Continuous improvement: the increased utilization of Main Boss

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TITLE

CONTINUOUS IMPROVEMENT: THE INCREASED UTILIZATION OF MAINBOSS

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SUMMARY

The report gives details into the revisions made to MainBoss and the Preventive as well as Corrective Maintenance work orders. It also goes on to describe the planned increase in the utilization of MainBoss in the form of Work Requests and Corrective Maintenance work orders.

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CONTINUOUS IMPROVEMENT: THE INCREASED UTILIZATION OF MAINBOSS

SR-2006-03

FRED BRADBURY

APRIL 2006

SUMMARY:

The enclosed report is based upon the work term experience gained by the author while employed with the National Research Council of Canada (NRC-CNRC) at the Institute for Ocean Technology (IOT), Memorial campus, St. John's, Newfoundland. It describes the continuous improvement of the computerized maintenance management software, MainBoss version2.9. It also documents the revisions made to the existing preventive and corrective maintenance work order structures as well as the increased utilization of the MainBoss software through the development of the database to contain inventory and vendor information. It also describes the progress of the work request section offered by MainBoss version 2.9.

TABLE OF CONTENTS:

Page

APPENDICES:

ACKNOWLEDGEMENTS:

I would like to take this opportunity to thank Mr. Rod Griffiths, Maintenance Supervisor at IOT, for his assistance in answering any questions I had dealing with preventive and corrective maintenance as well as the operation of the Heating, Ventilating and Air Conditioning (HVAC) systems and the on-site Ammonia plant. I would also like to thank the following for their assistance in revising the preventive maintenance work orders as well as gratuitously answering any questions I asked pertaining to the equipment that they are responsible for:

Refrigeration Operators: Max Mews, Monty Fudge, and Vince Barrington

Millwright: Roger Morgan

Millwright Apprentice: Cordell Mews

Electricians: Otto Byrne and Bernard Lynch.

I would also like to thank Mr. Paul Attwood, Maintenance Manager at IOT, assisting in the selecting of the report topic as well as for reading and approving my report.

1.0 INTRODUCTION

At the Institute for Ocean Technology (IOT), it has always been a goal to produce high quality products and services for clients. This goal has traditionally been applied to the products that are produced for external clients through research and development, but it can also be viewed as an internal goal as well. Facilities Engineering Support & Maintenance (FESM) is one of the departments of IOT that strive to achieve this goal on a daily basis. FESM must ensure that the maintenance services provided to the entire IOT facility are to the best of their abilities. One of the ways that FESM is trying to fulfill expectations is by incorporating continuous improvement into daily operations. Continuous Improvement is the constant effort to eliminate waste, reduce response time, simplify the design of both products and processes, and improve quality and customer service.[1] Two of the key focus areas of this statement are to eliminate waste and simplify processes. Note: Waste is the difference between the way things are now and the way things could be if everything were perfect – no errors, troubles, problems or complexities.[2] Processes are the methods by which a task is completed.

[1] Definition taken from (1).
[2] Definition taken from (2)

2.0 HISTORY

2.1 Initial Development

In May 2005, FESM hired a Coop student, Mr. Fred Bradbury, from the College of the North Atlantic's Mechanical Engineering Technology program[3] to improve on their existing Preventive Maintenance (PM) system by installing and developing the Computerized Maintenance Management Software (CMMS), MainBoss.[4] There initial PM work orders (WO) were Microsoft Word based[5] and their Corrective Maintenance (CM) WO were hand-written[6]. After a 4-month work term, MainBoss was developed enough to generate PM WO when needed, but more training was required in order to develop CM WO from the system.[7] Likewise, the quality of the product produced by MainBoss[8], although superior to the previous WO, was not to the exact requirements of FESM[9]. Then, in August 2005, MainBoss' development was ceased due to the end of the work term contract.

[3] Manufacturing Major
[4] At the present moment, FESM is running version 2.9.
[5] See Appendix C for a detailed description of initial PM WO.
[6] See Appendix A for a detailed description of initial CM WO.
[7] The ability was present but not enough time was spent on the explanation of exacting how to produce them with the proper details attached.
[8] The generated WO.
[9] See Appendix D for a detailed description of the MainBoss generated PM WO (August 2005). Note the extra details on the WO: the "Labour" , "Additional Labour & Material" and "For Office Use Only" headings, the captions: "Meter Reading", "Repair Code", "Down Time", "Charge Back", "Charge To", "Labour" and "Material".

