



La Science à l'œuvre pour le  
at work for Canada

## NRC Publications Archive Archives des publications du CNRC

### **CWTT Wave Prove Arm, 2006** Osmond, T.

For the publisher's version, please access the DOI link below./ Pour consulter la version de l'éditeur, utilisez le lien DOI ci-dessous.

<http://dx.doi.org/10.4224/8895628>

### **NRC Publications Record / Notice d'Archives des publications de CNRC:**

<http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/ctrl?action=rtdoc&an=8895628&lang=en>

<http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/ctrl?action=rtdoc&an=8895628&lang=fr>

Access and use of this website and the material on it are subject to the Terms and Conditions set forth at

[http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/jsp/nparc\\_cp.jsp?lang=en](http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/jsp/nparc_cp.jsp?lang=en)

READ THESE TERMS AND CONDITIONS CAREFULLY BEFORE USING THIS WEBSITE.

L'accès à ce site Web et l'utilisation de son contenu sont assujettis aux conditions présentées dans le site

[http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/jsp/nparc\\_cp.jsp?lang=fr](http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/jsp/nparc_cp.jsp?lang=fr)

LISEZ CES CONDITIONS ATTENTIVEMENT AVANT D'UTILISER CE SITE WEB.

Contact us / Contactez nous: [nparc.cisti@nrc-cnrc.gc.ca](mailto:nparc.cisti@nrc-cnrc.gc.ca).



National Research  
Council Canada

Conseil national  
de recherches Canada

Canada

## DOCUMENTATION PAGE

<b>REPORT NUMBER</b> SR-2006-02	<b>NRC REPORT NUMBER</b>	<b>DATE</b> April 2006		
<b>REPORT SECURITY CLASSIFICATION</b> unclassified		<b>DISTRIBUTION</b> unlimited		
<b>TITLE</b> <b>CWTT Wave Probe Arm, 2006</b>				
<b>AUTHOR(S)</b> T. Osmond				
<b>CORPORATE AUTHOR(S)/PERFORMING AGENCY(S)</b> National Research Council				
<b>PUBLICATION</b>				
<b>SPONSORING AGENCY(S)</b>				
<b>IOT PROJECT NUMBER</b> 421009		<b>NRC FILE NUMBER</b>		
<b>KEY WORDS</b> Wave Probe Arm		<b>PAGES</b> 4	<b>FIGS.</b> 0	<b>TABLES</b> 0
<b>SUMMARY</b> A new wave probe arm has been designed for the clear water tow tank as of 2006. This arm is much smaller and lighter than the currently existing wave arm. It is intended for low load applications. This document contains the details of this design.				
<b>ADDRESS</b>	National Research Council Institute for Ocean Technology Arctic Avenue, P. O. Box 12093 St. John's, NL A1B 3T5 Tel.: (709) 772-5185, Fax: (709) 772-2462			



National Research Council  
Canada

Conseil national de recherches  
Canada

Institute for Ocean  
Technology

Institut des technologies  
océaniques

## **CWTT Wave Probe Arm, 2006**

SR-2006-02

T. Osmond

April 2006

## Introduction

January, 2006 – the Institute for Ocean Technology has established a need for a folding arm that extends almost half way across the clear water tow tank at full deployment. The arm is intended to be used to attach wave probes. The arm is to be a lighter more practical arm than the one currently employed in the tank. It is to operate in conjunction with the currently existing, much larger arm and is not intended to serve as a replacement. Howard Mesh established the necessity for this arm and its design has been the responsibility of the coop student within the Design and Fabrication Group working under Tony Randell. The design of the new wave probe arm was undertaken during the last three weeks in January, 2006. The arm is a basic aluminum frame hinged from a Stainless Steel bracket, anchored to the cement wall of the Clear Water Tow Tank. Fully deployed the arm extends away from the tank wall at a 90 degree angle. The arm can be locked both fully deployed and folded against the tank wall. An additional support piece has also been designed. Its purpose is to brace the arm against sway should it be a problem. The fabrication of this support piece is subject to its necessity pending testing of the arm. There were two phases to the design of this piece of equipment. The first phase led up to the design review meeting. Following the design meeting the wave probe arm was extensively redesigned to accommodate many new requests and suggestions posed by the group attending the design review meeting. The following report presents the factors of consideration and the features that were implemented into the design of both the wave probe arm and the supporting piece. Full CAD design is available under CAD\_User:\Projects\421009\_cwt\ProbeArm\ProbeArm.ckd.

## Shape

The total length of the wave probe arm is 175 inches from the wall of the tank to the tip of the arm at full deployment. This length includes the added distance of the bracket. The arm is almost 14 inches in height with two inches of width. Two parallel lengths of aluminum box tube are cross braced and supported by three 10 inch long, aluminum box tube supports and two aluminum gusset plates. The

purpose of the supports is to provide structural integrity and to reduce bending in the arm from externally applied loads and under its own weight. The lower length of box tube extends 50 inches beyond the upper as less support is necessary near the end of the arm. The arm is bolted to a stainless steel bracket that was previously fabricated. The bracket is to be modified to suit the purposes of the wave probe arm application. Modifications include two thick stainless steel plates welded to the upper and lower surfaces of the bracket and machined to be parallel with each other. This is necessary because the surfaces of the currently existing bracket are not parallel due to welding deflections during fabrication. Aluminum bushings and screws are used as the axis of rotation for the arm.

### Strength

The strength demands on the design of the wave probe arm are minimal. The weight of the wave probes are merely a few grams therefore the arm must be capable of sustaining very little beyond its own weight. For this reason the arm is designed of only 2 x 2 x 0.188 inch aluminum box tubing. The material is light, corrosion resistance and rigid. By separating the top and bottom lengths of tube a distance of approximately 10 inches the moment of inertia is elevated around the bending axes. This reduces deflection caused by loading of the arm should any loading be necessary in future applications. The box tube and gusset supported design also provide considerable rigidity in torsion and sway and will prevent the arm from folding in or collapsing under increased bending stress.

### Support Component

A supporting component has been designed to brace the wave probe arm against sway. It has not yet been determined whether this component is necessary. Should it be found that there is a flexing in the wave probe arm that interferes with the readings of the wave probes, the supporting component will be fabricated. The supporting component is more complicated in design than the wave probe arm itself. The base plate and joint attachment are made of stainless steel and bolts are used to attach the two together. The height of the

joint attachment is designed to be adjustable  $\pm$  one inch because the exact positioning of the plate through drilling the cement anchors cannot be set accurately. Attached to the joint is a long aluminum hollow rod. An optional cable can be attached to prevent the rod from bending if it is to be left unsupported for extended periods of time. At the end of the rod a threaded bushing is welded and set. A threaded rod is screwed into the bushing and screwed into an aluminum bottle screw at the other end. A rod end screws into the bottle screw and loops over a hook that is welded to the wave probe arm. When the bottle screw is turned it tightens and holds the arm in place.

### Features

As previously mentioned the lower length of the probe arm extends 50 inches beyond the main frame. It is to this section of the arm that the wave probes are intended to be attached. To do this a thin piece of flat bar is welded to the front surface of the arm so that the probes may clip on.

When deployed at full 90 degrees the arm is capable of locking in place. A  $\frac{1}{4}$  inch screw feeds through a hole in the arm near the bracket and screws into the bracket. Tightening this screw down will lock the arm in position. This however may provide little support for the arm against sway so a supporting component has been designed to account for this and is described above. When the arm is folded against the tank wall the bolt may again be tightened down to hold the arm in position.

The entire assembly has been designed to be corrosion resistant because the assembly will be fixed just above the water level in the Clear Water Tank where humidity will be very high. Most of the load bearing components are composed of stainless steel including the bracket, the wall plate for the supporting component and all of the bolts, buckles and anchors. The frame of the arm, the supporting arm and the bushings are made of aluminum and the tie rod end is

made of plastic. No lubrication should be needed for this design because of low loads and no wear applications.

Due to the low demands on the wave probe arm there are few complicated components. No bearings or lubricated components have been incorporated into the design. The arm is a lightweight, low load piece of equipment designed specifically for wave probes however may be used for other low load purposes. The loading limit for the wave probe arm will depend on the acceptable deflection for the application but the arm should not be loaded with any more than 20 lbs at the very tip of the arm.

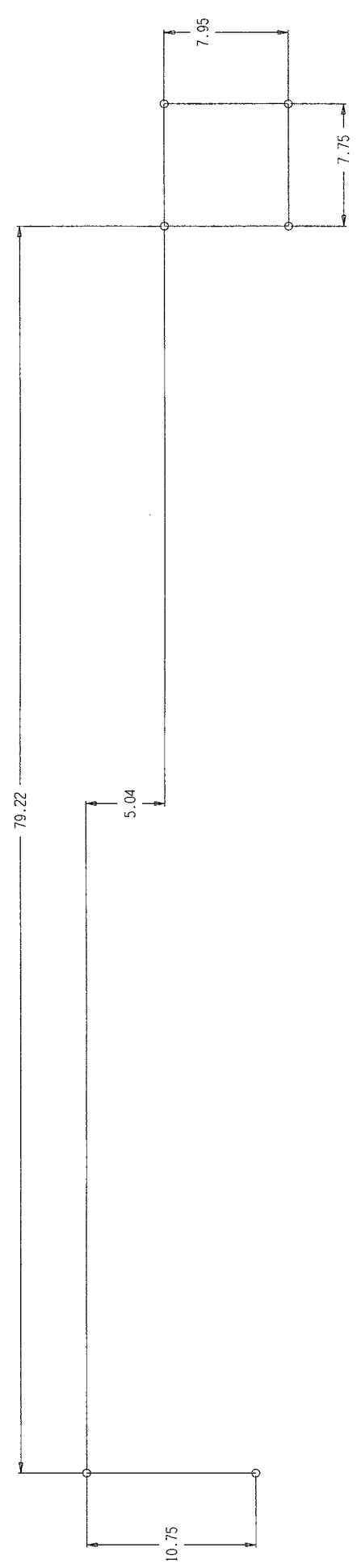
## **Drawings**



THE INFORMATION CONTAINED HEREIN IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE NATIONAL RESEARCH COUNCIL OF CANADA.

