



Hydrogenics Bus Application Overview

November, 2007



Hickam AFB Fuel Cell Bus



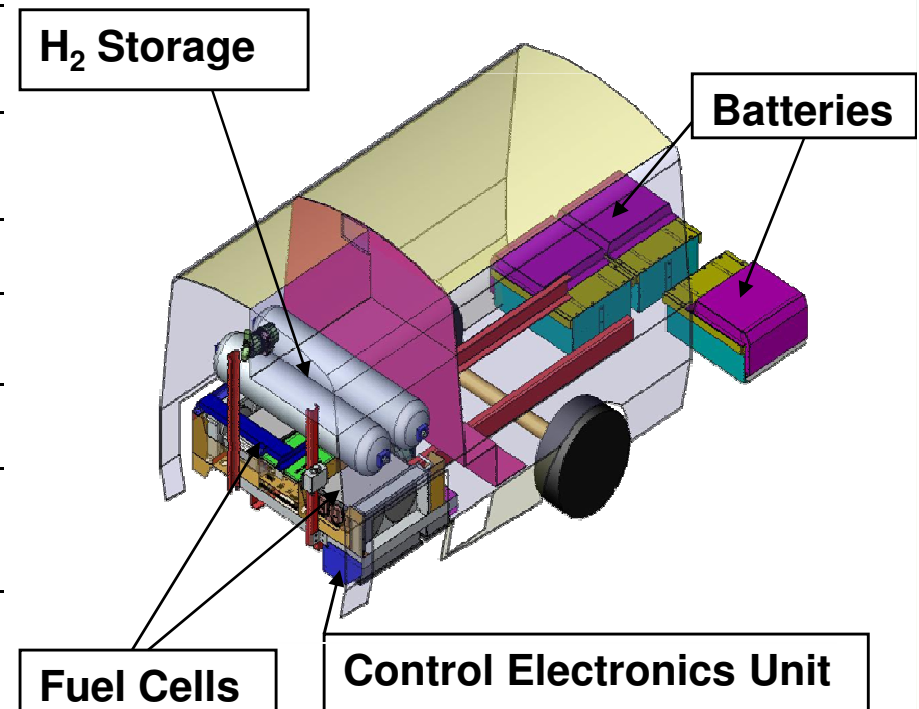
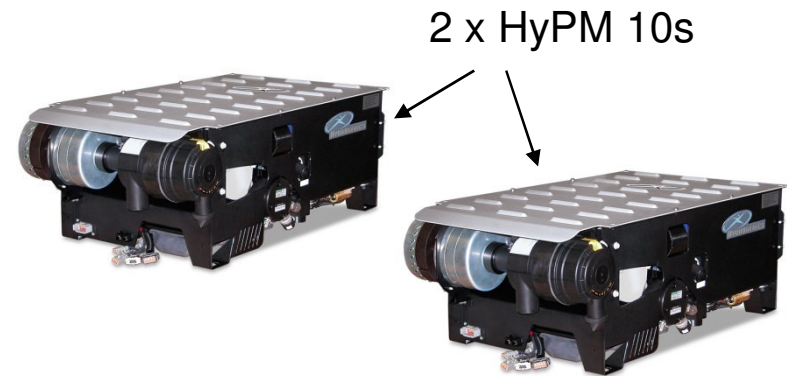


Hickam AFB Fuel Cell Bus



Technical Data

Length	30 ft (9.1 m) Eldorado National
Type	High floor
Seats	23
Max speed	20 mph (33 km/h)
Autonomy	125 mi (200 km)
Drive	24 kW PEM Fuel Cell
Motor	120 kW
Fuel	Hydrogen(99.99%)
Hydrogen storage	10 kg @ 5000 psi
Energy storage	Lead Acid Batteries





