

# Light Duty Vehicle CNG Tanks

**Dane A. Boysen, PhD**

Program Director

Advanced Research Projects Agency-Energy, US DOE

dane.boysen@doe.gov

**Fiber Reinforced Polymer Composite Manufacturing Workshop**

Advanced Manufacturing Office, EERE, US DOE

Arlington VA, January 13, 2014

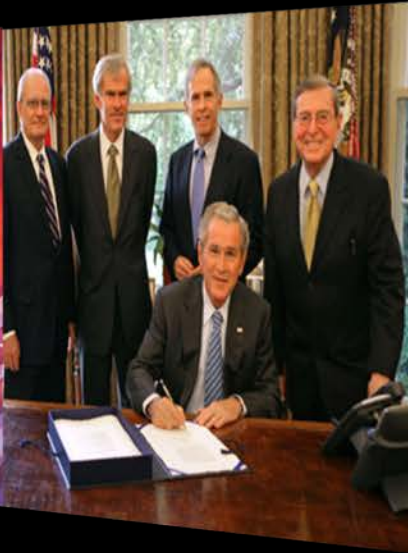
# Advanced Research Projects Agency-Energy

2006

2007 America COMPETES

2009 ARA

2009 ARPA-E



Can I put my luggage in the trunk?



**Uh, sorry no**

# Commercial CNG Tanks

Tank	Type I	Type IV
Material	steel	carbon fiber
Capacity	12 gallon	12 gallon
Weight	<b>490 lb</b>	190 lb
Cost	\$1,700	<b>\$4,300</b>

**too heavy**

**too costly**



**too bulky**

**Current options too heavy, too costly, too bulky**

# Tank Challenge

## Now

heavy, expensive, and **cylindrical**



3600 psi load carried by  
**Tension**

## Need

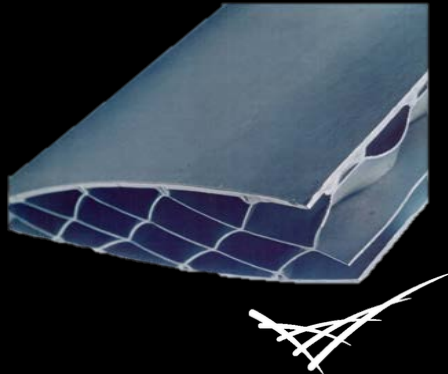
lightweight, low cost, and **conformable**



15 psi load carried by  
**Torque**

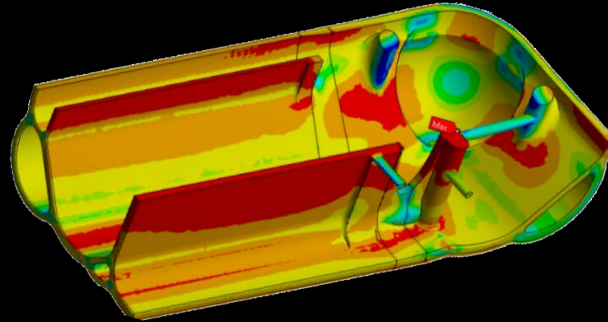
# ARPA-E Tank Projects

## Superplastic-Formed



Pacific Northwest  
NATIONAL LABORATORY

## Modular Cell

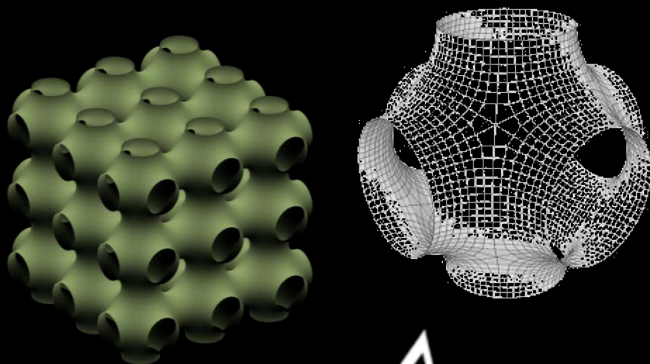


United Technologies  
Research Center

## Targets

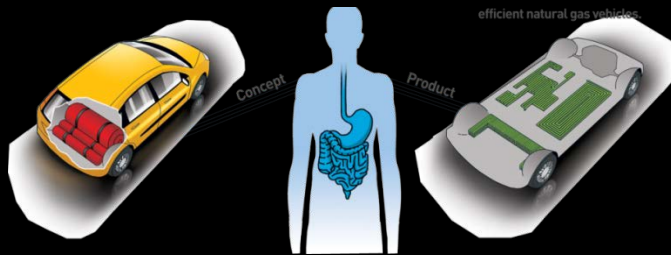
- 10 gge tank
- > 90% conformal
- > 12 MJ/kg
- < \$1500 tank

## 3-D Squeeze Cast



REL

## Intestine Tube



Otherlab

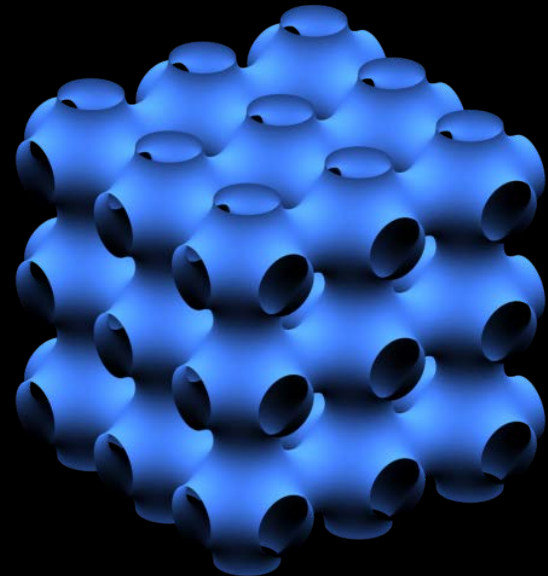
conformal



# Composite Fabrication Challenge

- Fabricate 3-D structures
- Fabricated cost < \$30/kg
- Specific strength > 200 kN·m/kg

Can you make this?



Schwarz P Surface