XX209'.   |
| <b>Sort Order</b>   | Allows you to specify the Sort order that the audit trail records will be reported in. Available sort orders are:<br>'1' Timestamp – Ascending.<br>'2' Timestamp – Descending.<br>'3' User Id – Ascending.<br>'4' User Id – Descending.<br>'5' Line Number – Ascending.<br>'6' Line Number – Descending.  |

*Note: Field level help is available and is invoked by typing '?' in the field. A pop-up window is displayed with all the available Sort Orders.*

| SCREEN ITEMS        | DESCRIPTION   |
|---------------------|---|
| <b>Object Types</b> | Displays the object types to be referenced. Object types can be selected/de-selected by using 'PF2' (Types). Available selections are: <ul style="list-style-type: none"> <li>'4' Classes</li> <li>'C' Copycode</li> <li>'3' Dialogs</li> <li>'G' Global Data Areas</li> <li>'H' Help routines</li> <li>'L' Local Data Areas</li> <li>'M' Maps</li> <li>'A' Parameter Data Areas</li> <li>'P' Programs</li> <li>'N' Subprograms</li> <li>'S' Subroutines</li> </ul> |

| PFKEYS      | DESCRIPTION   |
|-------------|---|
| <b>PF1</b>  | Activates the help function.                                  |
| <b>PF2</b>  | Invoke the Object Type Selection pop-up window.               |
| <b>PF3</b>  | Exit from the current function and return to previous screen. |
| <b>PF5</b>  | Invoke NATRJE Job Submission screen.                          |
| <b>PF6</b>  | Invoke the Impact Version screen.                             |
| <b>PF12</b> | Returns to the Natural Engineer Main Menu.                    |

After all the CMT report criteria have been specified, use 'PF5' (Sub) to submit the batch job via the NATRJE Job Submission screen.

## 2

### Natural Engineer Utilities

The following Figure 2-2 illustrates the NATRJE submission screen for the CMT option.

```

- Job Submission -           Application: HOSPITAL

Job Selection details
-----
Job Selected   : (CMTREP) CMTS REPORT

Job Card details
-----
Job Name      : XGSLXX__
Job Class     : _

Job Control Record details
-----
Control Status :
Last Job Submitted - Job Name :
                  - Opid      :
                  - Step      :
                  - Return Code :

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10---PF11---PF12---
      Help      Exit      Sub   Ref              Rel              Main
```

**Figure 2-2 NATRJE Job Submission screen**

*Note: For more information on the NATRJE Job Submission screen refer to the Natural Engineer Batch Processing (Mainframes) manual.*

## CMT Example

---

To illustrate the Change Management Tracking process, an example is shown using the sample Natural application HOSPITAL.

This example will demonstrate the CMT Reports Selection option to produce a CMT report showing a simple set of audit trail records for objects that have been modified using the sample application HOSPITAL.

All the objects from the HOSPITAL application have been extracted and loaded into the Repository and the steps in this example start from the Impact Analysis process.

**Step 1** Version 1 impact search criteria have been specified to search for keyword DATAITEM with search values of #G-MESSAGE, #L-MESSAGE and #M-MESSAGE. Replace values for each of these criteria have been specified as #G-MSG, #L-MSG and #M-MSG respectively.

## 2

### Natural Engineer Utilities

The following Figure 2-3 illustrates the Impact Criteria Summary screen.

| Search Keyword |          | Search Value |            | Replace Value |        | Replace TLM |  |
|----------------|----------|--------------|------------|---------------|--------|-------------|--|
| -              | DATAITEM |              | #G-MESSAGE |               | #G-MSG |             |  |
| -              | DATAITEM |              | #L-MESSAGE |               | #L-MSG |             |  |
| -              | DATAITEM |              | #M-MESSAGE |               | #M-MSG |             |  |

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---  
Help DeleC Exit GetSa SaveA Add Prev Next W< W> Main

Figure 2-3 Impact Criteria Summary screen

**Step 2** After Impact Analysis has been executed; modification has been applied to all the impacted objects.

The following Figure 2-4 illustrates the Modification Element Categorization screen after all the objects have been modified. Object XX000G00 has been selected and also data item #G-MESSAGE, just to show the modification parameters that have been applied.

```

- Element Categorization -      Application: HOSPITAL
                                Version: 01
                                Page: 1
Object: XX000G00
Field : #G-MESSAGE
Attr  : A070  External Object Name:
Category : A Automatic          Replace Defn: _____ TLM: _____
Type    : I_ Data Item          Pos: _____
Replace Value: #G-MSG_____
User Comment : _____
TLM Data    : _____
Reason : Data item can be automatically changed
User ID:      Last Update      :
              Execution Date : 28 Sep 2001 at 17:00:39

Stmt Source Line
0020  1 #G-MESSAGE              A 70

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10---PF11---PF12---
      Help      Exit      Updt SCrit Prev Next +Parm Ctxt      Main

```

**Figure 2-4 Modification Element Maintenance screen after all objects have been modified**

## 2

### Natural Engineer Utilities

**Step 3** The CMT option is selected using 'M' (Change Management Tracking) from the Utilities Menu screen. On the CMT Reports Selection screen; module XX001P01 has been selected and all the other options have been left as per default settings.

This will result in the CMT report displaying all the audit trail information for object XX001P01 in timestamp ascending order.

The following Figure 2-5 illustrates the CMT Reports Selection screen showing the specified reporting options.

```
Change Management Tracking  Application: HOSPITAL
Reports Selection          Version: 01

Object:      XX001P01 to _____
or All Objects: N

All Versions:  N

Date Operator:  ___ Date:  ___ ___  (dd mm yyyy)
                To:  ___ ___  (dd mm yyyy)

User Id:      _____

Sort Order:   1  Timestamp - Asc

Object Types:  GLASNHMP3C4      (PF2 to set)

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10---PF11---PF12---
      Help  Types Exit          Sub   Vers                               Main
```

Figure 2-5 CMTS Reports Selection screen showing the specified reporting options

**Step 4** By using 'PF5' (Sub) on the CMT Reports Selection screen; the NATRJE Job Submission screen is displayed. After the correct Job Name and Job Class have been specified, the CMT Report job is submitted using 'PF5' (Sub).

The following Figure 2-6 illustrates the NATRJE Job Submission screen after the CMT Report job has been submitted.

```

- Job Submission -           Application: HOSPITAL

Job Selection details
-----
Job Selected   : (CMTREP) CMTS REPORT

Job Card details
-----
Job Name      : XGSLXX01
Job Class     : X

Job Control Record details
-----
Control Status :
Last Job Submitted - Job Name :
                  - Opid      :
                  - Step      :
                  - Return Code :

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help      Exit      Sub  Ref      Rel      Main
Job : XGSLXX01 Submitted Successfully

```

**Figure 2-6 NATRJE Job Submission screen after submitting job**

## 2

### Natural Engineer Utilities

**Step 5** Once the job has completed, the CMT Report can be viewed from the job output file.

The following Figure 2-7 illustrates the CMT audit trail records for object XX001P01.

```
Change Management Tracking System Report                28/09/2001
Application:      HOSPITAL
Criteria Order:  Sorted by Timestamp - Ascending
Criteria Range:  Object: XX001P01 (Object Types: DGLASNHMP3C4)
Criteria Dates:  For all Timestamps
Criteria Vers:   1
Object Name:     XX001P01
-----
Version:  1 Timestamp: 28/09/2001 17:00:41.3 User: XGSLXX01
Before:   0120 RESET #L-MESSAGE
After:    0120 RESET #L-MSG /* NEE MODIFIED AUTO
Version:  1 Timestamp: 28/09/2001 17:00:41.3 User: XGSLXX01
Before:   0250 MOVE "INVALID OPTION SELECTED" TO #L-MESSAGE
After:    0250 MOVE "INVALID OPTION SELECTED" TO #L-MSG /* NEE MODIFIED
Version:  1 Timestamp: 28/09/2001 17:00:41.4 User: XGSLXX01
Before:   0270 MOVE "INVALID PF KEY PRESSED" TO #L-MESSAGE
After:    0270 MOVE "INVALID PF KEY PRESSED" TO #L-MSG /* NEE MODIFIED
```

**Figure 2-7 CMT audit trail records for object XX001P01**

# MODE CONVERSION

## Chapter Overview

---

This chapter describes the Mode Conversion option available from the Utilities menu. The Mode Conversion option provides the facility to convert Natural Reporting mode objects into Natural Structured mode objects.

