Solving the Reliability vs. Innovation Dilemma:

How Tanktwo Helped a Primary Defense Contractor Shorten the Path to Electrification

Did you know critical mission systems in the U.S. still use 8" floppy disks because of reliability concerns?

It's not the only example where the defense industry has to navigate the dilemma of innovation vs. reliability. The military essentially wants *cutting-edge technologies* that have been proven to work safely and reliable over *~40 years*. You have to demonstrate that there's no way anything can go wrong if you use solutions that doesn't come with decades of track record.

This case study shows you how Tanktwo's software-defined, data-driven electrification solution solves the immediate challenges of electrifying military vehicles and equipment that require extreme reliability and serviceability.

We also introduced a paradigm change where reliability no longer means using technology from the dinosaur era (no time warp needed.)

The Situation

A primary military contractor recognized the benefits of advancing electrification in military vehicles and equipment. But its engineers couldn't figure out where to begin — not even conceptually.

It must also solve numerous technical implementation challenges to fulfill the customer's boundary-pushing requirements for reliability, redundancy, resiliency, fault recovery, etc. while posing no harm to human lives no matter where the equipment or vehicles are.

The Challenges

The client needed an electrification solution to address every imaginable scenario — an exercise of "what can possibly go wrong" in the most live-or-death sense.

It needed solutions that can continue to work in combat situations even when parts of the hardware are destroyed. But traditional battery systems have a single point of failure. When they're damaged, they not only stop working — they may also risk having thermal runaway events that can severely harm nearby human lives and equipment.

Additionally, the client required a technology that allows the equipment to lay dormant for years yet ready to perform at 100% capacity within a moment's notice. In many cases, it's forced to work with old technologies that are well-understood and are proven to work — even if they're not the optimal solution.

But how can the most advanced nation afford to run 40 years behind the technology cycle just to be certain that things don't break?

The Solution

About 5 years ago, this defense contractor approached Tanktwo to help devise a battery solution that solves the impossible puzzle. We have two things going for us: (1) Our founder Bert's motto is "there is always a way," and (2) When you tell Juha, the head of R&D, that something can't be done, he'll come back with 3 patents and a solution two months later.

We built on the Tanktwo string cell technologies and developed a series of bespoke prototypes for this client. The combination of advanced software and custom-designed hardware meets the most peculiar requirements that stumped even the client's internal engineering teams.

Our solutions deliver features and capabilities that simply aren't achievable by traditional battery solutions:

Our technology allows each battery module or individual series to operate independently to eliminate a single point of failure — if 10% of the battery is destroyed, you'll retain 90% of the capacity. The enemy can blow a hole in our battery pack, and the vehicle can keep moving — a scenario unheard of in the battery industry.

Our data-driven approach achieves the visibility we need to know where to push a battery pack's performance boundary without risking failure. We can balance various factors to make pinpoint decisions to gain battle advantages. E.g., we can temporarily dial up the performance to 125% at the expense of the cells' longevity in an emergency.

Our analytics solution provides a statistic-based forecast to ensure a battery pack's reliability. The insights into the health of each cell enable us to dimension and configure the system via a software interface to optimize performance from minute to minute without putting a mission or lives in danger.

Our yellow flagging technology maximizes service efficiency so battery packs can operate at optimal conditions for longer while reducing downtime caused by scheduled or unscheduled maintenance. The yellow-flagged cells don't work as hard in day-to-day operations but can be activated in critical situations to achieve >100% performance.
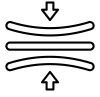
Our software-defined batteries can charge from any power source and <u>at any voltage</u>, regardless of output voltage they need to deliver. They're backward compatible and can adapt to different standards and environments. Such charging independence solves many logistic challenges and reduces the military's reliance on logistic support systems.

**"Infantry wins battles, logistics wins wars." ~ Army General John J. Pershing**

Our batteries can adjust to various output voltages at the drop of a hat. In critical situations (e.g., escaping an attack,) the vehicle operator can reconfigure the system to put non-critical low-voltage tasks (e.g., radio) on pause and direct all the cells to support high-voltage applications (i.e., powering the vehicle.)

Our software-defined batteries can adapt to the environment (e.g., to prevent extreme temperatures,) so our client doesn't have to over-dimension battery packs or design specialized solutions just to account for the 1% situations. Vehicles can be more efficient and nimble, making them suitable for a broader range of circumstances.
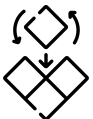
Our software can support battery packs of any shape and form. The client no longer has to design equipment and vehicles around available battery solutions or invest years in R&D. It can apply our solution to virtually any application without reinventing the wheel.

Our software solution is platform-independent and portable. It can adapt to the military's proprietary software platform (written from the ground up without any connection to commercially available ones) for seamless integration into the existing architecture.

Our modular solution maximizes serviceability. We dimension the units so a human can handle the maintenance tasks without heavy equipment. Field personnel can replace the modular battery units between major scheduled maintenance with minimum downtime.

