Swiss
Propulsion
Laboratory

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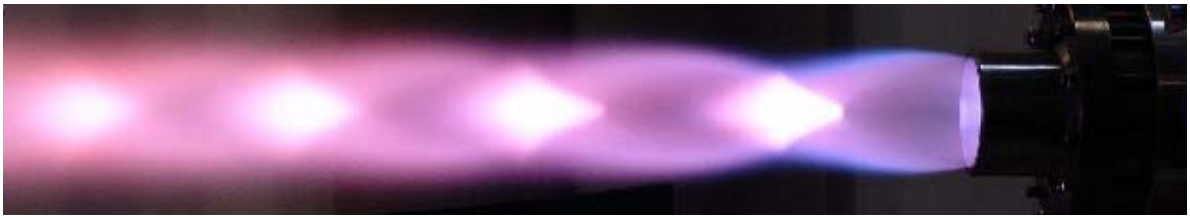
BASIC DOSSIER

Swiss Propulsion Laboratory (SPL) in Detail



Date: 10.02.2010

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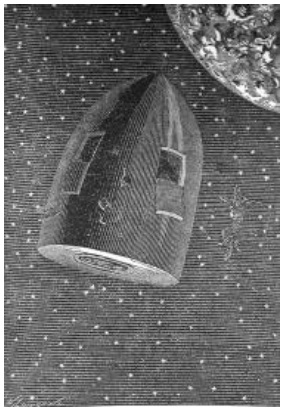
VISION

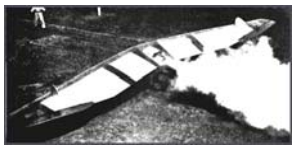


"The dreams of yesterday are the hopes of today and the reality of tomorrow."

Robert H. Goddard, pioneer

We envision a low cost service to space assisting science and economy as the key to success for an innovative and competitive society. The goal of SPL, founded in 1998, is to develop and test reliable and low cost propulsion components for small- and middle-sized space projects.

VALUES



1929: Espenlaub E15. First plane, which was developed for the use of rocket motors. Constructed by the Swiss engineer A. Sohlendorff.

The pioneering spirit of the former generations of Switzerland has made this country a country which is renowned today for precise and sophisticated products. The confederation has also acquired a range of space or near space experience since the 1920ties, for example with the development and implementation of the ZENIT sounding rocket.

We believe that it is worth to continue in this tradition!

We accomplish this with efficient, scientific engineering methods, in an eco-friendly way for civil purposes.

As we do this, it is important to us to communicate in a transparently earnest and scientific manner with universities, the public and the media.

Mirage IIIS: Ground test with liquid propelled rocket booster SEPR; Photo: Peter Gunti

CREW

Hans Ulrich Ammann, Director
Hans Ulrich Ammann is one of the founders of SPL, the initiator and our driving force. He holds a Master of Science in Mechanical Engineering from the Swiss Federal Institute of Technology ETH, and he is the director of ARO TECHNOLOGIES, of one of our most important sponsors.

Bruno Berger
Bruno Berger, is also one of the founders of SPL. He holds a Master of Applied Science in Mechanical Engineering from the FHBB in Basle and also a Degree in Software Engineering from the SWS in Bern.