The following topics are covered:

1. [Mode Conversion Overview](#)
2. [Mode Conversion Techniques](#)
3. [Mode Conversion GDA Processing](#)
4. [Mode Conversion Object Processing](#)

## Mode Conversion Overview

---

Applications that utilize Natural Reporting mode can become more difficult to maintain, as they become more complex through continual expansion and development.

Key issues with Natural Reporting mode are:

- User defined variables can be defined anywhere, making it difficult to identify what variables are in use.
- Database fields do not need to be defined anywhere, making it difficult to identify the database data that is being referenced.
- Loop constructs are closed using the LOOP statement, making it difficult to identify where loop processing ends. For example READ, FIND, REPEAT and FOR blocks.
- Logical constructs are bound using the DO/DOEND statements, making it difficult to identify what conditional statements will be executed within complex logical blocks (nested IF statements).

Applications written in Natural Structured mode provide clear and well-defined program structure for complex application solutions.

Key benefits with Natural Structured mode are:

- All user defined variables are contained in the DEFINE DATA statement at the top of each object, making it easier to identify what variables are in use.
- All database fields must be defined using a view of the database file and are contained in the DEFINE DATA statement at the top of each object, making it easier to identify the database data being referenced.
- Loop constructs must be explicitly closed using corresponding 'END' constructs, making it easier to identify where each individual loop construct ends. For example END-READ, END-FIND, END-REPEAT and END-FOR.
- Logical constructs must be bound by using END-IF statements, making it easier to identify what conditional statements will be executed within complex logical blocks.

The Mode Conversion option provides the facility to convert Natural Reporting mode objects into Natural Structured mode objects.

Applications that are to be converted are extracted and loaded into the Repository using the Extract and Load processes. The modification library (where the converted objects will reside) is controlled within the Application Preferences screen. The Mode Conversion option can be used once the application has been loaded into the Repository.

*Note: For more information on the Application Preferences, Extract and Load processes refer to the Application Management for Windows manual.*

The Mode Conversion process is split into two sub-processes:

### **1. Global Data**

The Global data requirements within an application are specified first and if required, a new GDA object can be generated. Once generated, it will contain all the Global data referenced within the application.

### **2. Object Conversion**

Objects to be converted can be selected individually, in groups, or all objects within the application. The GDA option specified will be taken into account and the correct references added to the converted objects.

Mode Conversion can only be applied to the following Natural object types:

- Programs
- Subprograms
- Subroutines
- Help routines
- Copycodes

After the Mode Conversion process has completed, the conversion details are displayed in the batch job output file.

## Mode Conversion Techniques

---

This section describes the main conversion techniques applied during the Mode Conversion process.

### Global Data Definitions

There are 2 conversion techniques available for Global data definitions:

#### 1. Generate a new GDA.

- Will rationalize all existing GDA objects and/or in-line Global data definitions into one single new GDA object.
- Existing DEFINE DATA GLOBAL USING statements will be modified to reference the new GDA object name.
- A DEFINE DATA GLOBAL USING statement will be added to any objects that reference in-line Global data definitions only.
- Format and length attributes will be removed from in-line Global data definitions.

Example:

#### Before Conversion:

```
GDA1
0010 DEFINE DATA GLOBAL
0020 1 +ALPHA (A5)
0030 END-DEFINE

PROGRAM1
0010 DEFINE DATA
0020 GLOBAL USING GDA1
0030 END-DEFINE
0040 MOVE 'ABCDE' TO +ALPHA
0050 FETCH 'PROGRAM2'
0060 END
```

```
GDA2
0010 DEFINE DATA GLOBAL
0020 1 +NUMBER (N3)
0030 END-DEFINE

PROGRAM2
0010 DEFINE DATA
0020 GLOBAL USING GDA2
0030 END-DEFINE
0040 MOVE 123 TO +NUMBER
0050 MOVE 'HELLO WORLD'
0060 TO +TEXT-GLOBAL (A20)
0070 END
```

**After Conversion:****NEWGDA**

```
0010 DEFINE DATA GLOBAL
0020 1 +ALPHA (A5)
0030 1 +NUMBER (N3)
0040 1 +TEXT-GLOBAL (A20)
0050 END-DEFINE
```

**PROGRAM1**

```
::::
0050 DEFINE DATA
0060 GLOBAL USING NEWGDA
0070 END-DEFINE
0080 MOVE 'ABCDE' TO +ALPHA
0090 FETCH 'PROGRAM2'
0100 END
```

**PROGRAM2**

```
::::
0050 DEFINE DATA
0060 GLOBAL USING NEWGDA
0070 END-DEFINE
0080 MOVE 123 TO +NUMBER
0090 MOVE 'HELLO WORLD'
0100 TO +TEXT-GLOBAL
0110 END
```

**2. Use existing GDA object structure.**

- No new GDA objects will be generated.
- Existing DEFINE DATA GLOBAL USING statements will not be modified.

Example:

**Before Conversion:****OLDGDA**

```
0010 DEFINE DATA GLOBAL
0020 1 +LAST-PGM (A8)
0030 1 +NEXT-PGM (A8)
0040 END-DEFINE
```

**PROGRAM1**

```
0010 DEFINE DATA
0020 GLOBAL USING OLDGDA
0030 END-DEFINE
0040 MOVE 'PROGRAM1' TO +LAST-PGM
0050 MOVE 'PROGRAM2' TO +NEXT-PGM
0060 FETCH +NEXT-PGM
0070 END
```

**After Conversion:****OLDGDA**

```
0010 DEFINE DATA GLOBAL
0020 1 +LAST-PGM (A8)
0030 1 +NEXT-PGM (A8)
0040 END-DEFINE
```

**PROGRAM1**

```
::::
0050 DEFINE DATA
0060 GLOBAL USING OLDGDA
0070 END-DEFINE
0080 MOVE 'PROGRAM1' TO +LAST-PGM
0090 MOVE 'PROGRAM2' TO +NEXT-PGM
0100 FETCH +NEXT-PGM
0110 END
```

# 3

## Natural Engineer Utilities

### User Defined Variables

- A DEFINE DATA LOCAL statement is added to the object and all user defined variables used within the object are defined here.
- Format and length attributes will be removed from the in-line user defined variables.
- RESET statements are added immediately after the END-DEFINE statement for any in-line user defined variables that have been defined using the RESET statement. For example: RESET #FIELD(A10).

Example:

#### Before Conversion:

```
PROGRAM1
0010 RESET #NAME (A20) #ADDRESS (A50)
0020 REDEFINE #ADDRESS (#ADDRESS-1 (A25) #ADDRESS-2 (A25))
0030 MOVE 'SMITH' TO #NAME
0040 MOVE '101 THE AVENUE' TO #ADDRESS-1
0050 MOVE 'UNITED KINGDOM' TO #ADDRESS-2
0060 MOVE 1234567890 TO #TELEPHONE-NUMBER (N10)
0070 END
```

#### After Conversion:

```
PROGRAM1
:::
0050 DEFINE DATA LOCAL
0060 1 #NAME (A20)
0070 1 #ADDRESS (A50)
0080 1 REDEFINE #ADDRESS
0090 2 #ADDRESS-1 (A25)
0100 2 #ADDRESS-2 (A25)
0110 1 #TELEPHONE-NUMBER (N10)
0120 END-DEFINE
0130 RESET #NAME #ADDRESS
0140 MOVE 'SMITH' TO #NAME
0150 MOVE '101 THE AVENUE' TO #ADDRESS-1
0160 MOVE 'UNITED KINGDOM' TO #ADDRESS-2
0170 MOVE 1234567890 TO #TELEPHONE-NUMBER
0180 END
```

## Database Fields

- A DEFINE DATA LOCAL statement is added to the object and view definitions are added here.
- A separate view definition will be created for each database access statement referencing the same database file.
- The view definitions will contain the definitions found for each database field referenced within the object.

