Questions that should be asked but aren't

Chris Tsai, Director, DFMA® Implementation Services, Boothroyd Dewhurst Inc.

David Meeker, Principal, Neoteric Product Development

Design & Phase/Gate Reviews

- What questions are typically asked during a Design Review?
  - Performance issues
  - Schedule risks
  - Technical risks
  - Quality and Reliability concerns and results
  - Supply Chain issues
  - Unit Manf. Cost (UMC) estimate
  - Industrial Design & Usability

What about Part Count?

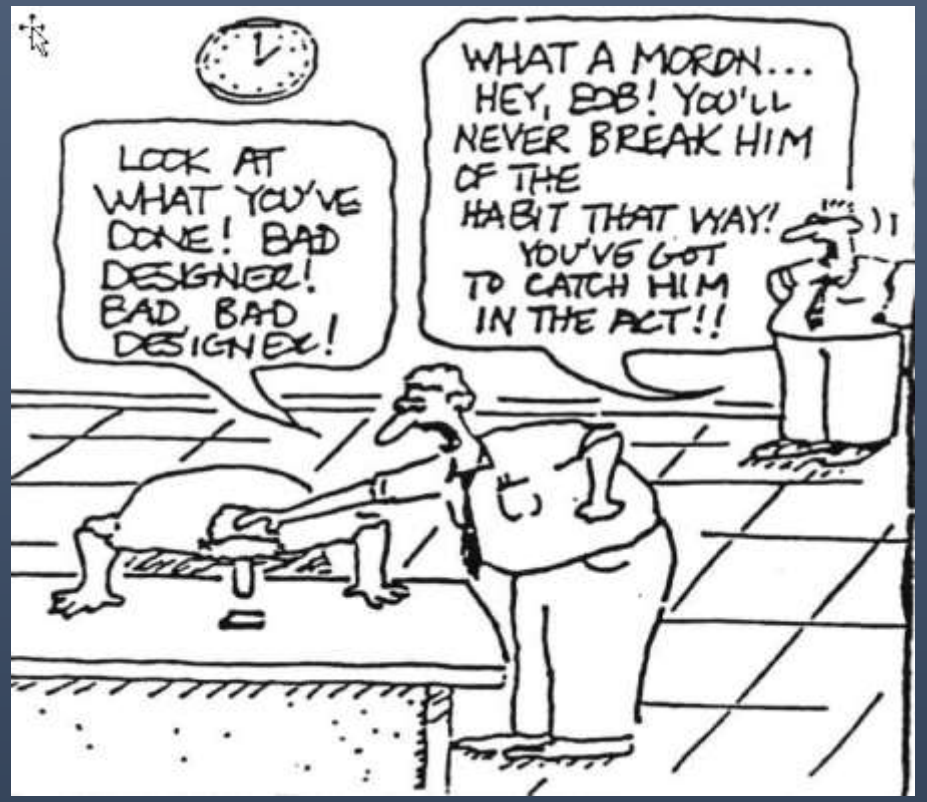
Questions That Should Be Asked …

- What's the Theoretical Minimum Part Count?
- What's the current total part count?
- How many total steps/entries (parts & operations)?
- What alternative design concepts have been developed and what are their part & entry counts?
- What risks/enablers exist with those concepts?

Product Simplification

So why do designs fail to meet TMPC ?

- Design engineers have never been exposed to concept
- Engineers ignore the technique during design
- Company doesn't have B&D Software



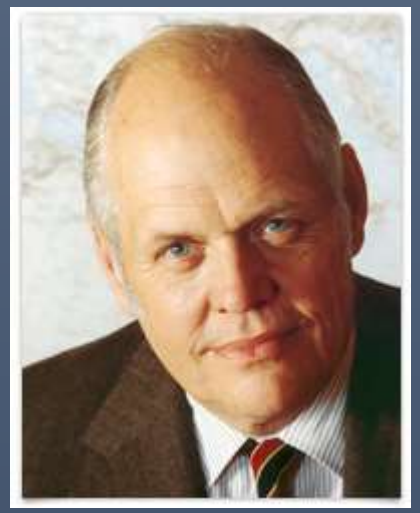
So why do designs fail to meet TMPC ?

- Designers are aware of the technique but do not collect the information as part of DFMA analysis
- Answer the TMPC questions but don’t use it because it is not embedded in the design process

So why do designs fail to meet TMPC ?

- Cost reduction in many companies is thought of as a quick fix “IF” they get into trouble at end of design
- Design only recognizes cost problem near end of process, because don’t have accurate cost estimating tools.
- Exercise is left to supply chain / purchasing folks to “quickly” reduce to cost through negotiating with vendors, substituting less costly parts, possibly removing a feature from a product, and shipping the product overseas for manufacture.

Case Study Digital Equipment Corporation



Ken Olsen

1926 -2011

Case Study Digital Equipment Corporation

Case Study Digital Equipment Corporation

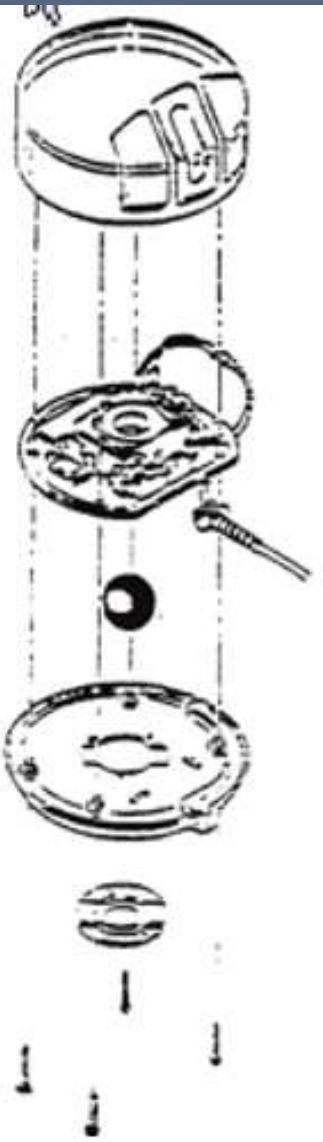
Small problem arouse

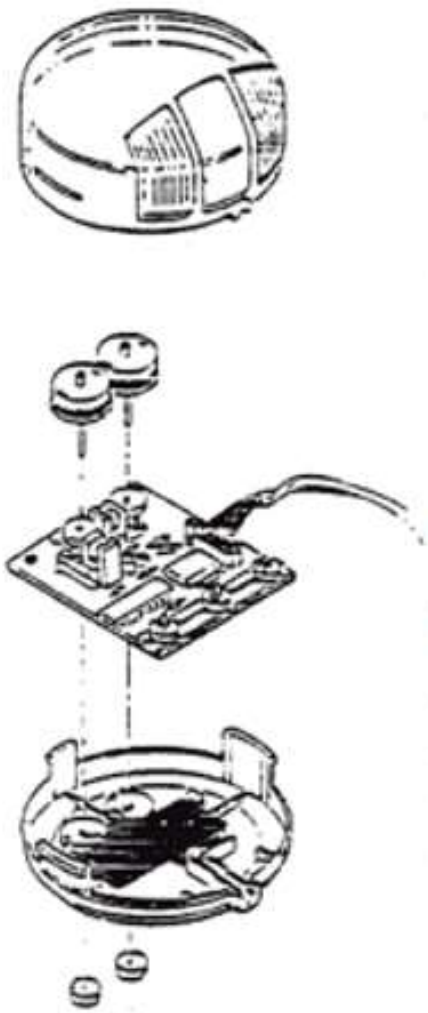
Case Study Digital Equipment Corporation

