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Engineering Portfolio

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THUNDER GLOBALSTAR CONSTELLATION (MDA SPACE)



Context	Tasks	Results
At MDA Space, I work on vibration and shock testing for Globalstar's Thunder constellation, where flight hardware has to withstand launch loads and deployment events. The first set of 8 Thunder satellites are successfully in orbit, which makes careful, well-documented testing an important part of getting hardware ready to fly.	I tested many of the unit-level hardware and supported testing of the spacecraft platform. I ran random vibration and shock tests using shaker systems and Siemens Simcenter Testlab, analyzing power spectral density (PSD) and response data against customer launch requirements and MIL-STD-810. I also executed solar array deployment tests to verify mechanisms functioned under simulated operational conditions.	Hardware I tested at the unit level, and platform testing I supported, contributed to the first Thunder satellites reaching orbit. The solar array deployment testing confirmed the mechanisms would operate reliably as planned. All test responses and spectral data were recorded, with any anomalies documented for engineering review boards to preserve hardware safety margins.

MDA CHORUS EARTH OBSERVATION (MDA SPACE)



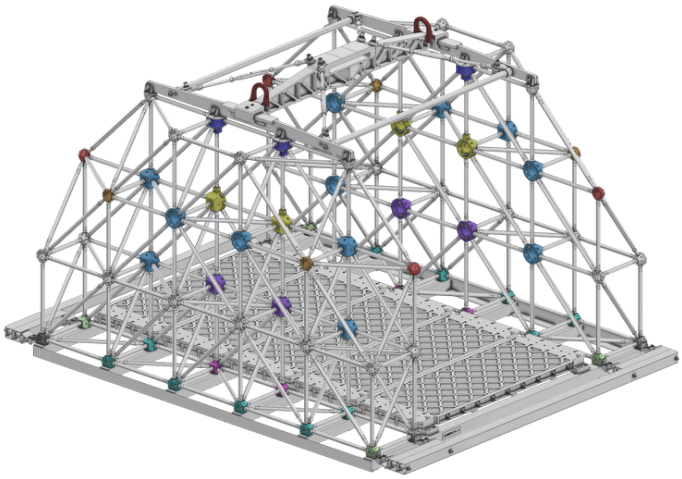
Context	Tasks	Results
MDA CHORUS™ is a next-generation Earth observation constellation building on the RADARSAT program, incorporating C-band and X-band SAR satellites to deliver day-and-night imaging under all weather conditions. Operating as a test engineer on this platform, I ensure the structural integrity of the satellite assemblies and mechanisms before their scheduled SpaceX Falcon 9 launch.	I conducted critical environmental testing on CHORUS flight hardware, including sine and random vibration testing, pyrotechnic shock testing, and solar array deployment verifications. Additionally, I executed the Launch Vehicle Adapter (LVA) release test to ensure clean separation of the spacecraft platform from the launch vehicle interface during staging.	The LVA release test and solar array deployment sequences successfully met their mechanical performance criteria, confirming structural separation and kinematics align with flight profiles. Vibration and shock data verified that the assemblies conform to launch vehicle specs, and structural readiness documentation was completed to clear the hardware for system-level integration.

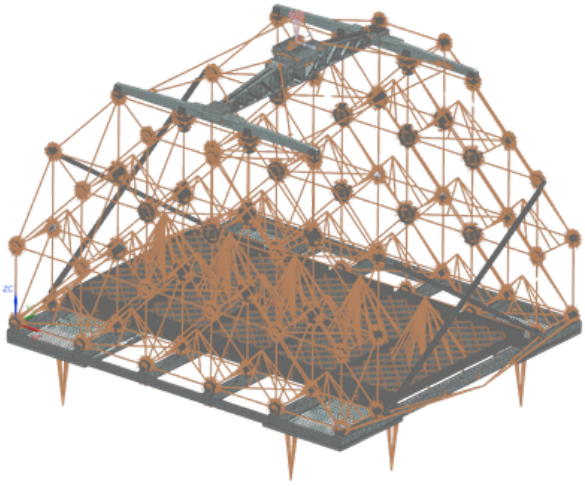
CANADARM3 (CANADIAN SPACE AGENCY)



