



FIREFIGHTER NEAR MISS

**Auto Fire with
Compressed Natural Gas
(CNG) Fuel Tank Explosion**

Prepared By Operations Division

April 2, 2007



Arson: Incident #26564

- Dispatch 0230 hours for car fire (E10)
- E10 arrived and requested FIB for multiple vehicles with possible structural exposures (freeway columns and overpasses)
- 12 vehicles damaged or destroyed
- Firefighter near miss when CNG vehicle exploded as E10 crew approached with a handline (approximately 50-75' away)

**Fire
Garage**

S Dearborn St

Gate (Key
Access)

Gate (Key
Access)

Maynard Ave S

S Charles St

9th Av

S Plummer St

Airport Ways

7th Ave S

I-90 Express Ln E



I-90 Express Ln W





Access Gate

8th Ave South

E10

Royal Brougham

Airport-Ways

2B

90

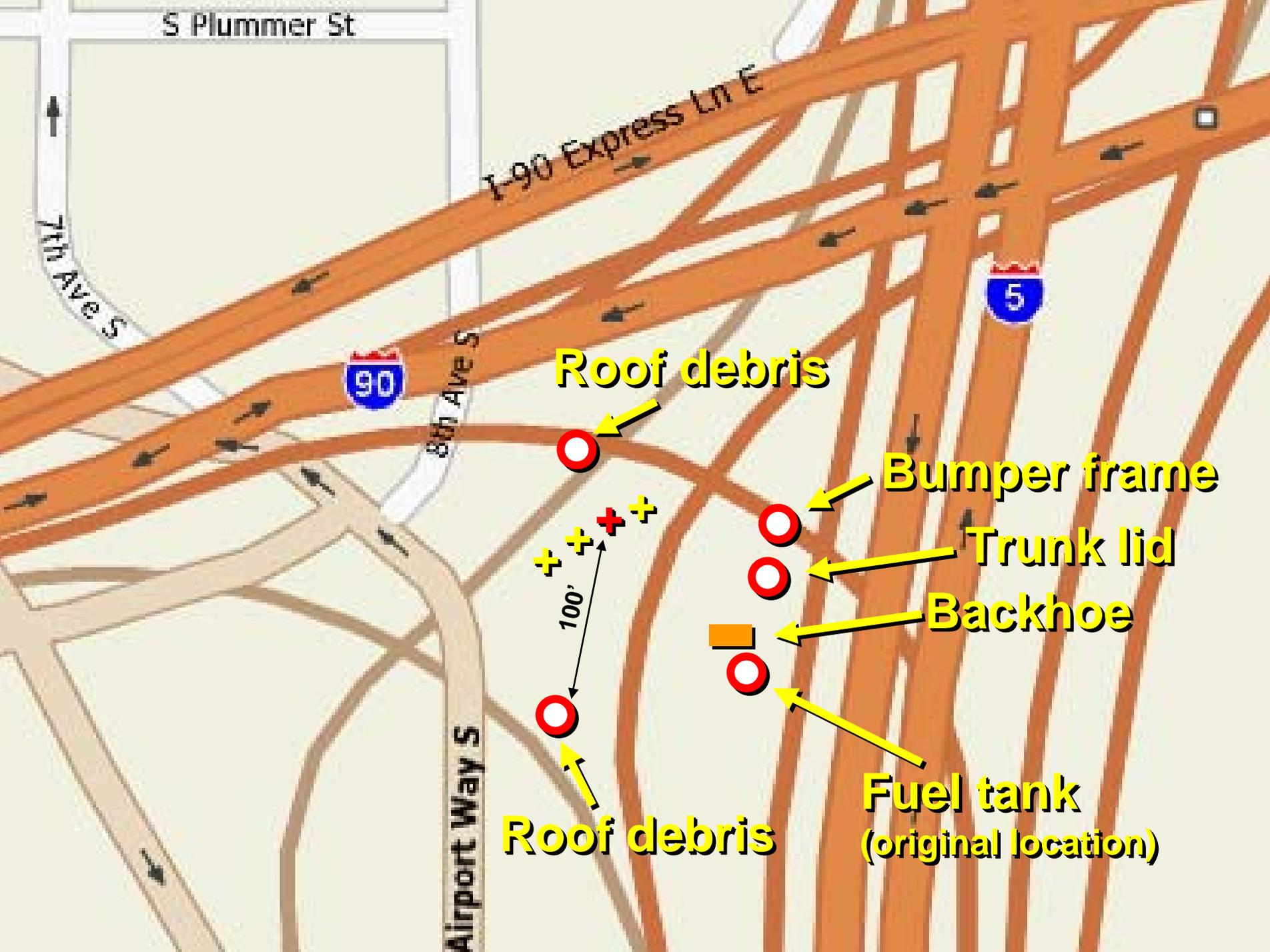
I-90



E10 parked outside the gate here



Debris from the explosion was thrown up to 100' in all directions including on the overpasses above the incident.