The supplier of the track ball mechanism wanted a substantial royalty and was not willing to negotiate

A decision was made to do a new design using DFMA methodology with emphasis on TMPC

Case Study Digital Equipment Corporation

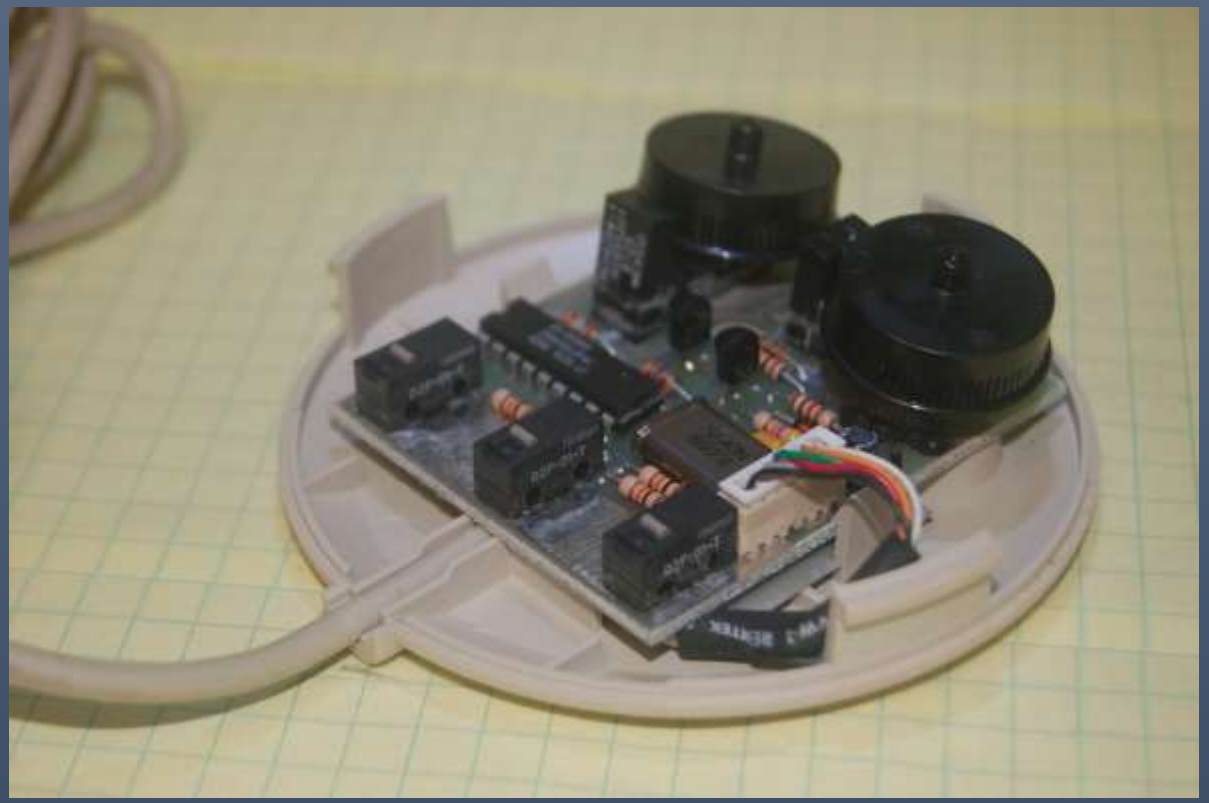




	Old	New
Part count	61	44
mechanical	31	16
electrical	30	28
Assm. Time	17 min.	6
Assm. Oprs.	83	56
Adjustments	11	0
Fasteners (3 types)	10	0
Material Cost Reduction		>40%

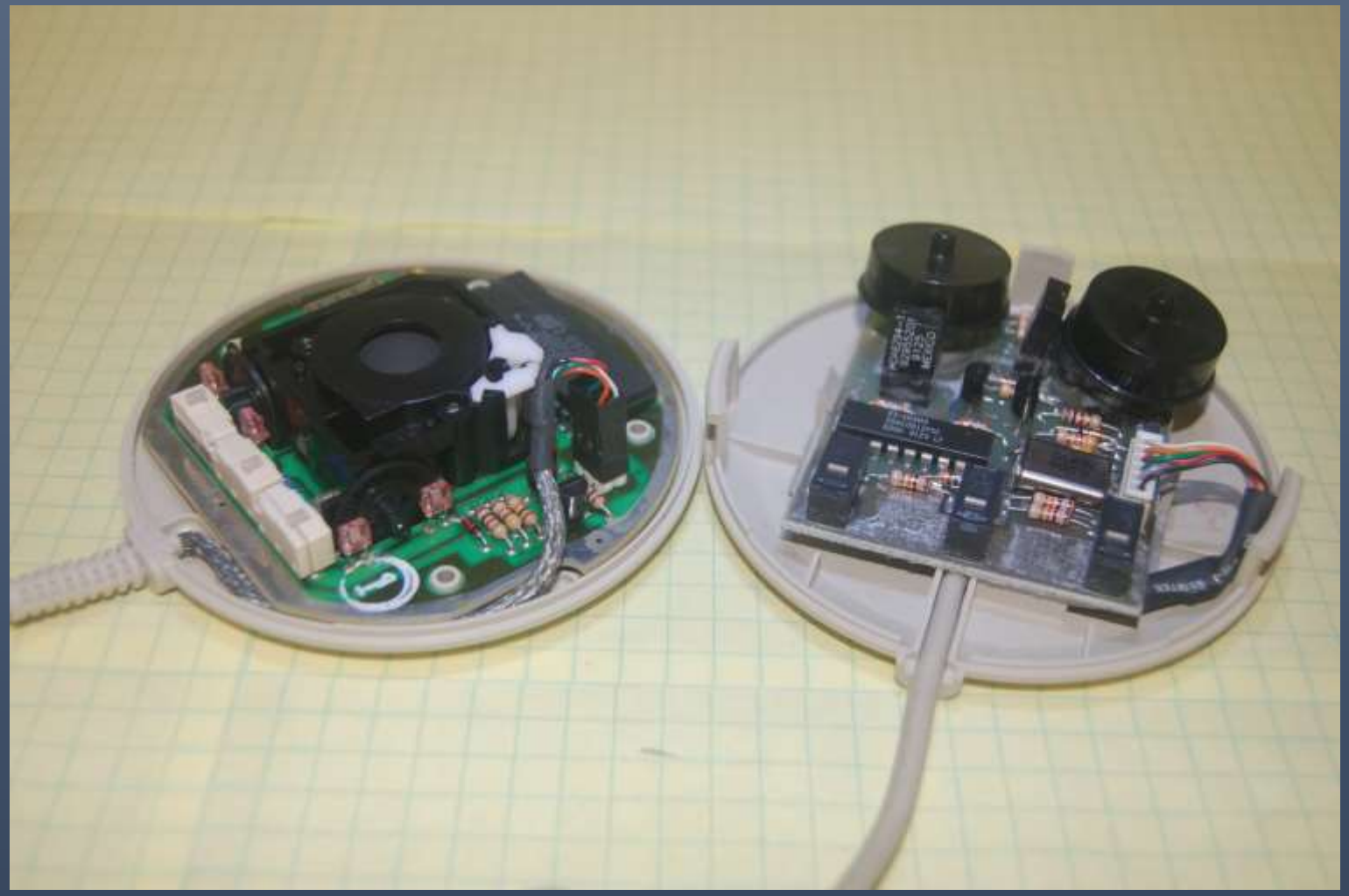
Case Study Digital Equipment Corporation

