Michigan Tech Racing

# 2015 Formula SAE Fastening Challenge!

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COMPONENT SOLUTIONS

# The Problem

- 2015 car implements a Continuously Variable Transmission (CVT) into existing space frame chassis design.
- Engine placement restricts packaging options for the CVT's primary clutch
- Removal of primary clutch is not possible with current frame design due to a tube interference
  - Removal of the clutch is needed for general maintenance/inspection and ease of engine removal
  - The removal of the clutch is required to install custom flyweights for different dynamic events

Fig 1: Iso view of left rear quarter of model

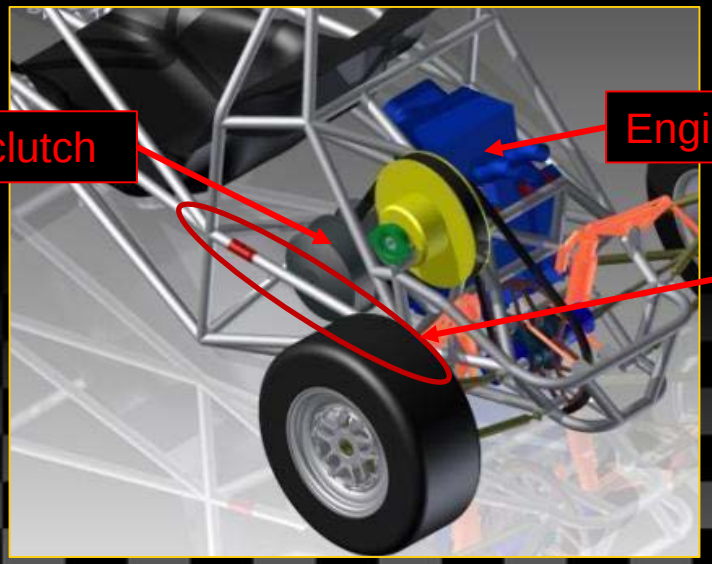
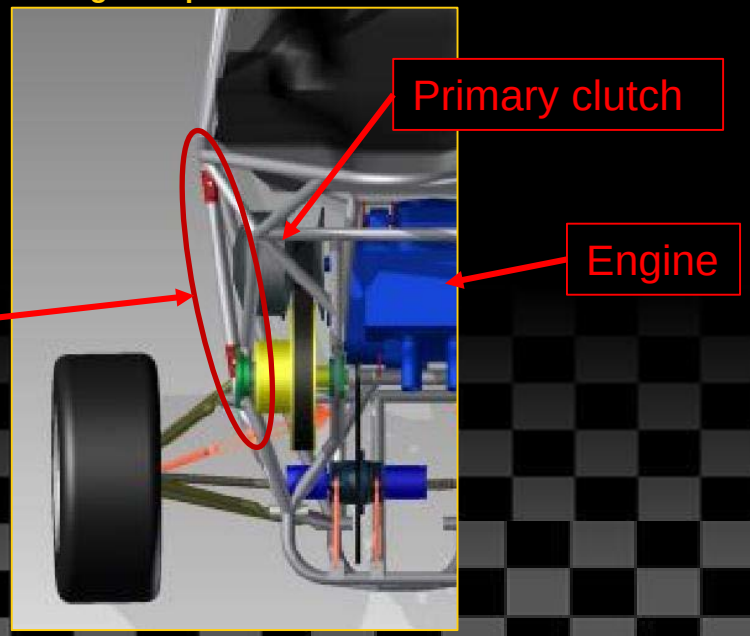



