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# Mechanical and Aerospace Engineering Machine Shop Guidelines and Procedures

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## Revision History

Revision	Effective Date	Sections Affected	Notes
REV-NC	13 September 2013	N/A	Original
REV-1	31 March 2014	Added priority list and section on last date to accept new work. Edited other sections	Major revision
REV-2	15 September 2016	Updated Section 3.0 Added shop request form and sample drawing format.	Major revision

## Acknowledgements

This document is heavily based on a previous document produced by Jamie Leveille.

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## **1.0 SECTION RESERVED FOR FUTURE USE**

## **2.0 Shop Guidelines**

### **2.1 Shop Safety**

Carleton University's 'Laboratory Health and Safety' rules apply in the MAE machine shop. A copy of this document can be found at <http://www.carleton.ca/ehs/programs/laboratory-health-and-safety/>. A short summary of additional general shop rules are listed below.

1. **IF IN DOUBT, ASK!**
2. You must check in with Alex Proctor or his designate prior to starting any work.
3. You must make yourself familiar with the location of emergency exits, fire extinguishers and emergency shut-off switches around the area in which you are planning to work.
4. You must work safely, obey safety rules and use all safety equipment associated with your task.
5. No open toed shoes, loose clothing, long hair or jewelry (including rings, bracelets, or campus card neck straps).
6. You may only work on the machine and on the operation on which you have been checked in. You must have permission before moving to another machine or operation.
7. Always clean up, return tools, return personal protective equipment and ensure all guards are in place.
8. Report broken tools or equipment to Alex Proctor or his designate.
9. Obey all instructions from machine shop staff.
10. Failure to obey these regulations or work safety will result in a permanent ban from the machine shop.

It is recommended that team manufacturing personnel invest in their own personal protective equipment, such as safety boots and safety glasses.

### **2.2 Shop Work Scheduling Priority**

Work in the MAE shop will be prioritized as follows:

- 1) Urgent or safety related facility and lab repairs and maintenance
- 2) Scheduled undergraduate course machining labs (e.g. MAAE 3901, CAD/CAM)
- 3) Pre-arranged and lead engineer approved manufacturing tasks from 4<sup>th</sup> year projects – with manufacturing drawings
- 4) Other pre-arranged course-related manufacturing (e.g. MAAE 3901) – with manufacturing drawings

- 5) Pre-arranged graduate research project work – approved by graduate supervisor and with manufacturing drawings
- 6) Other pre-arranged undergraduate extracurricular project work – with manufacturing drawings
- 7) Unscheduled walk-in 4<sup>th</sup> year project work (to be done by the student or staff after review - time permitting)
- 8) Other unscheduled walk-in graduate and undergraduate work (to be done by the student or staff after review - time permitting)

### **2.3 Fall and Winter Term Cut-Off Dates**

A cut-off date after which no new work will be accepted will be established for the Fall and Winter terms. This is required due to the cyclic nature of 4<sup>th</sup> year project work with peak workloads near the end of the Fall and Winter terms (e.g. late November and early March). The cut-off dates are the **third Friday in November** and the **first Friday in March** for each Fall and Winter term respectively. For the weeks immediately following these dates and until any 4<sup>th</sup> year project work backlog is cleared, no new pre-arranged or walk-in work will be accepted. Minor modifications or re-work to already completed or in-progress project work may be completed on a first come, first served basis, time permitting.

### **2.3 Location and Availability**

The Carleton University MAE machine shop is located on the first floor in the Mackenzie Engineering Building's first block. Normal operating hours are from 8:00 to 16:00 Monday to Friday, however due to different circumstances the shop may not always be open to students during this time. The Shop is normally closed from 12:00-13:00 for lunch. The Shop is closed for all University holidays and may only be partially open during Fall and Winter Reading Weeks.

An up to date copy of the MAE Machine Shop schedule is available in the shop and online at <http://www1.carleton.ca/mae/current-students/undergraduate/fourth-year-projects/>. Please make note of key entries such as the drawing review hours, 3901 lab hours, and pre-arranged shop closure dates.

In order to help the shop run as efficiently as possible a new approval process was implemented. This process is outlined in detail in Section 3.0 SHOP COORDINATION PROCEDURE below. At the same time, the number of people from each project who will be allowed to do the actual manufacturing work at the shop has been limited to 6. The chosen manufacturing persons are not required to have any prior machining experience; they will be trained to operate required machinery as necessary (this will require extra time and is subject to machinist availability).

