Project 6.9 Multiple Process Tooling Monthly Report

Project Team Leader

Institute for ADVANCED Composites Manufacturing INNOVATION

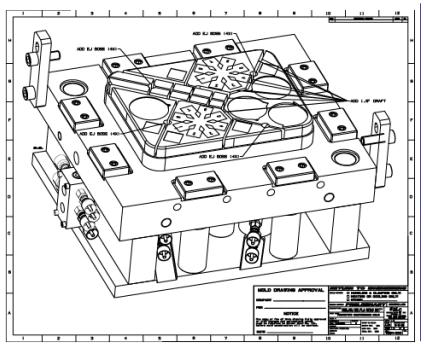
6.9 Multiple Process Tooling

- **Challenge:** Decisions made early in the automotive design process influence material selection, which in turn dictates process, then tool design. Because of the tool build time and cost of tooling, the original path is not easily altered, even if there is compelling evidence another material or process would be beneficial.
- **Approach:** The proposed project is a tool design which will be agile enough, to allow its use in multiple processes, injection, injection compression, extrusion-compression, and Compression
- **Impact:** *The cost of tooling is usually the bottleneck in innovation and part development. The ability to design and optimize product development with tooling applicable across multiple processes reduces significant costs.*

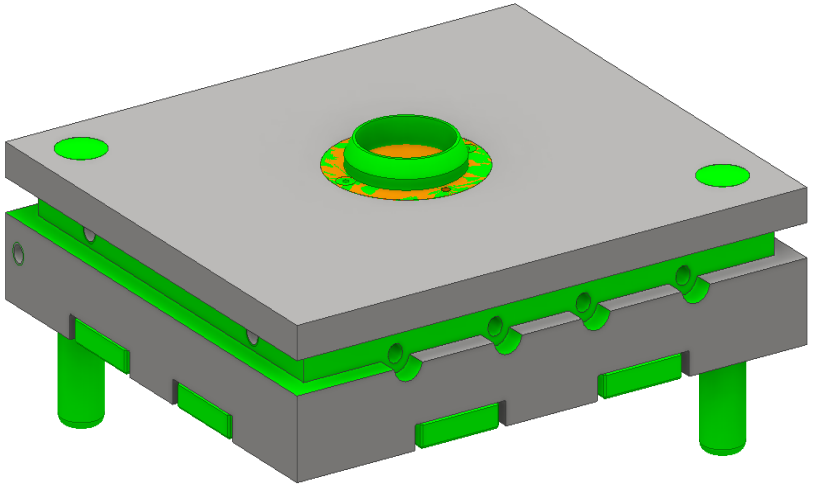
Team: Valley Enterprise, ORNL, UTK

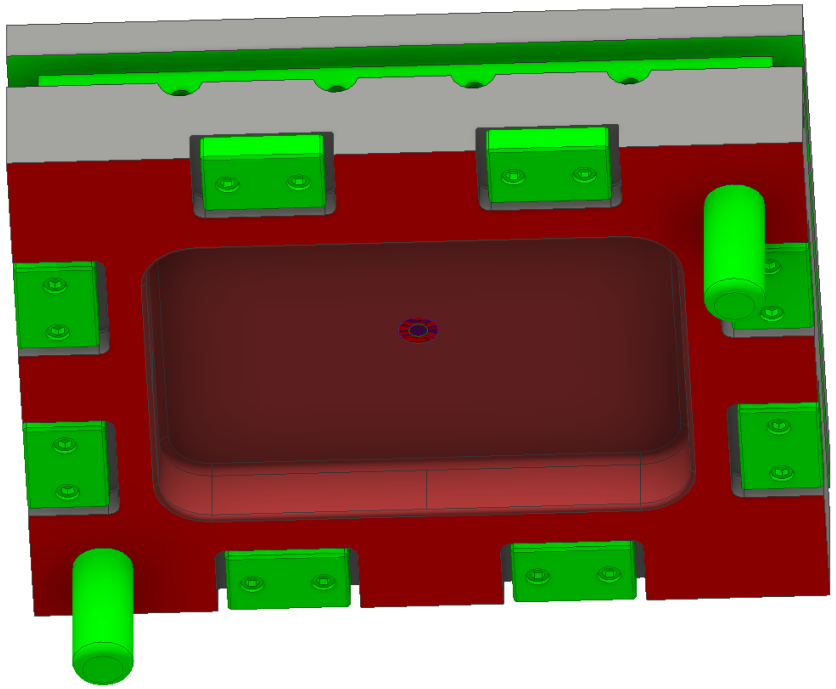
Technical Area: Material and Process

Type: Technical Collaboration – 11 months

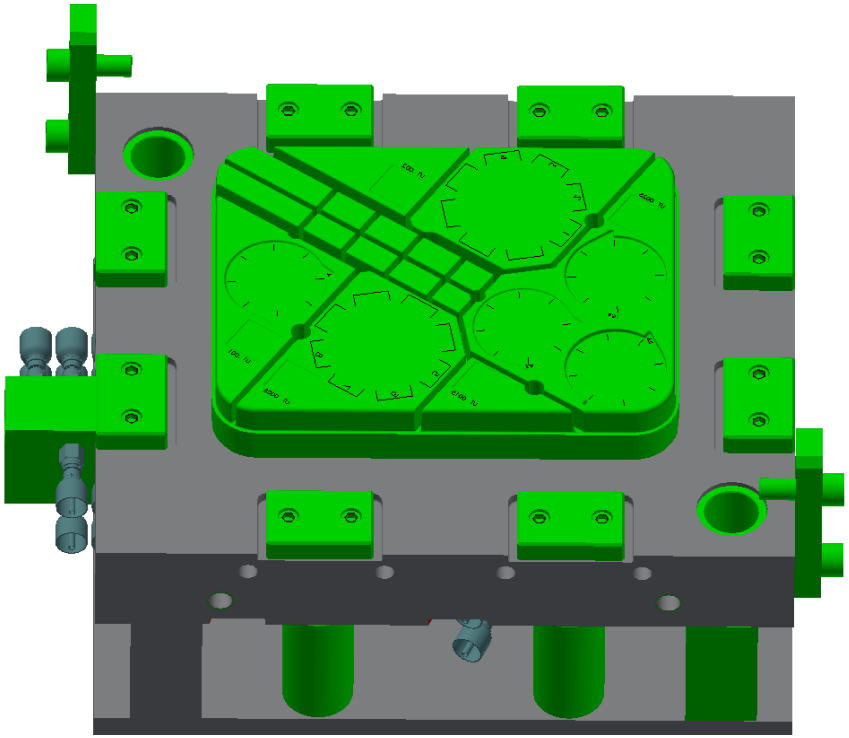


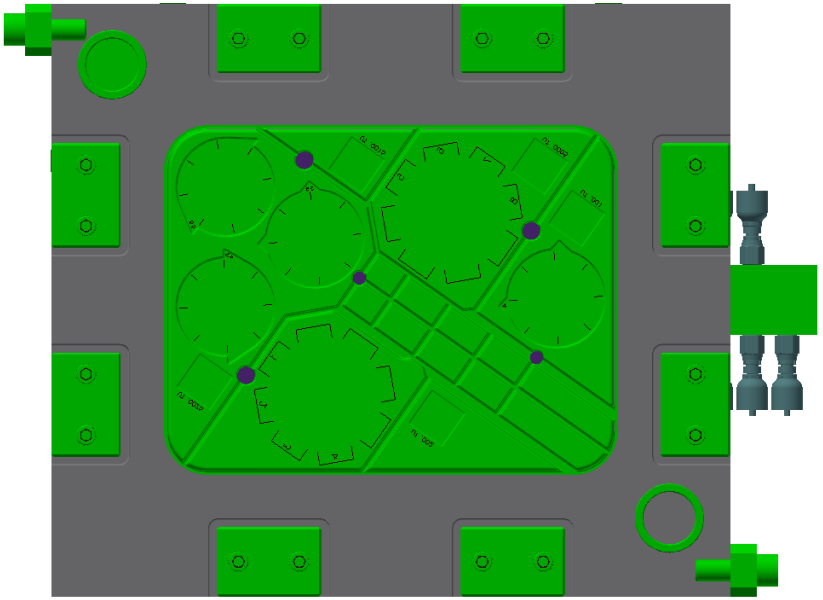
Cavity tool side



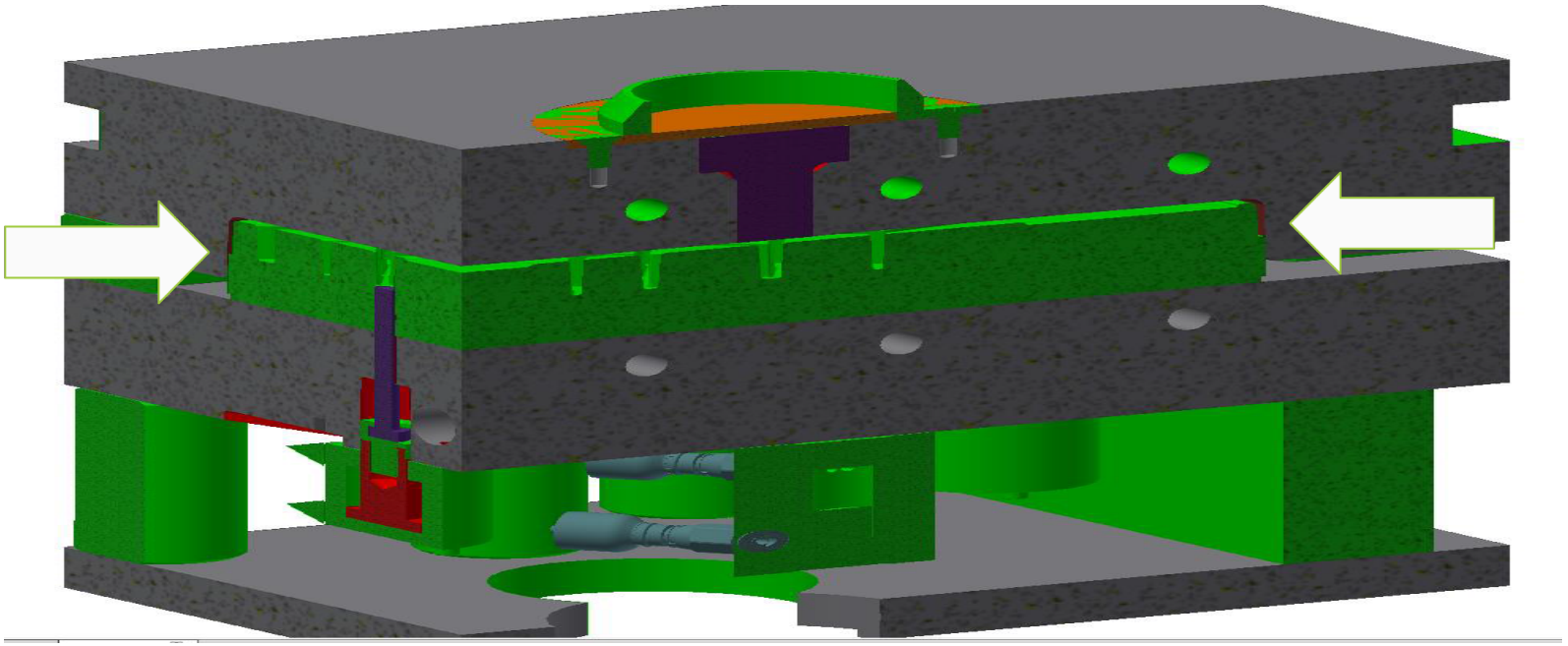


Core Side



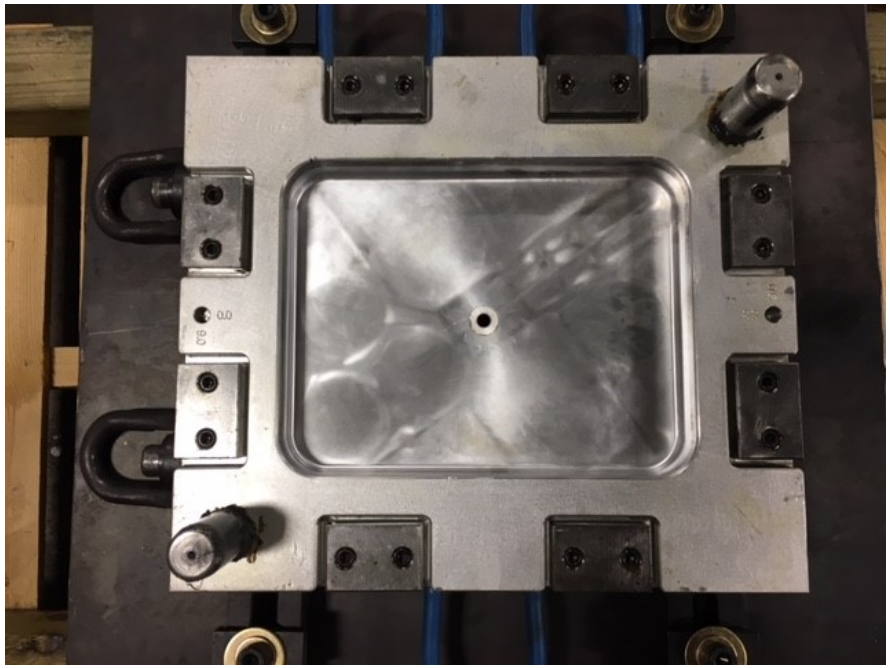


By-Pass perimeter to allow venting .001”, it also provided a fill barrier in compression processes.

