

Xilinx FPGA Design and IP Solutions

FPGA Solutions, Simplified

An **FPGA** can improve your project, but starting a new FPGA design can be a daunting process. With the complexity of the system components, multi-core SoCs, IP available from a variety of sources, and a need to learn the tools, it's a challenge to get it all done. Is there a simpler way to harness the advantages of this technology?

DornerWorks understands how challenging it is to design for an FPGA. As one of just a few Premier Members of Xilinx's Alliance Program, we have created many FPGA and SoC designs for numerous companies. You can depend on DornerWorks expertise to architect your solution, lower the risk on your project, and accelerate your time to market.



Our approach begins from your requirements, and builds incrementally to an optimal solution. We can build from an idea, through rapid prototypes (such as with Xilinx SDSoC), to a fully customized logic solution, depending on your budget and performance requirements. Not only can we handle your FPGA development, but our engineering team also has the experience to assist with your embedded software, electronics hardware, and test systems engineering needs. Our talented design teams can tackle any electronics engineering challenge.

Xilinx Integrated Design Solutions

- **Turnkey Solutions:** Requirements Development, Design, Validation, and Documentation
- **Design Migration:** Replacing discontinued parts with FPGAs and CPLDs, migrating designs to the latest technology
- **Algorithm Development & Acceleration:** Xilinx SDSoC/HLS, C/C++, Matlab, Simulink
- **Separation:** Open-source [Xen hypervisor](#) support for Zynq US+ MPSoC devices, Safety/Security fault mitigation
- **IP:** AES Cryptographic IP, Ethernet MAC, Network Time Synchronization

Tools

- **FPGA:** ISE, Vivado
- **Embedded:** EDK, SDK, SDx
- **Simulation:** Vivado, Mentor Graphics QuestaSim
- **Debug:** Chipscope, Vivado Logic Analyzer, Xilinx Virtual Cable (XVC)

Key Capabilities

- **Functional Safety:** DO-254 up to DAL A
- **Video:** Demosaicing, Filtering, Color Space Conversion, Scaling, Overlay, Image Fusion
- **Communication Protocols:** Ethernet, TCP/IP, AVB, TSN, IEEE 1588v2, PCIe, ARINC 429
- **DSP:** Transforms, Filters, Windowing, Radar Signal Processing
- **I/O Interfaces:** JESD204, Gigabit Serial, PCI
- **Processors:** Microblaze, Picoblaze, ARM Cortex-A9, ARM Cortex-A53
- **Devices:** Zynq-7000, Zynq US+, RFSoc, Artix, Kintex, Virtex
- **Memory Interfaces:** DDR2/3/4, SRAM, Flash, SDIO
- **Safety/Security:** Security Monitor, Isolation Design Flow (IDF), Partial Reconfiguration, Modular Redundancy, Lock-step
- **Languages:** VHDL, Verilog, SystemVerilog, C/C++



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FPGA Solutions Case Studies

ASIC Algorithm Development Platform

DornerWorks used a custom pulse sequence generated using a DAC and a feedback signal sampled with an ADC, fed into the customer's algorithm to test and identify several issues that would have resulted in a non-functioning ASIC. This saved the customer money and enabled them to develop a functioning ASIC more quickly.

Technologies: Xilinx ZC702 Dev Board, Zynq-7000, SPI ADC, Parallel DAC



Radar Processing

DornerWorks successfully facilitated a size, weight, and power reduction of an existing radar system on an AVNET MicroZed with a Zynq-7000 device, and integrated the customers' existing ADC capture logic to receive ADC samples. The ADC samples were processed using a Range FFT followed by a Doppler FFT to produce a Range-Doppler map. Existing customer software was split into functionality implemented as FPGA IP blocks and functionality run on the Zynq-7000 dual Cortex-A9 processor to balance performance and development schedule.

Technologies: Xilinx Zynq-7000, ARM Cortex-A9, CW Radar, FFT, DMA, AXI



Trailer Angle Detection

DornerWorks provided key assistance in developing the FPGA design logic for a leading manufacturer's Trailer Backup Assist technology and its Trailer Angle Detection (TAD) logic, which leverages advanced camera technology to track trailer position while working seamlessly with a manually controlled trailer-turn knob and the truck's steering and controls.

Technologies: Xilinx Zynq-7000, Microchip PIC32

Engine Anomaly Detection

DornerWorks developed a sensor data acquisition and processing system for detecting operation anomalies of an internal combustion engine. The system uses a Zynq-7000 with multiple sensor inputs to measure vibration, temperature, tachometer, and pressure from an internal combustion engine. Vibration and pressure data is processed with a DFT in order to detect engine anomalies. Simulations and testing were used to determine the optimal DFT/FFT method for calculating the necessary frequency data captured by the sensors. The final system allowed the customer to reliably detect engine anomalies early to avoid downtime and costly damage.

Technologies: Xilinx Zynq-7000, SPI ADC



Medical Network Interface

DornerWorks replaced the discontinued PCI bridge chip and dual port RAM used as the interface between a host PC and a CAN network processor with a Xilinx FPGA, and provided documentation to support the product's use as a medical device. Replacing the discontinued PCI bridge chip was transparent to software running on both the host computer and the CAN network processor, eliminating the need for expensive software updates by the customer.

Technologies: Xilinx Spartan-6, PCI

Portable Data Acquisition & Analysis Recorder

DornerWorks developed a full product solution for data acquisition and analysis, enabling 4-16 simultaneous 24-bit accelerometer channel acquisition, GPS input, Tachometer input, 24-bit Digital to Analog (DAC) output up to 108 kHz sample rate, Gigabit Ethernet, 802.11 b/g/n WiFi, and an operational battery life of over 6 hours. The customer's sampled data was then able to be easily stored to an SD card or streamed over Ethernet.

Technologies: Xilinx Zynq-7000, ARM Cortex-A9, Serial ADC, AXI, DMA, Linux, WiFi