



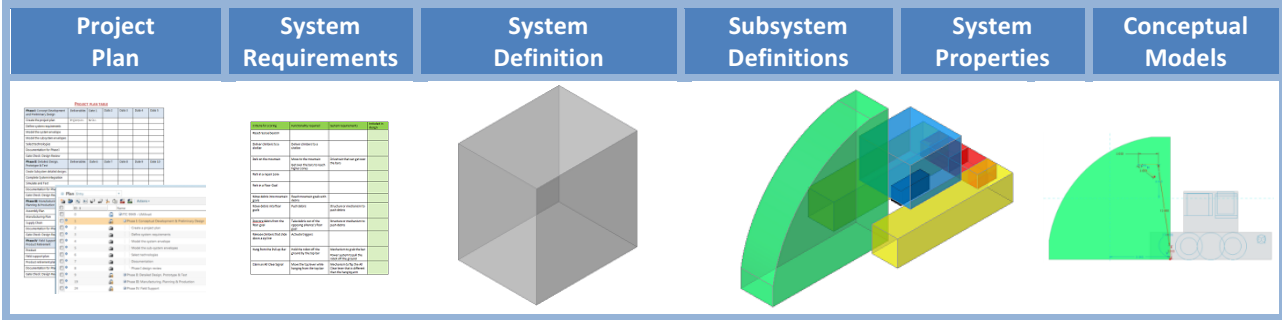
Overview of the Product Development Process

Creating a robot is a complicated problem. We can break down the complexity through a product development process that allows us to engineer solutions to simpler tasks which, taken together, form an integrated solution.

There are many product development strategies employed by different companies and across different industries. PTC prescribes a product development process that includes four phases:

- 1) concept development and preliminary design
- 2) detailed design, prototype, and test
- 3) manufacturing planning and production
- 4) field support and product retirement

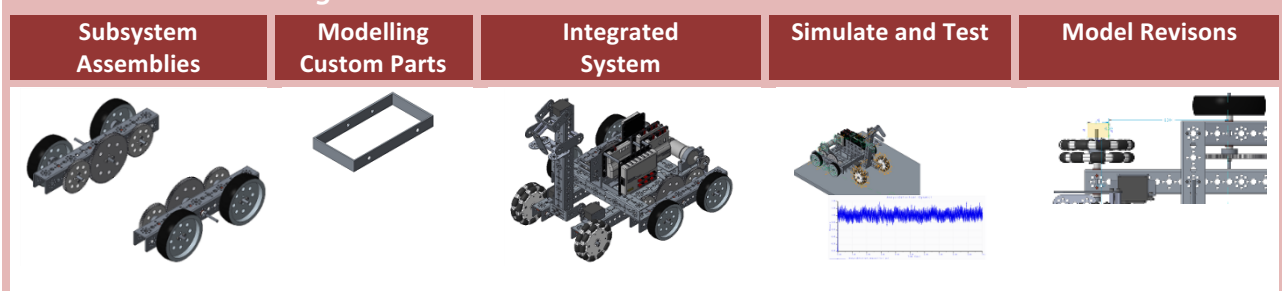
Phase I: Concept Development & Preliminary Design



The first phase of the product development process transforms great ideas into the initial concepts and preliminary robot designs.

Phase I includes creating a project plan, identifying the system requirement determined by the design challenge, defining the subsystems that will perform the required functions, and select the specific technologies that will become the components of the robotic system.

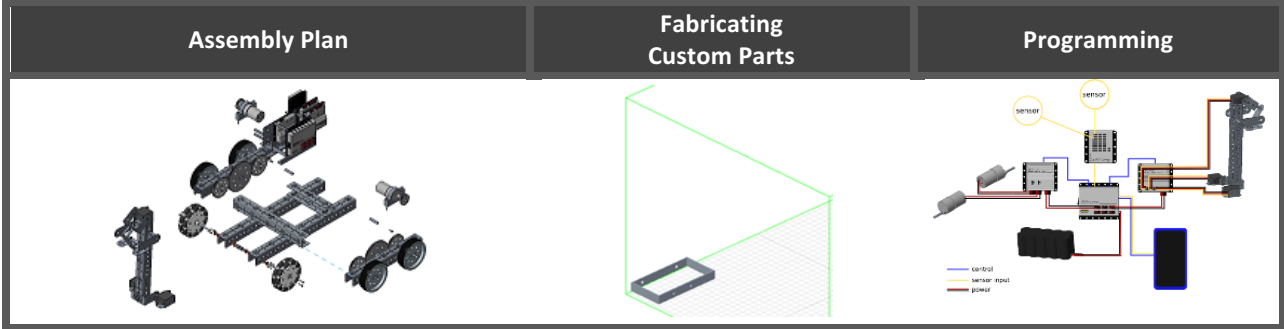
Phase II: Detailed Design



The second phase of the product development process transforms the preliminary designs of the first phase into detailed designs of each subsystem and integrates them into an overall system model.

Creo Parametric is used to make a solid model of the robot and conduct analyses. Simulations of robot performance ensure that it works correctly and is ready for assembly.

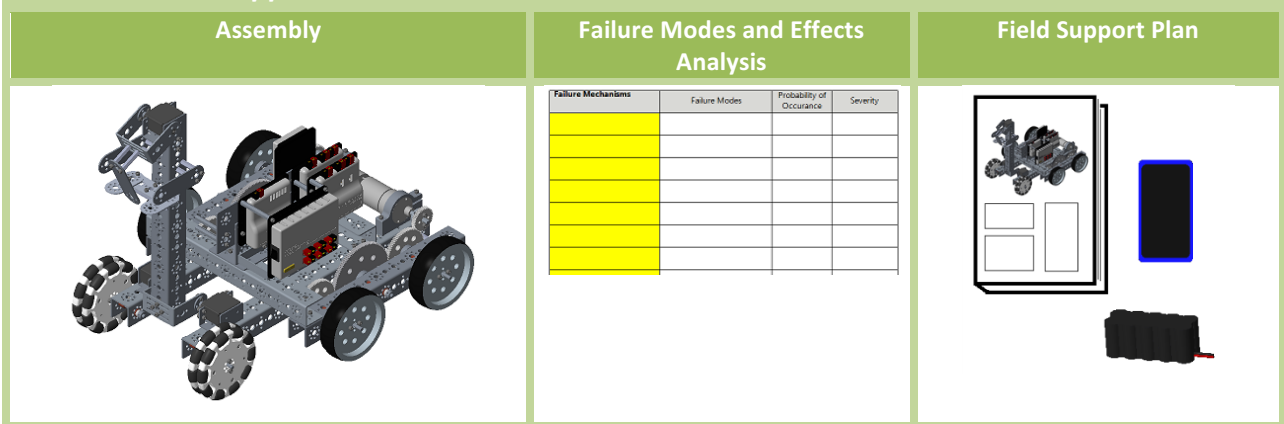
Phase III: Manufacturing Planning & Production



The third phase of the product development process documents the parts of the robot in a bill of materials and creates an assembly plan. It also includes the program that allows the robot to perform its required functions.

Phase III identifies how each of the parts will be obtained including the fabrication of custom parts.

Phase IV: Field Support & Product Retirement



The fourth phase of the product development process prepares the robot for operation in the field. It is the final phase and includes producing the robot, as well as conducting a failure means and effects analysis (FMEA) from which a field support plan is developed. A retirement plan is also created to inform decisions about how the robot will be used or disassembled after its competition.

Following this product development process gives us the advantage of breaking the complex challenge of creating a robotic solution into simpler problems that can be solved through engineering.

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FIRST@ptc.com