H3 Dynamics

HYDROGEN-ELECTRIC UAS

Power Solutions & Accessories

2023 Catalog

www.h3dynamics.com

H3 Dynamics

PRODUCTS AND SERVICES OVERVIEW

FUEL CELL SYSTEMS

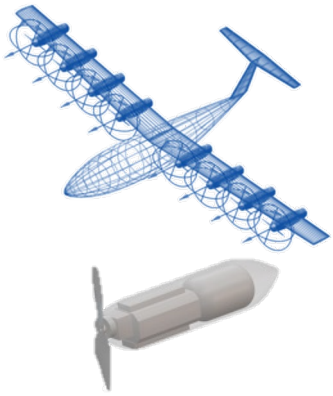
HYDROGEN STORAGE

COMPRESSORS

H2 PROPULSION NACELLES

H2 PRODUCTION & REFILLING

HYDROGEN UAS



CUSTOM SOLUTIONS

ENABLING HYDROGEN-ELECTRIC UAS

Power Solutions & Accessories

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H2FIELD-1 HYDROGEN REFUELING STATION

H³Dynamics

Access to hydrogen is a requirement for remote field operations. H3 Dynamics provides a unique mobile automatic refilling trailer to directly produce hydrogen from water. This trailer has the capability of refilling a 9L - 350 bar cylinder in under 2.5 hours continuously or in a couple of minutes depending on configuration

The Mobile Refilling Station is an automated turnkey system, easy to operate with little to no user intervention once started. The system fully controls the production of hydrogen gas and safely monitors the high-pressure filling of the hydrogen cylinder. It is designed to minimize maintenance and consumable requirements.

WATER → WATER PURIFICATION → ELECTROLYZER → DRYER → ACCUMULATOR → PRESSURE BOOSTER → HYDROGEN CYLINDER

WATER PURIFICATION SYSTEM

Input Water Maximum Salinity	> 99.999 %
Input Water Temperature Range	0 - 35 °C
Output Water Production Rate [1]	1.3 L / min

WATER STORAGE

Capacity	38.5 L
Max. Outlet H_20 Flow Rate	3.8 L / min
Water Tank H_2 Yield	160 L_{H2} at 350 bar

DRYER

H_2 Flow Rate	Up to 1 Nm^3/h
H_2 Output Purity	> 99.999 %
Average Dew Point [2]	< - 70°C

ELECTROLYZER

H_2 Production Rate	1 000 NL/h or 2.157 kg / 24h
H_2 Output Purity	> 99.999 %
Water Consumption	0.8 L / h

POWER

Power Supply	200 - 240 VAC | 50 / 60 Hz
Average Power (no booster)	5.7kW
Peak Power (no electrolyzer)	4.6kW
Peak Power	9.3kW

TRAILER

Box Dimensions	L: 2 140 mm | W: 1 550 mm | H: 1090 mm
Full Trailer Dimensions	L: 3 355 mm | W: 1 950 mm | H: 2 040 mm
Total Weight	1 600 kg
Mounting Points	4 x ½-UNC13

[1] Edith 500 mg/L TDS and 20 °C input water
[2] Compliant with ISO 14687

HYCOPTER HYDROGEN MULTI-ROTOR DRONE

UP TO 3.5 HOURS FLIGHT ENDURANCE

H³Dynamics

HYCOPTER is a hydrogen electric hexacopter drone capable of long endurance flight, making large-scale inspections easier and faster, compared to conventional battery UAVs.

The HYCOPTER integrates a lightweight airframe that houses an open cargo bay allowing multiple payload options. Featuring a modular design and an adjustable center of gravity (CG), the HYCOPTER can be perfectly balanced regardless of the payload and cylinder configuration.

The HYCOPTER is powered by H3 Dynamics AEROSTAK 2000 fuel cell, carries one hydrogen gas cylinder and has an emergency battery backup on board as a failsafe.

AIRCRAFT

MTOW	16.5 kg
Dimensions [1]	D : 1 450 mm | H : 500 mm
Flight Time [2]	Up to 3.5 h
FC Nominal Power [3]	2 000 W
LiPo Peak Power	4 000 W (< 10 s)
Oper. Temperature	-5 °C to 45 °C
Flight Controller	Pixhawk 2.0
Max. Speed [4]	48 km/h
Max. Ascendent Speed [4]	3.2 m/s
Max. Descendent Speed [4]	2.2 m/s
Max. Tilt Angle	32 °
Pitch	150 °°/s
Yaw	80 °°/s
Wind Survivability	32 km/h

[1] Excluding propellers
[2] Depending on H_2 cylinder and payload
[3] Using the Aerostak A-2000
[4] Payload dependent
[5] Optional

PAYLOAD

Volume	L : 260 mm | W : 330 mm | H :200 mm
Max. Weight	2.5 kg
Power Options	Fused 5V 1.5A, 12V 2A, Fused 32V-52V 3A
Max. Power [5]	180 W

