Introduction to DFMA at FEAmax LLC

Enhancing Product Design for Manufacturing Efficiency

Introduction to FEAmax LLC

➢ **Overview of FEAmax LLC:**

  ○ Founded in 2005

  ○ Located in Charlotte, North Carolina.

  ○ Provides professional engineering services from concept to production.

➢ Services:

  ○ CAD design and Drafting

  ○ Simulation (FEA, CFD, Moldflow)

  ○ Manufacturing & Global Sourcing.

What is DFMA

DFMA is a philosophy that

- Provides a set of guidelines for the product design cycle

DFMA is comprised of two processes

- DFA - A design process for reducing product assembly costs
- DFM - A design process for reducing part production costs

DFMA reduces

- Material
- Overhead
- Labor

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Engineering Solution

Why use DFMA?

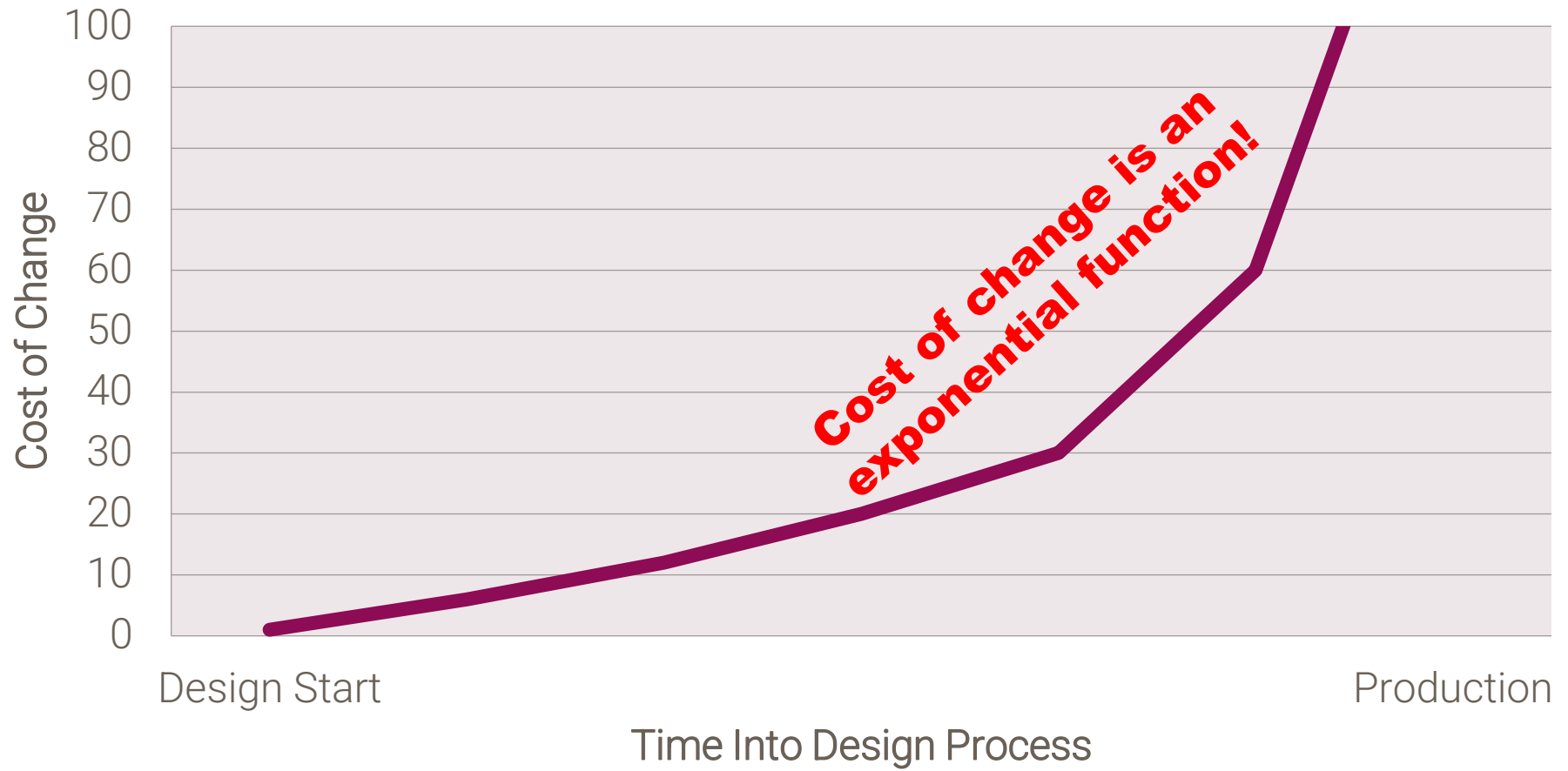|	
Reduce Lifecycle Costs	Fewer parts to source, manufacture, inspect and assemble
	Quicker assembly
	Less energy consumption
Faster to Market	Fewer parts to design and maintain
	Fewer parts to qualify (PPAP)
Better Product Quality	Fewer parts means less to go wrong
	Matched design and manufacturing CTQ's