NO.	DATE	REVISIONS	BY	APPROVED

Notes:  
 Wooden template to be fabricated  
 Source File:  
 CAD\_User\Projects\421009\_cad\Problem\009701



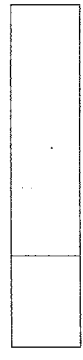
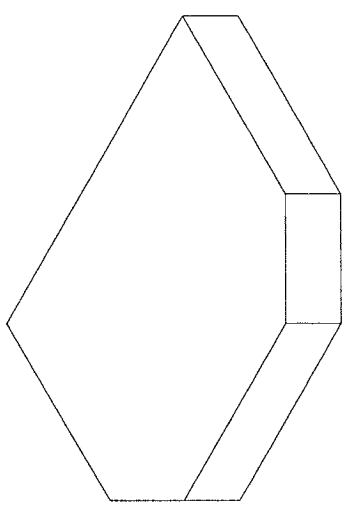
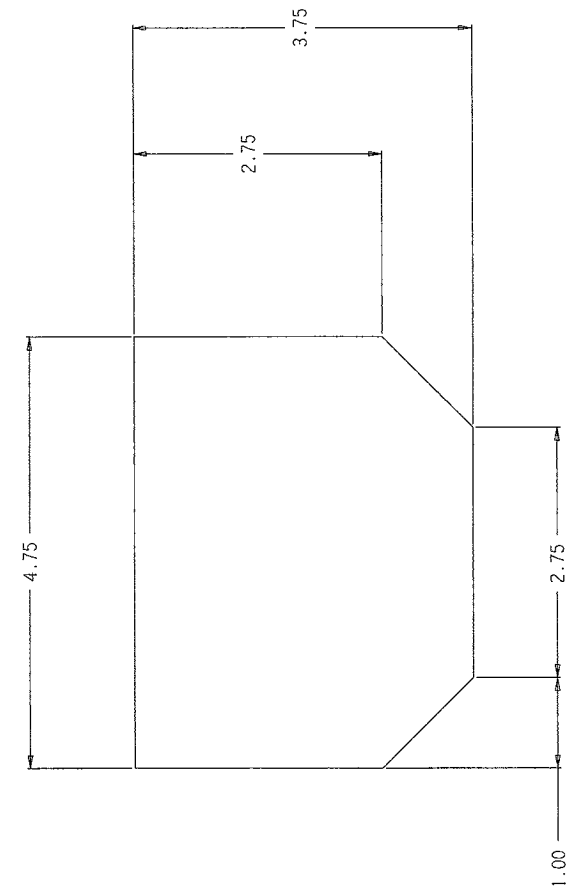
 National Research Council of Canada Institut national de recherches Canada	Material N/A Heat Treat N/A Finish N/A	TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction < 8 inch 1/16 > 8 inch 1/32	DRINKING WATER <input checked="" type="checkbox"/> MILLIPIES <input type="checkbox"/>  ROUND HOLE	TITLE 009 DRAWN I. Dismond APPROVED Blankity	PART A3 NUMBER 009701	DATE 2006-Jun-25	SHEET 1 of 1

NO.	DATE	REVISIONS

THE INFORMATION CONTAINED ON THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF THE NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE KEPT IN CONFIDENTIALITY AND IS NOT TO BE DISCLOSED TO ANY OTHER PERSON OR ORGANIZATION WITHOUT THE WRITTEN PERMISSION OF THE NATIONAL RESEARCH COUNCIL OF CANADA.

**Notes:**

- Deburr -- Remove All Sharp Edges
- Source File
- CAD\_User\Projects\421009\_cwr\ProbeArm\009T02

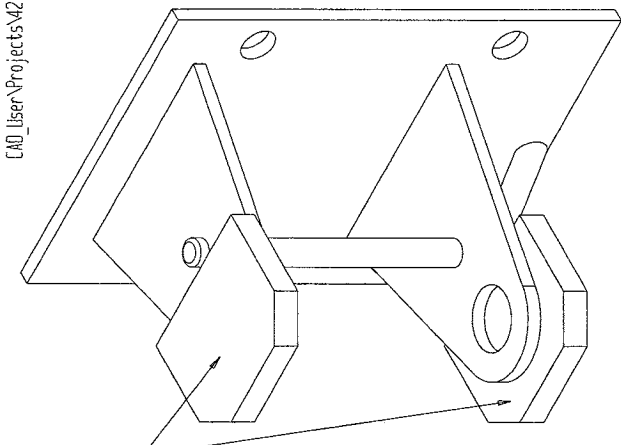
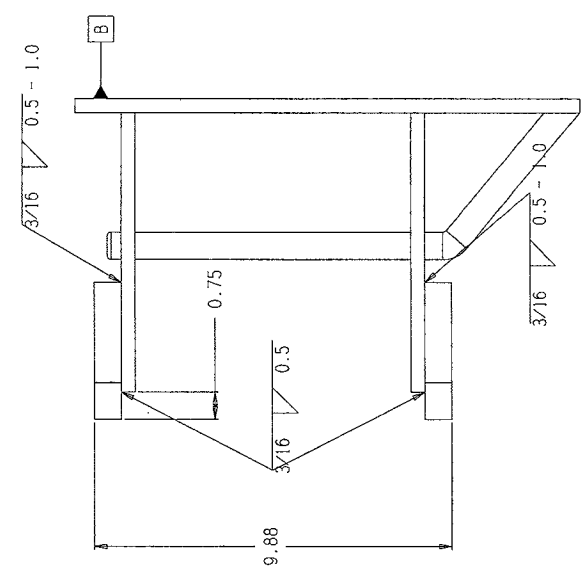
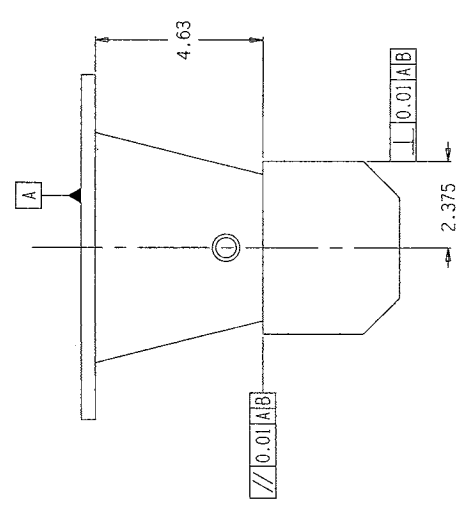


	National Research Council Canada Conseil national de recherches Canada	
	Institute for Marine Dynamics Kerwin Place, P.O. Box 120833, Postal Station A St. John's, Newfoundland A1B 3T5	
<b>TOLERANCES</b> (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication < 8 inch <math>\pm .04</math> > 8 inch <math>\pm .02</math>	Material SS Heat treatment N/A FINISH <input checked="" type="checkbox"/> POLISHED BY HAND <input type="checkbox"/> MILLFINISH <input type="checkbox"/>	TITLE 009 Hinge Fitting DRAWN I. Usmond APPROVED Quantity 2 PART NUMBER A3 009T02 SCALE 1:1.43 DATE 2006-Jun-25 SHEET 1 of 1

THE ORIGINAL AND ALL RIGHTS RESERVED BY THE ORIGINAL DESIGNER OR HIS SUCCESSORS. ANY REPRODUCTION OR TRANSMISSION OF THIS DRAWING WITHOUT THE WRITTEN PERMISSION OF THE ORIGINAL DESIGNER IS STRICTLY PROHIBITED. ANY REPRODUCTION OF THIS DRAWING FOR ANY PURPOSE IS SUBJECT TO THE ORIGINAL DESIGNER'S PERMISSION.

NO.	DATE	REVISION	APPROVED

Notes:  
 Deburr - Remove All Sharp Edges  
 Source File  
 CAD\_User\Projects\421009\_cwt\Probekrm\009103



 National Research Council Canada	Conseil national de recherches Canada <b>NRCC-CNRC</b> Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5	TITLE <b>009</b>	PART <b>A3</b>	NUMBER <b>009103</b>
		DRAWN <b>I. Desmond</b>	QUANTITY <b>1</b>	SCALE <b>1 : 3</b>
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction 6/16 inch +/- 1/64 3/16 inch +/- 1/32		FINISH <input checked="" type="checkbox"/> NECK <input checked="" type="checkbox"/> HULL/POSTS <input type="checkbox"/> APPROVED	MATERIAL SS Heat Treatment None	REFERENCE 

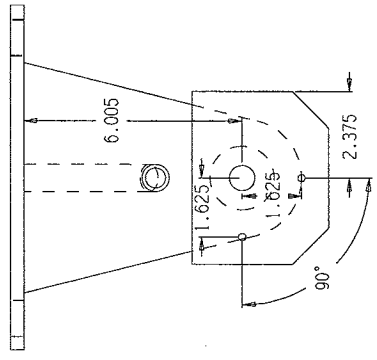
THE INFORMATION CONTAINED IN THIS DRAWING IS THE PROPERTY OF NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE USED ONLY FOR THE SPECIFIC PROJECT AND FOR THE SPECIFIC CLIENT FOR WHICH IT WAS PREPARED. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE EXPRESS WRITTEN PERMISSION OF NATIONAL RESEARCH COUNCIL OF CANADA. THIS DRAWING IS THE PROPERTY OF NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE USED ONLY FOR THE SPECIFIC PROJECT AND FOR THE SPECIFIC CLIENT FOR WHICH IT WAS PREPARED. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE EXPRESS WRITTEN PERMISSION OF NATIONAL RESEARCH COUNCIL OF CANADA.

