Profits & Business Models

18-849b Dependable Embedded Systems

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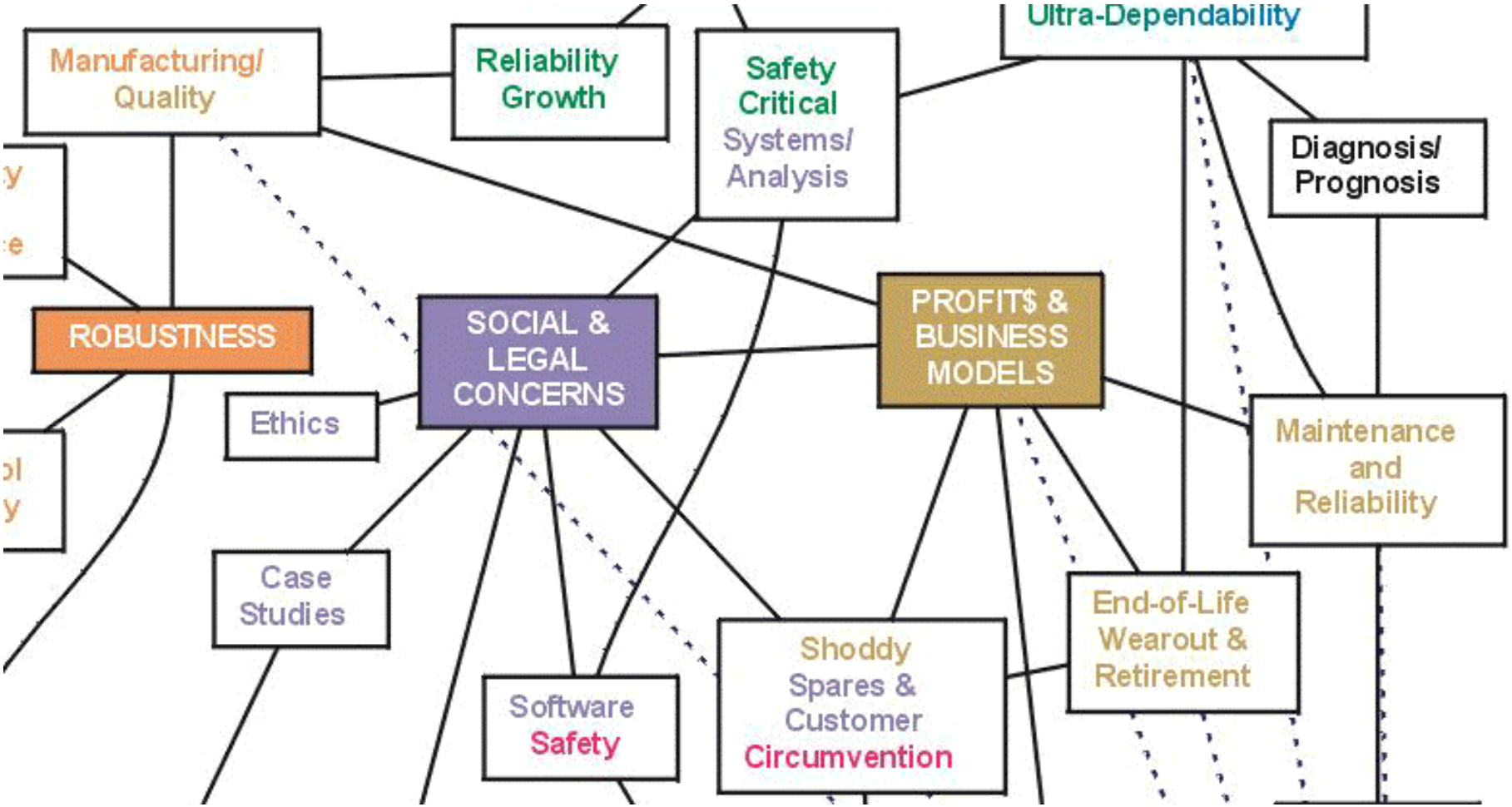
Overview: Profits & Business Models