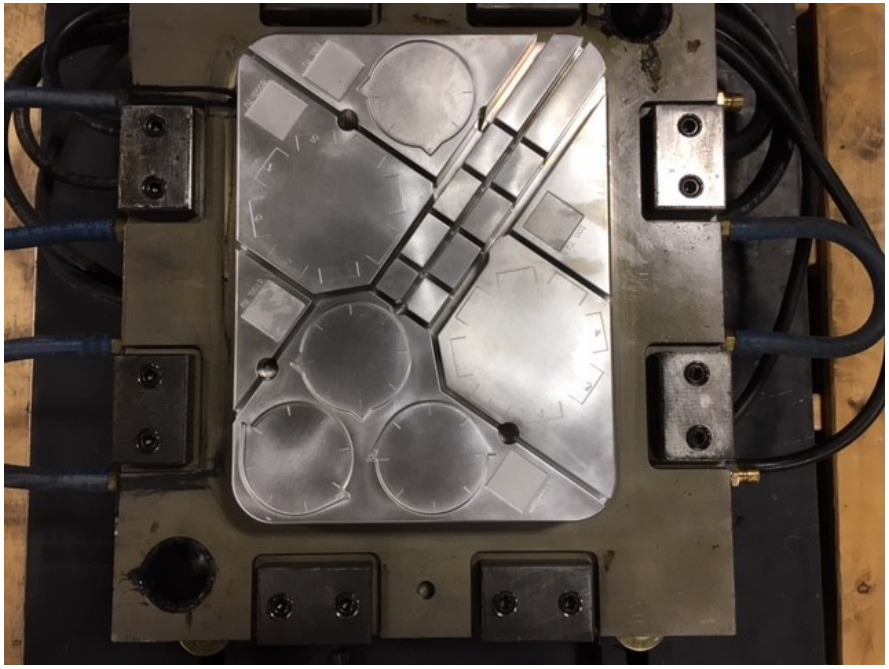


Tool

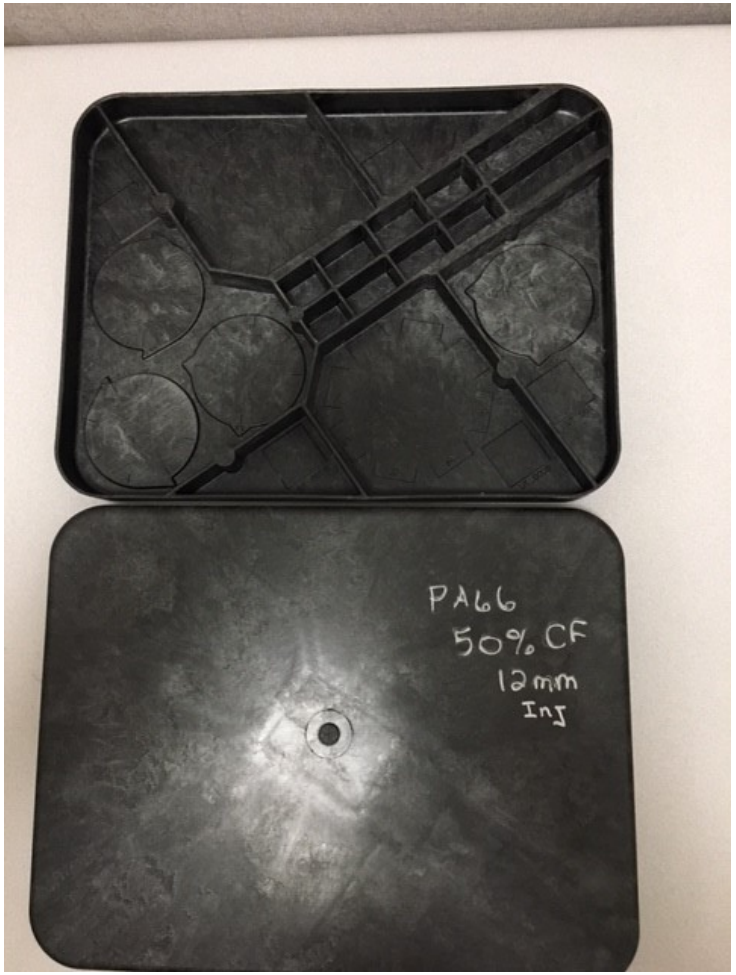
Cavity side

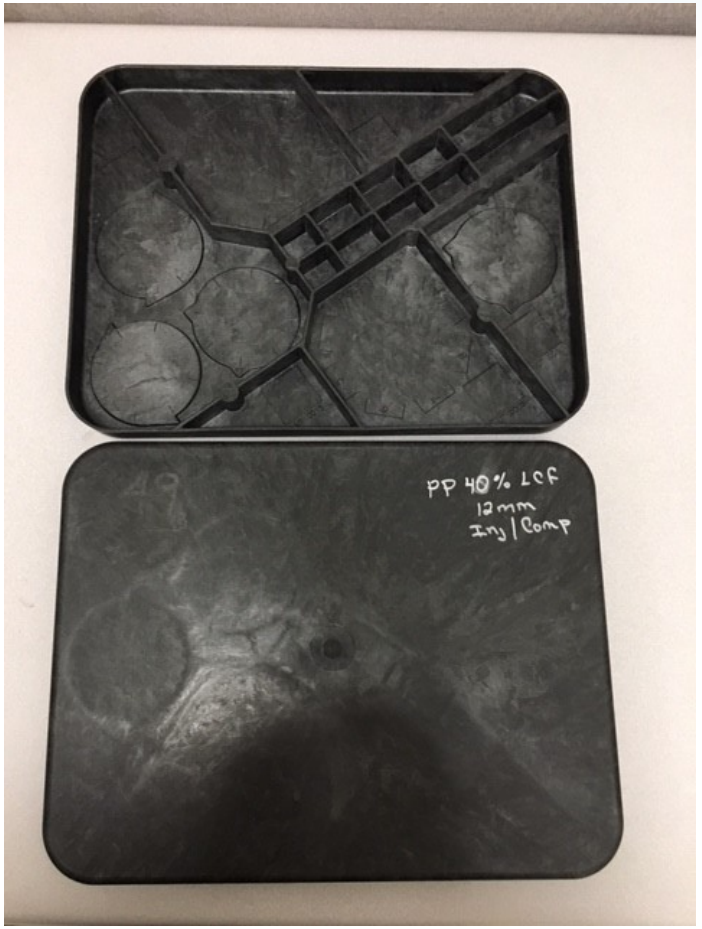


Core side

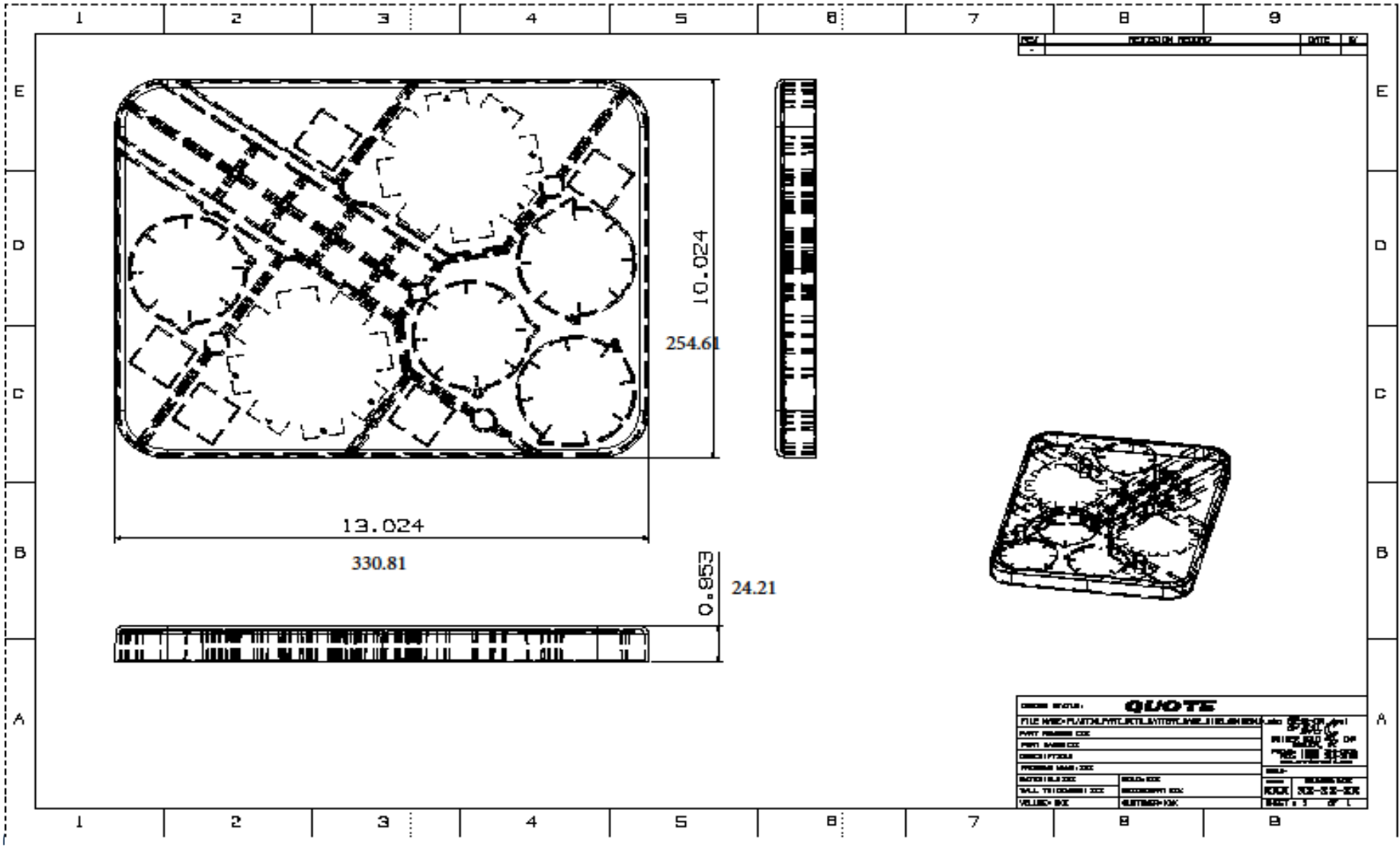


Molded Parts





Part Drawing



Initial dimensional results – No significant deviation from expected values.

			Part Actual (mm)			Tool (mm)			Part Calculated (mm)			% Actual to Calculated		
Material	Process	Shrink	L	W	H	L	W	H	L	W	H	L	W	H
PP	Injection	2.00%	325.75	250.58	23.72	330.81	254.61	24.21	324.19	249.52	23.73	100.48%	100.43%	99.98%
PP 40% LCF (12mm)	Injection	0.15%	330.42	254.00	24.21	330.81	254.61	24.21	330.31	254.23	24.17	100.03%	99.91%	100.15%
PP 40% LCF (12mm)	Injection/Compression	0.15%	330.41	254.23	24.10	330.81	254.61	24.21	330.31	254.23	24.17	100.03%	100.00%	99.70%