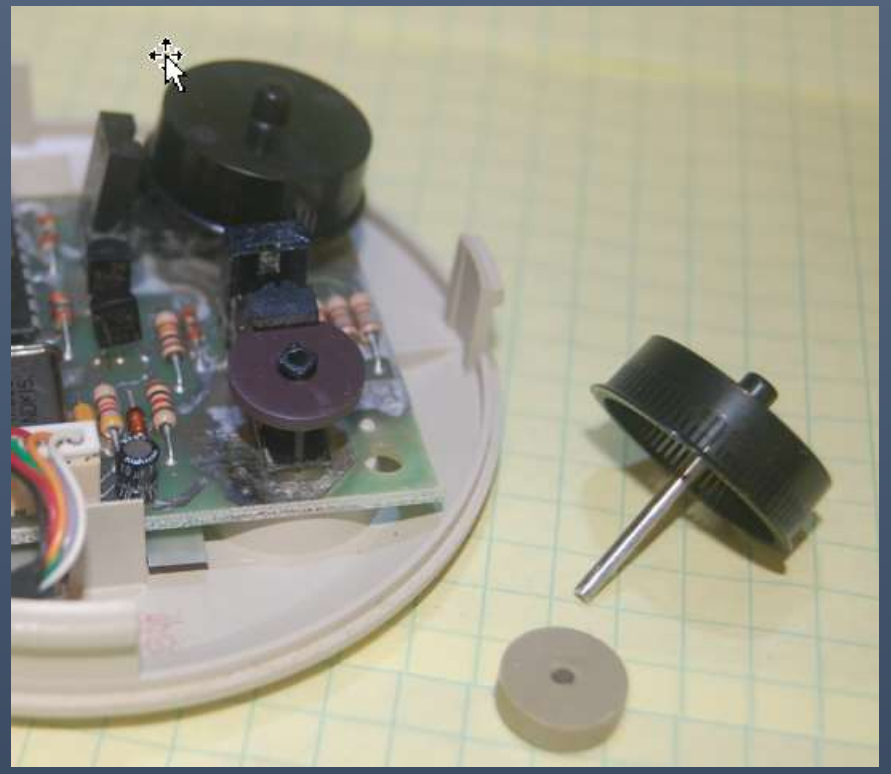
Case Study Digital Equipment Corporation



