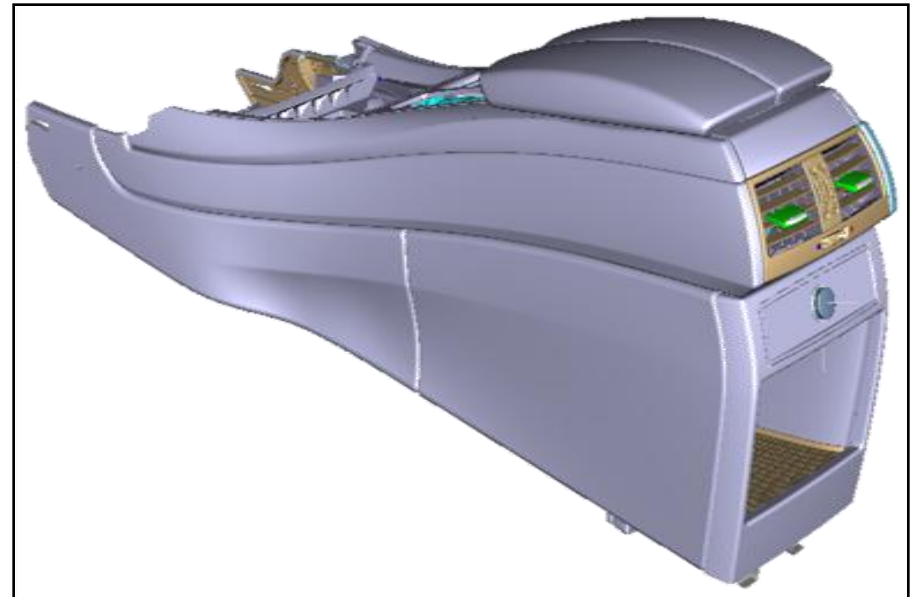


## Mechanical Engineering Design Group



### Active Participants:

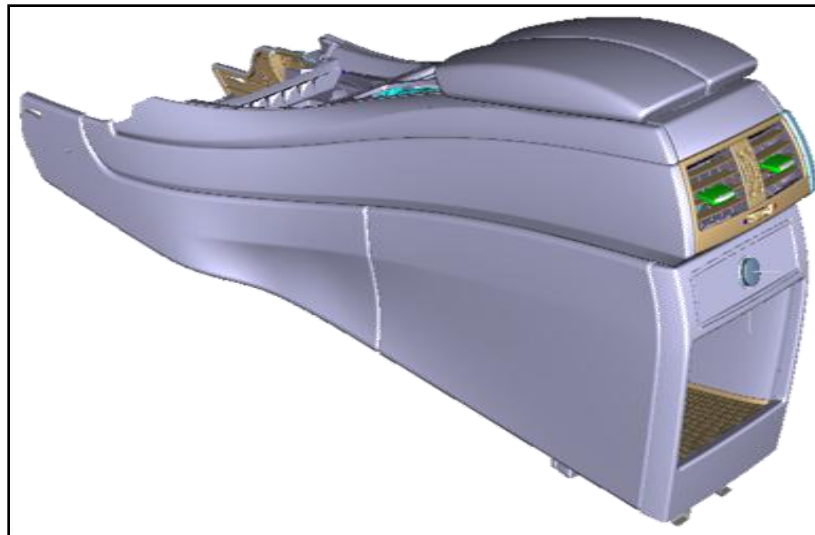
Benjamin Caldwell  
Yvette Price  
Essam Namouz  
Jay Richardson

### Lazy Participants:

Dr. Joshua Summers  
Dr. Gregory Mocko  
Chiradeep Sen

## Interior automotive console

- Located between driver and passenger seats
- Analyzed physically and virtually
- Contains approx. 90 parts plus fasteners
- Almost fully assembled before inserted into vehicle
- Functionality easy to comprehend by novice designers
- Analyzed using Lazy Parts Identification Method

