

The Abridged Solid Space Basics.

For IAT 336

Page 1

**Solid Space Fabrication and
Prototyping Lab.**

School Of Interactive Arts
and Technology.
Simon Fraser University, Surrey.
Room 3702.

Note: It's Card key access!

General Contact:

Maja Jensen,
Production Technologist.
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SFU phone: 778- 782-8911.

Everyone must go through safety and tool orientations to access the Solid Space Lab. You should also read the full documentation and guidelines (for the laser and the 3D printer) which are available online or through the production technologist (that's me). Just because a note on a file format, a booking link, or material limitation is not mentioned here, doesn't mean it doesn't apply.

General Guidelines:

<http://www.siat.sfu.ca/undergrad/studios/solid-space/>

The orientations, and the guidelines, will NOT make you a toolshop pro. They are there to ensure everyone is aware of safety procedures and to help coordinate Lab use. Following that, it is a way for you to get your project done in a predictable and safe manner.

Some of these guidelines may be different from previous classes or projects. This has happened for good reason. That said, feedback is welcome to take into consideration in the future.

The basic rules in the Lab:

Are detailed in the "Undergrad Safety Handout for Solid Space Access" section

Read it. You will be quizzed on your knowledge.

Remember that you cannot take your belongings (Backpacks, etc) into the Lab.

Bookings for Undergrads will be done through TAs. This will help ensure projects are ready (or at the right stage) before getting into the Lab.

People who are late for bookings or for orientations will forfeit their bookings/times. If rebooked, it will be with the lowest priority so **BE ON TIME!!**

Repeated issues with lateness will result in a suspension of Lab privileges. Bookings are not transferable.

Think: Before you go to the Lab, everything must be READY TO GO. This means, PLAN:

You essentially have what amounts to one work-day's worth of time to actually construct your project using the Lab itself .

You will need to bring your own supplies (dust masks, basic glues, screws, etc).

Large raw material sheet sizes cannot be cut down in the Lab- 4' x 8', 6' x 8' will not work. Get the vendor to cut it. Recommend keeping raw materials to about 4' x 4' or less.

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Laser cutter materials must be "ready to go":

Sheets for the Laser cutter should be cut down to **18" x 32"** or less, **beforehand. They must be flat. If you must cut it in Solid Space, book power tool time PRIOR to your laser cutter time.** If this is not done you will **forfeit your laser time.**

Files for Laser cutter and 3D Printer must be "ready to go" by the time you get to the Solid Space Lab. This means formatted, scaled properly and laid out in Coreldraw

There is no time for reformatting, modifying, or fixing files in the Lab. Resources exist to help you get you to that point, so use them.

The Solid Space guide online also notes how to get Solid Works files into Coreldraw if you need to use profiles from your file for laser cutting.

**CORELDRAW (FOR MAKING LASER READY FILES) IS IN LABS:
LABS SC3130 AND SC3140 (THERE IS NO MAC VERSION)**

Ask your TA or the Production technologist if you have a problem or a question.

Also, 'Ready-to-go' files means STLs (or pack files) for the 3D printer. See the online guidelines for the machine specifics.

If you do 3D printing: Keep you files small and simple. One person printing an exceedingly large and complex 3D print will cut into the time and materials for others. 3D printing is rewarding, but it takes time. And more time, especially if you want to paint or otherwise finish models. It also can't achieve some of the precision other methods can.

Again, read the full documentation.

A List of Acceptable Materials for Cutting and Marking. For IAT 336. This may differ from the online document in allowable thicknesses.

Generally, most wood compositeS (mdf, etc) materials are okay up to 3/16" (5MM)

Materials must be FLAT!

Always make sure you have some extra material for testing. If you are unsure of your material, ASK before hand and leave yourself time to work something else out in case it does not work out.

MAXIMUM SHEET SIZE IS 18" X 32". CUT MATERIALS TO SIZE PRIOR TO ENTERING LAB!

BOOK POWER TOOL TIME OR HAVE THE VENDOR DO IT.

