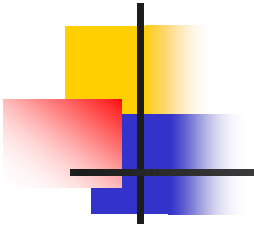
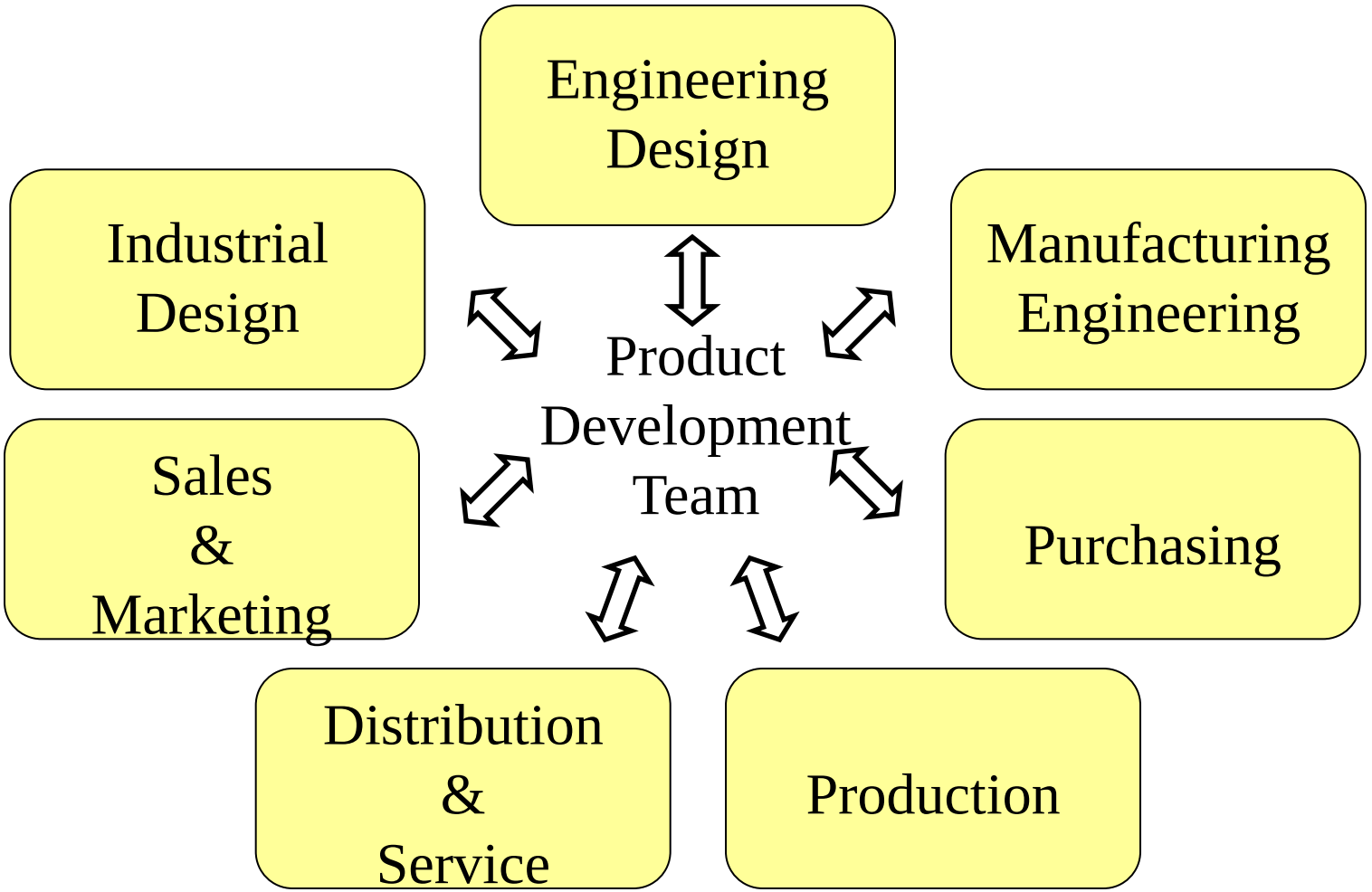


Detail Design

- Flow of design information
- Responsibility for details?
- Graphic communication
- Written communication
- Configuration design

Design information flow & decision-making



Design Engineering Responsibilities

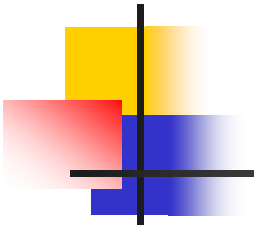
Detail design performance analyses
Preproduction prototype performance tests
Manufacturing process specifications
Owner manual(s) (technical:operation/maint)
Layout drawing
Detail drawings
Assembly drawings
Bills of materials
Engineering change notices
Patents, trademarks, copyrights

Industrial Engineering Responsibilities

Materials & Product flow
Facility layout/remodeling
Material handling equipment
Inventory warehousing
Assembly planning (machines & workers)

Manufacturing Engineering Responsibilities

Fixture design / fabrication
Tool design / fabrication
Process equipment refurbishment/adaptation
Process equipment acquisition / installation
Process planning