Case Study Digital Equipment Corporation

Case Study Digital Equipment Corporation

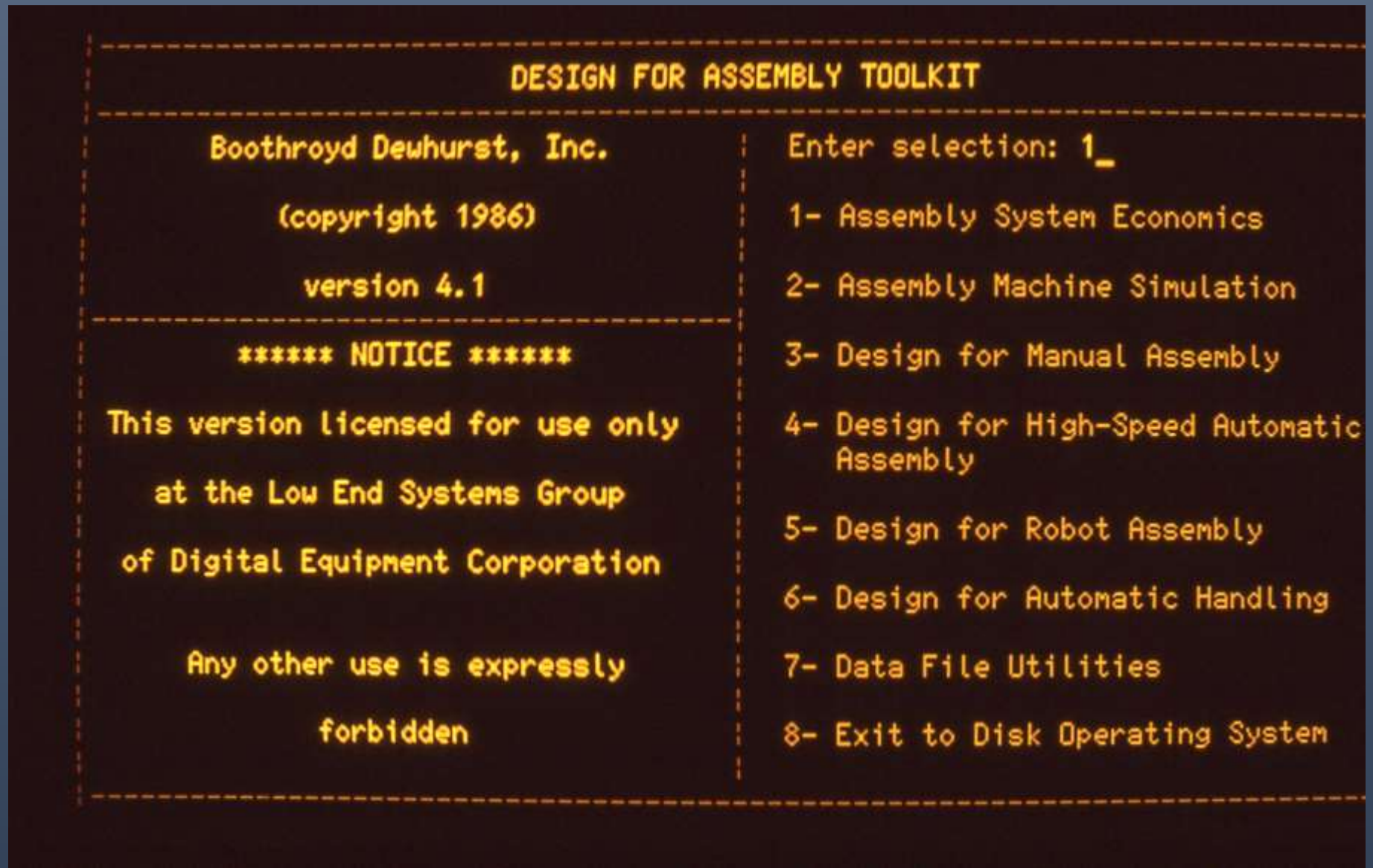




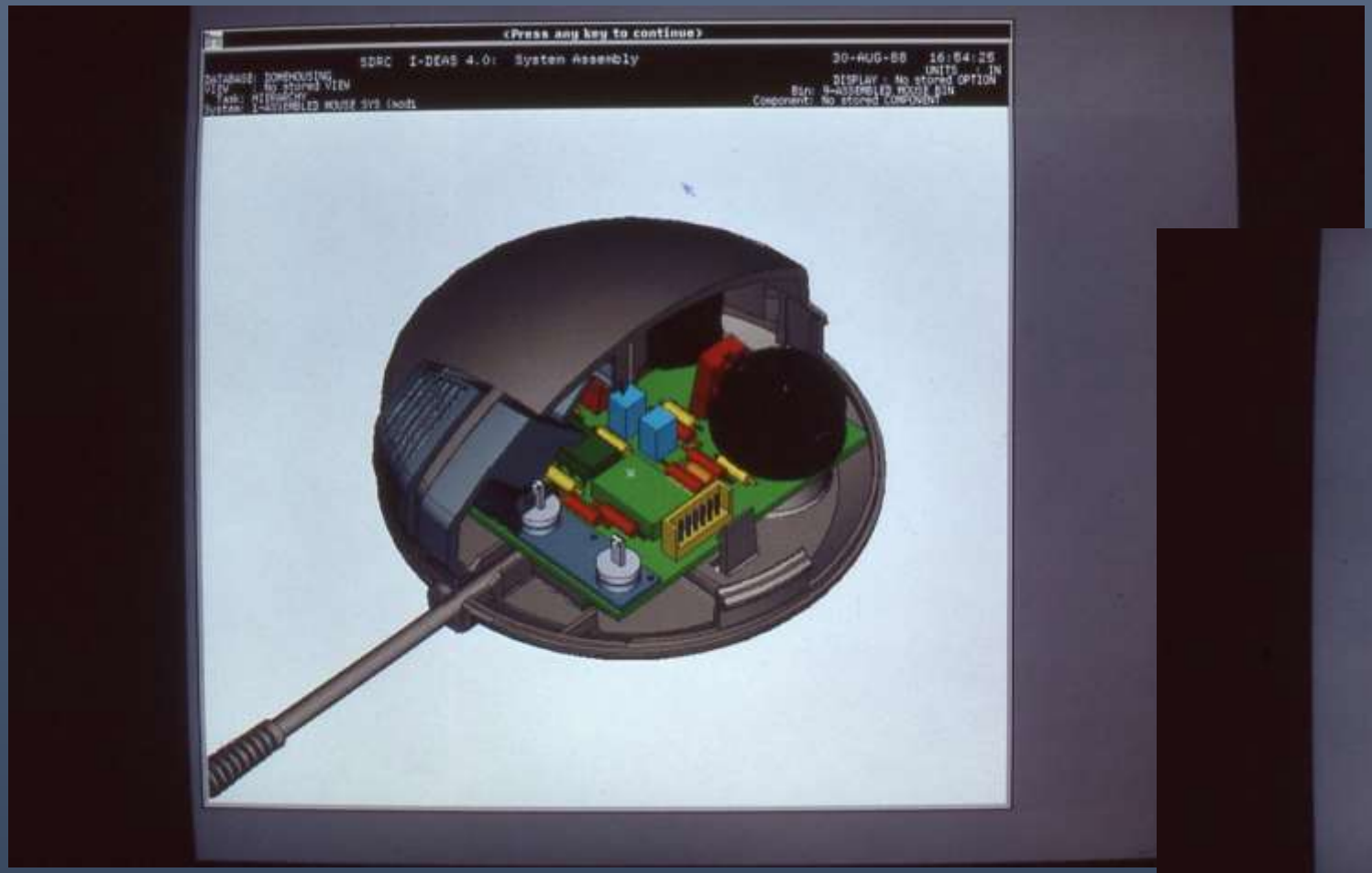
Case Study Digital Equipment Corporation

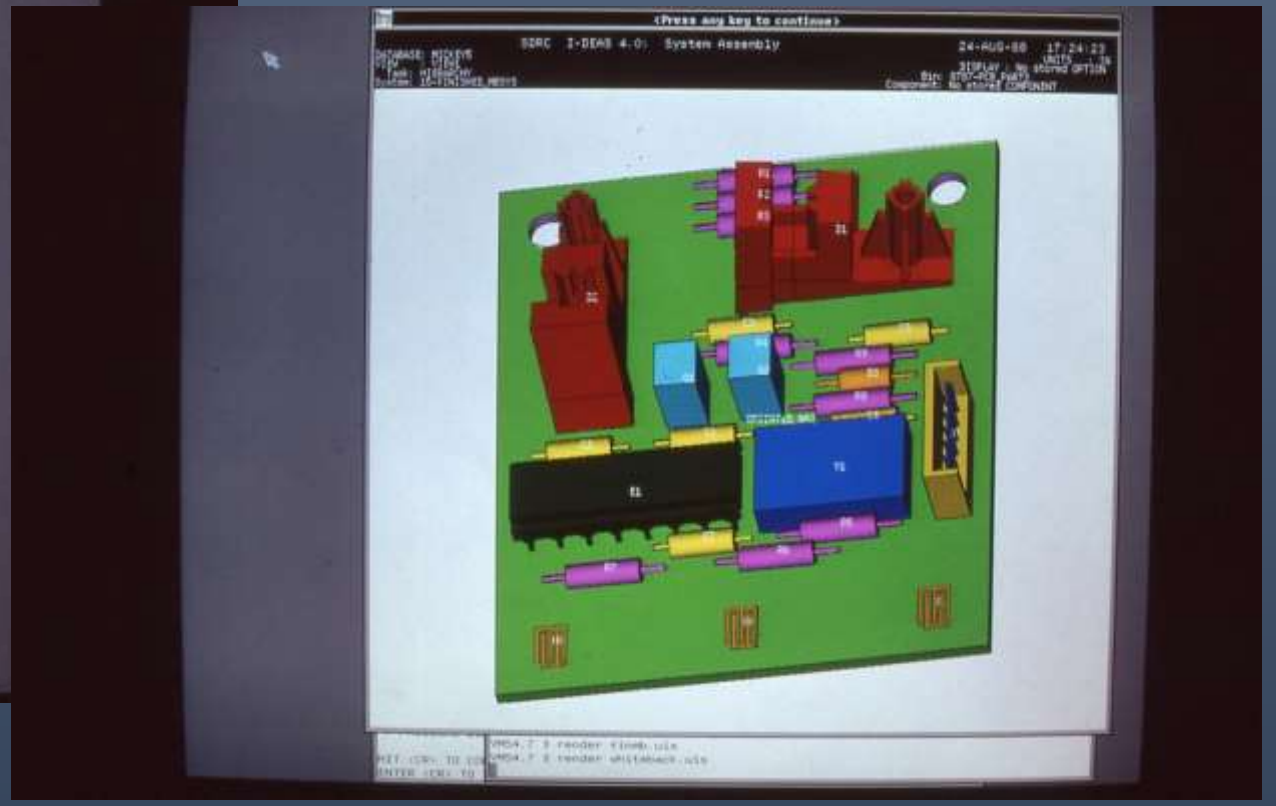
Case Study Digital Equipment Corporation