Example:

### Before Conversion:

```
PROGRAM1
0010 READ EMPLOYEES
0020 DISPLAY PERSONNEL-ID NAME
0030 END
```

```
PROGRAM2
0010 FIND VEHICLES WITH MAKE = 'FORD'
0020   DISPLAY MAKE MODEL
0030 LOOP
0040 FIND VEHICLES WITH MAKE = 'TVR'
0050   DISPLAY MAKE MODEL
0060 LOOP
0070 END
```

### After Conversion:

```
PROGRAM1
::::
0050 DEFINE DATA LOCAL
0060 1 EMPLOYEES VIEW OF EMPLOYEES
0070 2 PERSONNEL-ID
0080 2 FULL-NAME
0090 3 NAME
0100 /*
0110 END-DEFINE
0120 READ-0010.
0130 READ EMPLOYEES
0140 DISPLAY PERSONNEL-ID NAME
0150 END-READ
0160 END
```

```
PROGRAM2
::::
0050 DEFINE DATA LOCAL
0060 1 VEHICLES VIEW OF VEHICLES
0070 2 CAR-DETAILS
0080 3 MAKE
0090 3 MODEL
0100 /*
0110 1 VEHICLES-1 VIEW OF VEHICLES
0120 2 CAR-DETAILS
0130 3 MAKE
0140 3 MODEL
0150 /*
0160 END-DEFINE
0170 FIND-0010.
0180 FIND VEHICLES WITH MAKE = 'FORD'
0190 DISPLAY MAKE MODEL
0200 END-FIND
0210 FIND-0040.
0220 FIND VEHICLES-1 WITH MAKE = 'TVR'
0230 DISPLAY MAKE MODEL
0240 END-FIND
0250 END
```

## Loop Constructs

- LOOP processing statements are replaced with corresponding END constructs.
- Applies to the following Natural statements:

| Statement      | Corresponding END Construct |
|----------------|-----------------------------|
| CALL FILE      | END-FILE                    |
| CALL LOOP      | END-LOOP                    |
| FIND           | END-FIND                    |
| FOR            | END-FOR                     |
| HISTOGRAM      | END-HISTOGRAM               |
| READ           | END-READ                    |
| READ WORK FILE | END-WORK                    |
| REPEAT         | END-REPEAT                  |
| SORT           | END-SORT                    |

Example:

### Before Conversion:

```
PROGRAM1
0010 READ EMPLOYEES
0020 DISPLAY PERSONNEL-ID NAME
0030 LOOP
::::
```

### After Conversion:

```
PROGRAM1
::::
0120 READ-0010.
0130 READ EMPLOYEES
0140 DISPLAY PERSONNEL-ID NAME
0150 END-READ
::::
```

## Conditional Logic Blocks

- Conditional statements will have the corresponding END constructs added.
- Any DO/DOEND statements will be removed.
- Applies to the following Natural statements:

| Statement           | Corresponding END Construct |
|---------------------|-----------------------------|
| IF                  | END-IF                      |
| IF NO RECORDS FOUND | END-NOREC                   |
| AT BREAK            | END-BREAK                   |
| AT START OF DATA    | END-START                   |
| AT END OF DATA      | END-ENDDDATA                |
| AT TOP OF PAGE      | END-TOPPAGE                 |
| AT END OF PAGE      | END-ENDPAGE                 |
| ON ERROR            | END-ERROR                   |

Example:

### Before Conversion:

```

PROGRAM1
::::
0030 REPEAT
0040 ADD 1 TO #LOOP-CONTROL
0050 IF #LOOP-CONTROL LE 10
0060 DO
0070 WRITE 'STILL SOME PROCESSING TO DO'
0080 ESCAPE TOP
0090 DOEND
0100 ELSE
0110 DO
0120 WRITE 'PROCESSING COMPLETED'
0130 ESCAPE
0140 DOEND
0150 LOOP
::::

```

# 3

## Natural Engineer Utilities

### After Conversion:

#### PROGRAM1

```
::::  
0100 REPEAT-0030.  
0110 REPEAT  
0120 ADD 1 TO #LOOP-CONTROL  
0130 IF #LOOP-CONTROL LE 10  
0140 WRITE 'STILL SOME PROCESSING TO DO'  
0150 ESCAPE TOP  
0160 ELSE  
0170 WRITE 'PROCESSING COMPLETED'  
0180 ESCAPE BOTTOM  
0190 END-IF  
0200 END-REPEAT  
::::
```

## Subroutine Blocks

- Internal and external subroutines will have the RETURN statement replaced by the corresponding END-SUBROUTINE construct.

Example:

### Before Conversion:

```
PROGRAM1
::::
0060 PERFORM ##CALCULATE-COST
0070 /*
0080 WRITE 'TOTAL COST WITH TAX =' #TOTAL-COST
0090 /*
0100 DEFINE SUBROUTINE ##CALCULATE-COST
0110 RESET #TEMP-COST #TOTAL-COST
0120 COMPUTE #TEMP-COST = #COST * #TAX
0130 #TOTAL-COST = #COST + #TEMP-COST
0140 RETURN
0150 END
```

### After Conversion:

```
PROGRAM1
::::
0160 PERFORM ##CALCULATE-COST
0170 /*
0180 WRITE 'TOTAL COST WITH TAX =' #TOTAL-COST
0190 /*
0200 DEFINE SUBROUTINE ##CALCULATE-COST
0210 RESET #TEMP-COST #TOTAL-COST
0220 COMPUTE #TEMP-COST = #COST * #TAX
0230 COMPUTE #TOTAL-COST := #COST + #TEMP-COST
0240 END-SUBROUTINE
0250 END
```

## Open-ended ESCAPE Statements

- Any ESCAPE statements that do not specify a destination will have a destination of BOTTOM added.

Example:

### Before Conversion:

```
PROGRAM1
::::
0030 REPEAT
0040 ADD 1 TO #LOOP-CONTROL
0050 IF #LOOP-CONTROL GE 10
0060 DO
0070 WRITE 'LOOP WILL NOW STOP'
0080 ESCAPE
0090 DOEND
0100 LOOP
::::
```

### After Conversion:

```
PROGRAM1
::::
0100 REPEAT-0030.
0110 REPEAT
0120 ADD +1 TO #LOOP-CONTROL
0130 IF #LOOP-CONTROL GE 10
0140 WRITE 'LOOP WILL NOW STOP'
0150 ESCAPE BOTTOM
0160 END-IF
0170 END-REPEAT
::::
```

## Short Form ASSIGN and COMPUTE Statements

- Short form ASSIGN and COMPUTE statements (i.e. statements with the ASSIGN/COMPUTE keyword omitted) will have the ASSIGN/COMPUTE keyword added.

Example:

### Before Conversion:

```
PROGRAM1
::::
0030 #TAX = 0.0010
0040 ASSIGN #COST = 15000
::::
0120 COMPUTE #TEMP-COST = #COST * #TAX
0130 #TOTAL-COST = #COST + #TEMP-COST
::::
```

### After Conversion:

```
PROGRAM1
::::
0130 ASSIGN #TAX = 0.0010
0140 ASSIGN #COST = 15000
::::
0220 COMPUTE #TEMP-COST = #COST * #TAX
0230 COMPUTE #TOTAL-COST = #COST + #TEMP-COST
::::
```

# 3

## Natural Engineer Utilities

### Multiple Statements per Statement Line

- Any single statement line containing more than one statement will be split so that each statement is on a separate line.

