MATTHEW MURRAY

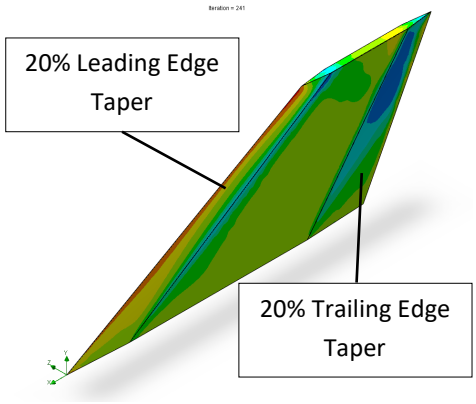
4th YEAR MECHANICAL ENGINEERING AT THE UNIVERISTY OF WATERLOO

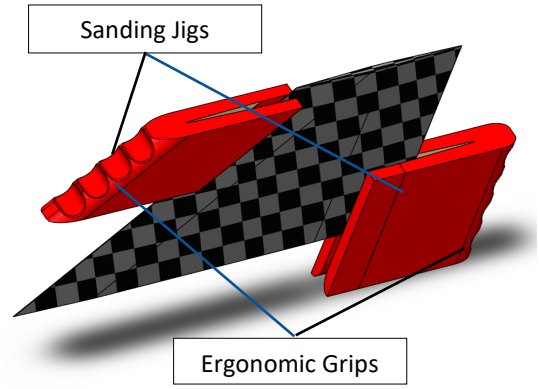
matthew.murray@uwaterloo.ca

linkedin.com/in/matthewamurray

(647) 574-4921

SUPERSONIC FIN OPTIMIZATION — WATERLOO ROCKETRY





What?

- Designed the fin's leading and trailing edged to be optimize in flight rocket performance and apogee.
- Design and 3D printed sanding jigs that allowing the fins to be sanded into a double diamond cross-section tapered shape.

How?

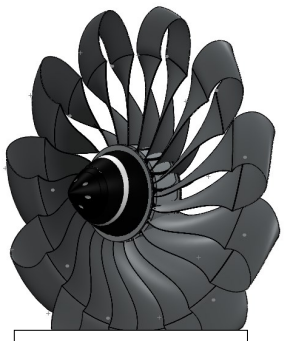
- Completed an iterative design process with CFD analysis to determine the optimal fin taper for the expected flight condition.
- Performed analysis to ensure there is a 1.8 factor of safety against fin flutter and air loads.

Results

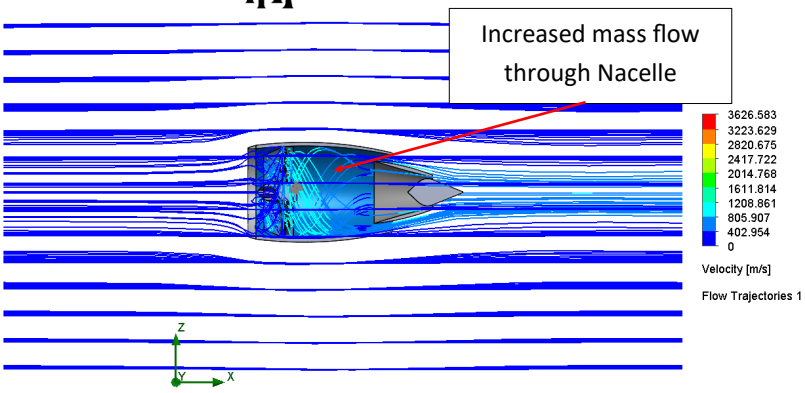
- Reduce frontal fin pressure drag by 60%.
- Reduced momentum loss in the supersonic flight regime increasing the rocket apogee by 4500 ft.

PROTOTYPE REDESIGN ROLLS-ROYCE TRENT-1000 INLET FAN

Trent-1000 Inlet Fan



Toroidal Inlet Fan



What?