Our software can program the cells' behaviors to mimic any battery technology, even solutions that are no longer supported. The client can retrofit old equipment with our advanced battery pack without changing anything else because the software makes the cells "speak the language" the equipment can recognize.
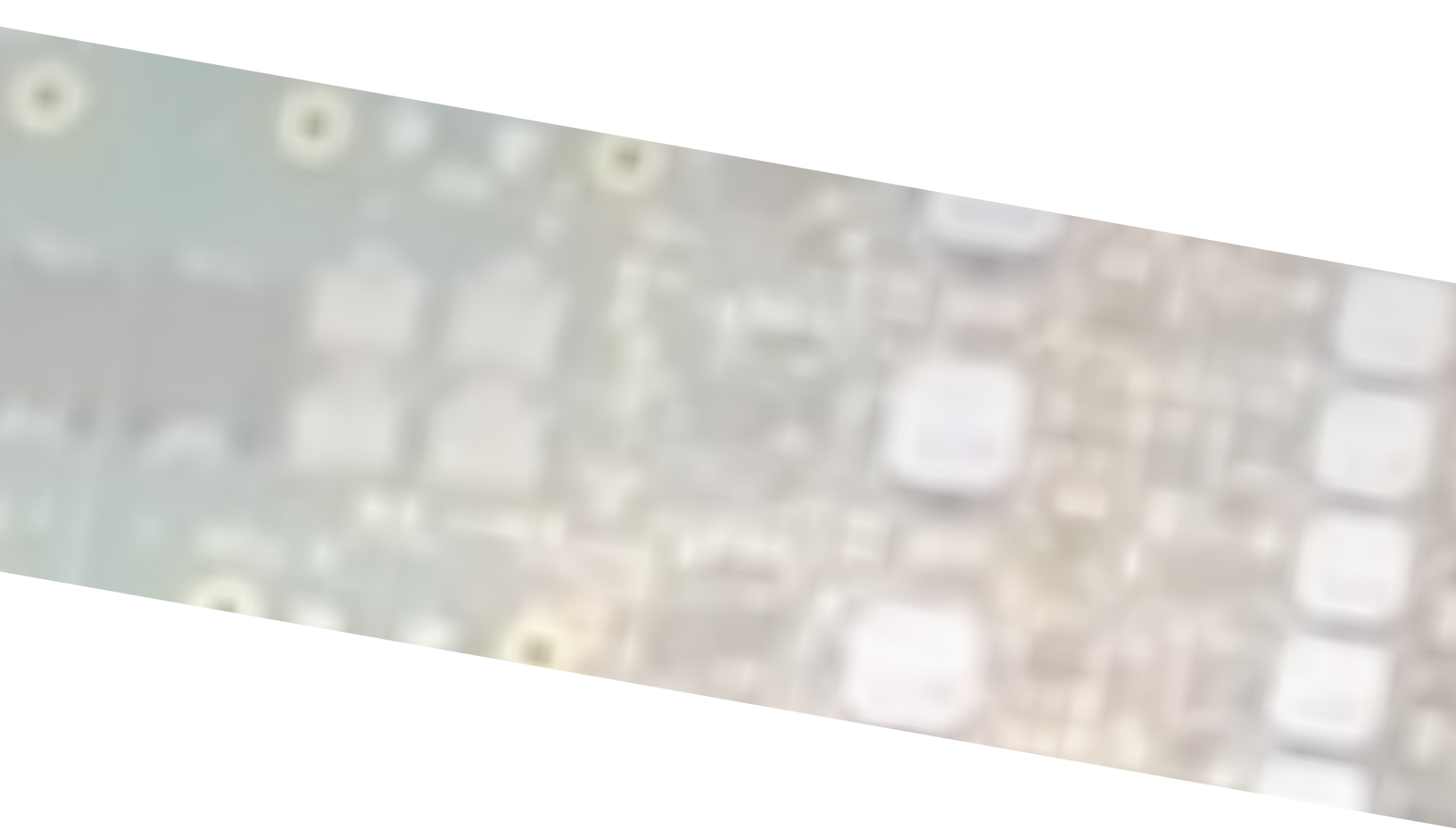
The Results

The military uses legacy technology because it needs proven solutions. Our data-driven approach, enabled by advanced software and algorithms, uses analytics to demonstrate resiliency and reliability to replace decades of empirical evidence.

Our technology introduces a paradigm change that relieves the pressure on defense contractors. They can use commercial off-the-shelf (COTS) products and shrink the buffer period to maximize cost-effectiveness. After all, a COTS technology from 40 years ago (e.g., the 8″ floppy disks) is probably expensive and not widely available today.

We have changed how defense contractors implement COTS products in military devices and equipment to accelerate development cycles and innovation. Our client can now use various electrification solutions that couldn't be applied in the past because of the lack of track record.

As a result of our collaboration, the client can introduce electrified equipment and vehicles faster. It can get its (cautious and skeptical) customers to accept innovative solutions to deliver better results within shorter timelines.

After all, analytics and statistical models are better proof of reliability than the speculation that if something has worked for 20 years, it'd likely make it through its twenty-first without a glitch.

The Tanktwo Battery Operating System (TBOS) has been through the wringer. It's proven to deliver the highest level of resiliency, reliability, safety, and performance for the most demanding customer.

In our next stage of growth, we'll apply the insights to create API-like battery solutions for industries that require advanced battery solutions to accelerate the pace and scale of electrification.

Contact us to learn more about our products and partnership or investment opportunities with Tanktwo.