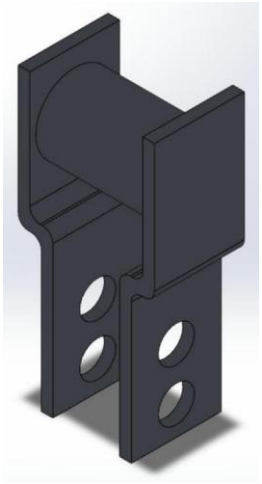
Car 5 Body Latch System

Manufacturing Process Outlines

Solar Gators, University of Florida
Cockpit Subsystem
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October 18, 2026





Parts Covered

Quantities are for one car with two latches. Part geometry and dimensions are taken from the final CAD models. Part drawings with tolerances are issued separately.

Part No.	Part	Material	Stock	Qty	Primary Process
SG-C5-LATCH-01	Bulkhead attachment plate	6061-T6 aluminum	0.150 in plate	4	Waterjet
SG-C5-LATCH-02	Bent rib bracket	1020 CR steel	0.100 in sheet	4	Waterjet, press brake
SG-C5-LATCH-03	Striker pin	1020 steel	3/4 in round bar	2	Lathe
SG-C5-LATCH-04	Rib attachment weldment	02 + 03	n/a	2	MIG weld

Referenced Throughout the Manufacturing Processes:

Shop Safety Check

1. Wear safety glasses and closed toe shoes. Tie back long hair and remove gloves, jewelry, and loose clothing before running any rotating machine.
2. Confirm you are trained on the machine and that a trained shop member is present when the shop requires one.
3. Clear chips, scrap, and loose tools from the machine and the work area.
4. Locate the emergency stop before starting the machine.

Waterjet Check

1. Confirm the material and thickness selected in the waterjet software match the stock on the table.
2. Clamp or weight the sheet so it cannot lift or shift while the jet pierces.
3. Trace the toolpath with the nozzle raised to confirm every part sits inside the sheet and clear of the clamps.
4. Keep hands out of the cutting area and stay at the machine while it runs.

Lathe Check

1. Make sure the power is off and the spindle has fully stopped before changing the workpiece or tooling.
2. Remove the chuck key immediately after tightening the chuck.
3. Check that the cutting tool is on center and the tool post is locked.
4. Set the spindle speed and confirm the spindle direction before cutting.
5. Close the chuck guard before turning the machine on.

Welding Check

1. Wear an auto darkening welding helmet, leather welding gloves, and a flame resistant jacket.
2. Remove flammables from the area, set up welding screens, and turn on fume extraction.
3. Attach the ground clamp to clean bare metal on the fixture or the part.
4. Set wire speed and voltage from the welder chart for 0.100 in steel and run a test bead on scrap of the same thickness.

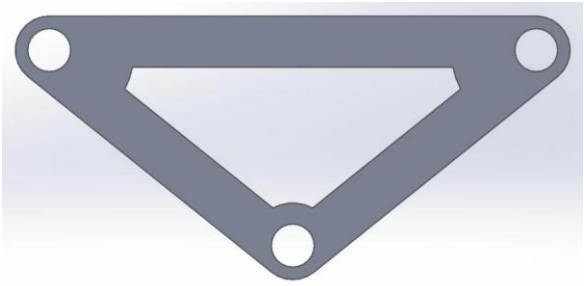
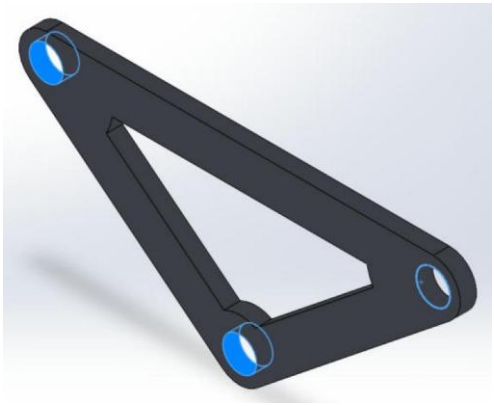
Spindle Speed Calculation

Eq. 1: $N = 12V / (\pi D)$, where N is spindle speed [RPM], V is the recommended surface speed [ft/min] for the tool and material, and D is the workpiece diameter [in].