To Cut:

- **Masonite (aka HDF, Hardboard): up to 3/16" (5mm) MUST BE SMOOTH BOTH SIDES. CHEAP AND READILY AVAILABLE. Edges will char. Ensure flatness.**
- **Bristol board, Matte board, Museum board. Edges may char.**
- **Corrugated cardboard: up to 1/4". Other thicknesses, please ask.**
- **'Pure' hardwood/softwoods up to 1/8" thick. Some can be thicker, such as woods like cedar. If in doubt, ask and we will test it. Edges will char.**
- **Interior Plywood: up to 1/8" thick. Edges will char. Smaller higher grade sheets are good. Ensure they are flat. ABSOLUTELY NO EXTERIOR GRADE PLYWOOD WILL BE CUT.**
- **Plexiglas, Lucite, Acrylic : up to 1/4" thick for cutting, cast preferred. Note: This is an excellent material for the laser.**
- **Particleboard. (aka Chipboard): Up to 1/8".**
- **Vellum.**
- **Depron Foam.**
- **Thin styrofoam: less than 1/4".**
- **Some natural fabrics on a TBD basis. Allow time. Fabric needs to be prepared.**

To Mark or engrave lightly: All of the above, plus:

- **Certain fabrics can be marked provided they are prepared correctly, please ask.**
- **Hardwoods.**
- **Anodized aluminum, metal with special coatings: Please ask**
- **Tiles and Glass: Please ask and allow time for tests.**

Prohibited Materials:

- **PVC or other synthetic materials that may have chloride in them. If your plastic is a mystery it will not be cut. If unsure, ask. Even some materials like foam core might be problematic.**
- **Styrene**

Undergrad Safety Handout for Solid Space Access

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Parts of this guide are excerpts from SFU EHS manuals, and from Worksafe BC's "Heads Up For Safety" Manual.

1.0 General SFU Safety Policies and How it Relates to Solid Space.

Everyone is responsible for Safety.

Students need to familiarize themselves with safe work practices while exercising common sense. EHS (Environmental Health and Safety) at SFU, along with other members of the SFU community, like the local Safety committees, are responsible for promoting safety and implementing a safe working culture.

Students are expected to be familiar with basic SFU policies and procedures, including: SFU's Occupational Health and safety Policy, Emergency Policy (covering disasters such as earthquakes, or events like accidents or explosions) and Fire Procedures.

Detailed information about EHS policies and emergency responses, can be seen online at www.ehs.sfu.ca OR you can also contact EHS directly at 778-782-5935.

SFU Safety policy:

SFU's Occupational Health and Safety Policy outlines the responsibilities for safety from the Deans office through to departmental safety committees. This includes students too.

Importantly it outlines how students are responsible for seeking first aid when injured, and how they need to report incidents during class time to the class supervisor.

SFU basic emergency procedures:

All campus land line phones have an orange sticker with the emergency number to reach campus security on it. Do not call 911. Calling 911 increases response time as first responders are not familiar with SFU Campuses.

**For emergencies, call 2-7511. There is a land line phone in Solid Space just for this.
If you are calling from your cellphone the campus emergency number is 778-782-7511**

1.1 Incident Reporting in the Solid Space Work Area

Examples of incidents include, but are not limited to:

- Situations causing personal injury
- Occupational illness
- Fire, major flooding, or explosion
- Collapse or structural failure
- Near miss incidents (those incidents that could have resulted in any of the above)

When an incident occurs:

1. *IF* needed right away, secure first aid or medical aid for injuries, and mitigate immediate hazards,
2. Report the incident to the Solid Space technician on duty.
 - For minor injuries, you and the technician will proceed to Campus Security/First Aid Station or to the First Aid Kit. There is a First Aid station by campus security on the mezzanine level/Dale B. Regeher Grand Hall.
 - First aid kit, fire extinguishers and E-stops (red panic buttons that cut power in the lab when pressed) exist in Solid Space and pointed out during orientations.

If a fire occurs in Solid Space:

1. Notify the on-duty Solid Space technician right away.
2. Leave Solid Space and the Graduate research area. Pull the fire alarm if required or if asked to do so. These are located outside of Solid Space and the Graduate research area and are pointed out during orientations. Unless you are trained to do so, don't use a fire extinguisher.

1.2 Notes on SFU Surrey Fire Evacuation and Fire Evacuation Procedures

For both the Tower and the campus space, routines are identical:

- **When you hear the intermittent fire alarm signal, stand by for further instructions over the Emergency Voice Paging system. Prepare for evacuation.**
- **When you hear the continuous alarm, follow the directions of the Floor Warden. Proceed to the nearest safe exit.**

Also:

- **Do not use the elevators.**
- **Use stairwells to exit.**
- **Close doors behind you.**
- **Go to designated assembly area outside.**
- **Do not return to the building until directed by emergency response personnel.**

Assembly Areas:

The Galleria/Mezzanine Assembly Area is west of the building in the open air parkade (rooftop parking).

