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# Formula Hybrid at VCU: Epicyclic Power Distribution System

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 Award Winners

MECHANICAL AND NUCLEAR



# Formula Hybrid at VCU

## Epicyclic Power Distribution System

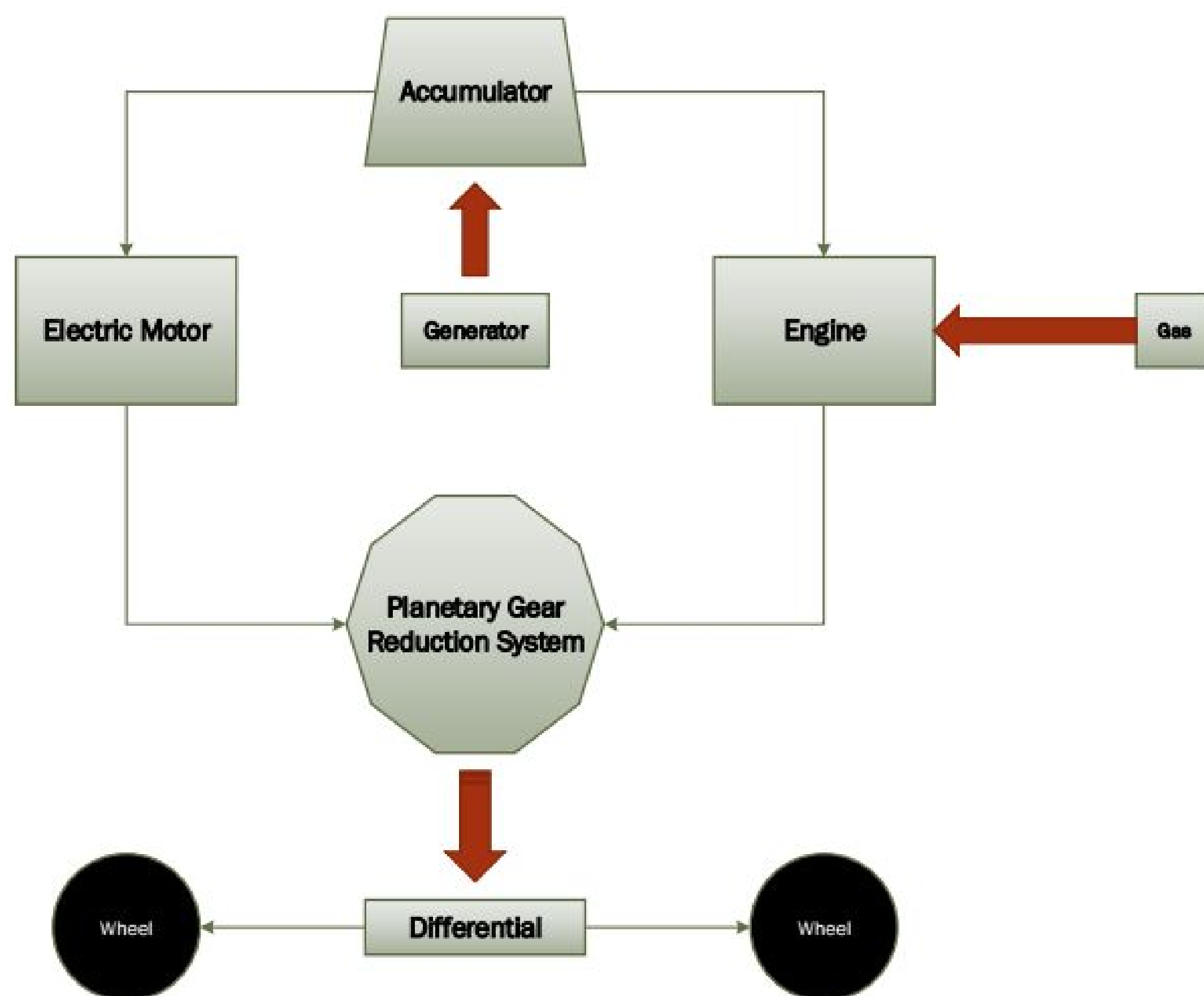
CAPSTONE DESIGN  
 EXPO 2016

### Purpose & System Flow

#### What is an Epicyclic Power Distribution System?

A system which combines two independent power inputs from both an electric motor and an internal combustion engine.

