

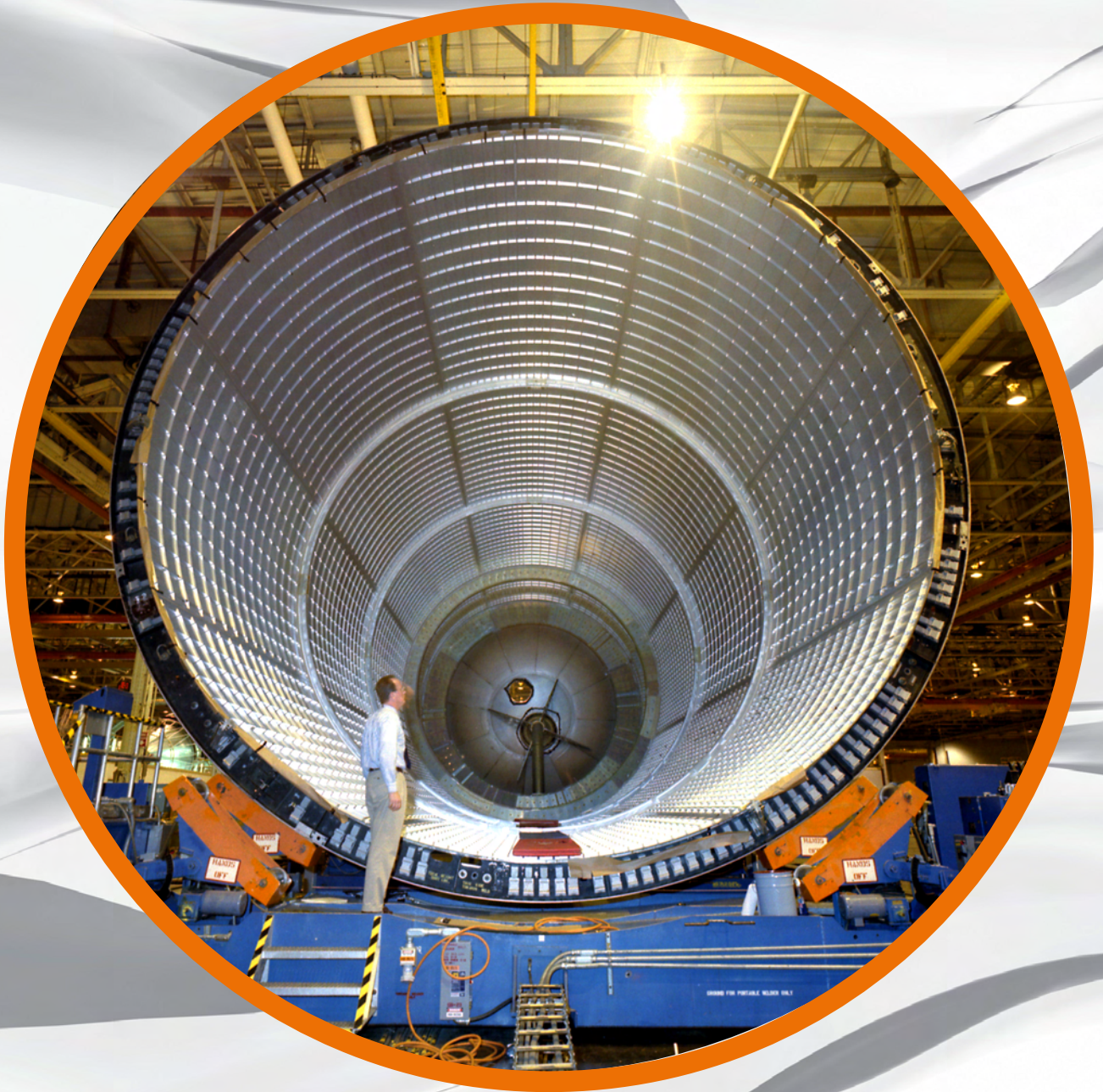
AMET

*Advanced
Manufacturing
Engineering
Technologies*



ADVANCED AUTOMATED WELDING SYSTEMS

**FOR AVIATION
AND AEROSPACE INDUSTRIES**



AMET is an international company with more than 20 years of expertise in automated welding. Our experience, knowledge, as well as our testing facilities, and manufacturing centers allow us the unique opportunity to provide our customers the most up-to-date, completely integrated, high precision automated welding systems, which solve customer's tasks in the most efficient manner.