Fig 2: Top view of model

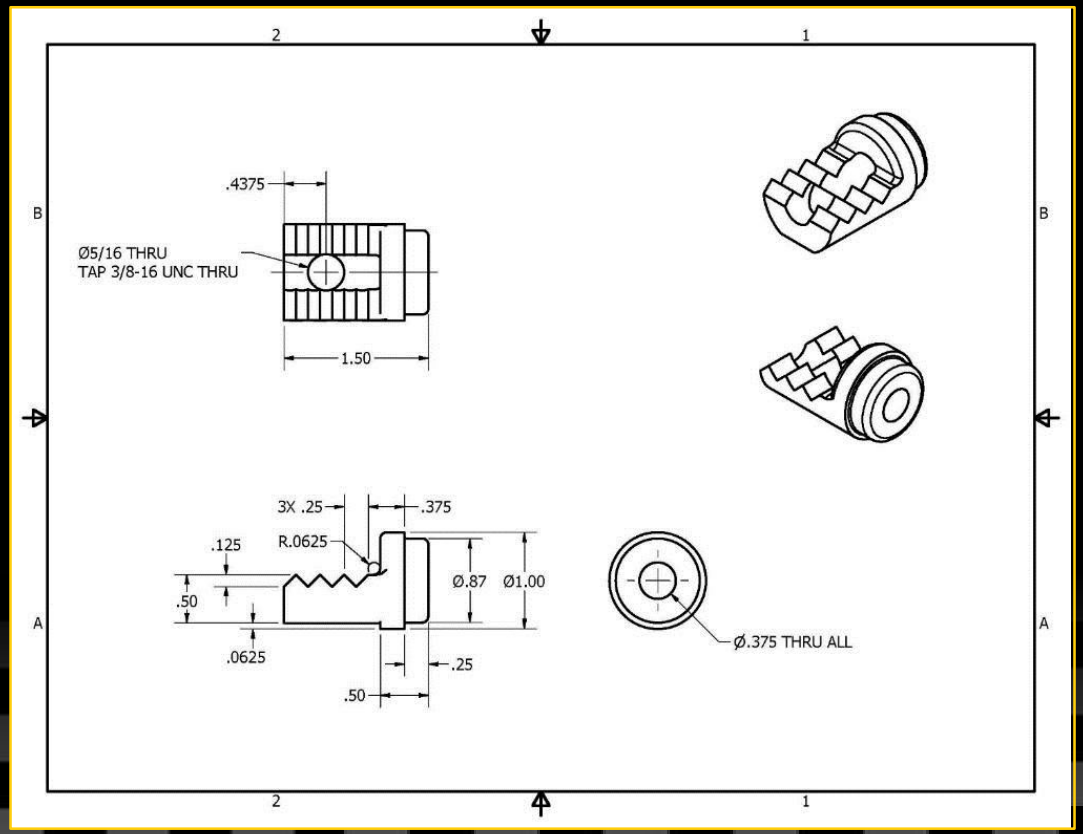


# The Solution

- Create a removable tube section to allow for easy removal of the primary clutch
  - Allows clutch to be pulled directly off of the output shaft
- Tube-end inserts were designed using:
  - A “ruffle chip” connection
  - 3/8” bolts fasten both sides through a tapped hole