REV	DATE	DESCRIPTION	BY/ISSUED

**Notes:**

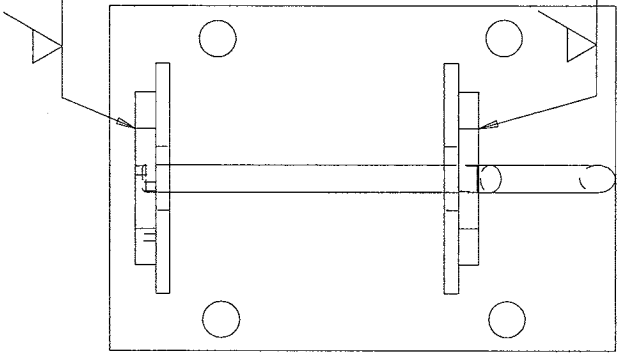
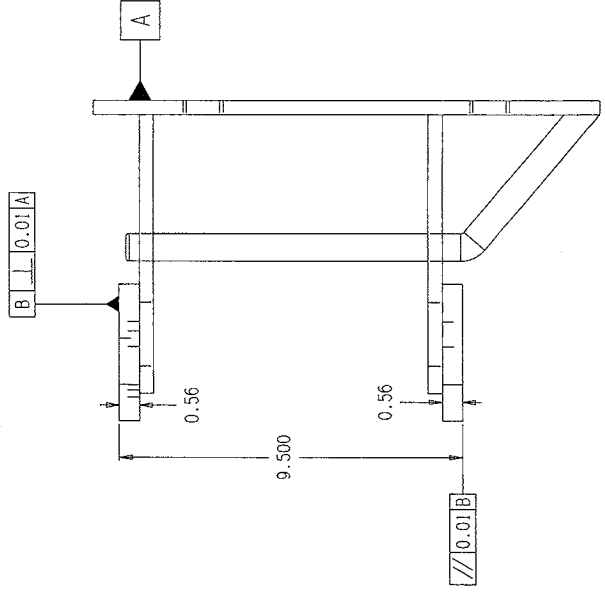
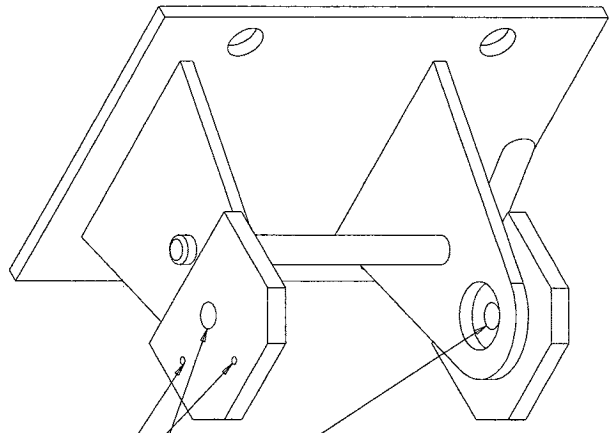
Deburr - Remove All Sharp Edges

Source File  
 CAD\_User\Projects\421009\_cwt\Prob\Arm\009104



Ø 1/4-20 UNC-2B  $\nabla$  0.56

Ø 3/4-10 UNC-2B THRU



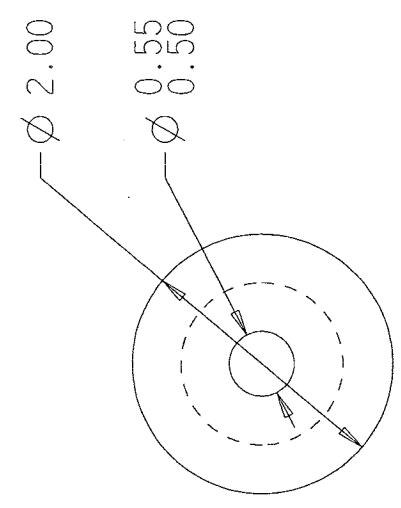
 National Research Council Canada Conseil national de recherches Canada	TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction 1/16 inch 1/8 3/8 inch 1/4 1/2	Material SS Heat Treatment None FINISH SPECIFICATIONS IN INCHES <input checked="" type="checkbox"/> MILLIMETERS <input type="checkbox"/>	TITLE 009 DRAWN BY T. Esmond APPROVED 	QUANTITY 1	PART NO. 009104	DATE 2006-Jun-25	SHEET 1 of 1

**NRC-CARC**  
 National Research Council Canada  
 Conseil national de recherches Canada  
 Institute for Marine Dynamics  
 Kerwin Place, P.O. Box 12093, Postal Station A  
 St. John's, Newfoundland A1B 3T5

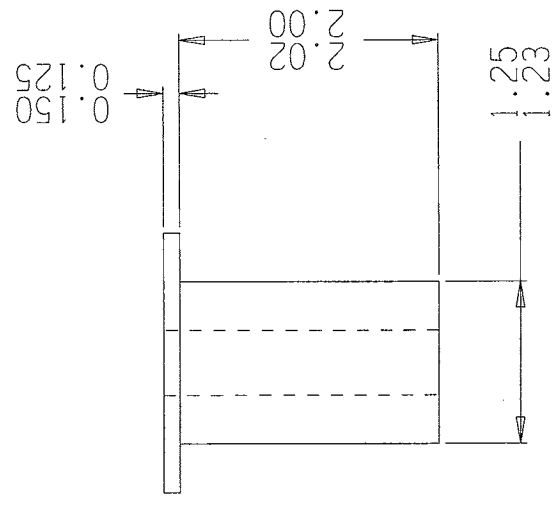
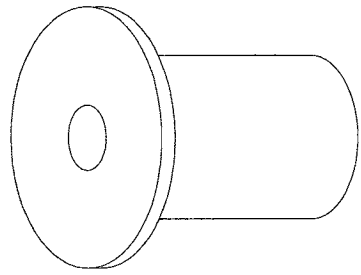
THE INFORMATION CONTAINED IN THIS RECORD IS CONFIDENTIAL AND IS NOT TO BE DISCLOSED TO ANY OTHER PERSON OR ORGANIZATION WITHOUT THE WRITTEN AUTHORIZATION OF THE NATIONAL RESEARCH COUNCIL OF CANADA AND IS SUBJECT TO REVISIONS IN DESIGN.

REVISIONS

NO.	DATE	DESCRIPTION	APPROVED



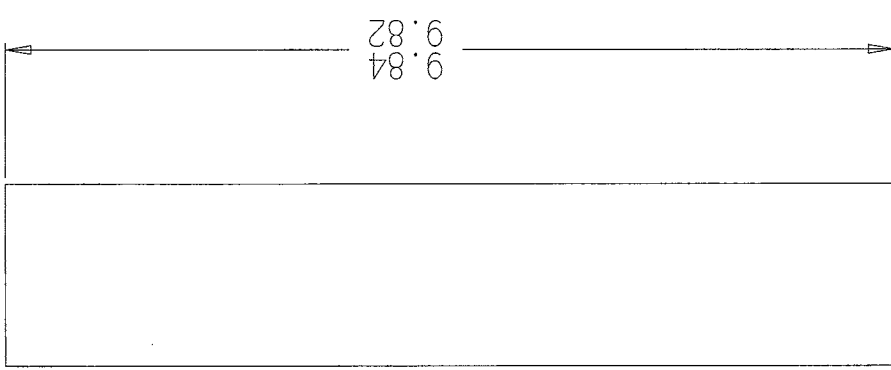
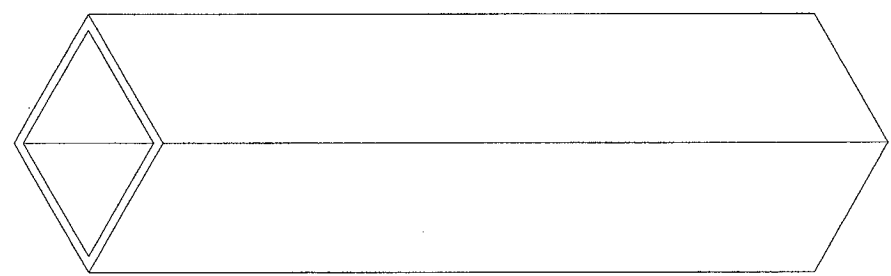
Notes:  
 Deburr - Remove All Sharp Edges  
 Source File  
 CAD\_User\Projects\421009\_cvt\ProbArm\009T05



 National Research Council Canada Conseil national de recherches Canada	Material AI 6061-T6	FINISH <input checked="" type="checkbox"/> POLISHED <input type="checkbox"/> HOLLOW POLISHED <input type="checkbox"/> HOLLOW ANGLE	TITLE 009 Bushing 1	PART NUMBER A3 009T05	SCALE 1:1	DATE 2005-Jun-25	SHEET 1 of 1
		TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction < 8 inch < 1/8	APPROVED T. Desmond	QUANTITY 2	INSTITUTE FOR MARINE DYNAMICS Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5	INSTITUTE FOR MARINE DYNAMICS Conseil national de recherches Canada	INSTITUTE FOR MARINE DYNAMICS Conseil national de recherches Canada

THE INFORMATION CONTAINED IN THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF THE NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE KEPT SECRET AND NOT TO BE DISCLOSED TO ANY OTHER PERSON OR ORGANIZATION WITHOUT THE WRITTEN PERMISSION OF THE NATIONAL RESEARCH COUNCIL OF CANADA AND IT IS SUBJECT TO REVISIONS.

Notes:  
 2x2x0.120  
 Round Corners  
 Deburr - Remove All Sharp Edges  
 Source File  
 CAD\_User\Projects\421009\_cmt\ProbetArm\009T06



NO.	LINE	REVISION	REASON	DATE	APPROVED

National Research Council of Canada Conseil national de recherches Canada <b>NRCC-CNRC</b>	Material <b>Al 6016-T6</b> Square Tubing	FINISH NONE	TITLE <b>009</b>	PART NUMBER <b>A3</b>	DATE 2006-Jun-25
		OPERATING INSTRUCTIONS <input checked="" type="checkbox"/> INSTRUCTIONS <input type="checkbox"/> TOLERANCES <input type="checkbox"/> THIRD ANGLE	DRAWN <b>I. Usmond</b>	APPROVED <b>Barbity 2</b>	SCALE <b>1:1.43</b>
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction > 8 inch +/- 1/32		Institute for Marine Dynamics Kerwin Place, P.O. Box 12083, Postal Station A St. John's, Newfoundland A1B 3T5			
INSTITUTION <b>Supports</b>		PROJECT NUMBER <b>009T06</b>			

