

## Plasma spray solutions

Praxair Surface Technologies, Inc. and TAFE Incorporated is a **world leader** in thermal spray equipment, materials, and coatings know-how. With a long history in the development and application of plasma spray, Praxair and TAFE has designed a portfolio of plasma products that reflects decades of equipment and **coatings expertise**. Our product line is certain to include a system that meets your specific quality, productivity, versatility, and economic needs.

We recognize that the selection of a new plasma spray system is just the initial step. That's why Praxair and TAFE continues to **develop and perfect** new plasma powders and coatings to help push thermal spray technology toward an exciting generation of wear, oxidation, and corrosion-resistant applications. We dedicate talented engineers to team with you to develop materials, processes, and **coating solutions** that expand the market for cost-effective thermal spray applications.

Let us work with you to select the **best plasma spray system**, and put that system to work to maximize your output and returns. For more information, please contact your local representative or contact our U.S. headquarters:

Phone: **1-603-223-2100**  
Fax: **1-603-225-4342**  
E-mail: **[psti-info@praxair.com](mailto:psti-info@praxair.com)**

*One of the key advantages of the SG-100 gun is its ability to adapt to the 2086A ID extension, shown spraying a TBC on an aircraft burner can.*



# A systems approach

# Systems

Whether you need simple, reliable plasma spray equipment or a sophisticated, robust computerized system, Praxair and TAFE has a solution for you. We take pride in offering a range of engineered systems, each including the necessary integrated components – power supply, high frequency starter, control console, powder feeder and gun – to allow you to get “up and running” quickly.

The years of excellent performance provided by our plasma systems are a reflection of our commitment and expertise in the field of plasma spray.

Praxair and TAFE's plasma systems are designed to produce quality plasma spray coatings in concert with the SG-100 or any of our outstanding plasma guns.

Praxair and TAFE can offer a complete plasma system that fits almost any requirements. And we support our hardware with unparalleled technical service and applications assistance, along with one of the most capable powder operations in the thermal spray industry. Praxair and TAFE's equipment options, powder quality and selection, and coatings know-how offer you the best value for a total plasma coating system.

Add it up and you will agree: Praxair and TAFE has the right plasma solution to meet your needs.

### PlazJet™

The one-of-a-kind, high energy and high productivity unit;

### Net Energy™ 5500-2000

The patented, computer-controlled closed-loop system;

### 3620 Semi-automatic

The workhorse system for any and all applications;

### 3710 Manual

The economy unit, suitable for low to medium production rates;

### GTS

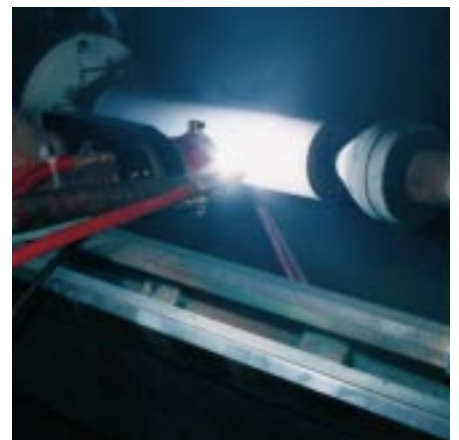
The *Global Tasking System*, a computerized multiple process controller that operates plasma and other thermal spray processes from a single console;

### Customized Systems

Configured to your precise specifications.



*Each plasma spray system includes everything you need to produce outstanding coatings, whether your applications require a simple unit with an SG-100 gun (right) or a sophisticated, fully integrated robotic system (above).*



## Versatility and performance

# Versatility

Praxair and TAFE's SG-100 plasma spray gun is a model of versatility and performance. The SG-100 produces exceptional plasma coatings, regardless of which system "drives" it. Operating at energy levels up to 80 kW in any of three modes – subsonic, Mach I, and Mach II – the gun is suitable for a wide range of applications requiring metals, carbides or ceramics. The SG-100's unique design accepts internal and/or external powder injection at a variety of injection angles, and features anodes and cathodes renowned for long service life. Flexibility, efficiency and proven excellence have made the SG-100 plasma gun an industry favorite.