Context	Tasks	Results
During a co-op term at the Canadian Space Agency, I worked on Canadarm3 for the Gateway station, where the arm model had to be placed correctly in different configurations. The work involved checking its position against design requirements and showing how it would move.	I positioned the Canadarm3 model in multiple configurations on the Gateway station model, verifying alignment with design requirements. I also built NX Motion animations demonstrating arm movement, capabilities, and functionality for review, so the team could see how the arm would operate in each setup.	The Canadarm3 model was positioned and checked in multiple configurations, with alignment verified against design requirements. The NX Motion animations gave a clear view of arm movement, capabilities, and functionality for the project team and for later design work.

STRATOSPHERIC BALLOON PROGRAM (CANADIAN SPACE AGENCY)





Context	Tasks	Results
For the stratospheric balloon program at CSA, bolted joints in the gondola had to be checked across multiple flight configurations. The analysis needed to account for temperature-driven thermo-elastic effects, so safety margins could be assessed properly.	I extracted finite element analysis results from Siemens NX and reconstructed the data for SpaceBolt compatibility. I then performed bolt analysis across multiple flight configurations, assessing gondola structural integrity by analysing bolted joints in SpaceBolt to ECSS guidelines.	I documented the findings and recommended design modifications to preserve safety margins. I also presented the bolt-analysis approach and findings at a student poster competition, explaining the work and its role in the program for stratospheric missions.

MECHANICAL MAINTENANCE (CANADIAN ARMED FORCES)



Context

During my service as a Corporal Vehicle Mechanic with 38 Service Battalion, I deployed to northern Manitoba for Exercise ARCTIC BISON 2020. The exercise tasked the Arctic Response Company Group with completing a grueling 300-kilometer snowmobile trek between Gillam and Churchill under austere, sub-zero winter conditions to prove domestic rapid-deployment capabilities.

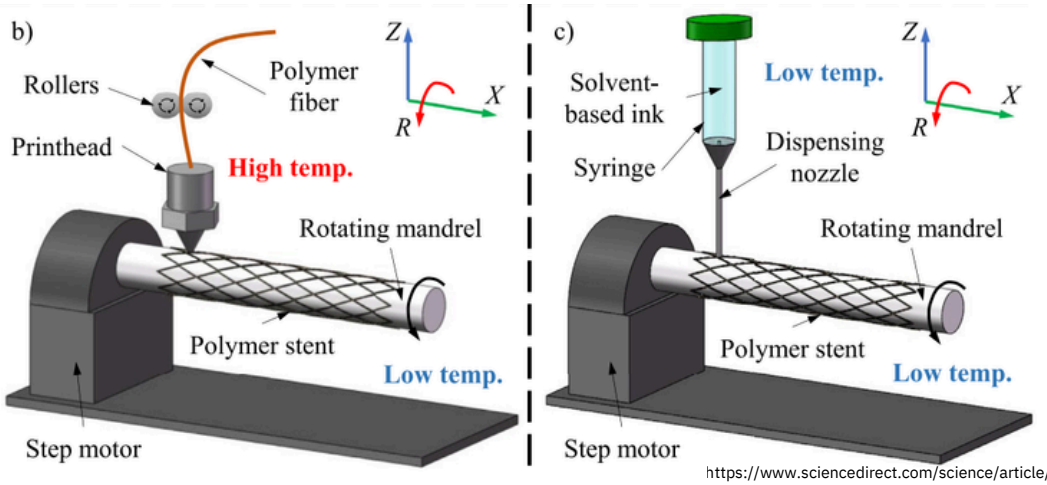
Tasks

I diagnosed, repaired, and maintained the detachment's fleet of snowmobiles, generators, and small support engines to guarantee maximum equipment reliability and operational readiness. Operating out of austere field environments, I worked alongside Canadian Rangers to troubleshoot mechanical issues on the trail, execute rapid field fixes, and keep the transit moving forward despite the extreme cold.