2.2 Developmental Revisions

Also, during the development of MainBoss many revisions were made to the existing WO in order to eliminate waste from the PM system. Many revisions included the deletion of obsolete and/or inaccurate maintenance instructions due to the fact that the associated equipment was either replaced or upgraded, making the related work a waste of employee time. Others included the amalgamation of similar PM WO due to the fact that they were either identical in nature or that they were required to be completed on the same equipment during the same scheduling period.

3.0 IMPROVEMENT OF MAINBOSS WORK ORDERS

3.1 Initial Improvements

In January 2006, Mr. Fred Bradbury was brought back for a second contract to continue with the development of MainBoss. This time the primary goal to begin with was to simplify the appearance of the WO by removing any extra details that FESM management deemed to be unnecessary. Therefore the following headings and captions were removed: the “Labour”, “Additional Labour & Material” and “For Office Use Only” headings, and the captions: “Meter Reading”, “Repair Code”, “Down Time”, “Charge Back”, “Charge To”, “Labour” and “Material”.[10]

[10] See Appendix E for a detailed description of new WO generated by MainBoss and refer to Footnote #9 for comparison to see improvements to WO.

3.2 Further Revisions to Preventive Maintenance Work Orders

After the removal of the unnecessary data, FESM then decided to improve on the clarification of the new WO. Therefore, the headings "Description" and "User Information" was changed to "DESCRIPTION – WORK REQ'D" and "EMPLOYEE SIGN-OFF" respectively. This allowed the maintenance employees to quickly identify pertinent areas applicable to them on the WO.[11] Other revisions to the PM WO included changes in some of the captions, such as: "Actual Start Date of Work" changing to "Date of Work Completed"[12], "Work Start" changing to "Work Issued On"[13], "Work End" changing to "Work Overdue On"[14] and "Cost Centre" changing to "WORK REQUIRED TO BE COMPLETED BY"[15].

[11] See Appendix E for a detailed description.
[12] FESM management decided that it was more important to know the date that the work order was completed rather than when the work actually began.
[13] This was to clarify, for the maintenance employees, the exact date at which the WO was issued.
[14] This was to clarify, for the maintenance employees, the exact date that the WO was overdue.
[15] This was to allow for the Maintenance Supervisor to accommodate for the required versatility of the equipment within IOT. It allowed for the scheduling of PM WO to vary in order to match maintenance work with scheduled down time of important equipment. It also removed the caption "Cost Centre" from the WO, which FESM management deemed unnecessary to be included.

3.3 Additions to Preventive Maintenance Work Orders to Improve Communication

In addition to the above changes, FESM required that the communication between management and personnel be improved upon. This led the way for the addition of the heading "FESM REPORT" as well as the caption "Description of Work Completed/Problems Found".[16] This supplied the maintenance employees with a means of communication that eliminated the need to find members of FESM management in order to explain details of work completed.

[16] See Appendix E for a detailed description.

4.0 FURTHER DEVELOPMENT OF MAINBOSS

4.1 Corrective Maintenance Work Order Generation[17]

Before the decision to generate CM WO from the MainBoss database, all CM WO were hand-written on small 4 inch by 8 ½ inch printed paper. They were comprised of three layers of coloured paper: white for the maintenance employee, yellow for the Maintenance Supervisor to use to track work progress and blue for records. This was a waste of paper as well as storage area and they had to be ordered with the work order template printed on them. Also, if you had to find a completed record to reference work completed; it would be very time consuming. The MainBoss database offered an ideal solution. It could store all completed work in an organized manner and it allowed for the easy retrieval of completed work. It also did not require the use of multiple pieces of paper to complete one task/work order. The MainBoss database printed CM WO with the same format as PM WO and therefore required no pre-printed paper.[18]

[17] Note: All revisions made to the appearance of Preventive Maintenance Work Orders are applied directly to Corrective Maintenance Work Orders. Therefore, there is no need to restate the revisions list.
[18] See Appendix B for a detailed description of Corrective Maintenance work order.

4.1.1 Problem with Generated Corrective Maintenance Work Order

The problem that arouse from creating CM WO from the MainBoss database was that both the CM and PM WO were indistinguishable from each other at first glance and the reader had to be very familiar with them in order to tell them apart. In order to fix this problem and make it easier for the maintenance employees to distinguish between PM and CM WO, FESM decided to use coloured paper enabling easy recognition of both PM and CM WO at a glance. FESM used white paper for their CM WO and blue paper for their PM WO.[19]

4.2 Development of Inventory[20]

There are two types of inventory that has to be considered in the development of MainBoss' inventory. The first is the actual inventory on-hand at the IOT facility and the second is the manufacturer recommended inventory.

