Before we Start

“Need Analysis” related difficulties are responsible for over 30% of project failures. Billions of dollars are spent annually on cancelled products.

Now, start taking notes. Today (in this studio) you will perform need analysis for your team project.
Introduction

- A successful design is the one that perfectly answers the customer needs; all the needs.
- Needs are expressed by the customer, but collected and formulated by the designer for a good understanding of the problem.
Example Needs Hierarchy

- Portable Audio Device
  - High-Quality Audio
    - Low Distortion
    - Low Noise
  - Portable
    - Lightweight
    - Small
    - Ergonomic
    - Environment
  - Easy to Use
    - Limited Controls
    - Multiple Data Formats
      - MP3 or CD Audio Format
      - CD
      - Flash Memory
    - Long Battery Life
      - Outdoor Temperatures
      - Runner’s Shock
      - Drop Resistant
      - Water Resistant
Example: Improve an existing motorcycle

What info would help us understand this design problem?

• How quickly should the cycle accelerate to 80 km/h?
• Is fuel consumption less important than acceleration?
• Will the customer tolerate a liquid cooling system?
• What should the top speed be?
• What riding comforts are expected?
• Is an electric starter desired?
• Will customer care about beauty?
• Requirements, constraints and criteria are interchangeable depending on the details of the design solution specification
• Customer says, “I want a fast motorcycle.” What does “fast” mean?
  120 mph top speed?
  32 ft/sec² acceleration?
  4,000 Hz engine frequency?
• Could be a constraint (top speed >120km/h)
  Could be a criterion (high speed)
• “must have” requirements = become design constraints
• “desirable” requirements = weighted by importance
Example: Portable Audio Player Requirements

- Work under water (Able to withstand submersion to 5 feet)
- Temp Specs (Operate from 0 to 50 degrees C)
- Shock environment (Operate during shock created by jogger)
- Play multiple existing formats and should be upgradeable
- Fast/Easy Connection to a PC (connect within 5 seconds)
- Capable of “data” storage, other than audio
- Reliable (Mean time between failures greater than 10,000 hours)
- Size should be equal to or smaller than an average mobile
- Battery life (up to 8 hours of continuous play per charge)
- Standard Interfaces
The next slides will quickly list some different types of requirements
Take notes and identify what applies to your project
Prepare yourself to perform a need analysis for your team project
Functional Requirements

- **Overall Geometry** – size, width, space, arrangement
- **Motion of parts** – type, direction, velocities, acceleration
- **Forces involved** – load direction, magnitude, load, impact
- **Energy needed** – heating, cooling, conversion, pressure
- **Materials to be used** – flow, transport, properties
- **Control system** – electrical, hydraulic, mechanical, pneumatic
- **Information flow** – inputs, outputs, form, display
Safety Requirements

• **Operational** – direct, indirect, hazard elimination
• **Human** – warnings, training
• **Environmental** – land, sea, air, noise, light, radiation, transport
Quality Requirements

- **Quality assurance** – regulations, standards, codes
- **Quality control** – inspection, testing, labeling
- **Reliability** – design life, failures, statistics
Manufacturing Requirements

- **Production of components** – factory limitations, means of production, wastes
- **Purchase of components** – supplier quality, reliability, quality control, inspection
- **Assembly** – installation, foundations, bolting, welding
- **Transport** – material handling, clearance, packaging
Timing Requirements

• Design schedule – project planning, project control
• Development schedule – design detailing, compliance tests
• Production schedule – manufacture, assembly, packing, transport
• Delivery schedule – delivery date, distribution network, supply chains
Economic Requirements

- **Marketing analysis** – size of market, distribution, market segments
- **Design costs** – design team computing, information retrieval
- **Development costs** – design detailing, supplier costs, testing costs
- **Manufacturing cost** - tooling, labor, overhead, assembly, inspection
- **Distribution costs** - packing, transport, service centers, spare parts, warranty
- **Resources** – time, budget, labor, capital, machines, material
Ecological Requirements

- **General environmental impact**
  impact on natural resources, social resources
- **Sustainability**
  political and commercial consequences, implications for following generations
- **Material selection**
  solid, liquid, gas, stability, protection, toxicity
- **Working fluid selection**
  fluid, gas, flammability, toxicity
Aesthetic Requirements

- **Customer appeal** – shape, color, texture, form, feel, smell
- **Fashion** – culture, history, trends
- **Future expectations** – rate of change in technology, trends, product families
Life-Cycle Requirements

• **Distribution** – means of transport, nature and conditions of dispatch, rules, regulations
• **Operation** – quietness, wear, special uses, working environments
• **Maintenance** – servicing intervals, inspection, exchange and repair, cleaning, diagnostics
• **Disposal** – recycle, scrap
Legal/Ethical Requirements

• Regulations – FDA, other rules
• Ethics – public safety, health, welfare and integrity
• Intellectual Property – patents, trademarks, copyrights
Activity

Over the next hour, teams are required to perform need analysis for their projects:

• Requirement hierarchy
• Primary objectives
• Secondary Objectives
• Constraints
• Criteria
• Problem statement