Results

The technical support and quick-turnaround field maintenance I provided directly contributed to the platoon successfully completing the full 300-kilometer transit safely. By keeping critical transport and power assets functional, we met all mission requirements while establishing reliable lines of communication and liaison between the training mechanics and local Canadian Ranger patrols.

DRUG-INFUSED PLA VASCULAR STENT PROPOSAL (MECH 4360)



https://www.sciencedirect.com/science/article/pii/S2772665722000101

Context

For my Biomaterials for Medical Applications course (MECH 4360) at the University of Manitoba, our team developed a proposal for a fully biodegradable and biocompatible vascular stent to treat coronary artery disease. The project focused on utilizing Poly-Lactic Acid (PLA) to eliminate the long-term clinical complications associated with permanent metallic stents, such as late stent thrombosis and restenosis.

Tasks

I evaluated material options and method of manufacturing, focusing on the mechanical integrity, flexibility, and degradation timelines of various polymers. I designed the research methodology to evaluate the stent's structural performance in vitro (radial strength, expansion capacity, and elastic recoil) and its biocompatibility in vivo using histological analysis, MTT assays, and cell proliferation metrics.

Results

Our proposal established a manufacturing path using rotating mandrel-assisted FDM 3D printing and a PLGA-polydopamine matrix for localized drug delivery. The evaluation framework demonstrated how the non-toxic polymer stent could deliver anti-proliferative drugs like Rapamycin and safely dissolve into carbon dioxide and water.

AUTOMATION OF THROW VELOCITY TEST CART (PRICE INDUSTRIES)



old design



NEW DESIGN



NEW CAPABILITIES

Context

Price Industries' research and development centre needed an air-velocity test cart to replace manual measurements with handheld meters. As my capstone project, I designed a cart with vertical and horizontal measurement, an LCD display, and SD-card storage.

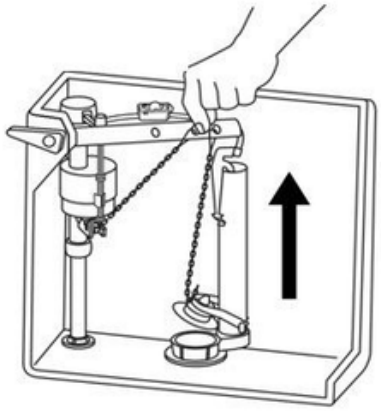
Tasks

I developed Arduino-based automation and data processing, and applied DFMEA to assess design risks. Motion control used a 6-inch horizontal linear module, a 36-inch vertical actuator, and a rotating mechanism with height adjustment from 54 to 124 inches, with sensors and limit switches.

Results

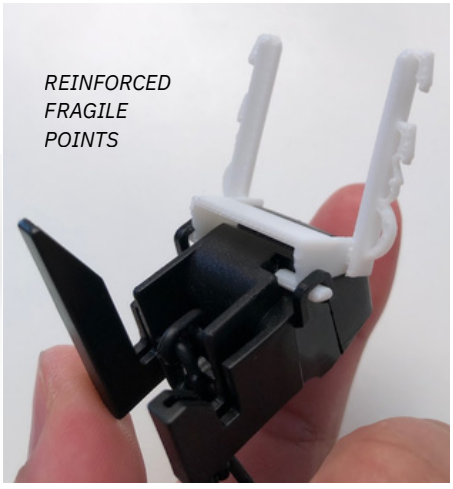
Manual adjustments and handheld-meter measurements were no longer needed, which reduced test time and improved measurement accuracy. I delivered CAD files with GD&T, a bill of materials, and a project report, with precise sensor positioning within a 6-inch by 36-inch grid.

TOILET LEAK GUARD (OFFERED 3D PRINTING SERVICES)



https://www.fluidmaster.com/toilet-problems/install-adjust-leak-sentry-valve/





REINFORCED FRAGILE POINTS

Context

A customer needed a broken leak guard device remade for 3D printing, with durability as the main concern. The original part had failed in use, so the replacement had to be measured carefully and redesigned to handle fill valve strain.

