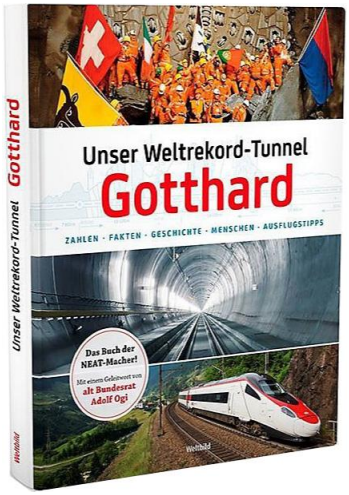
Swiss competence center for the innovative use of the underground space

A Swiss initiative committee found the internationally pioneering Swiss Center of Applied Underground Technologies (SCAUT).

(image)



Swiss know-how from the world-record tunnel

The **Gotthard Base Tunnel** opened in 2016 is the longest railway tunnel in the world. The Swiss Center of Applied Underground Technologies (SCAUT), which was initiated on the day the tunnel was inaugurated, is the **first-ever competency center** of its type globally and groups the know-how and the technology applied at the Gotthard Base tunnel, yet also of further innovative underground infrastructures, to make them available for various applications in the use of the underground space.

Creating spaces for increasing urbanization

The world's population continues to concentrate more and more in urban areas. In fact, more than 70 percent of the people on Earth will live in urban agglomerations by 2030. This, combined with the fact that the space still available for building above ground is limited, means that the use of underground construction is becoming increasingly important. This is where innovative technologies that enable people and industries to take advantage of underground spaces come in.

Advantages of underground construction

Underground spaces feature enormous capacities that have yet to be tapped, especially in metropolises. Using these spaces to relocate industrial facilities below the Earth's surface presents a number of decisive advantages:

- **Carriage of goods:** Fully automatic and continuous transport in a safe environment
- **Passenger transportation:** Faster, safer, and zero-emissions access to urban centers
- **Precision technology**: Low-vibration, zero-noise production conditions with stable climatic conditions
- **Chemical & biomedical sectors**: Sterile, low-radiation, isolated research and production environment with stable ambient conditions
- **Data centers**: Climatic stable and high security environment
- **Industrial and warehousing sectors**: Eliminates any impact on the cityscape above ground
- **Agriculture**: Plant breeding under definable and unchanging environmental conditions
- **Further uses**….

Challenges in the use of the underground space

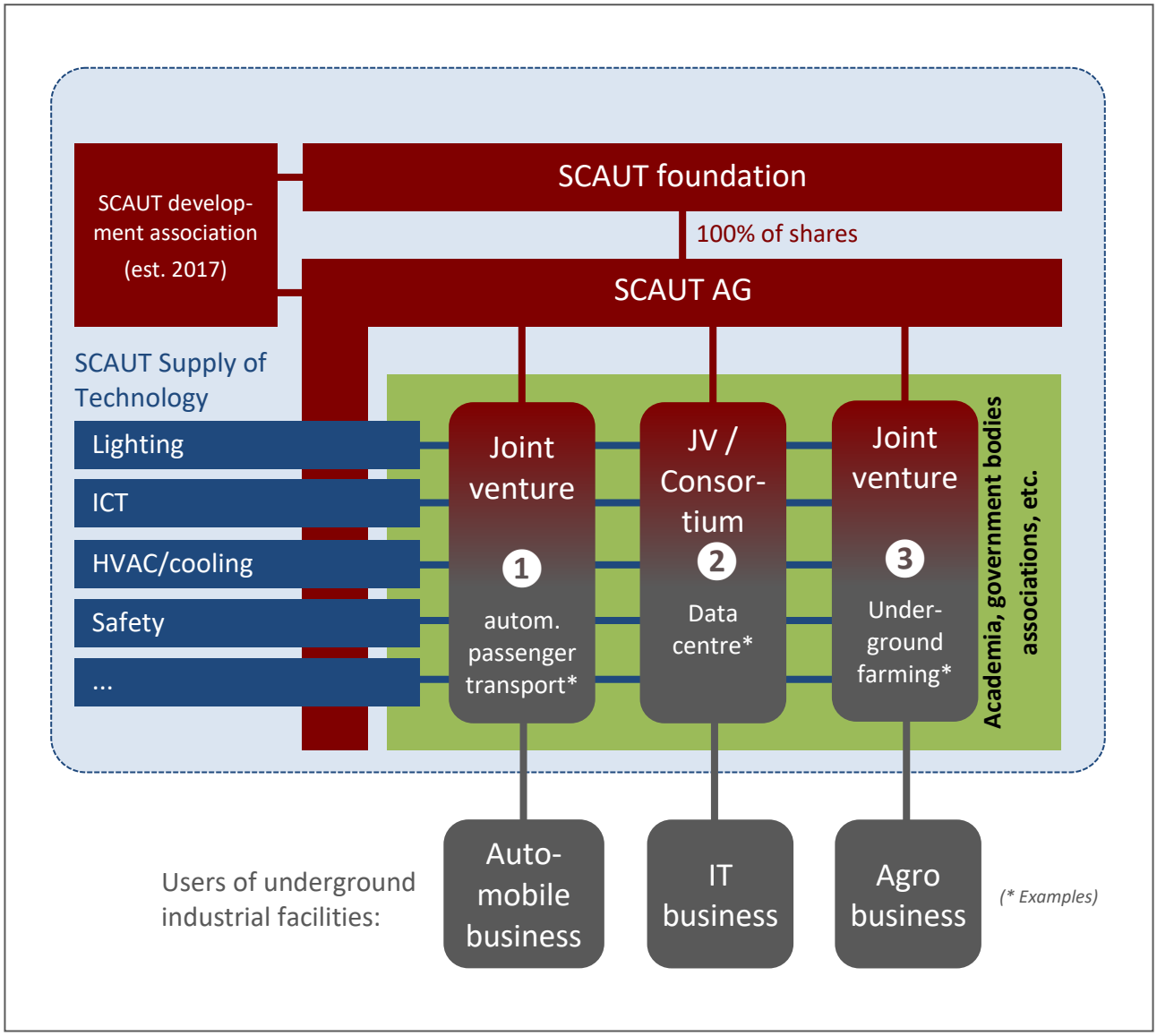
1. The space below ground needs to be opened up first.
2. The caverns' dimensions are limited by the underground area's physical properties.
3. The conversion of existing caverns (mines, tunnels, etc.) is challenging, expensive and rarely well-fitting for the new use.
4. The underground space used needs to be treated as an integral part of the space above ground.
5. Planning, implementation and usage of the underground space requires special know-how and expertise that is not yet available for the current aboveground industry stakeholders

