Executive Summary

To develop general background and context for determining what concept models can be applicable to the target area, Gaza Strip, research was conducted on general Mobile Health, Safe Motherhood Initiative, Gaza Strip, and structures of current mobile units. Using the researched material and their available benchmarking sources, eight user requirements were developed with corresponding engineering specifications. These requirements and specifications have been updated as follows. The 1st requirement is to accommodate requisite materials from the WHO's Life-Saving-Skills List for Safe Motherhood by providing enough volume space for a total equipment & supply weight of 1691 kg. The 2nd is to maintain optimal obstetrical conditions, mainly achieving floor areas of at least 11 m^2 and clearances of 1.07 m around the operating table. The 3rd is to minimize cost under a budget of 102,382 USD. The 4th is to follow transportation regulation limits for a weight of 11,340 kg and a volume of 77.409 m^3. The 5th is to minimize setup/disassembly effort by requiring a minimum number of 2 people to setup or disassemble within 1 hour. The 6th is to protect interior contents from environmental concerns such as flood immersions of 0.46 m and wind speeds of 16.7 m/s. The 7th is to meet the local child birth rate, which are 6 deliveries per day in the Gaza Strip. And the 8th is to accommodate 0.65 m^2 for one visitor.

For the concept generation process, a simple brainstorming session was held and a functional decomposition was developed. Structure ideas were mainly created through group discussion and the brainstorming session, and are provided in Appendix F. Pugh charts, which are provided in Appendix G with details on weight and scoring, were developed: the alpha structure concept selected was the Expandable Trailer and alpha layout design selected was the A/C Unit & Generator Attached onto outside Doors. Later, the beta design was developed because of the unnecessary complexity of the alpha design – the single-side expansion with motors. Also, the bulletproof specification for the unit had been dropped down since it makes the entire unit too heavy and impossible to expand in any ways. However, the selection was not repeated after the change in requirement because it was it was a still potential improvement in the future. But after there were major feedbacks on the first prototype, another selection process was inevitable. The first reason is using motor and gear system takes extra space and weight, and building a gear system in a shipping container can also take much space. Second, if the unit does not expand and contract frequently, having a manual expansion system reduces maintenance issues, cost, power consumption, and the unit's overall complexity. With bulletproof requirement removed and motor driven expansion to manual expansion, another concept selection was done with Pugh Chart. As a result, an expanding shipping container was chosen, with the same dimension and expansion length. The expanding mechanism is chosen to be hinges, so the walls, ceiling and the floor for the wing will be folded inside to outside as it expands.

Engineering design parameter analyses were performed to find out adequate material, necessity of supports for the extension, optimal interior layout, and the total power consumption. The final design was generated based on the engineering analyses and specifications. The final design is a shipping container with an expanding wing at its long side. The main purpose of the expansion is providing appropriate clearance area around the operating table. The expansion will be achieved by hinges. The unit is largely divided into three rooms: a lobby area, a birth unit, and storage.

The first prototype, which uses motor and gear system, did not receive positive feedbacks, and the second beta design was developed as mentioned earlier. However, the prototype for the second beta design could not be done because of the limited time after a major design change.