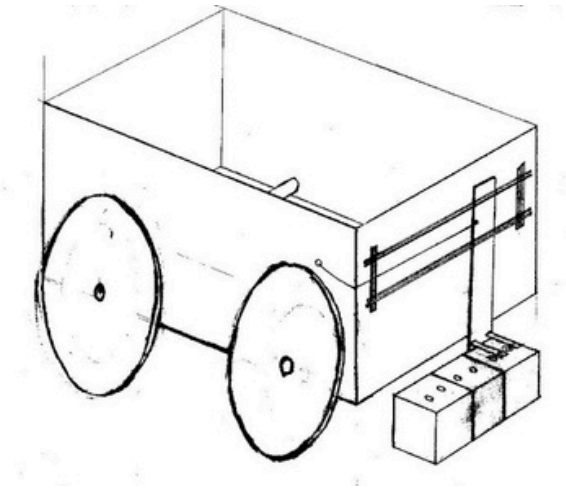
Tasks

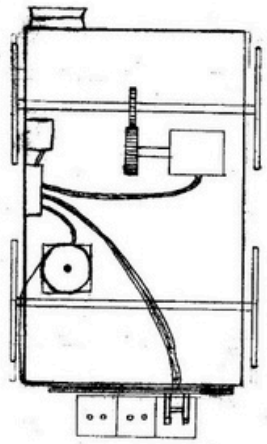
I measured the original part and built a CAD model for 3D printing, analysing failure points and strengthening critical areas through design iterations. I checked the design with the customer as it developed, so requirements were met through refinement.

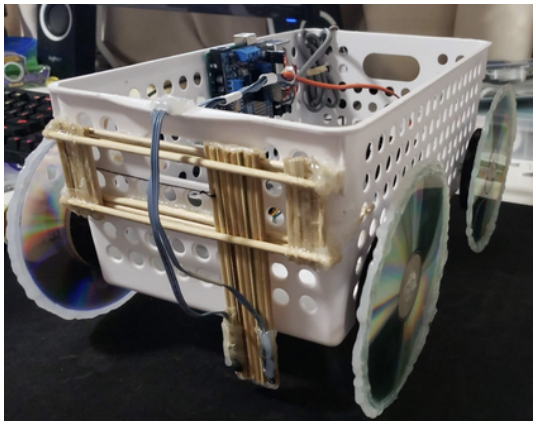
Results

The reinforced design withstood fill valve strain during extended use, and the customer approved the improved model. The customer ordered 50 sets, which confirmed the redesign met both functional and durability goals for the part.

MAGNETIC CUBES (ENG 1430 - DESIGN)

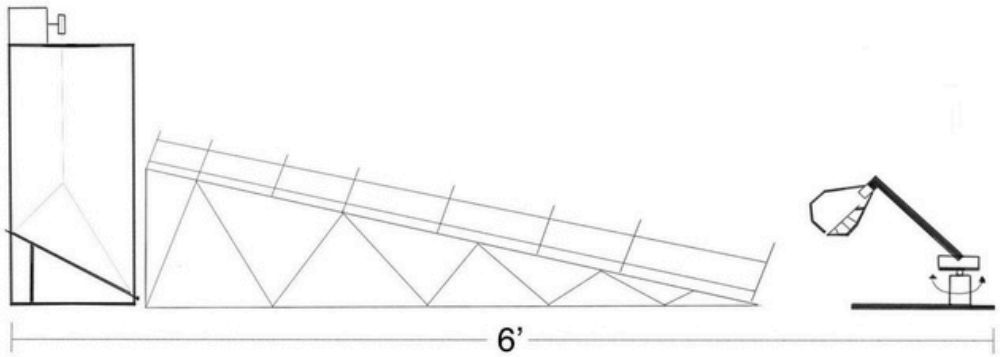






Context	Tasks	Results
For ENG 1430, our team built a vehicle to identify a numbered cube by magnetic polarity and move it, using Arduino and Hall-effect sensors. The build used household items where possible, to keep costs low without losing functionality.	I led a team building the vehicle, with a car frame made from household items and a slider mechanism for moving the cube. Arduino was programmed for cube detection and motor control, so the selected cube moved forward while the others stayed stationary.	The vehicle identified the numbered cube by magnetic polarity and moved it 20 feet with the slider mechanism. The selected cube moved forward as intended, while the other cubes stayed stationary, showing the detection and control worked as planned.

