



# *The Evolution of Plasma Cutting*

•Major milestones to today's High Performance Plasma Systems

Presented by Jim Colt

...in co-operation with MultiCam and Hypertherm

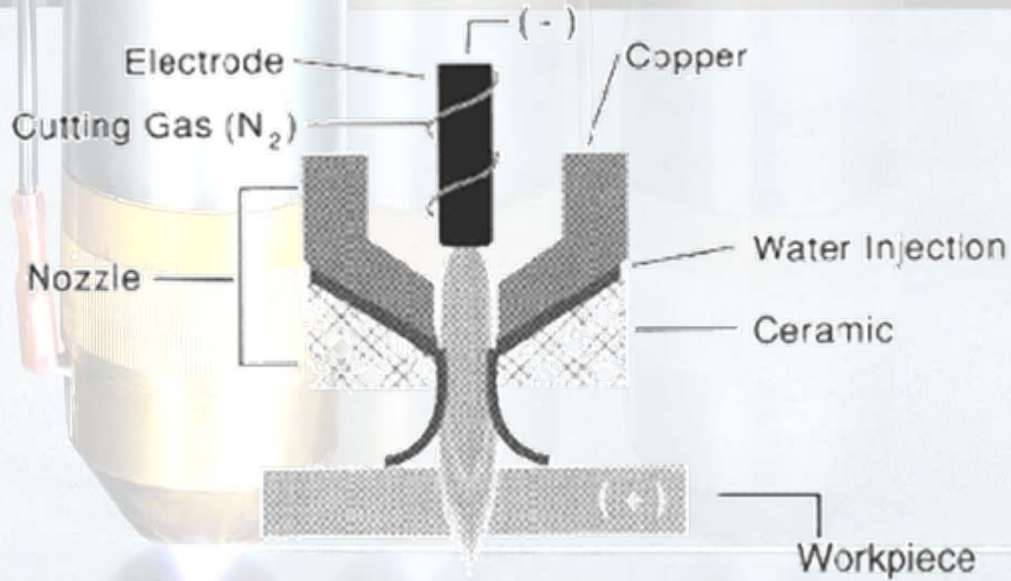
## - Late 1950's through mid 1960's.....

- Simple, high powered plasma systems were first used in the late 1950's
- First patented by Union Carbide Corporation
- Thermal Dynamics later improved the process with Dual-Flow technology
- Most productive way to contour cut non-ferrous metals



- *It took over 350 Amps to cut through 1/2" thick materials! This can be done with 50 amps today!*
- *Consumable life was measured in feet....not hours!*
- *Virtually all cuts required grinding to remove dross!*
- *Typical angularity of the cut face was 8 to 12 degrees from square!*
- *Cut quality was very poor on carbon steel.*

- **Radial Water Injection Plasma invented, Hypertherm Inc. 1968**



Water is radially injected around a Nitrogen plasma arc...effectively squeezing the arc to increase its energy density.

Advantages:

- **Faster speeds, less dross, less angularity, longer consumable life.**
- **The ability to cut carbon steel with plasma speed with no dross (thinner than 5/8")**

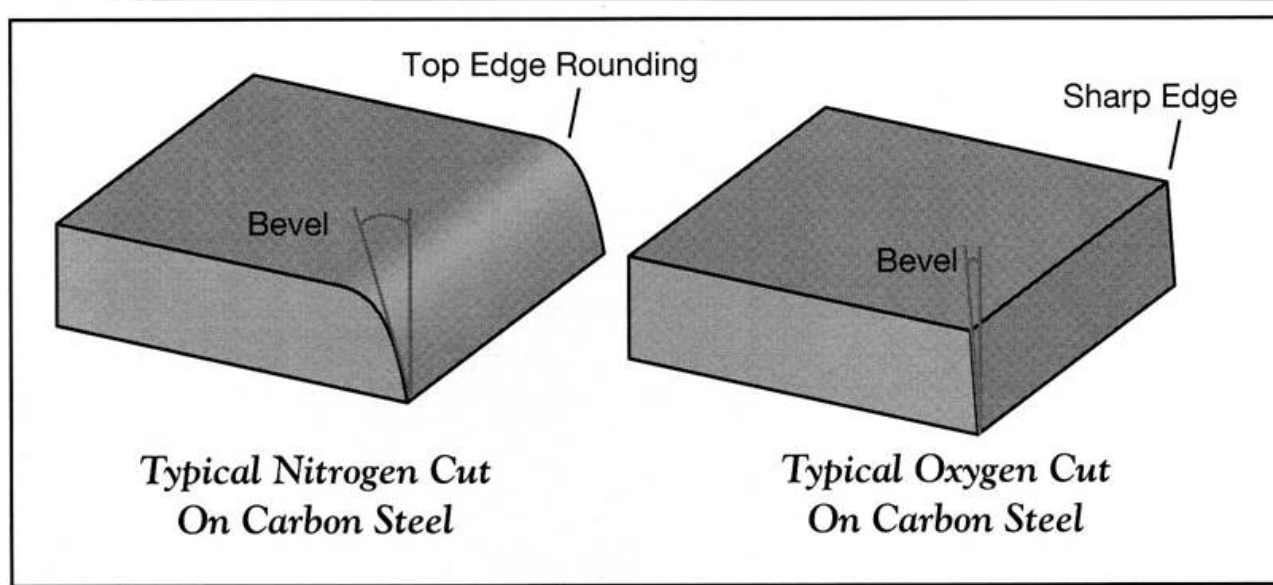
# Water Table and Water Muffler Plasma Cutting Processes