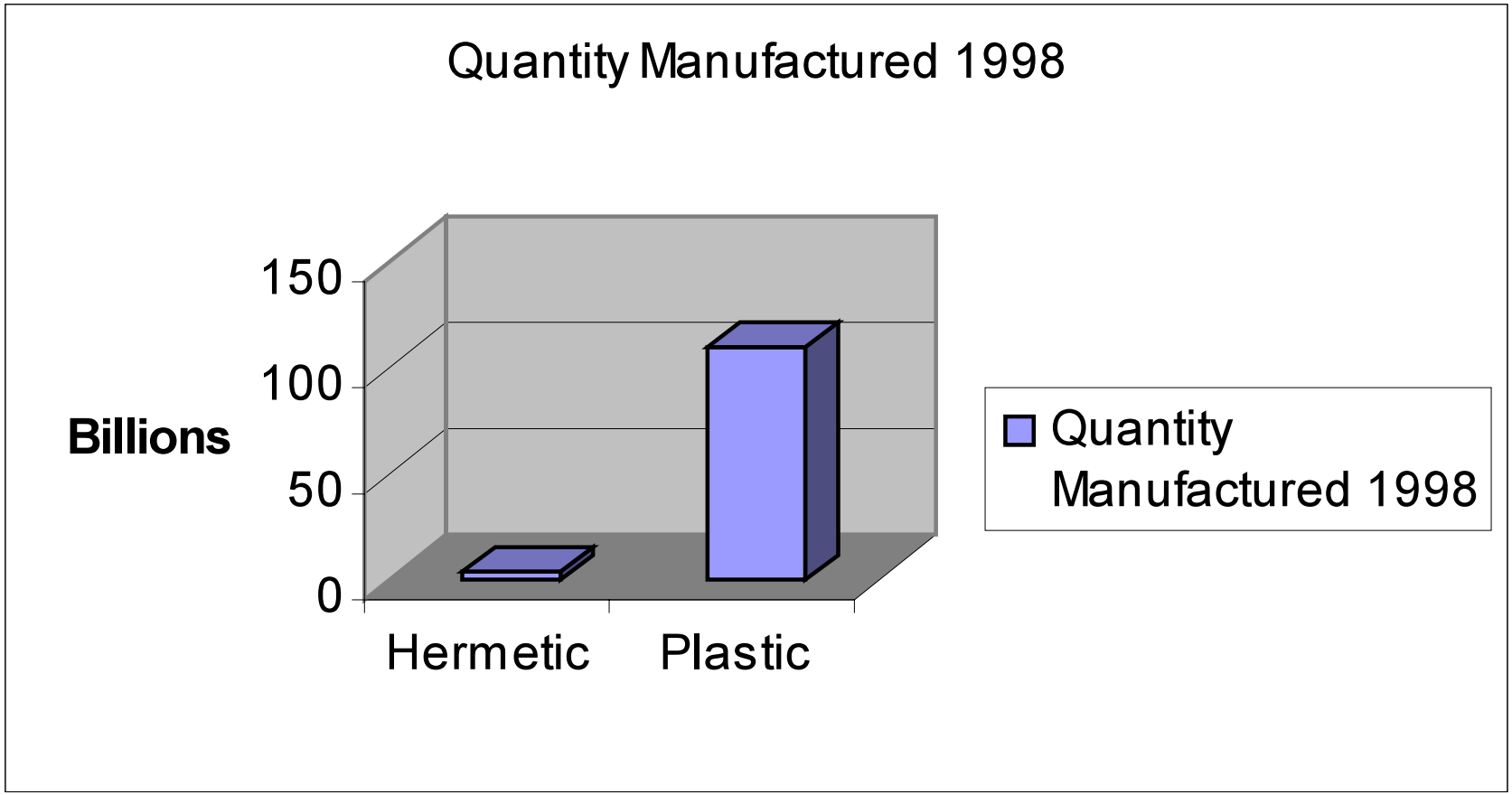
- **Introduction**
  - Difficulties…
  - Trends
- **Key concepts**
  - Safety vs. Profits vs. Ethics
  - Maintenance Policies
  - Time to Market
- **Tools / techniques / metrics**
  - Concurrent Engineering
  - $$$
- **Conclusions..**