### **2.4 Tool Rental**

Most hand tools and some powered tools are available for students to borrow to be used on school related projects at no cost. A tool sign-out sheet is located near the entrance to the machine shop. Please consult with one of the shop personnel to determine whether and for how long a certain tool may be borrowed. Please return any tools promptly when the planned task has been completed. Use tools for their intended purpose only

## 2.5 Walk-in Work

Walk-in work will be limited to SIMPLE part modification, fabrication, or joining tasks requiring minimal tooling and little set-up time. The drawing sign-off procedure is not required for this type of work, though drawings or sketches may still be required in some cases. No walk-in work will be admitted during the 3901 lab hours and no new walk-in work will be admitted after 15:00.

## 3.0 Machining Approval Process

### 3.1 Design Phase

Students are working within the project to design a component. Students must review the machine shop equipment and capabilities that will be listed on the machine shop page of the 4<sup>th</sup> year project website.

At this time, the students have the option to consult the Machine Shop Liaison TA (Justin Kernot) to ask about general manufacturability based on the shop capabilities. If there is a more complex inquiry, the student(s) will be directed to arrange a meeting with Alex Proctor to discuss.

### 3.2 Approval

Once the design is “complete”, the Project Engineers will approve the design/drawings to ensure that the parts are realistic, the correct information is on the drawings, and verify that the part is necessary to manufacture.

### 3.3 Materials

#### Ordering Material

Upon the approval of the design, the material will be ordered through the appropriate channels. A list of recommended suppliers will be added to the machine shop page of the 4<sup>th</sup> year project website.

Once the material is ordered, an email must be sent with a specific subject line format (i.e. **[MAAE4907]: Material Order Notice**) must be sent to Alex Proctor to give notice of pending material arrival. The email must include:

1. Project title
2. Professor/persons addressed to
3. Supplier
4. Order # or relevant Product #
5. Item description (i.e. 1.0” x 1.0” L-channel, 6061 aluminum, 8ft)
6. Quantity

## Material Arrival

Upon the arrival of the material, Alex Proctor will respond to the previously sent email to notify the student(s) that the material is in the shop. Further correspondences on this email should not be necessary.

## 3.4 Shop Time Request Form

### Send Request Form

At this time, the “Shop Time Request Form” must be completed (currently pending) and emailed as an attachment, along with the necessary drawing, to Alex Proctor and the project supervisor who approved the drawings. This email is to have a designated subject line (i.e. **[MAAE4907]: Shop Time Request**). The form can be found as a fillable PDF file on the machine shop webpage.

### Scheduling/Machine Assignment

Once the form is received by Alex Proctor, he will determine which machine(s) is/are necessary for the job, and estimate the required shop time. If an error or critical design flaw is noticed, the request is rejected and sent back to the project to get re-approved.

If the form is accepted, Alex Proctor will assign a Job ID# to the request form and rename the document “Job\_XX.pdf”, cross-reference the student availability with the shop/machine availability, and input the schedule into the Machine Shop calendar located on the web page. Following this, Alex Proctor will reply to the request form email with the Job ID# and a reminder to check the calendar for the scheduling details. It is at this point where the student(s) responsible for the drawing add the Job ID# to the drawing.

## 3.5 Manufacturing Process

When the student(s) arrive to manufacture their parts on the first day, they must bring a printed **signed** copy of the drawings along with the JobID#. There will be an excel sign-in sheet that must be filled in upon arrival and departure. This will be saved after every entry by each student (by quickly hitting the ctrl+s hot key), and backed up regularly to avoid file loss/corruption.

If students exceed the allocated shop time in the schedule, they must arrange for extra time with Alex Proctor.