REMOTE CONTROLLER

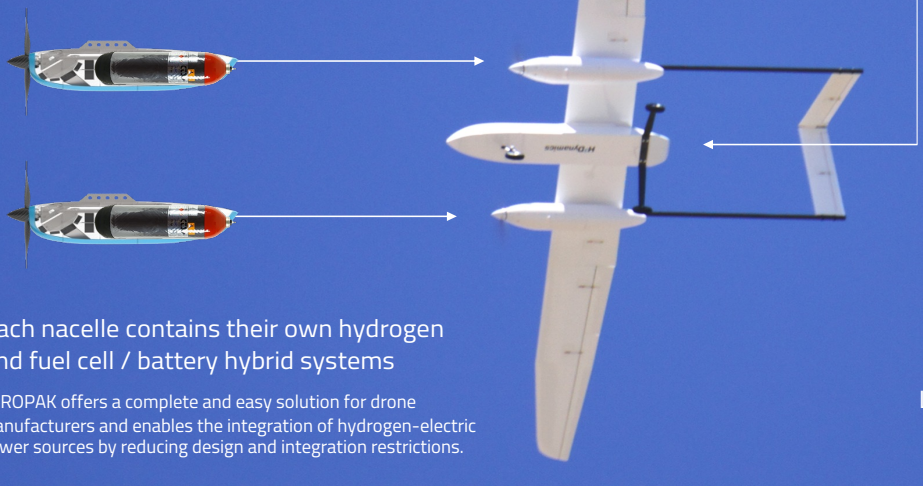
Model	HereLink
Operational Frequency	2.4 Ghz
Battery	4 950 mAh LiPo
Max. Transmitting Distance	FCC : 20 km | CE , SRRC : 12 km

The AEROPAK is a nacelle with a fully integrated hydrogen-electric powertrain to power fixed wing or VTOL drones.

AEROPAK HYDROGEN PROPULSION NACELLES

2X Distributed hydrogen nacelles

- 500W / 6.8L tank
- 5 to 15-hour flight endurance
- 7.8kg
- 110cm length
- 22cm diameter



Main fuselage is totally empty: more room for payload and freight.

30L / 5kg available for a 25kg TTOW UAS
(data can vary based on configuration)

AEROPAK can be distributed along the wing to increase overall propulsive power and to add redundancy.

Liquid or pressurized hydrogen gas storage

Each nacelle contains their own hydrogen and fuel cell / battery hybrid systems

AEROPAK offers a complete and easy solution for drone manufacturers and enables the integration of hydrogen-electric power sources by reducing design and integration restrictions.

AEROPAK-400	
Weight	5.8 kg
Dimensions	L: 800 mm D: 180 mm
Nominal Propulsive Power[1]	300 W
Propulsive Peak Power	1 100 W
Estimated Flight Time	3 h
Control	ESC/PWM

AEROPAK-800	
Weight	7.8 kg
Dimensions	L: 1 110 mm D: 220 mm
Nominal Propulsive Power[1]	520 W
Propulsive Peak Power	1 151W
Estimated Flight Time	5 h
Control	ESC/PWM

AEROPAK-1200	
Weight	11.5 kg
Dimensions	L: 1 100 mm D: 270 mm
Nominal Propulsive Power[1]	780 W
Propulsive Peak Power[1]	1 800 W
Estimated Flight Time	3h
Control	ESC/PWM

[1] 90 % motor and esc efficiency and 80 % propeller efficiency

AEROSTAK HYDROGEN FUEL CELL SYSTEMS FOR UAS

WORLD'S MOST POWER DENSE PEM FUEL CELL SYSTEMS

H³Dynamics

Introducing a full range of advanced ultra-light hydrogen fuel cell systems, from 250W to 6kW nominal power. AEROSTAKs feature a feather-light PEM fuel cell stack, full balance of plant, control electronics, LiPo-compatible hybrid electronics, and a transportable hard casing. They are plug and play, with performance data communication and software for viewing. Pair with high-performance hydrogen storage options, tiny pressure regulators, and refilling solutions for a complete power solution in lab and in the field.