S Plummer St

I-90 Express Ln E

7th Ave S

90

8th Ave S

5

Roof debris

Bumper frame

Trunk lid

Backhoe

Fuel tank
(original location)

Roof debris

100'

Honda CNG Vehicle







Rear of vehicle



**Roof is blown completely
off vehicle and doors blown
open**









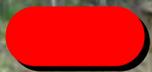


**Metal mounting
straps for CNG tank**

Trunk lid



Tank landed here,
moved down hill to here
for extinguishment



Rear bumper frame 90'+ away



Bumper shrapnel
Note burn marks on
ground.



Roof section about 75' away



This is your only warning of a CNG – fueled vehicle. Typically located on the trunk lid or bumper







Composite tank is carbon-fiber / fiberglass wrapped for strength – similar to our SCBA tanks.











**Tank blown approximately
95' from the vehicle**





August 07, 2003

Airport Taxis, Shuttles Convert to Natural Gas

New contract requires fleet conversions to improve air quality

The Port of Seattle Commission today authorized the renewal of contracts with two major providers of ground transportation at Seattle-Tacoma International Airport. The contracts, with the *Seattle Tacoma International Taxi Association (STITA) and Shuttle Express*, will require the two organizations to make major investments to convert their fleets to clean-burning natural gas.



Under its new contract, STITA will be required to convert its entire *160-cab fleet* to natural gas in the next three years. By converting more quickly, STITA will earn the right to extend the contract from five to seven years.



Historical Information

- Several NHTSA (National Highway Traffic Safety Administration) investigations
 - Example: January 27, 2003; Ford Crown Victoria on fire with flame impingement on CNG tank. The tank failed catastrophically prior to Pressure Relief Device (PRD) functioning.
 - Vehicle recall with dealers installing additional insulation behind back seat.
 - Number of vehicles still needing repair???



Code of Federal Regulations

- CFR 49, Part 571

- Standard 304

Compressed Natural Gas Fuel Container Integrity

Flame Test Standard:

Flame impingement generating 1550-1650° F. at the surface for the length of the cylinder for 20 minutes or until fuel is completely vented through PRV.



CNG Properties

- Compressed to 3,600 psi in fuel cylinder
- CNG rated at 117 octane fuel
- BTU per # = 22,800 (gasoline = 18,900)
- *Not* a liquid when compressed (it becomes a very close dense gas)
- *Not* the same as Liquified Natural Gas – LNG (cryogenic: -260° to become liquified)
- Lighter than air when released (.6 air)



CNG Properties

- LEL / UEL = 4 – 16% (gasoline = 1.3 – 7.6)
- 1 cubic foot of CNG = 245 cu.ft. of natural gas at sea level (uncompressed)
- 1 cubic foot of CNG weighs 13#
- 5.66# = 1 Gasoline Gallon Equivalent (GGE)
- Honda Civic tank = 8 GGE
- *Note: 1 gallon of gasoline properly vaporized has the explosive equivalency of 83 pounds of dynamite (CDC).*



