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).

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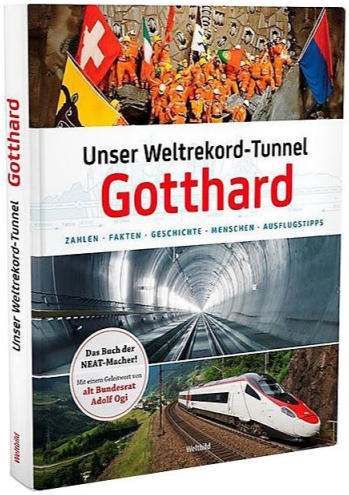


Swiss know-how from the world-record tunnel

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 centre** 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 centres
- **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 centres**: 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

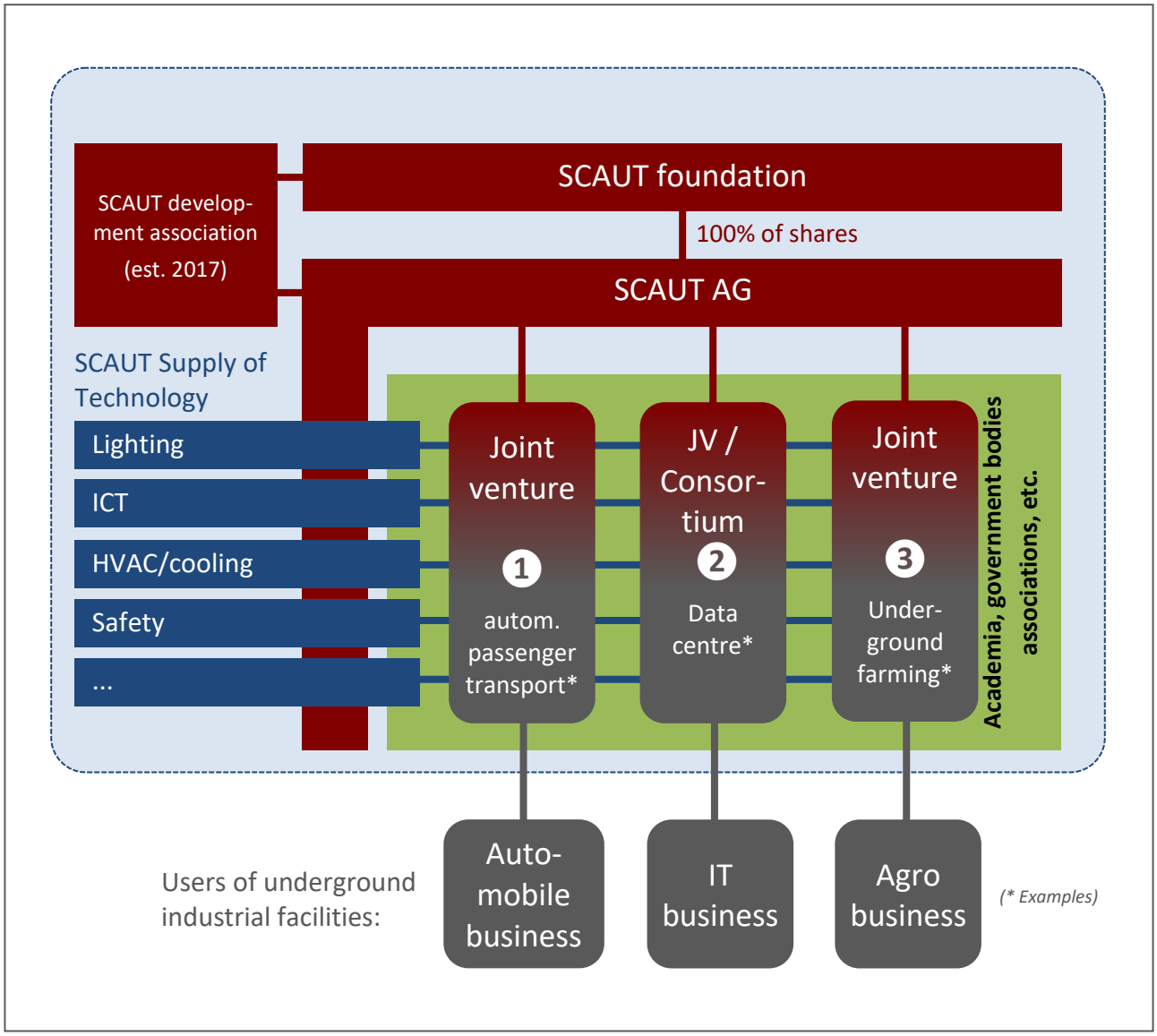
1. The space below ground needs to be opened up first.
2. The caverns' dimensions are limited by the underground area's physical properties.
3. The conversion of existing caverns (mines, tunnels, etc.) is challenging, expensive and rarely well-fitting for the new use.
4. The underground space used needs 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 Centre of Applied Underground Technologies (SCAUT) is the world's leading competency centre for the use of the underground space. It relies on high-end engineering, innovative solutions and most advanced ITC 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 Centre 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: Development of technologies for underground facilities

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 development projects have already been launched by SCAUT projects 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 build of a digital tunnel twin. The digital illustration allows for planning, organizing and implementing any attempt, process, demonstration and training purposes.