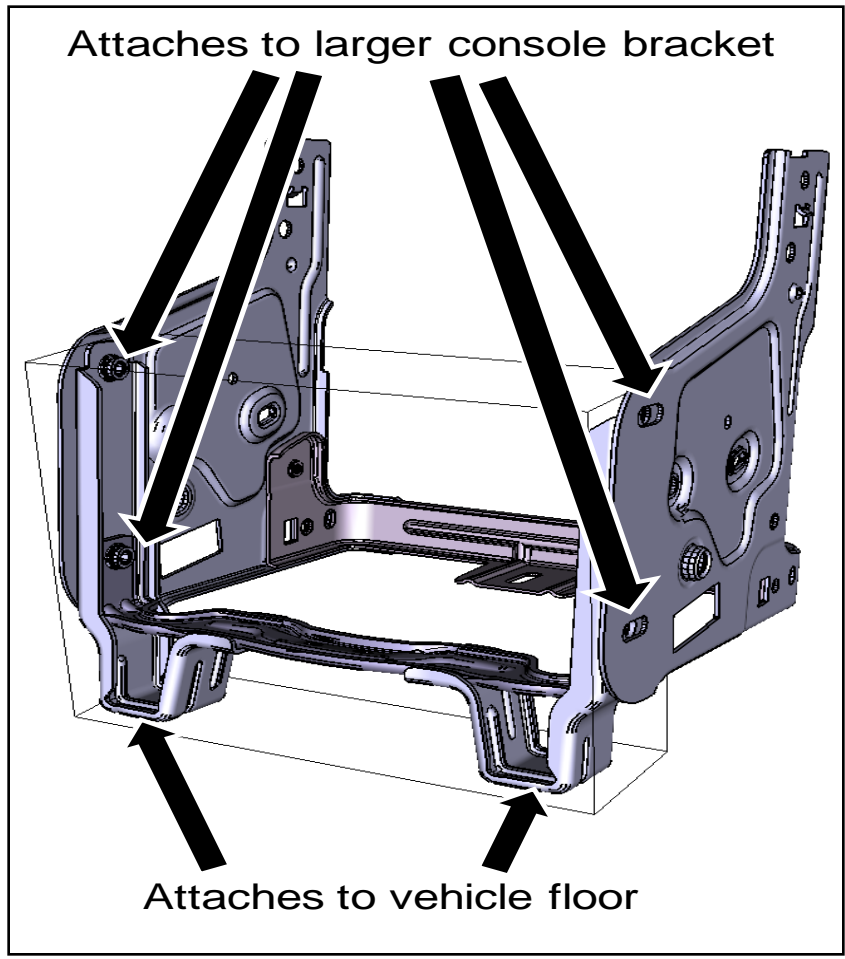
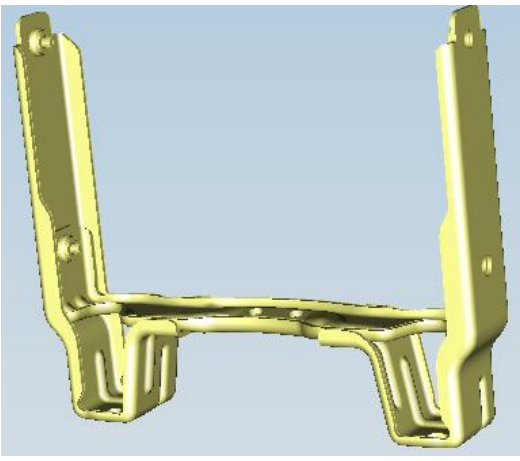


## Part No. 6958746 – back center console bracket (yellow)

Mass: 350 g  
Est. Savings: 10%

Indicator Checklist	
<b>rigid to rigid connection</b>	<b>A</b>
Support for a flexible, non-moving part	
Positioning features	
Duplicate geometry	
Fastener	
Bridging systems	
Material flow restriction	