- Designed a prototype upgrade for the Rolls-Royce Trent-1000 inlet fan from its OEM design to a toroidal inlet fan design.
- Used an iterative design process to refine the new fan design for optimal performance.

How?

- Conducted computational fluid dynamics (CFD) simulations to analyze and optimize its geometry for maximum performance and an increase of intake mass flow.
- Incorporated CFD results into the design refinement process using SolidWorks, modifying blade shape, curvature, and spacing.

Results

- Achieved a 7% increase in mass flow rate at cruise speed blade RPM, resulting in improved engine performance and higher thrust output.
- Explored the potential ability of increasing engine thrust at reduced noise operating levels.

MATTHEW MURRAY

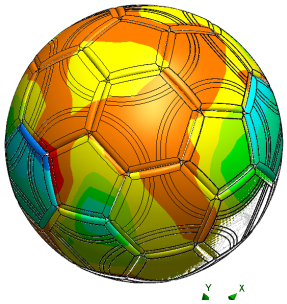
4th YEAR MECHANICAL ENGINEERING AT THE UNIVERISTY OF WATERLOO

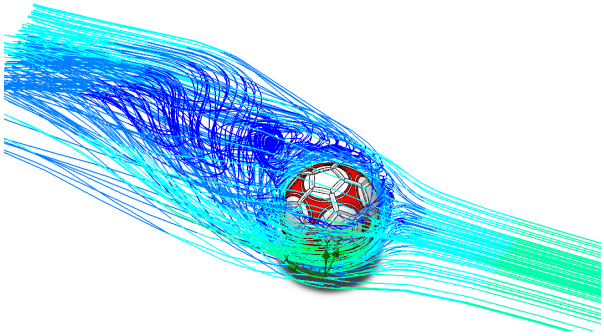
matthew.murray@uwaterloo.ca

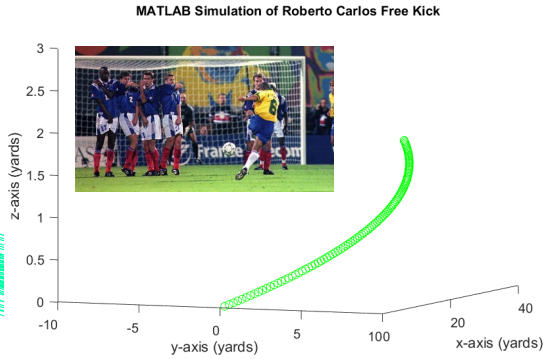
linkedin.com/in/matthewamurray

(647) 574-4921

MAGNUS EFFECT STUDY ON REBERTO CARLOS FREEKICK FIFA







What?

- Developed a CFD model to simulate the flight of a soccer ball
- Conducted trajectory analysis of the 1997 Roberto Carlos free kick using MATLAB

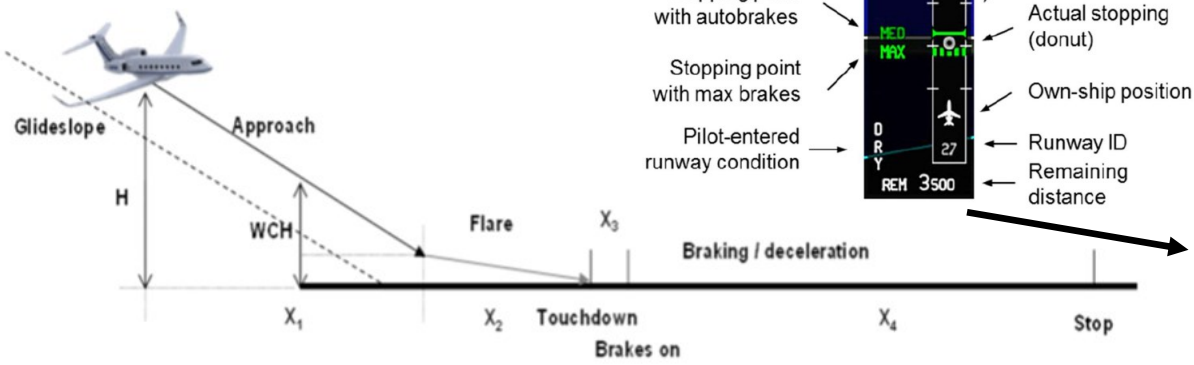
How?

