

DT to be supported through EDP

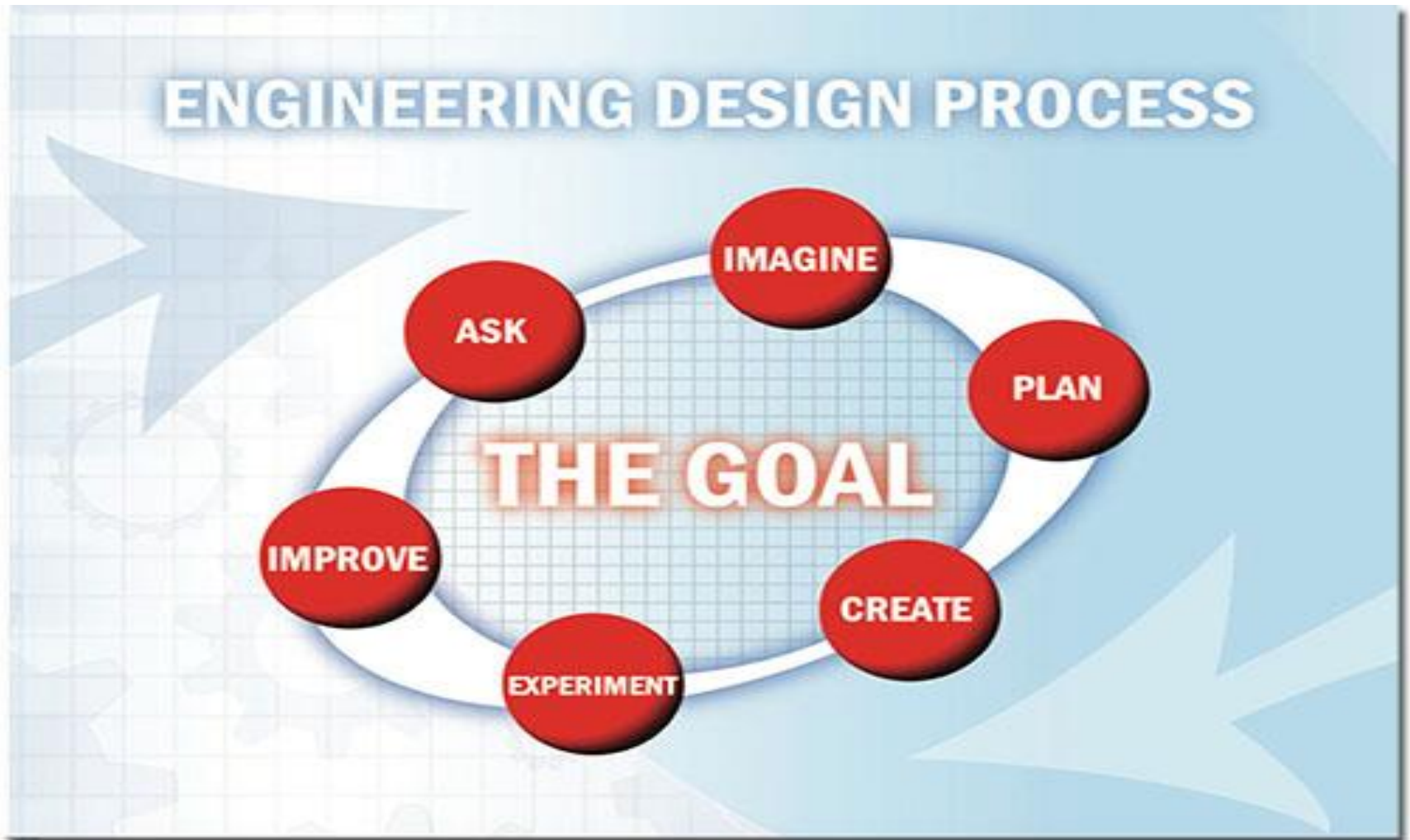
To solve **engineering problems**, engineers follow a **series of steps** called the “**Engineering Design Process (EDP)**”

- **‘Engineering Design Process (EDP)’** is a decision making process (often iterative) in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective.
- Among the fundamental elements of the design process are the establishment of objectives and criteria, analysis, synthesis, construction, testing and evaluation
—Accreditation Board for Engineering and Technology (ABET)* in USA

EDP as an umbrella covering several aspects, focuses on ideation, research, conceptual design, feasibility assessment, establishing design requirements, embodiment/ system-level design, detailed design, manufacturing planning, tool design, testing and production ramp up.



NASA's BEST Engineering Design Model (designed to teach students the EDP)



Engineering Design Process (NASA): The steps are described as follows.