YOU ARE HERE MAP



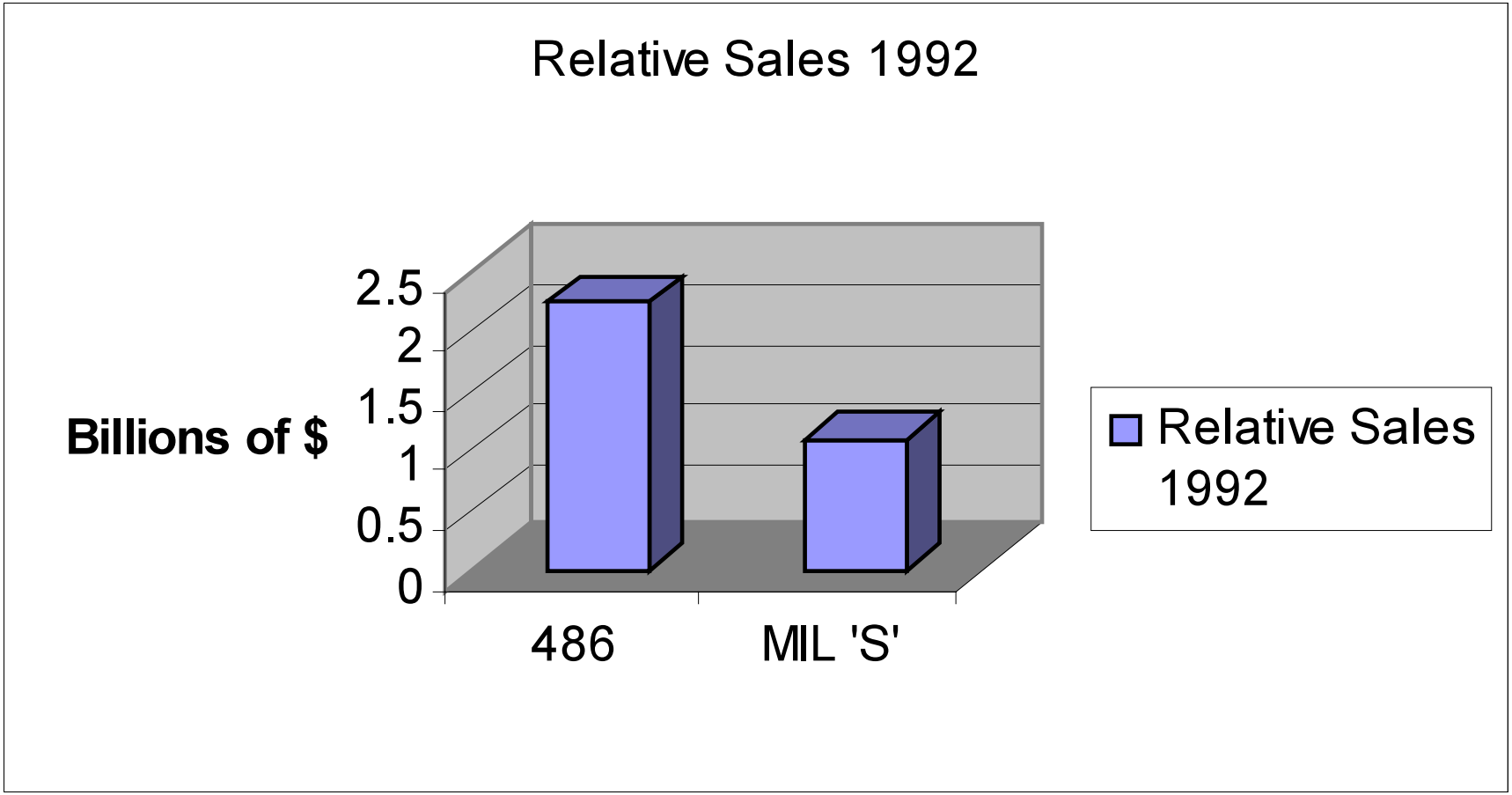
Trends… [Wall98]