EGG MOVER (ENG 1430 - DESIGN)



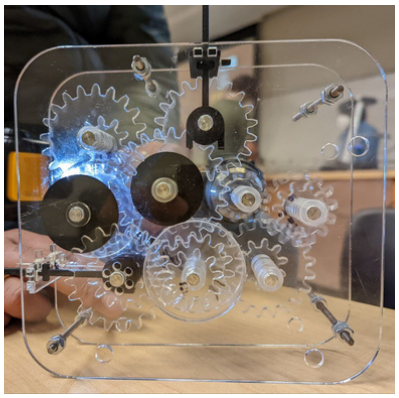


Context	Tasks	Results
For ENG 1430, I built a low-cost excavator setup to move an egg from one point to another. The setup had to pick up and transfer a fragile object reliably, using Arduino for motor control and joint movements, while keeping the build simple and low cost.	I built the excavator frame from skewers and hot glue, which kept costs down while maintaining stability. I programmed the motors with Arduino to control the excavator's joints, so movements for picking up and transporting the egg were accurate.	The excavator picked up the egg and transferred it onto another team's setup, meeting the project requirements. The build showed that a simple, low-cost setup could still handle a delicate task with reliability and precision.

GEARBOX (MECH 2112 - MECHANICAL AND COMPUTER AIDED DESIGN)

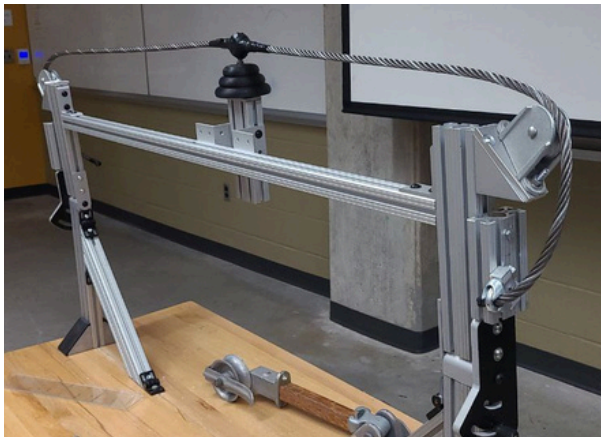


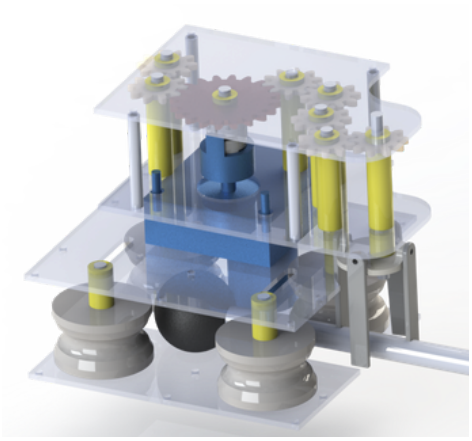


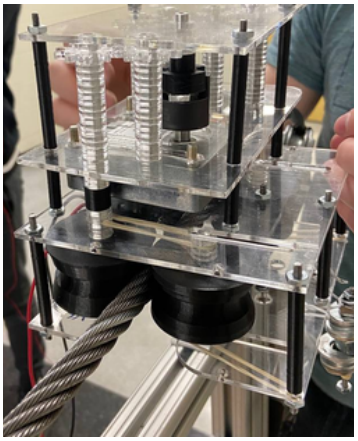


Context	Tasks	Results
For MECH 2112, I designed a 3-speed power transmission system for a moped vehicle. The gearbox had to fit within the frame and align with the frame's bolt placements, with functionality, durability, and precise integration as the main requirements.	I designed gears using the Involute Spur Gear Builder v2.0 by Dr. Hessmer and modelled individual components in SolidWorks. I then mated the parts together into an assembly, checking alignment and functionality within the moped frame.	The gearbox performed well under load and switched speeds under stress, as the design intended. A team review looked at successes and areas for future enhancements, giving a clear record of what worked and what could be improved.