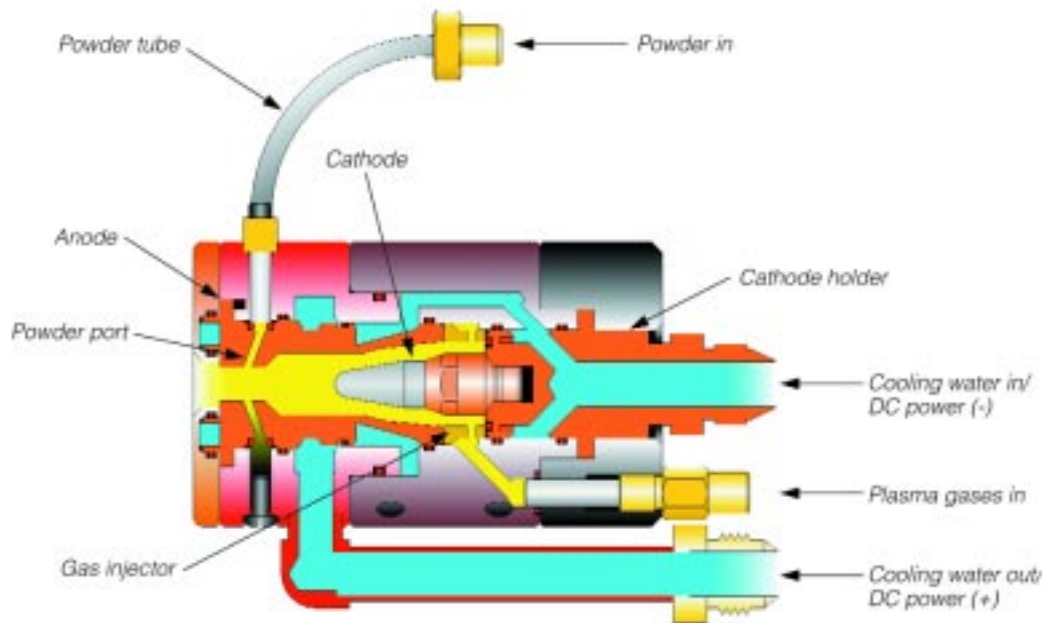
### SG-100 features:

- Self-aligning components
- A range of hardware configurations
- Extended life anodes and cathodes
- High deposit efficiencies
- Internal diameter capability

The versatility of the SG-100 gun literally extends to the capability of coating internal diameters as small as 1.5 inches (38 mm). The model 2086A and model 2700 extensions to the standard SG-100 produce quality ID coatings at energy levels up to 30 kW. Inter-changeable components allow quick conversion from OD to ID operation, adding to the unmatched capability of the SG-100 gun. The 2086A extension can deposit coatings into diameters as small as 2.5" (64 mm) and the 2700 can coat diameters as small as 1.5" (38 mm).

The SG-200 plasma spray gun is a smaller version of the SG-100, designed for energy levels up to 40 kW. Specifically suited for machine-mounted applications, including true 90 degree ID coatings, the SG-200 works best in production environments requiring rapid, uniform and repeatable coatings.

*The SG-100 plasma gun design is simple yet robust, producing excellent coatings of all types and allowing easy conversion to ID spraying.*



# Sophisticated process control Control

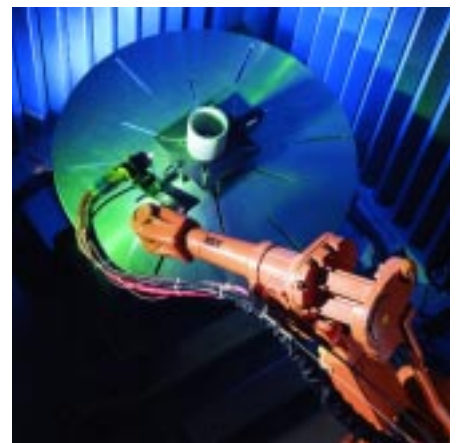
In order to produce superb plasma sprayed coatings with a wide variety of materials, plasma equipment must perform consistently, whether the energy level is as low as 15 kW or over 200 kW. To provide consistent control over the complete range of systems and power levels, Praxair and Tafa offers three standard types of plasma controllers: conventional plasma with jeweled critical orifice control; conventional plasma with mass flow control; and high energy plasma with mass flow control for the PlazJet.