Our developed solution process integrates design, manufacturing, testing, applying trend-setting welding technologies, and the highest quality mechanical components, with only nominal backlash. Thus we provide our customers with an optimized fully tailored complex system which fits to the tasks at hand both in the case of the commissioning of a new manufacturing line as well as in the case of retrofitting the customer's existing systems to allow for new manufacturing tasks including new welding technologies.

For many years we have provided the welding industry with the best automated welding systems combined with the best after-sale support.

Our systems as well as our customer support exceed expectations, and prove to be a worthwhile investment, allowing to achieve the maximum quality, productivity and repeatability.

This is what makes our systems far ahead of any competition:

- Intuitive operator interface
- The ease of programming of manufacturing process
- Fully integrated controls of all welding and mechanical components
- The most up-to-date welding power sources, which allow for a wide range of welding processes
- Native digital interface to welding power sources, minimizing any delays while controlling the welding process
- Versatility, flexibility and adaptability
- Easy up-scaling through adding welding and mechanical components and appropriate controllers
- Unsurpassed precision and reliability
- Ease of diagnostics
- Reliable process verification through weld data acquisition
- Uniformity of components of the system and ease of their replacement



THE MAIN COMPONENTS OF THE SYSTEM

Many companies in the world produce and manufacture welding fixtures. The quality of these fixtures varies greatly from company to company. A number of these companies then add a simple sequencer and sell «an automated welding system». Such an integrator cannot be responsible for the stability of the programmable control unit, including for resistance to virus attacks. Being an ad hoc hybrid, these systems still require a significant amount of operator assistance and input to successfully weld the customer's products.

Such approach is also very limited in nature — newer, faster, and better welding processes often need specially designed welding fixtures and flexible, high-speed, matched and closely integrated control equipment. “Narrow specialist” integrators can't achieve best possible integration of best available welding fixtures, welding technologies, and welding controls to meet growing customers demands for quality, productivity and welding complex configurations.

In contrast, AMET, being “one source”, starts a welding system with the best suitable welding process and then continues literally from the ground, by designing and manufacturing a high quality welding fixture. We spend time to stress relieve and machine most of our fixtures to ensure they are precise and will remain so for many years to come. We use high quality components to guarantee precise motion with only nominal backlash. Encoder feedback is used on all motion devices for accurate velocity and position control.

A system control package is then added to match the project requirement.



Precision Welding Fixtures

We offer a complete line of precision welding fixtures for the entire welding industry, including:

- linear seam welders,
- weld lathes,
- manipulators,
- gantries,
- positioners,
- turn tables,
- turning rolls,
- weld chambers,
- roll planishers,
- tracks & carriages.



In addition, we design and produce custom equipment for specialized projects, like rotor welding and repair.



Specialized Welding Heads

Over the past several years AMET has developed specialized torches and complete welding heads to meet the specific needs of our customers and their projects' requirements.

We are now able to provide solutions for many specialized applications, including:

- narrow groove hot/cold wire GTAW;
- reduced groove tandem SAW;
- narrow groove tandem SAW;
- hot/cold wire bore cladding;
- small bore GMAW;
- multiple wire SAW (both ID and OD);
- PAW applications.

The usage of specialized welding heads allows us to decrease the number of other weld fixtures used in the process, make mechanical motions simpler, more precise, better controllable, as well as to guarantee high quality, repeatability, and productivity of the operations.

These specialized welding heads have been tried and proved successful in the nuclear, space aviation, tube-rolling, and food industries.