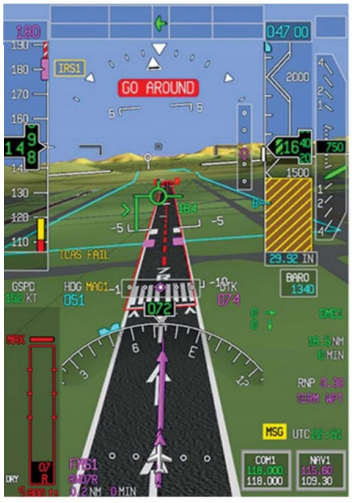
- Implemented numerical methods in CFD to solve the Navier-Stokes equations for fluid flow around a soccer ball
- Used MATLAB to analyze the trajectory of the ball, taking into account the effects of air resistance and spin.

Results

- Determined the flight mechanics of the soccer ball, including the drag coefficient and magnus lift force
- Calculated the angular velocity (rpm) of the ball during the free kick, providing insight into the spin-induced trajectory deviation

RUNWAY OVERRUN AWARENESS AND ALERTING SYSTEM BOMBARDIER





What?

- Development of a Runway Overrun Awareness and Alerting System (ROAAS) for the Global 6500 and 5500 aircraft models.
- Early-stage research and development aimed at improving runway safety and preventing runway overruns.

How?

- Identified and integrated sensor data from various sources such as radar altimeters, GPS, air data systems, and others, to provide accurate and real-time alerts to pilots through the ROAAS.
- Integrated the capability of measuring runway stopping distances for six distinct landing weather conditions.

Results

- Successfully demonstrated the feasibility and effectiveness of the ROAAS system in reducing the risk of runway overruns.
- Identified areas for further research and development to improve the system's accuracy and effectiveness, including refining the algorithms and integrating additional data sources.

MATTHEW MURRAY

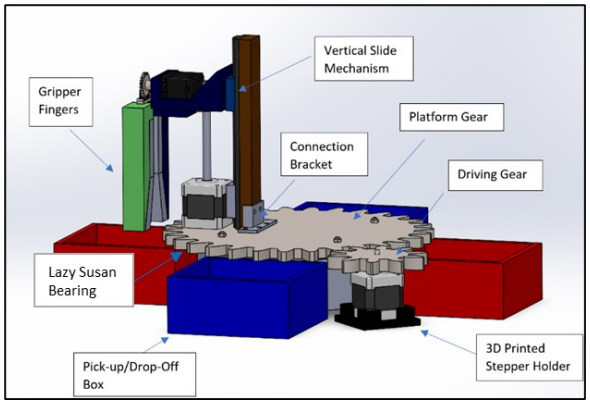
4th YEAR MECHANICAL ENGINEERING AT THE UNIVERISTY OF WATERLOO