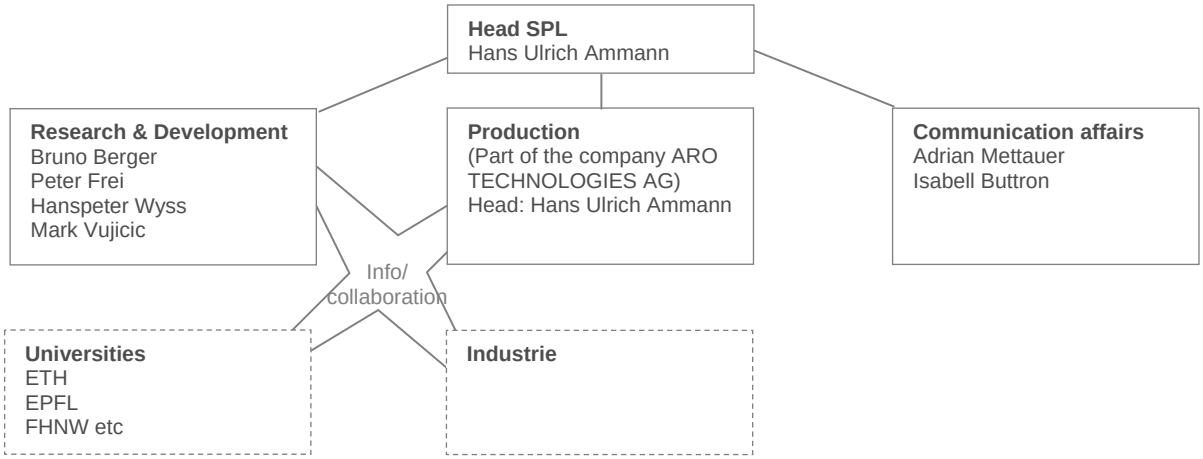
Peter Frei
Peter Frei, is also one of the founders of SPL. He holds a Master of Applied Science in Electrical Engineering and Medical Devices. He studied at the Engineering School Bern and at the Neutechnikum Buchs

Hans Peter Wyss
H. P. Wyss joined SPL in 2001. He is an electrical and mechanical technician and works for Micro Crystal, a Swiss Manufacturer of miniature Quartz Crystals and Oscillators.

Mark Vujicic
Mark Vujicic holds a Bachelor of Science in Aviation and also an Aeronautics Diploma. He has logged over 1700 hours of flight time in aircraft and supports the team's basic research (Research & Development).

Adrian Mettauer
A. Mettauer joined SPL in 2006. He is responsible for communication affairs. He holds a Diploma as/in: Corporate Publisher, Webmaster, Marketing Communications

Isabell Buttron
Isabell Buttron holds a Degree in Cell and Molecular Biology. She is supporting communication affairs since 2009.



CORE BUSINESS

SLR10k-I generates a thrust of 1 ton

Detailed Information:
www.spl.ch → Products

Since 1998 we have been developing and testing our self produced rocket engines and additional propulsion system components. With a thrust range performance of 0.1kg to 1'200kg. SPL's rocket engines, complete propulsion systems and consulting services have already been successfully brought to the market.

Liquid propulsion systems

All of our liquid propulsion systems are built through a modular approach, this implies that the injection plate, nozzle etc. can be exchanged and tested separately in order to bring an engine up to the desired performance.

We use bio-ethanol, a carbon-neutral fuel created from domestic production, together with liquid oxygen.

