

# Design Services

**Product Design**  
from concept to production



01

**ELECTRONICS**

Digital, Analog, FPGA, mixed-signal  
8/16/32-bit Microcontrollers, DSP  
LTE, WiFi, Bluetooth LE, Zigbee, LoRA  
Brushless, stepper control

02

**FIRMWARE**

Microchip / Atmel  
Renesas, STMicro  
Xilinx  
Matlab/Simulink

03

**MECHANICAL**

Machine Design  
SolidWorks CAD/CAM/Plastics  
Robot Kinematics/Dynamics

04

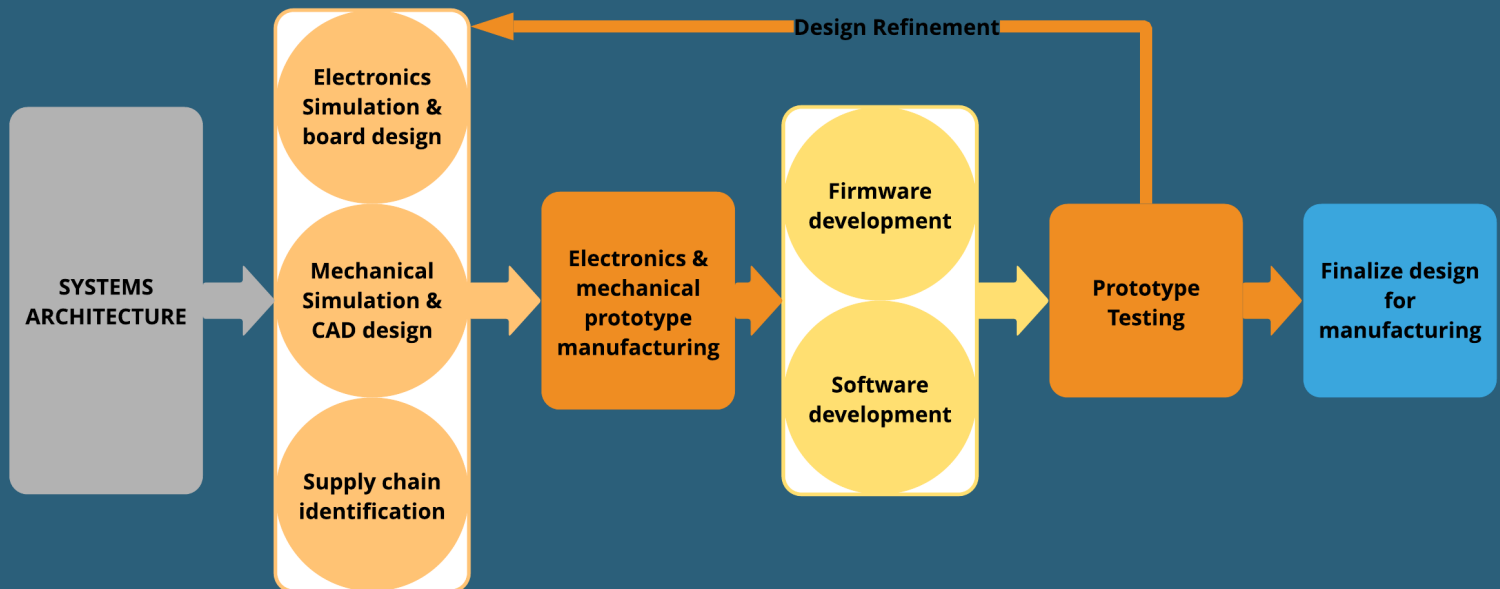
**SOFTWARE**

Visual Studio C#  
Java, Python  
Networking stacks  
MQQT, CoAP

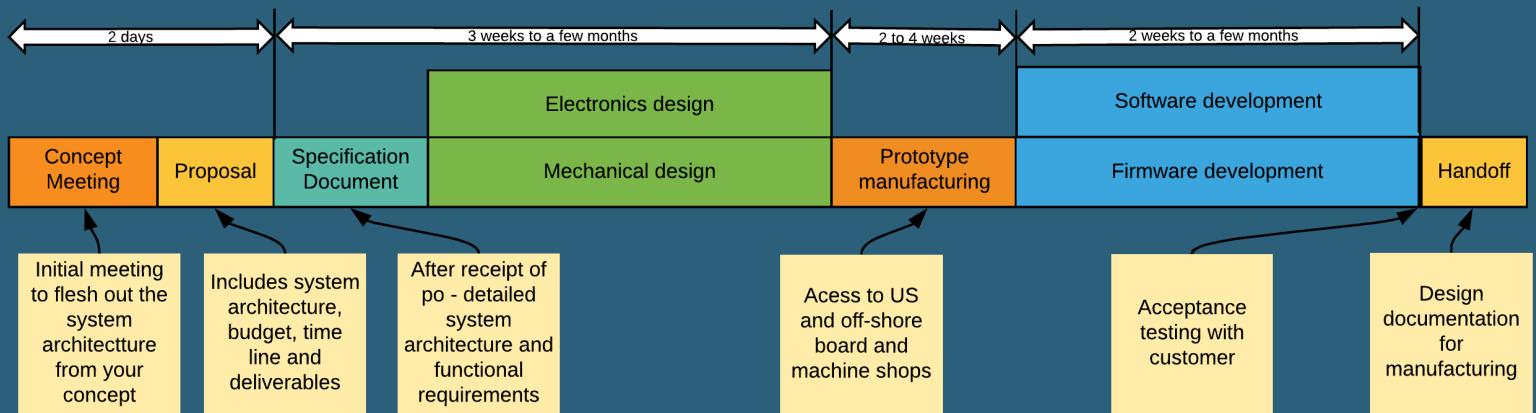
**Product Design**

# A systems approach to product design

## Design Flow:



## Project Flow:

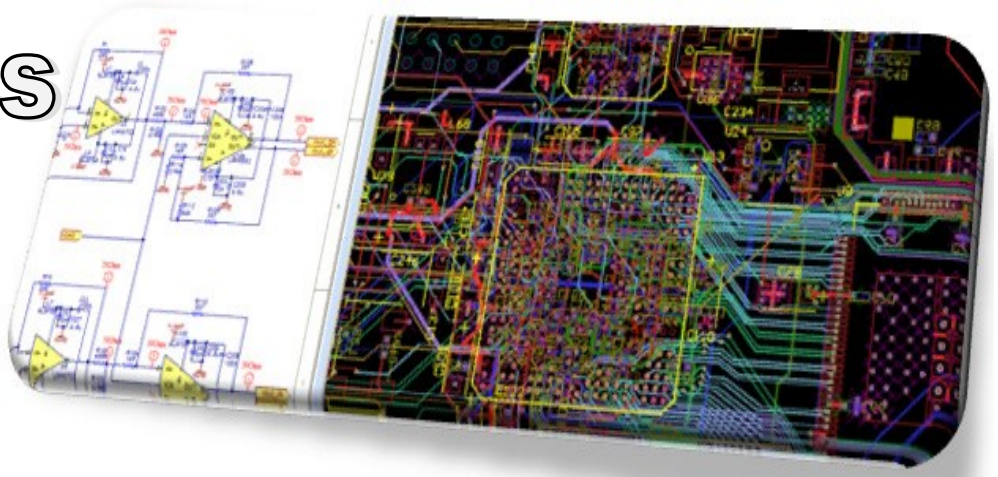


ARG does not invoice until acceptance testing is completed.

ARG provides free unlimited bug and design support for the lifetime of the design.



# Electronics Design



Complete product level OR sub-system design involving boards, harnesses and enclosures for a turnkey embedded system using Altium and SolidWorks

## Embedded Systems

- Microchip/Atmel (authorized design partner), Renesas, STMicro, ARM Cortex microcontrollers, Infineon motor control
- Sensors, transducers, motor controllers, displays and communication protocols for custom embedded systems
- In-house tool chains and debuggers along with years of custom IP are available for rapid systems development

## Programmable Logic

- Xilinx family of FPGAs, mixed signal SOC and CPLDs with toolchains
- In house developed Verilog IP for customer use -(canOpen, RS232, SPI, digital FIR filters and many DSP blocks)
- Mathworks / Simulink tool suite for generating Verilog code from Simulink models

## Power Electronics

- Brush, Brushless and stepper motor controller designs
- Control architectures—FOC, sensorless bldc, phase advance, field weakening techniques —with in-house C source
- Power stage design expertise— FETs and IGBTs up to 2KW
- Motor control chipsets from PMD, Renesas, ST micro, International Rectifier



**Authorized  
Design Partner**



## Sensors & transducers

- Selection of proper sensors and transducers for various applications
- Photo multiplier tubes, photo diodes, UV spectrometers for optical measurement and lab instrumentation
- Signal conditioning with ADC signal path designs up to 6 Gsps
- Sensor fusion techniques with in-house C source files

## Analog

- Pre-amplifier / Analog front end designs up to 2GHz
- Multi-pole active filter designs and instrumentation signal conditioning