1972



- Utilize a water table to trap hot particles of metal
- Utilize an airtight water shield that surrounds the plasma torch to reduce audible noise, and to eliminate smoke.
- Effectively eliminates heavy smoke, loud noise, and minimizes ultraviolet glare associated with high powered plasma cutting.

# Oxygen Plasma Cutting for Carbon Steel



- **Dramatic improvements in plasma cut quality and speed at the expense of consumable life.**
  - **Metalurgically pure edge...better welding, better forming, and better machining ability on the cut edge**
  - **Faster cutting speed at lower power levels....less noise, less smoke, narrower kerf**

**1985....Low cost air plasma systems are becoming popular, due to improved (chopper and inverter) power supply technology.**



- **Simple to retrofit to oxy-fuel machines**
- **Low capital cost, reasonable cut speed**
- **Can cut ferrous and non-ferrous**
- **Largest market is HVAC duct fabrication machines**

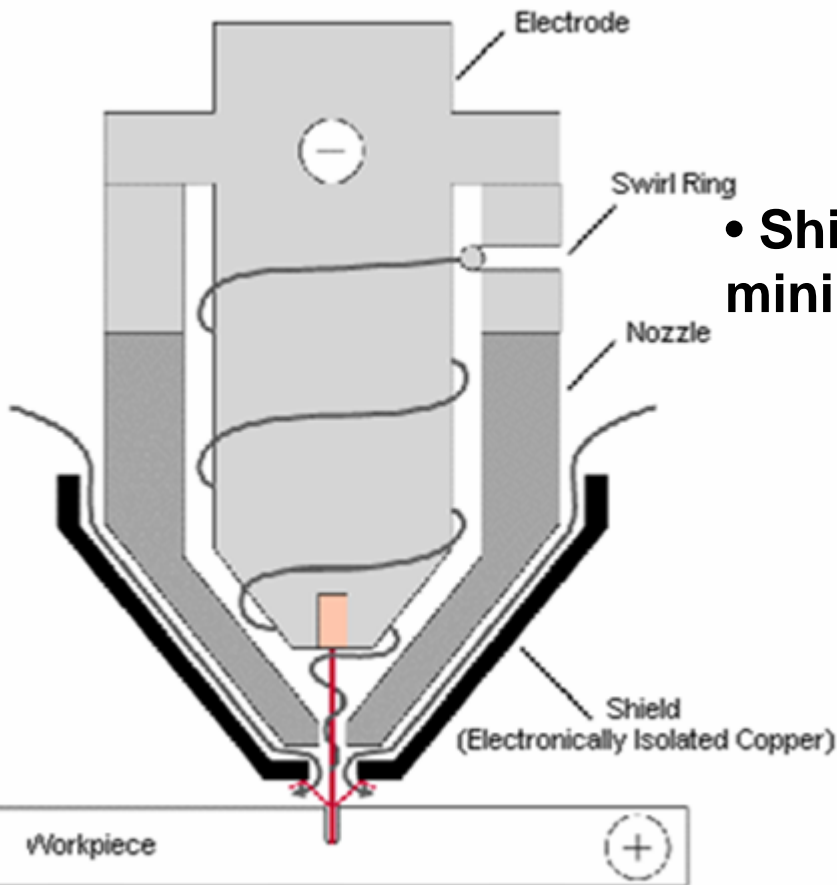
# Contact Start plasma systems developed that eliminate high frequency start circuit.....1987