[19] See Appendix F for the final revision (to date) of PM WO.
[20] Work-in-Progress, completion date unknown.

4.2.1 Actual Inventory

The calculation of the actual inventory at IOT is a tedious and time-consuming process that involves the actual counting and cataloguing of each spare part within the facility. It also has to take into account the addition and removal of parts based on the employee usage: ordering and part replacement. Then, each item must be input into the MainBoss database.

4.2.2 Manufacturer Recommended Inventory

The calculation of the manufacturer recommended inventory for the IOT facility follows a completely different path than the calculation of the actual inventory in that all the spare parts are referenced from manufacturer's equipment manuals and recommended websites. These recommended spare parts are a list of what the manufacturer expects will fail on the associated equipment and if they are stored on-hand, then equipment down time can be significantly reduced.

4.2.3 Inventory Comparison Advantages

By comparing the actual inventory at IOT to the manufacturer recommended inventory, it is easy to see what spare parts IOT does not have on-hand and therefore, the necessary precautions can be taken to acquire these parts. It is not recommended to have the entire manufacturer recommended inventory on-hand[21]. This would require a large area for inventory storage and it is unnecessary. Ideally, a percentage of the total sum of the recommended spare parts should be keep on-hand.[22]

4.2.4 MainBoss Inventory Advantages

The MainBoss inventory allows for reports to be printed that describe the state of the inventory at the time of printing. This is only feasible if the maintenance staff reports all spare parts usage and only if this reported data is input into MainBoss. Another key aspect is that MainBoss also allows the operator to print a detailed checklist for inventory control that includes the spare parts, their locations, previously stated quantities as well as a input box for tallying the number of parts found. [23]

[21] This refers to the sum of all the spare parts recommended by the manufacturers of all the equipment within IOT.
[22] Approximately 15 - 25% of the total recommended inventory should be sufficient. Note: This should not be less than the number of replacement parts required by any one piece of equipment at any one time.
[23] See Appendix G for a detailed description of the inventory checklist.

4.3 Plan to Initialize Work Requests[24]

FESM management has decided that it is not the right time to open MainBoss to the entire IOT staff. This is to be done when a greater understanding of MainBoss is achieved by FESM itself.

4.3.1 Work Request Development

The Work Request section of MainBoss has been developed to a level where every member of IOT has their contact information within the MainBoss database. This was completed in anticipation of opening the Work Request section of MainBoss.

4.3.2 Work Request Advantages

The Work Request section of MainBoss will increase the level of communication between FESM management and IOT staff. It will eliminate the need to find a member of FESM management in order to explain difficulties with equipment or to request that a required task be completed. This will save IOT staff time and ensure that the required work is completed as quick as possible. Another key aspect of the Work Request section is that it can convert the work request made by IOT staff to FESM directly into CM WO, saving FESM time in maintenance planning also.

[24] Future plans

4.4 Development of Vendors List[25]

The MainBoss Vendors List contains the names, contact information, addresses and comments on products offered for a large number of vendors used by IOT. It uses categories to group vendors offering similar products and/or services together for easy comparison.

4.4.1 Advantages of Vendors List

A) The list allows the operator to easily acquire the contact information of any of FESM's trusted suppliers.

B) It also allows for FESM to acquire numerous price quotes quickly for any particular part or service, without having to search for possible vendors using the phone book or Internet.

C) It holds the contact information of vendors offering specialty products, such as Tanis Inc., a company based in the USA that manufacturers replacement brushes to fit the ice tank and Clearwater tank.

D) If backup properly, contact information will not be lost or misplaced over time.

[25] Work-in-Progress, completion date unknown.

5.0 CONCLUSION

The stated information summarizes the development and continuous improvement of MainBoss over the past 4 months (January 2006 to April 2006) and also shows that there is still more development and improvement that can be expected. The MainBoss database is completed in terms of how far it can be developed in the sense of PM and CM creation, but there is still the opportunity for the continuous improvement of the structure of the WO as well as the scheduling and task information contained within the database.