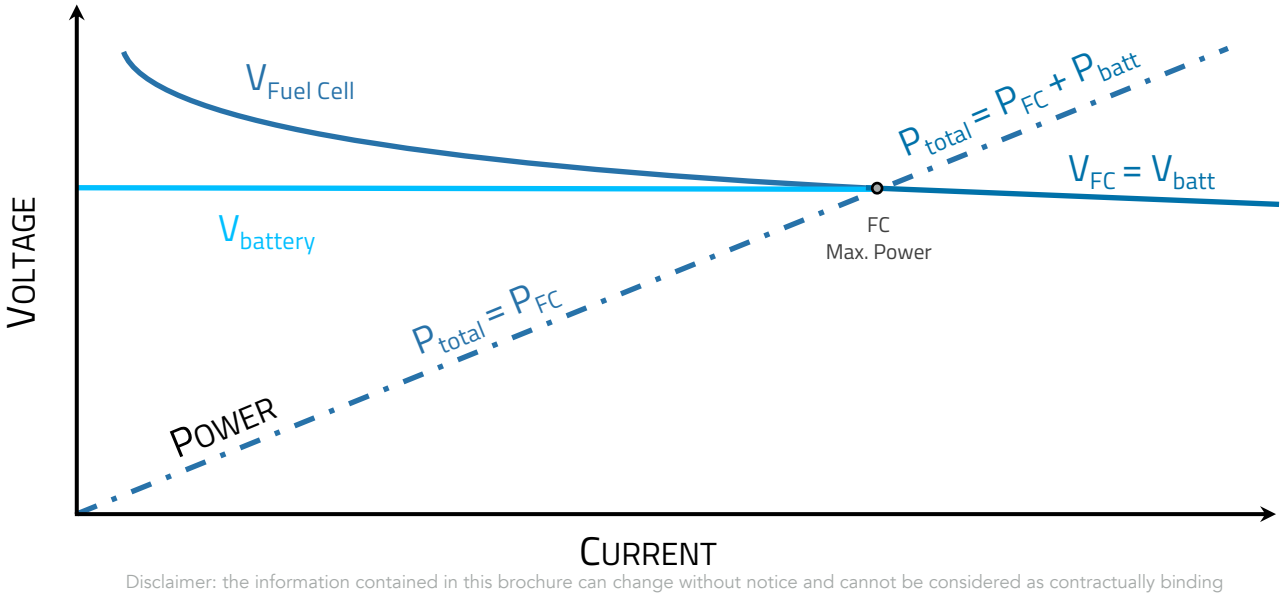
Operational data (voltage, current, power, temperature) can be provided via RS232 connection to ground control equipment. Wireless data transmission is optional. LiPo battery powers startup and provides peak power to supplement the fuel cell stack and optimize system size. Our hybrid card offers up to 1.5A for battery recharge during excess power conditions.

Standard system features:

- Remote ON/OFF button
- RS232 Data monitoring (Connect via USB)
- Maintenance cycle signal
- Waterproof hard case for transport
- H2 supply tube and quick-connect
- Performance monitoring software

Specialty add-ons:

- DC/DC converter
- Wireless telemetry
- Custom firmware development
- Scalable power architecture to reach higher power
- Custom integration and engineering
- Integrated Shock and Vibration Damping



A-2000 (2000W)

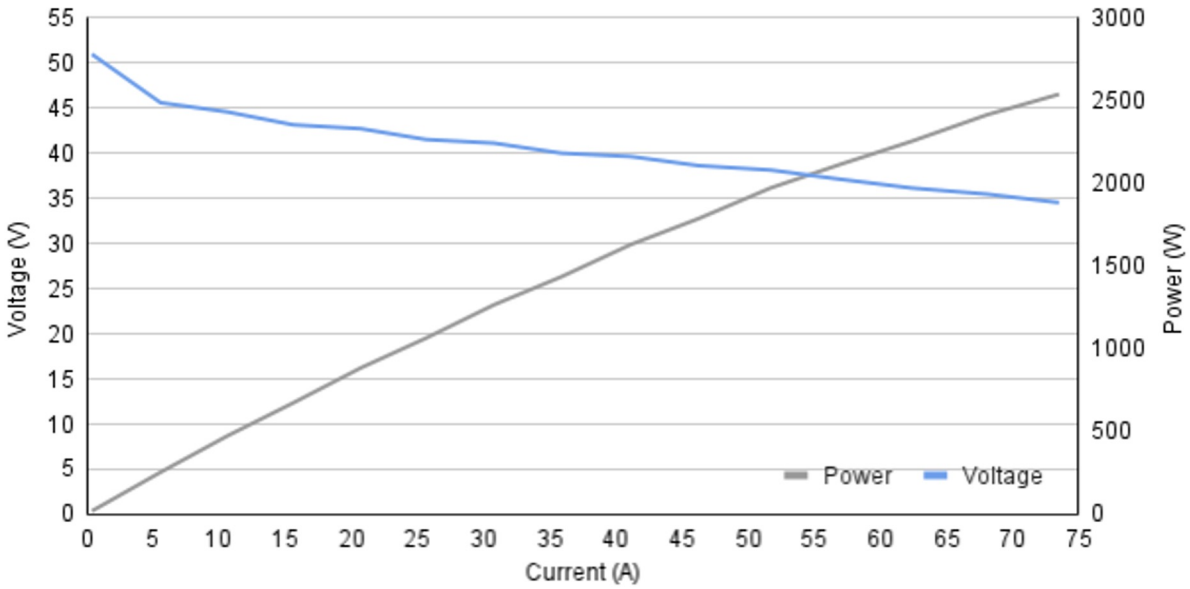
ADVANCED LIGHTWEIGHT FUEL CELL SYSTEM

H³Dynamics

AEROSTAK 2000 is suitable for larger payload multi rotor UAV, for fixed wing, VTOL and other higher power mobile applications.