- Further reduces cost of air plasma systems
- Totally eliminates electrical noise interference associated with high frequency start plasma systems

# Shielded Torch Nozzle Dramatically Improves Nozzle Life

1989



- **Shield electrically isolates the nozzle to minimize nozzle damaging double arc**

- **Allows thicker piercing**

- **Allows drag cutting..or contact with the plate**

- **Improves nozzle cooling**

- **Helps shield gas control cut quality**





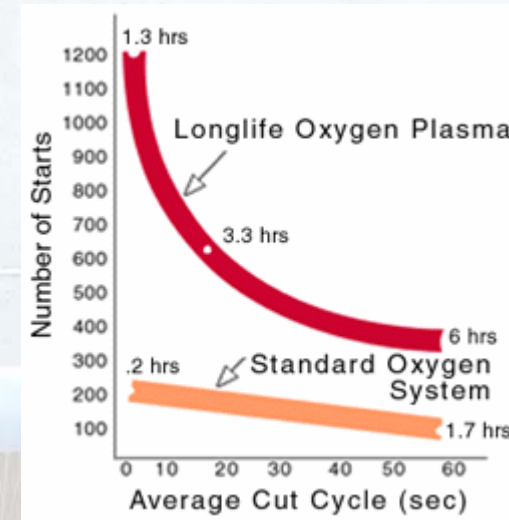
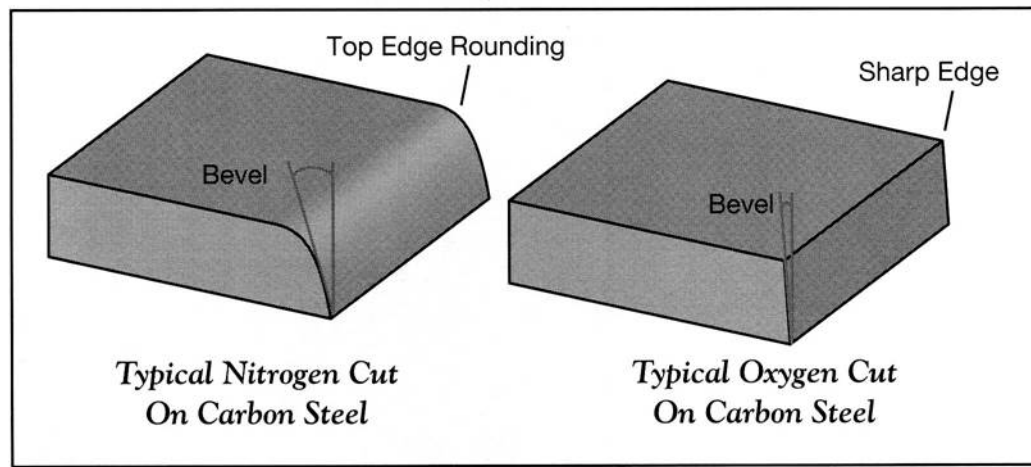
## 1992: Perhaps the finest year in Plasma Cutting History!

- Long Life Oxygen Cutting Technology released to the market
- High Flow Vortex Nozzle Technology invented
- High Definition Plasma introduced

**• These three technologies....all released in 1992....have combined to revolutionize plasma cutting with....lower operating cost and dramatically improved cut edge angularity and overall quality**

# Long Life Oxygen Technology

- The superior cut quality of oxygen....combined with consumable life that rivals that of Nitrogen plasma systems

