Hot Metal Gas Forming

The TEAM and the HMGF program’s vision
The TEAM

Boeing Aircraft Company
DaimlerChrysler Company
Ford Motor Company

OEMs

Production
Product Supplier
Copperweld
Alcoa

Wayne State University
Universities

NIST
ATP

Battelle Memorial Institute
Altarum

Research Institutes

Equipment and Tooling Suppliers
Atlas Technologies
Erie Press Systems
Rockwell Automation A-B
Sekely Industries
TOCCO

Temper
(Product Leader / Engineering)

Product Design / CAD Software
AutoDesk
The vision was to develop the next level of metal forming technology.

### Tubular Hydroforming vs Stampings

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DIS-ADVANTAGES</th>
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<td>Lowest cost metal forming operation</td>
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<td>Predictable performance</td>
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<td>- dimensional</td>
<td>Low Engineering scrap</td>
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<td>- material performance changes is minimal</td>
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### Original Vision of Process

March 98
High capital costs
Equipment
Facilities
Long Cycle times
Expensive tooling

Over simplified example of basic cost driver differences

Hot Metal Gas
Forming Press

These two presses would produce approximately the same size parts
Original Goals of program

- **Goal 1** - Verify feasibility of the process (To prove out HMGF techniques using simple laboratory tooling)  
  Completed Dec 2000

- **Goal 2** - To build a prototype production system using tooling, material and processing techniques to prove process robustness and production costs  
  Completed June 2003

- **Goal 3** - To prove out low temperature enhanced plasticity techniques at high strain rates
  - > 50% for steel
  - > 100% for aluminum  
  Completed May 2001

What did the team accomplish?

ABC
Technology
Teamwork
Leadership
Three Phases of the Program

Phase I - (Completed)
1. Utilizing a Tensile System, determine forming limits / process parameters
2. To determine process parameters/equipment capabilities - for phase II

Phase II – (Completed)
1. Design, build and launch the Laboratory Forming System (LFS).
2. Utilizing the LFS, determine forming limits / process parameters
3. Determine process parameters / equipment capabilities required for prototype production forming system – For phase III

Phase III – (Completed)
• Design, build and launch the Prototype Production Forming System (PPFS) to validate process robustness