A. e.g., Part is the rigid connection between the frame and side reinforcement brackets (6954942, 6954938)

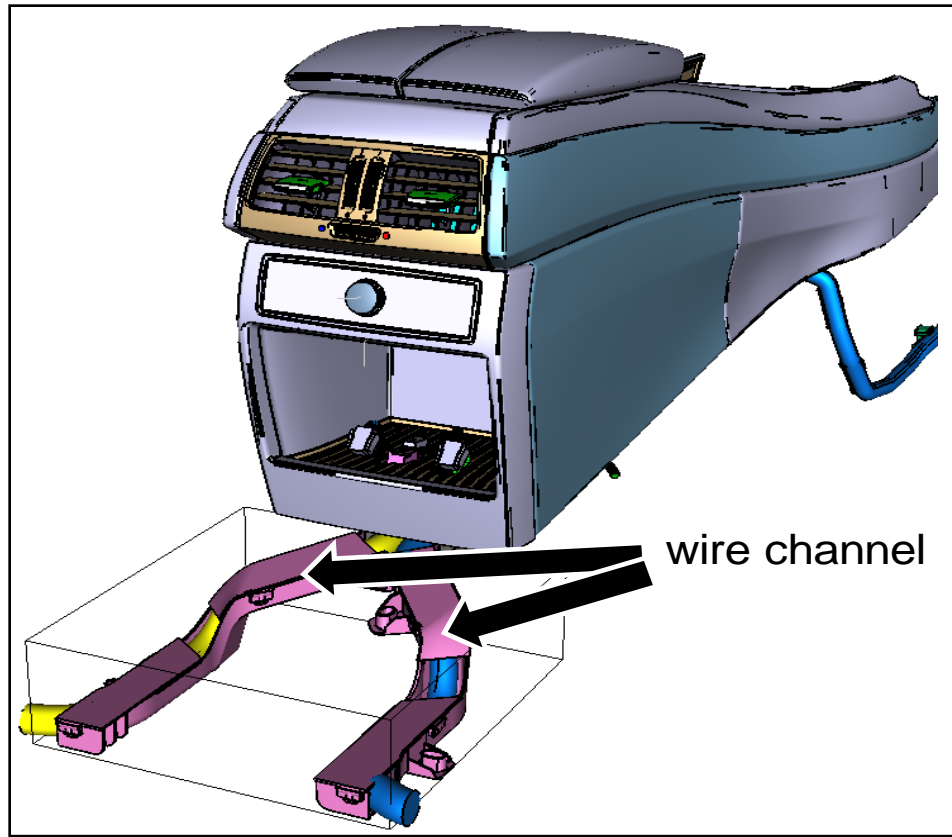
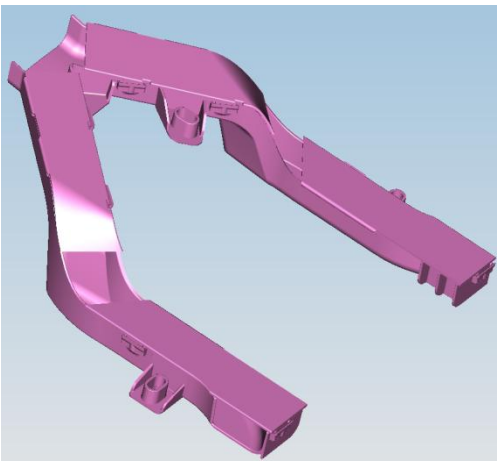


## Part No. 6970108

Mass: 138 g  
Est. Savings: 50%

Indicator Checklist	
rigid to rigid connection	
<b>Support for a flexible, non-moving part</b>	<b>A</b>
Positioning features	
Duplicate geometry	
Fastener	
Bridging systems	
Material flow restriction	