Stack Design	55 cells
Rated Power (FC)	2 000 W
Max Power (FC)	2 200 W
Peak Power (FC + battery)	**up to 8 000 W**
Voltage	33.0 - 53.0 V
Current	0 - 60 A
Weight	**3 kg**
Specific Power	667 W/kg
Power Density	240 W/L

Dimensions	339 x 143 x 172 mm
Cooling	Air
Air Input Temperature	0 - 40°C
Hydrogen Input Pressure	0.6 - 0.8 bar
Hydrogen Purity Required	99,998%
Max. Consumption	< 21.0 L/min
Start Up Time	< 20 s
Suggested Hybrid LiPo	9S (>100C)



A-1200 HV (1200W)

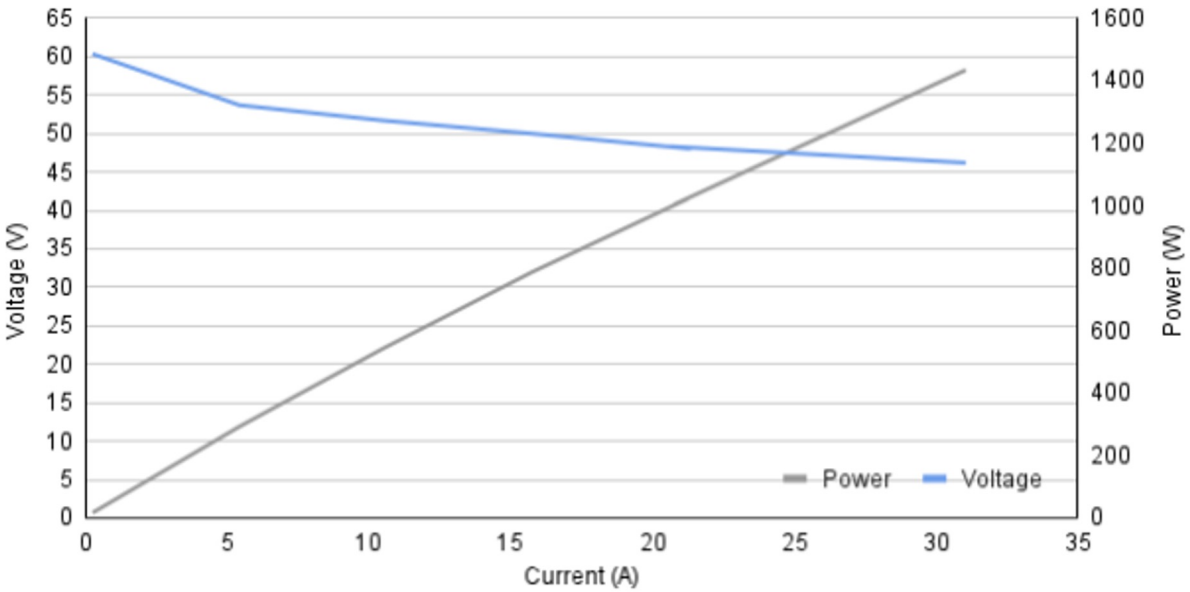
ADVANCED LIGHTWEIGHT FUEL CELL SYSTEM

H³Dynamics

AEROSTAK 1200-HV is designed to power large fixed wing drones and mid-sized multi rotor UAV's (<10 kg MTOW), as well as other portable applications.

Stack Design	65 cells
Rated Power (FC)	1 200 W
Max Power (FC)	1 400 W
Peak Power (FC + battery)	**3 800 W**
Voltage	39.0 - 61.8 V
Current	0 - 32 A
Weight	**2.1 kg**
Specific Power	570 W/kg
Power Density	252 W/L

Dimensions	194 x 127 x 193 mm
Cooling	Air
Air Input Temperature	0 - 40°C
Hydrogen Input Pressure	0.6 - 0.8 bar
Hydrogen Purity Required	99,998%
Max. Consumption	< 12.5 L/min
Start Up Time	< 20 s
Suggested Hybrid LiPo	10 S (>100C)



A-1200 LV (1200W)