DE-ICER (MECH 2112 - MECHANICAL AND COMPUTER AIDED DESIGN)

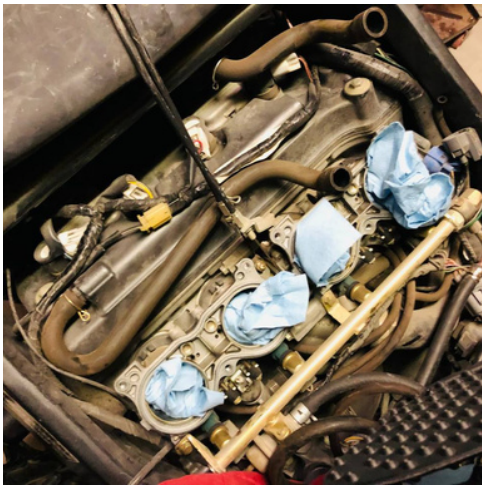


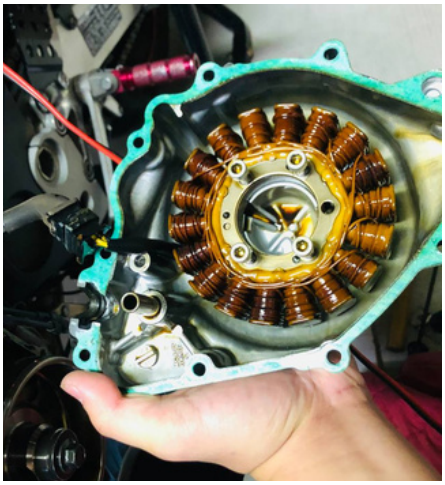




Context	Tasks	Results
For MECH 2112, I designed a small-scale de-icer prototype for HVDC power transmission lines. The prototype had to maintain contact with the cable while powered by a motor, and clear ice from the cable, with precision engineering and teamwork as part of the work.	I designed and assembled the prototype in SolidWorks, with a rotating disc and slats to clear ice from the cable. I also designed a wheel system with two spring-loaded wheels to navigate insulated balls on the line, powered by a motor.	The initial prototype did not meet all requirements, and the course timeline left limited time for revision. The team identified key areas for improvement and gained insights for future iterations, which is the outcome I am reporting here.

HONDA CBR954RR (PERSONAL INTEREST)







Context

For my Honda CBR954RR, I carried out maintenance and aesthetic improvements to improve performance and appearance. The work involved repairs, replacements, and customisations, with fasteners and parts organised systematically for smooth reassembly throughout the job.

Tasks

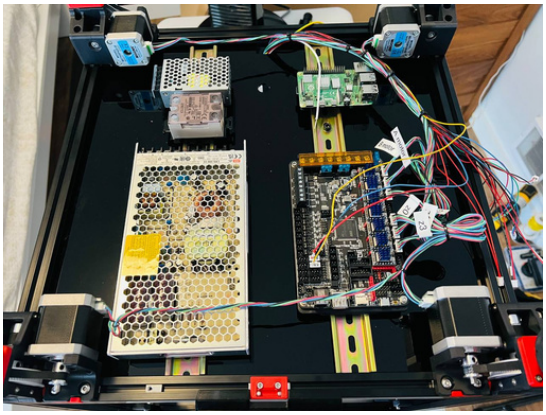
I cleaned the intake air filter, replaced spark plugs, and changed the stator cover to improve engine efficiency. I repaired, painted, and applied stickers to the motorcycle fairings, keeping fasteners and parts organised for reassembly.

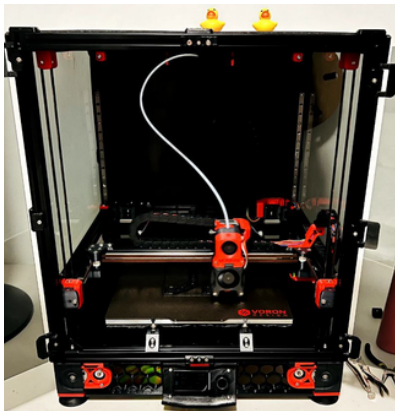
Results

The motorcycle ran more efficiently and had a refreshed appearance, with improved functionality and visual appeal. Organising parts systematically also made reassembly smoother in the end, with fewer issues from missing or misplaced fasteners.