Mobile Energy Solutions Fuel Cell Plug-in Hybrid Bus



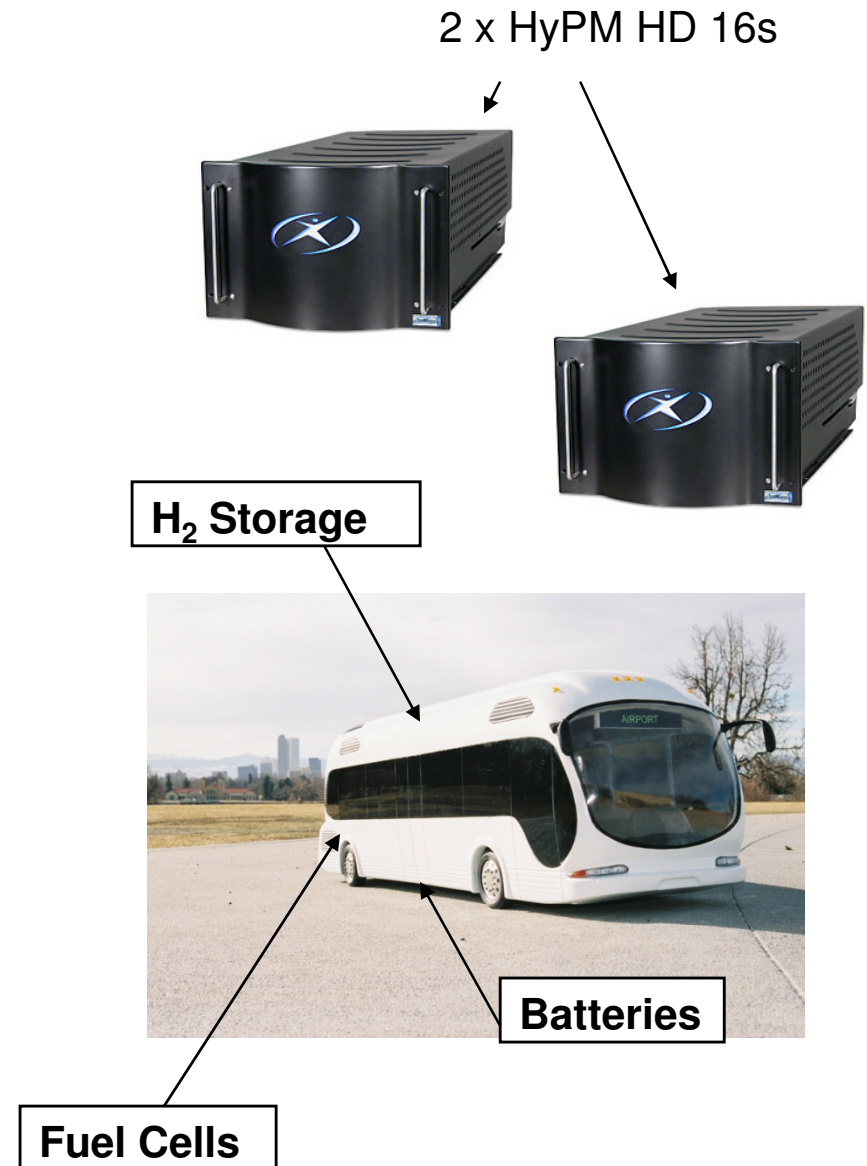


Mobile Energy Solutions Fuel Cell Plug-in Hybrid Bus



Technical Data

Length	35 ft (10.7 m)
Type	Low floor
Seats	37
Max speed	60 mph (96 km/h)
Autonomy	Est'd 300 mi (480 km)
Drive	32 kW PEM Fuel Cell
Motor	150 kW
Fuel	Hydrogen (99.99 %)
Hydrogen storage	15 kg
Energy storage	NiMH Batteries





