



# Integrated Natural Gas Storage System

Lighter, Cheaper Natural Gas Storage for Vehicles

ENERGY  
EFFICIENCY AND  
RENEWABLE  
ENERGY

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TRANSPORTATION  
TECHNOLOGIES



## Transportation FOR THE 21ST CENTURY

### Background

While natural gas vehicles (NGVs) have penetrated some niche commercial markets for buses, delivery vans, and trucks, their success is still heavily constrained by the cost, weight, size, and packaging considerations of existing natural gas storage cylinders. To address these problems, The U.S. Department of Energy's Office of Transportation Technologies and the Gas Research Institute provided funding to Johns Hopkins Applied Physics Laboratory (APL) and Lincoln Composites to develop an alternative system for on-board storage of natural gas. This three-year cost shared research and development effort culminated in December 1997 in the development of a state-of-the-art, safety-certified natural gas storage unit called the Integrated Storage System (ISS).

### The Technology

The ISS utilizes lightweight, high-density polyethylene to construct small diameter cylinders (called pressure cells) which are subsequently encapsulated within a high-strength fiberglass shell containing impact-absorbing foam. This arrangement combines the pressure-cells into a single container and provides protection from external impact abuse and environmental exposure. The ISS is designed to be similar in shape to a conventional gasoline tank and can be attached to the vehicle chassis with steel straps. This method of attachment does not interfere with the vehicle's "crumple-zone" in the event of a severe rear-end collision. Two separate tanks (one on the undercarriage

and one located in the trunk) provide a total energy storage capacity of 12 gge (gasoline gallons equivalent) at a service pressure of 3600 psi. This improves automobile driving range to over 300 miles, which is comparable to those powered by gasoline. ISS technology also reduces the amount of costly carbon fiber in the pressure-cell overwrap without sacrificing safety, simplifies the gas control system for multiple natural gas cylinders, and provides the container as a complete unit ready for installation. These innovations reduce the cost of the ISS by nearly 50% compared to NGV storage tanks five years ago.

### Commercialization

DaimlerChrysler is currently testing the ISS (more than 15,000 miles to date) in three of its sedans — the Plymouth Breeze, Dodge Stratus, and Chrysler Cirrus. In addition to the driving tests, DaimlerChrysler has provided automotive hardware, technical data, and state-of-the-art facilities. DaimlerChrysler has reported very positive test results which has led them to endorse the ISS. Although cost of natural gas storage is significantly reduced with the ISS, DaimlerChrysler continues to seek manufacturers and suppliers that can produce the ISS at even lower costs. DaimlerChrysler has sent out letters to various equipment manufacturers and is currently meeting with suppliers for ISS production. APL and Lincoln Composites have received four patents for the ISS and are further developing cheaper, lighter weight ISS components.

### Benefits

- Cost is reduced by nearly 50%
- Weight savings up to 70% compared to steel and aluminum cylinders
- 300-mile driving range for automobiles
- Does not interfere with car's "crumple-zone"



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