HEX-Cap: Hexcel Ergonomic eXperience Capstone

**Background**

- Hexcel is a leading carbon fiber manufacturer, specializing in composite parts for aerospace manufacturers.
- Poor lamination hand tools were resulting in workplace injuries
- New tool designs were commissioned to improve ergonomics
  - This required the development of objective measurements to evaluate ergonomic improvement

**Problem**

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**Survey Results**

- Are you satisfied with your work environment?
- Have you ever had a work related injury?
- Have you ever had a work related strain?
- How often do you use your hands?

**Economic Impact of Carpal Tunnel Syndrome**

- About 1/3 of employers are self-insured in the state of Washington. Meaning they handle and pay work related injury claims.
- Carpal Tunnel sufferers miss twice as much work (138 days vs. 46 days) and file nearly twice as many claims per year (4443 vs 2544) than upper extremity fractures.
- An average loss of earnings per claimant can range from $45,000 to $89,000 over 6 years.


**Developing Ergonomic Metrics**

**Phase 1: Monitoring Employee Processes**

- Workers were instructed to try laminating 5 surfaces with each of the test sweeps
- Mold design was created to emulate standard working conditions

**Phase 2: Incorporating Sensors**

- Sensors were incorporated into the sweep handle to measure wrist extension and flexion

**Phase 3: Developing a Standardized Procedure**

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- Mold design was created to emulate standard working conditions

**Sweep Creation**

**Phase 1: 3D CAD Modelling**

- For quick visualization and conceptual design, 3D computer-aided design models were created in Solidworks.

**Phase 2: 3D Printing**

- From the 3D CAD models, physical prototypes were created using PLA filament. Unfortunately, the 3D printed sweeps are not approved for direct use in the actual lamination process.

**Phase 3: Machining Process-ready prototypes**

- Taking into account recommendations and comments, the next iteration of prototypes were manufactured using lamination process-approved HDPE plastic.

**Numbers/Findings**

- Workers were instructed to try laminating 5 surfaces with each of the test sweeps
- Mold design was created to emulate standard working conditions

**Conclusions**

- HEX-Cap parallel handle sweep minimized wrist extension leading to improved ergonomics.
- Experienced employees will require a training period to see benefit from new sweep designs.

**Moving Forward**

- Foster employee buy-in for new sweeps and practices
- New employees should immediately start using new sweep designs.