

Ruggedized assembly of control boxes and panel assemblies:

Cypress Technologies is a UL 508A Certified Panel Fabricator. We place special emphasis on cost reduction, the separation of power and control elements, and qualification testing to assure that the panel safely handles its maximum overcurrent rating. Assembly techniques conform to a workmanship standard, IPC-A-610 Level 3 (military/aerospace). We are experts in corrosion control and chemical resistance designs. All programs are thoroughly documented with materials, assembly process, and testing results, providing traceability.



PROGRAMMED FIELD LOGISTICS

Cypress Technologies managed the field logistics for this program, with the scope of procurement, arranging shipping, inventory securitization and control, shipment marking standards and control, and local warehousing.

- Consolidated procurement from a range of vendors into our sole responsibility for materials procurement and management which reduced cost of procurement
- Managed the master program timeline
- Staged subsystem and component deliveries synchronized to the program timeline
- Created clear and uniform shipment marking and component numbering standards and enforced consistent usage
- Operated a staging warehouse near the client's facility to eliminate freight movement and create consolidation efficiencies. This warehouse saved the client \$51,200 in freight bills.
- A PCBA-level design error was discovered later in the program timeline. The client issued an ECO; Cypress quickly built new boards, installed them; and the program stayed on its timeline.

How a Rugged Reliable Control Platform Handles a Tricky Material

By Steven Ruth

Marketing Director, Cypress Technologies Corporation

Just when you think your job is tough, imagine repurposing a fleet of oilfield service trucks on a tight budget, in a short time frame, without losing any productivity. Cypress Technologies, an electrical integrator based in Texas, was contacted by long-term customer, Baker Hughes to do just that.

CONTINUOUS FLOW OF SAND

What is frac sand? Simply put, it is composed of well-rounded grains of silica that have the strength to prop open the cracks in oil or gas wells created by hydraulic fracturing. Frac sand is referred to as a proppant; it has garnered favor in the industry for being natural and cheaper than synthetic alternatives. The demand for frac sand has skyrocketed over the past several years, and has only waned moderately in the face of lower oil prices. The drop in demand has been tempered by a trend in the industry to pump even more sand into the wells to maximize production and ultimately cut costs. An even and continuous flow of sand is a process requirement for fracking.

Oilfield production service companies bring specialized skill sets and proprietary techniques to the wellpad jobsites that enhance production throughput. Having specialized heavy equipment equipped with a common control interface allows for flexibility when job circumstances require that the configuration be able to change to meet a desired outcome.



SAND KING TRUCKS

Some of our readers are also digital gamers who know of the Sandking as an off-road utility vehicle first introduced in the game Grand Theft Auto, but in this instance, we are referring to Sand King haulers, a class of standard heavy oilfield production trucks, produced by several OEM's in a variety of configurations, used to haul and dispense sand at remote well sites. Sand Kings are at the center of a multiple truck system: Sand Queens are used to haul sand to well sites and feed it into the Sand Kings; Sand Kings meter sand onto a conveyor system feeding into the wellhead; and Hydration trucks add a proprietary fluid to the conveyed sand, which aids in the fracking process.

ABOUT CYPRESS TECHNOLOGIES

We have a 29-year legacy as a supplier of rugged reliable electronics to the specialized electrical equipment needs within oil & gas processing industries. Our blue chip client base includes Schlumberger, Baker Hughes, and Halliburton, and ranges from Fortune 100 corporations to entrepreneurially-driven startups. As we diversify our account base, we push on the cost reduction and reliability improvement vectors to find and deliver value. If it takes time, attention, and requires perfection, it's for us. Our focus is on low volume/high mix situations. We do the things that no one else wants to do; we'll build one or a dozen assemblies, turn it to you for field testing, and do reliability-enhancing failure analysis, redesign, and rebuild.

Cypress Technologies has 50 people in a well-organized 30,000 square foot manufacturing plant. Our people design, test, certify, and build electromechanical and electronic assemblies with a focus on ruggedization and high reliability. The facility is ISO 9001:2008 certified, a UL 508A Industrial Panel Control Certified Fabricator, and our assemblers are trained to IPC-A-610 Level 3 standards.

