Press Release: May 1st, 2019

LAS, Electric Rocket

Current rockets are using polluting, explosive, corrosive, toxic, carcinogenic propellants. At launch, a rocket releases polluting chemicals into the atmosphere as much as 1 million cars running simultaneously.

ARCA created an electric, water based rocket that works as first stage, or booster for launch vehicles, allowing the reduction of polluting propellant with around 25%, or boost the payload capability with around 30%, pollution free. Such system isn't only clean, but unprecedently safe and cost effective.

But how such engine works?

The rocket tank is filled with 98% water and benign phase destabilizers. The water is electrically heated to 250°C. When the water is injected into the engine, part of it flashes into water vapors. A second heating phase occurs in the engine powered by high discharge LiPo batteries. The same type of batteries used by ARCA to power the cutting edge, 700kW ArcaBoard. At 42MW, the amount of electric energy released during engine run is more than what a small nuclear reactor generates. Solar and wind power can recharge the rocket's batteries.

Using water as propellant has another groundbreaking advantage: cost. Decades long efforts of the industry to reduce launch cost were unsuccessful. The root cause of rocket's high cost is the type of propellants and related complexity. They are polluting, volatile, explosive, corrosive, toxic, cryogenic, carcinogenic, requiring extreme safety measures, complex fabrication and operations. This leads to an unavoidable result: extremely high costs.

Like early electric cars, an electric rocket is not as efficient as one using polluting fuels. But it's ideal as launch booster, or first stage, because it's able to generate extremely high thrust at launch. ARCA named it Launch Assist System (LAS).

The rockets are using the majority of their fuel at take off when they are heavy. LAS can accelerate rockets to 3,000m and Mach 2, reducing the polluting propellants with 25%, or increase their payload capability with 30%, using just water and electricity. New, more advanced designs like ARCA's Haas 2CA Single Stage to Orbit Rocket will reduce its polluting propellant mass from 16 to 6 tons using 18 tons of water instead.

LAS is built by ARCA in two configurations: an expendable and a fully reusable one. ARCA is currently testing a 25 tons of thrust expendable version, called LAS 25D, that will be shortly followed by a larger reusable vehicle, LAS 50R, already under construction.

The current reusable rockets didn't deliver the expected cost cut and fast turnaround. After each flight the vehicles need to be extensively checked and refurbished. The components affected by high temperatures and pressures have to be replaced. Due to benign nature of water, LAS will land, be refueled from the sea and reused like a true shuttle, providing high frequency launch services, attempting to solve decades-long efforts to achieve significant cost reduction of orbital launches.

In regards to space tourism, or manned spaceflight in general, current vehicles use polluting propellants. In terms of safety, what more can a paying space tourist ask for, than water as fuel?

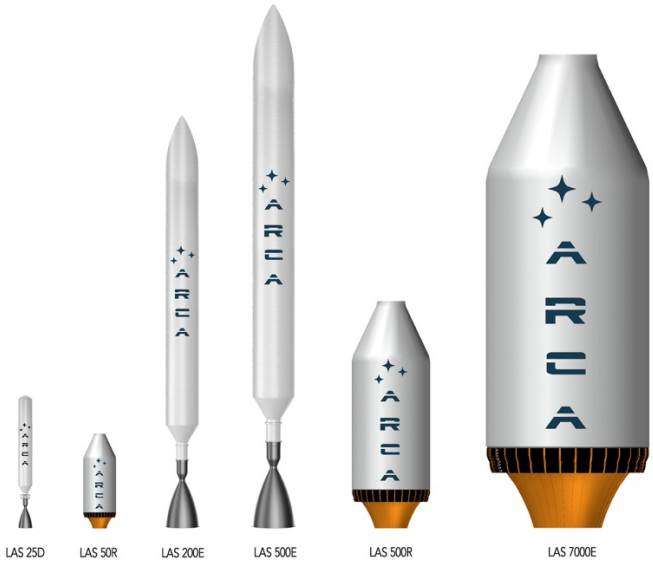
ARCA is considering a heavy orbital rocket launcher, to compete with the most powerful, but also one of the most polluting rockets: Falcon Heavy and SLS Block 1. Haas Heavy, will be able to put 60 tons into low earth orbit, while 70% of its total mass will be water.