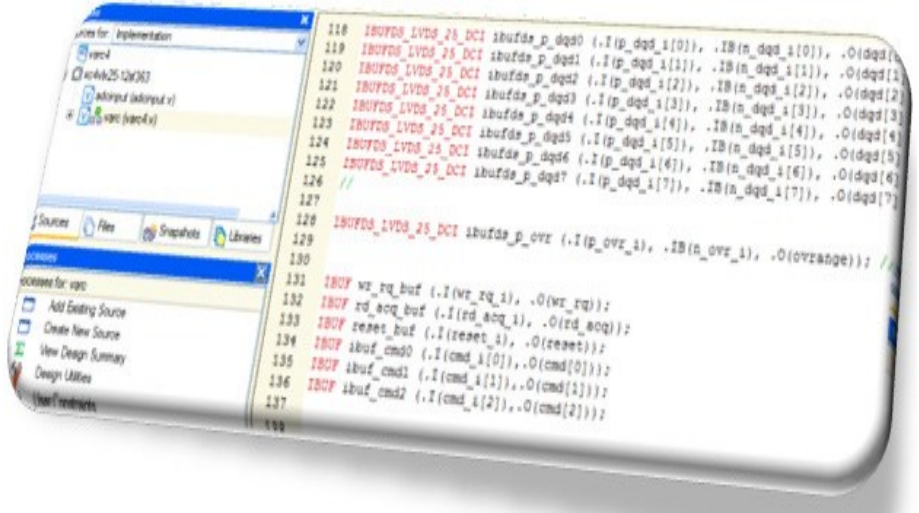
## Wireless

- Short and long haul wireless communication links in the ISM band
- WiFi, Bluetooth low energy, Zibgee, Zwave , RFID, GPS , GSM/LTE—using modules or SOCs
- Digi xBee ecosystem, Nordic SOCs, uBlox modules, Telit SOCs

## Networking

- TCP/IP networking modules from Microchip, uBlox and ConnectOne
- Mesh routing expertise with Bluetooth LE

# Firmware & Software



Embedded C with tool chains for Microchip, ARM, STMicro, Renesas

Verilog IP for Xilinx FPGAs and CPLDs. Visual Studio C# and Java

## Microcontrollers

- Embedded C for Microchip/Atmel, Renesas, STMicro, ARM Cortex processors
- In-house C source for UART, SPI, I2C, CAN, Ethernet, A/D, D/A
- In-house C source for Bluetooth LE, Ethernet, Zigbee and other protocols
- Various 16/32-bit microcontroller RTOS implementations
- In-house C source for Brushless motor and stepper control stack with trajectory generation

## FPGA IP

- Over 25 years of in-house developed IP for Xilinx family of FPGAs, mixed signal SOC and CPLDs
- Digital filters, FFT and storage IP
- Mathworks system generator for Xilinx Zynq SoCs

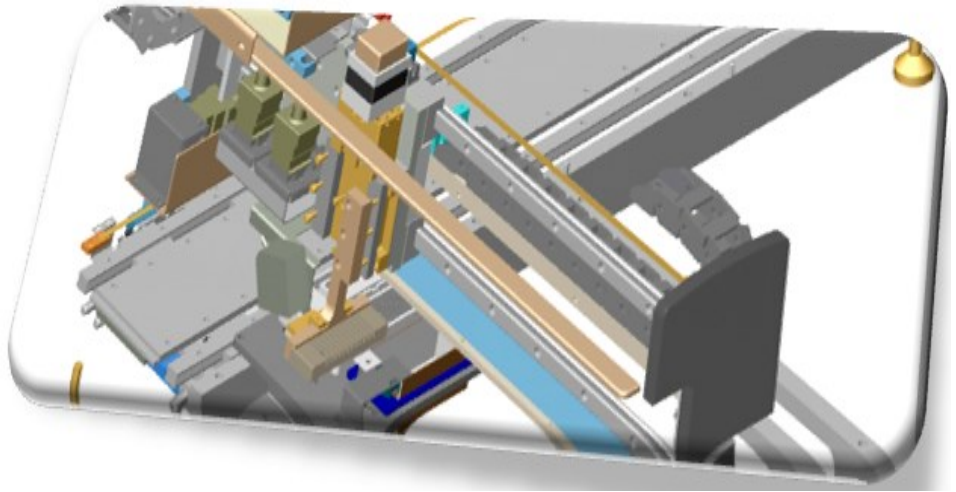
## Operating Systems

- FreeRTOS, TinyRTOS, VxWorks
- Linux—Debian on ARM cores

## Software

- Visual studio C# - for user interfaces
- Java, Python, Server back end development
- Matlab / Simulink for model based code generation

# Mechanical & Prototyping



**Machine design from low cost stepper and belt drives to multi axis high performance brushless linear motor driven systems**

## Machine Design

- Design of multi-axis gantry type systems used in laboratory and industrial automation
- Stepper & belt drives to high speed brushless linear motor based machines with linear encoders
- System calculations for motor selection based on payload and trajectory. Kinematics and Dynamics for robotics
- Motion simulation in SolidWorks

## Enclosure Design

- SolidWorks sheet metal design for electronics enclosures with attention to EMI/RFI mitigation
- Plastics design and mold generation with SolidWorks plastics and mold tools
- CAM generation with SolidWorks CAM
- Quick turnaround prototypes using 3D printing and short run plastic molding

## Prototype and short run production

- Network of board and contract manufacturing shops in Pennsylvania, California, China and India
- Supply chain management
- Bill-of-materials analysis for component sourcing and end-of-life issues

**Leverage our 30+ years of expertise in the areas of automotive electronics, industrial automation, scientific instrumentation, wireless networks and robotics to hand off parts of your electronics design , sub systems or the entire product design.**



**Located at:**

**University of Pennsylvania, Pennovation works campus**

**Pennovation Works**

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