User Needs Feedback to User Function

Functional Requirements

STEP 1. Specify Embedded System Functional Requirements

Emergency Responder
Job Safety Analysis

STEP 2. Allocate Functions to Control Boards and Analyze/Simulate

Functional Requirements

CAD Drawings and Control Board - Equipment Interface Specifications

STEP 3. Design Embedded Control

Design Specifications

DKYS Embedded Control Design Specification

DKYS Hardware Control Boards, Software, and Firmware

STEP 4. Prototype Embedded Control

Prototype Embeded Control

STEP 5. Release Prototype to Production Management

User = First Responder

Feedback to User
STEP 3B. Embedded Software/Firmware Development Process

Customer = System Engineer

Functional Requirements

Design Specifications

DKYS
- Embedded Control
- Design Specification

Gate 3B1: Review Requirements

Gate 3B2: Review Design

Gate 3B3: Review Software Logic

Gate 3B4: Review Testing

Tested Code

Step 4

Discrepancy Reports
Requirements Review
Assess requirements for completeness:
* input/output data ranges, units, and accuracy,
* safety critical variables identification and use,
* TBD’s addressed

Computer-Aided Software Engineering (CASE) Diagrams
Data dictionary
Control flow digrams
Data flow diagrams
State transition diagrams
Calling Structure

Coding Conventions
Follow code writing conventions, for example:
* variable initialization and naming,
* In-line documentation,
* module size and fan in/fan out limitations,
* Disallowed constructs (e.g. use of pointer arithmetic),
* use of assertions such as pre-conditions and post-conditions, exception handling

Test Procedures
* static analysis of code
  - safety critical data flow
  - adherence to coding conventions
* dynamic execution of code
  - multiple condition coverage
  - boundary value
  - sequencing/state transition tests
  - nominal and off-nominal tests
  - timing tests

Test Levels
* function/utility libraries
* unit (subroutine)
* module or object
* sub-frame (part of a Sense-Process-Actuate) sequence
* frame (all of a Sense-Process-Actuate) sequence
STEP 4. PROTOTYPE DEVELOPMENT PROCESS

STEP 4A. GATE 4A: Load Embedded Software/Firmware onto Control Hardware
- Customer = System Engineer
- Electronic Control Board(s)
- DKYS Software/Firmware

STEP 4B. GATE 4B: Test Run Emulated/Simulated Usage Tests
- Embedded Control

STEP 4C. GATE 4C: Integrate Check Embedded Control into Integrated Equipment
- Embedded Control

STEP 4D. GATE 4D: Run Usage Tests
- Embedded Control

Step 5

 DKYS Prototype

Discrepancy Reports