Example:

#### Before Conversion:

##### PROGRAM1

```
::::  
0140 READ (10) PERSONNEL  
0150 IF NAME EQ 'ADKINSON' DO WRITE PERSONNEL-NUMBER NAME DOEND  
0160 LOOP  
::::
```

#### After Conversion:

##### PROGRAM1

```
::::  
0430 READ-0140.  
0440 READ (10) PERSONNEL  
0450 IF NAME EQ 'ADKINSON'  
0460 WRITE PERSONNEL-NUMBER NAME  
0470 END-IF  
0480 END-READ  
::::
```

## MOVE INDEXED Statements

- MOVE INDEXED statements are replaced with standard MOVE statements.
- Suitable array definitions will be added for any MOVE INDEXED source variables that are not defined as arrays.

Example:

### Before Conversion:

#### PROGRAM1

```

:::
0010 RESET #BLOCK-MULTIPLE (A26) #FIRST (A1) #LAST (A1)
0020 REDEFINE #BLOCK-MULTIPLE (#BLOCK-SINGLE (A1))
0030 RESET #CURRENCY-CODES (A3/4) #INDEX (I02)
0040 /*
0050 FORMAT LS=250
0060 /*
0070 MOVE 'ABCDEFGHJKLMNOPQRSTUVWXYZ' TO #BLOCK-MULTIPLE
0080 MOVE INDEXED #BLOCK-SINGLE <1> TO #FIRST
0090 MOVE INDEXED #BLOCK-SINGLE <26> TO #LAST
0100 WRITE '=' #FIRST '=' #LAST
0110 /*
0120 FORMAT LS=250
0130 MOVE 3 TO #ISN
0140 FIND EMPLOYEES WITH PERSONNEL-ID EQ '11100106'
0150 OBTAIN CURR-CODE (1-4)
0160 WRITE '=' PERSONNEL-ID / '=' NAME
0170 FOR #INDEX EQ 1 TO 4
0180 MOVE INDEXED CURR-CODE<#INDEX> TO #CURRENCY-CODES (#INDEX)
0190 WRITE #INDEX '=' #CURRENCY-CODES (#INDEX)
0200 LOOP
0210 LOOP
0220 /*
0230 END

```

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## Natural Engineer Utilities

After Conversion:PROGRAM1

```

:::
0050 DEFINE DATA LOCAL
0060 1 #BLOCK-MULTIPLE (A026)
0070 1 REDEFINE #BLOCK-MULTIPLE
0080 2 #BLOCK-SINGLE (A001)
0090 1 REDEFINE #BLOCK-MULTIPLE
0100 2 #NEE@MI-#BLOCK-SINGLE (A001/1:26)
0110 1 #FIRST (A001)
0120 1 #LAST (A001)
0130 1 #CURRENCY-CODES (A003/1:4)
0140 1 #INDEX (I002)
0150 1 #ISN (N007)
0160 1 EMPLOYEES VIEW OF EMPLOYEES
0170 2 PERSONNEL-ID
0180 2 FULL-NAME
0190 3 NAME
0200 2 INCOME
0210 3 CURR-CODE(0000001:0000004)
0220 /*
0230 END-DEFINE
0240 RESET #BLOCK-MULTIPLE #FIRST #LAST
0250 RESET #CURRENCY-CODES (1:4) #INDEX
0260 /*
0270 FORMAT LS=250
0280 /*
0290 MOVE 'ABCDEFGHJKLMNOPQRSTUVWXYZ' TO #BLOCK-MULTIPLE
0300 MOVE #NEE@MI-#BLOCK-SINGLE (1) TO #FIRST
0310 MOVE #NEE@MI-#BLOCK-SINGLE (26) TO #LAST
0320 WRITE '=' #FIRST '=' #LAST
0330 /*
0340 FORMAT LS=250
0350 MOVE 3 TO #ISN
0360 FIND-0140.
0370 FIND EMPLOYEES WITH PERSONNEL-ID EQ '11100106'
0380 WRITE '=' PERSONNEL-ID / '=' NAME
0390 FOR-0170.
0400 FOR #INDEX EQ 1 TO 4
0410 MOVE CURR-CODE (#INDEX) TO #CURRENCY-CODES (#INDEX)
0420 WRITE #INDEX '=' #CURRENCY-CODES (#INDEX)
0430 END-FOR
0440 END-FIND
0450 /*
0460 END

```

## Statement Reference Notation

- Statement labels are added to all loop processing statements and also to GET and STORE statements. The format used is:  
KEYWORD-NNNN  
where:  
KEYWORD is the Natural keyword used in the statement. For example READ or FIND.  
NNNN is the line number for the start of the statement in the original object.
- Any existing statement reference notation using source-code line numbers will be modified to use the new statement labels.
- Any existing statement labels will remain unchanged.
- Any database access view names will be modified to reflect the new view definitions.
- Any view name qualifiers on database fields will be modified to reflect the new view definitions.

Example:

### **Before Conversion:**

#### **PROGRAM1**

```
0010 LIMIT 5
0020 READ EMPLOYEES
0030   DISPLAY PERSONNEL-ID NAME
0040 LOOP
0050 /*
0060 R2.
0070 READ EMPLOYEES
0080   DISPLAY PERSONNEL-ID (R2.) NAME (R2.)
0090 LOOP (R2.)
0100 /*
0110 READ EMPLOYEES
0120   DISPLAY PERSONNEL-ID (0110) NAME (0110)
0130 LOOP (0110)
0140 /*
0150 READ EMPLOYEES
0160   DISPLAY EMPLOYEES.PERSONNEL-ID EMPLOYEES.NAME
0170 LOOP
0180 /*
0190 END
```

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## Natural Engineer Utilities

### After Conversion:

#### PROGRAM1

```
::::
0050 DEFINE DATA LOCAL
0060 1 EMPLOYEES VIEW OF EMPLOYEES
0070 2 PERSONNEL-ID
0080 2 FULL-NAME
0090 3 NAME
0100 /*
0110 1 EMPLOYEES-1 VIEW OF EMPLOYEES
0120 2 PERSONNEL-ID
0130 2 FULL-NAME
0140 3 NAME
0150 /*
0160 1 EMPLOYEES-2 VIEW OF EMPLOYEES
0170 2 PERSONNEL-ID
0180 2 FULL-NAME
0190 3 NAME
0200 /*
0210 1 EMPLOYEES-3 VIEW OF EMPLOYEES
0220 2 PERSONNEL-ID
0230 2 FULL-NAME
0240 3 NAME
0250 /*
0260 END-DEFINE
0270 LIMIT 5
0280 READ-0020.
0290 READ EMPLOYEES
0300 DISPLAY PERSONNEL-ID NAME
0310 END-READ
0320 /*
0330 R2.
0340 READ EMPLOYEES-1
0350 DISPLAY PERSONNEL-ID (R2.) NAME (R2.)
0360 END-READ
0370 /*
0380 READ-0110.
0390 READ EMPLOYEES-2
0400 DISPLAY PERSONNEL-ID (READ-0110.) NAME (READ-0110.)
0410 END-READ
0420 /*
0430 READ-0150.
0440 READ EMPLOYEES-3
0450 DISPLAY EMPLOYEES-3.PERSONNEL-ID EMPLOYEES-3.NAME
0460 END-READ
0470 /*
0480 END
```

## OBTAIN Statements

- OBTAIN statements are removed and are replaced with index values specified in the view definition for each database field referenced in the old OBTAIN statements.

Example:

### Before Conversion:

```
PROGRAM1
0010 FIND EMPLOYEES WITH PERSONNEL-ID EQ '88888888'
0020   OBTAIN CURR-CODE (1:4)
0030   OBTAIN BONUS (1:4,1:4)
0040   DISPLAY PERSONNEL-ID BONUS (*,*) CURR-CODE (*)
0050 LOOP
0060 END
```

### After Conversion:

```
PROGRAM1
:::
0050 DEFINE DATA LOCAL
0060 1 EMPLOYEES VIEW OF EMPLOYEES
0070 2 PERSONNEL-ID
0080 2 INCOME
0090 3 CURR-CODE (0000001:0000004)
0100 3 BONUS (0000001:0000004,0000001:0000004)
0110 /*
0120 END-DEFINE
0130 FIND-0010.
0140 FIND EMPLOYEES WITH PERSONNEL-ID EQ '88888888'
0150 DISPLAY PERSONNEL-ID BONUS (*,*) CURR-CODE (*)
0160 END-FIND
0170 END
```

## SORT Statements

- The END-ALL statement will be inserted prior to the SORT statement.
- A statement notation label will be added using the format SORT-NNNN, where NNNN is the statement line number for the SORT statement in the original object.
- Corresponding END-SORT added.