- Designed for the Formula Hybrid race car at VCU
- First and only Formula Hybrid team in Virginia
- Opportunities for future cross-discipline integration
- Focus on reduction of vehicle emissions



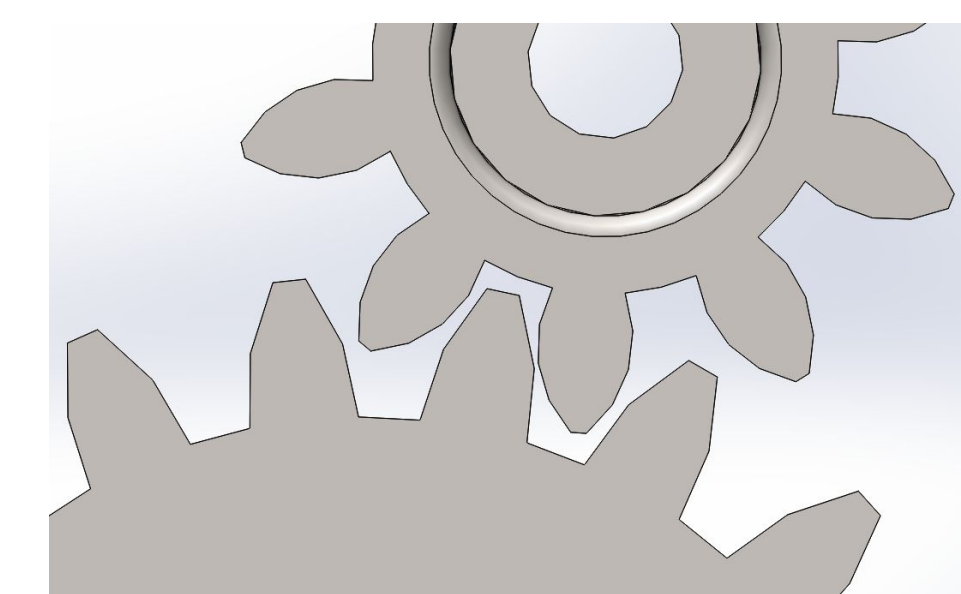
#### Torque and Power Inputs

- Lynch LEM170-96 Electric motor
- Yamaha YZ250F | 250cc Motorcycle engine
- Both motors operate independently & simultaneously, as well as increase the efficiency of the engine in both hybrid and all-electric modes

### Design

#### Gears

- Involute Profile
- Low Friction
- Easy to manufacture
- Constant pressure angle
- High strength steel alloy

