THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

Proceedings of the REAPS Technical Symposium

Paper No. 12:
Network Scheduling of Shipyard Production, Engineering, and Material Procurement

U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER
### The National Shipbuilding Research Program Proceedings of the REAPS Technical Symposium Paper No.12 Network Scheduling of Shipyard Production, Engineering, and Material Procurement

**1. REPORT DATE**
SEP 1979

**2. REPORT TYPE**
N/A

**3. DATES COVERED**
-

**4. TITLE AND SUBTITLE**

**5a. CONTRACT NUMBER**
-

**5b. GRANT NUMBER**
-

**5c. PROGRAM ELEMENT NUMBER**
-

**5d. PROJECT NUMBER**
-

**5e. TASK NUMBER**
-

**5f. WORK UNIT NUMBER**
-

**6. AUTHOR(S)**
-

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
Naval Surface Warfare Center CD Code 2230- Design Integration Tools Building 192, Room 138 9500 MacArthur Blvd Bethesda, MD 20817-5000

**8. PERFORMING ORGANIZATION REPORT NUMBER**
-

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**
-

**10. SPONSOR/MONITOR’S ACRONYM(S)**
-

**11. SPONSOR/MONITOR’S REPORT NUMBER(S)**
-

**12. DISTRIBUTION/AVAILABILITY STATEMENT**
Approved for public release, distribution unlimited

**13. SUPPLEMENTARY NOTES**
-

**14. ABSTRACT**
-

**15. SUBJECT TERMS**
-

**16. SECURITY CLASSIFICATION OF:***
<table>
<thead>
<tr>
<th>a. REPORT</th>
<th>b. ABSTRACT</th>
<th>c. THIS PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>unclassified</td>
<td>unclassified</td>
<td>unclassified</td>
</tr>
</tbody>
</table>

**17. LIMITATION OF ABSTRACT**
SAR

**18. NUMBER OF PAGES**
15

**19a. NAME OF RESPONSIBLE PERSON**
-

---

Standard Form 298 (Rev. 8-98)
Prepared by ANSI Std Z39-18
DISCLAIMER

These reports were prepared as an account of government-sponsored work. Neither the United States, nor the United States Navy, nor any person acting on behalf of the United States Navy (A) makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness or usefulness of the information contained in this report/manual, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or (B) assumes any liabilities with respect to the use of or for damages resulting from the use of any information, apparatus, method, or process disclosed in the report. As used in the above, “Persons acting on behalf of the United States Navy” includes any employee, contractor, or subcontractor to the contractor of the United States Navy to the extent that such employee, contractor, or subcontractor to the contractor prepares, handles, or distributes, or provides access to any information pursuant to his employment or contract or subcontract to the contractor with the United States Navy. ANY POSSIBLE IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR PURPOSE ARE SPECIFICALLY DISCLAIMED.
NETWORK SCHEDULING OF SHIPYARD PRODUCTION,
ENGINEERING AND MATERIAL PROCUREMENT

Marc Boucher
Director, Shipyard Planning Services
SPAR Associates Incorporated
Annapolis, Maryland

As Director of Shipyard Planning Services, Mr. Boucher is currently responsible for production planning and control services in shipyards, as well as system development and research. For the past 7 years, he has been involved in assisting various shipyards in the United States and Canada to improve their planning techniques and cost/schedule control systems. SPAR is currently engaged in providing production scheduling services to a number of yards in support of their planning staffs.

Prior to his involvement with SPAR, Mr. Boucher studied business administration and worked in management consulting.
PERT-PAC FEATURES

* Random network node numbering
* Multiple starting/ending, networks
* Sub-network, processing
* Multiple network processing
* Automatic network, loop detection
* Positive or negative activity lead time
* Automatic holiday and/or weekend schedule adjustment
* Automatic work week or shift adjustments
* Various activity sort list options
* Activity schedule bar charts
* Detailed node event schedule reports
* Summary milestone event schedule reports
* Critical activities analysis reports
* Activity cataloguing to work breakdown structure, production work centers, ship zone, and/or steel unit.
PERM-PAC

SPECIAL BENEFITS

* Direct access to WORK-PAC and performance information

* Simultaneous processing of preliminary planning work packages with actual, detailed production work packages

* Automatic re-scheduling of WORK-PAC options

* Automatic network updating; manual progress assessments not required

* Automated in-progress work adjustments

* Automated completed work adjustments

* Automated lead time adjustments

* Management visibility through schedule summary reports

  Milestone Report
  Critical Activity Report

* Schedule variance reporting

  * Automatic comparison of planned versus actual and current projected schedules
  * Total Project Slippage Report

* Automatic impact visibility of change orders and design changes
FIGURE 5
PERT-PAC SLIPPAGE ADJUSTMENTS
SAMPLE 27 ACTIVITY NETWORK

Planned Duration: 13.0 weeks

With 1/2-adjust feature on actual lead time

Without 1/2-adjust feature

Current Projected Duration: 12.4 weeks
## PERT-PAC CRITICAL ACTIVITY ANALYSIS

<table>
<thead>
<tr>
<th>WKS DELAY</th>
<th>STAKT</th>
<th>FINISH</th>
<th>CURRENT</th>
<th>START</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.3</td>
<td>-0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.3</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.3</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.3</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>-0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1</td>
<td>1.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Current Schedule Slippages Have Caused Network to Slip: 0.57 Work Weeks = -2.87 Work Days**

### Total Duration

1/0 1/0 THRU 3/28/0

12.43 Work Weeks = 62.14 Work Days

**Figure 8:** PERT-PAC Critical Activity Analysis
MANPOWER PLANNING & CONTROL

From scheduled work packages, WORK-PAC develops

* Planned manpower
* Actual manpower expended to-date
* Projected manpower using production performance data

Special options include:

* Monthly averaging
* Trade breakdown detail
* Manpower Levelling
* Automatic generation of manhour "S" curve:
  : planned
  : actual
  : projected
FIGURE 5c: Computer Generated (PERT-PAC) Manloading With Desired Manload Levels Superimposed
FIGURE 5d: Computer Generated (PERT-PAC) Levelling Of Manload Within Constraints Of Critical Delivery Schedules
MICRONETS

Pre-developed sub-networks:

* Can be used for any number of projects
* Can be used as often as needed within a given project
* Can be linked to other micronets

Major Benefits:

* Increased Confidence in Network By Production and Management
* Reduced Network Development, Efforts
* Reduced Data Errors
* Reduced Opportunities To Neglect Important Activities

Disciplined & Orderly Network Logic:

* 'Improved Visibility Even With More Detail
* Easier Networks To Modify'

Special Feature

* Automated Activity Numbering
* Automated Node Numbering
* Automated Activity Budget Computations
* Automated Activity Duration Computations
Figure 1: Transfer of micro-net from library to project network
Additional copies of this report can be obtained from the National Shipbuilding Research and Documentation Center:

http://www.nsnet.com/docctr/

Documentation Center  
The University of Michigan  
Transportation Research Institute  
Marine Systems Division  
2901 Baxter Road  
Ann Arbor, MI  48109-2150

Phone: 734-763-2465  
Fax: 734-763-4862  
E-mail: Doc.Center@umich.edu