Example:

### Before Conversion:

#### PROGRAM1

```

:::
0190 FIND EMPLOYEES WITH CITY = 'DERBY'
0200 OBTAIN SALARY(1:2)
0210 /*
0220 COMPUTE #TOTAL-SALARY (P11) = SALARY (1) + SALARY (2)
0230 ACCEPT IF #TOTAL-SALARY GT 0
0240 /*
0250 SORT BY PERSONNEL-ID USING #TOTAL-SALARY SALARY(*) CURR-CODE
0260 GIVE AVER(#TOTAL-SALARY)
0270 /*
0280 AT START OF DATA
0290 DO
0300 WRITE NOTITLE '*' (40)
0310 'AVERAGE CUMULATIVE SALARY:' *AVER(#TOTAL-SALARY)
0320 MOVE *AVER (#TOTAL-SALARY) TO #AVERAGE (P11)
0330 DOEND
0340 /*
0350 COMPUTE #AVERAGE-PERCENT (N3.2) = #TOTAL-SALARY / #AVERAGE * 100
0360 ADD #TOTAL-SALARY TO #TOTAL-TOTAL (P11)
0370 /*
0380 DISPLAY NOTITLE PERSONNEL-ID SALARY (1) SALARY (2)
0390 #TOTAL-SALARY CURR-CODE (1)
0400 'PERCENT/OF/AVER' #AVERAGE-PERCENT
0410 /*
0420 AT END OF DATA
0430 WRITE / '*' (40) 'TOTAL SALARIES PAID: ' #TOTAL-TOTAL
0440 /*
0450 END

```

**After Conversion:****PROGRAM1**

```
::::
0370 FIND-0190.
0380 FIND EMPLOYEES WITH CITY = 'DERBY'
0390 /*
0400 COMPUTE #TOTAL-SALARY = SALARY (1) + SALARY (2)
0410 ACCEPT
0420 IF #TOTAL-SALARY GT 0
0430 /*
0440 END-ALL
0450 SORT-0250.
0460 SORT BY PERSONNEL-ID USING #TOTAL-SALARY SALARY (*) CURR-CODE (1:1)
0470 GIVE AVER (#TOTAL-SALARY)
0480 /*
0490 AT START OF DATA
0500 WRITE NOTITLE '*' (40)
0510 'AVERAGE CUMULATIVE SALARY:' *AVER (#TOTAL-SALARY)
0520 MOVE *AVER (#TOTAL-SALARY) TO #AVERAGE
0530 END-START
0540 /*
0550 COMPUTE #AVERAGE-PERCENT = #TOTAL-SALARY / #AVERAGE * 100
0560 ADD #TOTAL-SALARY TO #TOTAL-TOTAL
0570 /*
0580 DISPLAY NOTITLE PERSONNEL-ID SALARY (1) SALARY (2)
0590 #TOTAL-SALARY CURR-CODE (1)
0600 'PERCENT/OF/AVER' #AVERAGE-PERCENT
0610 /*
0620 AT END OF DATA
0630 WRITE / '*' (40) 'TOTAL SALARIES PAID: ' #TOTAL-TOTAL
0640 /*
0650 END-ENDDATA
0660 END-SORT
0670 END
```

## FIND FIRST/NUMBER/UNIQUE Statements

- FIND FIRST statements are converted to FIND (1) statements and a GET statement is added to reference any data. FIND FIRST is not valid in Structured mode.
- FIND NUMBER statements are converted to FIND (1) statements. The WHERE clause for FIND NUMBER is not valid in Structured mode.
- FIND UNIQUE statements are converted to FIND (1) statements and a GET statement is added to reference any data. FIND UNIQUE is not valid in Structured mode.

Example:

### Before Conversion:

```
PROGRAM1
::::
0040 FIND FIRST EMPLOYEES WITH NAME = 'ADKINSON'
0050 WHERE SEX EQ 'F'
0060 WRITE '=' (70)
0070 WRITE 'THE NUMBER OF ADKINSON'S ON FILE =' *NUMBER
0080 WRITE 'THE NUMBER OF FEMALE ADKINSON'S =' *COUNTER
0090 WRITE 'THE FIRST RECORD LOCATED IS:'
0100 / 5T 'P-id:' PERSONNEL-ID (CD=RE)
0110 / 5T 'Name:' NAME (CD=RE)
0120 / 5T 'Sex :' SEX (CD=RE)
::::
0160 FIND NUMBER VEHICLES WITH MAKE = 'BMW'
0170 WHERE COLOR EQ 'BLACK'
0180 WRITE 'THE NUMBER OF BMW'S FOUND =' *NUMBER
0190 WRITE 'THE NUMBER OF BLACK BMW'S =' *COUNTER
::::
0230 FIND UNIQUE PERSONNEL WITH NAME = 'BAYER'
0240 WRITE 'PERSONNEL INFORMATION FOUND :'
0250 / 'Last Name:' NAME (CD=GR)
0260 / 'First Name:' FIRST-NAME (CD=GR)
0270 / 'Job Title :' JOB (CD=GR)
::::
```

**After Conversion:****PROGRAM1**

```
::::
0280 FIND-0040.
0290 FIND (1) EMPLOYEES WITH NAME = 'ADKINSON'
0300 WHERE SEX EQ 'F'
0310 END-FIND
0320 GET-FIND-0040.
0330 GET EMPLOYEES *ISN ( FIND-0040. )
0340 WRITE '=' (70)
0350 WRITE 'THE NUMBER OF ADKINSON'S ON FILE =' *NUMBER (FIND-0040.)
0360 WRITE 'THE NUMBER OF FEMALE ADKINSON'S =' *COUNTER (FIND-0040.)
0370 WRITE 'THE FIRST RECORD LOCATED IS:'
0380 / 5T 'P-id:' PERSONNEL-ID (CD=RE)
0390 / 5T 'Name:' NAME (CD=RE)
0400 / 5T 'Sex :' SEX (CD=RE)
::::
0440 FIND-0160.
0450 FIND (1) VEHICLES WITH MAKE = 'BMW'
0460 WHERE COLOR EQ 'BLACK'
0470 END-FIND
0480 WRITE 'THE NUMBER OF BMW'S FOUND =' *NUMBER (FIND-0160.)
0490 WRITE 'THE NUMBER OF BLACK BMW'S =' *COUNTER (FIND-0160.)
::::
0530 FIND-0230.
0540 FIND (1) PERSONNEL WITH NAME = 'BAYER'
0550 END-FIND
0560 GET-FIND-0230.
0570 GET PERSONNEL *ISN ( FIND-0230. )
0580 WRITE 'PERSONNEL INFORMATION FOUND :'
0590 / 'Last Name:' NAME (CD=GR)
0600 / 'First Name:' FIRST-NAME (CD=GR)
0610 / 'Job Title :' JOB (CD=GR)
::::
```

## Mode Conversion GDA Processing

---

The first stage of the Mode Conversion process is to address the Global data requirements within the application.

### GDA Options Overview

When the Mode Conversion option is invoked, the Mode Conversion GDA Information window is displayed showing the GDA usage for the current application and the default GDA Options that will be set on the Mode Conversion GDA Options screen.

For each application being converted, there are three possible GDA options available:

#### 1. Use new GDA

This will generate a new GDA object which will contain all the Global data used within the application. This may include all Global data from one or more existing GDA objects already used by the application and/or any in-line Global data definitions found within individual objects. The Mode Conversion process will use the new GDA object name as part of the 'DEFINE DATA GLOBAL USING' statement within each newly converted object that references Global data.

It is recommended that this option is used to ensure all Global data used by the application, is encapsulated within one GDA object. For applications using multiple GDA objects, this option will rationalize the GDA objects into one single GDA object.