6.0 RECOMMENDATIONS

1) The continuation of the development of the Vendors List can aid in future purchasing of parts and services.
2) The completion of the MainBoss Inventory can aid in both the finding of parts as well as future inventory checks. It can also be expanded to include the Stores Area in order to assist Calvin in his annual inventory checks as well as ordering.
3) The opening of the Work Request section of MainBoss to IOT staff will ensure the documentation of all IOT maintenance work and enable FESM as well as the maintenance employees to perform their duties more efficiently.

REFERENCES

(1) http://services.eliteral.com/glossary/managerial-accounting-glossary.php

(2) Waste Chasers: A Pocket Companion to Quality and Productivity, page 3

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eLiterial: The Moving Constant, Managerial Accounting Glossary: Continuous Improvement, 2006

URL: http://services.eliteral.com/glossary/managerial-accounting-glossary.php

Conway Management Company

Waste Chasers: A Pocket Companion to Quality and Productivity

Written By: The staff of Conway Management Company

Coordinated By: Lawrence C. Hornor & Curtis King

Edited By: Brock Dethier

ISBN #: 0-9631464-1-6

APPENDIX A:
EXAMPLE OF ORIGINAL CORRECTIVE MAINTENANCE WORK ORDER

1926

ASSET | ACTIVITY | LAB / PROJ | EQUIPMENT | DESCRIPTION

47

I O T MAINT DEPT

WORK ORDER

WORK REQUIRED

ISSUED TO: Mech

ISSUED: DAY 26 MONTH 09 YEAR 05

APPROVED BY: K. Griffith

ISSUED: DAY 26 MONTH 09 YEAR 05

TRADE	ESTIMATE HOURS	ACTUAL HOURS

IF YOU NEED A SCISSOR LIFT, PLEASE RENT ONE OUT. AND IF YOU FIND WE ARE OUT OF TIME, DO THE P.M ON THE DO

Check out the ICE TANK Thermal OVERHEAD DOOR. Apparently the Loops of Cable Are getting ENTANGLED with the Door, when the Door Is being RAISED And tripping the LIMIT Switches before THE Door Is Fully UP.

COMMENTS

Check with Chris For DETAILS.

This MAY HAVE TO BE REPAIRED on Monday 26/9/11 MAINT DEPT.

COMPLETED

DATE | INITIALS

APPENDIX B:
EXAMPLE OF NEW CORRECTIVE MAINTENANCE WORK ORDER

NATIONAL RESEARCH COUNCIL

Open Work Order

NRC·CNRC

* INST FOR OCEAN TECH
ARCTIC AVENUE
P.O. BOX 12093, STATION A
ST. JOHN'S, NL
CANADA A1B 3T5

WO#1369

Mar 16, 2006

ASSET CODE: E000
(ELECTRICAL DISTRIBUTION, GENERAL)

Corrective

TASK: ELECTRICAL DISTRIBUTION, GENERAL - FESM

Location					
Work Start	Feb 27, 2006		Work Days	7	
Work End	Mar 05, 2006		Request Date	Mar 13, 2006	11:11 AM
Model			Serial Number		
Project	MTANCE	FACILITY MAINTENANCE	Requested By	Rod Griffiths	
Access Time	DAY	DAY SHIFT	Phone	(709) 772-7987	
Work Category	ELEC 2	ELECTRICAL REPAIRS	Priority	MODERATE	
Cost Centre	421021	FACILITY ENGINEERING			

DESCRIPTION - WORK REQ'D

PROJECTOR INSTALLATION
Performed by Electrician

WITH THE ASSISTANCE OF A TRADES HELPER, RUN DATA CABLES AND AC ELECTRICAL POWER CABLES TO THE ARCTIC AND PACIFIC ROOM FOR THE INSTALLATION OF PROJECTORS.

ALSO INSTALL MOUNTING BRACKETS IN THOSE ROOMS FOR THE PROJECTORS.

*SEE GILBERT WONG AND LET HIM KNOW THE LENGTH OF THE CABLES REQUIRED SO HE CAN ORDER THEM. WE DON'T HAVE ANY ON HAND.