PA6 33% Glass (3mm)	Injection	0.15%	330.15	253.48	24.18	330.81	254.61	24.21	330.31	254.23	24.17	99.95%	99.71%	100.03%
PA66 LCF 50% (12mm)	Injection	0.12%	330.31	254.35	24.31	330.81	254.61	24.21	330.41	254.30	24.18	99.97%	100.02%	100.53%
PA66 LCF 50% (12mm)	Injection/Compression	0.12%	330.29	254.28	24.28	330.81	254.61	24.21	330.41	254.30	24.18	99.96%	99.99%	100.41%
PA66 LCGF 25/25% (12mm)	Injection/Compression	0.13%	330.23	254.18	24.09	330.81	254.61	24.21	330.38	254.28	24.18	99.95%	99.96%	99.63%

Budget Status (June 2018)

Labor Cost Share

Name/Title	Date	Hours	Rate	Total Cost
F Ahearn/Maint.	4/27/2018	12.23	$50.00	$611.50
Total				$61,597.00
				$0.00

Equipment Cost Share (Please attach quote, invoice, receipt, or basis of value)

Equipment Description	Cost Share Type (Check only ONE)	Rate/Hour (if applicable)	Hours (if applicable)	Equipment Value (if applicable)	Total Cost
specialty Injection mold screw - Trial #3	_____				$1,392.00
				Total Cost	$38,692.00

Material Cost Share (Please attach quote, invoice, receipt, or basis of value)

Material Description	Quantity	Unit Cost	Total Cost
PlastiComp LCF40-PP 1-14 NAT	[illegible]	[illegible]	$1,849.65
PlastiComp LCF40-PP 1-14 NAT	[illegible]	[illegible]	$840.75
PlastiComp LCF50-PA66 1014 NAT	[illegible]	[illegible]	$2,409.00
PlastiComp LCF50-PA66 1014 NAT	[illegible]	[illegible]	$1,606.00
PlastiComp LCG25/25-PA66 1014 NAT	[illegible]	[illegible]	$2,064.15
Polyone - Polypropylene	[illegible]	[illegible]	$294.00
BASF - PA6	[illegible]	[illegible]	$891.00
	Total		$9,954.55

Purpose and # of Traveler(s)	Origin/ Destination	Airfare $	Lodging $	Mileage/Rental $	Meals $	Other $	Total Cost
							-
							-

Other Cost Share (Please attach quote, invoice, receipt, or basis of value)

Item Description	Number of Items	Item Unit Cost	Total Cost
Carton	24.00	1.58	$37.92
Freight	1.00	175.10	$175.10
		total	$213.02

Indirect Cost

Type	Rate	Total Cost
Fringe Benefits		
F&A / G&A		
Overhead		
Other _____		

Total Cost Share (Sum of all cost share above) $110,456.57

Certification (I certify the cost share information provided is applicable, reasonable, verifiable, and allowable to the IACMI program and is not from or included as contribution to any other federally-assisted project or effort.)