Design For Assembly

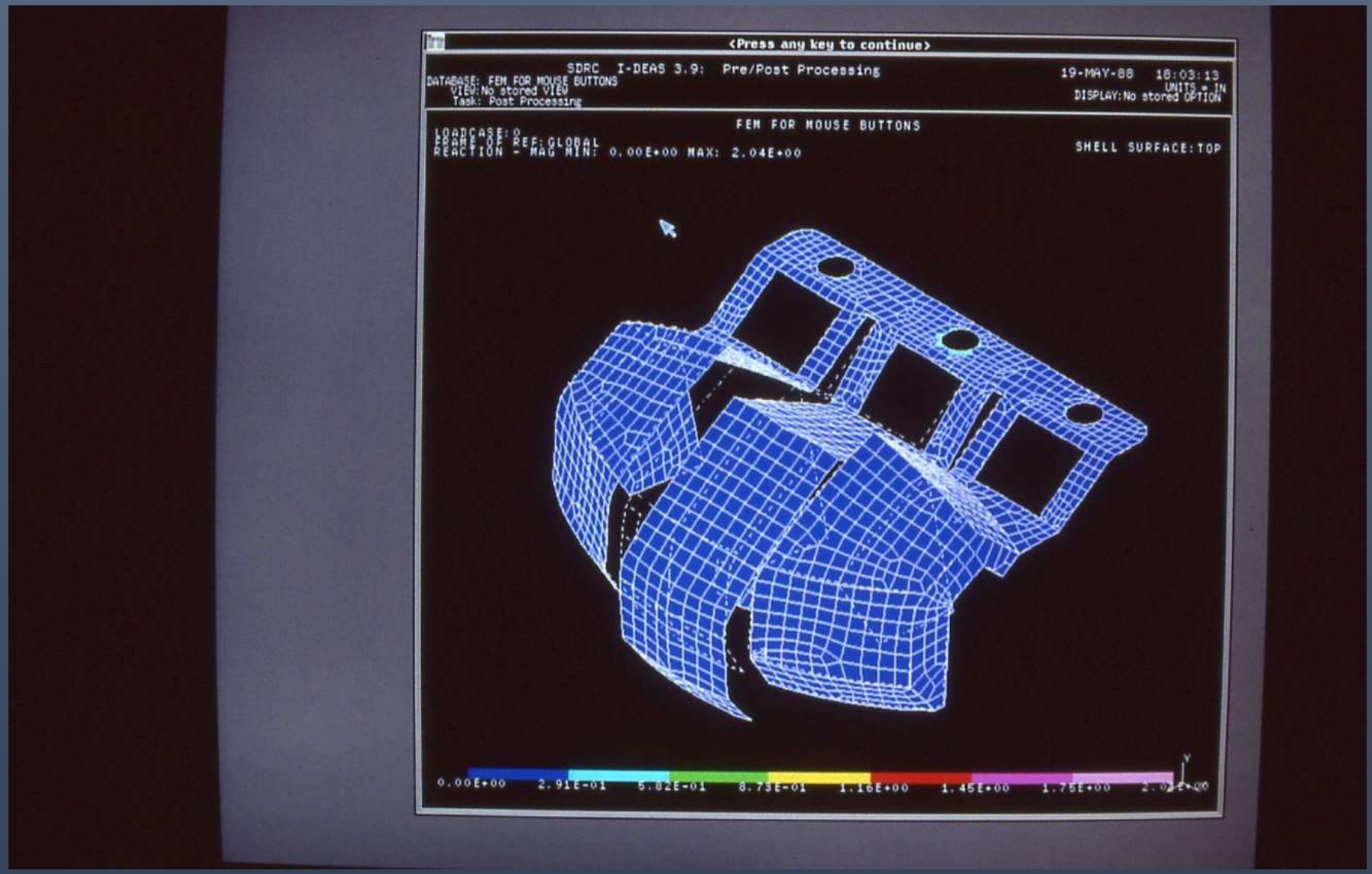


SDRC CAD


(Press any key to continue)
SDRC I-DEAS 4.0: System Assembly
30-AUG-88 16:04:25

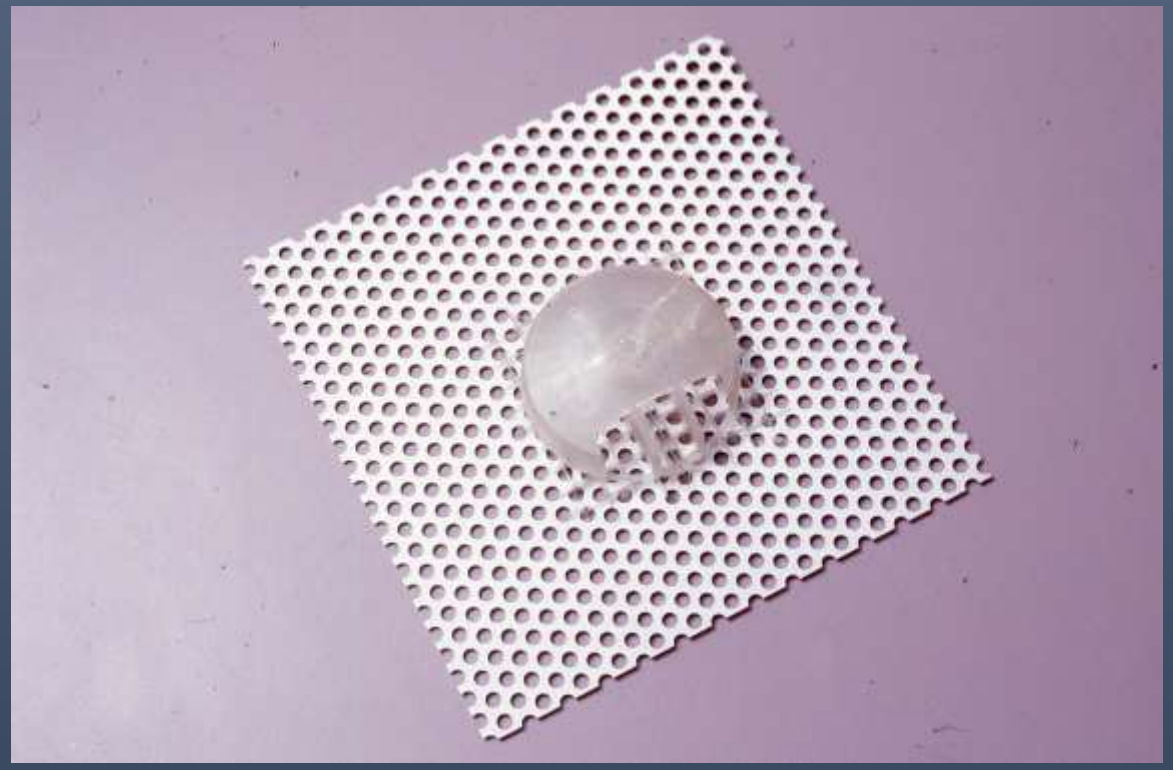

(Press any key to continue)
SDRC I-DEAS 4.0: System Assembly
24-AUG-88 17:24:23

Finite Element Analysis

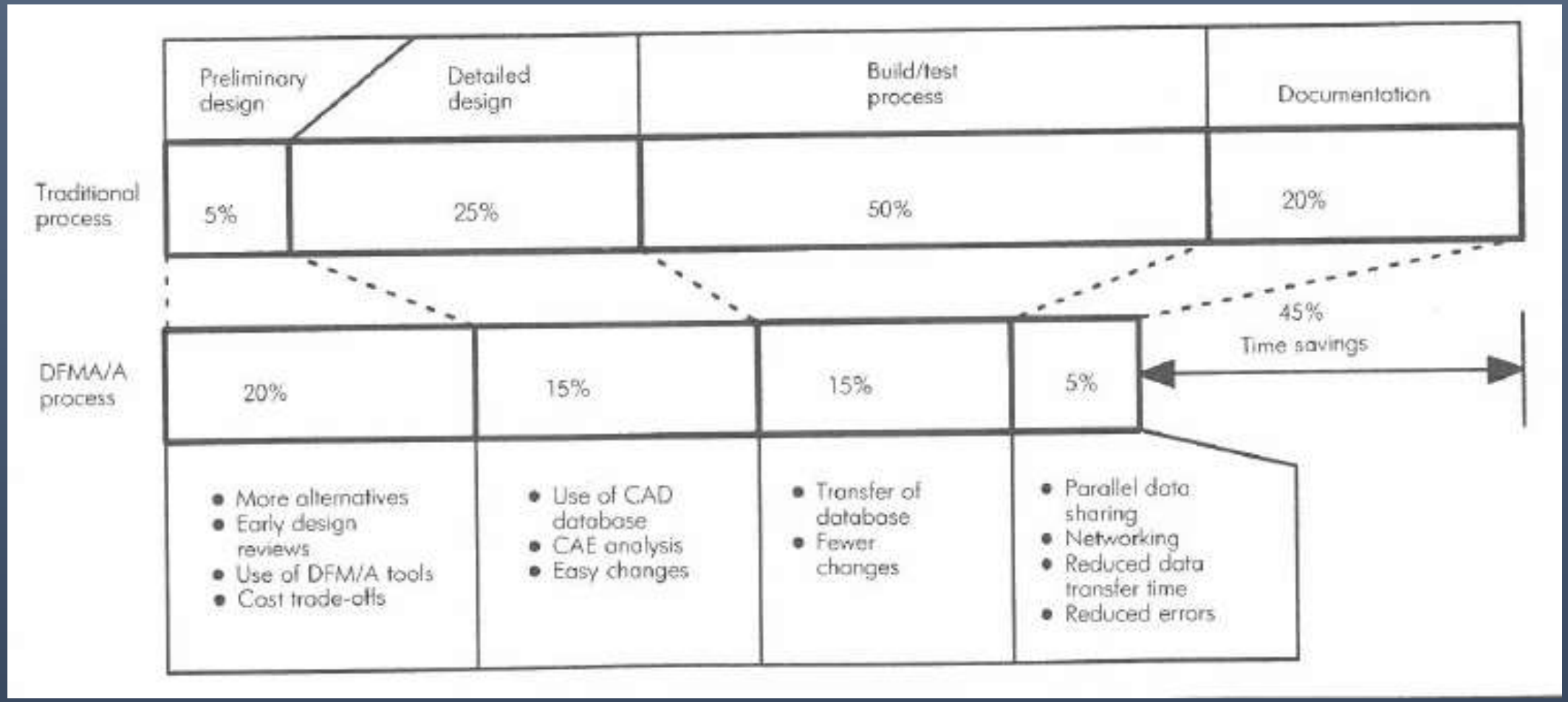


CNC milling from CAD files

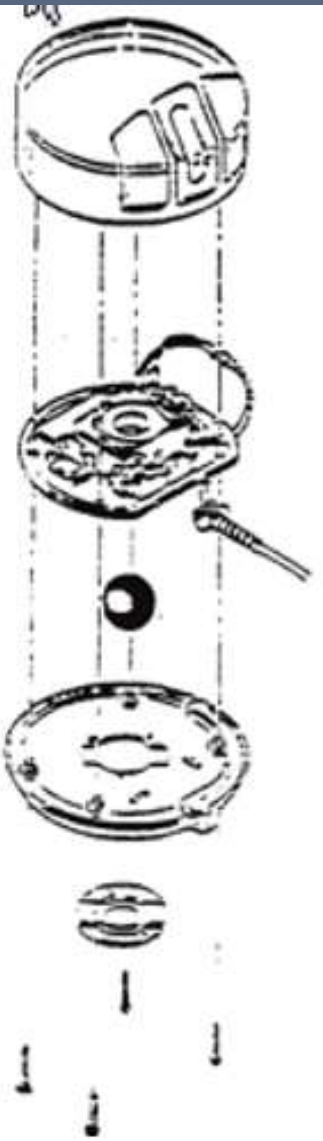