A. Part is used to support a wiring harness (4157187)

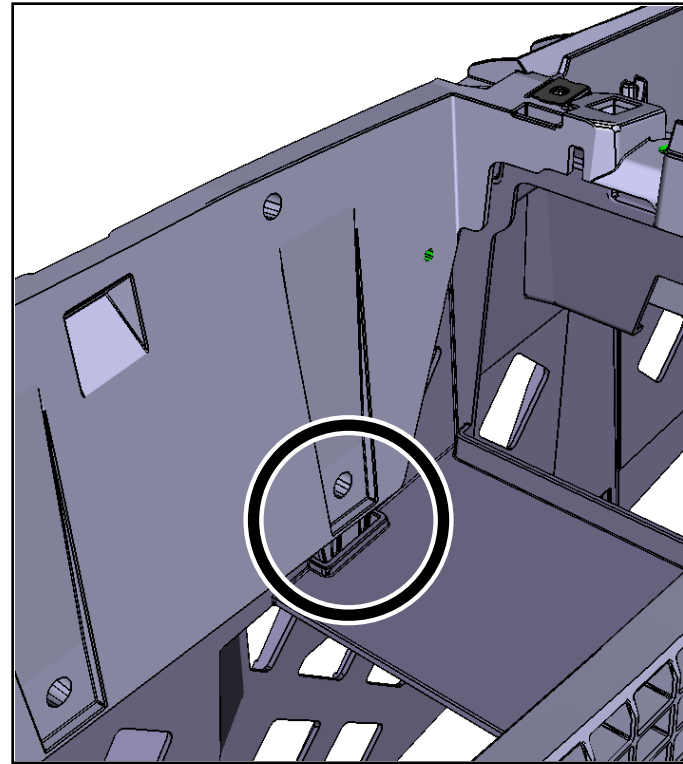
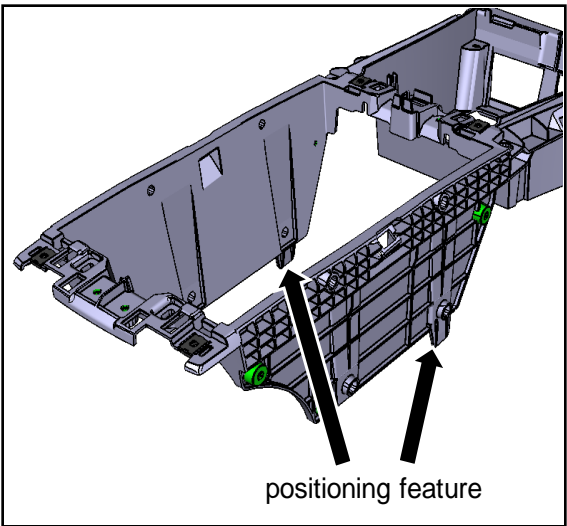


## Part No. 6954939 – console upper base frame (yellow)

Mass: 928 g  
Est. Savings: 10%

Indicator Checklist	
rigid to rigid connection	A
Support for a flexible, non-moving part	
<b>Positioning features</b>	<b>B</b>
Duplicate geometry	C
Fastener	
Bridging systems	
Material flow restriction	

- A. e.g., Part is rigid connection between lower frame (6954938) and cup holders, storage compartment lid (6969544), etc.
- B. e.g., Part positions itself with respect to lower frame (6954938)**
- C. e.g., duplicate with respect to parts 6954938, 6969544, 6971727

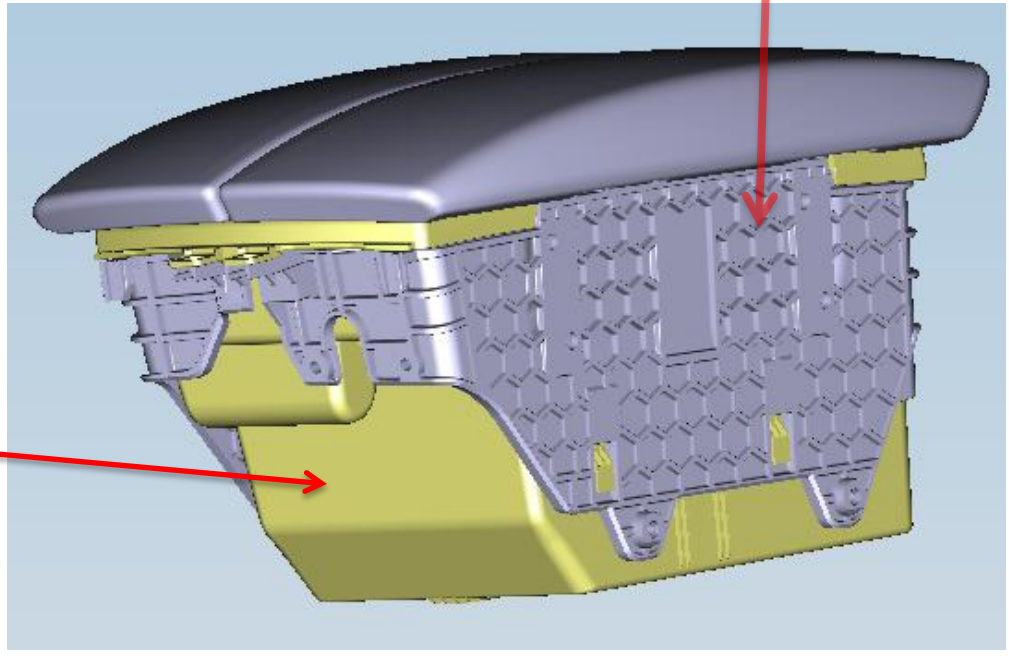
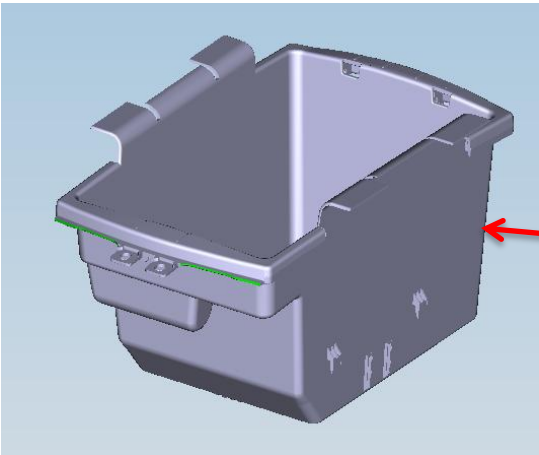