AMET's engineering capability has allowed us to expand into these specialized areas, and we are always willing to consider your special application or requirement.

Welding Power Sources

High-quality adaptive control of the welding process greatly benefits from short response time of only tens of milliseconds, while transient processes are rapidly damped.

A close control of the welding process has been made possible through the usage of digital power sources with processors reaching full control at the frequency of 100KHz.

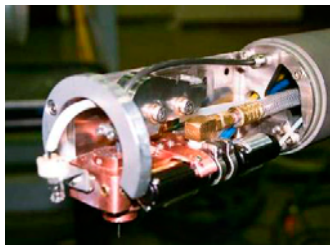
The main advantage of a welding machine with digital controls is the ability to almost instantly, without interrupting the welding or causing disturbance in the welding pool, change the mode and parameters of the weld, depending on the number of the welding pass, as well as the current position, stick-out and other factors. Combined with the precision head and the positioning components controls, this allows to achieve consistent welding complemented with real-time welding data acquisition process.



After more than 20 years of working in the field, we had to integrate our welding systems with a large number of power sources from various manufacturers. Nevertheless, we recommend our customers to have a close look at the PowerWave Waveform Control 3RD Generation Lincoln Electric power sources.

The decisive arguments for supporting the abovementioned power sources are:

- The fact that the power sources were designed to be used for automated welding applications with a digital control, which cardinally sets them apart from all the other power sources on the market, with controls established via a pendant imitator.
- Fast response speed to the mode and parameter changes during the actual welding process.
- Standard open protocol for digital communications.



THE MAIN COMPONENTS OF THE SYSTEM

We also offer our own custom-built welding power sources, meant for projects that cannot be implemented efficiently using standard power sources.

- Variable polarity power sources (VPC-450) have a maximum current of 450A and are used for argon-arc and plasma arc welding, variable polarity modes, constant current, and combination modes.

This power source is controlled by a Digital Signal Processor (DSP), which allows achieving high precision of regulation with variable polarity resulting in minimal pulsations.



- The hot wire power source generates a true sine wave and is used for preheating the filler wire for argon-arc and plasma arc welding.

The desired goal is to increase deposition rates over traditional cold wire feeding by preheating the wire before it enters the weld puddle.



- The plasma console is designed to handle up to 400 amps welding.



A bright, easily readable screen of the VPC-450 provides for easy parameter input, and data monitoring.

Advanced System Controls

At the next stage, the welding system is equipped with system controls.

The repeatability of the welding procedures, minimizing operator mistakes while setting up for and executing the welding, the ease of programming of the positioning, welding and automatic tracking parameters, the reliability of assembly and process verification — all of those are the characteristics associated with the design and quality of the system controls.

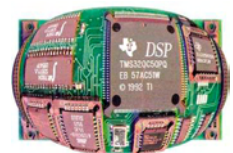
Each of the three our control systems us (SX, XM and Advent) provide for the functions of the controller, as well as for the thorough control of the process throughout the weld, depending on the positioning in the molten pool.

The systems we offer are the result of 20 years of development, manufacturing and servicing multi-processor networked digital system controls.



Our control systems were from the start developed as welding process control systems, which allowed us to optimize and simplify the programming and provided for accurate welding parameters data acquisition. Furthermore, the welding preparation time has been shortened, the room for operator mistakes has been decreased, and the possibility of adding controlled mechanisms as well as power sources has been established.

The modular, multi-processor, networked based system is based on Digital Signal Processors (DSP), with each of them dedicated to controlling a single process task such as the power supply, travel axis, AVC, etc.



The control and monitoring of the welding arc requires a high calculating speed. This is the reason why DSPs are used. Thus, we have achieved an unmatched level of control of the welding process, and a high functioning reliability of the system. Each of the welding parameters is controlled by a single DSP in real time. This allows the system to respond almost instantly to any changes in the welding conditions, as well as to operator commands.

THE MAIN COMPONENTS OF THE SYSTEM

The control system is Linux-based, which also makes it impenetrable to the widespread viruses.