Development trends in underground construction

- Maintenance, repair, renovation, and conversion work on underground infrastructure must become more efficient.
- Research and development activities dealing with underground construction are on the rise worldwide and require more space for tests at full scale.
- Underground developments and constructions suitable for industrial use are to a large extend the purview of large enterprises with global operations. In contrast, technological innovations are driven significantly by agile SME, university spin-offs and start-ups.
- The fast pace of digitalization and new developments in Internet technologies (e.g., the Internet of Things) will also be crucial to the construction and use of underground space.

SCAUT organizational structure

The industry services provided by SCAUT will initially be rendered by a development association and later by a limited company which will be wholly owned by a foundation.



SCAUT organizational structure

SCAUT's vision

The Swiss Center of Applied Underground Technologies (SCAUT) is the world's leading competency center for the use of the underground space. It relies on high-end engineering, innovative solutions and most advanced ICT to make a substantial contribution to the creation of underground spaces for the future and to provide relief for metropolises and highly populated urban areas.

SCAUT's mission

The Swiss Center of Applied Underground Technologies is committed to three main tasks:

1. **Innovative underground concepts**
   Leading network and know-how provider for the evaluation, concepts and implementation of innovative industrial usages the underground space.
2. **Driving innovative technology**
   Facilitating technology development projects relevant in the world of underground facilities, as well as disseminating know-how by means of publications, events and networking platforms
3. **Creation of high-tech jobs**
   Proactively winning contracts for innovative underground projects domestically and abroad and handling them by creating and coordinating consortiums consisting of high-tech companies

SCAUT's range of services

For providers of products and services in the underground facilities sector:	**For national and international partners, investors and clients:**
• Securing contracts for innovative projects for underground industrial applications	• Know-how and expertise platform to source resources for innovative projects
• Creating consortiums and joint ventures	• Conceptual designs, feasibility studies, laboratory tests, pilot projects for construction and technologies
• Creation and support of consortia, joint ventures etc.	• Concepts, feasibility studies, lab tests, prototyping, pilot studies etc. for various usages and technologies
• Assisting in the international positioning through joint platforms	• Centrally organizing underground maintenance & services
• Being actively involved in trends and ongoing projects	• Central contact for investors in the field of underground applications
• Know-how and cooperation platform	• ...

Project type 1: Technology projects

The construction of underground industrial facilities requires the adaptation of the technologies used in above-ground industrial facility construction to suit the special conditions encountered in underground construction. Lighting, ventilation, safety and other systems for underground facilities differ from comparable conventional systems in sometimes large manner.

The following technology projects have already been launched by SCAUT in cooperation with industrial partners:

Insert element for crosscut termination

Development of an integral prefabricated push-in wall element for terminating the tunnel crosscut that is immediately ready for use (plug-and-play).

Industry partners (amongst others):

ELKUCH GROUP

MÜLLER-STEINAG ELEMENT AG

Digital Twin

Development and commissioning of a demo center of a digital tunnel. The focus is put on cross-phase and cross-functional system solutions that cover the entire value chain, resp. the entire lifecycle of a tunnel – including BIM and digital maintenance services.