VORON 3D PRINTER (PERSONAL INTEREST)







Context

I assembled a Voron 2.4 300mm 3D printer, which required mechanical, electrical, and coding work. Precision and organisation mattered throughout, so the printer could function well and produce high-quality prints once assembled from a kit of components.

Tasks

I installed all mechanical components with proper alignment, and organised and labelled wires neatly for identification and maintenance. I integrated electrical and coding elements to complete the assembly, checking function as the build came together.

Results

The printer was fully functional and capable of producing complex parts with good print quality, showing reliability and precision in use. It became a practical tool for prototyping and functional parts in later work for my own projects.

QUALITY JOURNAL (ENG 4110 - OPERATIONAL EXCELLENCE)

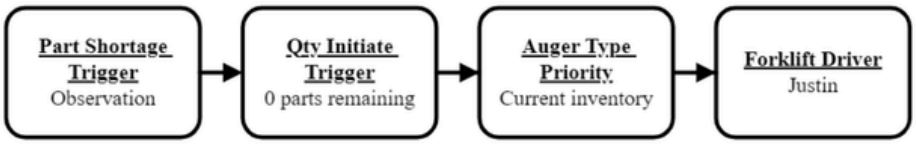


Figure 29: Previous part delivery procedure.

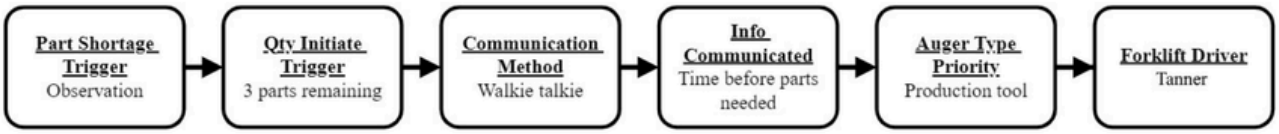
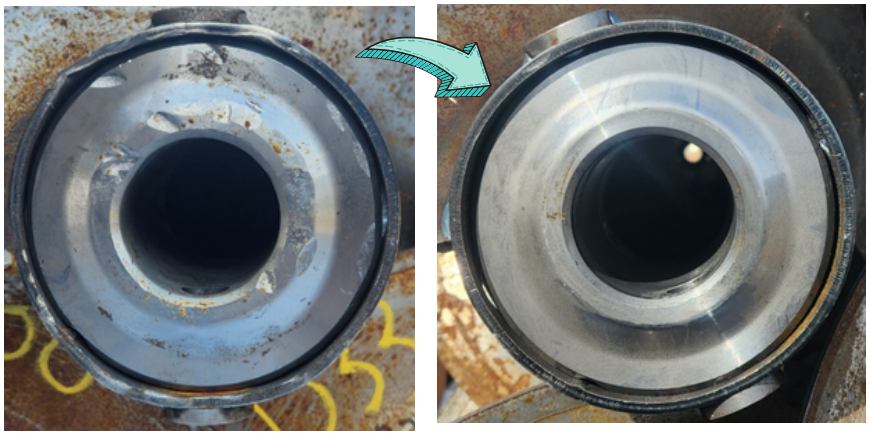


Figure 30: Standardized part delivery procedure.

Context	Tasks	Results
For ENG 4110, I worked on the auger flighting station, where throughput had to meet a takt time of 30 minutes, with buffer time eliminated and Lean Manufacturing principles applied. The aim was to improve efficiency and reduce labour costs.	I followed Quality Journal Analysis steps to assess the process and created a communication system for parts shortages. I engaged stakeholders, conducted GEMBA walks, applied Kaizens and 5S methodology, and reallocated a process performer to optimise cycle time.	The manufacturing process was stabilised, which made future improvements easier to implement. Annual labour cost savings reached CAD$108,000, waste was reduced, and the shop was organised to align more closely with Lean Manufacturing principles for the station.