Recommended HSS surface speeds from [1] are 250 ft/min for aluminum and 100 ft/min for mild steel (0.2 to 0.3 percent carbon). For the striker pin, D = 0.750 in gives $N = 12(100) / (\pi \cdot 0.750) = 509$ RPM, so the lathe is set to the nearest available speed at or below 509 RPM.

Bulkhead Attachment Plate (SG-C5-LATCH-01)

Material	6061-T6 aluminum	**Quantity**	4 (2 per latch)
Stock	0.150 in plate	**Part envelope**	4.075 in x 1.930 in
Features	3 x Ø 0.3125 in holes, triangular cutout	**Mass**	0.044 lb each

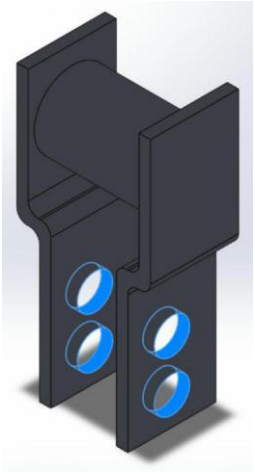
Manufacturing Processes	Process Setup
In SolidWorks, select the top face of the bulkhead attachment and export it as a 1:1 DXF in inches. Load the DXF into the waterjet software.	
Nest four plates, plus one spare if the stock allows, with at least 0.25 in between parts and from the sheet edge. Place lead ins on the scrap side of each profile.	
Select 6061-T6 aluminum at 0.150 in in the material settings. Perform the shop safety check and the waterjet check.	
Load the plate, clamp it, and set the origin and nozzle standoff.	
Cut the three Ø 0.3125 in holes first.	

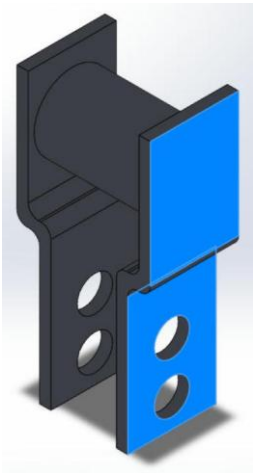
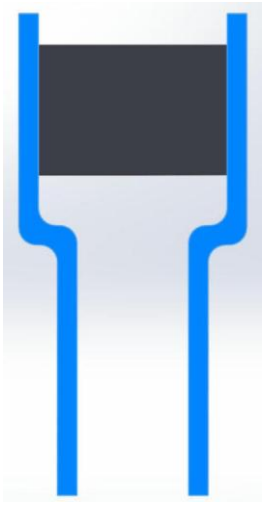
Manufacturing Processes	Process Setup
Cut the triangular lightening cutout next.	
Cut the outer profile last so the part stays held in the sheet while the inner features are cut.	
Remove the parts, rinse off the garnet, and dry them.	
Deburr all outer edges, the cutout, and both sides of each hole with a deburring tool and a file. Break all sharp edges.	
Check the part envelope (4.075 in x 1.930 in), the 3.575 in spacing between the top holes, and the 1.430 in drop from the top holes to the bottom hole with calipers. Confirm the mounting bolt passes through each hole.	
Label and bag the parts. Clean the waterjet table and work area.	

