

# Auvtionics Design Department Procedure

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Figure 1: Flowchart of the Design Process

This document explains the design procedure to be used by the design department of Auvitronics.

## 1 Design Process

Figure 1 shows a flowchart of the process that the department follows. In the following sections we briefly discuss each stage and the deliverables expected at the end of each stage.

### 1.1 Need

Any new project is initiated with the proposal or approval of a project idea by the upper management. This idea will be based on certain motivations driven by any one of the following:

- Customer needs
- Anticipation of a potential market
- Manufacturing process improvement or automation needs within the company

The *Statement of Need* will be written down establishing the needs and goals for the project. This will be approved by the management so that exact needs are well-established among all stake-holders of the project.

### 1.2 Specifications

The needs or goals established in the earlier step have to be translated in this stage into technical specifications that will serve as design goals for the technical team delivering the project. These specifications may include design specifications, testing specifications, certification or compliance with standards, how the product will be maintained throughout its life-time.

The *Specifications* document may have the following sample headings:

- Introduction
- Environment
- Performance
- Physical Size and Weight
- Power
- Life
- Reliability
- Cost
- Manufacturing Process
- Maintenance

### 1.3 Conception

In this stage, the conceptual design of the product will be finalized. All possible design solutions will be considered. The pros and cons of each design will be weighed. Uncertainties in the decision-making process may require proof of certain new concepts that are being considered, and may lead to quick research or development sub-projects aimed at proving the new concepts. Based on the all available information regarding costs, time, resources and the like required in each alternative solution, one will be selected that minimizes the costs and maximizes the utility for the end-user. Other considerations may include manufacturability, ease of testing, maintainability, scalability, service/support costs and running costs of the designs being considered. This *Conception* document will be delivered by system-designers that may include several inputs from the upper management as well as the design engineers, production team, manufactureres, suppliers etc. And the document should explain clearly the decision-making process used to choose one design solution among many.

### 1.4 Planning

In this stage a *Project Plan* will be initiated, where:

1. Components of the system will be identified
2. It will be identified which components will be designed in-house and which will be purchased off the shelf
3. For off-the-shelf purchases, the suppliers will be finalized
4. For in-house production and design responsibilities and timelines will be assigned
5. Testing procedures for in-house designs will be determined and planned with responsibilities and timelines assigned
6. Overall project timeline will be determined, clearly stating—for each designed component, sub-assembly, full assembly and testing equipment built in-house—the stages of: design, design-verification, prototyping, prototype-verification, pilot production and product validation. Responsibilities and timelines for each will be allocated.
7. Reporting requirements will be determined. These may include mechanism for reporting design progress to upper management, mechanism for reviewing the project plan on a regular basis etc.
8. Documentation requirements will be determined and assignend. These may include: Designing of brochures, user guides, installation guides etc.

The next six stages: Design, design-verification, prototyping, prototype-verification, production data and product validation will be followed separately for each designed component, sub-assembly, full assembly and testing equipment built in-house.

## 1.5 Design

In this stage, the following documents will be delivered, as applicable:

- Engineering drawings, assembly drawings and material specifications
- Schematic diagrams and wiring diagrams
- Algorithms, codes and software documentation that goes with it
- Documents providing rationale for each design decisions not immediately apparent in the supplied drawings and schematics
- Documents detailing production and maintenance processes for the designed part

## 1.6 Design Verification

Mathematical analysis or computer simulations of the designs will be carried out, if possible, to prove mathematically that the suggested design meets the design requirements. Upon failure to meet the requirements, design will be reviewed and revised. *Design Review* document will state the results of verification and comments on the reasons of failure, if any.

## 1.7 Prototype

Initial material list to be purchased will be prepared called the *Prototype Material List* and an initial production procedure for the prototype will be prepared called *Prototype Production Procedure*. Then, preferably with the help/involvement of the production team, models of the design will be developed, such as circuit boards (vero-boards) for electronic circuits, or cheaply constructed assemblies for mechanical parts etc. New production equipment or training should be identified at this stage.

## 1.8 Prototype Verification

The prototypes will be verified according to the testing procedures. Upon failure to meet the requirements, design will be reviewed and revised. The *Prototype Review* document will state the results of the verification and comments on the reasons of failure, if any.

## 1.9 Production Data

Necessary data that needs to be prepared for production of the finalized design will be delivered. This may include PCB layouts, mold data and the like.

## 1.10 Pilot Production

Upon verification of the prototype of the full assembly, a *Final Material List* and *Final Production Procedure* will be handed over to the production team which will be required to produce the product in small quantity with support from the design department, if any. The in-house testing of each produced product should be carried out as part of the quality assurance procedure by

the production team itself. Such testing procedures should be part of the *Final Production Procedure* delivered by the design team.

### **1.11 Product Validation**

The final product will be delivered to the customer, and verified according to agreed testing specifications and customer sign-off will be obtained as a sign of customer satisfaction.

### **1.12 Final Production**

Large-scale production or as-per-requirement will now be setup as a final stage of complete handover of the project from the design team to the production team.

### **1.13 Customer Support**

User guides, maintenance guides, repair guides, design improvements upon feedback from the customer or the production team or the service/repair teams will be the responsibility of the design department for the remaining life of the product or till the time the product is stable.

## **2 Deliverables**

Based on the above description, following is the list of documents to be delivered for any project to be carried out by the department:

1. Statement of Need
2. Requirements Specifications
3. System Conception
4. Project Plan
5. Design documents
  - (a) Drawings of parts, assemblies with material specifications
  - (b) Schematics and Wiring Diagrams
  - (c) Codes, software
  - (d) Documentation stating rationale for each design decision
6. Design Review
7. Prototype material list
8. Prototype production procedure
9. Prototype review
10. Production data (PCB data, mold data, and the like)
11. Final material list

12. Final production procedure
13. User guide
14. Maintenance guide