

# CASE STUDY

United States of America

**E-A-R Specialty Composites®**

Automotive, Aerospace, Industrial, Electronics

**Solutions for Noise, Vibration, Shock & Cushioning**

PULSE, Software, Transducers

*E-A-R Specialty Composites is a part of the Aearo Company. Founded over 30 years ago, E-A-R Specialty Composites is a world market leader in the development and manufacture of high performance materials and systems for noise control, vibration damping, shock isolation and cushioning. The broad product base includes polyurethane and PVC foams, PVC, urethane and thermoplastic elastomers, composite materials and adhesives.*

*A wide range of Brüel & Kjær products and solutions is used including PULSE™ systems, materials testing system, transducers, calibrators, conditioning and power amplifiers, and shakers.*



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## A World Leader

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E-A-R Specialty Composites, with its headquarters in Indianapolis, Indiana, was founded over 30 years ago. Now a part of the Aearo Company, E-A-R Specialty Composites uses state-of-the-art technologies to develop and manufacture a vast range of polyurethane and PVC foams, PVC, urethane and thermoplastic elastomers, composite materials and adhesives for advanced noise, vibration, shock and motion control solutions.

E-A-R Specialty Composites is a world market leader and its materials solutions are used in a number of markets, especially:

- Transportation (heavy-duty trucks and automotive)
- Precision electronics/industrial equipment
- Aircraft

Many of E-A-R's standard urethane, vinyl and specialty elastomer formulations can be customised for properties such as temperature range, damping capabilities, durometer, etc. With such versatility, E-A-R can precisely meet the needs of the most complex and demanding applications.

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## In-house Production

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*Fig. 1  
The E-A-R Specialty  
Composites facility  
at Indianapolis*



E-A-R has more than 250 employees and maintains more than 375 000 square feet of capacity in two plants – in Indianapolis and Newark, Delaware, near Philadelphia. Both facilities are certified to ISO 9002 and QS 9000 standards.

In Indianapolis, the plant includes lines for casting and extruding sheets, rolls, and composite materials, and for manufacturing specialty urethane foam buns.

Additionally, E-A-R fabricates custom products including die-cut parts and laminated composites, and manufactures injection, transfer and compression-moulded engineered components.

The Indianapolis facility is also E-A-R's headquarters and houses the operating staff and support functions, including customer service, applications engineering and R & D.

E-A-R's Newark plant features a unique 225 feet (68.6 m) long casting line for urethanes and other thermosets, and thermoplastics formulations. It's capable of producing sheet or roll products up to 60 inches (1.52 m) wide, and up to 3 inches (76 mm) thick or as thin as 30 mills (762 microns). This patented line casts foams and solids in continuous thin sheets, resulting in extraordinary process control, quality and consistency.

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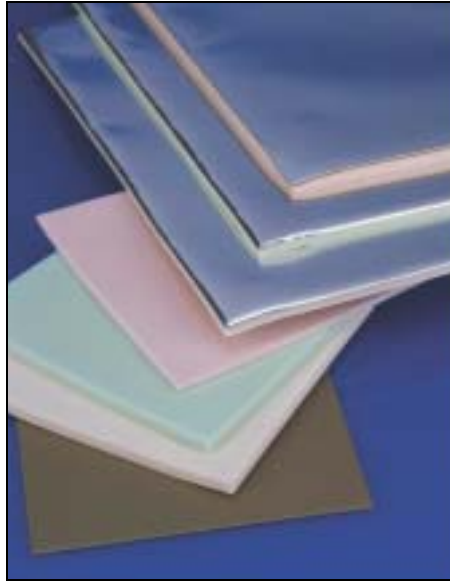
## Market Focus

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There is a strong focus on the trucking and aircraft industries and collectively, transportation accounts for about half of E-A-R's business. The company has extensive resources that are dedicated to providing customers with solutions. E-A-R works with its customers in:

- Vehicle analysis (especially commercial, auto and trucks)
- Aircraft cabin analysis (both in-flight and computer-simulated)
- System and component design
- Materials development
- Materials manufacture
- Component fabrication

**Fig. 2**  
E-A-R Specialty Composites manufactures a range of advanced products for the aerospace industry



In the transportation industry, E-A-R supplies complete noise and vibration solutions to numerous truck manufacturers. The packages include materials for insulation of floors, sleeper compartment walls, roof, doors, etc. E-A-R provides a “just-in-time” delivery system to many of its customers.