The modules are synchronized through CANBUS, an industrial Ethernet, which has proven itself in such applications. The modular control design allows for the ease of adaptation of the system to the frequently changing manufacturing tasks. Despite the fact that the modules are responsible for controlling different processes, they are interchangeable. There are practically no limitations to the number of modules that can be plugged into the system. Incorporating additional modules into the system can usually solve the development and retrofitting tasks. These modules can be integrated into the system, or can be separately controlled by the operator.

The main factor that determines the designation of a given module is the easily updateable software. The module network is operated by a single controller.

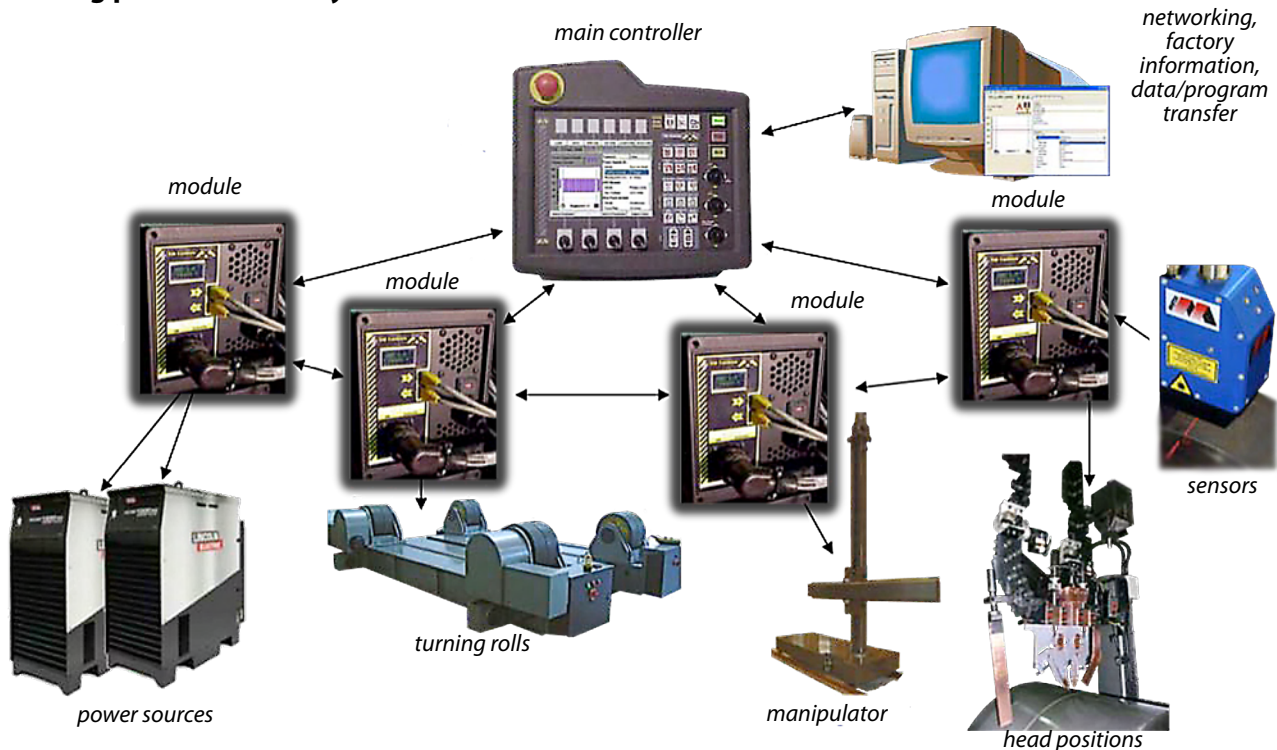
If needed, modules can be equipped with power drives, which provide for direct control of the servomotor via optical or other sensors. Special attention is paid to the correct response to emergency situations, which can arise due to heavy machinery malfunctions or operator mistakes.

CANBUS provides for the possibility of connecting a wide range of various mechanisms manufactured by unrelated companies to the controller.