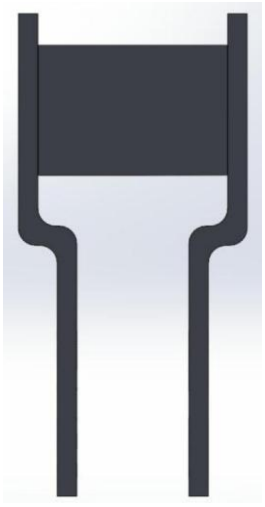
Bent Rib Bracket (SG-C5-LATCH-02)

Material	1020 cold rolled steel	**Quantity**	4 (2 per latch)
Stock	0.100 in sheet	**Blank**	0.779 in wide x flat pattern length
Features	2 x Ø 0.3125 in holes, 0.200 in joggle	**Finished height**	2.500 in

Both brackets in a pair are the same part. One is rotated 180 degrees at assembly so the joggles face outward.

Manufacturing Processes	Process Setup
Generate the flat pattern of the bracket in SolidWorks as a sheet metal part at 0.100 in, using the inside bend radius of the brake tooling. Export the flat face as a 1:1 DXF in inches. The blank is 0.779 in wide.	
Nest four blanks, plus one spare, in the waterjet software with lead ins on the scrap side. Select 1020 steel at 0.100 in. Perform the shop safety check and the waterjet check.	
Load and clamp the sheet. Cut the two Ø 0.3125 in holes, then the blank outline. The holes sit on the centerline at 0.25 in and 0.70 in from the bottom end.	

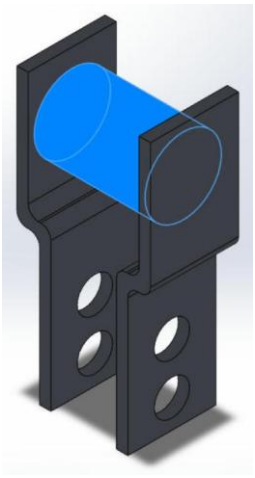
Manufacturing Processes	Process Setup
Remove the blanks, rinse, and dry immediately so the steel does not flash rust. Deburr all edges and both sides of each hole.	
Apply layout fluid and scribe both bend lines across each blank, measured from the hole end using the flat pattern.	
Set up the press brake with punch and die for 0.100 in steel. Perform the shop safety check.	
Make the first bend on the lower bend line.	
Flip the blank and make the second, opposing bend on the upper bend line so the two tabs end up parallel with a 0.200 in offset.	

Manufacturing Processes	Process Setup
Check each bracket with calipers. Offset between outer faces is 0.200 in, overall height is 2.500 in, and the straight lengths on the outer face are 1.11 in (upper tab) and 1.21 in (lower tab). Re-hit a bend if needed.	
Repeat for all four brackets. Clean the press brake and work area.	

Striker Pin (SG-C5-LATCH-03)

Material	1020 steel	**Quantity**	2 (1 per latch)
Stock	3/4 in round bar	**Finished size**	Ø 0.675 in x 0.979 in
Process	Bandsaw, lathe	**Spindle speed**	509 RPM max (Eq. 1)

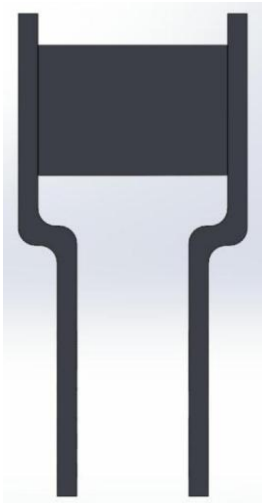
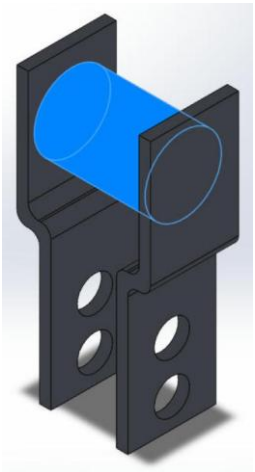
The pin is steel so it can be MIG welded to the steel brackets.