Stereo Lithography

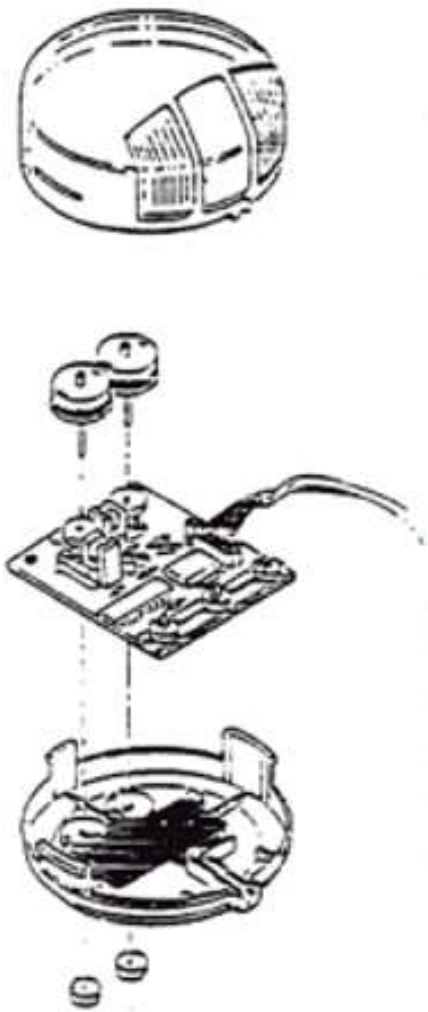


Case Study Digital Equipment Corporation



Case Study Digital Equipment Corporation

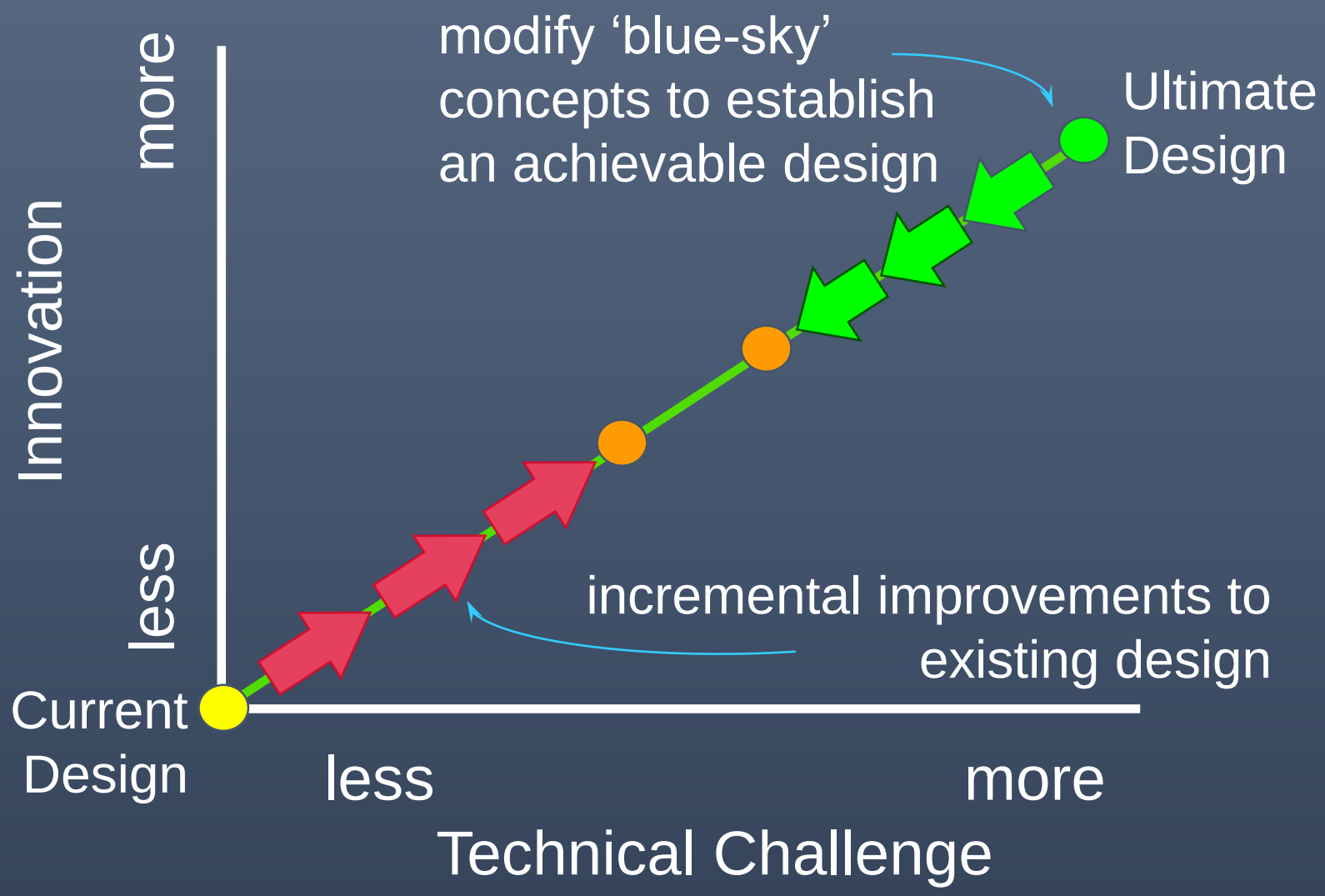




	Old	New
Part count	61	44
mechanical	31	16
electrical	30	28
Assm. Time	17 min.	6
Assm. Oprs.	83	56
Adjustments	11	0
Fasteners (3 types)	10	0
Material Cost Reduction		>40%

Break The Habit!!!!

