# LAWS 800™

*Liburdi Automated Welding Systems*

High Pressure Compressor (HPC)

High Pressure Turbine (HTC)

Low Pressure Turbine (LPT)


3 - 6 Axis

Multiple Part Fixturing

3 Welding Processes Available in 'One System' including LASER, Plasma and GTAW

Process Configurations:
Wire
Powder
Autogenous
Rod

The LAWS 800™ is the culmination of 20 years of aerospace welding of turbine components, from the thinnest component edge under 0.010" (0.254 mm), to flight engine CF6 HP Nozzle. The LAWS 800™ is a powerful PC based welding system that can incorporate 2D & 3D robotic vision technologies for adaptive motion feedback control.

The LAWS 800™ system features a multi-feed wire and/or powder fill mechanisms for flexibility that allows the best suited and specified materials to be used on demanding alloy applications.

Liburdi pioneered the LAWS system which has evolved over the past 20 years into the most comprehensive automated welding system for gas turbine component repairs with over 150 customer base LAWS/LRC programming installed worldwide.

In conjunction with LAWS, Liburdi Robotic Controller™ (LRC) delivers the only machine whose root architecture is designed and evolved around welding gas turbine components.

We offer the ability to develop the manufacturing and/or repair process development with the purchase of a production capable system. Software Engineering, Mechanical tool design for welding, Metallurgical and engineering process quality assurance are all structured for the customer as part of systems purchases. Training and after sales service and support are an integral part of the Liburdi LAWS advantage.

LIBURDI AUTOMATION®

INTERNATIONAL | tel: 1-905-689-0734 | liburdi@liburdi.com
www.liburdi.com

# LAWS 800™

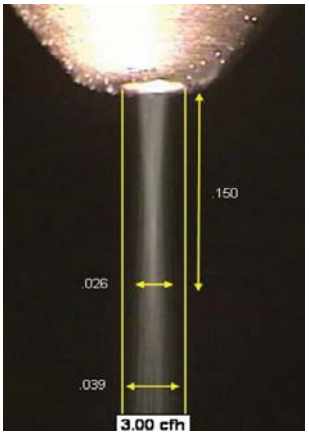
*Liburdi Automated Welding Systems*

## Technology

The LAWS 800™ architecture provides a modular solution for clients that require assorted processes in order to recondition gas turbine components.

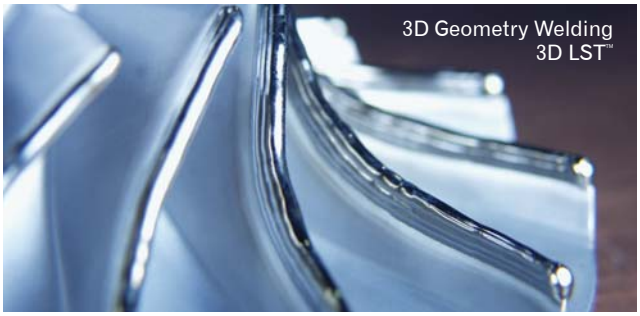
Multiple process configurations and tooling can easily be combined in one system to repair multiple part types using a central software program. Component part geometry is captured via high definition cameras or laser surface profile measurement tools automatically updating motion weld path for each part. Coupled with our WinLAWS weld programming software, all process variables are controlled with high accuracy and repeatability to maximise metallurgical quality and throughput.

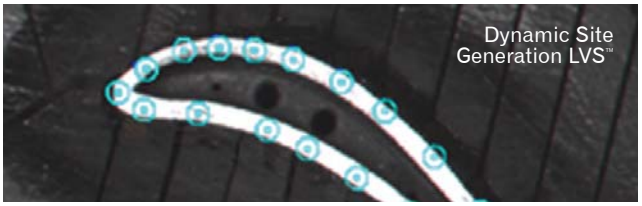
Our Touch Pendant Controller was designed to program all aspects of welding from laser, plasma or GTAW power sources and to program the vision and motion control for path generation.

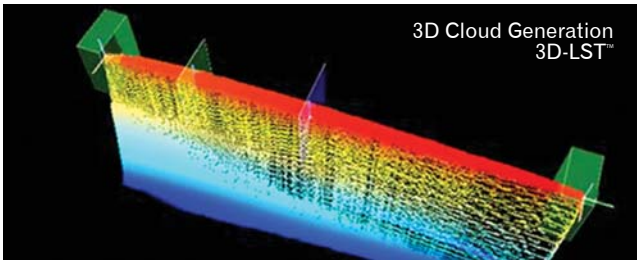


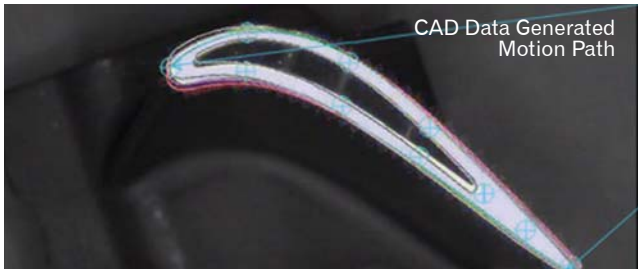

GEN I Nozzle: Columnar powder flow up to 10mm below nozzle, up to 95% powder deposition. When overspray is unacceptable in the process.