- **ASK (Identify a need):** Identify the problem, **requirements** that must be met, and **constraints** that must be considered.
- **IMAGINE (To develop possible solutions):** **Brainstorm** solutions and **research** ideas including **exploring what others have done**.
- **PLAN (To decide best course):** Choose two to **three best ideas** from brainstormed list and sketch possible designs, **ultimately selecting one to prototype**.
- **CREATE (To develop a Prototype- a test model of the product:** **Build** a working model, or prototype, that aligns with **design requirements** and that is **within design constraints**.
- **TEST/ Experiment (To evaluate the prototype and Cost-Benefit Analysis)**
: Evaluate the solution through testing; **collect and analyze data**; summarize strengths and weaknesses of the design, revealed from testing.
- **IMPROVE (To modify and retest the solution):** Based on the results of tests, to make improvements on the design, also **identify changes to make**

STEP 1- ASK

(Images from Science Photo Library)

The 1st step is to identify a need.

- **Define** and research a need or **problem** that is being tried to be solved.
- **Example:** The need may be to provide **prosthetic support/ devices** to people who are missing limbs, for re-enabling them to perform routine activities.

Engineers might need to study and analyze:

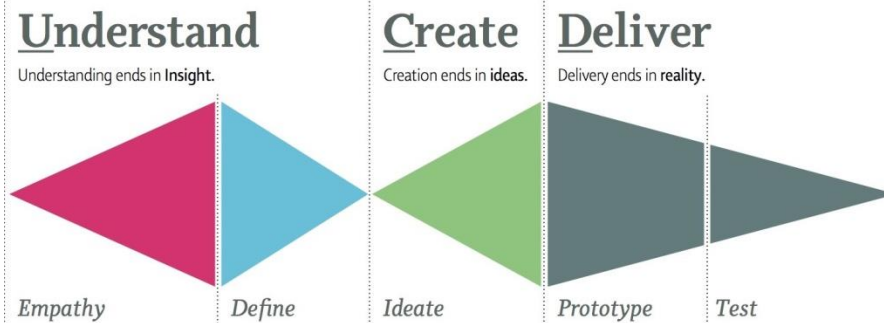
- (i) the person's precise needs,
- (ii) shortcomings of available prosthetic devices, and
- (iii) the related biomechanics.



STEP 2- IMAGINE:

The 2nd step is to develop possible alternative solutions.

- **This step entails brainstorming for ideas** - Discussion and sharing ideas in order to cultivate additional concepts.
- **Example:** A type of prosthetic foot was designed mimicking the springs used in a car.



STEP 3 & 4 - PLAN and CREATE:

The 3rd step is generate Ideas/ Concepts and the 4th step is to begin making a prototype.

- Building a **prototype** (a test model of the product) will allow engineers to see if their design works the way they expect it to.



STEP 5- TEST:



The 5th step is to test and evaluate the prototype.

- To insure that the technology/ product/ solution accomplishes the task it was designed for.

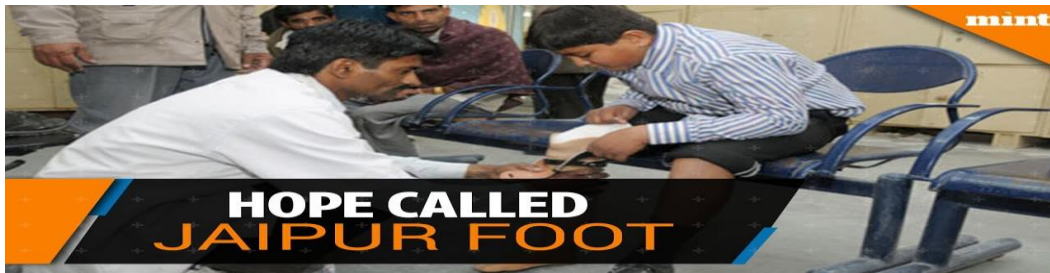
- **Cost-Benefit Analysis**

To assert that the cost of developing (designing and manufacturing) the new product is worth in terms of benefit.

STEP 6- IMPROVE:

The 6th step is to modify and retest the solution/ product prototype to improve.

- If the prototype does now work successfully or at all, the engineers may prefer to modify the first model or try a new solution.
- Generally, will also scout around for other possible uses for the developed product.
- **Example:** Computerized Tomography (CT) scanning was developed to see internal structures in the body. Now used also for modeling limbs for better fit of prosthetics.



Focus on Fuzzy Front End (FFE) of Product Development

The Fuzzy Front End phase covers the generation of a new product idea to its approval for development or its termination. Cooper (1988) distinguishes four stages in the FFE: idea generation, idea screening, preliminary evaluation and new product concept evaluation.

According to Khurana and Rosenthal (1998), the FFE includes: the formulation and communication of new product strategy, opportunities identification, generation and screening of ideas, product definition and planning and design activities.

Therefore, it may be stated that the pre-development stages, including,

- Need Identification
- Idea Generation
- Idea Screening
- Concept Generation
- Concept Screening

as the vital elements of FFE.

Justification for Focusing on FFE

(Tangram Technology presents the following)

