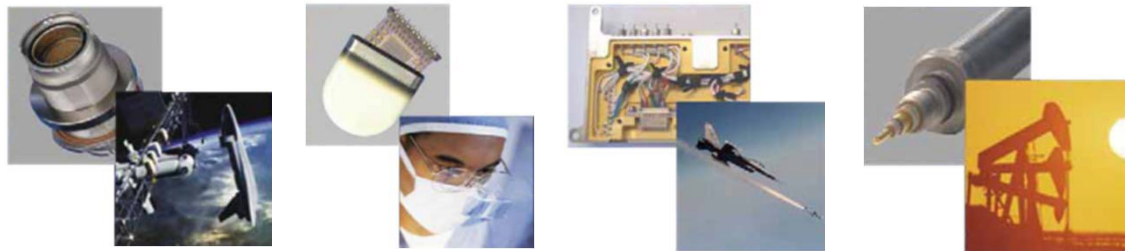


# PA&E: Explosive Metal Forming

March 2017



8/27/2015



# PA&E Bonded Metals Division:



2249 Diamond Point Road  
Sequim Washington



8/27/2015



# Bonded Metals Division

## Who we are:

### PA&E Bonded Metals Division

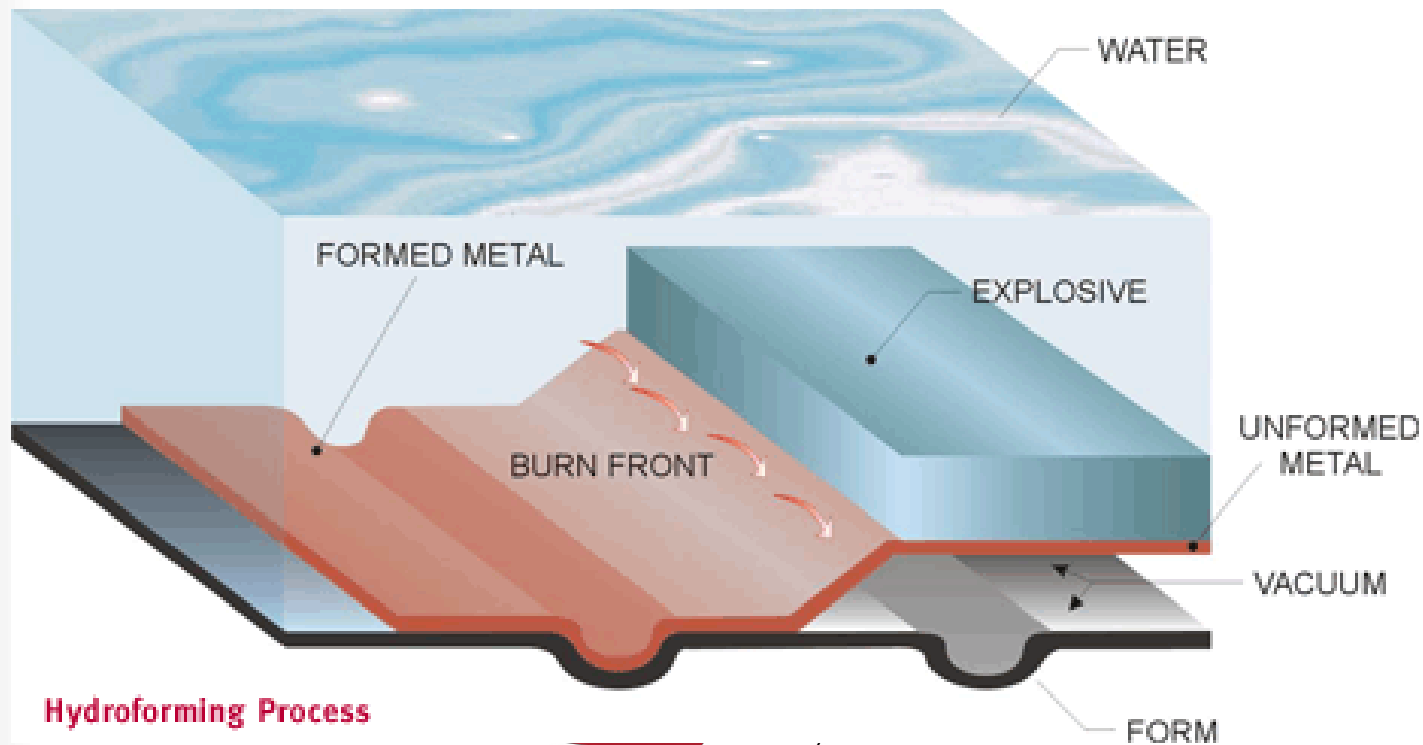
- In operation since 1970
- Formally known as Northwest Technical Industries

## What we do:

We use explosives to weld or bond dissimilar metals together and to explosively form metals into exotic shapes that are difficult or impossible to do by conventional methods. Explosives are also used to compact or consolidate metal powders into near net shapes.

# The Explosive Metal Forming Process

This technique uses the energy generated by an explosive detonation to form the metal work piece. This process can deliver a great deal of flexibility in the metal-forming process.



Hydroforming Process

# Why Explosive Forming?

- It can simulate a variety of other conventional metal forming techniques such as stamp- or press-forming and spin-forming in a single operation
- It can offer significant cost savings on short-run parts because a one-sided tooling die is generally all that's required
- Explosive hydro-forming can efficiently form large parts – up to 14' square or 10' in diameter

# The Explosive Metal Forming Process

## Preparation

A PA&E Employee Matches Material To Die and Applies an Explosive Charge



# The Explosive Metal Forming Process

## Detonation

Material is Lowered into Blasting Pond  
and the Explosive is Detonated





# The Explosive Metal Forming Process

## Post Detonation

Explosively Formed Sheet



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# The Explosive Metal Forming Process

## Other Examples of Explosively Formed Sheets



Boiler Products



Missile Components



Aircraft Radar Shields

# The Explosive Metal Forming Process

## Examples of Explosively Formed Cones



Rocket Engine  
Nozzles



Space Shuttle Cone and After Explosive Forming

# The Explosive Metal Forming Process

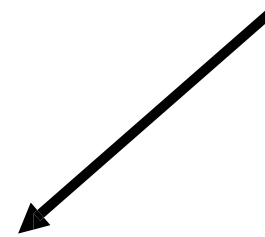
## Turbine Components



Hastelloy® Tubes



Explosive Forming Die



Finished Parts



# The Explosive Metal Forming Process

## Learn More

Contact PA&E's Bonded Metals Division via:

- E-mail at [bondedmetals@pacaero.com](mailto:bondedmetals@pacaero.com)
- Phone at: 360-683-4167

Or Visit:

- <http://www.pacaero.com/products/explosive-forming.htm>

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