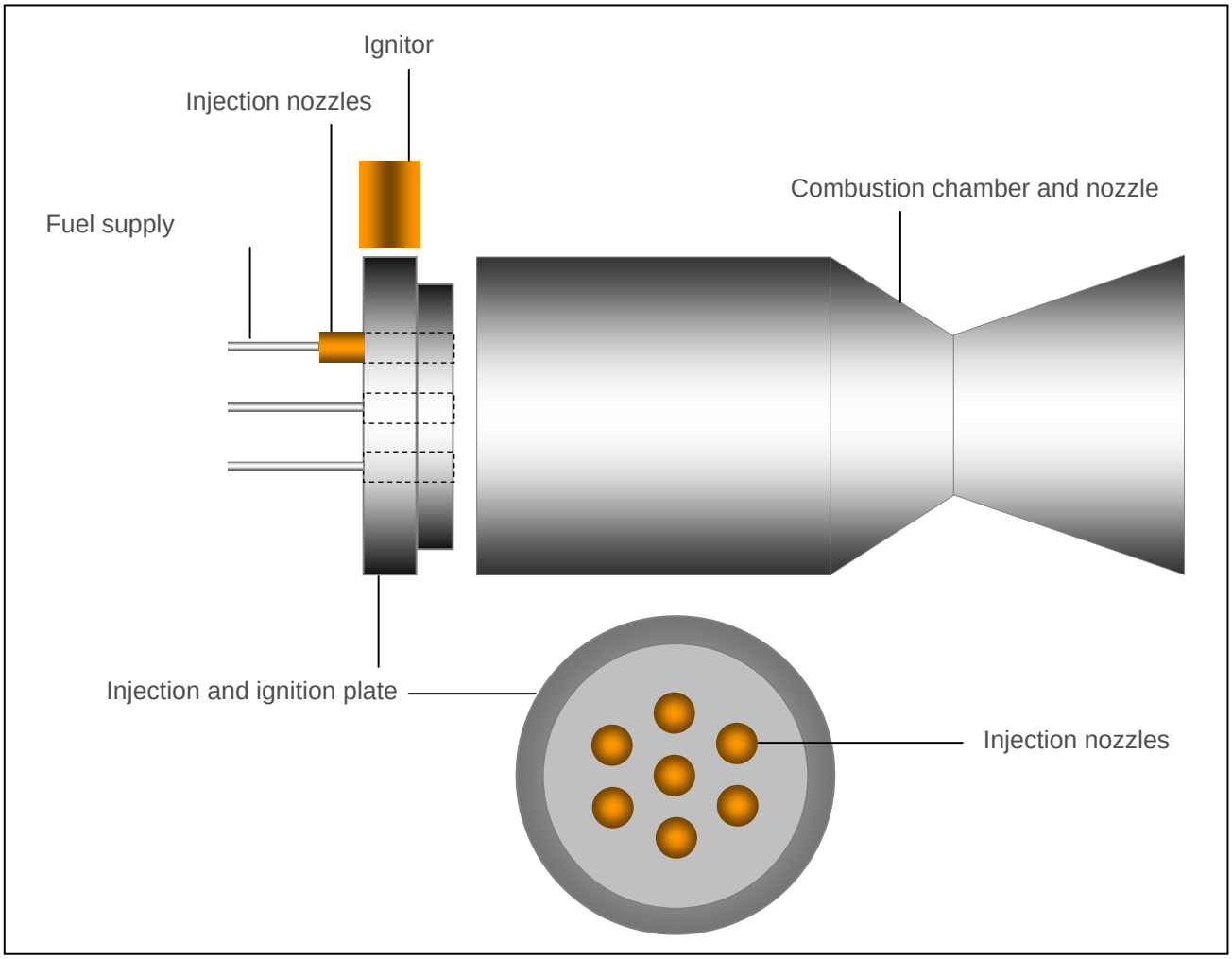


Figure: Modular construction illustrated by the example of our SLR10k-I engine (with a thrust of 1 ton)

Solid propulsion systems

Solid propellants are used in this type of propulsion system. Once started, the combustion cannot be influenced anymore. In addition, the gaseous residues of the combustion are toxic – this is a disadvantage when compared to the liquid propulsion systems. The advantage, is that the production of these rockets is quick and they can be stored until needed.

Example: the SSR12k-I “Tethis” booster:

Short description	Tested on	Measured thrust
The solid booster was developed primarily as a starting aid for rockets, applying the same principle that is used on the Space Shuttle.	13.04.2002	1’200 kg

Steam propulsion

SHWR1.2k-I produces a thrust of 120kg

Hot water rockets use water that is heated electricaly. Via a valve the pressure can be released in a controlled manner. Hot water rockets are used routinely as a starting aid for fighter aircraft (JATO). The advantage is that: it is an environmentally friendly system and provides easy operation to the user. The disadvantage is that: the maximum thrust can only be kept for a short period of time.

Additional components

Apart from rocket engines, we develop additional components such as complete ignition systems, cryogenic valves, tanks, pressurisation gas systems etc. as well as a thrust test stand. During the process we managed to file several patents, for example a “Device for Pressurizing Propellant Tanks” (23rd of March 2004).

FACILITIES

Test stand

The heart of SPL is the test stand – developed and designed by ourselves. Here we are able to test rocket engines with up to 10 tons of thrust. The test stand consists of two parts: the assembly room where the engine is set up and the sound absorbing tunnel (the orange part).