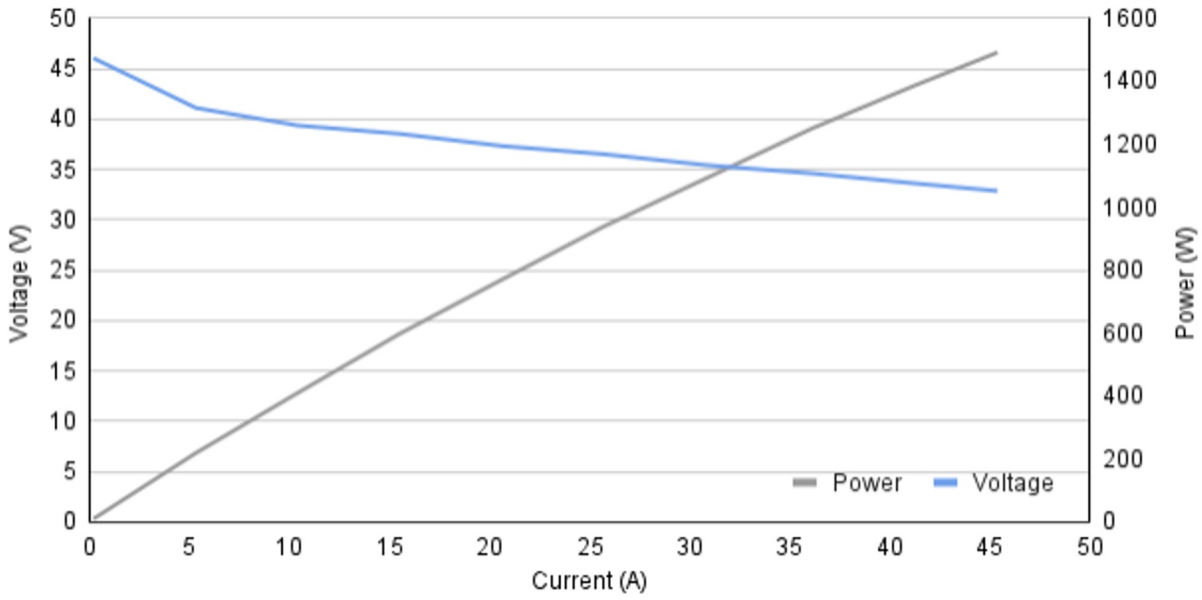
ADVANCED LIGHTWEIGHT FUEL CELL SYSTEM

H³Dynamics

The AEROSTAK 1200-LV has been designed to power large fixed wing drones and mid-sized multi rotor UAV's (<10 kg MTOW), as well as other portable applications.

Stack Design	50 cells
Rated Power (FC)	1 200 W
Max Power (FC)	1 400 W
Peak Power (FC + battery)	**3 250 W**
Voltage	32.0 - 47.5 V
Current	0 - 47 A
Weight	**2.15 kg**
Specific Power	560 W/kg
Power Density	236 W/L

Dimensions	279 x 127 x 143 mm
Cooling	Air
Air Input Temperature	0 - 40°C
Hydrogen Input Pressure	0.6 - 0.8 bar
Hydrogen Purity Required	99,998%
Max. Consumption	< 12.5 L/min
Start Up Time	< 20 s
Suggested Hybrid LiPo	8 S (>100C)



A-800 (800W)

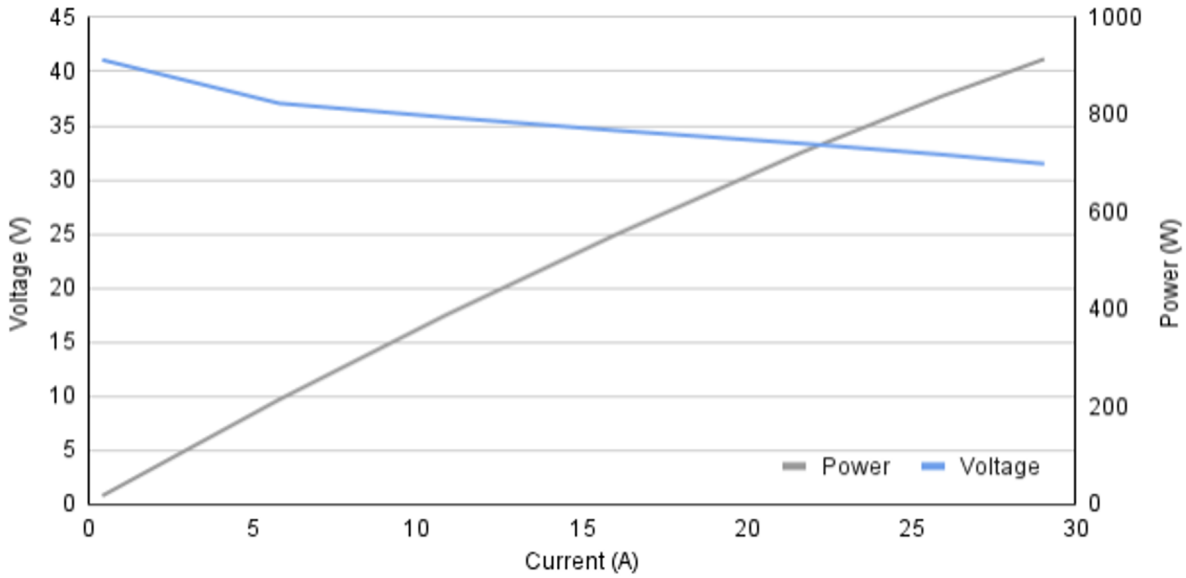
ADVANCED LIGHTWEIGHT FUEL CELL SYSTEM

H³Dynamics

The AEROSTAK 800 has the perfect power and form factor for fixed wing and VTOL drones.

