

A TRAVEL INTO SPACE

AND THEY ARE WELL ON THE WAY



- And we had not come very far if it had not been for Migatronik who has spent nearly half a century on optimizing welding technology.

**Kristian von Bengtson and Peter Madsen
fra Copenhagen Suborbitals**

Kristian von Bengtson with the hatch for the space capsule

Kristian von Bengtson and Peter Madsen of Copenhagen Suborbitals aim high but the words come straight from their hearts.

Kristian von Bengtson is a trained architect and has worked at NASA's manned space centre in Houston, Texas. Peter Madsen has no formal education beyond high school but has designed and built three functioning submarines. The latest is 18 metres long and weighs over 32 tons. He has

sent into the stratosphere from a position at sea 20 nautical miles east of the Danish island Bornholm. Permission has recently been given by The Admiral Danfleet Headquarters and the Danish Maritime Authority.

The first astronaut will be a dummy but in the longer term, Peter Madsen himself intends to travel into space in his home-built rocket.



Peter Madsen at the space rocket engine itself

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**Kristian von Bengtson,
Copenhagen Suborbitals**

studied engineering and can be described as a rocket artist and submarine builder. Quite recently, the partners have attracted media attention with a spectacular test of their home-built rocket engine at the former B&W shipyard in Copenhagen. The rocket is called HEAT and is one of the world's strongest amateur-built rocket engines. The propellant weighs a ton.

Everything takes place in a rusted hangar in Corten steel, situated furthest away in the B&W shipyard area. The rocket engine has been tested and in August, the entire space rocket will be

The hangar in Copenhagen accommodates several "production units". In the front part, Kristian von Bengtson works on the space capsule. It lies in a kind of cradle, allowing it to be rotated so that it is easier to work on it. Beside the space capsule is a prototype of the astronaut's seat. Further inside the hangar, Peter Madsen hangs out with the rocket engine. There is also an office in the hangar with long tables, computers, a newly built hatch for a rocket and a small lunch table with coffee cups, soft rolls and chocolate biscuits. Mattresses up against the wall are for the rocket builders to sleep on when they run out



Peter Madsen with the Migatronik Omega Advanced welding machine

of time working on their dream project day and night.

Migatronik-engineer noticed rocket builders' search

Four welding machines from Danish welding machine manufacturer Migatronik play a decisive part in the project. Without these green welding machines (including a "Mamba", a "Navigator", an "Omega Advanced" and a "Tig Pilot"), the rocket builders would not be able to carry through their plans.

- We build everything ourselves,

the space rocket, the launch tower, and the catamaran for carrying the rocket into the sea. That would not be possible without easy-to-use and efficient welding machines. The mere fact that we are able to weld, makes this project possible. We are up against large pressurized workpieces and welded steel structures that must be absolutely tight and very strong. If we should have bolted or riveted like in the old days, we would not have been able to cope with it. We enjoy the benefits of the welding process which Migatronik has developed on the basis of our production requirements.



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Moreover, we have found exactly the welding machines that suit our type of welding operations, says Peter Madsen.

- For the rocket ship, I mostly Tig weld, using a small mobile Tig Pilot. That is typically in mild steel in 1.25 mm plates, says Kristian von Bengtson, pointing at the round entrance hatch for the space capsule where he has welded a headrest and a window.

The rocket builders found the welding machines by advertising for a special welding machine in the Danish magazine "Ingeniøren", where they contribute to the blog "A different way of space travel".

- For a long time we advertised for a welding machine that could weld both thin and thick plates, and as good luck would have it, Migatronik engineer Anders Jørgensen was following us on the blog and told us that they had such a machine at the factory in Fjerritslev, says Kristian Bengtson.

- It makes things easy. We can sit here by the computer, get a good idea and then turn on our heels and go into the hall to weld together the things that we have in mind, says Peter Madsen.

A delicate long seam

Three different welding processes are used by the rocket builders.

- The launch ramp and the launch vehicle are Mig welded in 4-10 mm thick steel. More or less the same procedure is used for structural parts of the booster rocket itself and the combustion chamber, and also in mild steel. The powerful Navigator machine is used for conventional Tig welding of the thin-walled plates in

the booster rocket. The Mamba, of course, is used if we need to be mobile or if we are welding outside in windy weather. Plasma welding is used for very strong welds, says Peter Madsen.

The long seam in the booster rocket tank for liquid oxygen is particularly important. The tank gets 183 degrees cold when it comes in contact with the extremely volatile rocket fuel and is therefore built in austenitic stainless steel. The long seam is the heaviest loaded weld in the booster rocket which is why the rocket builders chose to have this particular welding operation carried out by others. The plasma welding operations are carried out by the Danish company Vestjysk Stålteknik in a long-seam automatic machine.



We believe in the project and we are being taken more seriously in professional circles now

**Kristian von Bengtson,
Copenhagen Suborbitals**

- The tank section was subsequently subjected to a hydrostatic pressure test and in fact, the long seam turned out to be stronger than the base material. The tank was subjected to a pressure that was higher than the theoretical permanent elongation limit of steel. Even so, there was no permanent distortion after the test. It is extremely satisfactory when welds are better than what is theoretically possible.

Weirdos?

According to Kristian von Bengtson, they are fully aware that

throughout the years, people have some times considered them genuine weirdos.

- But we believe in the project and we are being taken more seriously in professional circles now, he says.

- We would like to be regarded as a bright spot in times of crisis and inspire others to act out something that everybody considers impossible. Just imagine! In only three years we may be able to leave this planet in a home-built spacecraft. It is a fundamental thing to be able to leave earth in something that you have invented, designed and built with your own hands. And Denmark will be the fourth nation in the world to be able to independently launch its citizens into space – behind

the USA, Russia and China. And we are doing it without spending taxpayers' money on it, says Peter Madsen.

The partners spend all their time on the space project. Resources to finance the project come from a fund contributed to by private persons and various enterprises.

- And apart from that, we earn our living by lecturing to companies and turning every penny.