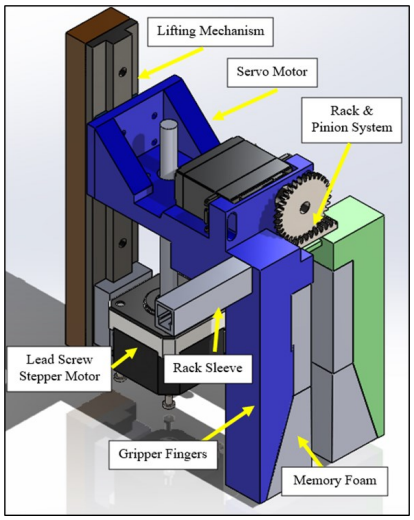
matthew.murray@uwaterloo.ca

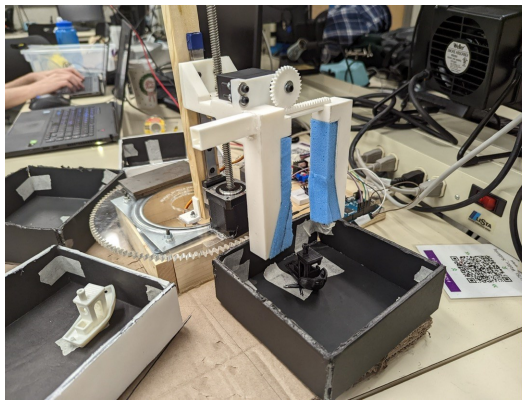
linkedin.com/in/matthewamurray

(647) 574-4921

MOVEMATE — MECHANICAL DESIGN I PROJECT







What?

- Designed and manufactured an automated pick and place robot for moving lifting objects with various geometries with high precision and smoothness.
- Developed a system for the robot to pick up and manipulate multiple tools at once.

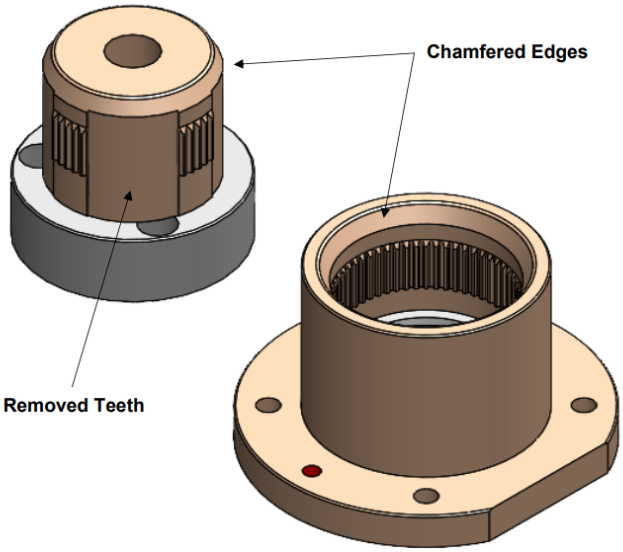
How?

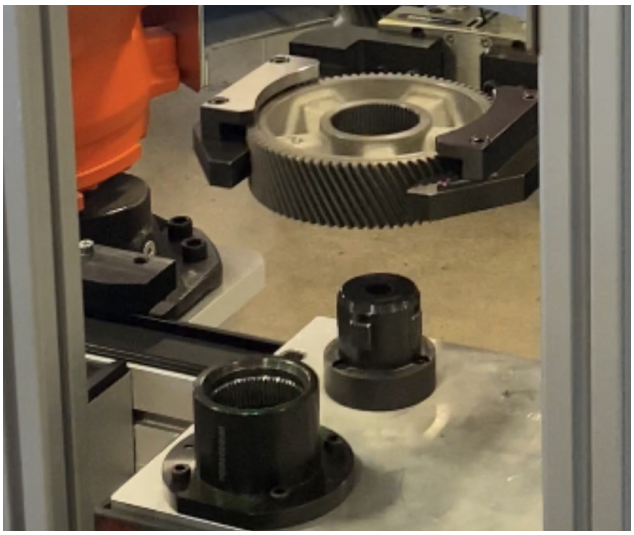
- Utilized 3D printing to fabricate parts for the robot, ensuring precision and accuracy in design and construction.
- Programmed the robot to operate automatically, enabling it to locate, and conform its grippers to pick up multiple objects.

Results

- Successfully demonstrated the robot's ability to manipulate objects with less than 0.8 g of acceleration, indicating its smooth and controlled operation.
- Successfully demonstrated the robot's capability to lift and manipulate 10 different 3D geometries.

GEAR AND PINION ALIGNMENT TOOL





What?

- Designed an ergonomic press fitting alignment fixture tool to accurately align gears and pinions onto conveyor belt pallets.

How?

- Conducted an iterations design process to refine the fixture tool design and ensure accurate and optimal functionality.

Results

- Achieved a repeatability rate of 95% in gear and pinion alignment, reducing the need for rework and increasing production efficiency.