Stack Design	45 cells
Rated Power (FC)	800 W
Max Power (FC)	1 000 W
Peak Power (FC + battery)	**2 750 W**
Voltage	27.0 - 42.8 V
Current	0 - 30 A
Weight	**1.23 kg**
Specific Power	645 W/kg
Power Density	235 W/L

Dimensions	214 x 123 x 130 mm
Cooling	Air
Air Input Temperature	0 - 40°C
Hydrogen Input Pressure	0.6 - 0.8 bar
Hydrogen Purity Required	99,998%
Max. Consumption	< 8.3 L/min
Start Up Time	< 20 s
Suggested Hybrid LiPo	7 S (>100C)



A-300 (300W)

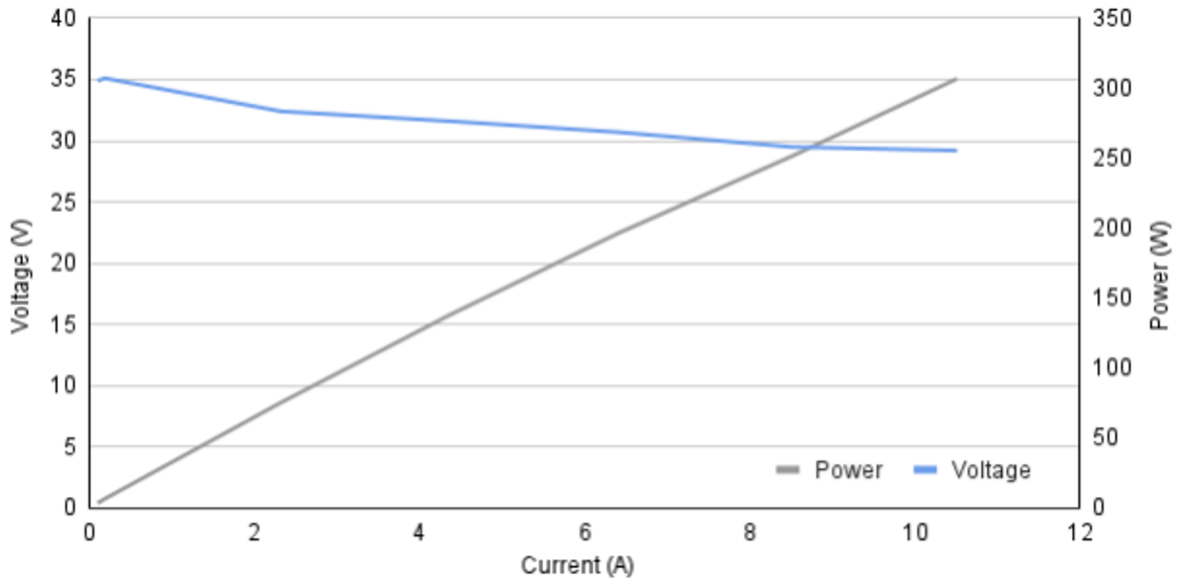
ADVANCED LIGHTWEIGHT FUEL CELL SYSTEM

H³Dynamics

AEROSTAK 300 is ideal for powering smaller fixed wing drones, scaled demonstrators, research, and other low-powered hydrogen applications.

Stack Design	37 cells
Rated Power (FC)	300 W
Max Power (FC)	350 W
Peak Power (FC + battery)	**800W up to 2 210W**
Voltage	22.2 - 35.2 V
Current	0 - 13 A
Weight	**0.72 kg**
Specific Power	486 W/kg
Power Density	208 W/L

Dimensions	122 x 123 x 112 mm
Cooling	Air
Air Input Temperature	0 - 40°C
Hydrogen Input Pressure	0.6 - 0.8 bar
Hydrogen Purity Required	99,998%
Max. Consumption	< 3.1 L/min
Start Up Time	< 20 s
Suggested Hybrid LiPo	7 S (>100C)



COMPATIBLE WITH
AEROSTAK PEM FUEL CELL
H_2 PRESSURE REGULATOR

A-Series Pressurized H_2 Gas Cylinders 350 bar

Pressure Regulator sold separately

H³Dynamics

A-Series cylinders are designed and manufactured following the best practices in the industry. They have a working pressure up to 350 bar and use a M18x1.5 thread compatible with our ultra-light pressure regulator.

	Weight [1]	Water Capacity	Hydrogen Mass	Dimensions	Specific Energy	Energy Density	Electrical Energy [2]
A5	1.65 kg	5 L	120 g	⌀ : 152 mm L : 395 mm	8 725 kJ/kg	2 879 kJ/L	2 000 Wh
A9	2.65 kg	9 L	216 g	⌀ : 173 mm L : 528 mm	9 779 kJ/kg	2 879 kJ/L	3 600 Wh
A12	3.30 kg	12 L	288 g	⌀ : 196 mm L : 532 mm	10 471 kJ/kg	2 879 kJ/L	4 800 Wh
A20	7.05 kg	20 L	480 g	⌀ : 230 mm L : 655 mm	8 169 kJ/kg	2 879 kJ/L	8 000 Wh

