Clutch Tail Rotor System for Bell Helicopter

Overview
A primary concern of medical flight missions is safely working around the rear tail rotor of the helicopter. Despite safety and training programs injuries are still all too common, especially at night. The proposed solution is to design a clutch system that will enable the rear tail rotor to be disengaged while the aircraft is grounded. This has to be accomplished without decreasing tail rotor efficiency or diminishing the overall integrity of the helicopter.

Objectives
The principle objective of this project was to engage and disengage the tail rotor while sustaining the current efficiency. The specific requirements are as follows:

- System must last 3000 flight hours
- Monitor peak torques in the system
- Find maximum stresses to ensure system lasts for 2 million cycles
- Design to keep weight to a minimum

Approach
- Teleconferences with the Bell team established the customer needs and specific requirements
- Any information or data needed was requested during these meetings as well
- With the customer needs in mind, preliminary concept generation was conducted, followed by a final concept selection process
- CAD models of our final design were created to solidify final sizing and weight of the system
- Simulink models of the helicopter and clutch were integrated together to view the torques in the system and to see how the two systems work together
- FEA was conducted in SolidWorks to confirm the system would last 2 million cycles
- A prototype was not fabricated, only a demonstrational model
- Testing consisted of our analysis and making sure peak torques were within limit and that the clutch was structurally sound with specifications set by Bell

Outcomes/Recommendations
An innovative and feasible clutch system was presented that the aircraft industry has never seen before.

- Material optimization is recommended to reduce weight
- Engagement time should be increased at current speeds to reduce peak torques
- Efficiency was not decreased
- Project was within budget