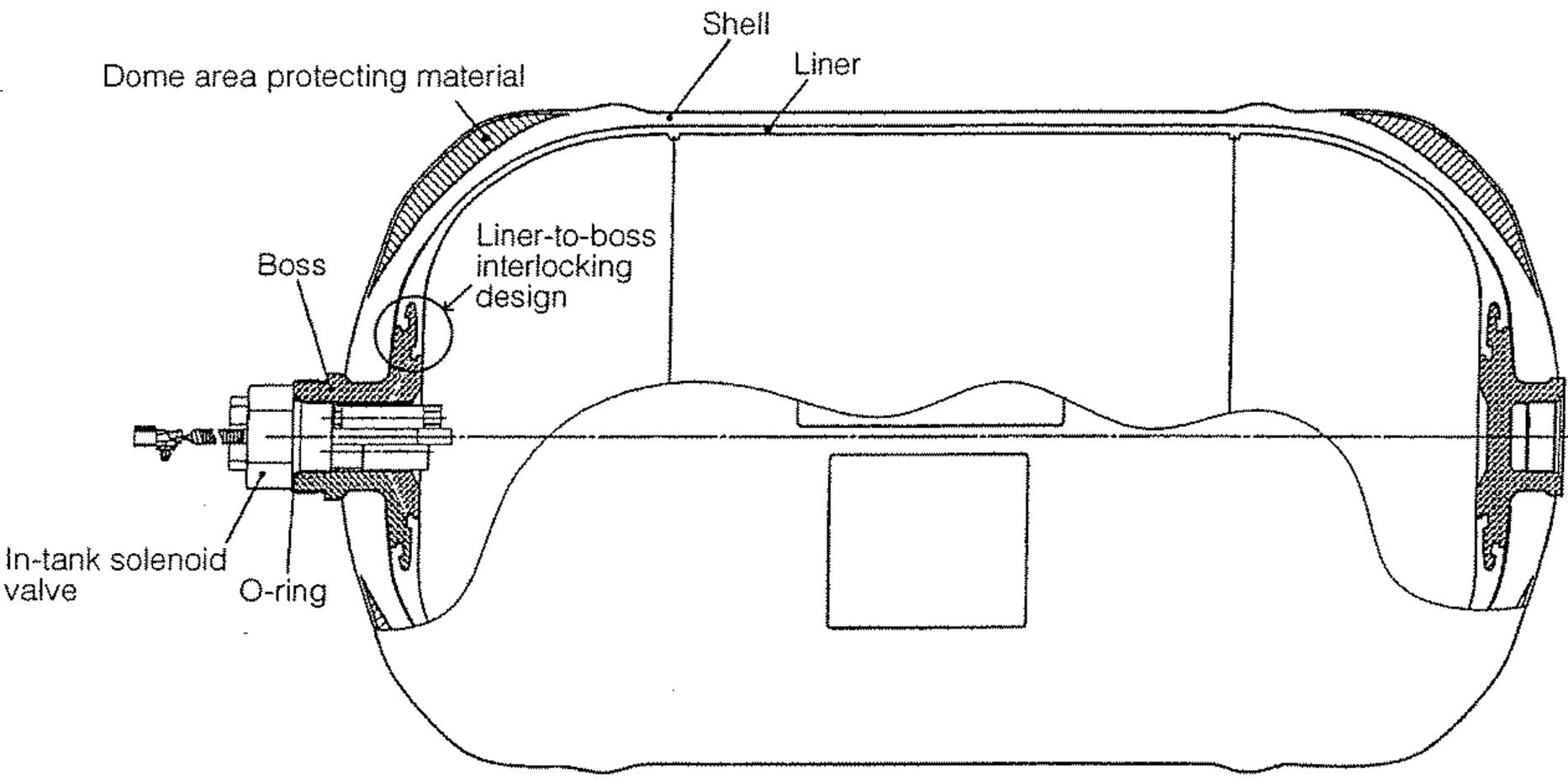
Cylinder Properties

- Four Cylinder Types:
 - Type 1: all metal (steel or aluminum)
 - Type 2: hoop wrapped steel or aluminum
 - Type 3: fully wrapped steel or aluminum
 - Type 4: all-composite (non-metallic)*

*Early model Honda Civic uses Type 4;
later models use Type 3

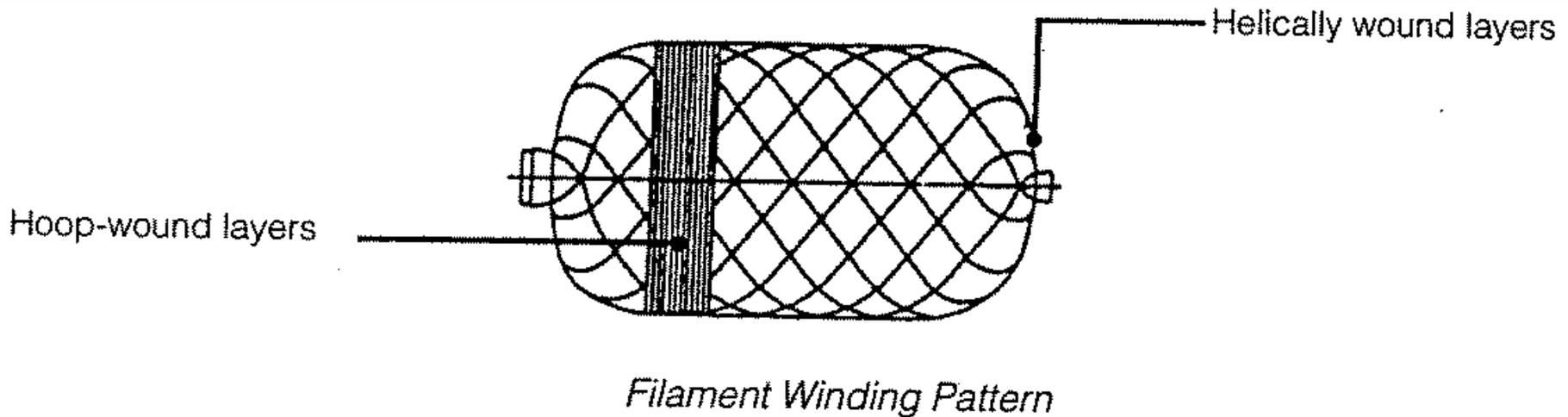


Honda Civic Tank Design





Honda Civic Tank Design



Note: The PRD (pressure relief device) activates similar to a fusible link (it fails versus resealing like a spring-assisted pressure reducing valve – PRV). The gas is vented out the vent tube until the tank is empty. Discharge time depends on fuel level.



Lessons Learned /Best Practices

- Approach from 45° angle to vehicle ends
- Be aware of CNG vehicles
 - Cabs, city vehicles, shuttles
- Look for CNG placards
- Watch for other hazards, i.e. bumper struts; hood and tailgate struts; airbags; burning fuel runoff; hazardous vehicle contents; exploding tires; other traffic
- Consider cooling streams from a distance