Product Cost

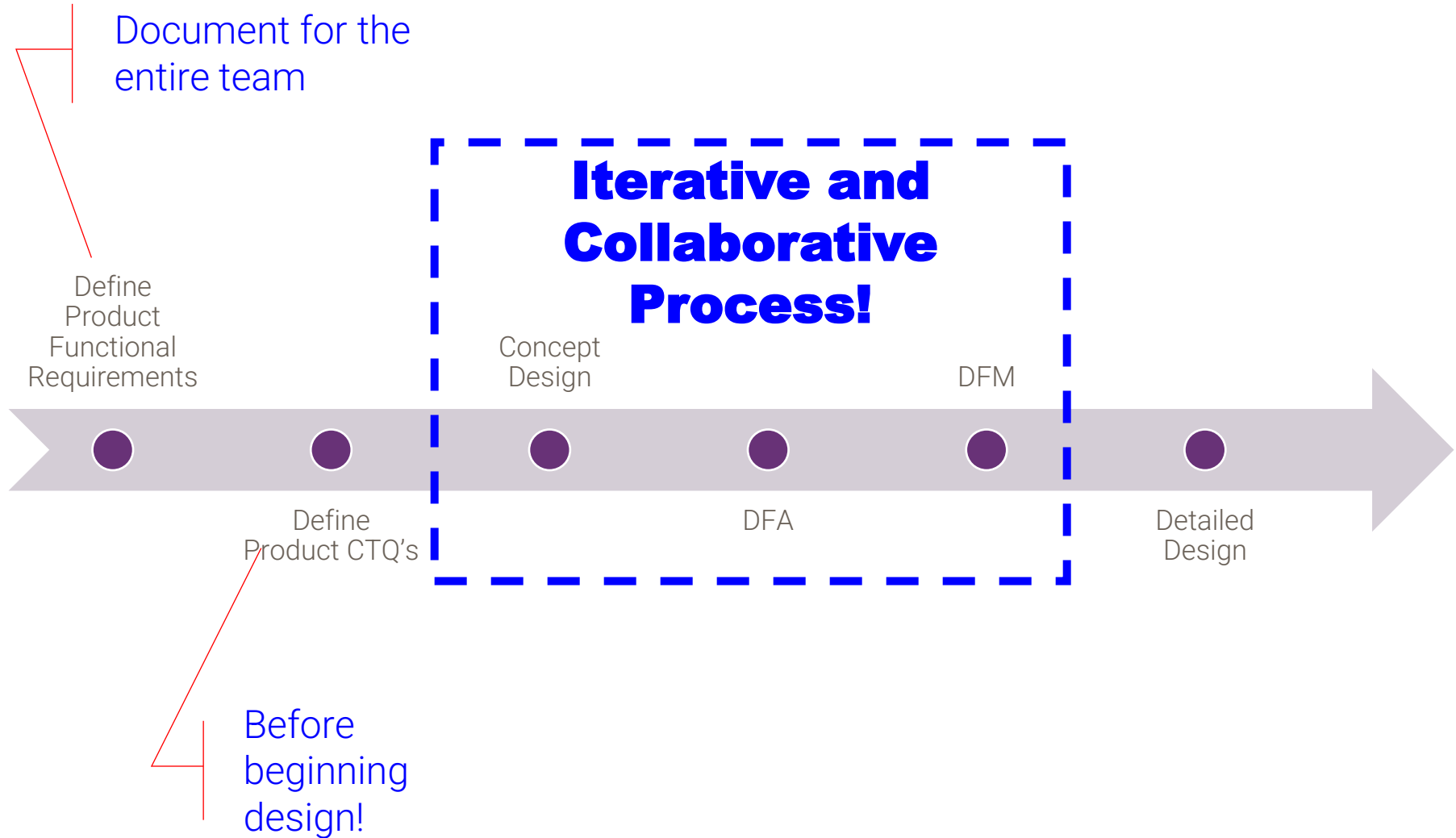## What has the biggest influence on price, quality and cycle time?