Production

Tooling changeover (assist)
Acceptance testing (QC, SPC)
Worker training
Workforce scheduling

Communicating Design Information

Phone calls
Hallway discussions
Email
Memoranda / Letters
Phone calls/voice mails
Reports
Meetings

Communicate to all the stakeholders:

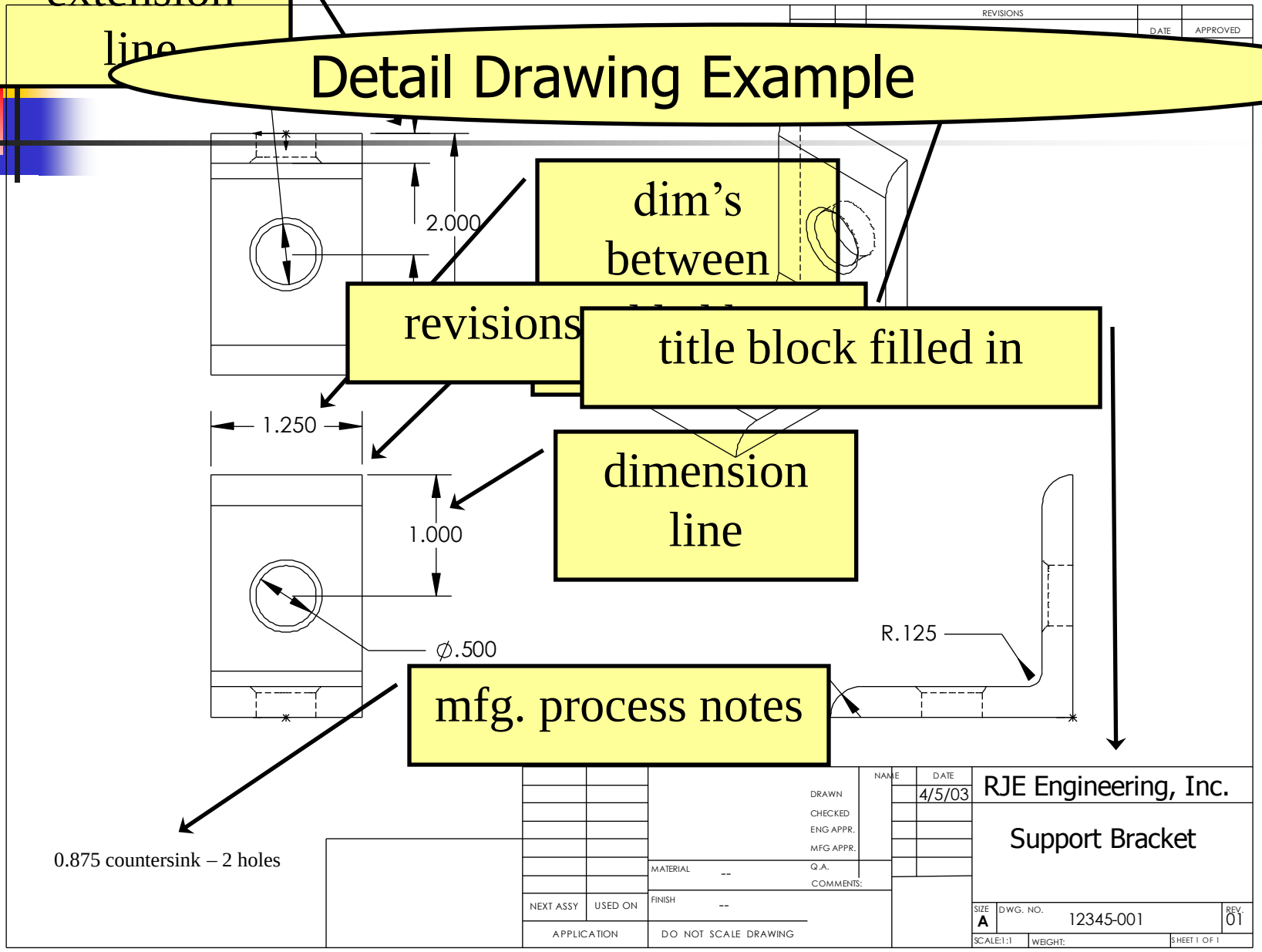
1) often
2) thoroughly and
3) clearly.

Let's look at some sample engineering-related communications:

Production / Working drawings

- Detail drawing
- Assembly Drawing
- Bill of Materials (sometimes on Assembly)
- Layout (sketch)