#### 2. Use converted GDA

This will use a previously generated GDA object, from a previous Mode Conversion execution using option 1 above. The Mode Conversion process will use the previously converted GDA object name as part of the 'DEFINE DATA GLOBAL USING' statement within each newly converted object that references Global data.

This option may be used if an application is being converted in phases using object ranges, or when additional single objects are being converted.

*Note: This option is only available if the Mode Conversion process has been previously executed using the 'Use new GDA' option and the modification library contains the GDA object specified.*

### 3. Use existing GDA

This will use the existing application GDA objects and the Mode Conversion process will not change the 'DEFINE DATA GLOBAL USING' statements within each newly converted object that references the GDA data.

If the application uses any in-line Global data definitions in addition to GDA objects, then the Mode Conversion In-line Global Variables option is invoked. This option allows you to specify the GDA object name, which will be generated to encapsulate all in-line Global data definitions used by the application. The Mode Conversion process will then add the 'DEFINE DATA GLOBAL USING' statements within each newly converted object that only references in-line Global data definitions.

*Note: The Mode Conversion In-line Global Variables option is mandatory for any application that uses a mix of GDA objects and in-line Global data definitions when using the 'Use existing GDA' option. This is to ensure that the application Global data usage integrity is maintained after conversion.*

## GDA Processing Considerations

### 1. Duplicate Global data definitions.

Any Global data definitions that have the same name, format and length will be rationalized as one variable in the generated GDA.

Any Global data definitions that have the same name but different format and/or length will not be added to the generated GDA object. These will be reported in the Mode Conversion Log. For example:

```
Duplicate Global variable name with different format detected in Object: G02
- Global variable: +DUPLICATE-NAME-DIFF-FORMAT (A020)
- Global variable already included from Object: G01
```

### 2. Global data definitions used by subprograms.

Any Global data definitions found within GDA objects only used by subprograms will not be added to the generated GDA object. These will be reported in the Mode Conversion Log. For example:

```
GDA object only used by Subprograms detected - Object: SPGMGDA1
- This GDA is not included in the new GDA
```

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Any in-line Global data definitions found within subprograms will not be added to the generated GDA object. These will be reported in the Mode Conversion Log. For example:

```
In-line Global variable only used by Subprograms detected - Object: SUBPGM1
- Global variable: +SUBPGM-INLINE-GLOBAL
- This Global variable is not included in the new GDA
```

*Note: Any subprograms containing in-line Global data definitions will not be converted. These will have to be manually rationalized before conversion is allowed. Subprograms using GDA objects will be converted.*

### 3. Applications using multiple GDA objects.

Applications using multiple GDA objects can be addressed in any one of three ways:

1. Manually rationalize the multiple GDA objects into a new single GDA object. Any in-line Global data definitions would need to be identified and added to the new single GDA object. The application objects referencing Global data need to be changed to reference the new single GDA. Once this has been completed, the application needs to be extracted and loaded into the Repository, then the Mode Conversion process executed using the 'Use new GDA' option.

*Note: This is the recommended method of dealing with multiple GDA objects as it will ensure the stability of the Global data usage within the application.*

2. Automatically rationalize the multiple GDA objects into a new single GDA object using the Mode Conversion 'Use new GDA' option. This will generate a new single GDA object based on the GDA objects and any in-line Global data definitions found within the application.

3. Use the existing GDA objects. The existing GDA object usage within the application will be retained and any in-line Global data definitions will be encapsulated within a new single GDA object.

## Mode Conversion GDA Information Window

The Mode Conversion GDA Information window displays the Global data usage information for the application along with the default options that will be displayed on the Mode Conversion GDA Options screen.

The Mode Conversion GDA Information window will be displayed after selecting option 'C' (Mode Conversion) from the Utilities Menu screen.

The following Figure 3-1 illustrates an example of the Mode Conversion GDA Information window.

```

                                     - Utilities Menu -           Application: MODECONV
                                     Information
Your application has no Global Data Area in use

Your application uses in-line global variables

Default GDA name set to COMMON
Default option 'Use new GDA' has been selected

Press ENTER to continue

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help           Exit                                     Main
```

Figure 3-1 Example of the Mode Conversion GDA Information window

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The information displayed will be based on the following cases:

### 1. Application uses no Global data.

The application uses no Global data, either as GDA objects or in-line Global variable definitions.

| SCREEN ITEMS           | DESCRIPTION   |
|------------------------|---|
| <b>GDA Information</b> | For all GDA process executions:<br>"Your application has no Global variables" |
| <b>Default Options</b> | Not applicable for this case.   |
| <b>ENTER key</b>       | Invokes the Mode Conversion Object Selection screen.                          |

### 2. Application uses in-line Global variables only.

The application uses Global variables that have been defined in-line. The application does not use any GDA objects.

| SCREEN ITEMS           | DESCRIPTION  |
|------------------------|--|
| <b>GDA Information</b> | For all GDA process executions:<br>"Your application has no Global Data Area in use"<br>"Your application uses in-line global variables"   |
| <b>Default Options</b> | For first time GDA process execution:<br>"Default GDA name set to COMMON"<br>"Default option 'Use new GDA' has been selected"<br>For subsequent GDA process execution:<br>"Default option 'Use converted GDA' has been selected" |
| <b>ENTER key</b>       | Invokes the Mode Conversion GDA Options screen.  |

### 3. Application uses a single GDA object only.

The application uses Global variables that have been defined in a single GDA object. The application does not use any Global variables that have been defined in-line.

| SCREEN ITEMS           | DESCRIPTION   |
|------------------------|---|
| <b>GDA Information</b> | For all GDA process executions:<br>"Your application has one Global Data Area in use"<br>- 'GDA-name' |
| <b>Default Options</b> | For all GDA process executions:<br>"Default option 'Use existing GDA' has been selected"              |
| <b>ENTER key</b>       | Invokes the Mode Conversion GDA Options screen.   |

*Note: 'GDA-name' will be the GDA object name within the application.*

### 4. Application uses a single GDA object and in-line Global variables.

The application uses Global variables that have been defined using a single GDA object and in-line definitions.

| SCREEN ITEMS           | DESCRIPTION  |
|------------------------|--|
| <b>GDA Information</b> | For all GDA process executions:<br>"Your application has one Global Data Area in use"<br>- 'GDA-name'<br>"Your application uses in-line global variables"  |
| <b>Default Options</b> | For first time GDA process execution:<br>"Default GDA name set to 'GDA-name'"<br>"Default option 'Use new GDA' has been selected"<br>For subsequent GDA process execution:<br>"Default option 'Use converted GDA' has been selected" |
| <b>ENTER key</b>       | Invokes the Mode Conversion GDA Options screen.  |

*Note: 'GDA-name' will be the GDA object name within the application.*

**5. Application uses multiple GDA objects and no in-line Global variables.**

The application uses Global variables that have been defined in more than one GDA object. The application does not use any Global variables that have been defined in-line.

| SCREEN ITEMS           | DESCRIPTION   |
|------------------------|---|
| <b>GDA Information</b> | <p>For all GDA process executions:</p> <p>"Your application has more than one Global Data Area in use"</p> <p>- 'GDA-name'</p> <p>- 'GDA-name'</p> <p><i>Note: A maximum of four GDA object names will be displayed. If there are more than four GDA objects are used, then the text '&lt;MORE&gt;' will be shown. For example:</i></p> <p>- 'GDA-name'</p> <p>- 'GDA-name'</p> <p>- 'GDA-name'</p> <p>- 'GDA-name'</p> <p>- &lt;MORE&gt;</p> |
| <b>Default Options</b> | <p>For all GDA process executions:</p> <p>"Default option 'Use existing GDAs' has been selected"</p>  |
| <b>ENTER key</b>       | Invokes the Mode Conversion GDA Options screen.   |

*Note: 'GDA-name' will be the GDA object name within the application.*

## 6. Application uses a mix of multiple GDA objects and in-line Global variables.

The application uses Global variables that have been defined using both GDA objects and in-line definitions.