## Part No. 9115081 – inner console tray

Mass: 494 g  
Est. Savings: 10%

Indicator Checklist	
rigid to rigid connection	
Support for a flexible, non-moving part	
Positioning features	
<b>Duplicate geometry</b>	<b>A</b>
Fastener	
Bridging systems	
Material flow restriction	

A. Part is duplicate to arm rest (side walls) (6969543, 6969544)

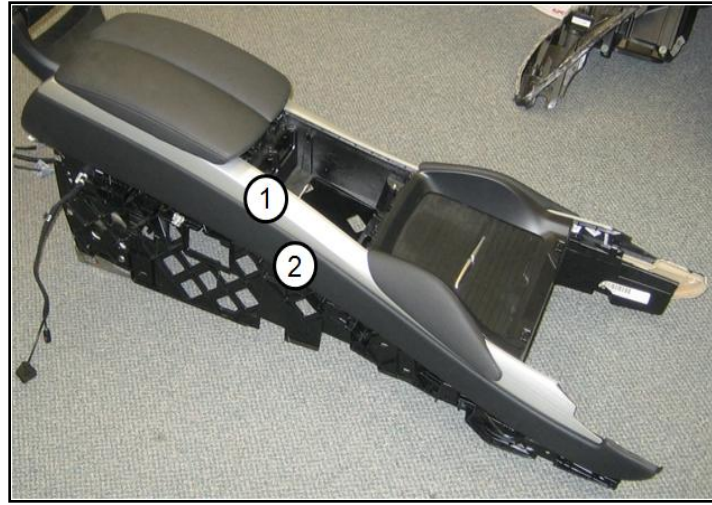
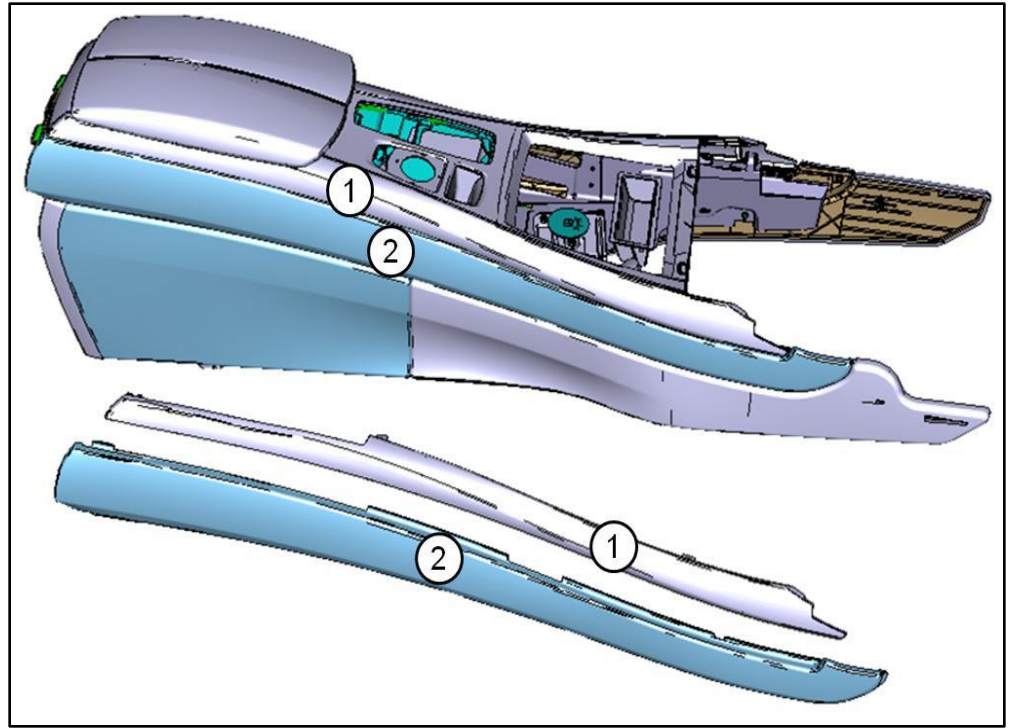