Our primary services are:

- Failure Analysis
- Engineering and Design
- Prototyping
- Box & Panel Assembly to UL 508A certification
- Battery Design, Testing, Assembly
- PCB Assembly (Through Hole & SMT)
- PCBA ruggedization enhancements: conformal coatings, vacuum encapsulation, and BGA mounted component underfills.
- Electromechanical Assembly
- Cable & Harness Assembly including complex machine harnesses
- Quality Assurance
- Troubleshooting and Repair
- Fulfillment of Service Parts Programs
- Custom Metal Parts Machining and Fabrication

29 YEARS IN BUSINESS



508A
INDUSTRIAL
CONTROL PANEL
FABRICATOR



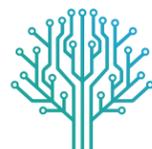
CERTIFIED
IPC-A-610
SPECIALIST
ASSOCIATION CONNECTING
ELECTRONIC INDUSTRIES®



WHMA
All our products are built / tested to the
IPC / WHMA-A-620 Standard



ISO
9001
Quality
Management
FM 53100



CYPRESS
TECHNOLOGIES
RUGGED RELIABLE MANUFACTURING

PROGRAM MISSION

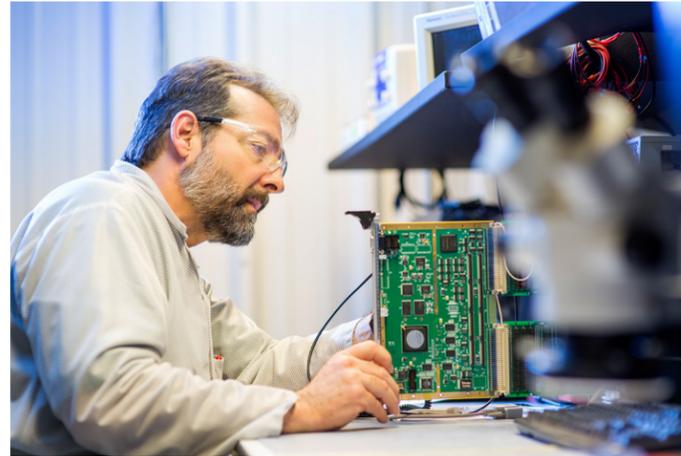
Our client outlined the scope of work and timeline on the project. The mission was to enter into design collaboration, verification testing, process documentation, manufacturing, and field logistical phases to repurpose 152 trucks with this new upgraded frac sand control system. The trucks were to remain on their everyday use pattern, with the repurposing functionality to be installed only during scheduled off-line time. Cypress Technologies provided programmed logistical support to a remote installation depot the client set up near where the trucks are stored during their brief downtime periods.

Additionally, our client stipulated a requirement of system interchangeability, and led design efforts of a unique logic system that can be used among the three types of trucks. This design replaced a classic PLC-based controller limited in capability to its truck-type. This interchangeability drove some valuable outcomes: Simpler field-installed repairs, elimination of some trips back to a maintenance depot, and simplified procurement by reducing to one purchased item instead of three.



Although in this Sand King case, the client took the lead in control system design, we were charged with a design collaboration and design feedback mission. Working in this role, two significant outcomes came about. The program moved towards completion faster than it would have otherwise, given that needed changes were continuously communicated and implemented as they were ideated. And cost reduction opportunities were brought up continuously as well. Once vetted by the client, they too would be quickly implemented.

Cypress Technologies utilizes an Enterprise Resource Planning system for its program management. In an environment of constant design changes, this system enabled rapid adjustments in assembly procedures, Bills-of-Material, assembly travelers, and material requirements plans.



FEEDBACK CONTROL SYSTEM

Electronic sand control on the Sand King truck's shaker box enables operators to dispense sand onto the feed belt at a constant flow rate, regardless of the clumping-nature or variable moisture level of the sand. This assures a continuous and even flow of sand to the hydraulic fracking operation down the encased well, generally several miles underground from the truck's location on the wellpad.

