The following summary discusses an analysis of a Tyco International camera housing mount. The housing mount will be tested for its mechanical properties and its reliability. Its manufacturing process will also be analyzed for cost reduction improvements. Tyco International redesigned their i625 PTZ outdoor camera, adding additional weight to the existing camera. The objective of this project is to validate that this redesigned outdoor camera housing can withstand the additional weight.

The main objective is to develop a housing arm that can withstand the additional weight of the new camera. Minimally the housing arm must be able to hold 26.4 kg before failure. The analysis will be done using Finite Element Analysis (FEA) techniques in SolidWorks while also utilizing mechanical tests on the prototype housing arm.

Based on preliminary discussions with Tyco International, a list of customer needs were obtained which include: low production cost, light weight design, similar aesthetics to the previous design, efficient heat dissipation rate, and able to support the weight of the camera plus additional weight. From these customer needs, a set of target specifications were derived with the intention of meeting each of the customer needs. It was decided that the housing would have to hold an equivalent of 6.6 kg with a factor of safety (FOS) of 4 (26.4 kg) to meet the strength requirements while maintaining the arm length and current operating conditions. The original slotted housing arm was tested using SolidWorks FEA and it was determined that it did not meet the FOS requirement.

To redesign the housing arm to meet each of these aforementioned specifications, a number of concepts were generated. Some of the concepts generated include reducing the overall arm length, changing materials, and increases the cross sectional area (thickness) of the base. To test the validity of these concepts, a thorough analysis of the housing arm was conducted utilizing the built in FEA software in SolidWorks. After the analysis, concepts were discarded using a screening process and a Pugh Scoring table. The concept selected is a new slotted design with a 4 mm thick base made out of ASTM A36 steel. Additional concepts such as a four hole design are discussed as well. Ultimately these other concepts have been screened out due to not meeting safety requirements or the increased assembly time.

The original slotted design was deemed inadequate because it only returned a FOS of 2.03 in SolidWorks FEA. The team then developed the four hole design with a 4 mm thick base to solve this issue. The four hole design with the 4 mm thick base had a safety factor in SolidWorks FEA of 5.051 and 5.976 for 5052 H-32 Aluminum Alloy and ASTM A36 Steel respectively (Table 12 & 13). This design lacked in ease of assembly so was discarded. The new slotted design maintains the integrity of the current assembly process and improves the slippage that occurs where the housing arms mounts with the bracket. After an in depth analysis of the original housing arm, it is the team’s recommendation that the product switch over to the new slotted design in ASTM A36 Steel. The new slotted design made with ASTM A36 steel and the increased 4 mm thick base reduces costs and satisfies the safety requirements. The ASTM A36 Steel is a FOS of 5.985 and the 5052 H-32 Aluminum Alloy has a FOS 4.148 in SolidWorks FEA. These values are slightly lower when analyzed in ANSYS Workbench; ASTM A36 steel and 5052 H-32 Aluminum alloy with the new slotted design return a FOS of 4.826 and 3.789 respectively. Because of these slightly lower FOS of the aluminum the team feels it is best and safest to use the steel as the material choice moving forward. ASTM A36 has better strength properties at approximately 50% of the cost. A prototype was developed in Shanghai, China for $150. The quantity that all the housing arms are produced at could reduce these costs if Tyco decides to switch all housing arm production through Shanghai, China. Steel is easier than aluminum to weld which could result in labor savings. The new slotted design maintains the existing assembly method but improves the consistency of where the housing arm is mounted to the base. The new slotted design provides a mechanism to lock the housing arm into place before tightening the screws. It also reduces the amount of slippage that can be seen where the housing arm is mounted to the base. Ultimately switching to the new slotted design with the thicker base and new material solves many of Tyco’s concerns.