The entire system can be connected to a regular local computer network via Ethernet, which allows for the transmission of programs, data, as well as system status protocols.

All the movement, welding and monitoring parameters can be individually programmed for each welding pass. The maintenance of all the welding process parameters, as well as the movement and monitoring is executed in a uniform manner.

Welding process control system structure



COMPLETED PROJECTS

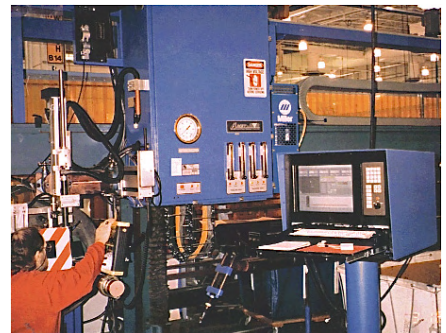
Boeing Commercial Airplanes Group

Systems for Aluminum, Stainless, Titanium Tube, Duct, Pipe and Flange Welding

System features

- Cold wire argon-arc welding
- Advent and XM VP control systems
- Up to 6 axis of motion control
- Synchronized current/wire/oscillation - pulsation
- Variable polarity
- AVC
- Integrated video display and recording

18 systems have been installed from September 1993 thru February 2006.



Lockheed Martin

System for Space Shuttle External Tank Fabrication

System features

- Plasma arc and argon-arc welding
- ADVENT VP control system
- 16 DSP I/O 10 KHz channels)
- Custom control and display of multiple computer controlled gas flow rates
- Remote operatr display
- Real-time data printout

Design, manufacturing, service and support of multiple generations of NASA Automated Welding Equipment.

18 systems have been installed from September 1998 thru July 2005.



The system was installed in August 1994.

Aeroquip

Circumferential Welding System for Fabrication of Aircraft Components

System features

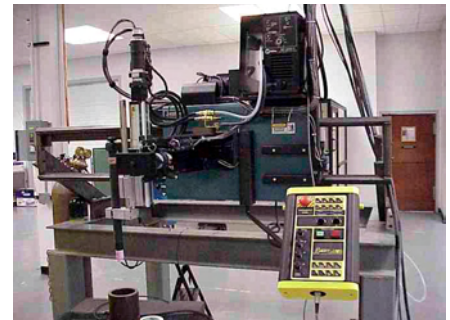
- Cold wire argon-arc welding
- Advent control system
- 3 wire feeders with programmable wire feed selection
- Rotary positioner
- 2-axis torch positioner
- Integrated video
- Wire positioner

Boeing - McDonnell Douglas

System for Fabrication of Titanium Sine Beam Aircraft Structures

System features

- Argon-arc welding
- Advent control system
- Adaptive photodiode penetration control
- Adaptive position control
- Torch positioner with Y-Z torch slide
- Integrated oxygen sensor



The system was installed in January 2000.

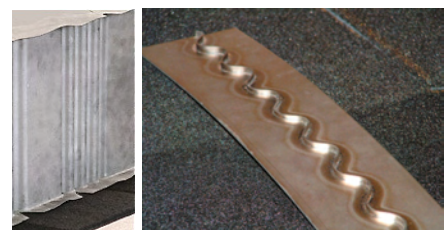
GKN Aerospace

System for Fabrication Of Titanium Sine Beam Aircraft Structures

System features

- Argon-arc welding
- Advent control system
- Adaptive photodiode penetration control
- Adaptive coordinated velocity and position control
- Torch positioner with Y-Z torch slide
- Integrated oxygen sensor

3 systems have been installed in January 2000.