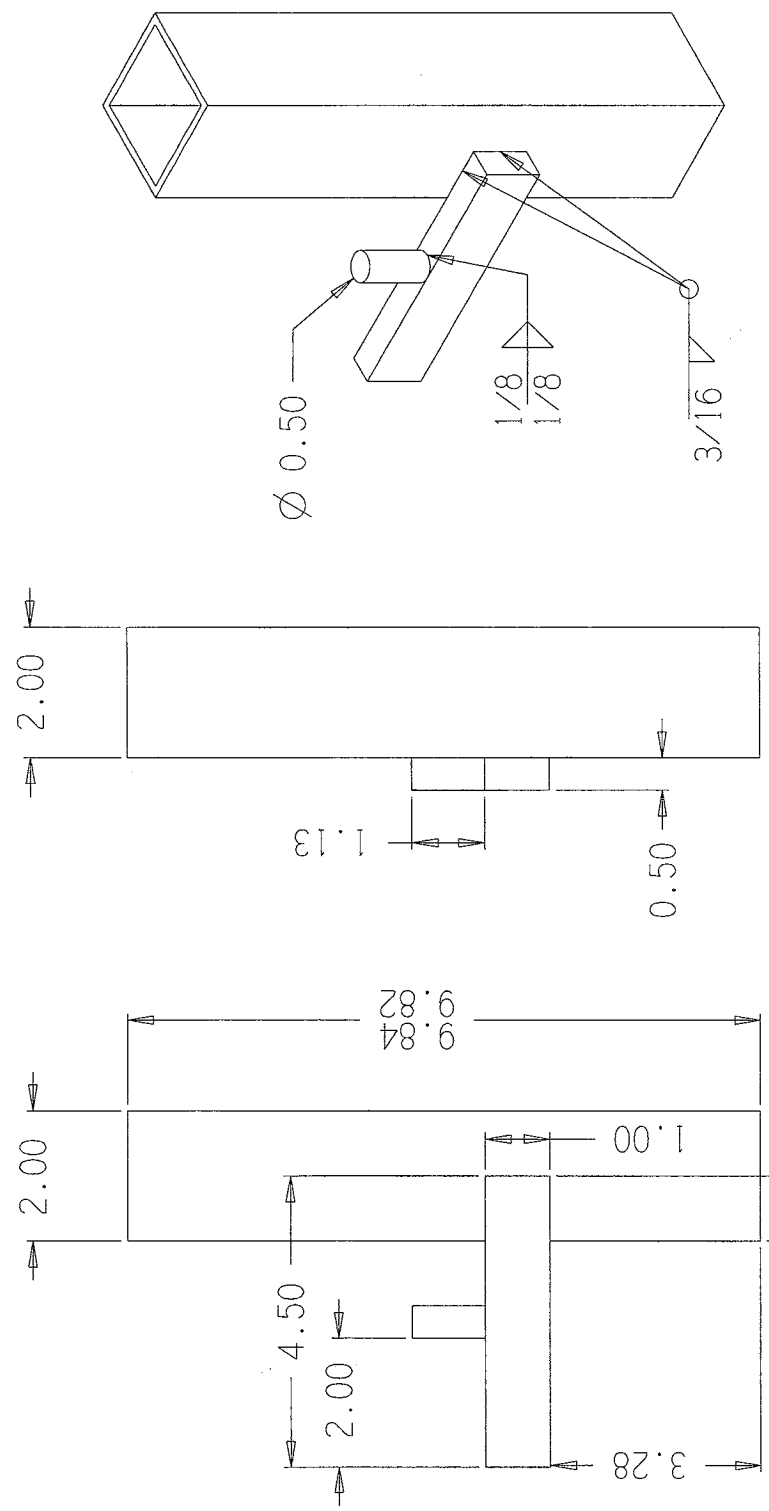
NO.	DATE	REVISIONS	REVISIONS	DATE	APPROVED

Notes:

- Main Support:
- Square Tubing
- 2x2x0.120
- Round Corners
- Deburr - Remove All Sharp Edges

Source File  
 CAD\_User\Projects\421009\_cvt\Probekm\009107

THIS DRAWING IS THE PROPERTY OF THE NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE USED ONLY FOR THE PROJECT AND FOR THE PURPOSES SPECIFIED THEREIN. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE NATIONAL RESEARCH COUNCIL OF CANADA. IF IT IS USED FOR ANY OTHER PURPOSE, THE USER ASSUMES ALL LIABILITY FOR ANY DAMAGE OR INJURY TO PERSONS OR PROPERTY, OF WHATEVER NATURE, ARISING IN CONNECTION WITH SUCH USE.

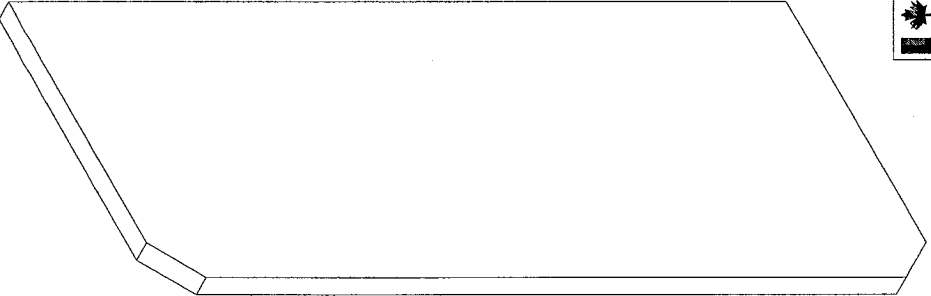


 National Research Council Canada	Conseil national de recherches Canada <b>NRCC-CNRC</b>
	Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5
Material AI 6061-T6	PART 009
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction 65 High 1/158 3.5 High 1/128	FINISH OPERATIONS IN: <input checked="" type="checkbox"/> ANNEAL <input type="checkbox"/> MILLING <input type="checkbox"/> DRILLING <input type="checkbox"/>
Quantity 1	DRAWN I. D'Smond APPROVED DATE 2006-Jun-25
Material AI 6061-T6	PART 009
FINISH OPERATIONS IN: <input checked="" type="checkbox"/> ANNEAL <input type="checkbox"/> MILLING <input type="checkbox"/> DRILLING <input type="checkbox"/>	DRAWN I. D'Smond APPROVED DATE 2006-Jun-25
Quantity 1	DRAWN I. D'Smond APPROVED DATE 2006-Jun-25

0 1 2 3 4 5 6 7 8

0 1 2 3 4 5 6 7 8

THE INFORMATION CONTAINED IN THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE USED ONLY FOR THE PURPOSES SPECIFICALLY AUTHORIZED BY WRITING FROM THE NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE RETURNED TO THE NATIONAL RESEARCH COUNCIL OF CANADA UPON REQUEST.



Notes:  
 Deburr - Remove All Sharp Edges

Source File  
 CAD\_User\Projects\421009\_cwt\Probekrm\009T08

REV.	DATE	DESCRIPTION	BY	CHKD.

National Research Council Canada Conseil national de recherches Canada		MTC-CATC	
Material AI 6061-T6 0.25" thickness		Institute for Marine Dynamics Kerwin Place, P.O. Box 12083, Postal Station A St. John's, Newfoundland A1B 3T5	
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction < 8 inch 1/16 > 8 inch 1/32	FINISH CHECKING IN: <input checked="" type="checkbox"/> HOLE <input type="checkbox"/> HULL/KOPF	TITLE Gusset	NUMBER 009T08
QUANTITY 2	DRAWN I. Desmond	DATE 2005-Jun-25	SHEET 1 of 1

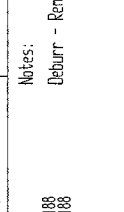
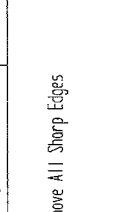


NO.	DATE	DESCRIPTION	REVISION

WE HEREBY CERTIFY THAT THE DIMENSIONS, MATERIALS, AND FINISHES SPECIFIED IN THIS DRAWING ARE IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT AND THE PROJECT OF THE CLIENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE NECESSARY PERMITS AND APPROVALS FROM THE APPROPRIATE AUTHORITIES.

Notes:  
 Deburr - Remove All Sharp Edges

Materials Needed:  
 1 x 170.0" length Al Square Tubing (Round Corners) - 2 x 2 x 0.188  
 1 x 124.0" length Al Square Tubing (Square Corners) - 2 x 2 x 0.188  
 1 x 30.0" length Al Flat Bar - 1/4 x 2.5



Hole to be drilled through both bars  
 $\varnothing$  1.27  
 1.25  
 7.00  
 5.38

Source File  
 CAD\_User\Projects\421009\_cvt\Problem\009109

	National Research Council Canada		Conseil national de recherches Canada
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- 5 deg. Fabrication +/- .04 Fraction 68 inch 1/4 1/8 38 inch 1/4 1/2		Material Al 6016-T6 FINISH DIMENSIONS IN INCHES <input checked="" type="checkbox"/> DECIMALS <input type="checkbox"/> FRACTIONS THRU HOLE <input checked="" type="checkbox"/> HOLE <input type="checkbox"/> REAMER QUANTITY 009 DRAWN T. Dismond APPROVED 009109 DATE 1: 12.5 DATE 2005-JUN-25 SHEET 1 OF 1	

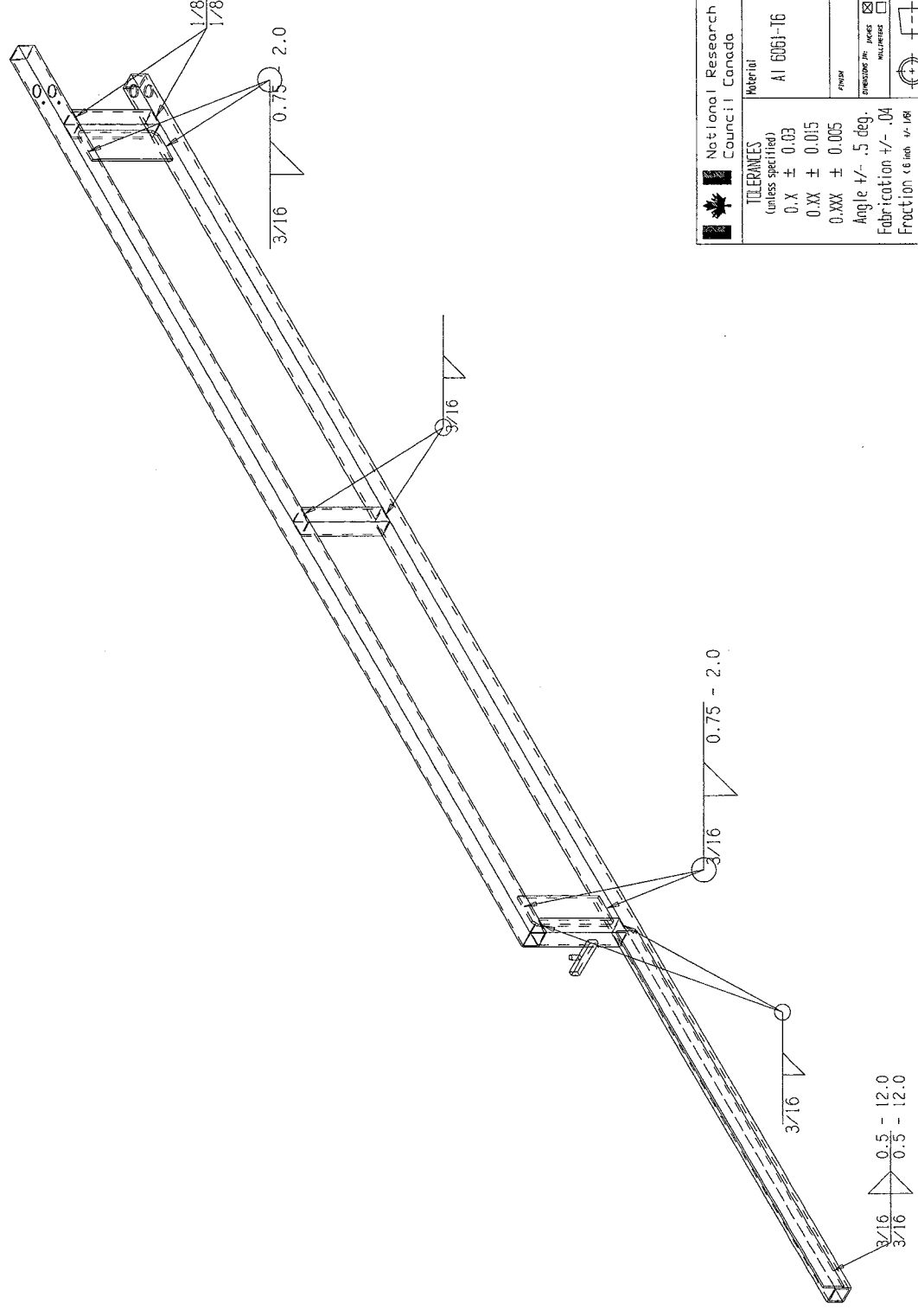
THE INFORMATION CONTAINED IN THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF NATIONAL RESEARCH COUNCIL OF CANADA. IT IS LOANED TO YOU BY THE NATIONAL RESEARCH COUNCIL OF CANADA AND IS SUBJECT TO RETURN TO ORIGINAL SOURCE.

