



pentad

design corporation

advanced consulting engineers

embedded electronic engineering

embedded software engineering

pcb design services

regulatory and agency compliance

mechanical engineering

Medical • Commercial • Industrial
Aircraft Systems • Scientific

Miniaturization • Digital Power
Portable Devices • Ultra Low Power



Pentad: n.

- 1) From Greek, a group of five elements.
- 2) The five disciplines of Pentad Design:
 - embedded electronic engineering
 - embedded software engineering
 - pcb design services
 - regulatory and agency compliance
 - mechanical engineering

*"Committed to providing expert technical resources, value and integrity
to our partners while developing concise, timely and strategic solutions."*

*Member Texas Instruments, MCU Developer Network
Freescale Alliance Program Member
Microchip Design Partner*

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PENTAD DESIGN CORPORATION
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PENTAD DESIGN'S DISTINCTIVE CAPABILITIES

Pentad Design is a comprehensive **product development consulting firm** with an emphasis on embedded electronics and software development. The company was founded with the philosophy of providing expert services from ideation through production for Class I, II, III medical devices, consumer, commercial (including transportation and aircraft), and industrial products.

Medical Experience:

Pentad Design's engineering staff, led by Senior Partners Rick Gros and Lindon Baker, have many years experience developing successful medical devices that captured market leading positions and were highly profitable for the client firms.

Medical Devices continue to be a specialty after formation of Pentad Design in 2003. Pentad Design has developed a number of devices, Class II and Class III, with complete documentation packages including creation and execution of all the V&V documentation and procedures.

Embedded Systems:

Pentad Design has a number of very experienced staff with many years in the embedded arena. We leverage experience from bygone days of limited performance processors and tiny memories to create modern, high-performance, cost-effective, highly optimized hardware-software systems. Pentad Design has ported TI C2000 applications to TI MSP430 for significant power savings, and optimized MSP430 applications to fit into smaller and less expensive family members. Pentad Design understands control systems, z-transforms, digital power AC/DC, PFC, DC/DC, Digital motor (FOC – field oriented control), algorithm development and optimization, and optimizes these systems to best use the CLA found in newer C2000 products. Pentad Design also supports migration from other processors, notably Atmel or PIC, to MSP430. And, if you're looking for high quality C-based embedded software for general product applications, Pentad Design does that too.

Small and Power Managed:

Pentad Design has many projects where small size and extended battery runtime are required, but the client can only use the smallest, off-the-shelf silicon and catalog packages. Pentad Design finds unique solutions to their size and power management challenges.

USB:

Pentad Design has developed USB for many different applications, (including the TI MSP 5xx) that is embedded system friendly and is ideal for use in commercial embedded products. It doesn't monopolize the processor and coexists seamlessly with end applications.

Low Power Wireless:

Pentad Design has a number of successful designs using Low Power Wireless chip sets, including TI. We also have product experience using low frequency RFid technology as wireless data links in environments where low frequency is less attenuated. Pentad Design is not an RF specialty house, but we do implement and integrate low power wireless solutions into embedded systems.

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ELECTRONIC AND SOFTWARE ENGINEERING CAPABILITIES

EMBEDDED SYSTEMS

Embedded Systems:

- System Architecture
- Hardware/Software Partitioning
- Special Safety Systems for Safety Critical Devices
- Microcontroller / DSP / Programmable Logic
- Ultra Low Power Portable Products
- RF Wireless – Zigbee, SimpliciTI, ANT, RFID
- Digital Motion Systems
- Battery Powered Products
- Power Management
- Digital Power
- Wide Range of MCU/CPU/DSP Experience
- 8 / 16 / 32 Bit Processors
- TI MSP430 / DSP / OMAP-L
- RISC / ARM™
- FPGA
- Language Support (C, C++, Assembly)
- Legacy Language Support
- RTOS “Custom, Off-the-Shelf”
- Peripherals
- Comprehensive Expertise

Medical Device Embedded Systems:

- Class I, II, III
- Ventilators
- Oxygen Delivery
- Implantable
- Drug Delivery
- Respiratory Monitoring
- In-Vitro Diagnostics
- Dental
- Smoke Evacuators
- Disposable and Reusable Electronics
- Blood Analyzers
- Infusion Pumps

Types of Products:

- Industrial
- Scientific
- Medical
- Consumer Electronics
- Commercial / Professional
- Aerospace

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SOFTWARE ENGINEERING CAPABILITIES