The proposed LAS vehicles have the following technical characteristics and performance:

Table 2

Characteristic	LAS 25D	LAS 50R	LAS 200E*	LAS 500E*	LAS 500R	LAS 7000R
Application	Test bed	Haas 2CA Mini	Intended for Vulcan class rockets.	Intended for Ariane 62 class rockets.	- Haas 3 - Intended for Vega class rockets.	Haas Heavy
Propellant	98% water + 2% benign, clean phase destabilizers;					
Engine type	Bell nozzle.	Toroidal aerospike.	Bell nozzle.	Bell nozzle.	Toroidal aerospike.	Toroidal aerospike.
Reusable	N/A	Yes	No	No	Yes	Yes
Diameter (m)	1.2	2.4	2.4	3.4	6	12
Length (m)*	9.2	7.2	28	44	18	36
Empty mass (t)	1.8	4.8	6.8	19.4	42	390
Water mass (t)	8	18	80	200	200	2,800
Tank pressure (bar)	28	40	40	40	40	40
Engine thrust sea level (tf)	25	50	200	500	500	7,000
Specific impulse (s)	50	67	50	50	67	67
Engine run time (s)	16	23	20	19	26	25
Max. altitude with payload (m)	N/A	3,200	N/A	N/A	3,100	3,600
Max. velocity with payload (km/h)	N/A	1,500	N/A	N/A	1,200	1,400
Max. altitude no payload (m)	N/A	15,100	27,000	27,000	23,300	50,000
Max. velocity no payload (km/h)	N/A	2,300	3,700	4,600	2,700	4,600
Payload mass (t)	N/A	6.6	N/A	N/A	95	1085

* It will be developed only if clear orders exist. For now there's only ARCA's intention to propose them for the indicated vehicles. No discussions with third parties were initiated as of now.



There are plans from space agencies and companies to use the resources from other planets to produce the rocket propellants onsite in support for spaceships sent from Earth.

For instance, there are plans to obtain methane from CO_2 and liquid oxygen from water through electrolysis and then liquefaction, on Mars. These are indeed possible, but involves additional equipment and effort. On the other hand, icy water is abundantly found in the Solar System, on the Moon, Mars, Europa, Enceladus, Titan, the asteroids, etc. A LAS technology vehicle will just require ice in the tank. The ice will melt using the onboard resistors. In this way, LAS could become a good choice for a deep space exploration vehicle since its propellant is abundantly found through the Solar System.

Without considering potential orders from third parties for the LAS technology, ARCA will continue with the ground tests of LAS 25D towards the middle of 2019 and will start the construction of LAS 50R with the first VTOL flight scheduled for the fall of 2019.

We will also continue with the development of Haas 2CA Mini that works in conjunction with LAS 50. The first flight of Haas 2CA Mini + LAS 50R should be expected for 2020, when we should also expect the start of commercial services for small payloads of 200kg to LEO.

The development of Haas 3 + LAS 500R with capabilities of 3000kg to LEO should start in 2021 with the first flight expected in 2022, followed by the launch of commercial services in 2023.

The construction start of Haas Heavy + LAS 7000R should be expected in 2022 with the LAS 7000R VTOL flights performed in 2023 and the complete vehicle first flight in 2024.

LAS is a stepping stone for a new generation of clean, safe and affordable rockets.

Read more about the LAS technology in the White Paper:
http://www.arcaspace.com/docs/ARCA_LAS_White_Paper_May_1_2019_Issue_1.pdf

Video - LAS, Electric Rocket: https://youtu.be/zV8j08mCBEs

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