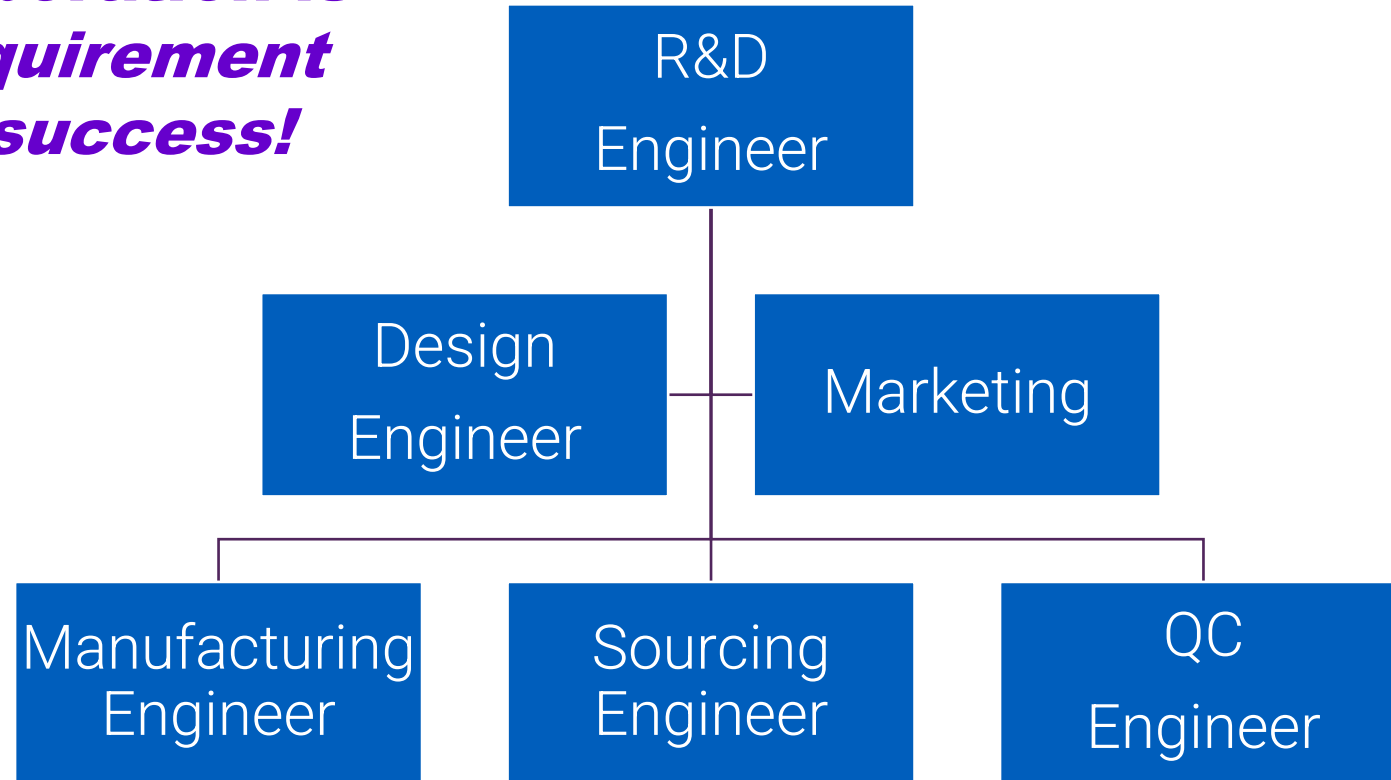- Design 70 - 80%
- Supply Chain 20 - 30%

Cost of Change?

Cost of change is an exponential function!

Vertical axis: Cost of Change (0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100)

Horizontal axis: Time Into Design Process

Design Start — Production

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Product Design Cycle

Document for the entire team

Define Product Functional Requirements

Define Product CTQ's

Before beginning design!

Concept Design

Iterative and Collaborative Process!

DFA

DFM

Detailed Design

FEAmax LLC. Engineering Design & Analysis Service
https://www.FEAmax.com

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Engineering Solution

DFMA Team

Collaboration is a requirement for success!