Critical orifice gas controls, 'jeweled' to a precise size, are employed in the 3620 Semi-automatic and the 3710 Manual systems. Decades of reliable performance stand testament to the benefits of critical orifice technology. The low maintenance aspect of critical orifices means there are no periodic calibrations necessary to ensure accurate and consistent plasma gas flows. Simple to operate, highly repeatable and proven over time – all reasons to consider the 3620 and 3710 controllers when selecting your plasma system.

Many complex thermal spray coatings demand that the plasma process be controlled even more closely. The dynamic nature of plasma spray, along with strict requirements for process control verification and diagnostics, require robust system design and sophisticated, closed-loop computer control. That's when it is time to consider the uniquely qualified Net Energy™ 5500-2000 system, which uses the model 5501 control console to produce unparalleled plasma stability through advanced engineering. Simply put, the more stable and consistent

the plasma energy, the better and more repeatable the plasma coatings. By controlling the actual energy of the plasma flame and making "real-time" adjustments to maintain the desired output, the 5500-2000 system offers the capability to produce the highest quality plasma coatings, each and every time.

All of Praxair and Tafa's conventional plasma systems utilize the PS-1000 power supply for primary power. The PS-1000 incorporates the latest advancements in high power rectifier design to provide precise amperage/voltage control and stability for high quality plasma spraying. Where necessary, two PS-1000 units may be "banked" to increase energy output.



Among the advanced plasma control options available are the integrated, PLC-based Net Energy 5500-2000 (above) and the unique Global Tasking System (left), a multiple thermal spray process controller.

Equipment solutions  
for outstanding coatings

# Equipment Solutions

## 3710

### 3710 Economy Plasma Spray System

3710 Plasma Spray Control Console  
PS-1000 Power Supply  
SG-100 Plasma Spray Gun  
1264 Powder Feeder  
HF 2200 High Frequency Arc Starter

#### 3710 Economy Features:

Critical orifice gas flow control\*  
Built-in PC-100 power supply controller with digital displays  
Dual powder feeder control capability  
NFPA Type "Z" purging with audio/visual alarms  
Best combination of economy and performance



3710 Control Console

## 3620

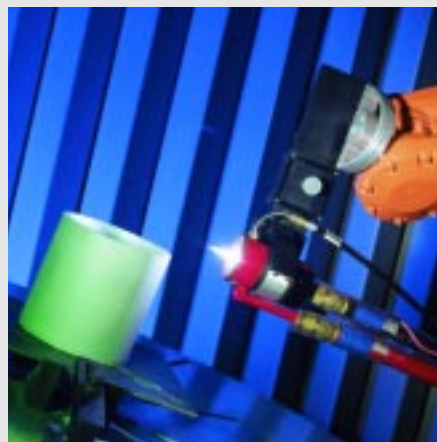
### 3620 Semi-automatic Plasma Spray System

3620 Plasma Spray Control Console  
PS-1000 Power Supply  
SG-100 Plasma Spray Gun  
1264 Powder Feeder  
HF 2200 High Frequency Starter

#### 3620 Semi-automatic Features:

Critical orifice gas flow control\*  
Microprocessor-based controller with automatic gas and power sequencing  
Dual powder feeder control capability  
Multiple safety interlocks  
Aircraft quality coating capability and control