The aerospace industry is also a significant market and E-A-R has developed a range of weight-efficient high performance materials. With these and other components, E-A-R designs complete thermal and acoustic systems, reducing cabin and cockpit noise. The company works with aircraft manufacturers, completion centres and refurbishers.

E-A-R’s other core markets include:

- Precision electronics
- Industrial equipment

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## Engineering Expertise

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**Fig. 3**  
Manuel Sánchez, Ph.D. is a Senior Applications Engineer for E-A-R Specialty Composites



Manuel Sánchez has worked at E-A-R for five years as a Senior Applications Engineer. Manuel gained his Master’s degree at the Institute of Sound and Vibration Research at Southampton University, England. He says this is where he got “hooked” on sound and vibration analysis. This was followed by a Ph.D. in Industrial Engineering.

Dan Stanley, Senior Lab Technician, has been with E-A-R for nearly 20 years. He has a degree in electronics. Dan explains, “Acoustics and sound have always been a personal interest; I was fortunate to be able to integrate my hobby into my work”.

**Fig. 4**  
Dan Stanley works with a PULSE system. Dan is a Senior Lab Technician at E-A-R



Dan continues, “We supply our customers with solutions, not just materials. We have made huge investments in the latest test and analysis technology which we use extensively in R&D applications to develop exactly the right products for our customers”.

Manuel explains, “We have a broader line of products than any of our competitors and I believe we have a special position in our markets. Our customers value the technical support we are able to provide and we can take a project right through from the design stage using CAD, through testing and evaluation, and into production. We optimise our solutions to best fit our customers’ needs. Cost is always a critical factor.

We define the cost target and then determine the best solution within the applicable cost and weight limits.”

Manuel continues, “Other considerations include determining the level of noise and vibration reduction that is to be achieved. Noise performance is an important product differentiator. So too is “ruggedness” – the ability of a customer’s product to withstand shock or vibration, such as computer hard drive, pager or mobile phone.”

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## PULSE

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**Fig. 5**  
*The operating console for E·A·R's 8-channel PULSE system*

A wide range of Brüel & Kjær products and solutions is used, including PULSE systems and other analyzers, materials testing system, transducers, calibrators, conditioning and power amplifiers, shakers and a Complex Modulus Apparatus.

Manuel explains, “We have used Brüel & Kjær products for more than 15 years and the company’s technical support has been consistently excellent. We still have some older Brüel & Kjær analyzers. They are totally accurate and reliable and we still use them daily. Of course they are not as portable as modern analyzers but they still have a place in our test lab”.

Manuel adds, “So, when we decided to upgrade, we looked at all the available options. Based on our long experience with Brüel & Kjær products, the company’s quality and reputation, we decided to standardise on PULSE. I especially like the new portable PULSE concept. It’s a commodity-based analyzer using the analysis power of the PC. As computers increase in speed and performance, so the analysis power of PULSE increases too. This is the way we want to go in the future”.



**Fig. 6**  
*A Brüel & Kjær Type 2032 Analyzer and Type 4206 Impedance Measurement Tube setup is used for material testing*

Dan says, “We currently have an 8-channel PULSE that is mainly used in the test lab. We also have a 12-channel portable PULSE system. This has two front-ends – one with 7-channels and the other with 5-channels. We can either stack the two together and use the total number of channels, or we can split the system to provide two separate analyzers – one 7-channel and one 5-channel”.



**Fig. 7**  
*A Brüel & Kjær Type 3930 Complex Modulus Apparatus. Products are typically tested in the frequency range from 30Hz to 4kHz*

Dan continues, “It’s useful to be able to use the system in this way and it’s really versatile. With all 12 channels, we are well equipped to do complete systems optimisation testing. When we got the first PULSE system, I attended a 2-day PULSE training seminar. It was very useful and I felt completely comfortable with the system. I also referred to the “PULSE Startup Guide”. PULSE is intuitive and easy to use, and it doesn’t take long for me to train new employees in the test lab. We also use Brüel & Kjær transducers, which are really stable. They provide very high quality signals”.



