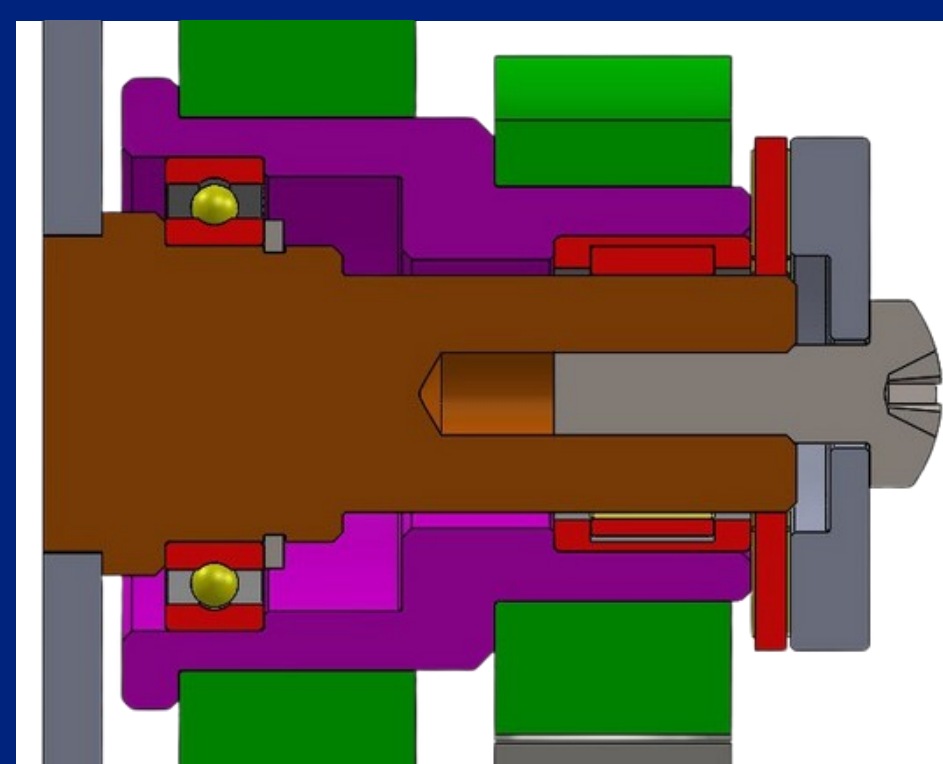


# EAPC MOTOR & GEARBOX

## DMT 1C Electrically Assisted Pedal Cycle Drivetrain

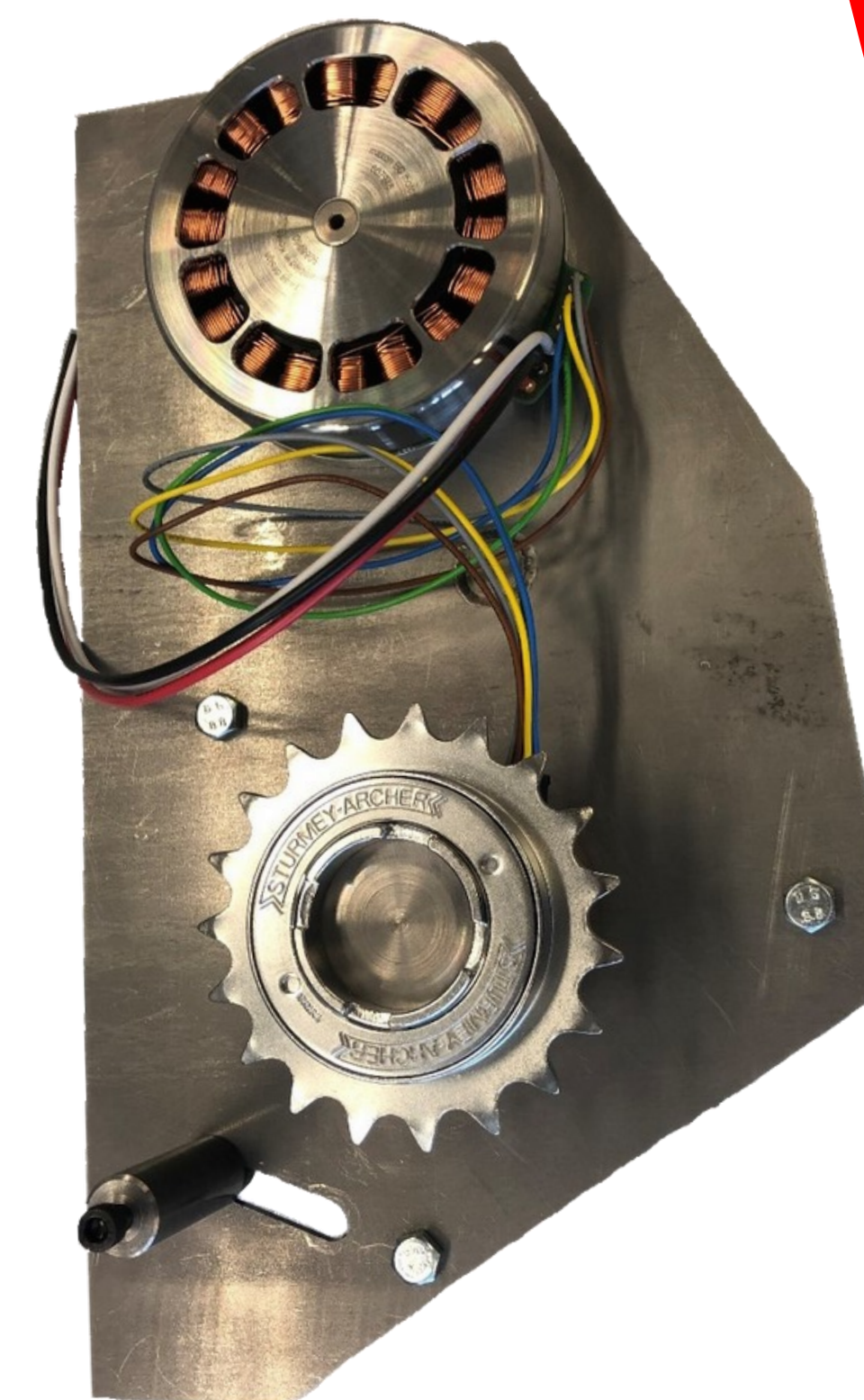
### Main Design

- 42.2:1 step down in speed of motor in 3 stages
- Double reduction spur gear transmission utilised
- 1.5 MOD steel gears had 19, 80, 21 and 80 teeth
- Freewheel to crankset chain drive reduction
- Torque sensing bottom bracket gives torque-controlled feedback to the 220 W motor
- Design dimensions of 299 x 177 x 108 mm
- Mass of 4.2 kg
- Transmission supplies 36 Nm of torque at 60 RPM to the crankset