*\* Mass flow controls are available as an option.*



SG-100 Gun

# Net Energy

## Net Energy 5500-2000 Computer Controlled Plasma Spray System

5501 Computerized Control Console  
5502 Mass Flow Controlled Gas Module  
PS-1000 Power Supply  
SG-100 Plasma Spray Gun  
2 each 1264 Powder Feeders  
2 each Closed Loop Feedrate Controls  
HF 2200 High Frequency Starter

### Net Energy 5500-2000 Features:

Mass flow control of plasma and carrier gases  
Fully automatic, PLC-based process control  
Sophisticated data acquisition hardware and software  
Closed-loop, "real-time" verification of the energy of the plasma plume  
Consistent coatings of the highest quality, every time

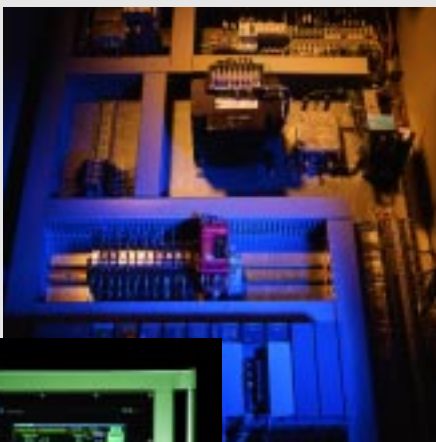
# PlazJet

## PlazJet High Energy Plasma Spray System

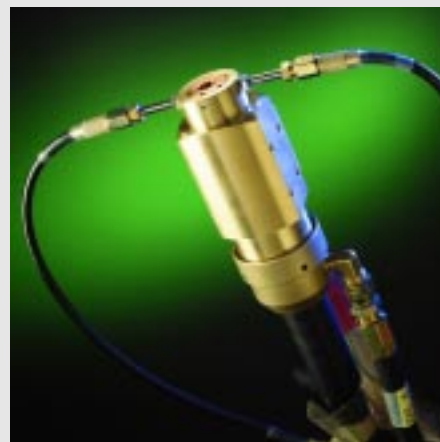
7170 PLC-based Control Console  
7405 Mass Flow Controlled Gas Console  
7304 Power Supply  
7070 PlazJet Plasma Spray Gun  
2 each 1264 Powder Feeders  
2 each Closed Loop Feedrate Controls  
7565 Water Module  
7391 High Frequency Starter

### PlazJet Features:

Mass flow control of plasma and carrier gases  
Fastest coating cycles and throughput  
Low overall coating costs  
Very high spray rates  
High and controllable coating density and hardness



*The 5501 controller housed in the Spray Process Execution Control (S.P.E.C.) Station, with separate electrical (shown) and mechanical modules.*