How DFMA Product Simplification Differs



“Timing Is Everything” … Concept Phase/Gate

- Once a part is “allowed” to remain, it’s very hard to get rid of it
  - Engineering Analysis
  - Tooling
  - Qualification Testing
  - Regulatory Filing
- “Designed” parts are taken for granted … need to aggressively challenge necessity

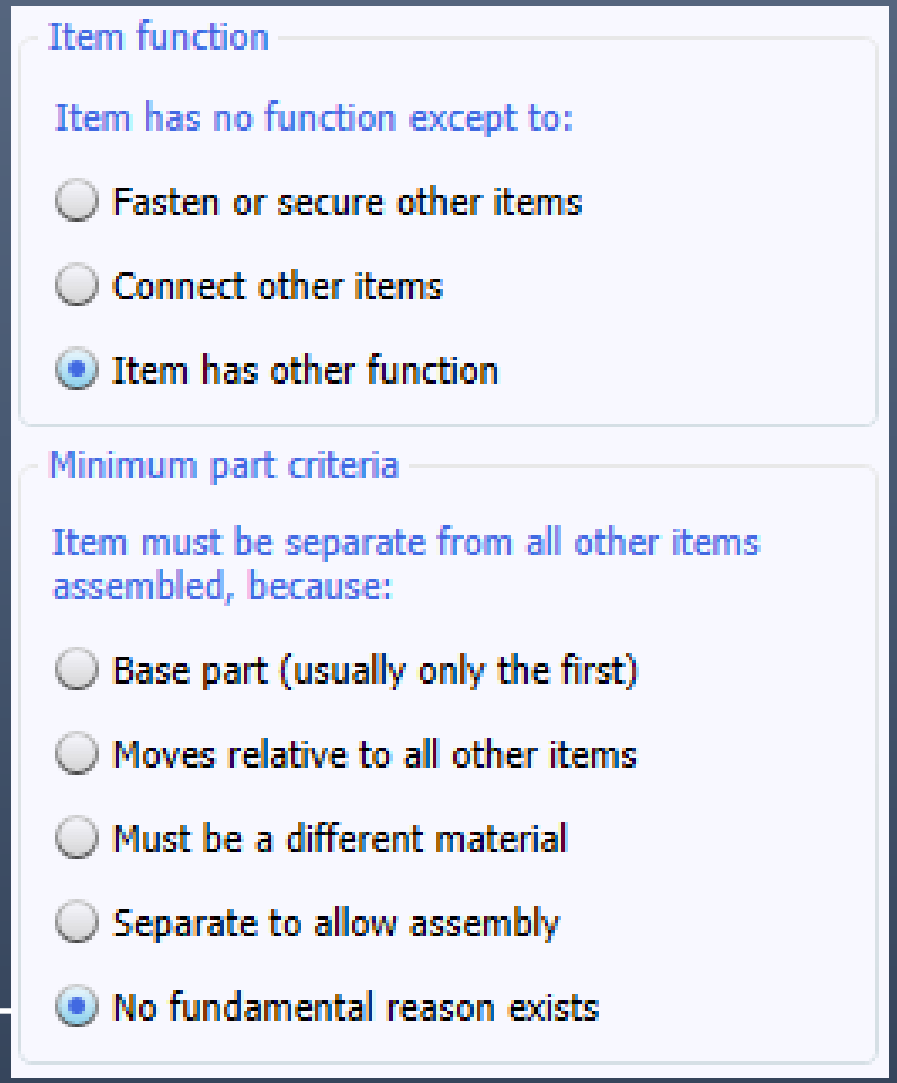
Now it’s your turn … sample product simplification project