Notes:

Deburr - Remove All Sharp Edges

Source File

CAD\_User\Projects\421009\_cvt\ProbArm\009T10



1 2 3 4 5 6 7 8

NO	DATE	REVISION	REVISION	DATE	APPROVED

 National Research Council Canada	Conseil national de recherches Canada <b>NRCC-CNRC</b>
	Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5
Material A1 6061-T6	ITEM 009
FINISH <input checked="" type="checkbox"/> MACH <input type="checkbox"/> MILL/TURNED <input type="checkbox"/>	TITLE Probe Arm Gen Assembly 2
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction 6/16th +/- 1/64 3/16th +/- 1/32	DRAWN T. Desmond APPROVED Quantity 1
AUTO MESH	PART NUMBER A3 009T10
DATE 2006-01-25	SCALE 1:12.5

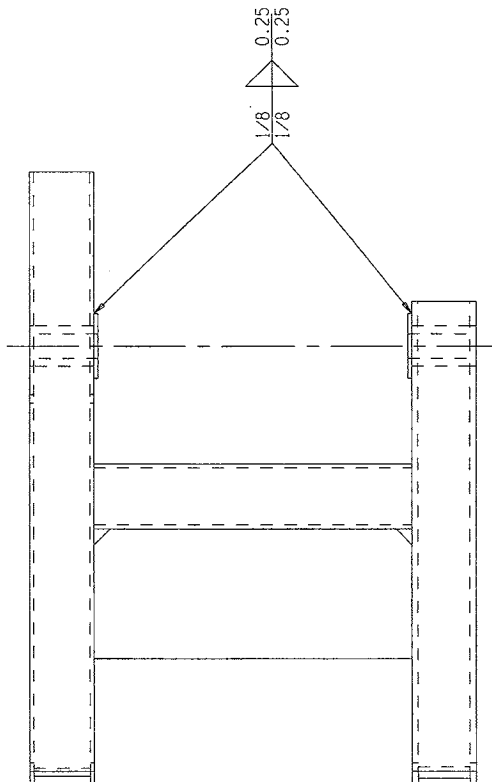
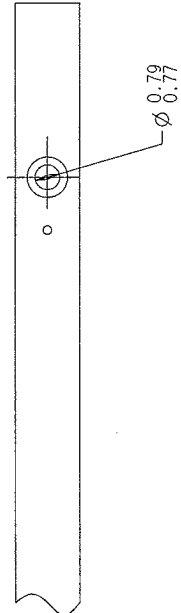
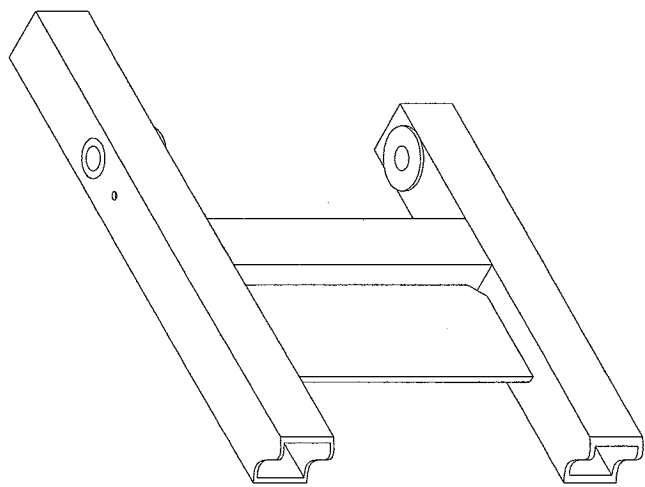
1 2 3 4 5 6 7 8

FOR INFORMATION: THIS DRAWING IS THE PROPERTY OF NATIONAL RESEARCH COUNCIL OF CANADA AND IS LOANED TO YOU. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF NATIONAL RESEARCH COUNCIL OF CANADA AND IS SUBJECT TO PATENT AND COPYRIGHT PROTECTION.

NO.	DATE	REVISIONS	BY	APPROVED

**Notes:**

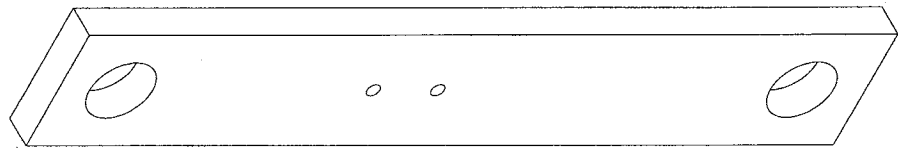
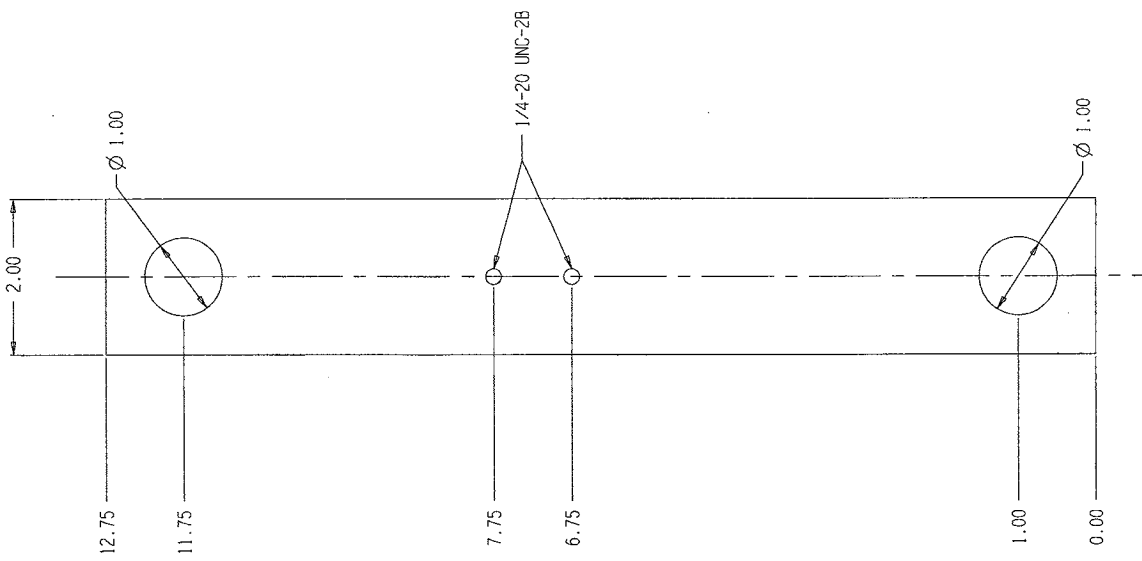
- Deburr - Remove All Sharp Edges
- Weld bushings in place using minimal weld
- Rebore holes in both bushings to be coaxial



Source File  
 CAD\_User\Projects\421009\_cwt\ProbeArm\009111

 National Research Council Canada Conseil national de recherches Canada <b>NRCC-CNRC</b>	Material Al 6061-T6	PART NO 009	TITLE Probe Arm Gen Assembly 3
	TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 3/8 inch +/- 1/32	DRAWN BY T. Desmond	NUMBER 009111
QUANTITY 1	APPROVED 	DATE 2006-06-25	DRAWN BY T. Desmond

THE INFORMATION CONTAINED ON THIS DOCUMENT IS  
 CONFIDENTIAL AND IS THE PROPERTY OF THE  
 NATIONAL RESEARCH COUNCIL OF CANADA.  
 IT IS TO BE KEPT IN STRICTLY CONFIDENTIAL  
 AND IS NOT TO BE DISCLOSED TO ANY OTHER  
 PERSON OR ORGANIZATION WITHOUT THE WRITTEN  
 PERMISSION OF THE NATIONAL RESEARCH  
 COUNCIL OF CANADA.