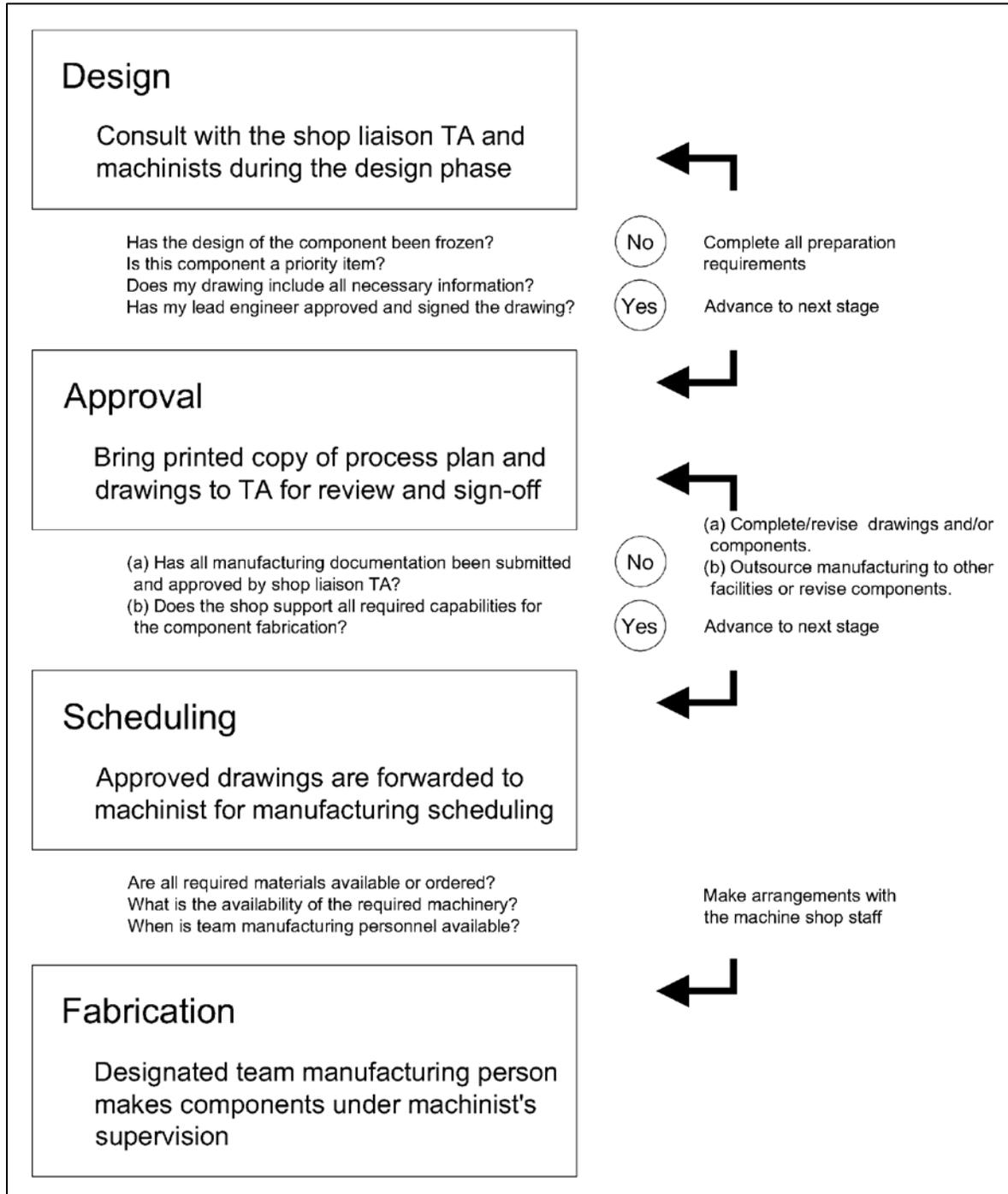


Figure 1: MAE shop manufacturing approval process.

# Machine Shop Request Form

Be sure to confirm that your drawings use the provided template, are approved by a project manager, and that you have your material before completing this form. Send this form to Alex Proctor ([Alex.Proctor@carleton.ca](mailto:Alex.Proctor@carleton.ca)) and the supervisor who approved the drawings, along with any drawings/models of the part.

## Project Information

Project Name:

Drawn by:  Approved by:

\*Primary Student:  \*Secondary Student:

*\*both students must be present the first scheduled day of manufacturing*

## Part Details

Part Name:

Part/DWG No.:  Qty:  CNC Required?:

Material:

Other Hardware:

## Scheduling

Part must be completed by:

General Availability:

	Mon	Tues	Wed	Thurs	Fri
Available Times					

Comments:

Appendix A: Sample Drawing Template

<p>UNLESS OTHERWISE SPECIFIED:</p> <p>DIMENSIONS ARE IN INCHES</p> <p>TOLERANCES:</p> <p>X.XX ± 0.01</p> <p>X.XXX ± 0.005</p> <p>ANGULAR: ± 1°</p> <p>DEBUR AND BREAK SHARP EDGES</p> <p>MATERIAL</p> <p>6061 Aluminum</p> <p>FINISH</p> <p>Normal Surface</p> <p>DO NOT SCALE DRAWING</p>					NAME	SIGNATURE	DATE	PROJECT: <b>Carleton - JKAP</b>		
					DRAWN	DREW PAHRT		14-09-16	TITLE:	
					APPROVED	JANE PLAINE		20-09-16		
					JOB ID #	PROJ_025	QTY	42	<p><b>PART NAME 1</b></p>	
					COMMENTS:					
Anything regarding mating parts, key features, or other significant information not conveyed through the drawing itself				<table border="1"> <tr> <td>SIZE</td> <td>DWG. NO.</td> <td>REV</td> </tr> <tr> <td><b>A</b></td> <td><b>PRT_001</b></td> <td><b>01</b></td> </tr> </table>	SIZE	DWG. NO.	REV	<b>A</b>	<b>PRT_001</b>	<b>01</b>
SIZE	DWG. NO.	REV								
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SCALE: 1:1			SHEET 1 OF 1							

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