*PlazJet Gun*

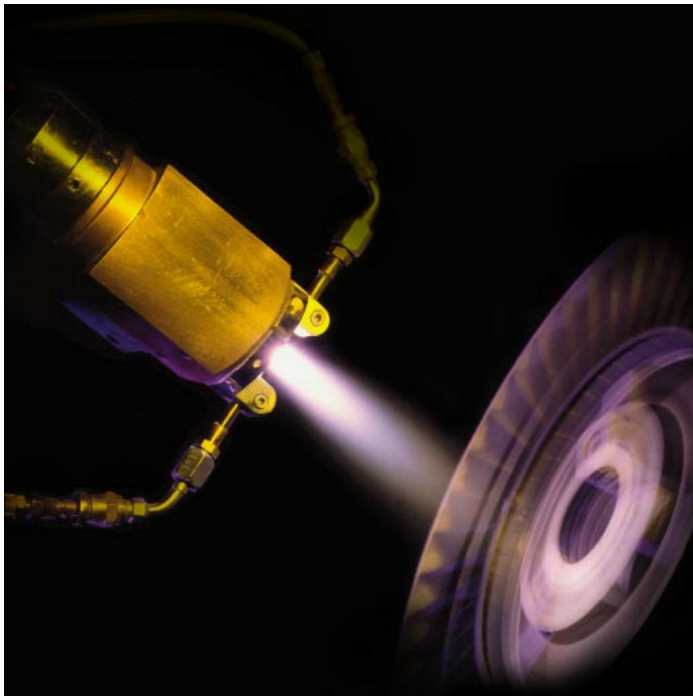
# One-of-a-kind system Unique

Praxair and TFA's PlazJet™ high energy plasma is a one-of-a-kind system that uses a simple, effective design to produce coatings of incomparable quality. PlazJet generates a high voltage, low amperage plasma with the desirable combination of extremely high thermal energy and exceptional gas and particle velocities, applying very dense coatings at unmatched spray rates. Unlike other plasma systems that operate up to 80 kW – typically below 40 kW – the PlazJet runs at a typical steady state of about 200 kW, providing more than enough power to deposit outstanding coatings.

The unique design of PlazJet represents a revolutionary change from conventional plasma systems. The basic operating characteristics of DC plasma spraying had remained relatively unchanged for several decades of use. PlazJet, however, is a quantum leap in technology.

#### PlazJet advantages:

- Improved coating density, hardness, bond strength, electrical properties, finish and corrosion resistance due to higher particle velocity than other plasma systems;
- Higher spray rates, making the process more economical and allowing the system to be more productive in a given period of time;
- Longer component life and surprisingly high electrical efficiency due to reduced amperage levels.



*The improved PlazJet system produces high density coatings of all types—ceramics, carbides or alloys—with exceptional spray rates.*

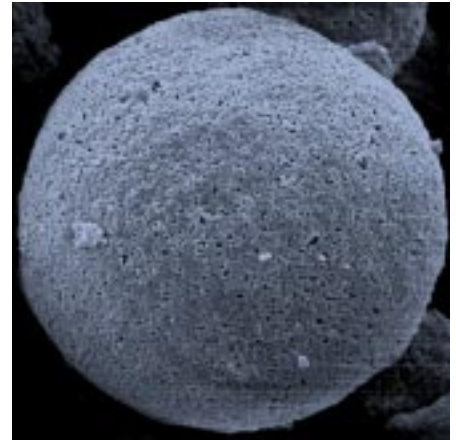
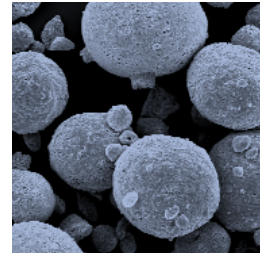
# A quantum leap in technology

# Technology

The PlazJet system is controlled by the sophisticated model 7170 console, featuring fully automatic, closed-loop PLC management. All the user needs to do is select a pre-programmed "recipe" from the menu and the 7170 takes over, interfacing as necessary with a robot or complete automation package. The result is complete, accurate control of all plasma parameters, precise monitoring of process conditions, automatic adjustments as required and, most importantly, coatings of higher density, bond strength, hardness, and overall quality than you would ever expect from a plasma system.

The ability of the PlazJet to produce very dense, thick ceramic coatings has extended the spectrum of plasma applications. For example, material systems designed to provide resistance to high temperatures and thermal cycling, such as thermal barrier coatings (TBCs), historically feature porous zirconia-yttria topcoat layers. Now the standard of excellence is a dense stabilized zirconia coating that is efficiently and cost-effectively applied by the PlazJet.

No other plasma system offers the technological advantages and unique capabilities of the PlazJet.



*PlazJet transforms spherical Yttria-stabilized Zirconia powder into turbine blade coatings with unique properties that allow industrial gas engines to run longer and more efficiently.*

