**Facilities, Equipment, and Other Resources**

**I. UCI SAMUELI SCHOOL OF ENGINEERING SHARED FACILITIES**

**Institute for Design and Manufacturing Innovation (IDMI)**

IDMI is a research institute within the Samueli School of Engineering with a goal to promote excellence in advanced manufacturing through strategic integration of research, education and community outreach. IDMI maintains state-of-the-art manufacturing facilities, with equipment available to UCI researchers, students, industrial partners, and members of the community. IDMI’s two distinct facilities are (1) RapidTech and (2) FABWorks. IDMI has a Machine Shop that supports researchers, students, and course requirements.

**A. RapidTech**

RapidTech is IDMI’s high-end facility, featuring some of the most advanced manufacturing equipment on the market, with a clear emphasis on additive manufacturing (3D printing) technologies. RapidTech owns and operates high-end equipment for nearly every additive manufacturing process, from Material Extrusion, Vat Polymerization, Binder Jetting, Material Jetting and Powder Bed Fusion (metals and polymers). Laser cutters, 3-D scanners and subtractive equipment are also available. RapidTech offers a variety of educational and training modules to students and industrial clients, and provides state-of­the-art multimaterial, multiscale processes to support research and development at all levels. The equipment at RapidTech is primarily used for research, graduate education, advanced professional training and industrial services but also to support undergrad classes and activities.

*Key equipment:*

##### **Stratasys Fortus 450MC**

**Category:** Material Extrusion
**Materials:** ABS-M30, ABS-M30i, ABS-ESD7, ASA, PC-ISO white, PC-ISO clear, **PC**, FDM Nylon 12, ULTEM 9085, ULTEM 1010
**Build Envelope:** 406x355x406mm/16x14x16”
**Layer Thickness:** 127um/.005″, 178um/.007″, 254um/.010″, 330um/.013″
**Description:** This industry grade machine extrudes a multitude of engineered thermoplastics with better material properties, greater detail and larger build envelope than its smaller siblings
**Class:** Industry
**Example Uses:**Functional bracketry, gears, enclosures, forming tools, higher temp/chemical resistant parts

##### **Stratasys Objet260 Connex3**

**Category:** Material Deposition
**Materials:** Blends of VeroGray, VeroBlue, VeroBlackPlus, VeroCyan, VeroMagenta, VeroYellow, VeroBlack, VeroWhitePlus, VeroPureWhite, VeroClear, TangoBlack, TangoBlackPlus, TangoClear, DurusWhite, AgilusClea, AgilusBlack, etc
**Build Envelope:** 255x252x200mm/10.0×9.9×7.9″
**Layer Thickness:** 16um/.0006″, 32um/.0013″
**Description:** This photopolymer based machine deposits droplets of several resins simultaneously, allowing for over 1000 different materials including parts with translucent, opaque, flexible, and rigid components.
**Class:** Industry
**Example Uses:** Soft touch parts, overmold simulations, mold masters, hinges, buttons, multiple stiffnesses and durometers.

**SLM 125HL**

**Category:** Powderbed Fusion
**Materials:** Titanium, Aluminum, Cobalt Chrome, **Stainless Steel**, Tool Steel, Nickle Based Alloys
**Build Envelope:** 125x125x125mm/4.9×4.9×4.9″, 50x50x50mm/1.97×1.97×1.97″
**Layer Thickness:** 20-75um/.0008-.003″
**Description:** This machine uses a laser to selectively melt layers of powdered metallic materials to create complex end-use parts and allow for materials development
**Class:** Industry
**Example Uses:** Complex end use parts, medical and aerospace parts, material development

##### **Autodesk Ember**

**Category:** Vat Photopolymerization
**Materials:** Open photopolymers
**Build Envelope:** 60x40x134mm
**Layer Thickness:** 10-100um
**Description:** This machine uses a projector to selectively cure thin layers of photopolymer to create high resolution plastic parts and allows for materials development.
**Class:** Prosumer/Experimental
**Example Uses:** High resolution small plastic parts, materials development

##### **Trotec Speedy 360**

**Category:** Laser cutter/engraver
**Materials:** Various plastics, wood, foam
**Build Envelope:** 813x508mm/32×20″
**Layer Thickness:** 80w
**Description:** This machine uses an 80watt CO2 laser to quickly cut and engrave many plastics, woods, and foams.
**Class:** Industry
**Example Uses:** Microfluidic devices, linkages, custom boxes, gaskets, awards, giveaways