Industry partner (amongst others):

AMBERG ENGINEERING

SIEMENS Ingenuity for life

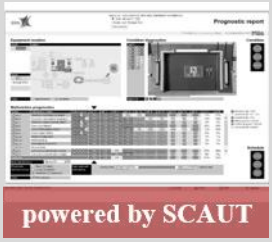
Construction 4.0 / Internet of Things

By the help of the Internet of Things (IoT), different components can be clearly identified and located, pressures measured and monitored. Furthermore, information can be exchanged in real time and considered in the management processes.

Industry partner (amongst others):

SPAETER Stahl & Metall | Bau | Haustechnik

swissmobile Lösungen die bewegen www.swissmobile.com



Cross Passage Door 4.0

Knowledge building in the field of data collection, data analysis and action strategy planning with the aid of a functional prototype. The aim is to develop a concept for predictive maintenance.

Industry partner (amongst others):

CASSANTEC

jm systems gmbh

Project type 2: Concept studies for the industrial utilization of underground spaces

Technology suppliers, investors, users and operators who wish to use underground spaces for commercial projects (e.g. underground data centers) require a reliable basis on which to make decisions for optimal strategy orientation in this new market segment.

Within the framework of the concept studies, new, innovative concepts and solutions for the use of subterranean space are developed together with industrial partners. The partners involved contribute their know-how and performance to the project and develop it further in the consortium.

The focus is on the application of the developed concept ("applied technologies"): Innovative solutions must satisfy a market need, as only then can they become economically viable. It is imperative that the partners are also able to promote and sell the developments as a product or service. All intellectual property rights (IPR) to the developed products do not pass to SCAUT but remain entirely with the industry partners.

SCAUT concept studies answer the most important questions concerning specific utilization projects. The impact of different parameters is tested and evaluated using prototypes built and operated on a 1:1 scale. The studies also analyse economic aspects and develop go-to-market approaches.

The following studies are currently under way:

Underground Green Farming

Development of a modular generic system for underground food production. Thereby, an alternative for the loss of arable land through degradation of soil is provided. This innovative approach towards farming involves consideration of various technical aspects, requirements, future trends and ethical questions in the food industry.

Data storage (Underground Data Center)

The trend towards edge computing as a decentralized solution leads to an increasing demand for local micro data centers, especially in urban areas. The project 'Underground Data Center' aims to develop, prototype and market an appropriate solution for modular underground data center and the subsequently necessary processes.

Further concept studies planned by SCAUT:

- High-precision production (e.g. chip manufacturing)
- Energy storage
- Chemical & biomedical sectors (pharmaceuticals)

SCAUT working method and benefits of a SCAUT membership

SCAUT sees itself as a platform that enables the exchange of information between partners from a wide range of industries and drives innovation together with the partners (catalyst effect).

In projects, SCAUT takes over the coordination & project management as well as promotion & marketing on behalf of the industrial partners. All intellectual property rights (IPR) remain with the project partners.

The SCAUT association offers its members

- Access to a comprehensive partner network
- Information exchange and active involvement in innovative trend topics
- Competence platform for central sourcing of project resources
- Formation of working groups, joint ventures and consortia
- Support in the development and implementation of projects
- Acquisition of innovative projects for underground industrial applications
- Support for international positioning through joint platform
- Support in marketing & sales of the developed product solution

SCAUT team

SCAUT Management

Klaus Wachter
MSc Mining and Tunneling
Managing Director

SCAUT Development Association - Steering Board

Felix Amberg (Chairman)

MSc CE ETHZ · Owner of the Amberg Group, one of the world's leading underground engineering companies

Michael Lierau

MSc ME ETHZ, MBA degree from the George Washington University, CEO of Elkuch Bator AG, one of Europe's leading manufacturers of tunnel door systems

Thomas Freuler

MSc CE ETHZ, EMBA degree from HSG · CEO of Spaeter Group, swiss-wide active steel supplier

SCAUT takes up recommendations of the Swiss Federal Council

The Swiss Federal Council's Report on the Utilization of Underground Spaces dated 5-12-2014 shows that the utilization of underground spaces in Switzerland needs to be coordinated at a national level. A survey of the two federal offices, BFE for energy and ARE for spatial development, yielded the following results, amongst others, in all cantons:

- It would be desirable to have a pool of independent, possibly even certified experts who could be consulted by the cantons.
- The option of a Swiss competence center (of the federal government or in the private sector) providing assistance for deep boring and geothermal projects would also be desirable.
- All cantons are in favour of a platform for the exchange of knowledge.

SCAUT has picked up on these ideas and expanded the spectrum of highly innovative and future-oriented uses of underground spaces.

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bericht des Bundesrates zur Nutzung des Untergrundes in Erfüllung des Postulats 11.3229, Kathy Riklin, vom 17. März 2011

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Vom 5. Dezember 2014

Inhalt

Swiss Federal Council's report "Utilization of Underground Space"

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