**SEE ME IF YOU HAVE ANY QUESTIONS.

FESM REPORT

****

DESCRIPTION OF WORK COMPLETED/PROBLEMS FOUND:

EMPLOYEE SIGN-OFF

****

DATE OF WORK COMPLETION _____ SIGNATURE _____

APPENDIX C:
EXAMPLE OF ORIGINAL WORD BASED PREVENTIVE MAINTENANCE WORK ORDER

94-12-01

W.O.NO.	ASSET	PROJ.	DESCRIPTION	
205	S100		Line Model Milling M/C	M-S1

TRADESMAN	WEEK NO.	TRADE	EST HR	ACT HR
_____	_____	Mechanical	8.0	7

APPROVED P. Hammond

REQUIRED Sept 19, 2005

PAGE 1 OF 2

WORK ORDER REFER TO LINE MAINTENANCE MANUAL

1.0 Hydraulic Unit
- a) Check the system equipment and piping for leaks or other anomalies. Clean up and correct any problems.
- b) Check the oil condition. Note the presence of froth (air leaks) or a cloudy appearance(water in the oil).
- c) Check the oil level. If necessary top up to the required level. Use a transfer pump with a 25 micrometer filter. Use Energol HLP 32.
- d) Check and adjust the pressure settings of the pressure switches.
- e) Check the pump and pipe supports. Tighten as necessary.
- f) Clean the unit, especially the top of all dust, dirt and other debris using a vacuum cleaner.

2.0 Slide Ways, Motor Reducer,Gear Box
- a) Lubricate the linear roller bearings and track rollers with ENERGREASE LS-EP2. Refer to attached drawing.
- b) Lubricate the motor reducers with OMALA 68. Refer to attached drawing.
- c) Lubricate the gear boxes with ENERGOL HLP 32. Refer to attached drawings.

3.0 Compressed Air System
- a) Check for leaks in the system.
- b) Check for proper operation of the pressure switch.
- c) Service the filter and lubricator. Check for proper operation of the pressure control valve.
- d) Clean the system.

4.0 Miscellaneous

a) Clean the unit floor, walls and equipment using a vacuum cleaner. NOTE: WEAR A DUST MASK AND EYE PROTECTION WHEN CLEANING UP MILLING DUST ON THE MACHINE.
b) Check for loose piping, hoses and cables. Tighten clamps or holddown bolts as necessary.
c) Clean the teeth in the gears and the rack on the longitudinal drive (x-direction) and on the rack for the A/B axis of the spindle.
d) Clean and coat metal surfaces with a fine film of light machine oil.

COMPLETED

DATE INITIALS

Sept 30 RM

APPENDIX D:
EXAMPLE OF ORIGINAL MAINBOSS ISSUED PREVENTIVE MAINTENANCE WORK ORDER
(Issued at End of Work Term I)

INST OF OCEAN TECH

Open Work Order

NRC·CNRC

IOT INST FOR OCEAN TECH
ARCTIC AVENUE
P.O. BOX 12093, STATION A
ST. JOHN'S, NL
CANADA A1B 3T5

WO#0330

Jan 09, 2006

Equipment	**A050** (THERMAL BARRIER)				**Preventive**
Subject	**General Mechanical Inspection Performed Every 3 Months**				
Location	ICE TANK, EAST END				
Task	MECHANICAL - 3M/A050				
Work Start	Oct 03, 2005		**Work Days**	5	
Work End	Oct 07, 2005		**Request Date**	Jul 18, 2005	10:30 AM
Model	GHW		**Serial Number**		
Project	MTANCE	FACILITY MAINTENANCE	**Requested By**	Rod Griffiths	
Access	DAY	DAY SHIFT	**Phone**	(709) 772-7987	
Work Category	MECH	MECHANICAL	**Priority**	MODERATE	
Cost Centre	421021	PLANT ENGINEERING			

Description

NOTE: PREVIOUSLY WORK ORDER NO. 164

THERMAL BARRIER INSPECTION
Performed By Millwright/Apprentice

ESTIMATED TIME TO COMPLETE = 8 HOURS

NOTE: CALL RENTAL COMPANY TO ARRANGE FOR SCISSOR LIFT.