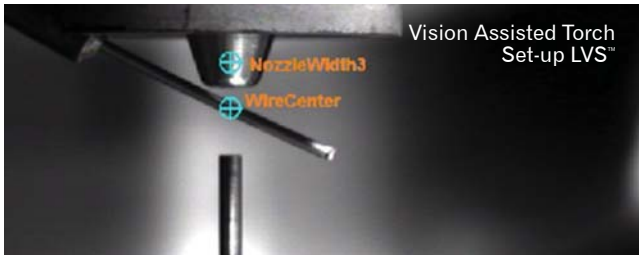
GEN II Nozzle: Design spray pattern. Nozzle shown with shield cup with beam and powder intersecting at work piece 7mm below the nozzle tip. Exceptional metallurgical results for low defect levels.

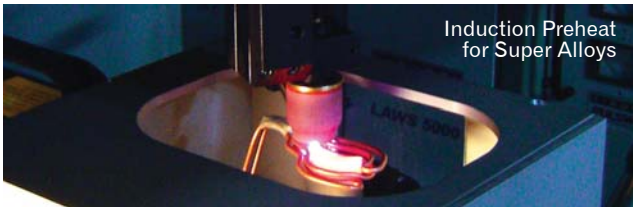
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The LAWS 800 is well suited for a variety of engine components.

## Commercial Engine Program Work

### General Electric

**CF34** (Turbofan)
**CF6** (High-by pass Turbofan)
**CT7** (Turboshaft and Turboprop)
**GE90** (High-by pass Turbofan)

### CFM International (Snecma/GE joint venture)

**CFM56-5, CFM56-7** (High-by pass Turbofan)

### Rolls-Royce

**RB-211** (High-by pass Turbofan)
**BR710, BR715** (BMW/Rolls-Royce Twin Shaft Turbofan)
**TRENT** (High-by pass Turbofan)
**AVON** (Aero-derivatives)

### Pratt & Whitney

**JT8D** (Low-bypass Turbofan engine)
**PW 2000** (Turbofan)
**PW 2037** (Turbofan)
**PW 4000** (Turbofan)
**GP7000** (Turbofan)

### Honeywell

**APU** (Auxiliary Power Unit)
**ALF 502** (Geared Turbofan)

## Alloys

- Ti 6/4V
- Ti 17
- Inco 718
- A286
- Rene 41
- Rene 77
- Rene 80
- Rene 125
- Rene 142
- CM64
- Tribaloy 800
- Hasaloy X
- SS 17/4PH
- CM 64
- Nimonic 100
- Nimonic 105
- Ti 6/4V
- Hastaloy X
- Haynes 188
- Inco 738
- Inco 901
- Mu 2 DS
- Mar-M-247 DS
- Merl 72
- PWA 1426 DS
- PWA 1440 SX
- PWA 1480 SX
- PWA 1484 SX
- PWA 1485
- Ti 6/4V

## Components

- High Pressure Compressor blades and vanes
- Tips, Leading Edge
- Trailing Edge
- High Pressure Turbine blades and vanes, tips, and radial cracks.
- Low Pressure Turbine blades, top seals, shroud
- Edges, abutment faces
- Nozzle guide vanes
- Blisk
- Impeller

## Military Engine Program Work

### General Electric

**T700** (Turboshaft)

## Components

- Knife edge seals

# LAWS 800™

*Liburdi Automated Welding Systems*

### Physical Characteristics

| | |
|---|---|
| Design: | Compact Multi-Axis Architecture |
| Height: | 115" (292 cm), 103" (261 cm) Shipping |
| Length: | 49" (125 cm) |
| Width: | 42" (107 cm) |
| Weight: | 3000 lbs approx (1400 kg) |
| Number of Axes: | 4 Standard (X,Y,Z,W) with additional axis options<br>*W axis is for wire feed only |

### Operating Environment

| | |
|---|---|
| Temperature: | 50°F to 100°F (10°C to 38°C) |
| Relative Humidity: | 10% to 80% (Non-Condensing) |