The Podium/Tower Assembly Area is north of the building in the parking lot across the street Rec Centre lot).

1.3 Hazard Reporting in the Solid Space Work Area

All hazards must be reported, and every employee is responsible for being aware of reporting procedures. Students need to do their part too, to bring attention to things they feel are a problem.

For hazards requiring IMMEDIATE ATTENTION:

Call 2-7511 if you notice something that requires immediate attention.

Examples of situations requiring immediate action include a suspicious package appearing in your area, or a gas smell.

If you are calling from your cellphone the campus emergency number is 778-782-7511

For hazards NOT requiring immediate attention- like a heavy box on a high shelf or something like that:

In Solid Space: report it to the Solid Space technician on duty, or to the Production Technologist.

1.4 On Working by Yourself or with Others In Solid Space:

SFU has a 'Working Alone or in Isolation Policy'. It outlines what is considered to be working alone or in isolation and how to comply with related policies.

Undergrad students, with IAT 336 and 337 and other classes such as Capstone, under no circumstances will be working alone or in isolation in Solid Space.

Lab access and work is only allowed with the supervision and presence of a designated, trained technician in the lab, and during pre-booked hours.

2.0 Solid Space Basic Safety Rules

Expected Lab Behavior:

You must have an approved orientation session in Solid Space before accessing it. After that, you must book to use it and be prepared when you come in. Prepared means having your materials ready, files ready, your dust masks, and any other things that you might need, such as glues.

Orientations DO NOT automatically qualify you for the use of all tools in Solid Space, they only allow access to the space.

You must also comply with all material requirements for the laser cutter.

There is absolutely no food or drink allowed in Solid Space.

6 people maximum can be working in Solid Space at the same time. However, this is also at the discretion of the Solid Space technician. If they feel 6 is too many for what is going on, they can have people leave.

Generally:

In Emergencies:

Emergency procedures: Follow SFU guidelines as noted earlier, **and if you have questions ask!!!**

Be familiar with emergency equipment including fire extinguishers, first aid kit(s), E-stop buttons, and eye wash stations in Solid Space. These are pointed out during orientations.

Behaviour:

- Adopt a calm, careful attitude at all times. DO NOT RUSH.
- Walk, don't run; avoid pushing or bumping
- Horseplay (e.g., throwing things) is not allowed
- NO CELL PHONE USE. Keep it silent and take/make calls outside
- No music player use (mp3 players etc)

Most accidents occur to people who are tired, rushed or under the influence of alcohol or drugs, so avoid working in these states.

You will be escorted out of Solid Space by security if you are found to be intoxicated or under the influence of anything.

Clothing expectations:

- Tuck in loose clothing and dangly bits, like strings for hoodies, tie back long hair, remove jewelry when working in Solid Space
- Wear sturdy shoes, no open toes, appropriate clothing for activity; wear protective gear when required

Eye protection:

Plenty of eye protection is available in Solid Space.

- Wear eye protection when required. This is when using the power tools.
- This also applies to when hammering metal, stone or other hard materials, as well as chiseling materials.

Protecting your hands and securing work:

Protect your hands. Statistics identify that most injuries in school workshops occur to students' hands.

- Make sure the piece you are working on is stable
- Secure the piece you are working on by putting it in a vise or clamp on the workbench
- Never hold stock with one hand while trying to cut, chisel or drill it with the other hand
- Do not use gloves when using power tools- the glove material can get caught in spinning bits or disks, twisting fingers, etc, and injuring you
- Keep your hands away from the blade on any cutting tool
- Test tools for sharpness on wood or paper, not with your fingers
- To test for heat, place your hand near, but not on, the object

Respiratory protection and dust:

You must supply your own dust masks. When doing sanding or cutting of materials, you will be expected to have them, or you won't be allowed to work on your project.

Hearing:

The majority of the machines in Solid Space do not make levels of noise considered harmful, given the time a student may spend operating it. However, a few do, and hearing protection is available if needed. Machines that are very noisy include the mitre (chop saw) and the Delta disc/belt sander (if used over a period of time), so hearing protection is required when using these.

Housekeeping:

Clutter poses unnecessary slipping and tripping hazards; keep the floor and work surfaces clean and clear.

- Tools, materials and projects should all be stored safely and securely. Ask permission before storing projects in Solid Space
- Aisles and exits should be unobstructed at all times; keep cupboard doors closed, unused vises closed, stow away shop-vacs, keep electrical cords in out of traffic areas.

