Element J: Documentation of external evaluation

On Saturday November 17th, 2012 the team met in person with Mr. Ascoli, the Albany branch manager of Thompson & Johnson Equipment Co., Inc., and Mr. Gorham, the Excutive Vice President of Thompson & Johnson, for the first time. The team presented both the visibility and stability problems and all of the conceived possible solutions up to that point (these are stated in the Stability Solution and Visibility Solution Matrices in Element D: Design concept generation, analysis, and selection). Mr. Gorham said that he was very interested in one of the visibility solution ideas, the swinging periscopic viewport, which ended up winning the Visibility Solution Matrix. Although he liked the idea very much, he did suggest to be aware of the device increasing the forklift height, and stated the

reasons why increasing the height of the forklift is not ideal. He also suggested that in addition to just giving the forklift driver greater forward visibility, the concept also has the potential to aid the operator with viewing in front of a tall load. The tall load would otherwise obstruct the operator's forward vision. Mr. Gorham and Mr. Ascoli both stated that they perceived the swinging periscopic viewport to be a viable solution concept and the most viable out of the brainstormed visibility solutions.

As for stability, Mr. Gorham and Mr. Ascoli suggested that the team should focus on longitudinal stability (foward tipovers) because it was a simpler concept to work with. "When you start talking about side tipovers not only do you have the weight, you also have angles and extra forces, the math gets really involved." But he also stated that lateral tipovers and tip overs on ramps are more common.

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(Picture was provided by Mr. Ascoli from **http://www.thompsonandjohnson.com/ (http://www.thompsonandjohnson.com/)**)

The team also met with the team mentor, Mr. Bovee, on November 19th and December 18th, 2012 to discuss the progress of the project. Both the visibility design, the swinging parascopic viewport, and the stability design, the undermounted hydraulic shifting counterwight system, were presented to him. For the stability design Mr. Bovee suggested that perhaps the team should consider using motors instead of hydraulic cylinders. He mentioned that if the weight that needs to be moved needs to be moved with high speed, motors could be a possible solution as well. Based on this advice, the team added the "undermounted motor moving counterweight" to the Stability Solution Matrix in

Element D: Design generation, analysis, and selection. When this possible solution was added, the undermounted hydraulic and the undermounted motor systems tied. At this point,the team began to look at both systems in more depth to determine which one to choose.

On January 16th 2013, *[redacted student name]* contacted Mr. Okamoto a product support specialist of Toyota Material Handling. He is also the person who contacts the chief Toyota engineers in Japan. As *[redacted student name]* described the stability idea of a moving counterweight to offset an imbalance of the center of gravity, he said "Wow! That is an encellent idea! My only advice to you is to make sure that the counterweight does not stick out from the forklift itself. When the forklift is taking a turn the last thing you want is a weight coming out of the sides. I'm not sure if you know this but forklifts don't have much room to make turns so you don't really want any extra width being added."

Kenro Okamoto
Product Support Specialist

[redacted student name] and *[redacted student name]* have gone to Thompson and Johnson to talk to Mr. Molano, the Service Manager, various times to discuss with him the new stability idea. The first visit in regards to this occurred on February 25th 2013. Mr. Molano approved of the stability idea. He did mention that the speed needed to be accounted for because
tip-overs were not only induced by overturning but also due to speed. Later that week *[redacted student name]* and *[redacted student name]* visited Mr. Molano to discuss the visibility design with him. Initially the team was going to use thin sheet metal to construct the body of the periscope. Mr. Molano suggested making the periscope out of something thicker because if a heavy load fell on top of the device it could get damaged. The team took Mr. Molano's advice and built the body of the periscope out of thicker sheets of metal.