- Higher rate of return for higher production lines.
- Hermetically sealed ICs less profitable..



Trends… [Wall98]

- **Selling Military Spec components just not profitable..**



Safety vs. Profits vs. Ethics

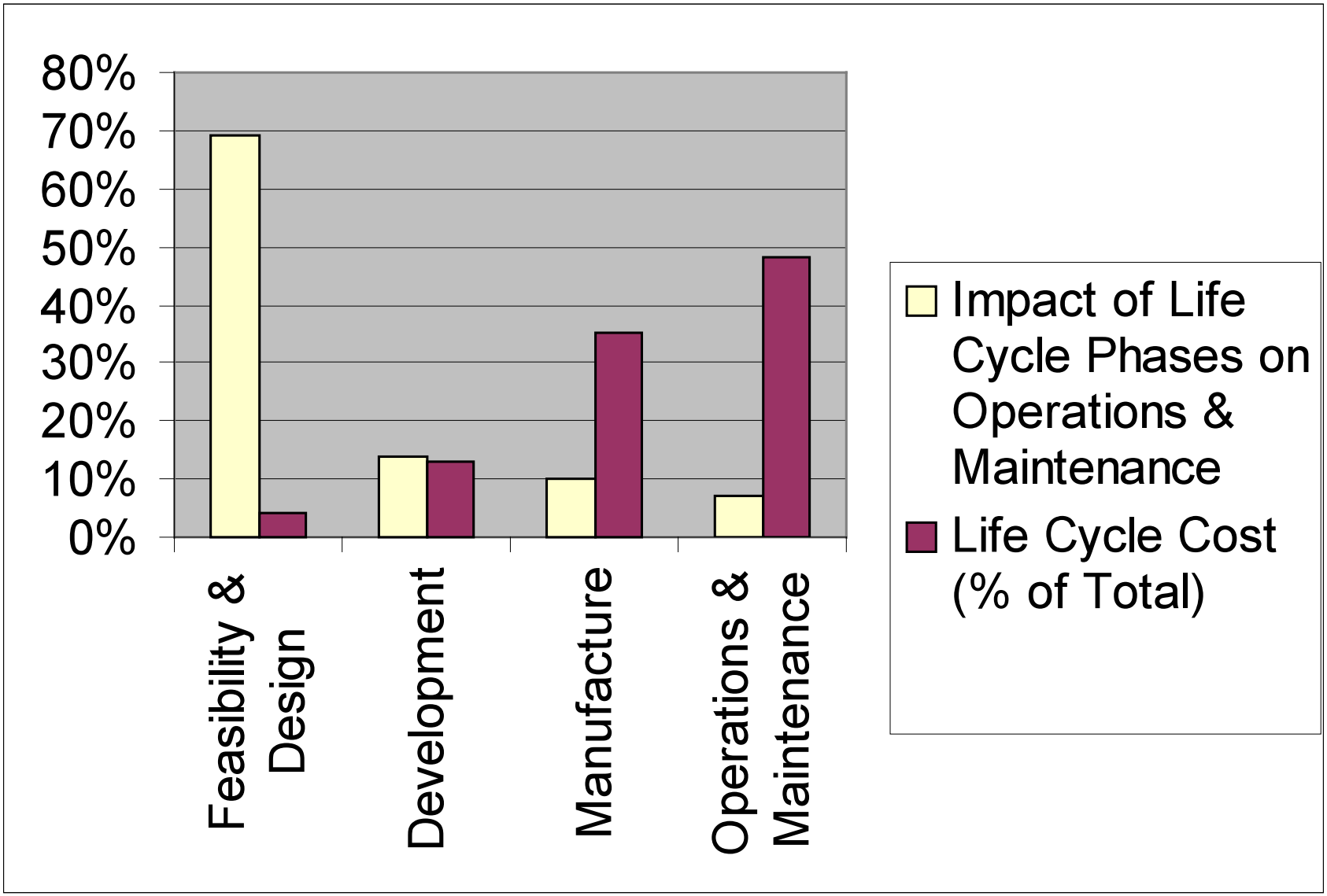
- **Safety costs money.. So how much safety?**
  - Spend too much, company won't make $$$
  - Spend too little, someone will get hurt, company name will be tarnished, etc.. --> company won't make $$$
  - So what is just right?
- **One can employ methods such as cost benefit analysis**
  - Attempt to identify and analyze a set of costs and benefits in order to present decision-makers with an economic justification for making a certain choice..
  - Can get into ethics - Ford Pinto case
    - CBA supposedly demonstrated that is was economically appropriate to not repair Pinto fuel system, even though a large # of lives were at stake.
  - Manufacturer might request government intervention so that it can follow what is required, and be "acting in good faith"