Fig 3: Assembled ruffle chip tube inserts

Fig 4: Ruffle chip tube insert design



# The Solution



## Additional Final Assembly Pictures

**Fig 5: Primary clutch in relation to engine and removable tube (view: front looking back)**

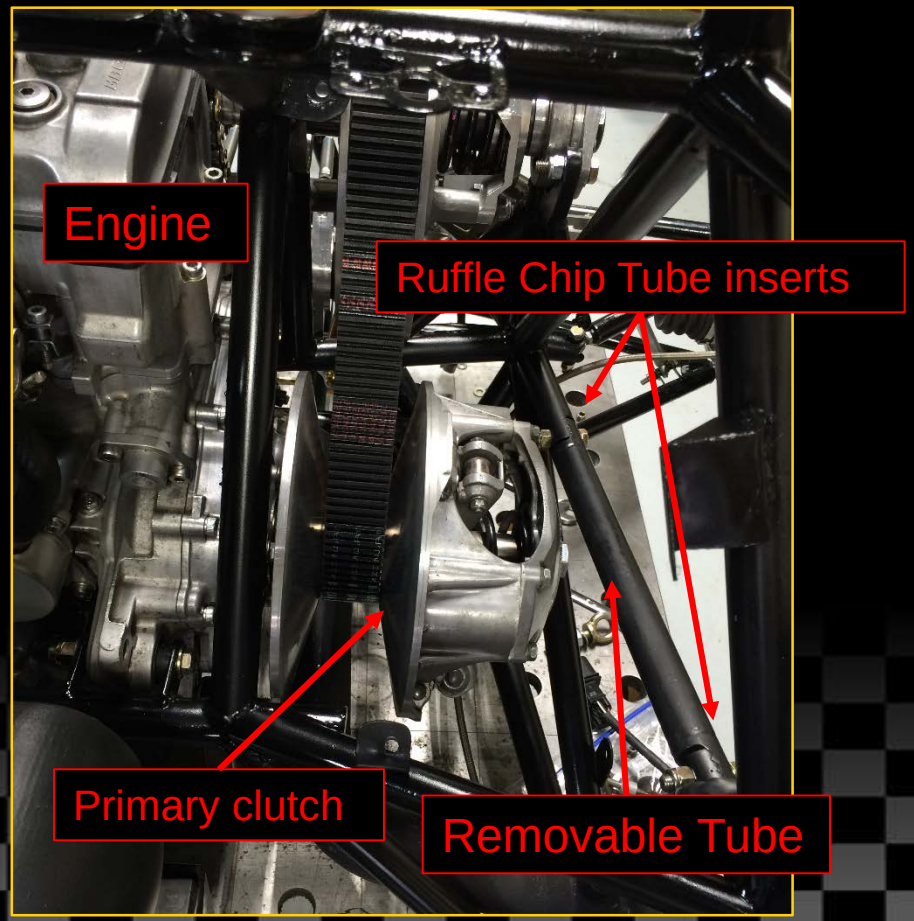
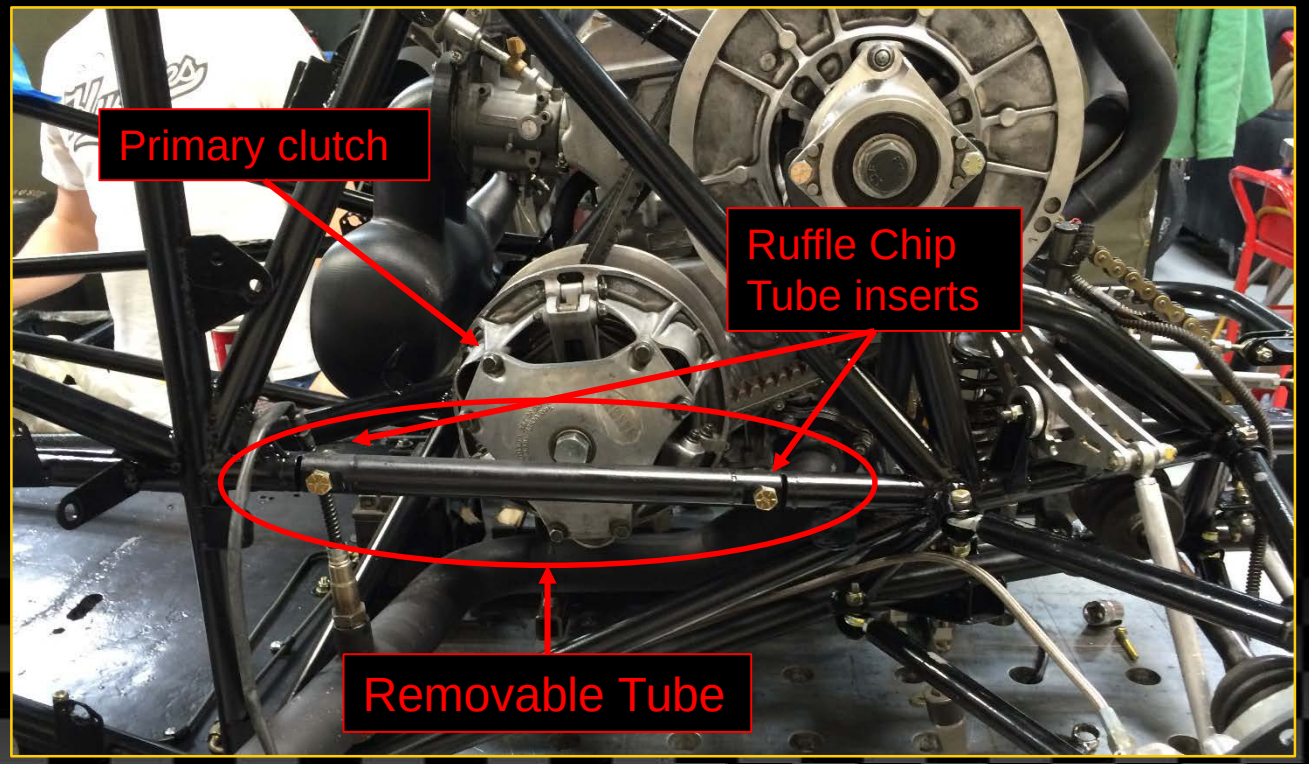