| SCREEN ITEMS           | DESCRIPTION   |
|------------------------|---|
| <b>GDA Information</b> | <p>For all GDA process executions:</p> <p>"Your application has more than one Global Data Area in use"</p> <ul style="list-style-type: none"> <li>- 'GDA-name'</li> <li>- 'GDA-name'</li> </ul> <p>"Your application uses in-line global variables"</p> <p><i>Note: A maximum of four GDA object names will be displayed. If there are more than four GDA objects are used, then the text '&lt;MORE&gt;' will be shown. For example:</i></p> <ul style="list-style-type: none"> <li>- 'GDA-name'</li> <li>- 'GDA-name'</li> <li>- 'GDA-name'</li> <li>- 'GDA-name'</li> <li>- &lt;MORE&gt;</li> </ul> |
| <b>Default Options</b> | <p>For all GDA process executions:</p> <p>"Default option 'Use existing GDAs' has been selected"</p>  |
| <b>ENTER key</b>       | Invokes the Mode Conversion GDA Options screen.   |

*Note: 'GDA-name' will be the GDA object name within the application.*

## Mode Conversion GDA Options Screen

The Mode Conversion GDA Options screen allows you to specify what GDA processing is to be applied to the converted application.

*Note: If the application uses no Global data (either as GDA objects or in-line Global variable definitions) then the Mode Conversion GDA Options screen will not be displayed.*

The Mode Conversion GDA Options screen is invoked by using the 'ENTER' key on the Mode Conversion GDA Information window.

The following Figure 3-2 illustrates the Mode Conversion GDA Options screen.

```

                                     - Utilities Menu -           Application: MODECONV
                                     Mode Conversion - GDA Options
                                     Y Use new GDA
                                     _ Use converted GDA      (COMMON)
                                     _ Use existing GDA

                                     Press ENTER to continue
                                     PF3   to exit

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
Help           Exit                                     Main

```

Figure 3-2 Mode Conversion GDA Options screen

| SCREEN ITEMS             | DESCRIPTION   |
|--------------------------|---|
| <b>Use new GDA</b>       | Specify this option to create a new GDA object to be used by the converted application.   |
| <b>GDA Name</b>          | <p>Specify the GDA object name to be used. The GDA name is mandatory if the 'Use new GDA' option has been selected.</p> <p>The GDA name will normally appear 'blank' except under the following conditions:</p> <ol style="list-style-type: none"> <li>1. Will be set to COMMON if the application only uses in-line Global definitions and has no GDA objects.</li> <li>2. Will be set to the 'GDA-name' used by the application if the application uses in-line Global definitions and a single GDA object.</li> </ol> <p><i>Note: These default values may be overwritten as required.</i></p> |
| <b>Use converted GDA</b> | <p>Specify this option if you wish to use a previously converted GDA object.</p> <p>The name of the previously converted GDA object will appear enclosed in brackets. For example [COMMON].</p> <p><i>Note: This option is only available if the Mode Conversion process has been previously executed using the 'Use new GDA' option and the modification library contains the GDA object specified.</i></p>  |
| <b>Use existing GDA</b>  | <p>Specify this option if you wish to use the application's existing GDA objects.</p> <p><i>Note: If the application uses any in-line Global definitions, then the Mode Conversion In-line Global Variables screen will be displayed.</i></p>   |

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| <b>PFKEYS</b> | <b>DESCRIPTION</b>   |
|---------------|--|
| <b>ENTER</b>  | <p>Validates the selection made and invokes one of the following processes depending on the option selected:</p> <ol style="list-style-type: none"><li><b>'Use new GDA'</b><br/>Mode Conversion Object Selection screen displayed.</li><li><b>'Use converted GDA'</b><br/>Mode Conversion Object Selection screen displayed.</li><li><b>'Use existing GDA'</b><br/>If the application uses no in-line Global definitions then the Mode Conversion Object Selection screen will be displayed.<br/>If the application does use in-line Global definitions, then the Mode Conversion In-line Global Variables screen will be displayed.</li></ol> |
| <b>PF3</b>    | <p>Exit from the current function and return to previous screen.</p>   |

## Mode Conversion In-line Global Variables Screen

The Mode Conversion In-line Global Variables screen allows you to specify the GDA object name to be used for any in-line Global variable definitions found within the application.

This option is mandatory if the application uses both GDA objects and in-line Global variable definitions.

*Note: The Mode Conversion In-line Global Variables screen is only displayed if the 'Use existing GDA' option has been selected on the Mode Conversion GDA Options screen and the application contains in-line Global variable definitions.*

The Mode Conversion In-line Global Variables screen is invoked by selecting option 'Use existing GDA' on the Mode Conversion GDA Options screen and using the 'ENTER' key.

The following Figure 3-3 illustrates the Mode Conversion In-line Global Variables screen.

```

- Utilities Menu -           Application: MODECONV

Mode Conversion - In-line Global Variables

You have selected to use existing GDA(s) but the application
also uses in-line Global variables. These need to be
rationalized into a new single GDA object as the conversion
process will remove any in-line format and length attributes.

The new GDA will be referenced by objects using in-line
Global variables only.

                GDA name      COMMON__

Press ENTER to continue
PF3   to exit

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10---PF11---PF12---
Help           Exit                                           Main

```

Figure 3-3 Mode Conversion In-line Global Variables screen

### 3

#### Natural Engineer Utilities

| <b>SCREEN ITEMS</b> | <b>DESCRIPTION</b> |
|---------------------|--------------------|
|---------------------|--------------------|

|                         |   |
|-------------------------|---|
| <b>Explanation text</b> | Provides an explanation for the Mode Conversion In-line Global Variables option.  |
| <b>GDA name</b>         | Specify the GDA object name to be used. The GDA name is mandatory and the GDA object name must not already exist on the modification library.<br><br>The default GDA name will be set to 'COMMON'. This may be overwritten as required. |

| <b>PFKEYS</b> | <b>DESCRIPTION</b> |
|---------------|--------------------|
|---------------|--------------------|

|              |  |
|--------------|--|
| <b>ENTER</b> | Validates the selection made and invokes the Mode Conversion Object Selection screen.<br><br><i>Note: If the GDA name specified already exists on the modification library an error message will be displayed. The GDA name will need to be changed before you can continue.</i> |
| <b>PF3</b>   | Exit from the current function and return to previous screen.  |

## Mode Conversion Object Processing

The second stage of the Mode Conversion process is to select the objects to be converted and then invoke the Mode Conversion Object processing.

### Mode Conversion Object Selection Screen

The Mode Conversion Object Selection screen allows you to select the objects that are to be converted for the application.

The Mode Conversion Object Selection screen is invoked by using the 'ENTER' key on the Mode Conversion GDA Options screen.

The following Figure 3-4 illustrates the Mode Conversion Object Selection screen.

```

- Mode Conversion -           Application: MODECONV
- Object Selection -
  Select   Object Name
  -       MCONVN07
  -       MCONVP01
  -       MCONVP02
  -       MCONVP03
  -       MCONVP04
  -       MCONVP05
  -       MCONVP06
  -       MCONVP07
  -       MCONVP08
  -       MCONVP09
  -       MCONVP10
  -       MCONVP11
  -       MCONVP12
  -       MCONVP13

                Reposition -> _____
Object Types: CHPNS   Object Selection -> *
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
      Help  Types Exit          Sub      Prev  Next                          Main