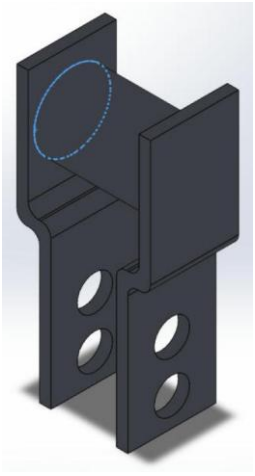
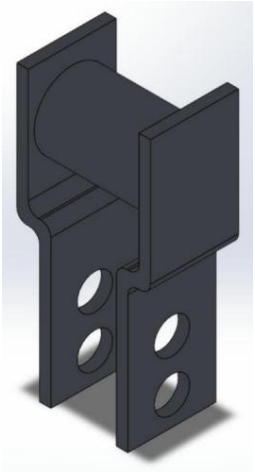
Manufacturing Processes	Process Setup
Clamp the 3/4 in round bar in the bandsaw vise, measure and mark, and cut a 2.5 in length for each pin.	
Remove the stock from the bandsaw vise and deburr the cut ends.	
Install the stock in the three jaw chuck with about 1.25 in sticking out. Perform the shop safety check and the lathe check, then set the spindle speed to the nearest available speed at or below 509 RPM.	
Face the end of the stock.	
Turn the outside diameter from 0.750 in down to 0.675 in over at least 1.1 in of length. Take roughing passes, then a light finishing pass.	
Lightly deburr the turned edge. Do not chamfer the end faces, since they are the weld faces.	
Turn off the machine and wait for the spindle to stop. Cut the pin off slightly over 0.979 in on the bandsaw.	

Manufacturing Processes	Process Setup
Flip the pin in the chuck and face the cut end to a final length of 0.979 in.	
Check the diameter (0.675 in) and length (0.979 in) with calipers. Test fit the pin in a rotary latch before welding. Clean the lathe.	

Rib Attachment Weldment (SG-C5-LATCH-04)

Components	2 x SG-C5-LATCH-02, 1 x SG-C5-LATCH-03	**Quantity**	2 (1 per latch)
Process	MIG weld	**Mass**	0.211 lb each
Lower tab gap	0.579 in (rib panel)	**Pin location**	0.50 in below top, centered

Manufacturing Processes	Process Setup
Grind the pin end faces and the inner faces of both upper tabs to bare metal with a flap disc, then wipe them with acetone.	
Clamp a 0.579 in spacer, or a scrap of the rib panel, between the lower tabs of two brackets with the joggles facing outward. Run bolts through the holes so both brackets line up.	
Set the striker pin between the upper tabs, centered across the 0.779 in width with its center 0.50 in below the top edge. Clamp the upper tabs against the pin ends.	
Perform the welding check. Tack each pin end in two spots on opposite sides.	

Manufacturing Processes	Process Setup
Recheck the pin position, the 0.579 in lower tab gap, and that the bolts still pass through both brackets. Break and redo a tack if anything moved.	
MIG weld a continuous fillet around each pin end where it meets the upper tab, alternating sides to limit distortion. Keep weld off the middle of the pin where the latch rotors close on it.	
Let the weldment air cool. Do not quench. Remove it from the fixture.	
Remove spatter with a wire brush. Inspect each weld for full fusion around the pin with no cracks, porosity, or undercut.	
Final check. Confirm the 0.579 in lower tab gap, that a bolt passes through both brackets, and that the pin closes freely in a rotary latch.	
Apply a rust preventive coating, keeping the pin contact surface clean. Label the weldments and clean the welding area.	

References:

[1] “Speeds and Feeds,” *Ufl.edu*, 2025. https://web.mae.ufl.edu/designlab/Advanced%20Manufacturing/Speeds%20and%20Feeds/Speeds%20and%20Feeds.htm

[2] J. Bethke, Car 5 final CAD models, “bulkhead attachment” and “bent rib attachment 2,” Solar Gators, October 2026.

[3] M. Sabag and J. Bethke, “Car 5 Body Latch System, Mechanical Design Review,” Solar Gators, University of Florida, 2026.