RTOS “Custom, Off-the-Shelf”:

- Custom, Including Real-time Preemptive, Multi-tasking

Peripherals:

- SPI
- I²C
- ADC
- DAC
- EEPROM
- USB / OTG
- SMBus / PMBus
- Asynchronous serial
- Parallel I/O
- One-Wire™
- Real Time Clock
- Watchdog
- Multi Port RAM
- Hardware FIFO
- Keypad / Buttons
- Touch Screen
- SD/MMC
- LCD
- Bitmap Graphics
- LED
- Buzzers
- Digital Audio
- Custom Devices
- RFID
- Wireless

Comprehensive Expertise:

- Remote Firmware Upgrades
- Floating-point Math Routines
- Motion Control
- Digital Power
- Field Oriented Control
- FFT
- JTAG
- GUI
- User Interface
- Software Digital Filter
- PWM Control
- Closed and Open Loop Control Systems
- Serial and Network Protocols
- Direct Frequency Hopping/Spread Spectrum
- Emulation Methodology: Target Hardware Simulation for Rapid Prototyping
- USB 2.0 Host / Device / OTG
- Controller Area Network – “CAN” and CANopen

Windows Applications:

- MFC
- C++
- Debug Test Applications
- Production Support Applications

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REGULATORY AND AGENCY COMPLIANCE

Pentad Design develops products for many different clients and industries in compliance with relevant requirements of each company's Quality System.

Medical Device

Pentad typically works under the client Quality System. Staff members at Pentad Design have many years of experience developing successful medical devices in conformance with evolving worldwide medical device regulations. Pentad can help from the initial specifications through engineering design and development, prototype verification, validation, and support your submittal process. Pentad works with accredited test labs to obtain needed Safety, EMC, and environmental test reports. We work with large or small firms, and startups are not a problem, even if your Quality System is incomplete. Class I, II, or III; 510(k) or PMA; FDA, Canada, Europe, or worldwide; Pentad will help you develop it, make it work, obtain marketing clearance, and support your production handoff.

Commercial Products

Commercial products may be developed under widely varying Quality Systems, or none at all. We will develop your product in conformance with your needs and the needs of your market. Pentad can help from the initial specifications, through engineering design and development, prototypes, testing, regulatory compliance, and support production startup. US, Canada, Europe, or worldwide, Pentad will help you develop it and get it to market.

Commercial Aerospace

Pentad Design has significant experience in commercial aircraft passenger cabin systems. Pentad works under the client Quality System. Pentad can help from the initial specifications, through engineering design and development, test planning, prototype verification, and final validation. RTCA DO-178 doesn't scare us. Pentad typically works with accredited test labs to obtain the additional Safety, EMC, and environmental test reports.

Hazardous / Classified Locations

Pentad Design has experience developing Intrinsically Safe equipment for hazardous environments. Pentad works under the client Quality System. Pentad can help from the initial specifications, through engineering design and development, prototype verification, validation, and support the regulatory approvals process. Pentad works with your test labs to obtain needed Safety, EMC, and environmental test reports. Pentad will help you develop it, make it work, and support your production handoff.

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MECHANICAL ENGINEERING CAPABILITIES

- Consumer, Commercial & Industrial Product Design and Engineering
- Class I, II, III Medical Devices
- Custom Process, Assembly, and Test Automation Equipment
- Lean Manufacturing Work Cells
- Technology Assessment
- Mechanism and Machine Design
- Proof of Concept
- Breadboard Development
- Electromechanical Integration
- Finite Element Analysis (Cosmos)
- Thermal and Flow Analysis
- Computed Fluid Dynamics (Cosmos)
- Failure Mode and Effects Analysis
- Trouble Shooting
- CAD Surface and Solid Modeling – ProE, SolidWorks, CATIA
- Process Based Engineering
- Rapid Prototyping
- Manufacturing Engineering (DFMA)
- Manufacturing Process and Procedures for New and Legacy Products
- Vendor Liaison
- Short-run/pilot-run assembly

INDUSTRIAL DESIGN CAPABILITIES

- Strategic Product Planning
- Conceptual Development - Evolution and Innovation
- 3D Modeling / Product Renderings
- Mockups
- Models
- Functional Models
- Usability-Engineering Process and Compliance
 - Usability Risk Analysis
 - Operator-Device Interface
- Ergonomic Studies
- Competitor Product Analysis
- Market Study for Product Placement
- User / Environment Analysis
- Focus Group Research
- Consumer Research

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