Test cell:
The engine is mounted on an adjustible mount. Various sensors and detectors collect data, for example, thrust development data. For security reasons, the assembly room itself is mounted on a 30 ton concrete plate.

Sound absorbing tunnel:
A tube of about 12 meters lenght and with a diameter of 1.75 meters contains the 2000°C flame. The tube is embedded into 40tons of sand which absorbs the noise.

The test stand's weight is about 100 tons. That is more then 2 empty Boeing 737's. Up until now numerous tests were performed and there is no comparable private institution like this in Switzerland.

Control Room:
All engine tests are being operated and monitored from the inside of this control room. The collected data is also analysed here. Several cameras provide additional data on the progress and performance of the test.

Showroom

Besides our resume of tested engines you will find more information on our projects in our 40 sm showroom, as well as information on other products - like our ignitors. Movies from real engine tests give an impression of our work.

Apart from that, an array of additional rooms, equipment and machines are made available by ARO TECHNOLOGIES; a pressure chamber, CNC machines, a microscope and an infrared camera make up a non-exhaustive list of what ARO TECHNOLOGIES can make available to SPL.

REFERENCES: ORDERS, PROJECTS

Projects

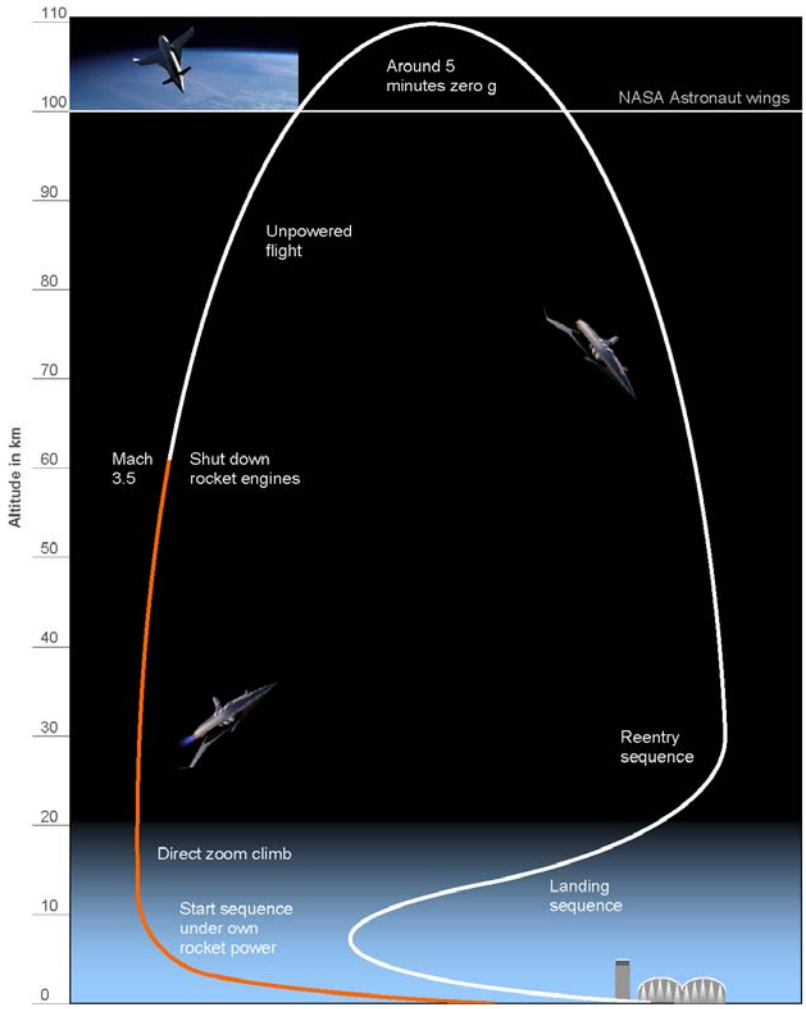
1. Project Enterprise

SPECIFICATIONS

Length: 12 m
wingspan 10 m
Weight: 14 tons
Thrust: 18 tons
Speed: Mach 3.5
Altitude: 110 km
Passengers: 3 – 5
Scientific Payoload:
up to 500 kg

This project was launched in 2004 by the German TALIS Institute. The goal is to develop a manned rocket propelled space-plane. It will take one pilot and up to three passengers - or scientific payload - suborbitally into space. The space-plane will be powered under it's own rocket power directly from the ground.