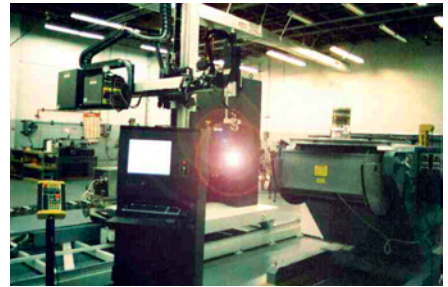
COMPLETED PROJECTS

Boeing - Rocketdyne

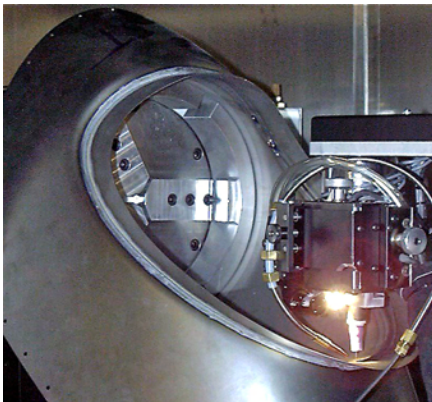
System for Fabricating Rocket Engine Components

System features

- Argon-arc and plasma arc welding
- ADVENT control system
- GTAW and PAW torch process capability
- Custom gas control unit with back purge pressure control
- 6-axis coordinated motion system
- Motorized wire nozzle positioner
- Wire feeder



The system was installed in February 2001.



The system was installed in June 2002.

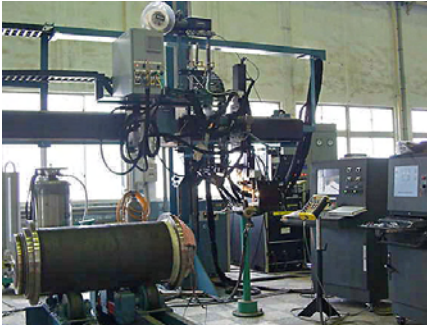
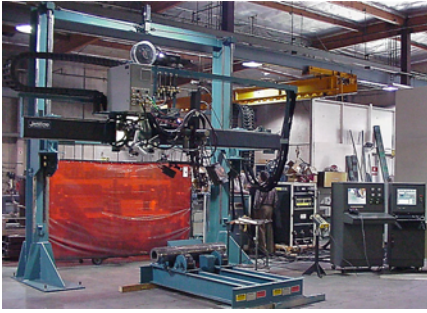
Boeing Commercial Airplanes Group

System for Titanium Aircraft Exhaust Fairings

System features

- Cold wire argon-arc welding
- Advent control system
- 3-axis torch slide assembly — coordinated motion of X, Z & rotation axis
- Integrated torch head rotary positioner
- AVC
- Wire nozzle positioner
- Wire feed
- Integrated video display and recording





CSIST - Taiwan

System for Defense-Related Products

System features

- Argon-arc and plasma arc welding
- Variable polarity welding
- Pulsed mode welding
- ADVENT control system
- 8 axis of servo-controlled motion for multiple fixtures
- 8 analog channels
- VP500 power supply
- Integrated video and seam tracking

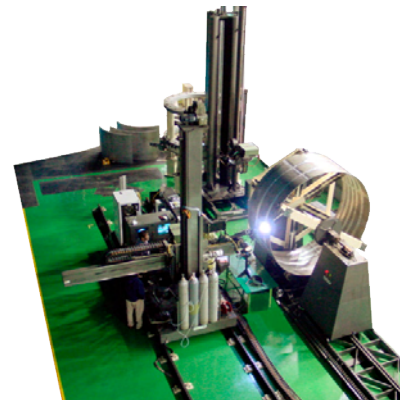
The system was installed in February 2002.

Kari Aerospace – Seoul Korea

System for Manufacturing Aluminum Tanks for Aerospace Applications

System features

- Plasma arc variable polarity welding
- ADVENT control system
- Custom fixtures to support both vertical up linear welding and circumferential welding:
 - » Precision 3M vertical seamer
 - » Precision 10M lathe
 - » Precision 3X3 manipulator on a travel cart to position the weld head and equipment at either fixture
 - » 2 axis weld head with AVC and oscillation
- VPC-450 variable polarity power supply
- High speed data acquisition
- Integrated video display and recording



The system was installed in January 2005.





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AMET

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