The client designed an embedded controller system, capable of controlling the desired functionality of each of the three truck types, which was tied to a durable PLC. Optocouplers were connected to sensors operating servo drivers and controls on the Sand King's sand shaker box. A radio system connected outputs from the embedded controller to a HMI panel for operator viewing. The design focus was on serving increasing requirements for accuracy, safety, interchangeability, reliability, and security. Sand must be agitated to flow correctly, and the complexity of the feedback control system design provided for control stability such that the output converged to the reference value and did not oscillate about it.



Design strategy:
Simplify the control box. Consolidate all functionality into the embedded control system, providing for a single point-of-failure. Allow quick field replacement to reduce downtime and eliminate truck return-to-depot maintenance costs

RUGGED, RELIABLE MANUFACTURING PRINCIPLES

Baker Hughes engaged Cypress Technologies on this truck fleet repurposing mission because of the deep legacy of our rugged reliable electrical integration know-how and acknowledged expertise in project management.

Over our 29-year history, we have perfected a number of techniques that enhance the reliability of equipment installed in hazardous environments.



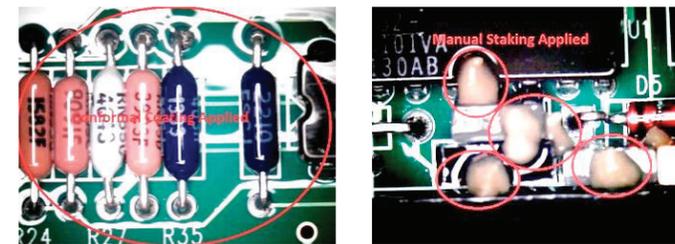
Printed circuit board assemblies and protection:

We produce complete printed circuit board assemblies. Clients submit their Bill-of-Material describing the components, and the Gerber files for the bare circuit board, and our team takes it from there. Surface mount, through-hole, and mixed technology assemblies are produced in our high reliability plant. Cypress takes pride in being a low volume/high mix specialist.

We utilize a variety of adhesives, sealants, and coatings to mechanically isolate, thermally protect, and chemically protect electrical componentry and printed circuit board assemblies (PCBA) within harsh environments.

Techniques include:

- Encapsulation/Potting/Vacuum Potting
- Isolation/shock mounting
- PCBA lead forming and prep
- PCBA component staking
- PCBA conformal coating
- Underfilling of BGA components



Application-specific, custom cables:

On the Sand King project, fast and effective field installation of wiring was a guiding design requirement. Field-installed complex wiring is best achieved with the use of application-specific, custom cables. Custom cables eliminate the step of installing conduits and vias, and

then pulling wires and hard wiring connections. For ruggedness, cable armoring can be selected to protect against the harshness of the use environment. The Sand King program required the creation of 14 discrete over-molded custom cable assemblies per truck. Wiring time on-site was reduced from long days to a mere few hours.

With proper design, both power and signal functions can be incorporated into a custom cable. Signal attenuation (signal dissipation over a longer cable run) must be considered with reliability testing to confirm full functionality.

Cypress Technologies offers polyurethane overmolded connectors, which bring enhanced protection from moisture and chemical ingress. Cables operating in high pressure environments gain extended life cycles through overmolding; high pressure gases are less likely to migrate into the assembly, causing failures. Overmolding also brings in strain relief, protecting the cable in field use. In complex custom machine harnesses, overmolding can eliminate the use of a connector backshell, a costly component, driving down costs.



Our overmolded cables feature a keyway indicator, with an arrow guiding the installer to orient the arrow on the cable in alignment with the main keyway on the mating connector mounted on the receiving end. This simple but useful feature greatly simplifies field installation.

Custom cables are manufactured to comply with assembly techniques meeting the IPC WHMA-A-620 standard and can be designed to customer-specified standards. Cables are tested with automated continuity checks with custom test fixturing, insulation resistance testing, and hi-pot testing. Instron pull test capabilities of mechanical robustness can be incorporated.

We offer a range of wire marking options, utilizing a choice or combination of gravure (pressure rolled), ink jet, and end marker methods are available. Thermal stripping is used; when working with tough insulation, thermal stripping is performed. This technique increases reliability, because conductors are never nicked with mechanical cutters, which can induce a failure point.