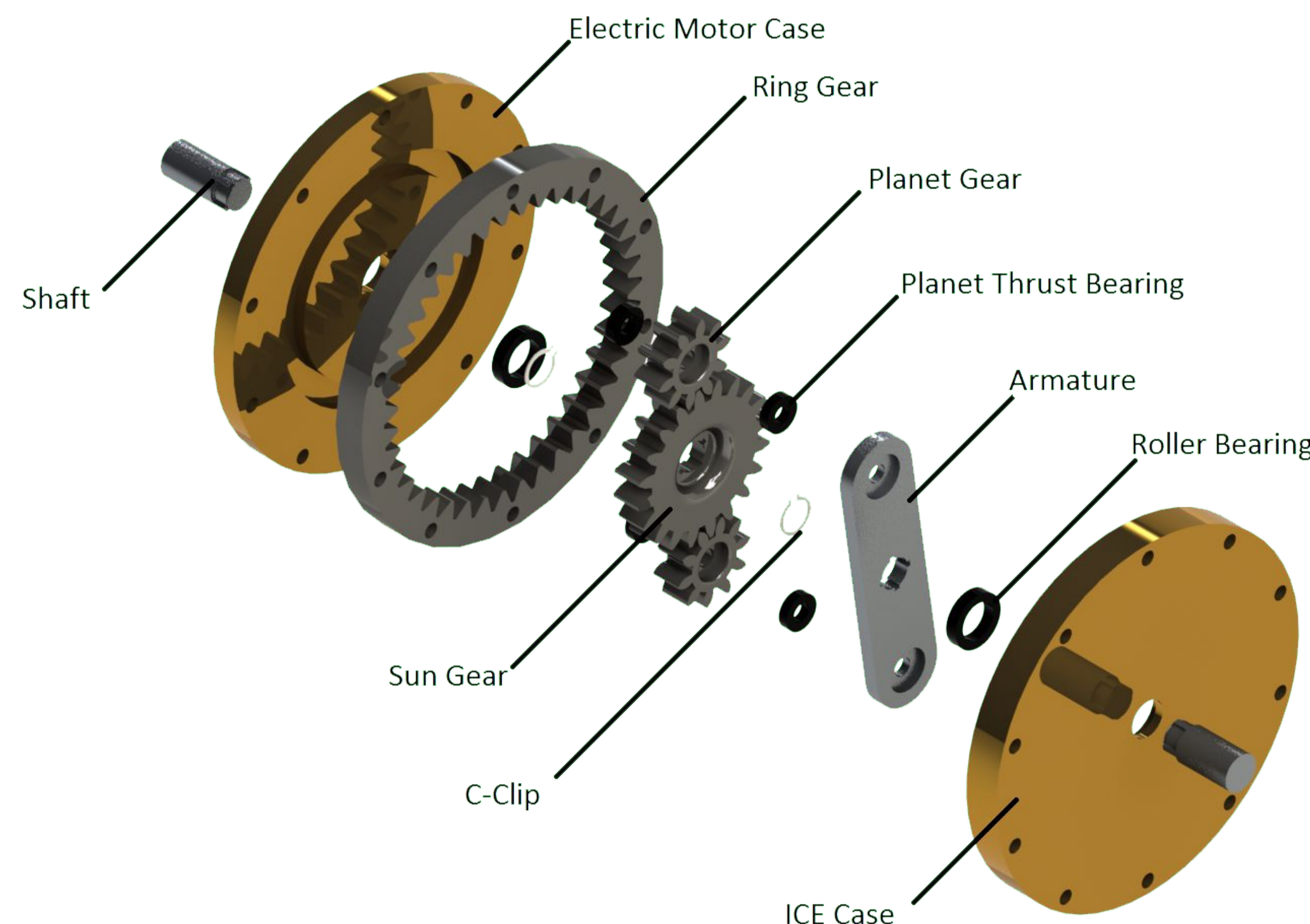


#### Bearings

- Thrust Bearings
- Roller Bearings

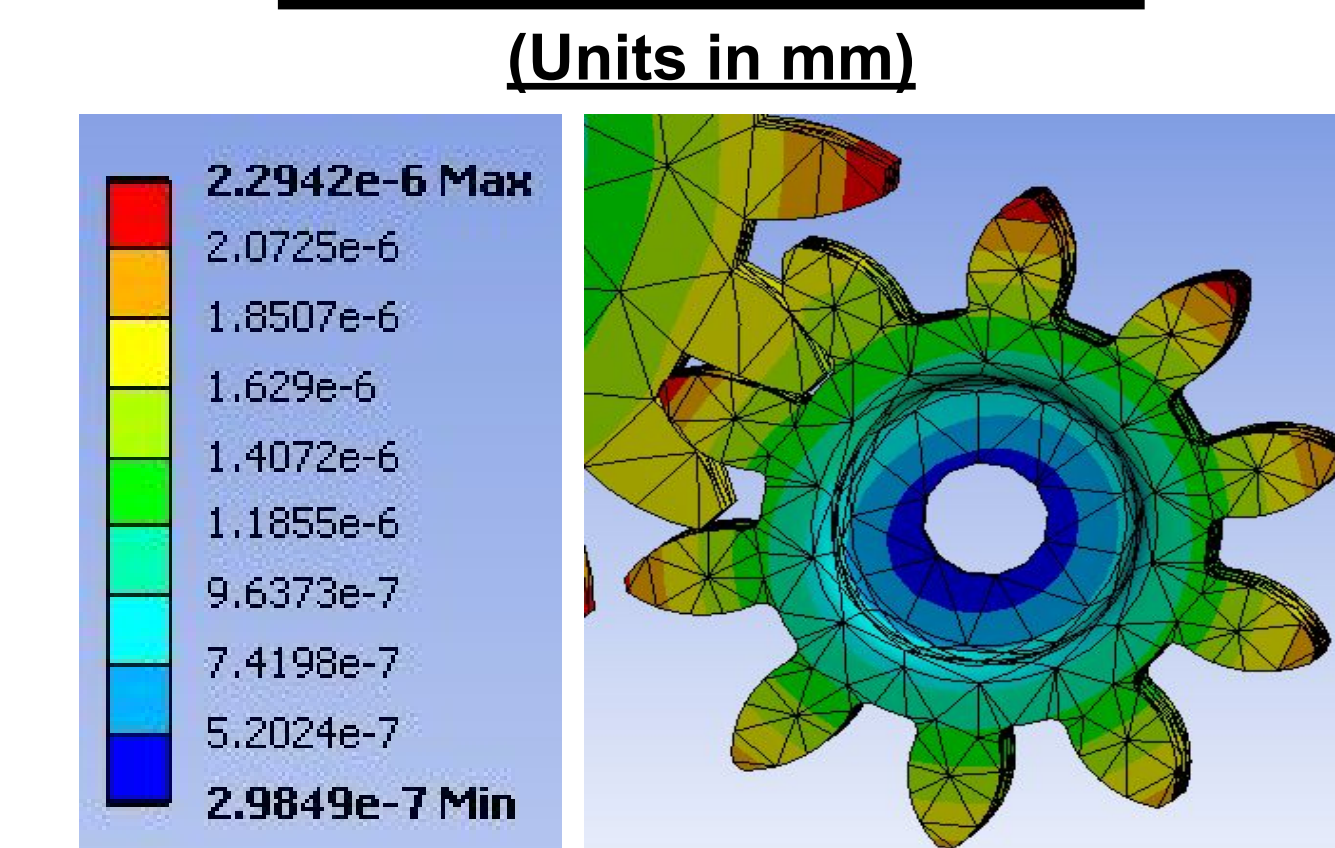
Planet Thrust Bearing

Roller Bearing

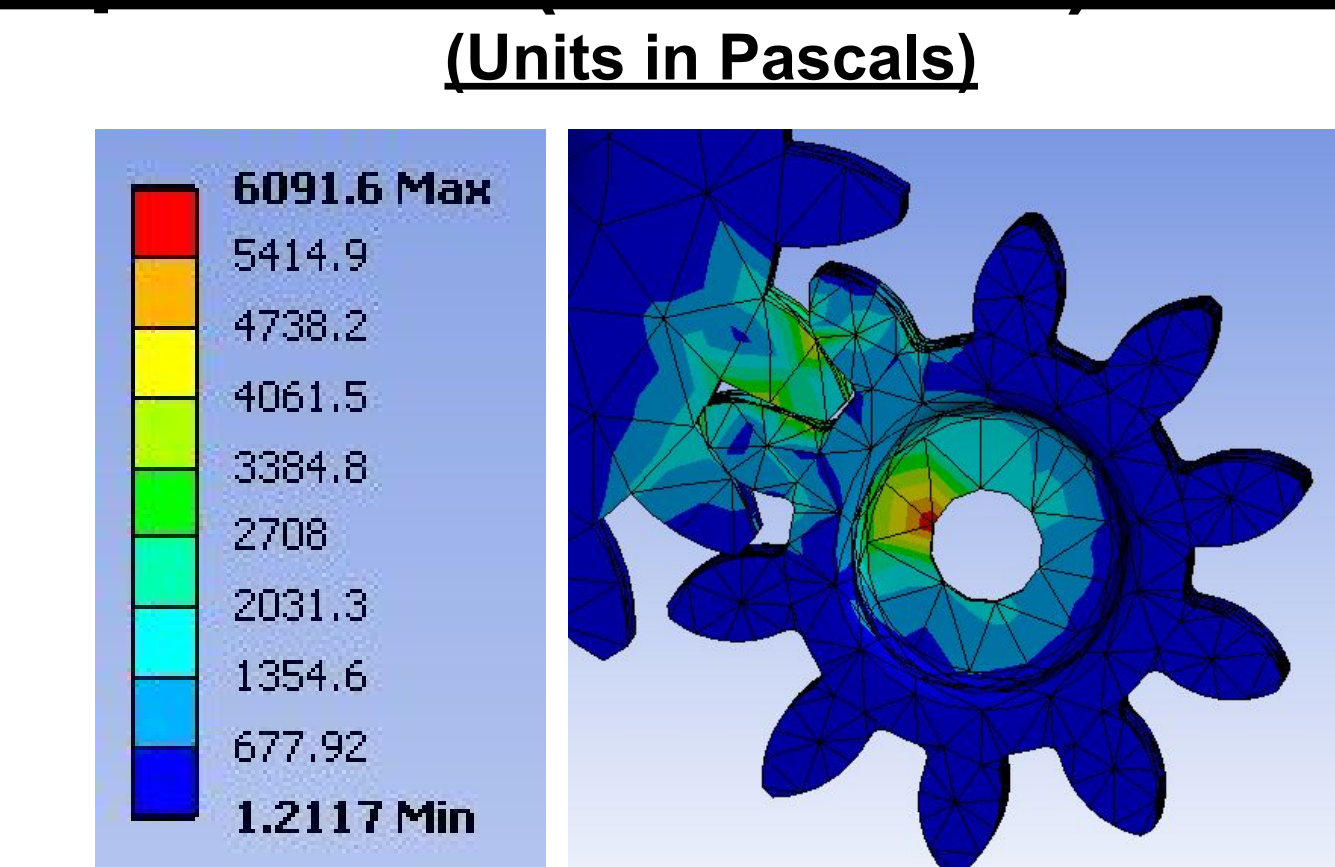


### Analysis

#### Total Deformation



#### Equivalent (Von-Mises) Stress



Operating torque from electric motor: 12 N-m  
 Total deformation and stress of input and output gears are well within operational limits

### Future Considerations

Future Formula Hybrid teams will need to consider:

- Clutch System
- Engine Management
- Chassis Improvements
- Manufacturability
- Procurement