"Enterprise" – trajectory:



This space-plane was conceived by TALIS and they have also performed the according feasibility study. Since 2004, TALIS has enlisted various partners from the space flight and aircraft construction industry like the Vega Group, DLR and XtremeAir. The German company XtremeAir will construct the airframe of the space-plane and the Swiss Propulsion Laboratory (SPL) will deliver the propulsion components. Until today, all partners and our first investors (ARO TECHNOLOGIES, Müller AG Handwerker Zentrum) have invested about 2.5 million Euros into this project.

Status Quo

In August 2008, **TALIS Enterprise AG** was founded in Switzerland.TALIS Enterprise AG took over the business responsibility from the TALIS Institute. A detailed businessplan is available. In addition, a certificate of cooperation with the Space Tourism Society-Malaysian Chapter (STS-MC) was signed on the 9th of May in 2009. They intend to co-finance the development of the space-planes and eventually want to operate them.

Rc model of the Black Sky under construction

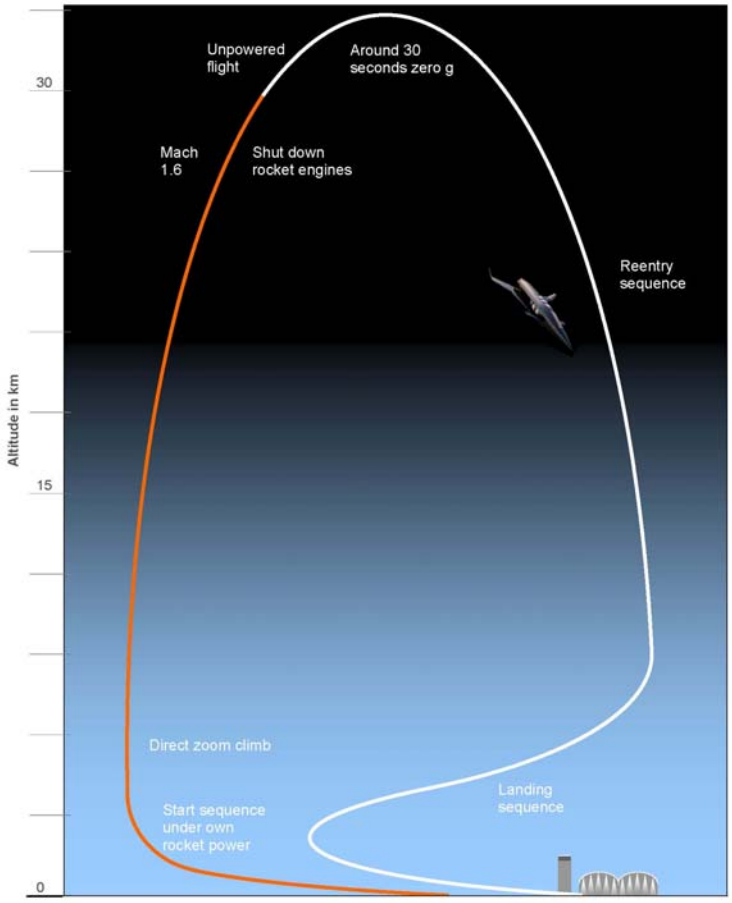
In a first step, a radio controlled three meter prototype was built. This plane is a down-scaled version of the first manned rocket space-plane, the “Black Sky”. The model will take off in 2010. In the first run, the model will be driven by a jet engine, which will later be replaced by a rocket engine.

