Tools

- Screw Driver
  - Slot
  - Phillips
  - Robertson
    - #0-3
- Awl
- Centre Punch
- Countersink
- Reamer / Large Drill Bit
- Rivet Gun
- Allen Key
- Torx Wrench
- Vise Grips
- Crescent Wrench
- Adjustable Spanner
- Retaining Ring Pliers
- Pipe Cutter
- Mini Anvil
- Hammer

Bolts & Screws

Bolts
- Hex
  - Metric
  - SI
- Tap
  - No shank
- Shoulder / Stripper
- Sex

Screws
- Self-tapping
- Countersunk
- Lag
- Cap
  - Allen (Socket)
  - Torx
- Set
Hex Bolts

- \( S \) = shank diameter
- \( T \) = thread diameter
  - Major diameter
  - Clear diameter
- \( R \) = root diameter
  - Minor diameter
  - Tap diameter
- \( H \) = head width
  - Wrench size

Tap / Die

- 4-40
  - #4 diameter
  - 40 threads/inch
- 6-32
- 8-32
- 10-24
- Metric

- Hole
  - Clear
  - Tap

- Thread
  - Hand turned
  - Hand drilled
  - Cutting fluid
## Nuts & Washers

<table>
<thead>
<tr>
<th>Nuts</th>
<th>Washers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hex</td>
<td>Flat</td>
</tr>
<tr>
<td>Wing</td>
<td>Fender</td>
</tr>
<tr>
<td>Lock</td>
<td>Lock</td>
</tr>
<tr>
<td>Deep</td>
<td>- Internal tooth</td>
</tr>
<tr>
<td></td>
<td>- External tooth</td>
</tr>
</tbody>
</table>

## Pins, Springs & Clips

<table>
<thead>
<tr>
<th>Pins</th>
<th>Clips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotter pin</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>- retaining</td>
</tr>
<tr>
<td>Springs</td>
<td>E</td>
</tr>
<tr>
<td>Compression</td>
<td>Retaining Ring</td>
</tr>
<tr>
<td>Extension</td>
<td>- Internal</td>
</tr>
<tr>
<td></td>
<td>- External</td>
</tr>
<tr>
<td></td>
<td>DIP</td>
</tr>
</tbody>
</table>
Chemicals

**Adhesives**
- Loctite
  - Red
  - Blue

**Lubricants**
- Grease
- WD40

Shafts

**Connections**
- Axial Constraint
  - Shoulder
  - Cotter pin
  - Retaining ring
  - Squeezed shaft
- Angular Constraint
  - D Shaft
  - Spline
- Full Constraint
  - Hose Clamp
  - Pinch Clamp
  - Compression Fit
  - Interference Fit

**Joints**
- Sintered Bearing
  - Plain
  - Thrust Washer
- Rolling Element
  - Ball
  - Roller
  - Needle
  - Self-Aligning
Connections

Support
• Cantilever
• Sandwich
  – Clear / Chamfer
  – Clear
  – Tap

Adjustability
• Chamfer
• Over-size drill / Fender washer
• Multi-Slot
• Pivot / Slot
• Slider / Set-Screw
• Slider / Pinch Clamp
• Slider / Through-bolt

Remember
• Glue does not stick to metal
• You cannot weld Al
• Fe rusts if it is not painted / powder coated
• A prototype should be
  – Disassemble-able
  – Adjustable
  – Modular
• The shop gets busier later in the term