Printed Name:	Mark Robinson	E-mail:	mrobinson@geminigroup.net
Title:	Manufacturing Engineering and R&D Manager	Phone Number:	989-553-5807
Signature:		Date:	5-Jul

Summary of Progress (June 2018)

- April 2018 – Injection Mold PP (PolyOne)
- May 2018 - Injection Mold PA6 33% GF (3mm) BASF
- May 2018 – Injection Mold PP 40% LCF (12mm) PlastiComp
- May 2018 – Injection/Compression Mold PP 40% LCF (12mm) PlastiComp
- June 2018 – Injection Mold PA66 50% LCF (12mm) PlastiComp
- June 2018 – Injection/Compression Mold PA66 50% LCF (12mm) PlastiComp
- June 2018 – Injection/Compression Mold PA66 25% LCF 25% LGF (12mm) PlastiComp
- June 2018 Injection Mold PA6 30% LCF
- June 2018 Injection Mold TPU 30% LCF

Milestone Status (month/year)

Milestones-Stage 1
(Show % completion each month)

Milestone 1. 6.9.2.1 Mold Drawings 100%

Milestone 2. 6.9.4.1 Identify Part 100%

Milestone 3 . 6.9.42 Mold Parts 50%

Milestones-Stage 1 (cont)

Milestone 4. 6.9.5.1 Report mechanical performance 7%

Milestone 5.

Milestone 6.

Go/No Go - 6.9.1 GNG – 0%

Schedule (month/year)

% Complete	Task Mode	Task Name	Duration	Start	Finish	Predecessors
100%	Manually Scheduled	6.9.2 Mold design	66 days	Tue 8/1/17	Tue 10/31/17	
100%	Manually Scheduled	6.9.2.1 Mold design and drawings	42 days	Wed 11/1/17	Thu 12/28/17	1
100%	Manually Scheduled	6.9.3.1 Tool sign Off	14 days	Fri 12/29/17	Wed 1/17/18	2
50%	Manually Scheduled	6.9.4 Mold Trials	110 days	Thu 4/26/18	Wed 9/26/18	
100%	Manually Scheduled	6.9.4.1 identify specific component	110 days	Thu 4/19/18	Wed 9/19/18	
50%	Manually Scheduled	6.9.4.2 Mold Parts 30 each	110 days	Fri 4/26/19	Thu 9/26/19	
7%	Manually Scheduled	6.9.5 Part Characterization	60 days	Fri 9/27/19	Thu 12/19/19	6
0%	Manually Scheduled	6.9.5.1 Report Mechanical Performance	21 days	Fri 12/20/19	Fri 1/17/20	7

Risk Update (June 2018)

Risks (scope, schedule, budget)

The main risk for this type of by-pass tooling with tight tolerance at the perimeter, is temperature balance between core and cavity tool halves. If temperature difference becomes too great, the expansion of metal can either create gapping issues (flash) or a crash condition (tool repair).

Plans for Risk Mitigation

Monitor tool temps. In production this would be done electronically, creating a "no go" condition, not allowing the equipment to cycle.

Next Steps

July 2018 – Begin Extrusion/Compression portion of the Project, PP, then Move to LCF filled Resins.

July 2018 Begin characterization of Injection and Injection/ Compression parts

Quarterly Requirement: Non-Confidential Accomplishment

- Tool is built, with design intent for multiple processes, with geometries, grains, textures, ribbing…etc. which will create valuable information after the parts have been characterized.
- Molding trial successes, indicate tool design is feasible for Injection and Injection/Compression.