R&D Engineer

Design Engineer

Marketing

Manufacturing Engineer

Sourcing Engineer

QC Engineer

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Product Design Cycle Tools

Process Maps

- Provides visual identification of each manufacturing/assembly processes
- Helps to identify process inter-relations
- Use to drive Manufacturing Control Plan

Manufacturing Control Plan

- Contains *all* of the product *and* process CTQ's
- Promotes buy-in from each stakeholder
- Forms basis for product and process qualifications

DFMA Software

- Product cost estimating
- "What-if" analysis for various manufacturing processes
- Product simplification

Guidelines

- Specific guidelines exist for mainstream, high volume manufacturing processes. For example:
  - Injection Molding: Avoid sharp corners and add ribs to improve mold flow
  - Stamping: Reduce the number of bend stages

DFA Rules of Thumb

Design for top down assembly

Minimize number of parts! Each part needs sourcing, inspection and assembly

Avoid connections - *Consolidate parts*

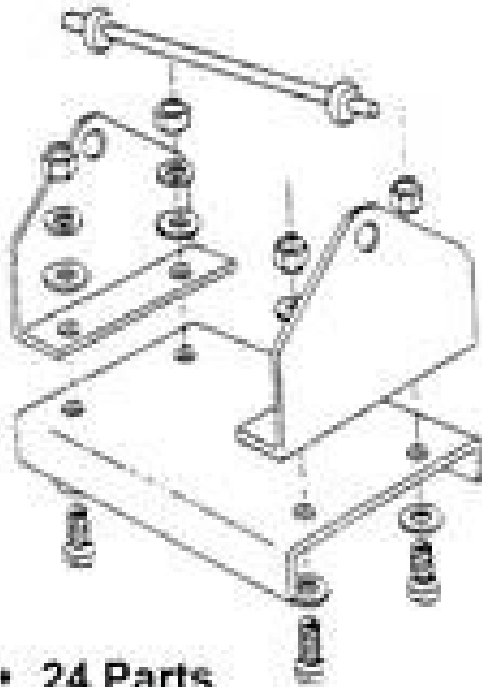Make parts self locating

Make parts self fastening

Design parts with symmetry or include "fool proof" assembly features

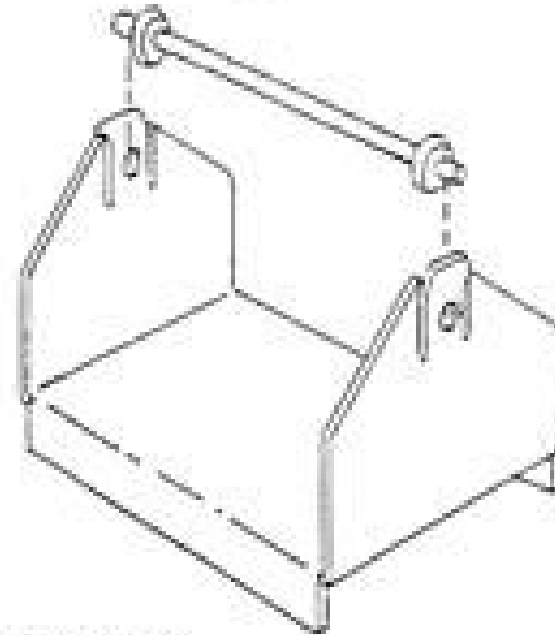Avoid difficult to handle parts (i.e. small, fragile, sharp)

Fastening- *Accounts for 5% of BoM costs, contributes to 70% of labor costs*

Avoid adjustments

Classic DFA Example

- 24 Parts
- 8 different parts
- multiple mfg. & assembly processes necessary

- 2 Parts
- 2 Manufacturing processes
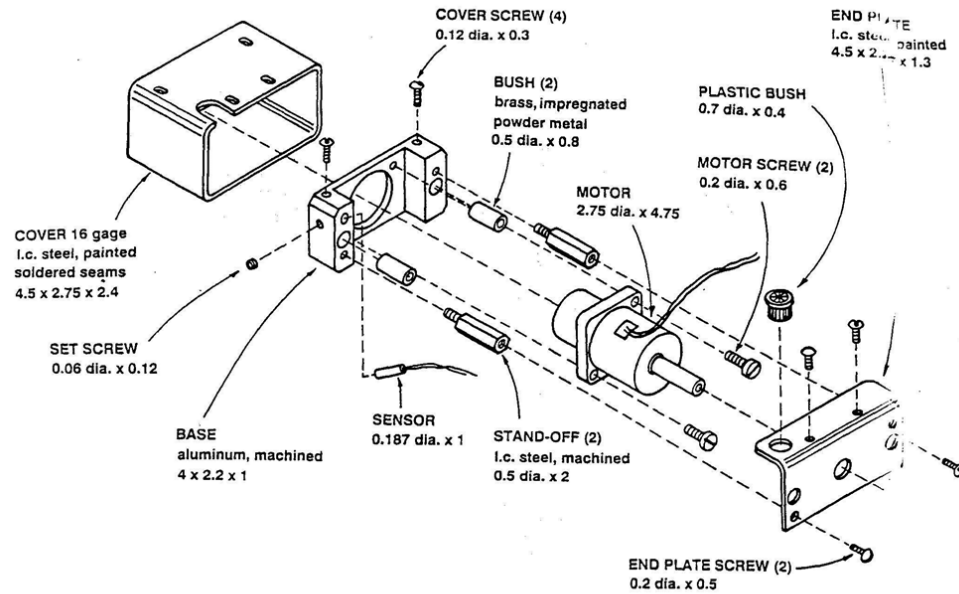- one assembly step

