NGC Gantry Crane

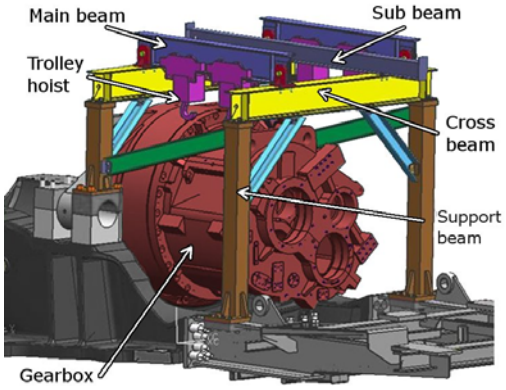
Purpose: Redesign gantry design system to reduce time, manpower and cost for NGC gearbox maintenance in GE Wind Turbines.

Current Design

- A NGC gantry crane is used to move the gearbox's casing (2MN) to access the high speed shaft (HSS) and subsequent rebuild/alignment
- Casing moves 100mm forward and separate top half 20mm up for process

Current Issues

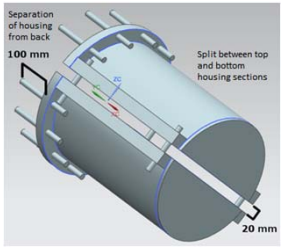
- Process requires 4 technicians to work 5 12-14 hour workdays
  - 1.5 days to install, 2 day to repair, 1.5 days to takedown (overlapping work)
  - 15-20 lifts for crane members, tools, and supplies
  - Bill of Materials: $117,000
  - Labor Costs: $27,000



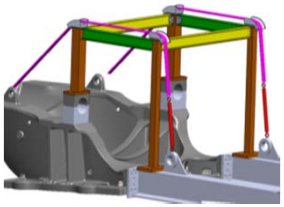
Assembled NGC gantry crane

Past Work

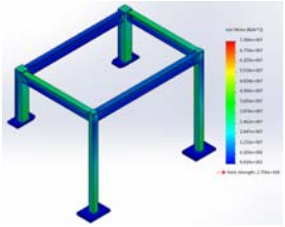
- Explored various member shape, size, and designs for optimization
  - Bolted, folded, and telescoping beams
- Identified two promising designs: bolt–hydraulic and cable suspension



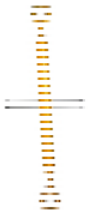
Separation of the gearbox casing



Cable suspension concept



FEA of redesigned gantry crane with 4.6 FOS

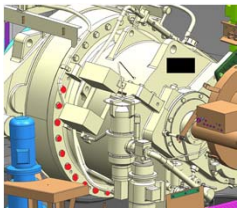


- Sheave Design (Above)
- Equalizer block for trolley (Left)
- Chain hoist to lift housing (Center)
- Turnbuckle to pre-tension sling (Right)

Eye & Eye Synthetic Sling

Semester Results

- Both designs are feasible and provide promising solutions
- Bolt supported system offers greatest cost and time savings



Highlighted bolt replacement

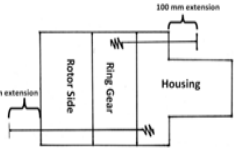
Design Concepts and Technical Accomplishments

Cable Suspension

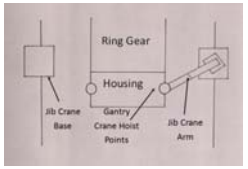
- Replace main beams in current gantry crane with cables
- Reduced size and weight of other crane members
- Pros
  - Reduced weight
  - Increased maneuverability
  - Reduced installation time
- Cons
  - Higher occupational risk
  - Inspection for cable fatigue

Bolt Supported

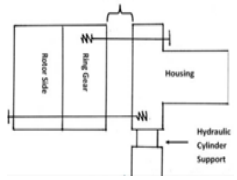
- Replace bottom half bolts in casing, function like cantilever beams
- Use 2 heavy duty jib cranes to help support housing
- Slide casing on bolts
- Issues
  - Housing binding on bolts
  - Realigning housing with gearbox components



Proposed bolt installation



Jib Crane Support



Setup after separation

Bolt Material Selection	FOS	Deflection (mm)	Machining Comments
Austempered Ductile Iron Grade 5	**3.09**	**13.6**	**Easy to cast Specific heat treatment**
Titanium Carbide K162B	2.29	5.15	Difficult to work Slender parts
Titanium Alloy Grade 6 Annealed	1.58	1.79	Easy to work Similar to stainless steel

Final Comparison

Metrics	Current Crane	Cable Design	Bolt Design
Time (days)	5	3	2
Weight (lbs)	1624	612	1231
Material Cost	$116,960.00	$22,000.00	$24,210.00
FOS	5	4.6	4.7