Notes:  
 Deburr - Remove All Sharp Edges  
 Source File  
 CAD\_User\Projects\421009\_cvt\Probekrm\009T12

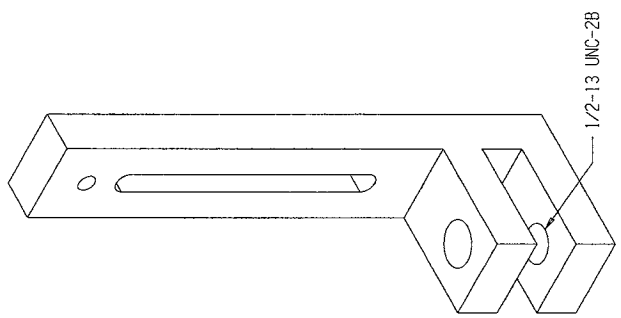
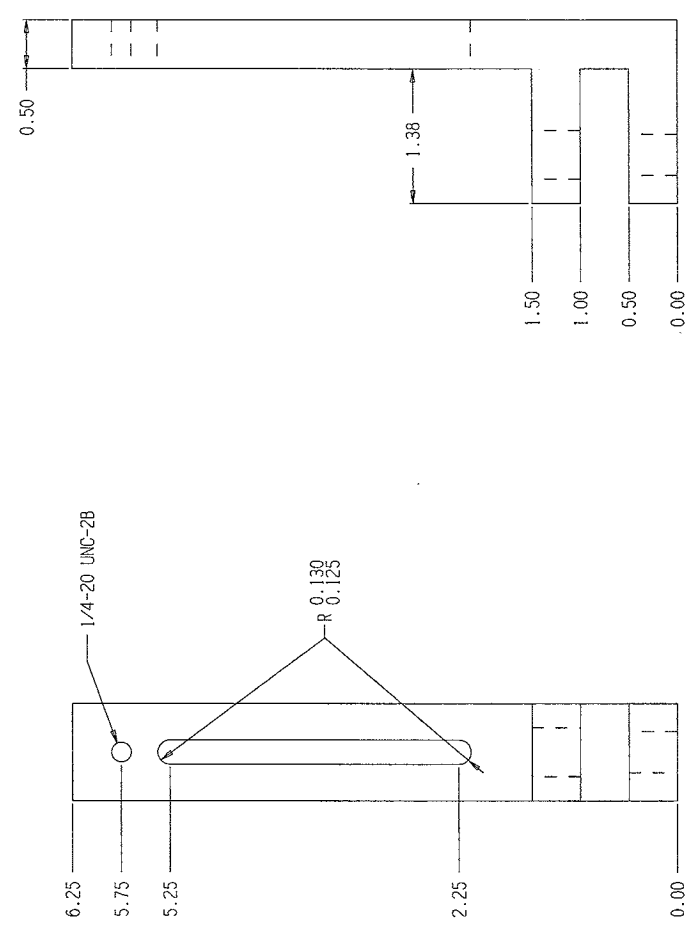
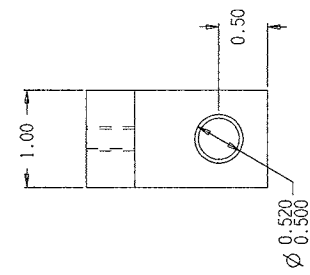
REV.	DATE	DESCRIPTION	BY	APPROVED

National Research Council of Canada Conseil national de recherches Canada	Material SS 1/2" thickness	PART NO 009	TITLE Support Plate
		QUANTITY 1	DATE 2006-Jun-25
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction < 8 inch +/- 1/64 > 8 inch +/- 1/32	FINISH 1/2" thickness	CHECKED BY <input checked="" type="checkbox"/> I. Usmond	APPROVED BY <input type="checkbox"/>
NATIONAL RESEARCH COUNCIL OF CANADA INSTITUT DE RECHERCHES EN SCIENCE ET EN TECHNOLOGIE	INSTITUTION Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5	DRAWN BY I. Usmond	PART NO 009T12
QUANTITY 1	DATE 2006-Jun-25	DRAWN BY I. Usmond	APPROVED BY <input type="checkbox"/>

NO.	DATE	DESCRIPTION	BY	APPROVED

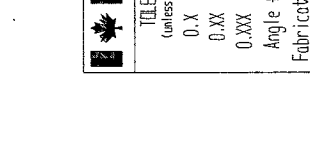
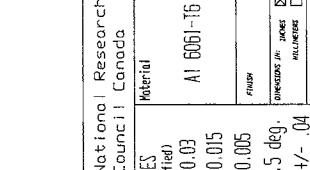
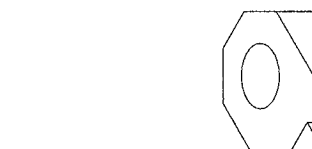
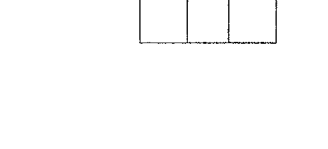
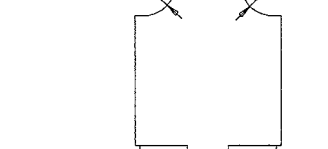
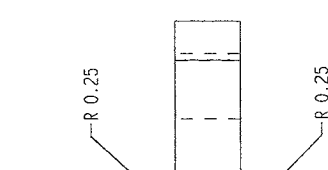
DESIGNER: [Name] DRAWN BY: [Name]  
 CHECKED BY: [Name] APPROVED BY: [Name]  
 DATE: [Date]

Notes:  
 Deburr - Remove All Sharp Edges  
 Source File  
 CAD\_User\Projects\421009\_cvt\ProbArrn\009113



 National Research Council Canada Conseil national de recherches Canada	Material SS	PART NO. 009	TITLE Slide Joint
	TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- -5 deg. Fabrication +/- .04 Fraction 1/8 inch 1/16 inch 1/32 inch	DRAWN BY T. Desmond	QUANTITY 1
INSTITUTION Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5	CHECKED BY <input type="checkbox"/>	APPROVED BY <input type="checkbox"/>	REV 009113

ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED ARE IN MILLIMETERS.  
 DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY.  
 DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY.  
 DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY.  
 DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY.



Notes:  
 Deburr - Remove All Sharp Edges  
 Source File  
 CAD\_User\Projects\421009\_cwt\Probekm\009T14

REV.	DATE	DESCRIPTION	BY	APPROVED

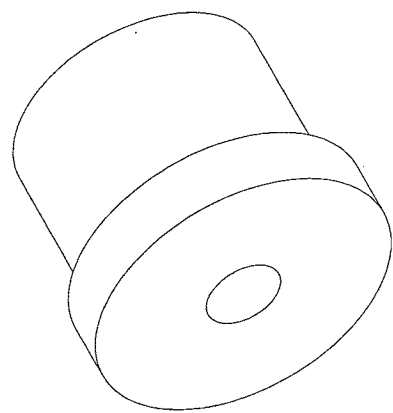
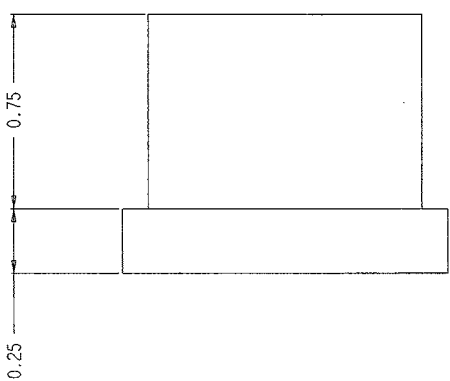
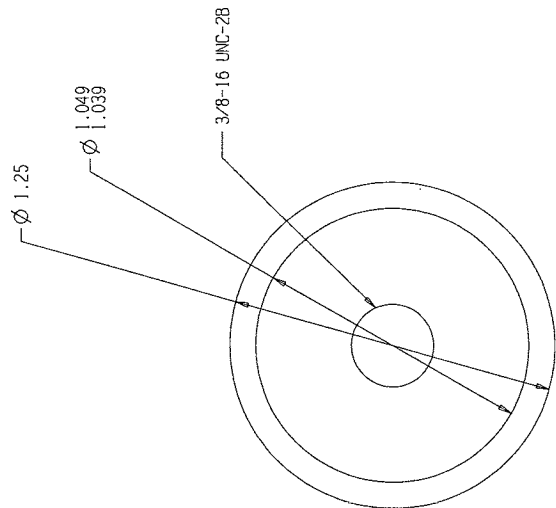
National Research Council Canada Conseil national de recherches Canada		ARC-CATC	
Material AI 6061-T6		Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5	
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction 6/16 inch 1/16 3/16 inch 1/32	FINISH DIMENSIONS IN PARENTHESES HULL/NECK <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	DATE 009	TITLE Insert Joint
DRAWN I. Usmond	APPROVED Quantity 1	NUMBER A3	REV. 009T14
SCALE 1:1		DATE 2006-Jun-25	

THE INFORMATION CONTAINED IN THIS DOCUMENT IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE. IT IS THE PROPERTY OF THE NATIONAL RESEARCH COUNCIL OF CANADA AND IS LOANED TO YOU BY THE NATIONAL ARCHIVES. IT IS TO BE RETURNED TO THE NATIONAL ARCHIVES AT THE END OF THE LOAN PERIOD. IF YOU HAVE ANY COMMENTS ON THIS DOCUMENT, PLEASE CONTACT THE NATIONAL ARCHIVES AT 395 COLLEGE STREET, OTTAWA, ONTARIO K1P 6K8.

Notes:

Deburr -- Remove All Sharp Edges

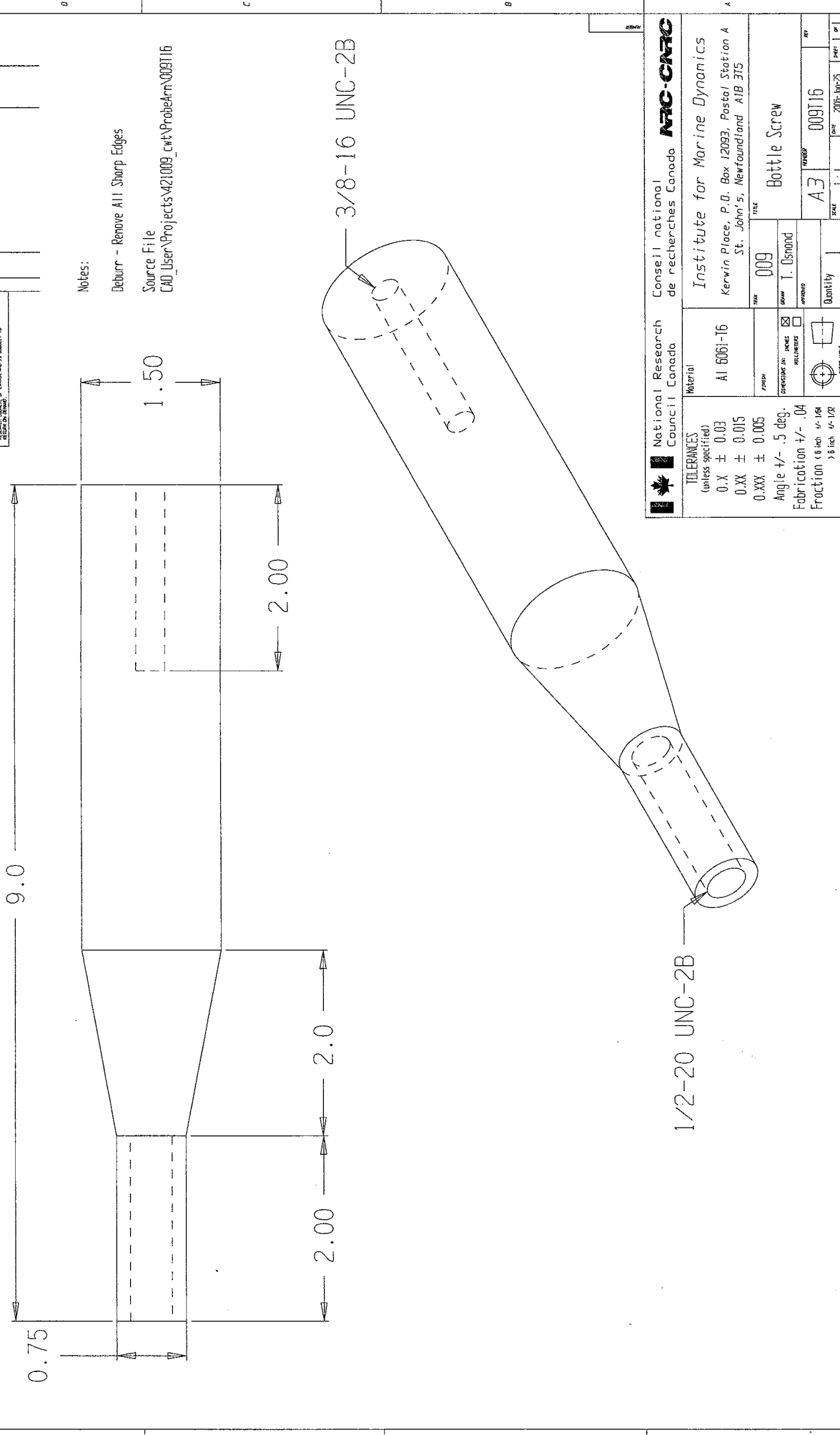
Source File  
 CAD\_User\Projects\421009\_cvt\Probetrm\009115



National Research Council of Canada Conseil national de recherches Canada		MTC-CATC	
Material A1 6061-T6		Institute for Marine Dynamics Kerwin Place, P.O. Box 12083, Postal Station A St. John's, Newfoundland A1B 3T5	
TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction < 8 inch < 1/64 > 8 inch < 1/32	FINISH 009	TITLE Bushing 2	QTY 009115
<input type="checkbox"/> PREPARED IN INCHES <input checked="" type="checkbox"/> PREPARED IN MILLIMETERS	DRAWN T. Usmond	APPROVED A3	SHEET 2 : 1
NATIONAL ARCHIVES 395 COLLEGE STREET OTTAWA, ONTARIO K1P 6K8		DATE 2006-Jun-25	

REV.	DATE	DESCRIPTION	APPROVED

THE INFORMATION CONTAINED ON THIS DRAWING IS FOR INFORMATION ONLY AND IS NOT TO BE USED FOR CONSTRUCTION OR FABRICATION OF ANY PART OF THE PROJECT UNLESS IT IS SPECIFICALLY IDENTIFIED AS SUCH BY THE PROJECT MANAGER. THE USER OF THIS DRAWING IS RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION CONTAINED HEREON AND IS ADVISED THAT THE INFORMATION IS SUBJECT TO CHANGE WITHOUT NOTICE.



Notes:

Deburr - Remove All Sharp Edges

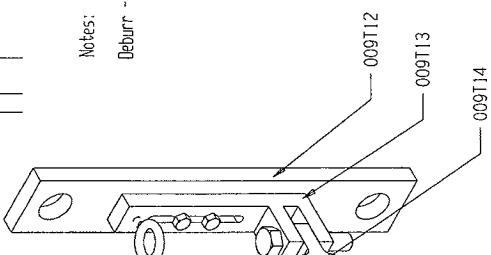
Source File

CAD\_User\Projects\421009\_cwt\Problem\009T16

 National Research Council Canada	Material AI 6061-16	FINISH <input checked="" type="checkbox"/> POLISHED <input type="checkbox"/> MILLFINISH <input type="checkbox"/> ANODIZED	TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction $\frac{6}{8}$ inch $\frac{1}{16}$ $\frac{3}{8}$ inch $\frac{1}{32}$	TITLE Bottle Screw
		PART NO 009	DRAWN I. Osmond	QUANTITY 1
INSTITUTIONAL Conseil national de recherches Canada <b>NRCC-CNRC</b> Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5	PROJECT NO AI 6061-16	CHECKED BY <input checked="" type="checkbox"/> I. Osmond	APPROVED <input type="checkbox"/>	SHEET 1 of 1



THE INFORMATION CONTAINED ON THIS DRAWING IS THE PROPERTY OF THE NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE USED ONLY FOR THE PROJECT AND FOR THE PURPOSES SPECIFIED IN THE CONTRACT. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF THE NATIONAL RESEARCH COUNCIL OF CANADA.



Notes:  
Deburr - Remove All Sharp Edges

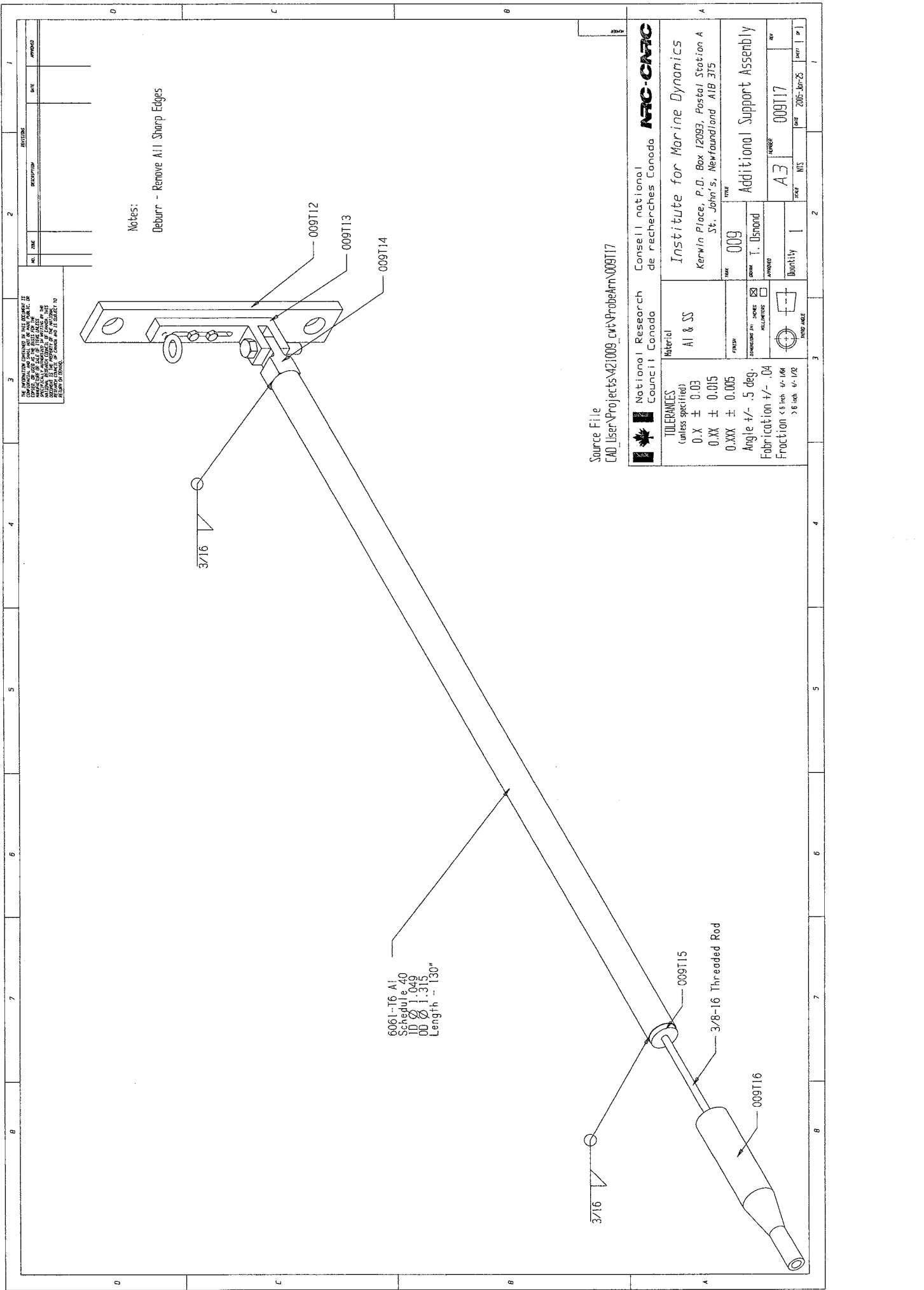
3/16

6061-T6 Al  
Schedule 40  
ID  $\varnothing$  1.049  
OD  $\varnothing$  1.315  
Length - 130"