Minimum Part Criteria – Focus on Function

Candidate for Elimination

Theoretically Necessary

Candidate for Elimination



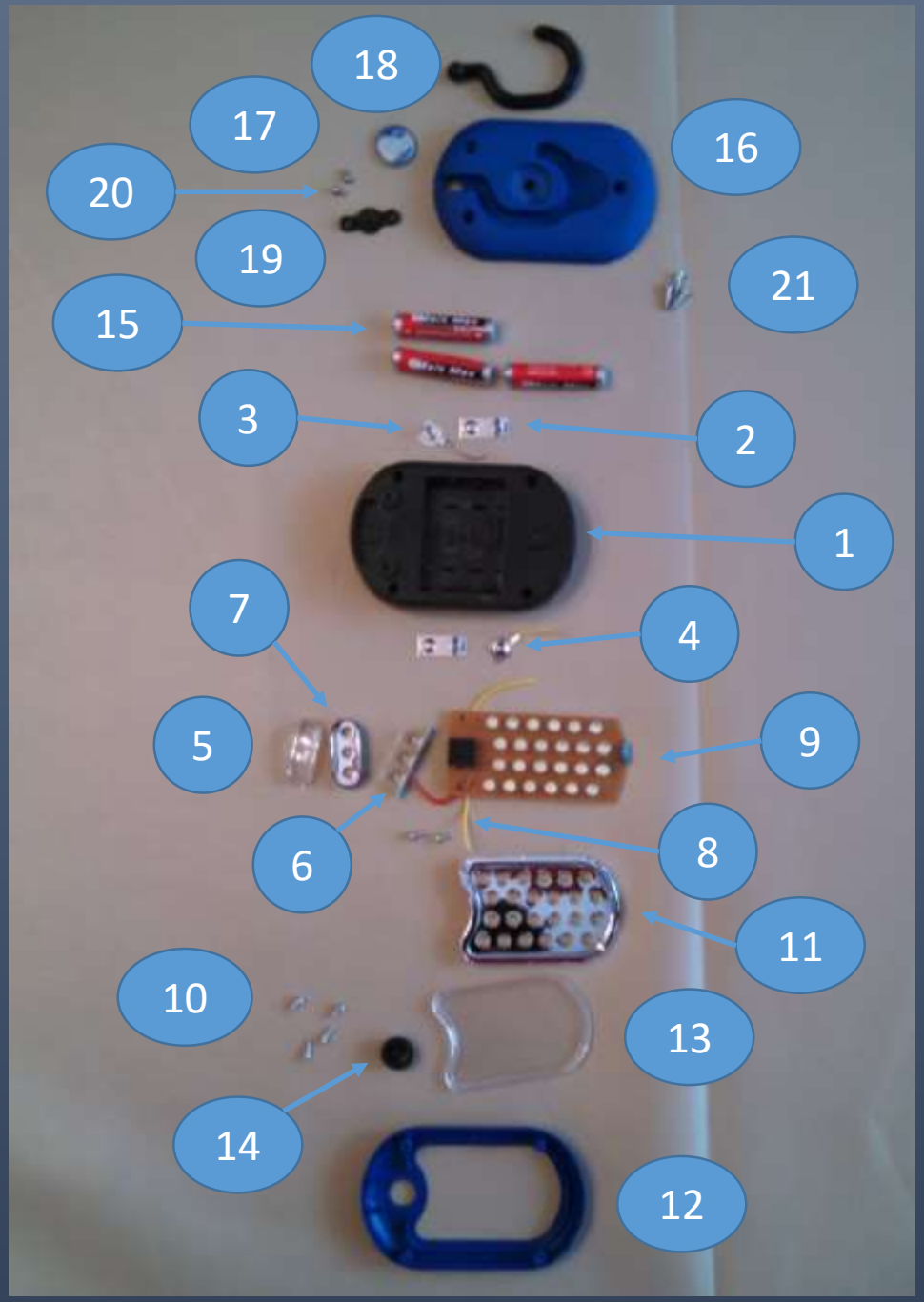
Fastener
Connector

Base
Moves
Material
Allow Assy
No Reason

The Minimum Part Criteria

- While examining parts:
  - Don’t consider technical or economic limitations
  - Evaluate with respect to all parts already assembled

20 Minutes



Harbor Freight Flashlight

	Name	Quantity	Min. Part Criteria	Min. Part Count
1	Chassis	1	*Base*	1
2	Battery Terminal - dual	2		
3	Battery Terminal - single pos	1		
4	Battery Terminal - single neg	1		
5	3 LED Lens	1		
6	3 LED Board & wires	1		
7	3 LED Reflector	1		
8	Battery Wire	2		
9	24 LED Board	1		
10	Screws - small	6		
11	24 LED Reflector	1		
12	Cover - Lens	1		
13	24 LED Lens	1		
14	Button	1		
15	Batteries - AAA	3		
16	Cover - Hook/Mag	1		
17	Magnet	1		
18	Hook	1		
19	Hook retainer	1		
20	Screws - retainer	2		
21	Screws	3		
22	Labels	3		

Solution

Harbor Freight Flashlight

	Name	Quantity	Min. Part Criteria	Min. Part Count
1	Chassis	1	Base	1
2	Battery Terminal - dual	2	Connector	0
3	Battery Terminal - single pos	1	Connector	0
4	Battery Terminal - single neg	1	Connector	0
5	3 LED Lens	1	No Reason	0
6	3 LED Board & wires	1	Material	1
7	3 LED Reflector	1	No Reason	0
8	Battery Wire	2	Connector	0
9	24 LED Board	1	No Reason	0
10	Screws - small	6	Fastener	0
11	24 LED Reflector	1	No Reason	0
12	Cover - Lens	1	Allow Assy	1
13	24 LED Lens	1	No Reason	0
14	Button	1	No Reason	0
15	Batteries - AAA	3	Material	1
16	Cover - Hook/Mag	1	No Reason	0
17	Magnet	1	Material	1
18	Hook	1	Movement	1
19	Hook retainer	1	No Reason	0
20	Screws - retainer	2	Fastener	0
21	Screws	3	Fastener	0
22	Labels	3	No Reason	0
				6

Recap

- Focus on the functional requirements of the system
- Err on the side of “elimination” to drive innovation
- “Name That Tune” challenge … strive for concepts with the fewest parts possible

Questions ?