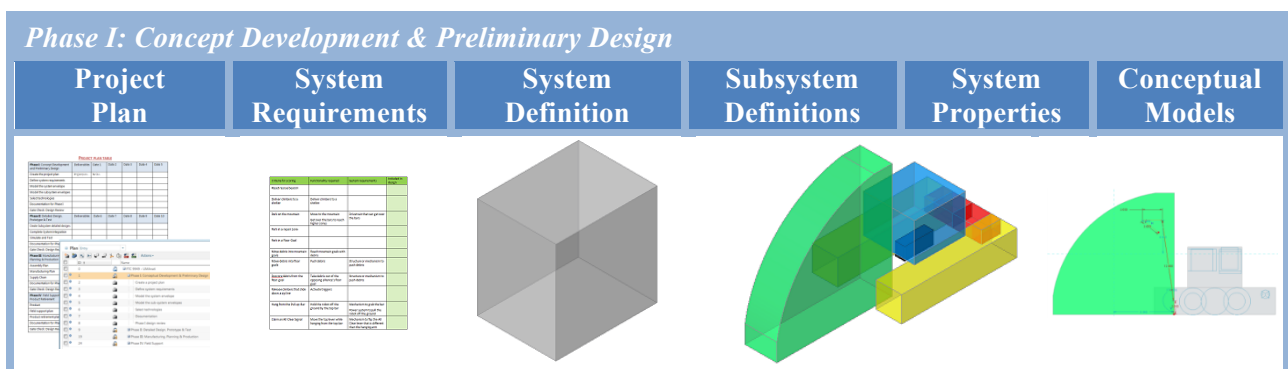




Let's break down the complexity of designing and building a robot through a product development process that allows you to engineer solutions to simpler tasks which, when taken together, form an integrated solution. That process has four phases that each contain a collection of deliverables and a gate check – giving you the chance to review and refine.

1. Concept development and preliminary design.
2. Detailed design, prototype, and test.
3. Manufacturing planning and production.
4. Field support and product retirement.



## System Requirements

A good design optimizes function or performance within a set of constraining factors. In the case of a robotics competition, the game description or challenge description will explain how your robot will score points or otherwise be evaluated. The ranges of possibility for designs are

limited by constraints including time, cost, and relevant rules or regulations. Use both the criteria and constraints specific to your challenge to guide your design process.

For a FIRST competition, a game manual is made available as two PDF files. Game Manual I covers general rules for the program that change little from season to season. Game Manual II covers the rules that are specific to that season’s game.

Use guiding questions to make your analysis more effective. Your research should produce answers to a set of questions that cover the essential information required for a successful design.

Example:

- What does the robot have to do?
- How will performance be evaluated (e.g. scoring points, graded, voted on, etc.)?
- What mechanical systems does the robot need to meet the criteria?
- What constraints limit the design options?

Include all the ways your robot can score in the game, and rules limiting what your robot can do or be. The example provided here is was completed by FTC team 9949 for the 2015-2016 FTC game RES-Q.

**Example: System requirements for the 2015-2016 FTC game RES-Q – FTC 9949**

Criteria for scoring	Functionality required	System requirements	Constraints
Reset rescue beacon	Autonomously locate the rescue beacon	Autonomous program and method of pushing button	No human control
Deliver climbers to a shelter	Autonomously locate the shelter Carry and drop climbers	Autonomous program and method of carrying and dropping climber	No human control
Park on the mountain (low, mid, and high zones)	Autonomously locate the mountain Get over the bars to reach higher zones	Autonomous program Drivetrain that can get over the bars	No human control
Park in a repair zone	Autonomously locate the repair zone	Autonomous program	No human control

Park in a floor goal	Autonomously locate the floor goal	Autonomous program	No human control
Move debris into mountain goals	Reach mountain goals while holding debris	An extendable mechanism that can reach the mountain goals	Must not exceed 18 inches at start
Move debris into floor goals	Push debris	Structure or mechanism to push debris	Cannot control more than 5 pieces of debris at one time
Descore debris from the floor goal	Push debris out of the opposing alliance's floor goal	Structure or mechanism to push debris	Cannot control more than 5 pieces of debris at one time
Release climbers that slide down a zip line	Activate triggers	Mechanism that can move horizontally	
Hang from the Pull-up Bar	Hold the robot off the ground by the top bar	Mechanism to grab the bar Strength to lift the robot off the ground	
Claim an All Clear Signal	Move the top lever while hanging from the top bar	Mechanism to flip the All Clear lever that is different than the hanging arm	

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