Detail Drawing Example

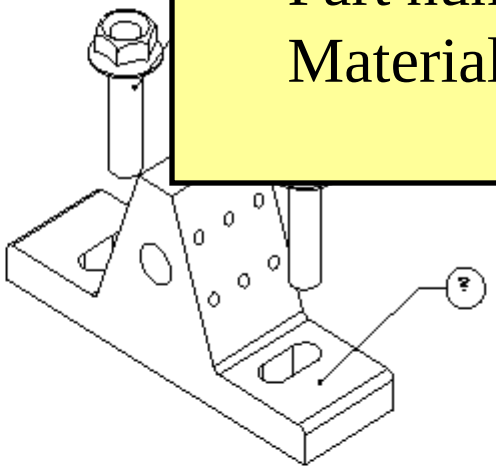


Assembly Drawing Example

balloon annotations

Item number
Quantity
Part number
Material type or Source

Exploded view



ITEM NO.	QTY.	PART NO.	MATERIAL
1	1	guide	

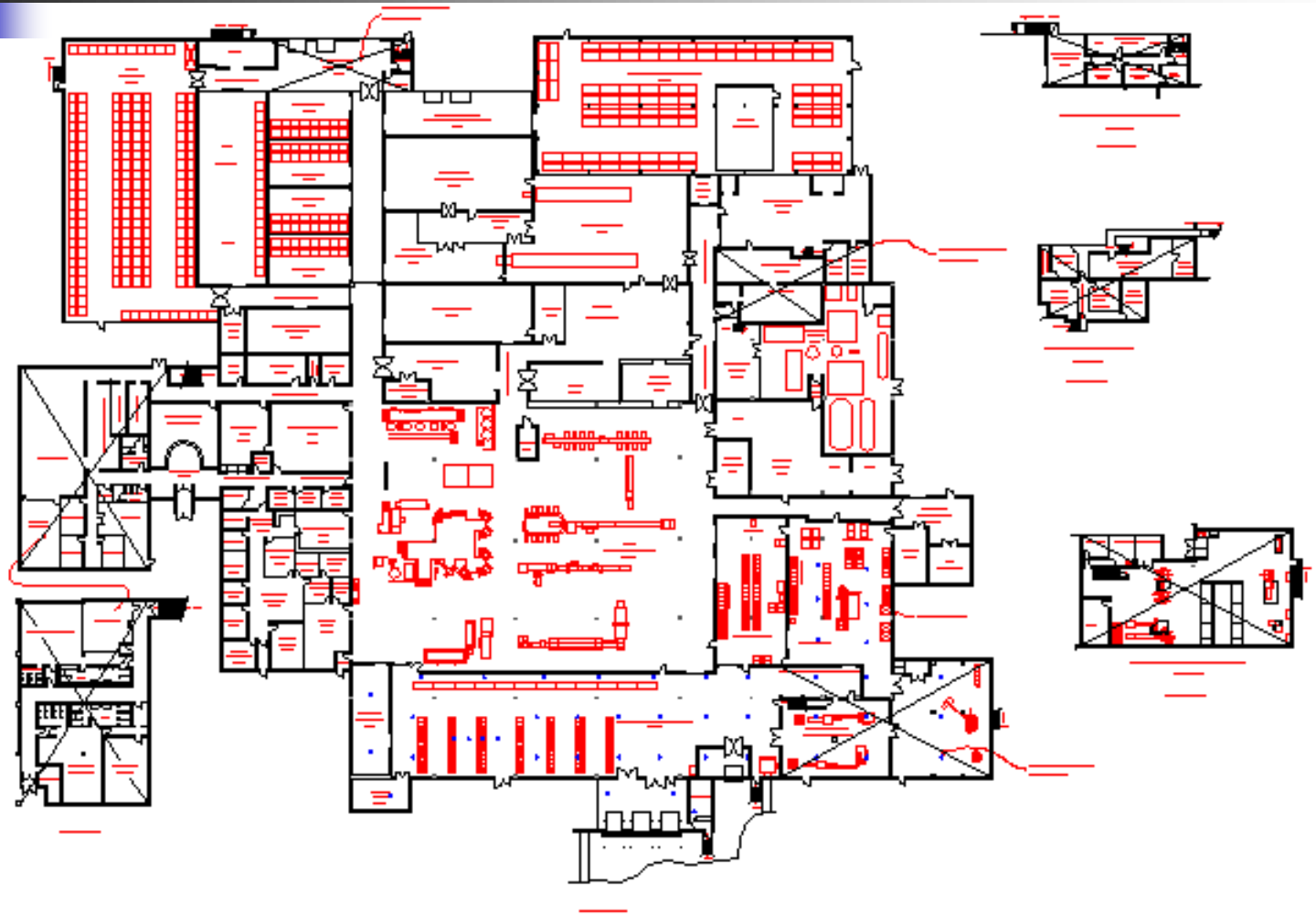
<COMPANY NAME>

1GR_ex ASSEMBLY

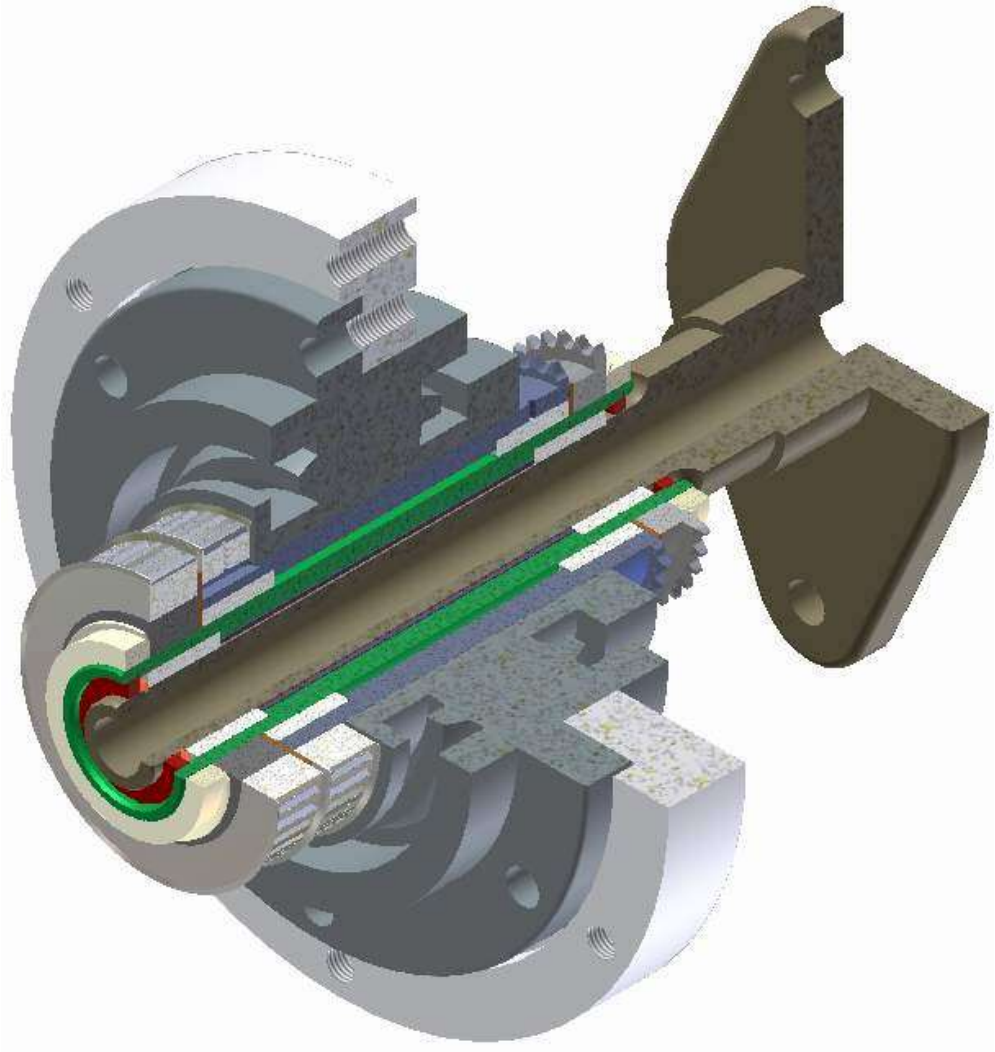
SIZE B | DWG. NO. | REV

SCALE: 1:1 | WEIGHT: | SHEET 1 OF 1

Facilities Layout



Assembly Drawing - Section View, aka “cutaway”



Graphic Communications – Illustrations