Industry partner (amongst others):

AMBERG GROUP

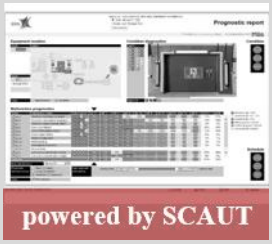
Construction 4.0 / Internet of Things

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 computer centres) require a reliable basis on which to make decisions for optimal strategy orientation in this new market segment.

SCAUT develops concept studies for selected areas of utilization in collaboration with experts. The following studies are already 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.

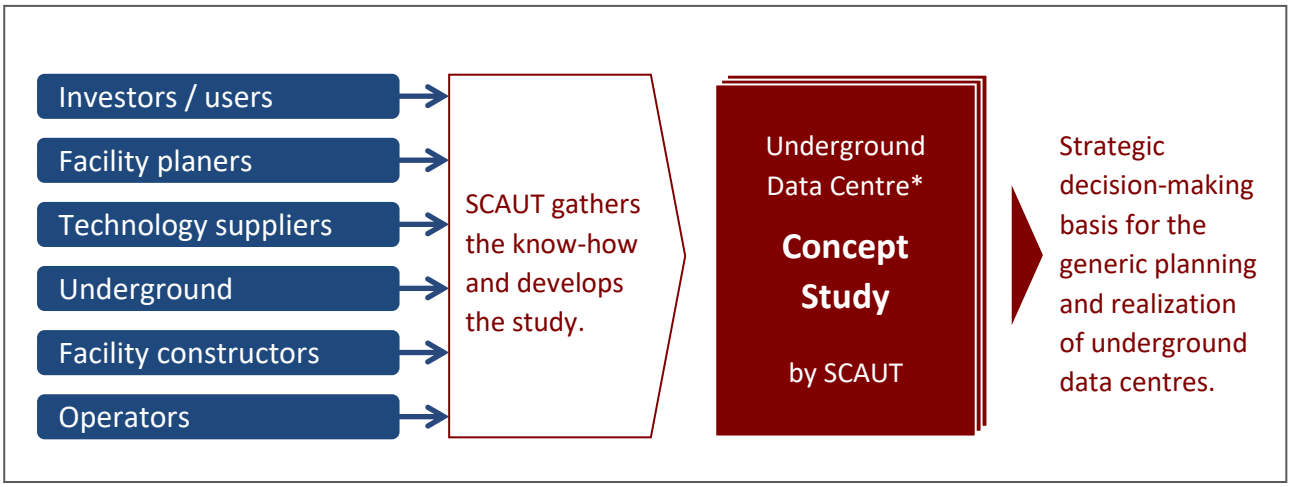
Energy storage

The availability of renewable energy forms, such as solar and wind power, is weather dependent (clouds, nightfall, no wind, etc.) and seldom correlates with the current needs of energy consumers. Large-scale energy storage methods nonetheless enable maximal exploitation of this energy which is then fed into the grid as consumers need it.

Further concept studies planned by SCAUT:

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

The suppliers of know-how have exclusive rights to the study results for a limited period of time. Interested parties can also obtain the same preferential rights by making a monetary contribution.



SCAUT concept studies answer the most important questions concerning specific utilization projects.

Project type 3: Specific commercial projects

SCAUT is conducting advanced talks and/or pre-projects with the project managers of the following underground construction projects:

Data centre High-security, high-performance computer centre with optimal energy and cooling-water supply for processing and storing big data. Modular underground data centres	Industry partner: Leading global ITC companies
Underground Green Farming Development, implementation and promotion of a prototype system for food production in underground conditions. Analysis of different parameters, design of a scalable concept solution and business model generation.	Industry partner: European consortium from the agricultural industry

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

Ernesto Schümperli
MSc CE ETHZ, MBA GSBA Zurich, Head Concrete & Waterproofing Division; Sika AG, Baar leading supplier of chemical construction products

SCAUT Initiative Committee

Dr. Alberto Belloli
Dr. Sc ME ETHZ, Owner of ROWA Tunnelling Logistics AG, logistics systems for underground construction

Reinhold Käslin
CEO of Creabeton Baustoffe AG and Müller-Steinag Element AG, supplier of concrete elements for civil construction

René Kotacka
MSc CE ETHZ, head of the business unit Infrastructures at Implenia AG, the largest Swiss construction company

Dr. Dieter Strich
Administrative board member of ACO Passavant AG, a drainage specialist which is part of the ACO Group with 4,200 employees

Daniel Isler
Dipl. El.-Ing. FH electrical engineering degree, CEO of Fargate AG, Switzerland's largest export network with 150 agents in 50 countries

Josef Ackermann
Specialist engineering degree from NTB · Independent consultant in the fields of strategy, certification, and quality management

Robert Böni
CEO of Hagerbach Test Gallery Ltd, a 5-kilometer-long test, R&D laboratory for underground construction

Jürgen Schlichting
Lic. rer. pol. degree Associate partner at Fargate AG, formerly CEO of various consulting firms, projects in more than 50 countries

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 centre (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.

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

Vom 5. Dezember 2014

Inhalt

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

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SCAUT
Swiss Center of Applied Underground Technologies

FOUNDATION OF SCAUT

06.03.2017 15:19

SCAUT association founded. On 6 March 2017 the SCAUT association was entered into the commercial register of the Canton of St. Gallen, Switzerland.