## Calibration

E-A-R uses Brüel & Kjær calibrators for the microphones and accelerometers. These include a Type 4231 Calibrator and a Type 4228 Pistonphone. Dan says, “The calibration process is quick, simple and completely accurate. We calibrate the microphones every day and every month we check the accuracy of our calibrator against a Brüel & Kjær calibrator used exclusively as a reference standard. Our long term records show a high degree of stability with Brüel & Kjær calibrators”.

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## Applications Engineering

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**Fig. 8**  
*E-A-R's test lab has a special test rig for drop-testing*

E-A-R uses a wide range of the latest test and analysis techniques to develop its noise and vibration control solutions. These include:

- Statistical energy analysis
- Sound quality analysis

The facilities include a large hemi-anechoic chamber, 25 × 25 × 30 feet (7.62 × 7.62 × 9.15 m), tested to ANSI Standards.

Manuel says, “Our customers are demanding tighter and tougher specifications. New materials and advanced analysis techniques are very important to achieve design goals. Our portable PULSE system is very useful when making measurements at a customer’s premises.”



### Typical Process

Manuel explains, “The first step is a complete exchange of information with our customer. We need to know what they want to achieve, what restrictions apply such as weight, cost, size, etc. The next stage is to define the problem – some of our customers have acoustics engineers and they know what they need to do – others don’t have acoustics or vibration experience and they rely on us completely. Next, we may visit the customer and take measurements – this is where portable PULSE is a real benefit”.

**Fig. 9**  
*A garage door opening mechanism is tested inside E-A-R's hemi-anechoic room. PULSE and seven microphones are used. Analysis of the noise helps develop effective noise reduction solutions*

Manuel continues, “Of course, if it’s a small item, then we can test it in our own lab. Then we move on to the design work and it’s here that our wide experience and technology over many years is such a huge advantage. We then present the solution to the customer, produce the prototypes and test the performance. The final stage is volume production. A good recent example is the development of special mountings for a satellite set-top box to effectively reduce noise and vibration”.



Manuel adds, “We want our customers to learn as much as possible about how sound and vibration characteristics influence their products, and how our engineered solutions are able to solve problems. With a basic understanding of the issues, our customers are able to use this knowledge in the design of new and improved products”.

## Data Handling and Documentation

All PULSE systems run under Windows® 2000. The test data is stored on the PC's hard disk and then archived, either on a CD-ROM or using a ZIP drive. Archived test data is frequently analysed and compared with new data. In this way, the effects of E-A-R's solutions can be accurately tracked.

Dan says, "To make written reports, we export the data to Microsoft® Word or Excel. This is a very useful feature and saves a huge amount of time".

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## The Future

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Manuel says, "We intend to extend our test and analysis capabilities. PULSE is a key tool. Modal analysis techniques will also be important. Especially in the automotive and aerospace industries, I believe that sound quality analysis will play a vital part. We recently purchased a Brüel & Kjær binaural head (Head and Torso Simulator) as well".

Manuel concludes, "We are confident in the skills of our applications engineering group and the technology we have available to help provide noise and vibration analysis and solutions for our customers".

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## Key Facts

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- E-A-R Specialty Composites was founded over 30 years ago – it is a part of the Aearo Company
- The company is a world market leader in the development and manufacture of high performance materials for noise control, vibration damping, shock isolation and cushioning
- E-A-R's broad product base includes polyurethane and PVC foams, PVC, polyurethane and thermoplastic elastomers, composite materials and adhesives
- E-A-R's products are used in a number of markets, including transportation, precision electronics, aircraft and industrial equipment
- Brüel & Kjær products have been used for more than 15 years
- A wide range of Brüel & Kjær products and solutions is used including PULSE systems, other analyzers, materials testing system, transducers, calibrators, conditioning and power amplifiers, and shakers
- Brüel & Kjær's technical support has been consistently excellent
- "Based on our long experience with Brüel & Kjær products, their quality and reputation, we decided to standardise on PULSE"
- All PULSE systems run under Windows® 2000
- Portable PULSE is a real benefit when E-A-R visits customers to make measurements
- Written reports are made in Microsoft® Word or Excel using the export feature in PULSE. E-A-R thinks this is very useful feature and saves a huge amount of time
- E-A-R intends to extend its test and analysis capabilities – PULSE will be a key tool