- ***Charts*** - portray relationship(s) among numerical data, for example sales versus time.
  e.g. bar charts, X versus Y, stress vs strain

- ***Diagrams*** - explain how something works or the relationship between the parts.
  e.g. free body diagrams to analyze static forces and moments.

- ***Schematics*** - uses abstract symbols
  e.g. piping schematic, or electronics schematic.

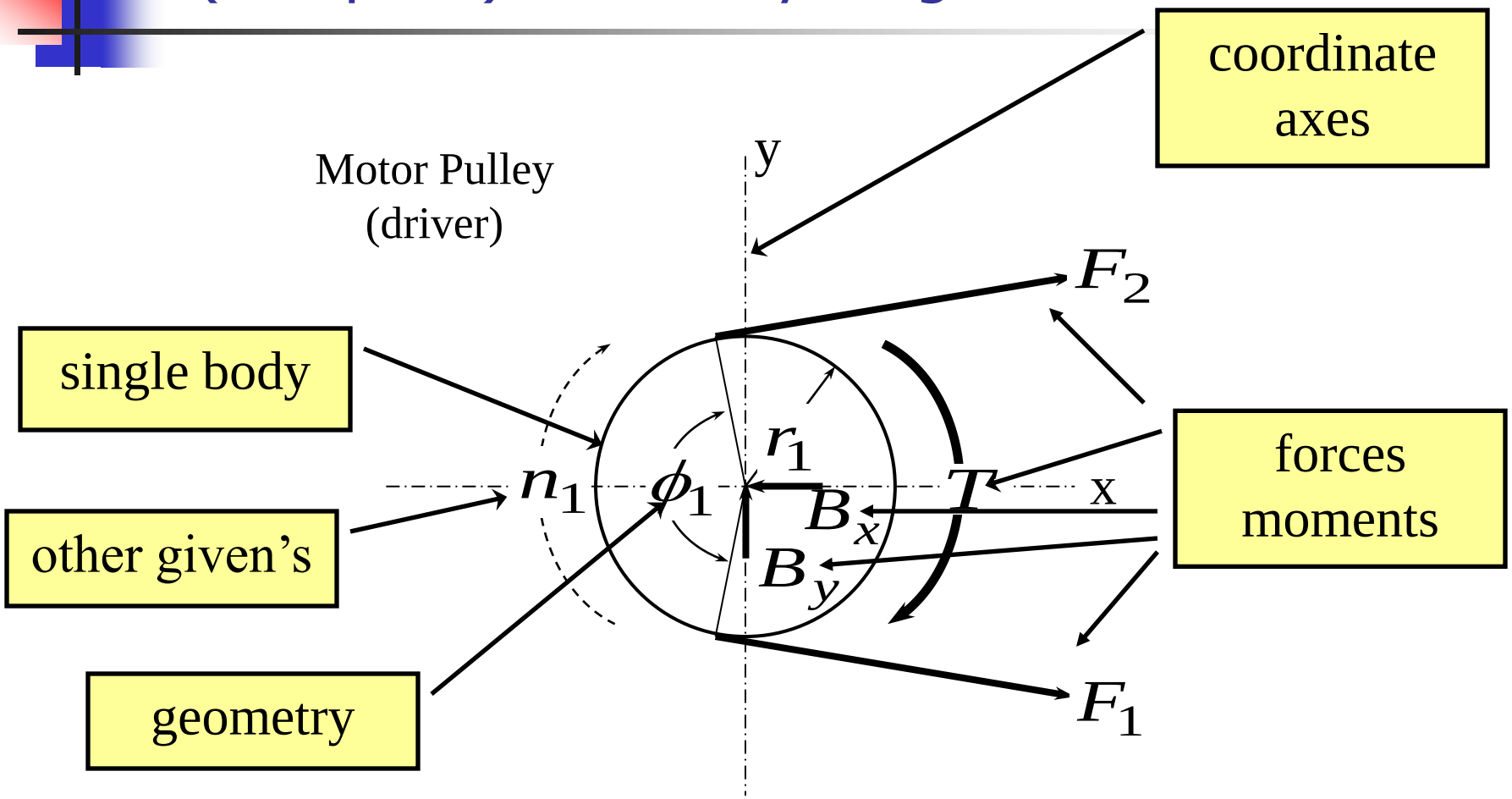
- ***Figures*** - illustrates textual material
  e.g. design process figure