##### **GOM ATOS Core 200**

**Category:** Structured Light Scanner
**Materials:** 80-130um/.0031-.0051″
**Build Envelope:** N/A – Scans can be stitched together to form larger objects
**Layer Thickness:** N/A
**Description:** This tripod mounted machine uses cameras, a projected pattern, and tracking dots to digitally recreate an object placed in front of it.
**Class:** Industry
**Example Uses:** Capturing 3D data from high detail objects like failed mechanical components, character sculpts, dental molds, engine parts, etc. for verification or reverse engineering

##### **ShopSabre 4860**

**Category:** Machining
**Materials:** Plastic, Wood, Foam, Wax
**Build Envelope:** Approximately 1475x1475x200mm/58x58x8″
**Layer Thickness:** 25um/.001″
**Description:** This machine uses a computer controlled router to cut stock precisely.
**Class:** Prosumer/Commercial
**Example Uses:** Machining polymer components like fMRI fixtures, nonmetallic molds for vacuum forming or composites, fixturing

**A.1. Saratech Suite**

Within the RapidTech facility lies the Saratech Suite. In a new partnership with Saratech, an award-winning provider of engineering and manufacturing solutions including Product Lifecycle Management (PLM) software, engineering and consulting services, and manufacturing hardware headquartered in Mission Viejo, CA, IDMI has broadened its additive manufacturing portfolio to include HP, Markforged, and BigRep. The partnership has brought a production capable HP Jet Fusion 4200 3D printer and depowdering station capable of high speed polyamide prints, access to the continuous fiber reinforced polymer parts capable Markforged Mark Two and X7 that bring carbon fiber, Kevlar, and fiberglass to the mix, as well as the Bigrep Studio for large platform, open material extruded builds. In addition, IDMI has access to the atomic diffusion additive manufacturing Markforged MetalX that uses polymer bound metal powders along with wash and sintering stages to create high detail metal components.

*Key equipment:*

##### **HP 4200 Jet Fusion Printer**

**Category:** Powderbed Fusion
**Materials:** PA 12, PA12 Glass Bead, PA 11
**Build Envelope:** 380 x 284 x 380 mm (15 x 11.2 x 15 in)
**Layer Thickness:** 0.08mm (0.003 in)
**Description:** This machine locally fuses polyamide powders to create many highly detailed, durable parts quickly.
**Class:** Commercial/Industrial
**Example Uses:** Wear items, lightweight replacement components, complex housings, orthotics, assemblies, production runs

##### **Markforged X7**

**Category:** Material Extrusion
**Materials:** Onyx, Carbon Fiber, Fiberglass, Kevlar, HSHT Fiberglass
**Build Envelope:** 330x270x200mm/13x10.6x7.9”
**Layer Thickness:** 50um/.002”
**Description:** This industry grade machine extrudes a multitude of engineered thermoplastics with better material properties, greater detail and larger build envelope than its smaller siblings
**Class:** Industry
**Example Uses:** Functional bracketry, gears, enclosures, forming tools, higher temp/chem resistant parts

##### **Markforged Mark Two**

**Category:** Material Extrusion
**Materials:** Onyx, Carbon Fiber, Fiberglass, Kevlar, HSHT Fiberglass
**Build Envelope:** 320x132x154mm/12.6x5.2x6”
**Layer Thickness:** 100um/.004”
**Description:** This commercial grade machine extrudes a multitude of engineered thermoplastics with better material properties, greater detail and larger build envelope than its smaller siblings
**Class:** Prosumer/commercial
**Example Uses:** Functional bracketry, gears, enclosures, forming tools, higher temp/chem resistant parts

##### **Markforged MetalX**

**Category:** Material Extrusion
**Materials:** Stainless steel, tool steel, Inconel, titanium
**Build Envelope:** 300x220x180mm/11.8x8.7x7.1”
**Layer Thickness:** 50um/.002”, 125um/.005”
**Description:** This machine extrudes metallic powders within a polymer matrix, reducing safety risks of traditional powder based metal additive manufacturing. The parts undergo a sintering operation to remove to polymer and leave behind metallic components.
**Class:** Industry
**Example Uses:** Metallic bracketry, gears, enclosures, forming tools, medical, dental, aerospace and automotive components

##### **Bigrep Studio**

**Category:** Material Extrusion
**Materials:** Open polymer filament
**Build Envelope:** 500x1000x500mm/19.7x39.4x19.7”
**Layer Thickness:**0.1mm-0.8mm depending on selected extruder/nozzle
**Description:** With a build envelope spanning meter long, the machine is made for 3D printing large-scale objects by extruding thermoplastic filaments.
**Class:** Prosumer/Commercial
**Example Uses:** Functional prototypes, composite tooling, mock-ups of large parts, body panels, seats, furniture

**B. FABWorks**

The mission of FABWorks is to reinvent the way people create and innovate, offering a space where students, faculty and the community can design and fabricate almost anything. Among FABWorks’ prosumer grade (above consumer grade) equipment are 3D printers and laser scanners, computer-controlled milling machines, laser cutters, electronics development and diagnostics equipment, industrial sewing machines and more. The FABWorks space offers expanded opportunities for those interested in hands-on, advanced-manufacturing experience and creates a hub where creativity can propel next-generation technologies. FABWorks offers training to member of UCI and the community as a whole.