### Utilities Required

| | |
|---|---|
| Primary Voltage: | 480 V or 400V 3 Phase |
| Current: | 50/60 Hz @ 30 Amp (depending on system config.) |
| Argon: | 100 psi (regulated) (690 kPa) |
| Air: | 100 psi (depending on tooling) (690 kPa) |

### Standard System Includes

- Air conditioned cabinet
- High Precision Axis
- LCD touch screen and standard keyboard interface
- LAWS™ Touch Pendant
- WinLaws software
- Integrated analog and digital I/O with up to 20 KHz pulsing
- Coordinated Motion

### Servo Axis Specifications

| Axis | Travel | Velocity |
|---|---|---|
| X | 14" (36 cm) | 200 IPM (85 mm/sec) |
| Y | 16" (40 cm) | 200 IPM (85 mm/sec) |
| Z | 12" (30 cm) | 200 IPM (85 mm/sec) |
| W - Rotary (Torch) | 340° | 10 RPM |

## Plasma Configuration Option

### Welding Power Supply Specifications

Weld Power Source: Liburdi Pulsweld® LP100 PAW Power Source
Current: 1 - 50 Amps

### Gas Console

- Oxygen scrubber cartridge system for Plasma gas
- Plasma Gas Mass Flow Controller
- 3 Auxiliary gas circuits for part shielding with rotometer control and flow sensing

### Wirefeed Assembly

- Micrometer adjustment for wire position
- 100 IPM motor located at the weld head near torch
- Wire pulsing to maximum of 10 Hz

## TIG Configuration Option

### Welding Power Supply Specifications

Weld Power Source: P200-004
Current: 1 - 200 Amps

### Gas Console

- 4 Auxiliary gas circuits for part shielding with rotometer control and flow sensing

### Wirefeed Assembly

- Micrometer adjustment for wire position
- 100 IPM motor located at the weld head near torch
- Wire pulsing to maximum of 10 Hz

## Laser Configuration Option

### Welding Power Supply Specifications

*1000W Multimode Continuous Wave Ytterbium Solid State Fibre LASER*
Duty: Continuous 100%
Pulsation: Up to 5 KHz
He-Ne Alignment Laser
Optional: System can be configured to use other lasers, types & powers

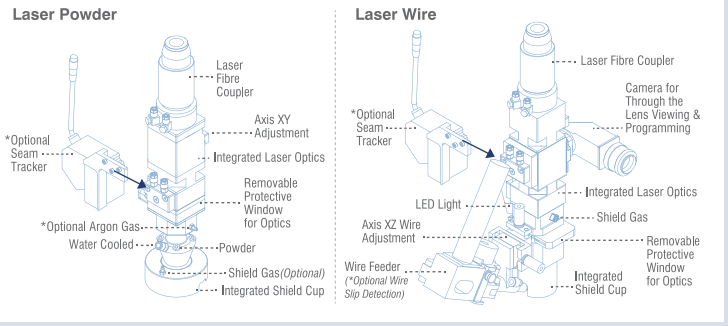
### Laser Options

Integrated power meter for laser calibration
Thru –the-lens-viewing camera (wire feed systems only)

### Optional Powder Feeder Specifications

2 powder hoppers for different powder types
Programmable precision volumetric control of powder

### Optional Laser Weld Head Configuration




### Weld Head Assembly

- Micrometer adjustment for torch centering
- Compact reliable design
- Break away device

### Liburdi Vision System™ (LVS)

- Latest 3-D version 3.0 software
- 1 Power over Ethernet Gigabit Camera for the X-Y plane
- 1 Power over Ethernet Gigabit Camera for the Z plane
- Weld monitoring camera with digital recording and real-time telemetry

### Liburdi Robotic Controller™ (LRC)

- English language programming, specifically designed for welding
- PC based, high performance, easily upgradable
- Fully integrated with vision system, graphical user interface
- Weld parameter generator and data logging capability

### Other Options

- 3D-LST™ point cloud vision system
- Fixture water cooler
- Off-line programming
- Remote desktop
- Dual monitor for vision system
- MFCs for process gases
- Fume Extractor

### Optional Process Development

- Process development for automated repair
- Part preparation tooling and specifications
- Development of weld program and parameters to meet customer and OEM requirements
- Metallurgical report summarizing results

### Optional Tooling

- Custom design as required to fixture customer parts
- Motorized / automated fixtures
- Standalone PLC controller
- Trail cup for improved weld protection
- Articulated Arm for part manipulation/loading

### Optional Factory Integration

- Custom Interface to customer shop floor data management system
- Conveyors, part handling
- Bar code scanning, RFID

### Service Plus Plans Available

- Silver, Gold, Platinum



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