- ***Sketches*** - hand-drawn preliminary, or rough “drawings”, drawn without the use of drawing instruments.

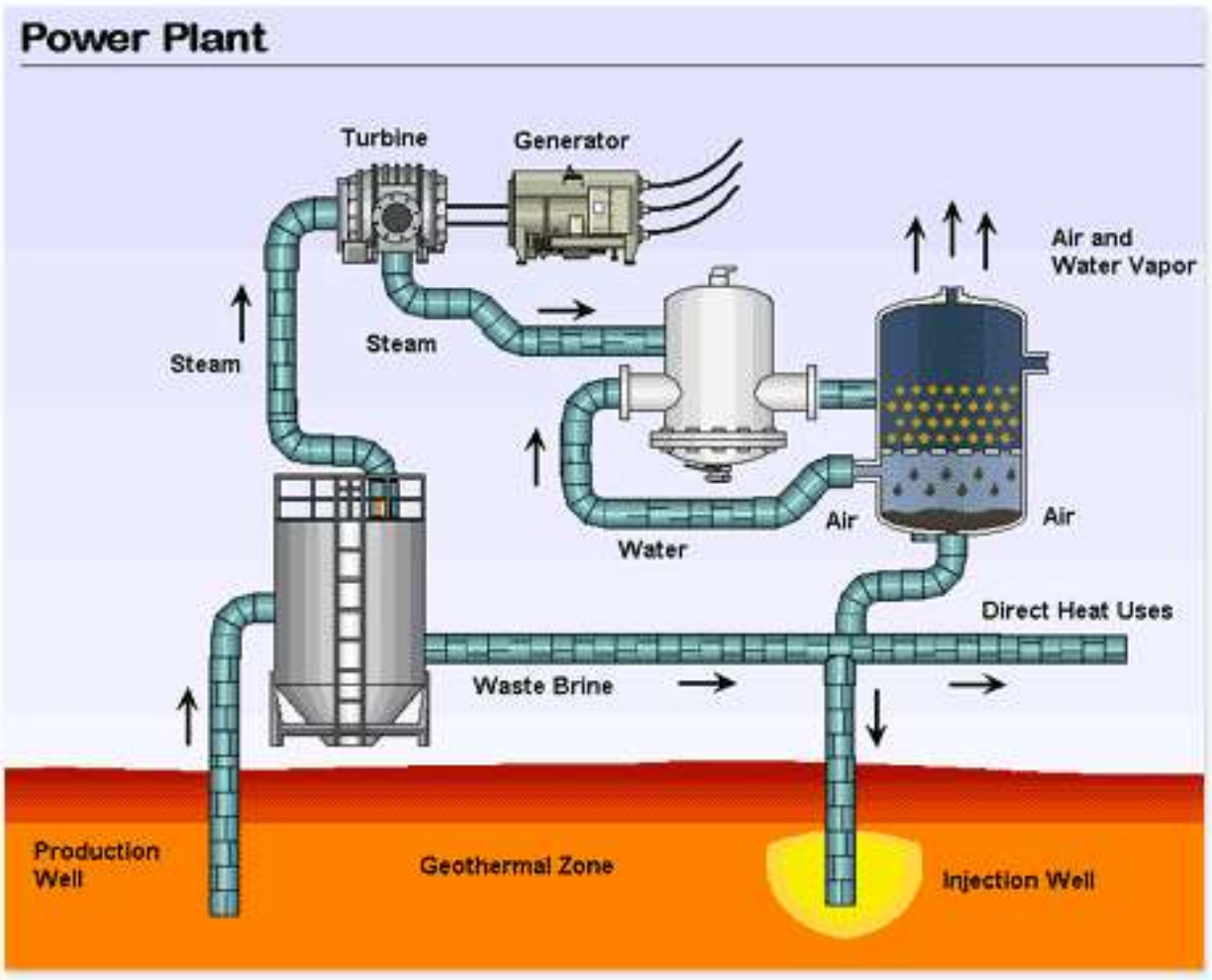
Gannt chart

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
Task	1/22-1/26	1/27-2/2	2/3-2/9	2/10-2/16	2/17-2/23	2/24-3/2	3/3-3/9	3/10-3/16	3/17-3/23
Design Problem Formulation									
1.1 Site Visit									
1.5 Benchmarking									
1.6 Contact Customers									
1.7 Determine PDP/DV/SEP									
1.10 Outline Work Scope									
1.8 Determine Schedule									
1.9 Calculate Budget									
1.4 Create EDS									
1.3 Satisfaction Curves									
1.2 Complete QFD/HOQ									
1.11Report 1									
Conceptual Design									
2.1,2,5,6,9 Generate Concepts									
2.7 Determine Physical Principles									
2.8 Conceptual Drawings									
2.3,4 Evaluate Concepts									
2.10 Report 2									
Configuration Design									
3.1,2,10 Determine Configuration									
3.3 Determine General Dimensions									
3.5,6 Estimate Forces									
3.9 Analyze Lifting Performance									
3.8 Analyze Tire/Wheel Performance									
3.4 Outline Cost Analysis									
3.7 Config. Sketches									