[1] Excluding Pressure Regulator
[2] Estimated at 50 % efficiency

COMPATIBLE WITH
AEROSTAK PEM FUEL CELL
H_2 PRESSURE REGULATOR

EN 12245

F-SERIES PRESSURIZED H_2 GAS CYLINDERS 300 BAR

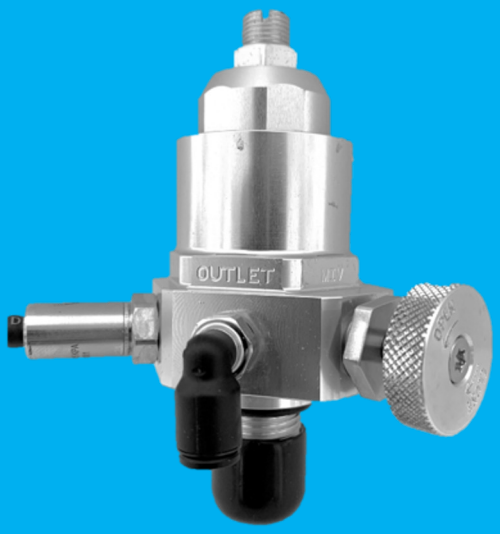
PRESSURE REGULATOR SOLD SEPARATELY

H³Dynamics

F-Series cylinders are designed and manufactured in conformity with EN 12245. The Series F have a working pressure up to 300 bar and a M18x1.5 thread compatible with our ultra-light pressure regulator.

	Weight [1]	Water Capacity	Hydrogen Mass	Dimensions	Specific Energy	Energy Density	Electrical Energy [2]
F2	1.46 kg	2 L	42 g	⌀ : 114 mm L : 371 mm	3 477 kJ/kg	2 538 kJ/L	705 Wh
F3	1.75 kg	3 L	63 g	⌀ : 120 mm L : 445 mm	4 351 kJ/kg	2 538 kJ/L	1 060 Wh
F6	2.89 kg	6 L	127 g	⌀ : 161 mm L : 481 mm	6 269 kJ/kg	2 538 kJ/L	2 115 Wh
F6.8	3.09 kg	6.8 L	144 g	⌀ : 161 mm L : 520 mm	5 585 kJ/kg	2 538 kJ/L	2 400 Wh
F7.2	3.29 kg	7.2 L	152 g	⌀ : 166 mm L : 550 mm	5 554 kJ/kg	2 538 kJ/L	2 540 Wh
F9	4.06 kg	9 L	190 g	⌀ : 186 mm L : 545 mm	5 626 kJ/kg	2 538 kJ/L	3 175 Wh
F13[3]	6.25 kg	13 L	275 g	⌀ : 225 mm L : 542 mm	5 076 kJ/kg	2 538 kJ/L	4 583 Wh

[1] Excluding Pressure Regulator, in Light Version
[2] Estimated at 50 % efficiency
[3] Goes up to 310 bar



COMPATIBLE WITH
AEROSTAK PEM FUEL CELLS SYSTEMS
A-SERIES AND F-SERIES CYLINDERS

Ultralight H_2 Gas Pressure Regulator

Pressure Regulator sold separately

H3Dynamics

The pressure regulator provides safety and performance in an ultralight package of only 300 grams. The single-stage regulator reduces pressure up to 350 bar storage to less than 1 bar with accurate reliable control. It includes a fill port, an outlet port, a transducer to monitor pressure inside the cylinder, a pressure gauge, a safety burst disk and a manual shut off valve. H3 Dynamics can also provide a refilling kit along with the regulator, to refuel the cylinder with hydrogen from a bottle.

Gas	Hydrogen
Material	Aluminum
Weight	305 g
Type	Single Stage
Max Input Pressure	350 bar
Adjustable Output Pressure [1]	0-1 bar
Cylinder Thread	M18 x 1.5
Outlet Port	1/8" NPT
Fill Port	1/8" NPT
Length	107 mm
Max Flow	< 45 slpm at 0.5 bar

[1] Higher output pressures available

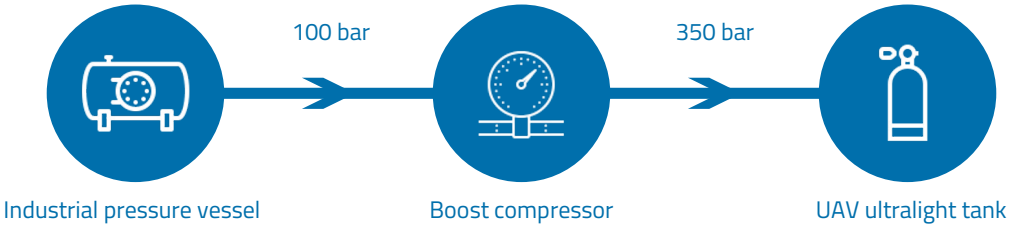
COMPATIBLE WITH
A SERIES & F SERIES CYLINDERS
H_2 PRESSURE REGULATOR

ELECTRIC BOOST COMPRESSOR

BOOSTS PRESSURE FILLING UP TO 300 OR 350 BAR

H3 Dynamics

H3 Dynamics' electric gas booster pump system increases a low-pressure hydrogen supply to allow filling of high pressure (300-350 bar) composite cylinders. The pump is self-contained with gauges, valves, an hour meter and a power switch. The pump includes a high and low pressure safety switch as well as a high pressure safety relief valve.