Schematic of the Black Sky

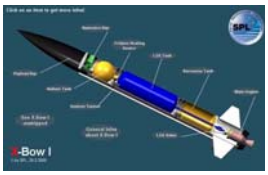
In parallel, the “Black Sky” will be developed. It will be built by XtremeAir and will use three SLR-10k-I rocket engines which translates into a thrust of about 3 tons. The "Black Sky" will reach mach one plus and an altitude of more than 30 km with a ballistic trajectory. It will be a two-seater craft able to carry a passenger. Flying at the edge of space the passenger will see the sky miraculously turn black, and clearly observe the slight curvature of the earth all while experiencing about 30 seconds of zero-g. The development of “Black Sky” is a proposed three year period from the commencement of sufficient financing.

More information: www.european-spacetourism.eu

“Black Sky” – trajectory:



Project X-Bow



Schematic of the X-Bow

SPL is developing a single-stage high-altitude sounding rocket in a co-operation with our university partners in Switzerland. The rocket will carry scientific payload of 25 kg to an altitude of over 100 km - presumably in 2012. A lager alternative vehicle that will carry a 25 kg payload in to orbit is under development.

Technical specifications of the X-Bow

Length: 5 m
Diameter: 30 cm
Altitude: 100 km

Thrust: 1 ton (SLR10k-I liquid rocket engine)
Scientific Payload: 25 kg

PARTNERS AND SPONSORS

Besides relations to governmental institutions and space agencies, the SPL fosters a close co-operation relationship with the following companies and institutions:

ARO TECHNOLOGIES (sponsor), Langenthal, Switzerland
The main sponsor of the SPL.
Homepage: www.aro.ch

Australian Space Research Institute (ASRI)
Homepage: www.asri.org.au

Deutsches Luft- und Raumfahrtzentrum (DLR)
Homepage: www.dlr.de

FHNW (University of applied science NW-Switzerland)
Homepage: www.fhnw.ch

Müller AG Handwerker Zentrum (sponsor), Langenthal, Switzerland
Homepage: www.mueller-hwz.ch

Space Center EPFL, Lausanne
Homepage: http://space.epfl.ch

Space Tourism Society - Malaysian Chapter (STS-MC)

TALIS Enterprise AG
Homepage: www.talis-enterprise.de

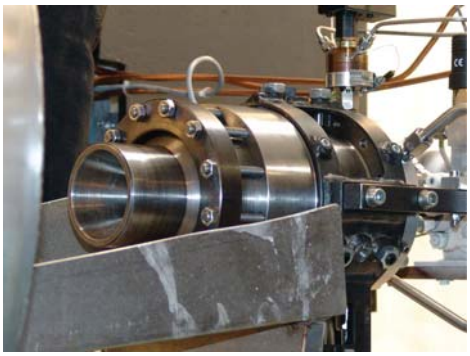
Vega
Homepage: www.vega.de

SELECTED PICTURES (Source: ***www.spl.ch***, TALIS Institut)

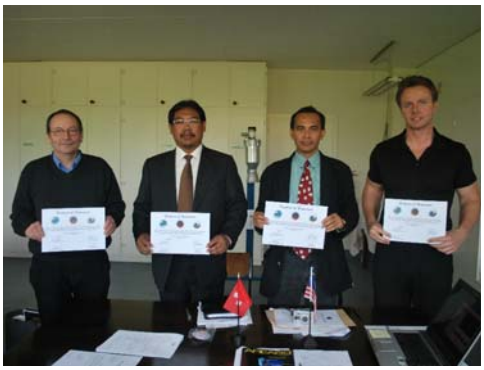
Back row: H. U. Ammann, M. Hummel, C. Nicollier, A. Mettauer; H. P. Wyss; Front row: P. Frei, B. Berger;

Photo: SPL 16.11.2007

Hans Ulrich Ammann testing a ignitor; Photo: C. Hüller 2008



SLR2.5k-I mounted on the test stand; Photo: SPL 2007



Signing the certificate of co-operation on the 9th of May 2009. From left to right: Hans Ulrich Ammann, Jalal Abu, Norul Ridzuan, Peer Gehrmann.

SLR2.5k-I at full throttle; Photo: SPL 2006

Project Enterprise: Black Sky – Design; Schematic: TALIS Enterprise AG 2009