## Part No. 6969551 -- Center Console Trim Layer

Mass: 1560g  
Est. Savings: 10%

Indicator Checklist	
rigid to rigid connection	
Support for a flexible, non-moving part	
Positioning features	
Duplicate geometry	A
Fastener	
Bridging systems	
<b>Material flow restriction</b>	<b>B</b>

- A. Trim is duplicate geometry to console frame.
- B. Part is used to prevent dirt, debris, etc from entering.



Part Index	Description	rigid-to-rigid connection	support for a flexible, non-moving part	positioning feature	duplicate geometry	fastener	bridging system	material flow restriction	Mass (g)	Estimated Mass Savings Per Part	Estimated Mass Savings Per Part (g)
1	Lower Base Frame	■							2302	10%	230
5	Upper Base Frame	■							928	10%	93
7	Small Mounting Bracket			■					796	50%	398
14	Cup Holder Trim							■	105	10%	11
17	Large Mounting Bracket	■							350	10%	35
21	Rear Storage Trim				■				322	10%	32
25	Left Aluminum Trim							■	240	10%	24
27	Left Lid Assembly	■			■				898	10%	90
31	Left Leather Trim							■	460	10%	46
34	Gear Selection/Switch Frame	■			■				310	10%	31
48	Interior Storage Trim				■				494	10%	49
70	Audio Wire Harness						■			1%	
71	Wire Channel		■	■					138	50%	69
<b>Sum:</b>								<b>14414</b>			<b>1998</b>

Approx. 14%  
Mass Reduction

<b>Indicators</b>	<b>Number of parts with indicator</b>	<b>Total mass of parts (g)</b>	<b>Total estimated mass savings (g)</b>	<b>Percent estimated mass savings</b>
Rigid-to-rigid connection	10	7200	1100	16%
Support for a flexible, non-moving part	1	140	69	50%
Positioning feature	6	3600	480	13%
Duplicate Geometry	13	7800	1100	14%
Fastener	30	320	320	100%
Bridging system	3	n/a	n/a	1%
Material flow restriction	13	3700	370	10%

Indicator Combination	rigid-to-rigid connection	support for a flexible, non-moving part	positioning feature	duplicate geometry	fastener	bridging system	material flow restriction	Number of parts with given combination	Total Mass of Parts (g)	Total Estimated Mass Savings (g)	Percent Savings of Total	Estimated Mass Savings Per Part (g)
1								5	3300	670	21%	130
2								11	3500	350	10%	32
3								30	320	320	100%	11
4								2	3200	320	10%	160
5								6	1100	120	11%	20
6								1	70	70	100%	70
7								1	140	69	50%	69
8								2	400	60	15%	30
9								2	190	19	10%	10
10								3	n/a	n/a	1%	n/a

The highest estimated savings is with the combination of rigid to rigid and duplicate geometry producing an estimated mass savings of 670g.

## Conclusion

- Estimated 14% mass savings
- Process helps novice designers identify potential mass savings
- Most promising combination of indicators includes *rigid-to-rigid connections* and *duplicate geometry*.
- Estimated mass reduction of 990 grams, which is approximately half of the potential savings in the entire console

## Future Work

- Full vehicle analysis (approx. 1500 parts)