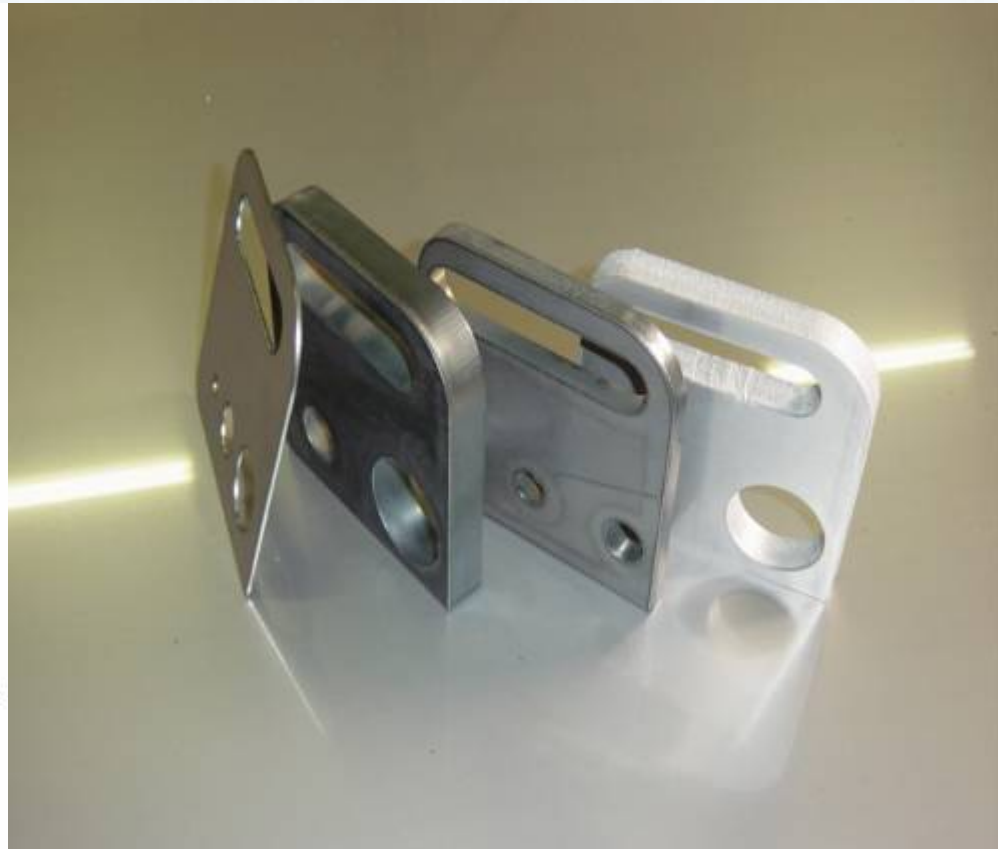
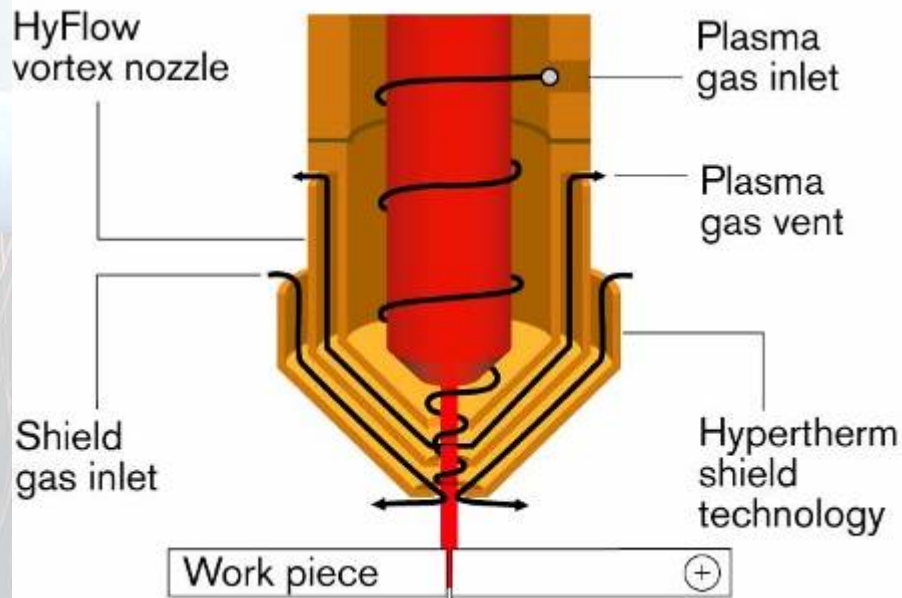


- Lower cost per foot of cut
- Minimal (if any) secondary operations required
- Faster at lower power levels
- Less Smoke
- Less Noise

## High Flow Vortex Nozzle Design

- Allows for highly efficient gas swirl....which improves edge squareness on carbon steel
- Dramatically increases energy density, while allowing long nozzle and electrode life

### Patented HyDefinition cutting for consistent quality



## High Definition Plasma Cutting Technology

- Superior cut quality...comparable to laser on some materials
- Quick disconnect torches for minimal downtime
- Cut part accuracy that perfectly fits between Laser and conventional Plasma
- Variety of gas and consumable combinations can be used to fine tune process