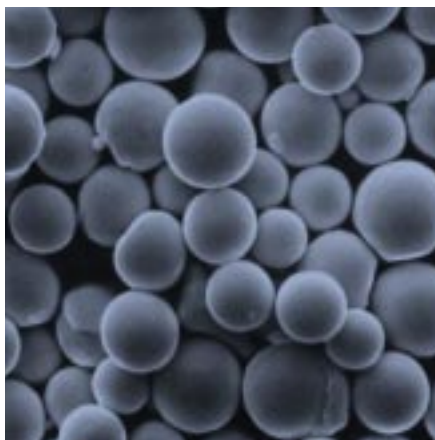
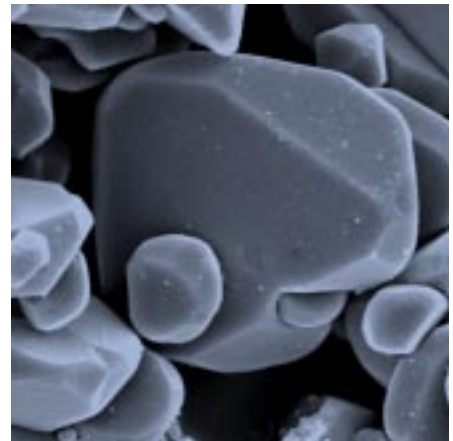
# Applications assistance

# Applications

As a company dedicated to providing exceptional coatings solutions, Praxair and TAFE recognizes the added importance of providing thermal spray powders and applications assistance. We realize that your interest is the coatings you produce – their quality, consistency and cost, and the speed, efficiency and repeatability with which they are produced.

That's why we are proud to supply a family of thermal spray powders designed specifically for use with each type of plasma spray device. Yet we go one step further: the sole mission of Praxair and TAFE's coating technology department is to perfect each of our processes. All day, *every day*, we work to refine coating parameters for our systems and powders. And we are never more effective than when working in tandem with you, helping to solve coating problems, developing new, innovative solutions, or increasing the deposit efficiency of proven coating solutions.

In order to get the maximum output from your plasma system, proper selection and use of premium thermal spray powders is a must. Look no further than Praxair and TAFE. Our state-of-the-art powder facility in Indianapolis, IN, sets the new standard for world class manufacture of thermal spray powders.



*Utilizing multiple production methods, including argon gas atomization, spray-drying and sintering, and proprietary technologies, we make high purity powders engineered to meet the exacting requirements of plasma spray systems.*

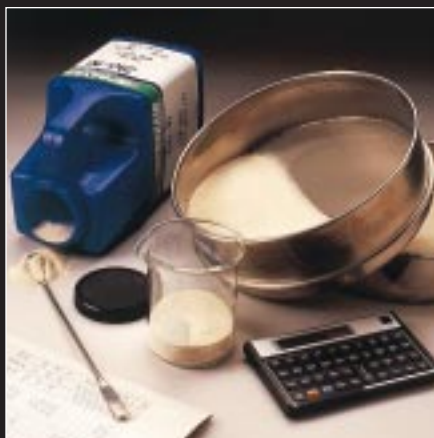
# Perfecting the process Know-how

## Plasma Powders

- High purity gas-atomized metals and alloys, including MCrAlY powders of all types;
- Spray-dried and sintered ceramic powders, including TBC Stabilized Zirconia;
- Dense, metal-free Chromium Oxide powders produced by a proprietary process;
- Spherical carbides of all types, including WC-Co-Cr and CrC-NiCr powders;
- Cast/crushed and sintered/crushed carbide powders, including WC-Co and WC-Ni;
- Proprietary, patent-protected Carbide Activation Technology carbide powders.

If required, we can customize a plasma powder, gun, complete system, or coating to meet the needs of your specific application. Our advanced systems engineering group is ready and able to integrate, automate or retrofit thermal spray systems, handling equipment, and facilities to make your operation more productive, safer, and more cost-effective.

Similarly, Praxair and TAFE's powder engineering team can work to match specific material solution needs, whether a new alloy, powder morphology or particle size distribution is required. And our coating technology group ties everything together, marrying hardware and powder advances to develop procedures, practices and methods to produce exceptional plasma coatings that open up opportunities for the entire thermal spray market.



*Our team of manufacturing and engineering professionals is focused on developing powders and system parameters that work perfectly with your plasma equipment to produce outstanding coatings, each and every time.*



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