THERMAL BARRIER (A050)
a) Lubrication
- grease: weight guides.
  COMPLETED (< >)
  : electric operator bearings, manual operation crank.
  COMPLETED (< >)
- oil: cables, roller chains, electric operator, hoist, shoot bolts and pulleys.
  COMPLETED (< >)

Refer to manufacturer's literature for lubrication chart and shop drawings indicating lubrication points.

b) Door Sections
- inspect section guide rollers for operation.
  COMPLETED (< >)
- inspect fail save device, shoot bolts, pulleys and cables (adjust if necessary) cable and chain connections to door sections. Make sure door sections are level.
  COMPLETED (< >)
- inspect all door gaskets for ice build-up.
  COMPLETED (< >)

c) Drive and Idler Assemblies
- inspect cables for frailing, chains for wear, pulleys and sprockets for lubrication. Replace if damaged.
  COMPLETED (< >)
  REPORT REPLACEMENTS _____
- inspect and tighten (if necessary) all set screws and make sure keys are in

NRC·CNRC

IOT INST FOR OCEAN TECH
ARCTIC AVENUE
P.O. BOX 12093, STATION A
ST. JOHN'S, NL
CANADA A1B 3T5

WO#0330

Jan 09, 2006

Equipment A050 Preventive
(THERMAL BARRIER)
Subject General Mechanical Inspection Performed Every 3 Months

Description

COMPLETED (< >)
- adjust tension of chains.
COMPLETED (< >)
- inspect torque limiter, friction discs.
COMPLETED (< >)
- adjust torque (if necessary), check thickness of friction discs, replace if damaged or thickness less than 1/16 inch (1.5 mm).
COMPLETED (< >)
- inspect and adjust (if necessary) manual chain.
COMPLETED (< >)
- inspect cable and chain connections to counter weights, adjust if necessary.
COMPLETED (< >)

Labour

Personnel	Trade	Start Date/Time	Duration	Cost
N/A	MILL/AP	E	8:00	$0.00
		Estimate	8:00	$0.00

Additional Labour and Material

	Personnel / Material	Trade	Start Date/Time / Building/Storeroom Location	Duration / Quantity	Cost
Labour					
Labour					
Material					
Material					

User Information

Date/Time _____ Repair Code _____
Meter Reading _____ Down Time _____
Comment _____
_____
Signature _____

==========For Office Use Only==========

Chg. Back _____ Charge To _____
Labour _____ Material _____

APPENDIX E:
EXAMPLE OF MAINBOSS ISSUED PREVENTIVE MAINTENANCE WORK ORDER
(Initial Improvement Over Work Term I Documents)

NATIONAL RESEARCH COUNCIL

Open Work Order

IOT INSTITUTE FOR OCEAN
ARCTIC AVENUE
P.O. BOX 12093, STATION A
ST. JOHN'S, NL
CANADA A1B 3T5

WO#0052

Jan 10, 2006

ASSET CODE: R730 **Preventive**
(OCEAN ENG. BASIN, HYD. SYSTEM)
TASK: General Mechanical Inspection Performed Every 6 Months

Location	OEB BASEMENT, WEST END, ROOM M 3C				
Task ID	MECHANICAL - 6M/R730				
Work Start	Jun 13, 2005		**Work Days**	5	
Work End	Jun 17, 2005		**Request Date**	May 24, 2005	9:13 AM
Model			**Serial Number**		
Project	MTANCE	FACILITY MAINTENANCE	**Requested By**	Rod Griffiths	
Access Time	DAY	DAY SHIFT	**Phone**	(709) 772-7987	
Work Category	MECH	MECHANICAL	**Priority**	MODERATE	
Cost Centre	421021	FACILITY ENGINEERING			

DESCRIPTION - WORK REQ'D

NOTE: PREVIOUSLY WORK ORDER NO. 203

OCEAN ENGINEERING BASIN, HYDRAULIC SYSTEM INSPECTION
Performed By Millwright/Apprentice

NOTE: TO BE DONE THE THIRD MONDAY OF THE MONTH.

REFER TO THE DAVIS MANUAL VOLUME 3 FOR DETAILED INSTRUCIONS.

BEFORE BEGINNING WORK, ENSURE THAT THE HYDRAULIC POWER SUPPLIES HAVE BEEN LOCKED OUT AND TAGGED AND THAT ANY RESIDUAL ENERGY HAS BEEN RELEASED FROM THE SYSTEM.

1.0 Reservoir
- a) Open, inspect, clean or replace as necessary the pressure line suction strainers.
- b) Obtain an oil sample from each reservoir and send for analysis. Supply the results to the engineer.
- c) Open, inspect, clean or replace as necessary the return line 3 micron strainer.
- d) Open, inspect, clean or replace as necessary the reservoir air filter.
- e) Replace all high pressure filter elements.
- f) Replace the cooling loop filter element.