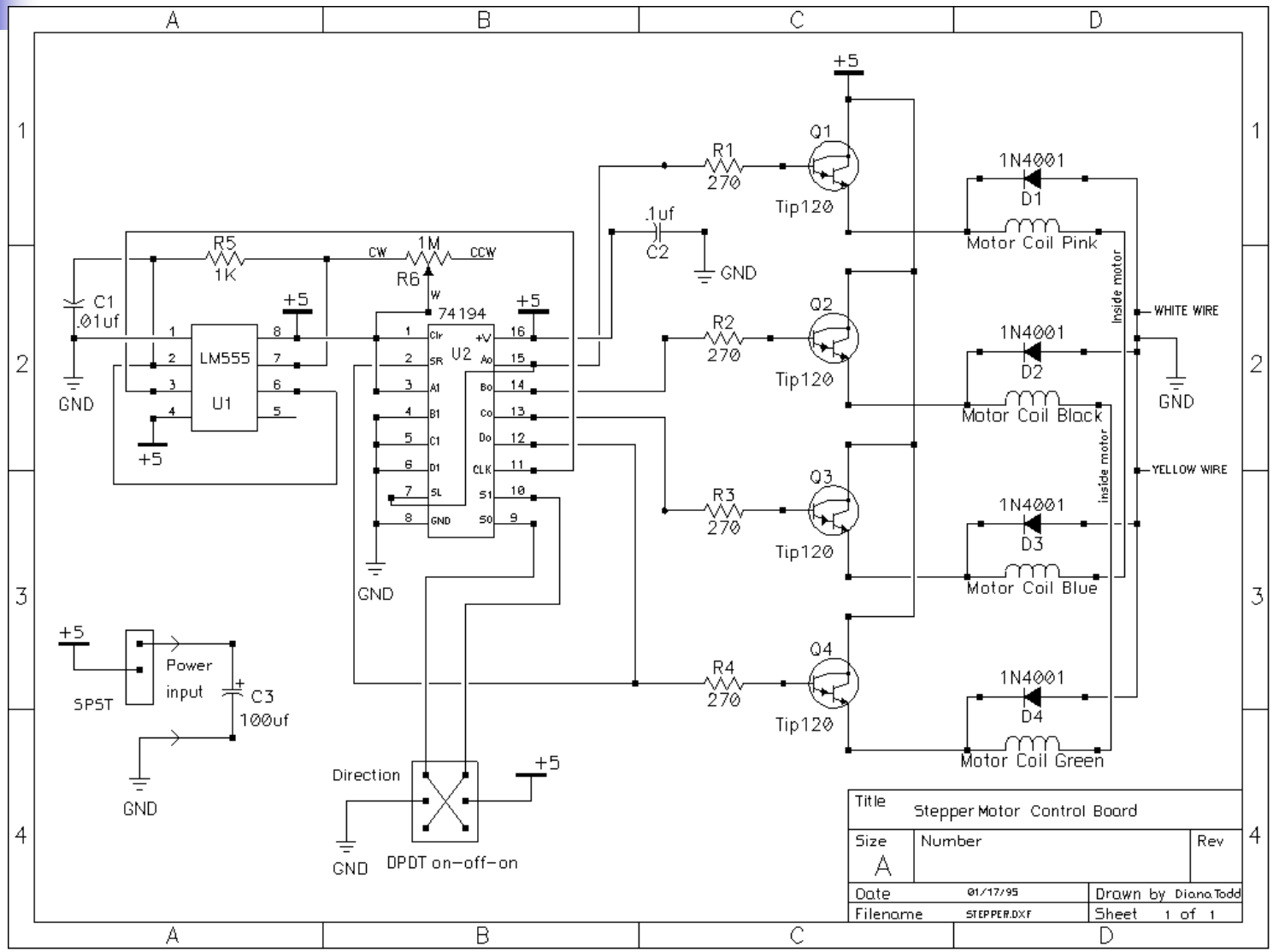
(Complete) Free Body Diagram



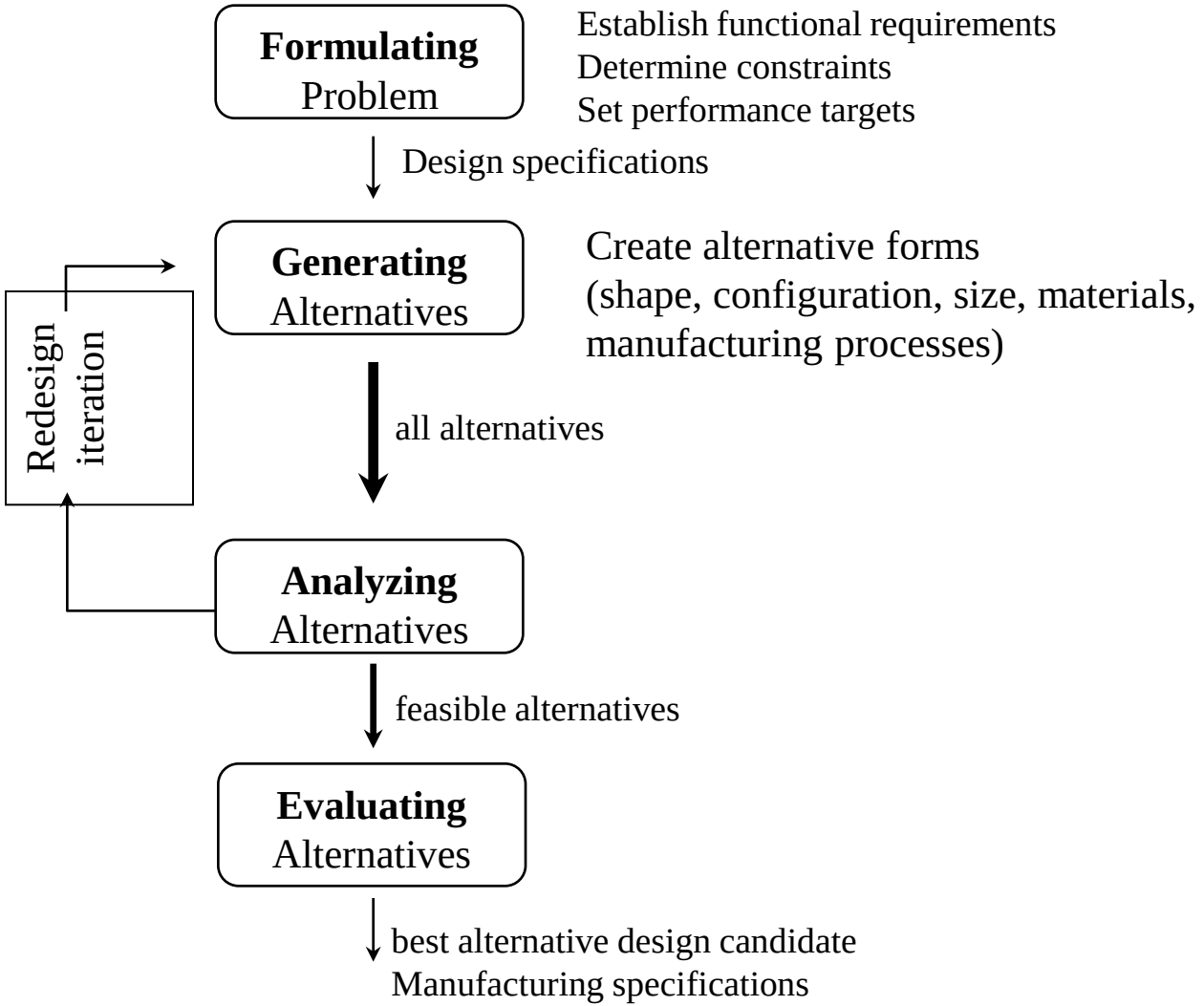
Geothermal Power Plant (diagram)



Electronics circuit (schematic)



Design process "Figure"



Written Design Communications

Test Reports

- Technical reports detailing engineering / scientific tests (on materials, prototypes and or products).
- Can vary in length from few pages to hundreds of pages.
- Contents include sections on: test objectives, test procedures, data/results, summary and recommendations.

Research reports

- Similar to test reports
- But longer in length and broader in coverage
- Include additional sections such as: an abstract, background, literature review, laboratory/test program description and bibliography.