```

Figure 3-4 Mode Conversion Object Selection screen

| SCREEN ITEMS            | DESCRIPTION  |
|-------------------------|--|
| <b>Select</b>           | This is the selection column where individual objects can be selected. Valid selections are:<br>'S' Select object.   |
| <b>Object Name</b>      | List of Reporting mode objects loaded in the Repository for the current application. No Structured mode objects will be listed. This list can be tailored to your requirements using 'PF2' (Types) option.   |
| <b>Reposition</b>       | Reposition the list of objects starting from the new value entered. This value can be a complete object name or part name using '*' wildcard. For example:<br>* Will reposition at the start of the Object list.<br><b>MCONV*</b> Will reposition at the first object name that matches the mask MCONV or is greater than the mask input.<br><b>MCONVP01</b> Will reposition at the first object name that matches the mask exactly or is greater than the object name input.  |
| <b>Object Selection</b> | The selected object or range of objects to be converted.<br><i>Note: Object Selection is mandatory except when using the 'Use new GDA' option, where the Object Selection can be 'blank' and will result in the Mode Conversion process generating a new GDA object only.</i><br>There are three valid cases allowed:<br>* Will apply the Mode Conversion process for ALL objects in the current application.<br><i>Note: This is the default setting.</i><br><b>MCONV*</b> Will apply the Mode Conversion process for ALL objects that have a name prefixed with MCONV.<br>For example: convert objects MCONVP01 and MCONVN01 but not MCONXP01.<br><b>MCONVP01</b> Will apply the Mode Conversion process for object MCONVP01 only. |
| <b>Object Types</b>     | Displays the object types to be referenced. Object types can be selected/de-selected by using 'PF2' (Types). Available selections are:<br>'C' Copycodes<br>'H' Helproutines<br>'P' Programs<br>'N' Subprograms<br>'S' Subroutines  |

| <b>PFKEYS</b> | <b>DESCRIPTION</b>  |
|---------------|---|
| <b>PF1</b>    | Activates the help function.                                  |
| <b>PF2</b>    | Invoke the Object Type Selection pop-up window.               |
| <b>PF3</b>    | Exit from the current function and return to previous screen. |
| <b>PF5</b>    | Invoke the Mode Conversion Information window.                |
| <b>PF7</b>    | Displays previous page.                                       |
| <b>PF8</b>    | Displays next page.   |
| <b>PF12</b>   | Returns to the Natural Engineer Main Menu.                    |

## Mode Conversion Information Window

The Mode Conversion Information window summarizes the GDA options to be applied during the conversion process. It is possible at this stage to cancel the conversion process and make new object selection and/or change the GDA options to be used.

*Note: If the application uses no Global data (either as GDA objects or in-line Global variable definitions) then the Mode Conversion Information window will not be displayed.*

The following Figure 3-5 illustrates an example of the Mode Conversion Information screen.

```

- Mode Conversion -      Application: MODECONV
- Object Selection -
Information
You are about to execute Mode Conversion with the following
GDA option:
- Use new GDA (COMMON)
Do you wish to continue ?  Y  (Y/N)
Object Types: CHPNS   Object Selection -> *_____
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
Help  Types Exit      Sub      Prev  Next      Main

```

**Figure 3-5 Example of the Mode Conversion Information screen**

| SCREEN ITEMS   | DESCRIPTION  |
|--|--|
| <b>You are about to execute Mode Conversion with the following GDA option:</b> | <p>List the GDA option that will be used during the conversion process.<br/>The GDA options available are:</p> <ul style="list-style-type: none"><li>- <b>Use new GDA ['GDA-name']</b><br/>Conversion will use the new GDA 'GDA-name' when converting objects.</li><li>- <b>Use converted GDA ['GDA-name']</b><br/>Conversion will use the previously converted GDA 'GDA-name' when converting objects.</li><li>- <b>Use existing GDA</b><br/>Conversion will use the existing application GDA when converting objects.</li></ul> <p><i>Note: 'GDA-name' will contain the name of the GDA that has been specified on the Mode Conversion GDA Options screen.</i></p> |
| <b>Do you wish to continue ?</b>   | <p>'Y' Invoke NATRJE Job Submission screen.</p> <p>'N' Cancel the Mode Conversion process and return back to the Mode Conversion Object Selection screen.</p>  |

### 3

#### Natural Engineer Utilities

The following Figure 3-6 illustrates the NATRJE submission screen for the Mode Conversion option.

```

- Job Submission -           Application: MODECONV

Job Selection details
-----
Job Selected : (RMRMOD) MODE CONVERSION

Job Card details
-----
Job Name   : XGSLXX__
Job Class  : _

Job Control Record details
-----
Control Status :
Last Job Submitted - Job Name :
                  - Opid      :
                  - Step      :
                  - Return Code :

Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10---PF11---PF12---
      Help      Exit      Sub   Ref              Rel              Main
```

**Figure 3-6 NATRJE Job Submission screen**

*Note: For more information on the NATRJE Job Submission screen refer to the Natural Engineer Batch Processing (Mainframes) manual.*

## Mode Conversion Log

The Mode Conversion Log is displayed in the batch job output file. The Mode conversion log will contain a list of entries showing the conversion process activity.

The following Figure 3-7 illustrates the Mode Conversion Log showing conversion details.

```
*****
*
*           Mode Conversion Log                11 Jun 2003 11:57
*
*   Library Information
*     Application       : MODECONV
*     Modification library : MODECNVX
*
*   GDA Options
*     Create new GDA   : Yes
*     GDA name         : COMMON
*
*   Object Selection
*     Convert objects  : Yes
*     Object selection : *           (All Objects)
*     Types           : CHPNS
*
*****
*
GDA COMMON created in MODECNVX
MCONVN07 converted to Structured mode
MCONVP01 converted to Structured mode
MCONVP02 converted to Structured mode
MCONVP03 converted to Structured mode
MCONVP04 converted to Structured mode
MCONVP05 converted to Structured mode
MCONVP06 converted to Structured mode
MCONVP07 converted to Structured mode
MCONVP08 converted to Structured mode
MCONVP09 converted to Structured mode
MCONVP10 converted to Structured mode
MCONVP11 converted to Structured mode
MCONVP12 converted to Structured mode
MCONVP13 converted to Structured mode
```

Figure 3-7 Mode Conversion Log showing conversion details

| REPORT ITEM                 | DESCRIPTION  |  |
|-----------------------------|--|--|
| <b>Application</b>          | The name of the application being processed.   |  |
| <b>Modification library</b> | The name of the modification library where the converted objects will reside.  |  |
| <b>Create new GDA</b>       | Indicates if a new GDA will be generated. Possible values are:<br><b>Yes</b> A new GDA object will be generated.<br><b>No</b> No new GDA object will be generated.   |  |
| <b>GDA name</b>             | The name of the generated GDA object.<br><i>Note: This will be blank if not using option 'Use new GDA'.</i>  |  |
| <b>Convert objects</b>      | Indicates if any objects have been selected for conversion. Possible values are:<br><b>Yes</b> Objects have been selected for conversion.<br><b>No</b> No objects have been selected for conversion. Only a new GDA object will be generated.<br><i>Note: This situation is only available for the 'Use new GDA' option.</i> |  |
| <b>Object selection</b>     | Indicates the object selection that has been used for the conversion. Possible values are:   |  |
|                             | 'blank' <b>(No Objects)</b>  | No objects have been selected for conversion.  |
|                             | * <b>(All Objects)</b>   | All objects in the application will be converted.  |
|                             | <b>MCONV*</b> <b>(Object Range)</b>  | A range of objects have been selected for conversion. For example all objects prefixed with MCONV will be converted. |
|                             | <b>MCONVP01</b> <b>(Single Object)</b>   | Only one object selected for conversion. For example MCONVP01.   |

| <b>REPORT ITEM</b>  | <b>DESCRIPTION</b>   |
|---------------------|--|
| <b>Object Types</b> | <p>Indicates the object types that have been selected for conversion. Possible values are:</p> <ul style="list-style-type: none"><li>'C' Copycodes</li><li>'H' Help routines</li><li>'P' Programs</li><li>'N' Subprograms</li><li>'S' Subroutines</li></ul>  |
| <b>Details</b>      | <p>A separate entry for each object and/or process action will be displayed here. Example entries:</p> <p><b>GDA COMMON created in MODECNVX</b></p> <p><b>PGM1 converted to Structured mode</b></p> <p><b>SUBPGM1 cannot be converted. SubProgram contains in-line globals</b></p> <p><i>Note: Entries for duplicate Global data definitions and Global data definitions used by subprograms are also displayed. For examples of these refer to section <a href="#">GDA Processing Considerations</a>.</i></p> |



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