Safety vs. Profits vs. Ethics (cont.)

- **Fault Tolerant Computing - Advanced Launch System**
  - Redundancy makes system more reliable
    - Costs money vs.:
      - » cost of launch equipment
      - » cost of scrubbing launch,
      - » failure investigation
      - » repairs
      - » cost due to schedule delays
  - So when is redundancy the answer…?
  - They found..
    - Redundancy to achieve fault tolerance is required for higher value missions
    - The use of less-highly qualified parts can lower costs for less expensive payloads.
      - » Requires a culture change to allow launching with known faults

Maintenance

Life Cycle Costs - Space Applications [Wall98]



Maintenance Policies

- **Customer replaceable units**
  - Laser printer toners.
- **Sell maintenance service?**
  - Diagnostics is what takes time. Fixing the problem is usually easy.
  - Include diagnostic software in product. 5% product increase. Usually worth it. Could help service competitors though.
  - In minicomputer market, service reaps 10% of system purchase price annually.
- **Periodic maintenance, preventative maintenance?**
  - Typically appropriate where electromechanical devices are used.
- **Design for targeted life.**
  - Device built with knowledge that design will allow a fixed limited useful life.
  - Generally ok, if item is cheap enough

Maintenance (cont.)

- **Third Party Maintenance**
  - originally established to support ranges of equipment which the suppliers regarded as obsolescent and for which they were unwilling to provide continuing support.
  - typically cheaper
  - Better response time
    - Smaller
    - Service centers can be spread all over
  - May not be as knowledgeable as manufacturer

Time to market

- **Vastly important in computer industry**
- **Not sure how important for safety critical systems:**
  - Consumer goods could be used in a safety critical way (pagers & doctors).
  - Time to market pressures could increase bugs, decrease reliability.
- **Time to market could have effect of decreasing safety.. Couldn't find anything on this..**
- **Found a bunch on computer companies such as Cisco whose business models have been very successful in 90s.**
  - Acquire/Contract technology outside of your core business.

Tools/Techniques/Metrics

- **Metrics… Aside from $$$?**

- **Techniques**
  - Concurrent Engineering - Design method that incorporates efficient collaboration in order to get more accomplished, even in the wake of technological complexity.
  - Technique known to decrease time to market when implemented properly.

Conclusions

- **In the end, Profit is KING.**
- **Redefining the metric: $$$, but can be global corporate profit rather than profit on a one life cycle phase.**
- **Level of redundancy/Safety considerations can be varied to accommodate the criticality/value of a particular mission/application.**