New Flyer Fuel Cell Hybrid Bus



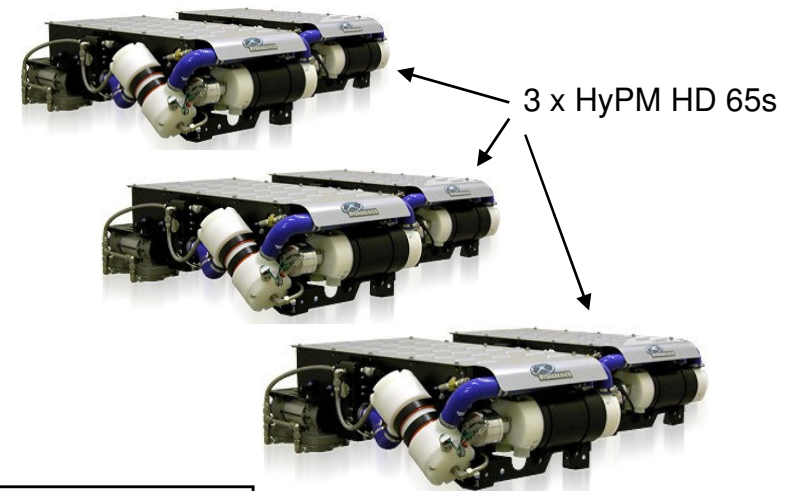


New Flyer Fuel Cell Hybrid Bus



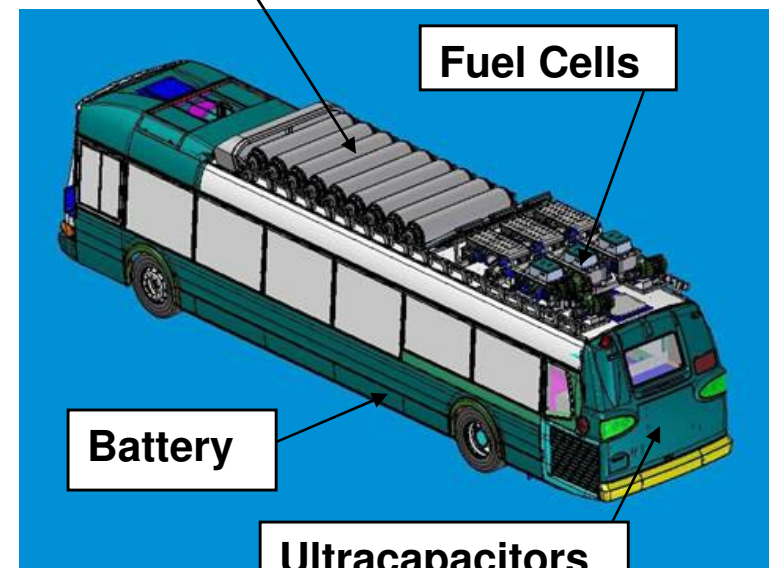
Technical Data

Length	40 ft (12 m) New Flyer Invero
Type	Low floor
Seats	39
Max speed	60 mph (60 km/h)
Autonomy	250 mi (400 km)
Fuel Cell Power	180 kW (~200 kW peak)
Motor	170 kW
Available Peak Power	350 kW including hybrid electrical energy storage
Fuel	Hydrogen (99.99%)
Hydrogen storage	45 kg
Energy storage	Ultracapacitors and NaNiCl Battery



H₂ Storage

Fuel Cells



Battery

Ultracapacitors



Hybrid APU for H2-ICE Bus



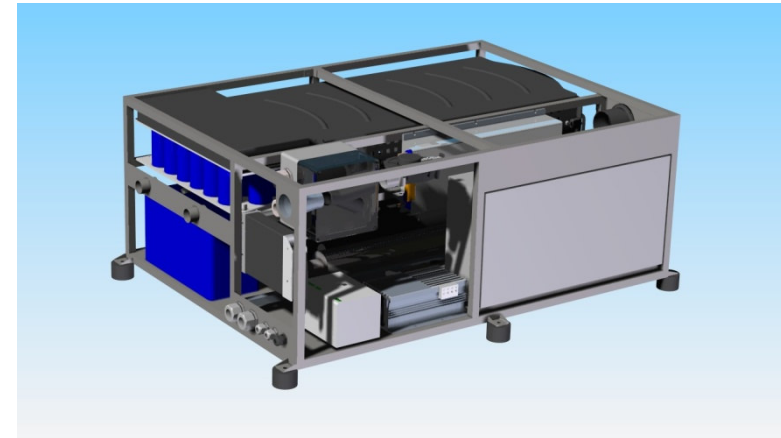


Fuel Cell Hybrid APU for MAN



Auxiliary Power Unit Technical Data

Fuel cell	16 kW_{el}
Peak power	30 kW for 2 sec
Energy storage	Ultracapacitors
Application	Onboard power Air conditioning Heating
Fuel	Hydrogen (99.99%)
Delivery	Fall 2007