Dimensions	L: 940 mm | H: 292 mm | D: 559 mm
Weight	65.9 kg
Voltage [1]	120 or 240 VAC single phase
Motor Frequency	60/50 Hz
Operational Speed [2]	70 cycles/min
Cooling	Air cooled
Noise	< 63 dB
Maximum Inlet Pressure	372 bar
Minimum Inlet Pressure	34 bar
Maximum Outlet Pressure	386 bar
Maximum Flow Rate [3]	617 slpm
Power Usage	15 A

[1] Other voltages available as well as 3 phases
[2] Variable Speed Option
[3] Dependent on input pressure

(NEW) LIQUID HYDROGEN STORAGE TANK

H³Dynamics

Designed for UAV applications

Volume	**12L**
Empty Weight	**2.6 kg**
Length	700 mm
Outside Diameter	205 mm
Volumetric Capacity	30 – 40 g/L
Gravimetric capacity	0-25 %wt
MAWP	3 barg
Material	Titanium

Includes

Digital Pressure Gauge
Relief Valve
Heater (24V)
Pressure regulator

110L version under development

Fueling long-endurance LH2-electric drones

H2 Liquefier Stationary Hydrogen Liquefier

H³Dynamics

GH2 source → LN2 Pre-Cooler → GM Cryocooler → JT Valve → LH2 Tank

The application of liquid hydrogen is the next major step for long-endurance missions. H3 Dynamics provides a stationary liquefier to produce liquid hydrogen from gaseous hydrogen on-site. The station can handle low purity GH2 (~ 99 %) and convert to > 99.95 % pure LH2 with only He as remaining impurity.

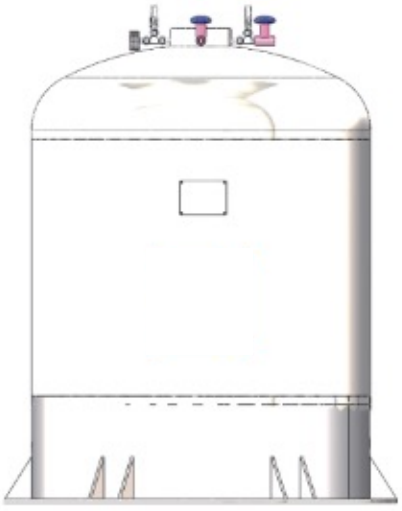
The liquefaction rate ranges from 1.5 kg/day to 100 kg/day and can be combined with a wide selection of LH2 storage tanks (100 – 2,000 L).

GM1 (1 cryocooler)	
Capacity	1.5 kg/day
GH2 pressure	+1 bar
Storage	100L LH2 storage

GM3 (3 cryocooler)	
Capacity	15 kg/day
GH2 pressure	+1 bar
Storage	250L LH2 storage

GM2JT (2 cryocooler & Regenerator)	
Capacity	50 kg/day
GH2 pressure	+10-30 bar
Storage	1000L LH2 storage

GM3JT (3 cryocooler & Regenerator)	
Capacity	100 kg/day
GH2 pressure	+10-30 bar
Storage	2,000 L LH2 storage



LH2 Buffer Storage Tank

H³Dynamics

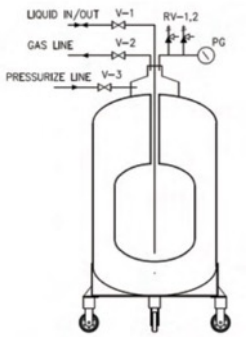
Liquid Hydrogen buffer storages enable a quick refilling of fuel tanks for mobile application. H3 Dynamics offers buffer storages with a volume of 50 L and 250 L. The tanks have a low boil-off rate of less than 4 %/day and are welded out of stainless steel. The tank uses a vapor cooled shield technology that keeps the inside at low temperatures. Transfer lines can be connected using the vacuum insulated bayonet interface. Filling equipment for the mobile tank is included.

50L LH2 Storage Tank

Net Volume	50 L
Total Volume	56 L
Tank Weight	156 kg
Boil-off rate	Max. 2.0 L/day
Storage Pressure	0 – 12 bar
Maximumum allowable pressure	12 bar

250L LH2 Storage Tank

Net Volume	250 L
Total Volume	280 L
Tank Weight	200 kg
Boil-off rate	5.0 L/day
Storage Pressure	0 – 12 bar
Maximumum allowable pressure	12 bar



Schematic

V-1	Liquid in/out valve
V-2	Gas vent valve
V-3	Pressurizing valve
RV-1	Relief valve 1 (11.4 bar)
RV-2	Relief valve 2 (12.0 bar)
PG	Pressure gauge

H3 Dynamics

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Contact: sales@h3dynamics.com

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