2.0 Actuator Service Manifold
- a) Replace all filter elements on the pressure side.

FESM REPORT

DESCRIPTION OF WORK COMPLETED/PROBLEMS FOUND:

_____
_____
_____
_____

EMPLOYEE SIGN-OFF

ACTUAL START DATE OF WORK _____ METER READING _____

APPENDIX F:
EXAMPLE OF IMPROVED MAINBOSS ISSUED PREVENTIVE MAINTENANCE WORK ORDER
(Issued at End of Work Term II – Final Revision to Date)

NATIONAL RESEARCH COUNCIL

Open Work Order

NRC·CNRC

INST FOR OCEAN TECH
ARCTIC AVENUE
P.O. BOX 12093, STATION A
ST. JOHN'S, NL
CANADA A1B 3T5

WO#1457

Apr 11, 2006

ASSET CODE: R200 (CWT WAVEMAKER) — **Preventive**

TASK: General Inspect Performed By Electrician - (Monthly)

Location	CLEAR WATER TANK, WEST END				
Task ID	ELECTRICAL - M/R200				
Work Issued On:	Apr 01, 2006		**Work Days**	30	
Work Overdue On:	Apr 30, 2006		**Request Date**	Mar 23, 2006	9:04 AM
Make	MTS				
Model			**Serial Number**		
Project	MTANCE	FACILITY MAINTENANCE	**Requested By**	Rod Griffiths	
Access Time	DAY	DAY SHIFT	**Phone**	(709) 772-7987	
Work Category	ELEC	ELECTRICAL	**Priority**	MODERATE	

WORK REQUIRED TO BE COMPLETED BY: _____

DESCRIPTION - WORK REQ'D

****

NOTE: PREVIOUSLY WORK ORDER NO. 334

CWT WAVEMAKER INSPECTION
Performed By Electrician

ESTIMATED TIME TO COMPLETE = 3 HOURS

1.0 CONTROL SYSTEM
 a) Clean electronic console filters and the control room general area.
 COMPLETED (< >)
 b) Check charge on standby batteries.
 COMPLETED (< >)
2.0 WAVEBOARD INSTRUMENTATION
 a) Check waveboard instrumentation including the ADT, LVDT, Diff. Pressure Transducer, Accelerometer for any damage. Check that the connections are tight, there is no water impinging on the unit and there is no corrosion. Check inside the connector where possible for loose wires, condensation or corrosion. Correct any problems.
 COMPLETED (< >)
 b) Check the wiring between the instrumentation and control panel for continuity. Note and correct any problems.
 COMPLETED (< >)
 REPORT _____

FESM REPORT

****

DESCRIPTION OF WORK COMPLETED/PROBLEMS FOUND:

_____
_____
_____
_____

EMPLOYEE SIGN-OFF

****

DATE OF WORK COMPLETION _____ SIGNATURE _____

APPENDIX G:
EXAMPLE OF THE MAINBOSS INVENTORY CHECKLIST

Report Inventory Status

For Inventory Categories B02 only, inventoried items only

Building/Storeroom BLDG 03/SOUTH BUILDING [STORAGE 3B/NORTH MEZZANINE, ICE TANK BSMT]

Location Norht Mezz., IT Bsmt

Item	Inventory Category	UOM	On Hand	
B1400 DEMAG BEARING - 6006Z	B02	EA	1	

Location North Mezz., IT Bsmt

Item	Inventory Category	UOM	On Hand	
B1051 STEYR BEARINGS - 320 05 CX 28	B02	EA	1	
B1201 SKF BEARINGS - 7210 BEP	B02	EA	1	
B1202 SKF BEARINGS - 7310 BEP	B02	EA	2	
B1203 SKF BEARINGS - 32211 J2	B02	EA	1	
B1204 SKF BEARINGS - 6309/C3	B02	EA	1	
B1205 SKF BEARING UNIT- YAR-206-103-2F, SY 1 3/16 TF	B02	EA	3	
B1206 SKF BEARINGS - YAR-207-107-2F	B02	EA	1	
B1207 SKF BEARING UNIT- YET-204-012, SY 3/4 FM	B02	EA	2	
B1300 NSK BEARING 696ZZ1MC3E NS7L5 FOR CABINET FANS-CWTC	B02	EA	8	
B1500 FAG BEARING - 6210	B02	EA	2	
B1501 FAG BEARING - 6310.C3	B02	EA	1	
B1502 FAG BEARING UNIT - SG 56206.103	B02	EA	2	
B1600 ZKL BEARING - 6310A-2RS	B02	EA	1	
B1700	B02	EA		