H₂ Storage

N.B.:
Exact roof location
of APU in planning





Fuel Cell Hybrid Midi Bus





Fuel Cell Hybrid Midi Bus

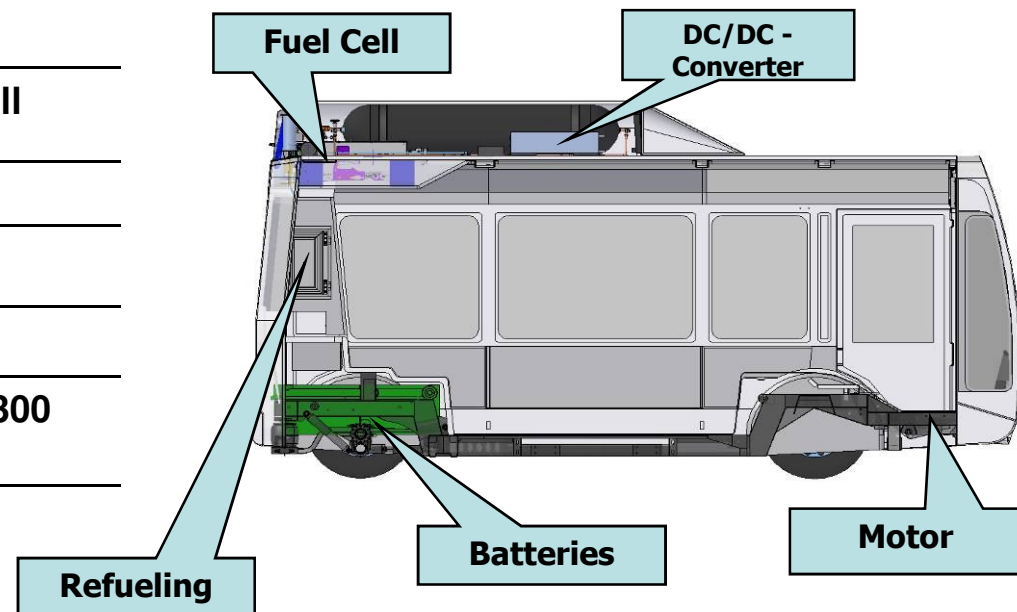


Technical Data

Length	17 ft (5.30 m) Tecnobus Gulliver
Type	Low floor
Passengers	22
Seats	8
Max speed	20 mph (33 km/h)
Autonomy	125 mi (200 km)
Drive	12 kW PEM Fuel Cell
Motor	25 kW
Fuel	Hydrogen (99.99%)
Hydrogen storage	5.8 kg @ 2850 psi (300 bar)
Energy storage	NiCd Batteries




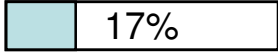
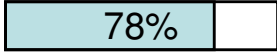

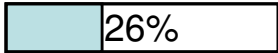
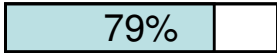

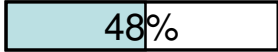
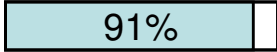

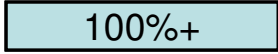
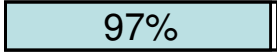
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Hybrid Ratio Comparisons



Examples	Fuel Cell Pwr / Motor Rated Pwr [kW]	Fuel Cell Power as a Percentage of Motor Power	Hydrogen (kWh _e) as a Percentage of Total kWh _e cap.
	20 / 120		
	32 / 123		
	12 / 25		
	180 / 170		



Rampini ZEV ALÉ Hidrogeno





Rampini ZEV ALÉ Hidrogeno



Technical Data (Project in Progress 11/2007)

Length	7.57 m
Type	Low floor
Passengers	44
Seats	9 + 1 disabled + driver
Max speed	55 km/h
Autonomy	170 ... 190 km (urban cyce)
Drive	16 kW PEM Fuel Cell
Motor	70/140 kW
Fuel	Hydrogen (99.99%)
Hydrogen storage	9.6 kg @ 350 bar
Energy storage	Lithium Ferrite



HyPM HD 16





Thank You

Changing power
...Powering Change