# Coaxial-Assist jet Technology

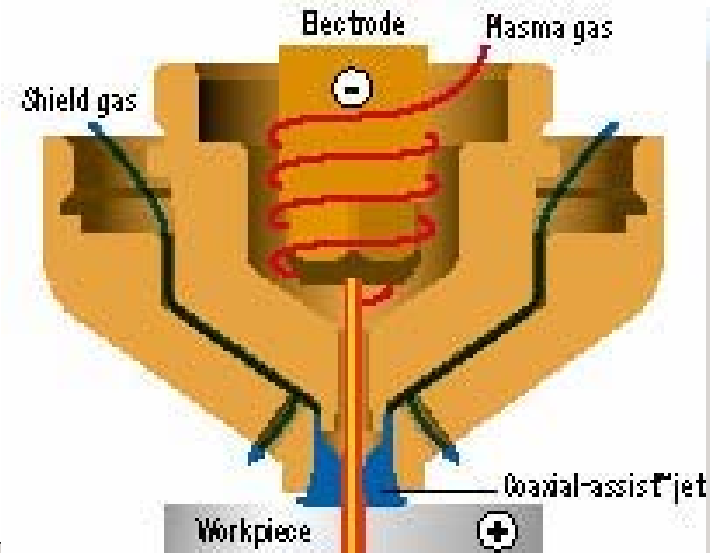
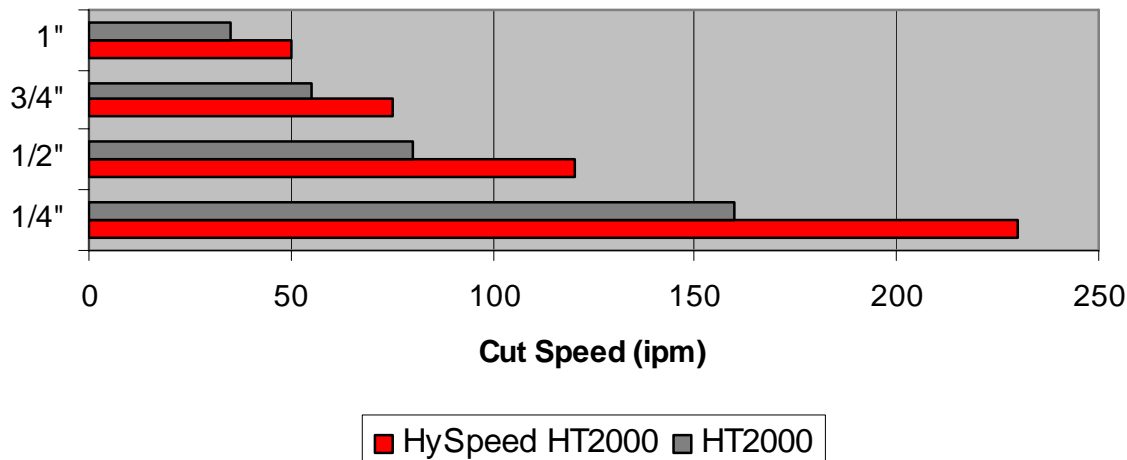
1999-2003

## • Dramatic Process Improvement

- Speeds increased up to 50% at same power levels
- Ability to pierce 1.5 times the thickness
- Squarer, straighter cuts on thicker materials



HySpeed HT2000 vs HT2000 Cut Speed Comparison



## 2004 High Performance Plasma Systems

- All of the best technologies:
  - Oxygen Plasma (all other gases available also)
  - Shielded technology for best piercing and longest nozzle life
  - High Flow Vortex gas flow technology
  - Long Life Oxygen
  - High Definition
- Combined with new technology:
  - Solid State automatic gas flow technology
  - Improved torch cooling circuit
  - Modular system design (shared components, 130 and 260 Amps)
  - Dramatic increase in consumable life...2 to 3x previous systems.
  - Cut quality traceable to ISO standards
  - Best quality cuts....easiest plasma system to operate



# 2004 High Performance Plasma Systems

- Modular...choose your power level
- Combines ease of use...with low operating cost and highest cut quality.



# 2004 High Performance Plasma Systems

Simple to operate

- Operator simply chooses material type, thickness and power level desired.....all parameter settings are made in 2.4 seconds!





# 2004 High Performance Plasma Systems

**Simple to operate**

- Can switch from cutting to marking process in 2.4 seconds (automatically, through the part program)...without changing torch consumables.





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