*Key equipment:*

##### **LulzBot Taz 6**

**Category:** Material Extrusion
**Materials:** ABS, PLA, TPE/TPU, nylon filaments **Build Envelope:** 280x280x250mm/11x11x 9.8″
**Layer thickness: 0.05-0.40mm/.002-.020” depending on settings
Notes:** The Lulzbot offers a larger build platform than most and can run rigid or flexible polymer filaments with the swap of a head.

**Ultimaker 3**
**Category:** Material Extrusion
**Materials:** PLA, ABS, CPE, CPE+, PVA, PC, TPU, 95A, PP, Nylon
**Build volume:** 197x215x200mm/7.8x8.5x7.9”
**Layer Thickness:** 60-600um/.002-.024” depending on nozzle and settings
**Notes:** The Ultimaker can print in a finer resolution than most material extrusion machines and with two materials simultaneously, allowing the use of water soluble PVA as a support.

**Formlabs Form2
Category:** Vat photopolymerization
**Materials:** Photopolymer resin (opaque, translucent, rigid, flexible)
**Build volume:** 145X145X175mm/5.7x5.7x6.9”
**Layer thickness:** 25um/.001”, 50um/.002”, 100um/.004”
**Notes:** The Form2 uses light to selectively cure a thin layer of photopolymer to create high resolution plastic parts. The Form2 is best suited for smaller parts and times when something needs to be watertight or translucent.

**Epilog Fusion M2**

**Category:** Laser cutter/engraver
**Materials:** Various plastics, wood, foam
**Build Envelope:** 1016x711mm/40×28″
**Layer Thickness:** N/A
**Notes:** This machine uses an CO2 laser to quickly cut and engrave many plastics, woods, and foams and could be good for microfluidic devices, linkages, custom boxes, gaskets, awards, and giveaways

##### **Epilog Mini**

**Category:** Laser cutter/engraver
**Materials:** Various plastics, wood, foam
**Build Envelope:** 457x305mm/18×12″
**Layer Thickness:** N/A
**Notes:** This machine uses a CO2 laser to cut and engrave many plastics, woods, and foams and could be good for smaller microfluidic devices, linkages, custom boxes, gaskets, awards, and giveaways

##### **ShopSabre 3636**

**Category:** Machining
**Materials:** Plastic, Wood, Foam, Wax
**Build Envelope:** Approximately 914x914x200mm/36x36x8″
**Layer Thickness:** 25um/.001″
**Description:** This machine uses a computer controlled router to cut stock precisely.
**Notes:** Great for machining foam and wood bucks for composite tooling, building knockdown furniture, creating rigid holders and parts

##### **NextEngine 3D Scanner**

**Category:** 3D laser scanner
**Materials:** Most opaque, non-reflective materials will scan
**Notes: Able to scan things smaller than a fist and bigger than a car with patience. Individual scans can be aligned and stitched together to create larger, more complete scans.**

Additionally, FABWorks also has woodworking tools like a sliding compound mitre saw, bandsaw, scrollsaw, belt sander, and drill press, as well as electronics tools like signal generators, voltage supplies, and soldering irons.

**C. Samueli School of Engineering Machine and Weld Shops**

The IDMI also oversees the Machine Shop and Weld Shops, whichsupports researchers, student clubs, and course requirements. Our highly skilled shop managers and instructors, Tucker Parris and Tyler Schuldt, are available to provide technical support to faculty and students working in the shops. Mills, lathes, and welding equipment are available for use. Machines are available on a walk-in basis (excluding in-session class instruction) or on a reserve request.  The Machine Shop is generally stocked with tools in imperial units including various taps of generic sizes.

**D. IDMI Governance and Staffing**

Professor Lorenzo Valdevit, Department of Materials Science and Engineering, is IDMI’s Director. As governance, IDMI has three faculty Associate Directors. Mr. Benjamin Dolan, is the Technical Director of the IDMI and Director of RapidTech. He has more than 15 years of experience in the development and use of technology for advanced manufacturing, specifically 3D printing as it applies to undergraduate education and product development. Mr. Don Fruta is IDMI’s Administrative Analyst. In addition to his administrative responsibilities, Mr. Fruta manages and maintains the IDMI website and social media updates to keep content accurate, timely and informative.