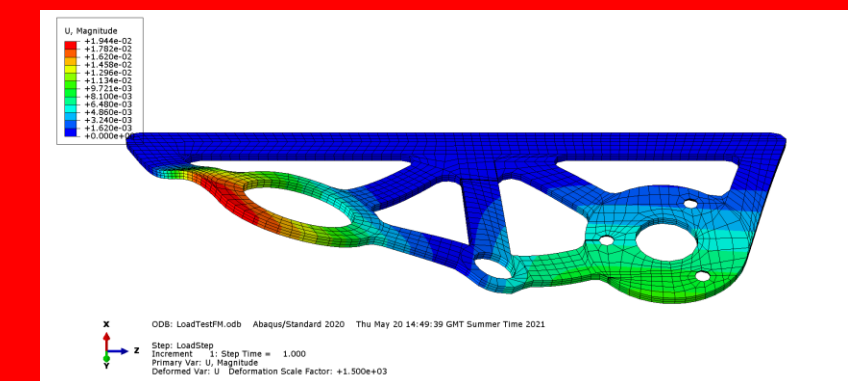
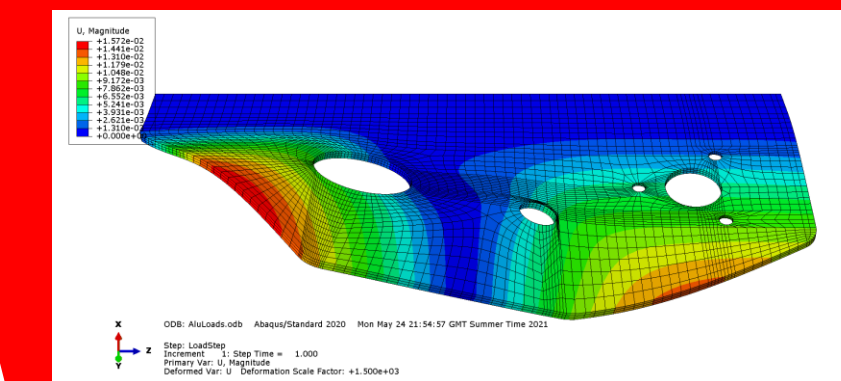
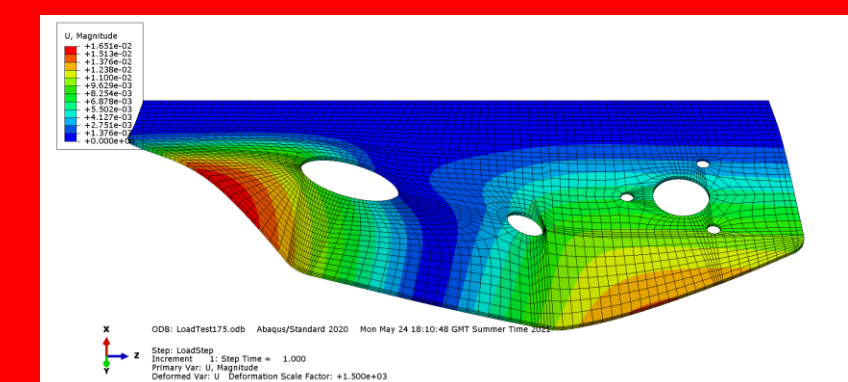
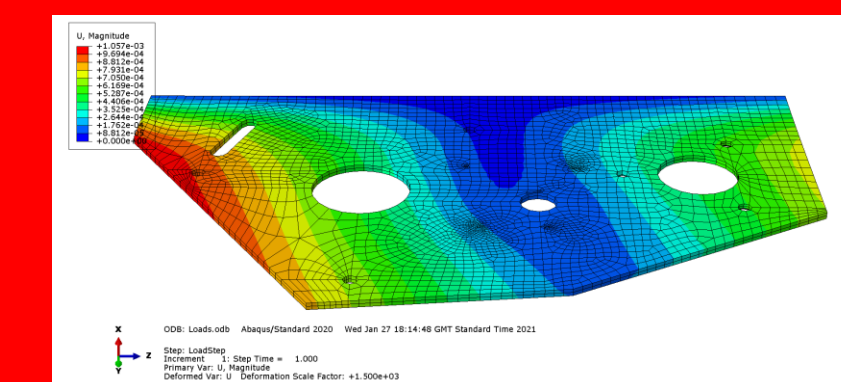
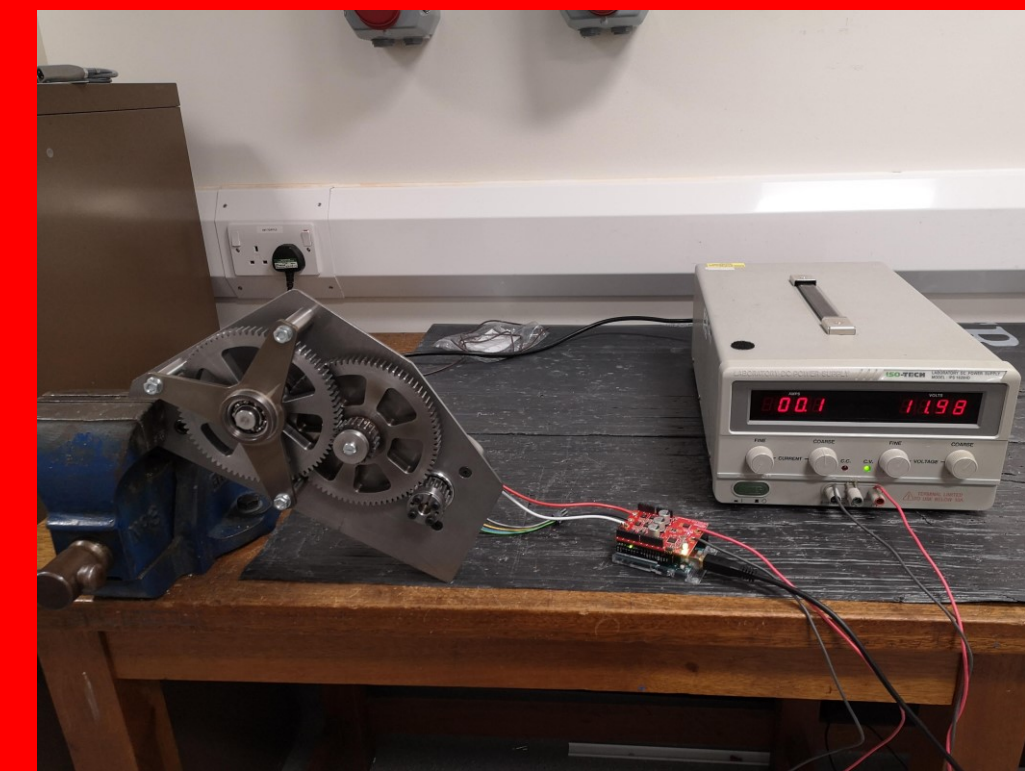
### Intermediate Shaft Assembly

- Stationary cantilevered shaft brazed to motor plate
- Sleeve acts as a bearing housing and rotates freely
- Gears brazed to sleeve, singular component for removal
- Adjusted bearing arrangement used
- HK1210 needle bearing used to minimise cross-section



### Testing

- Weight analysis identified areas for reduction
- Backlash test identified alignment issues (0.1317 mm below limit)
- No load test confirmed high efficiency of system (1.4 A at 12 V compared to 0.7 A no load at 24 V)



Redesign in FEA: Original design, reduced thickness, lattice design and material change to aluminium (clockwise from top left)

### Redesign

- Design could be simplified, leading to less parts to manufacture and significant weight loss
- Drive shaft was modified to be cantilevered
- Different concepts for the motor plate were examined in finite element analysis
- Weight loss of 1.06 kg (> 25%) possible