Personal responsibilities:

- If you feel unsafe about a particular activity, consult with your instructor or the Solid Space technician before proceeding
- If you see something dangerous, report it so it can be fixed
- Be aware of the risks your work may pose to others, especially when cutting long tubes, using compressed air, and grinders. See section on material handling.

Working conditions:

- Make sure your work area is well lit
- Ensure adequate ventilation
- Set your work up so that you are in a comfortable position and can avoid strains
- Use shop-vacs to clean clothing and shop areas

2.1 Solid Space Tool Use and Material Handling.

Power Tools:

You MUST ask before you go to use a power tool. If you can use it, it can only be under close supervision or with documented training. Some power tools are usually not available for general use: The router table, bench grinder, and plunge router. Whatever tool you are using, make sure it will cut, drill or grind only what you want to cut, drill or grind—you do not want the saw blade sticking out the bottom of the stock, the cutter hitting the top of a vise, or the drill bit breaking through the stock.

- Only use tools that are in good working order. Double check the blades, the power cords, for loose switches. If something does not seem right, ask about it
- If a tool is dull, broken or out of adjustment, has a bad power cord, or doesn't start up: Get the Solid Space technician on duty to remedy it. Do not do it yourself
- Adjustments requiring the re-configuration of a machine, such as changing sanding spindles or belts, changing blades on the band saw, tilting or altering machine tables are done only by a Solid Space Technician
- Know which direction your tool will go when you run material through it and which way the material will go; in other words, make sure you know what is going to happen before you operate a machine so you can be ready to control those forces.
- Be aware of the cutting path of the tool—keep your hands away from this area
- Make sure the cutting part is not going to come in contact with the power cord
- When using the drill press, you must **always clamp and secure** your materials to the drill press table
- Ensure the clamps themselves do not get in the way of what you are doing

When starting-up tools:

- Check to ensure that all guards and safety devices are in place and functioning properly
- Check to make sure the power switch is in the off position before plugging in a portable power tool
- Only the operator is to turn the tool on
- Stay beside running power tools
- Do not have machines running unattended and do not walk away from a machine you have been using until it comes to a complete stop
- Stop to make adjustments. Adjustments should never be made to a power tool while it is running. The operator's full attention should be on the cutter or active part of the machine.

Sharp objects:

Do not carry sharp objects such as nails, chisels, etc., in your pockets or mouth. Carry them with the pointed end facing downward.

Use tools as Intended:

Using tools improperly can lead to injury of self or damage to the tool, e.g., hammering with a wrench, prying with a chisel, using files without handles.

2.2

Material Handling Procedures in Solid Space:

- Move heavy objects using proper lifting techniques
- When moving heavy objects, be aware of others in the room
- Make sure materials are safely and securely stored, if necessary, ask for help
- Do not cut long tubing or similar material stock on the band saw
- Do not cut thin sheet goods such as 1/16" acrylic on the band saw. These can be cut with an Exacto knife more accurately and safely
- Have materials pre-sized whenever possible. ***When laser cutting this is a must.*** There is no table saw in Solid Space and we cannot cut down large sheet goods
- Solid Space is not equipped to do metalworking, heavy duty sanding (such as sanding down large flat solid wood tops or panels) or handle the use of solvents or spray paints

3.0 Bad Chemicals in Solid Space: Workplace Hazardous Materials Information System (WHMIS)

The Workplace Hazardous Materials Information System (WHMIS) describes safe use, storage, handling, supplier labels, workplace labels, and uses Material Safety Data Sheets (MSDS), to communicate information about hazardous materials.

Generally, spray paints, solvents and high VOC products cannot be, and will not be used in Solid Space. There is no adequate infrastructure in the space to let you safely use most of these things.

However, there are a few chemicals of a hazardous nature used in Solid Space that you should be aware of. The MSDS for these are in Solid Space.

To quickly summarize:

These are:

The chemicals used for the 3D printer.

Of special note is the tank with Sodium Hydroxide for dissolving the support materials for the 3D models. This is very caustic stuff and causes severe burns. ***It is off-limits to undergraduate students.***

The chemical tank, located by the sink,



Some glues you come into contact with when making prototypes can quite hazardous. Of note, and usually present in Solid Space, is Methylene Chloride . You must have extra ventilation and gloves when using this glue.

Always read the label and the MSDS, and follow the safe handling procedures before you use any product for the first time or cannot remember how to use it correctly.

Keep combustible supplies in the yellow fire cabinet on the counter