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**QUALIFYING WELDERS AND
CERTIFYING PROCESSES PRODUCES
QUALITY PRODUCTS (PREPRINT)**



Larry Perkins

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QUALIFYING WELDERS AND CERTIFYING PROCESSES PRODUCES QUALITY PRODUCTS

It was a fact-finding mission that brought Larry Perkins, senior technical advisor at the Air Force Research Laboratory's Materials and Manufacturing Directorate (AFRL/ML), to Hobart Institute this past June.

As an AF point of contact part of Larry's job to test, evaluate and improve the processes related to welding and joining and provide advice for solving day to day problems. He is also key to maintaining DoD welding and joining specifications. "I had, of course, known of Hobart Institute for a number of years," says Larry, "but never had the opportunity come for training. I wanted to learn more about what was covered and how the training is disseminated, so that I would have the background knowledge necessary to know when to recommend Hobart training and certification to AF suppliers."

The Air Force purchases planes and equipment from large manufacturers who, in turn, subcontract much of the welding of various parts to 2nd or 3rd level (subcontractor) job shops. It is essential that both the prime manufacturers and small shop personnel understand how critical their welds are and how important it is to maintain a quality product. Part of maintaining quality is skill upgrading through continuing education.

A few years ago, there was a thrust to eliminate military standards such as Mil-STD-1595A (Qualification of Aircraft, Missile, and Aerospace Fusion Welders) and Mil-STD-2219 (Fusion Welding for Aerospace Applications). The primary issue was the expense

associated with meeting the requirements. For example, one of the issues raised by industry with 1595A was the requirement to requalify welders every five years. Replacement industry specifications do not require periodic prequalification. However, the requalification process had many benefits including the chance to update skills, learn new equipment, evaluate physical changes experienced by the welder such as eyesight or coordination changes and interaction with other welders of the same industry. Facilities doing the work need to consider training and certification within this context and understand the associated cost benefits. Requalification will be a benefit to them, not only with their Dept. of Defense contracts, but also with raising the quality of the products they supply to civilian industry. Hobart Institute stands ready to assist in this effort, offering certification services as well as the basic training required for welders to qualify to the standards.

“Problems are surfacing,” says Larry, “and many of them are directly related to lack of knowledge and skill of the basic welding processes and techniques. Without the prequalification requirements in place, we have no way of knowing if the people doing the work are still qualified to produce a quality product reliably.”

“As more work is subcontracted, it falls to the small job shops to make sure that their welders and welder operators receive the proper training required for these critical applications. Many times, this part of the equation falls through the cracks, as they are operating on tight budgets and timelines to get the product out the door. But continuing

education (including prequalification), especially in welding, can actually save money by reducing rework, upgrading skills and reducing defective parts.” .

“We see welding becoming a much bigger part of aerospace,” Larry continues. “There is an effort to move away from the use of fastened structure within the aircraft as welding has proven in many instances to be a better, safer, more efficient way to join parts. It also has the benefit of reducing the amount of material used. With the cost rising and availability decreasing of critical materials, such as Titanium and Nickel, welding will play an increasing role by allowing smaller piece parts to be joined. Additive manufacturing processes, where the entire part is in essence a weldment made from powder or wire filler metal, can substantially reduced the material usage. However, personnel skilled in welding will be essential for these approaches to be successful “

“Another issue is that the aerospace industry has a lot of people nearing retirement,” says Larry, “So it is important to expose young people to at a time when the requirements (based on lessons learned contained in many of the specifications) can be explained by those with sufficient experience and breadth so that they are not lost and repeated at great cost. This type of education starts early even in high school vocational programs, where future welders and engineers need to concentrate on learning the basics throughly, and then to continue to a school like Hobart Institute for advanced training. And always remember that qualifying welders and processes is fundamental to consistent high quality welding”

Larry P. Perkins is a senior engineer at the Air Force Research Laboratory's Materials and Manufacturing Directorate (AFRL/ML). He works directly with Air Force program offices, logistics centers, major commands and industry to test, evaluate and improve materials and processes for new and legacy weapons systems. He also provides valuable technical direction and critiques of ongoing and planned programs in metallic materials applications and development, including welding and joining, and advanced processes. Over a period of several years, Larry has saved the Air Force millions of dollars through improved aircraft component reliability and flight crew safety enhancement. One project he directed involved engine fan blade repairs and resulted in a savings of more than \$300 million dollars.

Mr. Perkins has authored more than 200 technical evaluations, developed articles for technical handbooks, initiated numerous military standards, and personally influenced a number of highly important industry specifications. Prior to 1995, he directed programs developed to evaluate the applicability to existing and emerging materials of newly developed welding and joining technologies, such as friction stir, laser, and linear friction welding processes. He also managed programs in the Directorate's Manufacturing Technology Division in support of the nation's Strategic Defense Initiative (SDI) to include advanced repair processes for gas turbine engines, robotic de-sealing of fuel tanks, and environmentally acceptable cleaning techniques for engine hardware.

Notably, Larry Perkins has won numerous awards and commendations for his accomplishments including AFRL Fellow, one of the highest honors that can be bestowed upon a member of the AFRL scientific and engineering community.

Side bar:

Larry Perkins brought to the Hobart Institute for display purposes an F15 pylon Rib , piece of an aircraft wing. This is constructed of titanium, used for its combination of strength as related to its light weight, and is manufactured using a laser powder welding process. Originally, a piece such as this began as expensive titanium plate and was machined to exact specifications. Research and development proved that it was much more economical to begin with a smaller plate of titanium and build it up using a welding process to drawing rather than machining it away. The principle advantage is less time to make the part and less material used. To create greater savings, it may eventually be formed of aluminum, with titanium being used for only the areas where strength and durability are most crucial. It could also be welded with the gas metal arc welding process.