**Fig 6: Side view of final removable tube and primary clutch**



# Validation

- A tensile test was conducted to ensure structural equivalency when compared with standard fixed tube.
- As expected, failure occurred at the stress concentrator of the ruffle chip valleys and in line with the bolt hole
- The inserts failed with a 1.5 safety factor above the required force per the rules proving equivalent performance

**Fig 7: Inserts force-displacement curve**

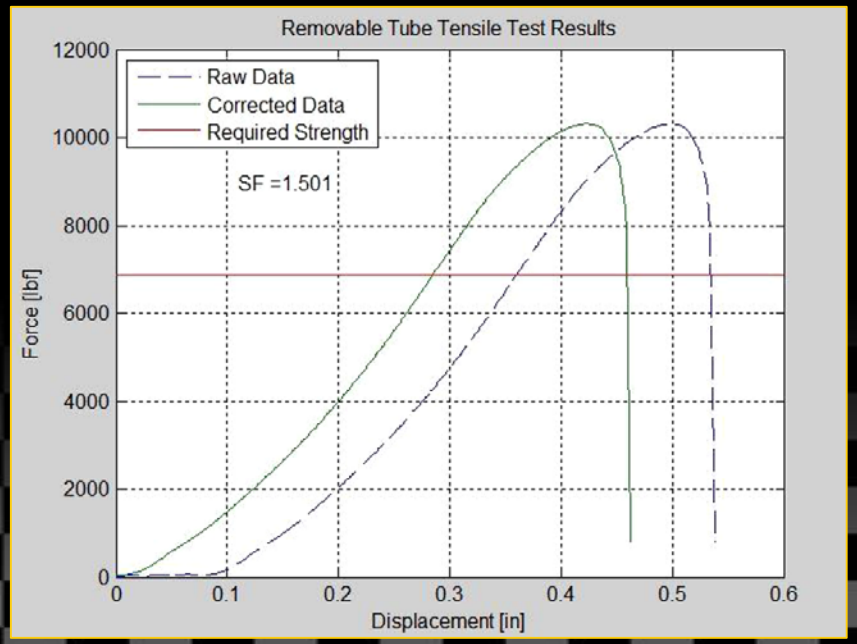



**Fig 8: Failed insert**

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# Lessons Learned

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- Creative use of fasteners can add modularity to previously fixed components while attaining superior performance
- Fasteners should be utilized to ease maintenance and assembly/disassembly
- Fasteners can make tightly packaged components accessible.
- Correct fastener use decreases the complexity of advanced assemblies

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# Thank You!

Michigan Tech Racing


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