1

SAFE TRANSIT

When assurance was need for satellites being transported across the USA, data acquisition expertise was required to solve several challenges

// JOHN CHALLEN

The movement of high value assets requires a lot of planning and careful monitoring along the route. So, when engineering and testing consultancy Dayton T. Brown was asked by an aerospace customer to help solve a logistics challenge, it found an ideal partner in Diversified Technical Systems. The task was to monitor a fleet of 40ft refrigerated shipping containers transporting satellites to launch sites across the USA. The customer wanted to measure every shock and vibration event the cargo encountered to ensure minimal disruption or damage.

"Satellites are fragile. So when they are shipped from the production facility to the launch site in a container, the client needs to make sure they aren't subjected to any loads above 2*g* when passing over bumps in the road, railroad tracks, or any other uneven surfaces," explains Rob Pazdur, mission systems operations manager at Dayton T. Brown (DTB). "When we searched for the technology that would enable us to monitor these loads to the client's requirements, the Diversified Technical Systems' product stood out.

"It was more advanced than anything else and the user interface was much easier to navigate, which made downloading the data so much easier."

DTB selected 21 TSR AIR data loggers from Diversified Technical Systems (DTS) for the project. DTS is known for its miniature, rugged onboard DAQ systems. The TSR AIR is a compact six degrees of freedom (6DOF) universal data logger. The unit includes low and high-*g* accelerometers, angular rate and environmental sensors, making it suitable for measuring shock, inertia, and vibration for asset tracking. The TSR AIR weighs only 50g and measures 43 x 43 x 15 mm.

A data logger was mounted inside each steel cart holding a satellite to monitor the forces experienced during transportation. There are up to four carts per truck. Pazdur says the containers typically travel up to 3,000 miles over four or five days. Since each TSR AIR features 11 built-in sensors, that meant collecting a lot of data.

"When the containers are out on the road, there is a team of people following them who will carry out the analysis," explains Pazdur. "The inside of the container is like a clean room, so drivers or engineers are not allowed to go into it during transportation.

2

1 // Miniature TSR AIR data loggers were used to monitor shock and vibration events that valuable satellite cargo encountered on the cross-country journey to the launch site

2 // The TSR AIR is a compact universal data logger with 11 built-in six degrees of freedom (6DOF) sensors, plus onboard recording or real-time streaming capabilities

"We worked with DTS to ensure we had the right equipment and components to download the data from the outside of the container at least once a day. Each TSR AIR data logger features onboard memory that can store up to 2,000 events or the ability to stream data in real time.

"The plan was to download the data whenever the truck stopped. The TSR AIR data loggers were daisy-chained, which made it easy to download the data via a single communication cable. DTB engineered a single cable connection that was accessible from the outside of the container which allowed the customer to get as close to real-time data as possible during the trip."

DTS' willingness to create a made-to-measure product was also a key factor in

3

DTB choosing the TSR AIR. "Not only did our customer need to know if its satellites experienced an event over 2*g*, they also wanted to be alerted of any trigger point above 0.5*g*, which is low," explains Pazdur.

The 0.5g trigger capabilities were developed to support the application requirements for Dayton T. Brown and its client. "Like with all products DTS offers, we continue to listen to the marketplace and customer requirements to help solve their challenges. Often, the feature requests can be added with additional firmware and / or software development," explains Huy Nguyen, DTS aerospace and defense sales manager.

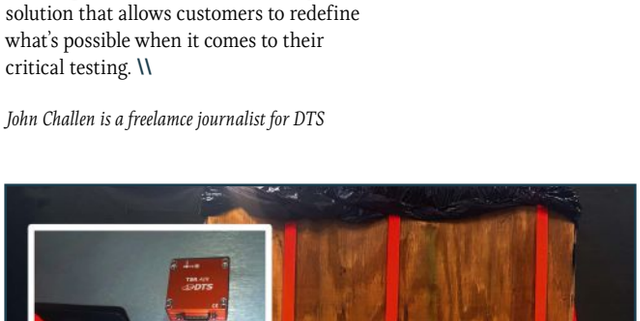
Trial runs were conducted with crates filled with sandbags, which matched the exact satellite weights. "We also learned that when you daisy chain four of them together and have such a low trigger threshold – those 2,000 events happen pretty quickly," explains Pazdur. "Working with DTS' technical support team, they were able to change a few configuration settings to make it more relatable to the real world environment."

Pazdur says, "The satellite world is exploding right now." For DTS, that means there is huge potential to help many more manufacturers with the transportation and monitoring of high value products. The work with DTB and its client shows that DTS' business model is focused on listening to customers to find the right solution that allows customers to redefine what's possible when it comes to their critical testing. \\

John Challen is a freelamce journalist for DTS

3 // (Left) The TSR AIR in its storage container when not in use. (Right) The SLICE6 Interface device provided power and communication to all the TSR AIR units. The CAT6 cable on the bottom connected to the input / output panel outside the trailer where the data was downloaded

4 // Events over 2g, plus any triggers above 0.5g were captured via the TSR AIR loggers mounted in the crates. Because the trailer was a 'clean room' environment, DTB engineered a solution to download the data without opening the trailer



4