DFA Example

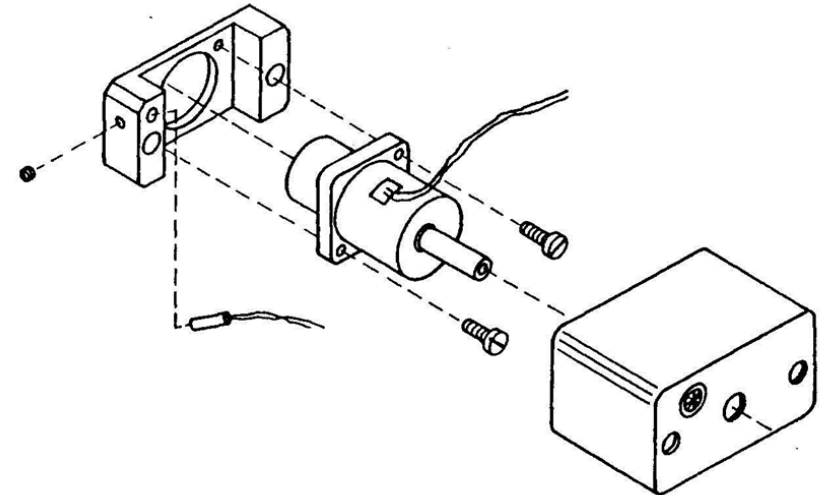Figure 1.5 Proposed design of motor drive assembly. (Dimensions in inches.)

Figure 1.6 Redesign of motor drive assembly following design for assembly (DFA) analysis.

DFM Rules of Thumb

- Specify mutually acceptable tolerances and finishes for all CTQ's (*Not every drawing callout is a CTQ!*)
- Minimize material removal
- Choose appropriate, easy to process materials
- Minimize post processing (plating, polishing, painting, etc)
- Design parts for automation
- Utilizing existing processes can improve factory absorption and minimize resource requirements (*internal manufacturing*)
- Are new, more cost effective manufacturing technologies available?

New Processes

Laser Surface Hardening – Fast and precise

Laser Surface Ablation - Replace printing

Laser Joining - Eliminates fasteners

Hard Milling – Improved mold manufacturing

DFMA Tools and Techniques

➢ CAD/CAE Integration:

  ✓ Utilizes advanced Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) software to streamline the design process.

  ✓ Enables precise modeling and simulation of products to identify and resolve potential issues early.

➢ Simulation tools (FEA, CFD & Moldflow):

  ✓ Employs FEA & CFD to predict how products will react to real-world forces, such as heat, vibration, fluid flow and other physical effects.

  ✓ Analyzes the injection molding process to ensure optimal mold design and material flow.

  ✓ Helps in optimizing material usage and enhancing product durability and performance.

➢ Manufacturing Tools:

  ✓ Integrates state-of-the-art manufacturing technologies to streamline production processes.

  ✓ Includes automation, CNC machining, and additive manufacturing for high precision and efficiency.

Getting Started with FEAmax

➢ Initial Consultation:

   ✓ Discuss your project requirements and objectives with our expert team.

   ✓ Receive a tailored proposal outlining the scope and approach.

➢ Project Planning and Scoping:

   ✓ Detailed planning to define timelines, resources, and deliverables.

   ✓ Collaborative approach to ensure alignment with client goals.

➢ Implementation and Support:

   ✓ Execution of the project using our advanced tools and techniques.

   ✓ Ongoing support and communication to address any queries or changes.

➢ Contact Information:

   ✓ Address: 15720 Brixham Hill Ave. Suite 300, Charlotte, NC USA 28277

   ✓ Email: info@feamax.com

   ✓ Website: https://www.FEAmax.com