Owner manuals

- Include sections on:
  - Setting-up / installing the product
  - Operating the product
  - Maintaining (i.e. clean, lubricate and adjust)
  - Repair, if necessary.
- Can vary in length from 1 page to hundreds of pages
- Illustrations usually very important

Project Progress Reports

- Sent to clients and other stakeholders,
- Covers project status re: workscope, schedule and budget.
- Can vary in length from few to hundreds of pages
- Prepared weekly, monthly, quarterly, and annually

Design Reports (can include following)

1. Introduction
2. Design Problem Formulation
3. Project Engineering
4. Concept Design
5. Configuration Design
6. Parametric Design
7. Prototype Tests
8. Final Design
9. Recommendations and Conclusions

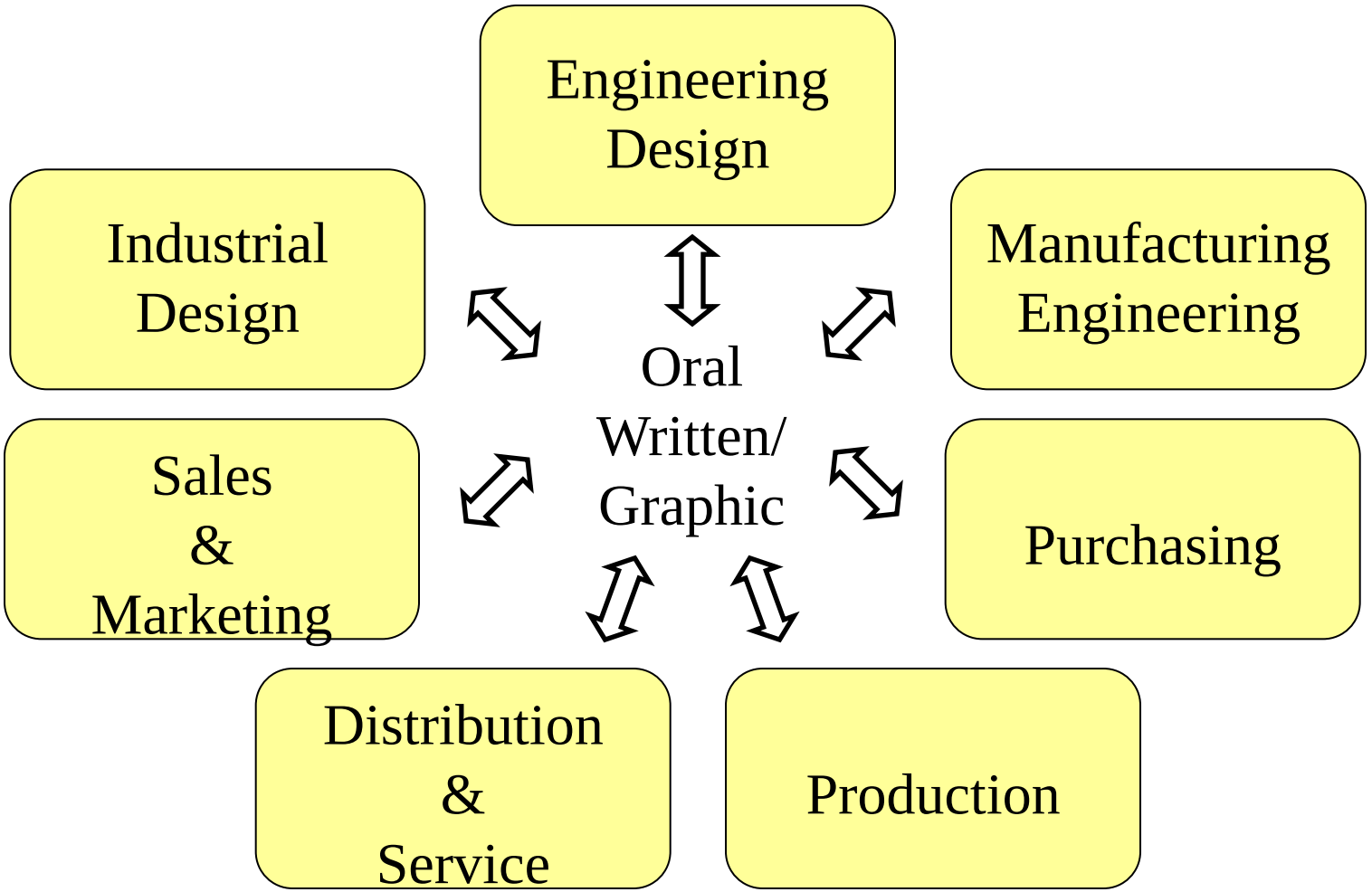
Patent, trademark and copyright information

Drawings, illustrations and textual materials are forms of "*intellectual property.*"

Represent investment of company funds, and as assests, they can be protected by law under:

- patents
- trademarks or
- copyrights

Design information flow & decision-making



Computer-Integrated Design and Manufacturing?

How can computers help us?

Let's consider:

- Types of product data
- Management issues

Types of Product Data

CAD drawings (*.dwg)

CAD models (*.prt)

Design Specifications

Design data

Mfg. Process Plans

NC programs

Analyses

Test Results

Bills of Materials

Summary

- Flow of design information
- Responsibility for “details”
- Graphic communication
- Written communication
- Oral presentations
- Product Data Management