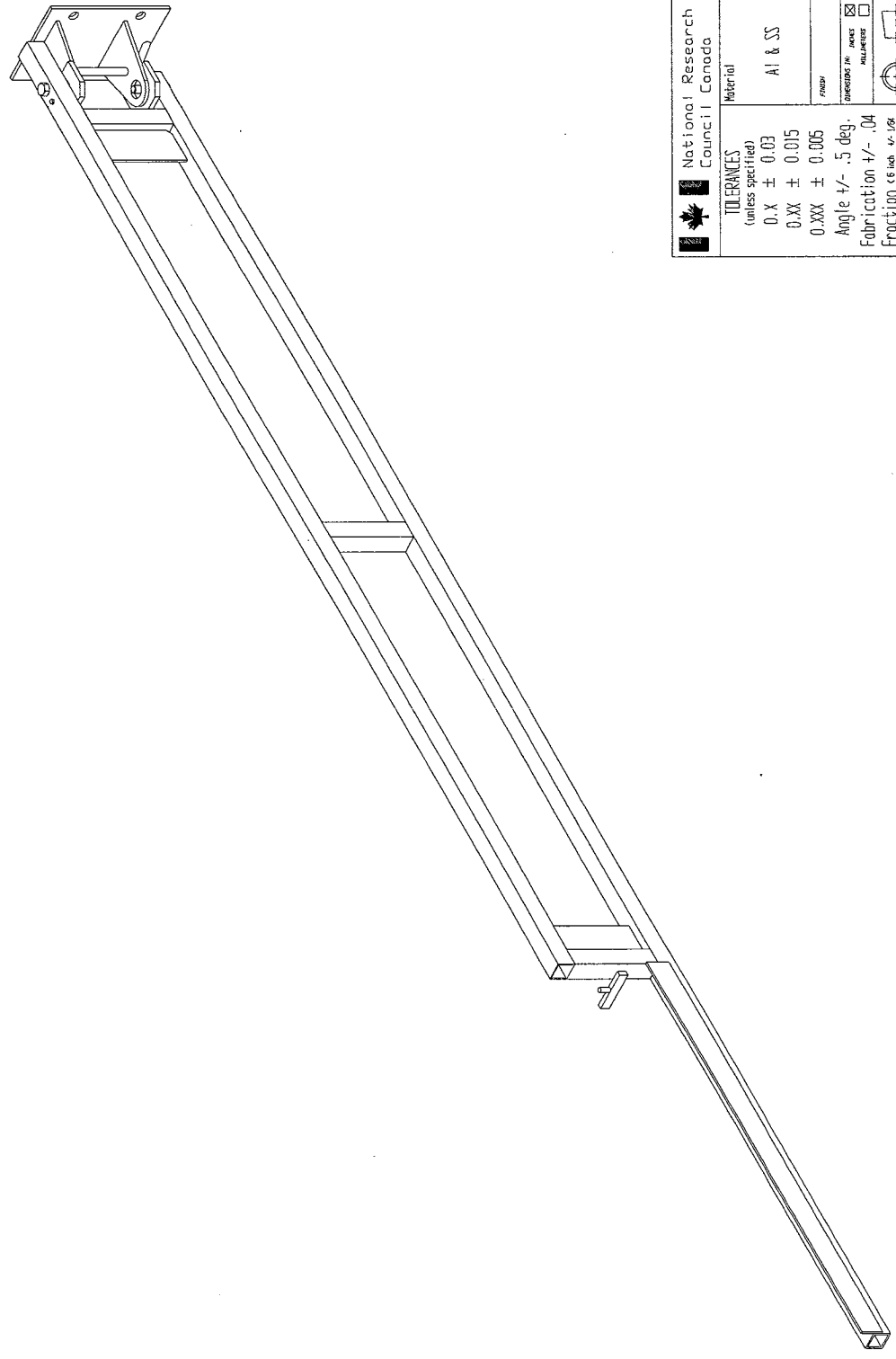
3/16  
009T15  
3/8-16 Threaded Rod  
009T16

Source File  
CAD\_User\Projects\421009\_cwt-ProbeArm\009T17

National Research Council of Canada Conseil national de recherches Canada			
Institute for Marine Dynamics Kerwin Place, P.O. Box 12093, Postal Station A St. John's, Newfoundland A1B 3T5		Additional Support Assembly	
TOLERANCES (unless specified) 0.X $\pm$ 0.03 0.XX $\pm$ 0.015 0.XXX $\pm$ 0.005 Angle +/- .5 deg. Fabrication <math>\frac{1}{16}</math> inch Fraction <math>\frac{1}{16}</math> inch > 6 inch <math>\frac{1}{32}</math> inch	Material Al & SS	PART NUMBER 009	DATE 2005-Jun-25
FINISH DIMENSIONS IN: <input checked="" type="checkbox"/> INCHES <input type="checkbox"/> MILLIMETERS HOLLOW: <input type="checkbox"/> <input checked="" type="checkbox"/>	QUANTITY 1	DRAWN BY T. Dstrand	PART NUMBER 009T17
THIRD ANGLE 	APPROVED 	CHECKED 	DATE 2005-Jun-25



THE INFORMATION CONTAINED IN THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF NATIONAL RESEARCH COUNCIL OF CANADA. IT IS TO BE USED ONLY FOR THE PURPOSES SPECIFICALLY STATED BY THE ISSUING OFFICE. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM NATIONAL RESEARCH COUNCIL OF CANADA AND IS SUBJECT TO THE APPLICABLE PATENT RIGHTS.



Notes:

Deburr - Remove All Sharp Edges

Source File  
 CAD\_User\Projects\421009\_cw\Prob\cra\009T18

REV	DATE	DESCRIPTION	APPROVED

 National Research Council Canada Conseil national de recherches Canada <b>NRC-CNRC</b>	Material Al & SS	FINISH <input checked="" type="checkbox"/> POLISHED <input type="checkbox"/> MILL FINISH <input type="checkbox"/> TURNED FINISH	PART NO 009	TITLE Full Assembly
	TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.006 Angle +/- .5 deg. Fabrication +/- .04 Fraction < 6 inch 1/16 > 6 inch 1/32	QUANTITY 1	DRAWN T. Desmond	DATE 2005-JUN-25

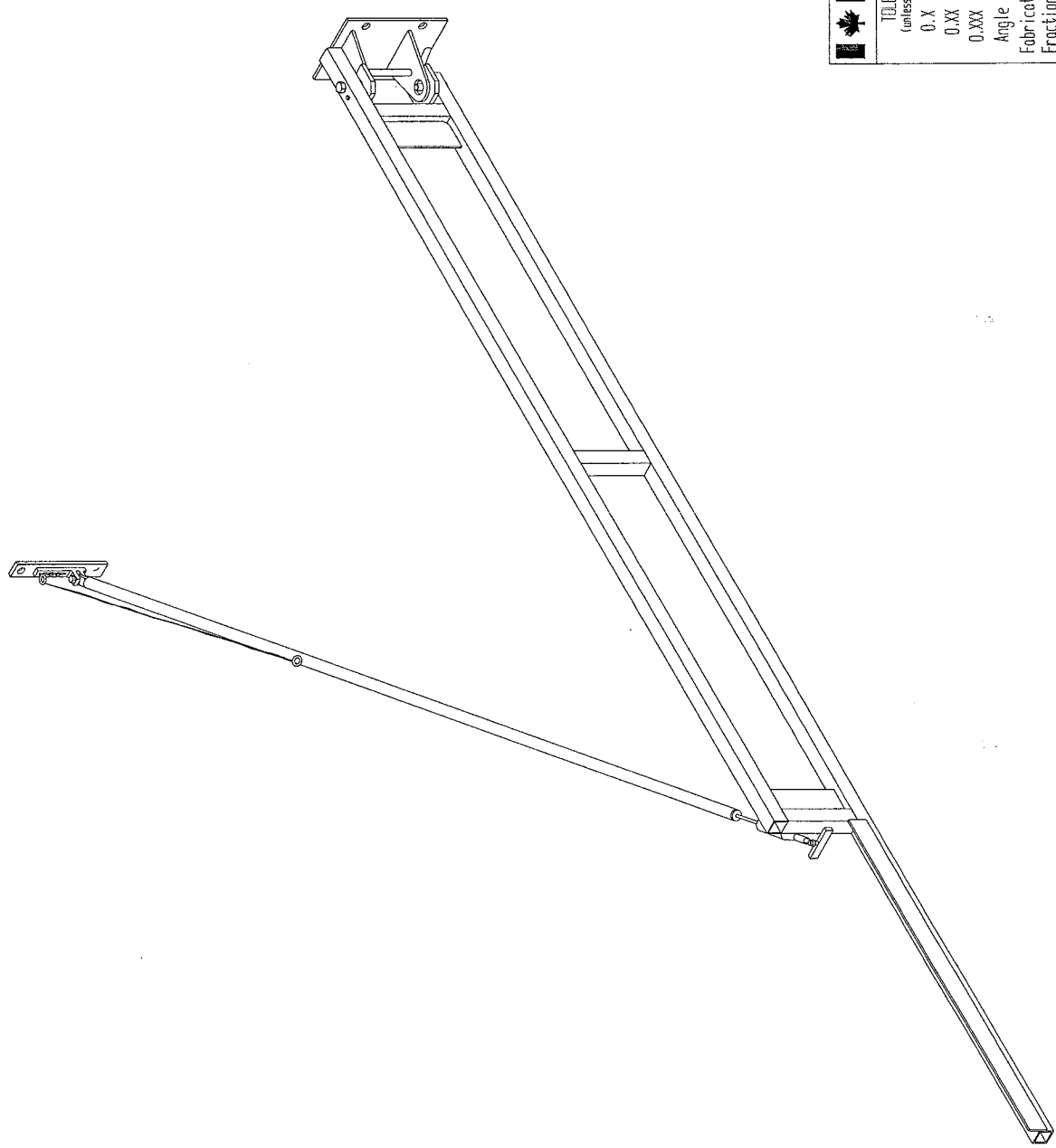
THE INFORMATION CONTAINED IN THIS DOCUMENT IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE. IT IS THE PROPERTY OF THE NATIONAL RESEARCH COUNCIL OF CANADA AND IS SUBJECT TO RESTRICTIONS ON REPRODUCTION IN ACCORDANCE WITH THE PATENT ACT AND THE COPYRIGHT ACT. LA REPRODUCTION DE CE DOCUMENT EST INTERDITE SAUF OÙ IL EST INDICÉ AUTrement. IL EST LA PROPRIÉTÉ DU CONSEIL NATIONAL DE RECHERCHES DU CANADA ET EST SOUS RÉSERVE DE RESTRICTIONS EN MATIÈRE DE BREVETS ET DE DROIT D'AUTEUR.

REV	DATE	DESCRIPTION	APPROVED

Notes:

Deburr - Remove All Sharp Edges

Source File  
 CAD\_User\Projects\421009\_cwt\ProbeArm\_009T19



National Research Council of Canada Conseil national de recherches Canada	Material <b>Al &amp; SS</b>	FINISH <input checked="" type="checkbox"/> POLISHED <input type="checkbox"/> MILL FINISH	PART NUMBER <b>009</b>	TITLE <b>Full Assembly with Support</b>
		TOLERANCES (unless specified) 0.X ± 0.03 0.XX ± 0.015 0.XXX ± 0.005 Angle +/- .5 deg. Fabrication +/- .04 Fraction < 6 inch 1/16 > 6 inch 1/32	DRAWN <b>T. Ostrand</b>	DATE <b>2005-Jun-25</b>
INSTITUTION <b>Institute for Marine Dynamics</b> Kerwin Place, P.O. Box 12083, Postal Station A St. John's, Newfoundland A1B 3T5	QUANTITY <b>1</b>	SHEET <b>A3</b>	OF <b>1</b>	DRAWN BY <b>009T19</b>