Electrical Engineering in the Real World

Topics
- Typical profiles of companies that use EEs
- Types of EE jobs in those companies
- Purpose of Engineering Dept in a company
- Production Documentation
- Engineering in the Production Dept

Typical Companies
- Design and manufacture products
- Contract engineering firms
  - Hired by industry to engineer products and devices
- Government Contractors
  - Lockheed Martin, Northrop Grumman, Boeing, BAE
- ODMs (Original Design and Manufacturers)
  - They will design and manufacture your product for you. Typically in Taiwan and China

Eng Dept in a Product Company
- An Engineer Project Manager is assigned
- His/her job: get the design done and released
- They are assigned team members (Hardware, SW, mechanical engineers plus technicians, CAD staff, documentation staff, etc)
- Works with Engineering management to balance the resources
Working in the Eng Dept

- In almost all cases you will be part of a team
- You will work in your area of expertise
- A typical engineer rarely only has one active project they have to work on
- Your manager (which may or may not be the Project Manager) will set your priorities
- Expect to split the time up during the day/week or finish a phase or task on one project then you jump on another other project

Why Will I have Multiple Projects?

1. There will always be points in a project where the engineer is waiting on something when they are not in the critical path.
2. Marketing usually wants more products then the engineer staff can handle
3. Management wants to keep the staff busy. No down time.

Ultimate Goal

What is the ultimate goal of the Engineering Dept?

**ANSWER:**

To create production documentation that enables manufacturing to build the product or device in volume that meets the product specifications.

Production Documentation

What documentation does manufacturing (sometimes called production) need to build and ship the product?

It’s a mountain of documents.....

(NOTE: This may give you a headache.)

Production Documentation

Bill of Materials

- Values
- Quantities Ref Designations
- Internal Part Numbers
- Approved vendor and their P/Ns

See sample BOM

Production Documentation

All PC Board documentation

- Source files
- Gerber files
- Pick and place files
- Solder Mask
- Silkscreen
**Production Documentation**

- Mechanical drawings
  - For anything that need fabrication
- Assembly drawings
  - Shows production how to put it together
- Wiring diagrams
  - If it’s a system that has multiple pieces
- Drawings to make the shipping material
  - Box and packing material

**Paper Documentation for the Box**

- Product Specification Sheet
- Quick Install/Setup Guide
- Set-up Diagrams
- User/Operator Manual

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**Documentation to Support Production**

**Needed for Quality Control**

- Schematics
- Engineering explanation of what each section of the circuit does
- Production Test Plan
  - Created by Engineering
- Production Test Procedure
  - May be created by the Test Engineer

**Design Changes**

- After the Engineering releases the documentation it is cast in stone.
- Subsequent design changes have to be controlled and documented
- Changers can be requested by Production, Marketing, the Product Manager or someone in engineering.
- The person requesting a change creates a Engineering Change Request (ECR)
- It get submitted to all parties and signed off and given to Engineering

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**Engineering Change Order (ECO)**

- Since engineering created the documentation, they are responsible for making any changes
- After the Engineering gets the ECR, it creates an Engineering Change Order (ECO), gets it approves and then its released to production
- Sometimes ECO is initiated by Engineering if they need to make change and it has no impact on the performance or the spec.
- In fact, oftentimes the change is needed to make the unit perform to spec!

**Quality Control (QC)**

- Sometime called Quality Assurance (QA)
- Separate from the manufacturing process but an integral part of the production process
- Their job: Make sure everything shipped meets the specifications
- They do this in two ways:
  - Test every unit before it ships
  - Perform visual inspections

**Goal:** To spend the least time possible doing this.
Test Department

- Tasked with testing each unit to ensure it works properly and complies with all specs
- Test engineers are assigned the task of creating the procedures and fixtures to accomplish this task
- They start with the Test Plan recommended by engineering and create their own system
- For large scale production Automatic Test Equipment (ATE) is used extensively if not exclusively.

Conclusions

- There is wide variation in the structure and procedures in companies with engineering and production capabilities
- This was an introduction to show how a typical company might function
- There is a lot of opportunity for Electrical Engineers out there and the need will never go away
- Find a niche or industry that interests you and apply for jobs there

Q & A Period

- Any questions?
- Any things you wish to discuss in more detail?

Thank You

Hope you found the presentation valuable.
Thank you for your time and attention.

Today's Quote

“Always remember that you are absolutely unique. Just like everyone else.”
-Margaret Mead
American cultural anthropologist