KAIZENS (ENG 4110 - OPERATIONAL EXCELLENCE)





Context	Tasks	Results
For ENG 4110, I worked on standardising operating conditions for grinding discs, to improve safety, reduce waste, and improve product quality. Quick Kaizen methods and Lean principles were used to optimise assembly processes and reduce cycle times.	I used Quick Kaizen techniques to eliminate waste and reduce auger cycle time, clearing ineffective grinding discs to improve tool safety. I developed visual guides to standardise operating conditions for grinding sheets and applied 5S methodology to the work.	Auger tube deformation was reduced, product quality improved, and 6 minutes were saved per coupler installation. Standardised operating conditions improved safety and efficiency, and 5S implementation streamlined operations and minimised waste across the station.

ENGINEERING NEWS

Daily Stratos

BOLTS EDITION

BOLT ANALYSIS

SECURING THE PAYLOADS



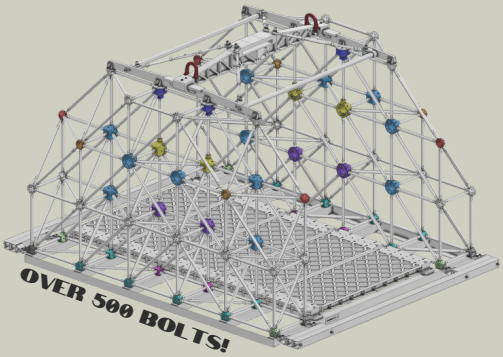
CIMSEC, "WHEN THE BALLOON GOES UP: NAVAL MESH NETWORKING WITH STRATOSPHERIC BALLOONS", 2023

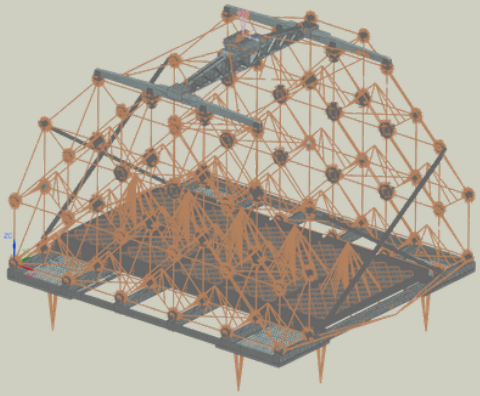
THE ESSENTIAL ROLE OF BOLT ANALYSIS

In the high-stakes Stratos mission, bolt analysis is crucial for payload safety and mission success. Bolts secure joints and maintain the gondola's structural integrity, enduring immense loads. Some key factors to consider include:

- Bolt Selection: Type of bolts with their counterparts, and materials
- Preload Requirements, depending on the bolt and materials
- Friction coefficients, including thread, under-head, sliding, and assembly
- Temperature Effects, difference in temperature could affect applied preload
- And more!

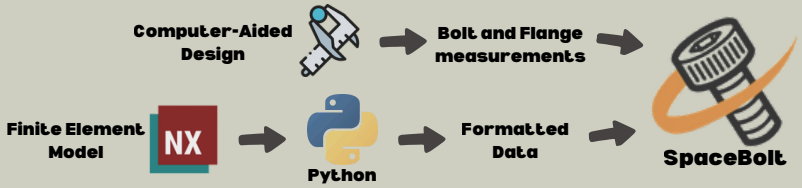
Rigorous analysis ensures bolts withstand operational forces, preventing failures and ensuring mission reliability.





THE THOROUGH PROCESS BEHIND BOLT ANALYSIS

The process of bolt analysis requires careful attention from material selection to final installation. Following finite element analysis (FEA) in Siemens NX, reaction loads at bolt joints are precisely extracted and reformatted using a Python script to ensure compatibility with SpaceBolt. Bolt groups are then meticulously configured in SpaceBolt to mirror real-world applications, incorporating computer-aided design (CAD) dimensions, bolt types, material properties, and preloads. Matching these parameters to installation conditions is crucial for maintaining the accuracy and reliability of the analysis.



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