

swiss space  Schweizerische Raumfahrt-Vereinigung
association Association Suisse d'Astronautique
Associazione Svizzera d'Astronautica

CRES
CENTRE DE RECHERCHES
ENTREPRISES ET SOCIÉTÉS

Meeting about Possible
Xi'an-Geneva Business Cooperation
in « High tech » Domains
17 novembre 2008 Villa Sarasin

 **FOIRE DE GENEVE**

A Glance at

Swiss Activities in Space Domain

**Dr. Jean-Daniel Dessimoz, MBA,
Prof. HESSO.HEIG-VD,
President of Swiss Space Association**

17.11.2008 Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space 1/68

swiss space  Schweizerische Raumfahrt-Vereinigung
association Association Suisse d'Astronautique
Associazione Svizzera d'Astronautica

Content

- **Swiss Space (overview)**
- **Relevant international contexts**
- **Swiss specific aspects**
- **Conclusion**

17.11.2008 Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space 2/68

Swiss Space Association

- For adventure, knowledge, Earth service, peace and well-being of mankind
- Established in 1951
- Member of IAF (incl. PAC) and SATW
- Cooperates with various society segments (research, education, industry, administration, general public, youth)

17.11.2008

Jean-Daniel De

Schweizerische Raumfahrt-Vereinigung



www.SwissSpace.org

office@srv-ch.org



Liebe Leserin, lieber Leser,

Wir freuen uns, dass Sie an der Schweizerischen Raumfahrt-Vereinigung Interesse zeigen und wir Ihnen unsere Broschüre vorstellen dürfen.

In wenigen Worten	4
Vorstand	6
Zweck der SRV	7
Ausbildung / Kurse	8
Forschung	9
Industrie	10
Organisationen	11
Jugend	14
Informationen	15
Veranstaltungen	16
Mitglieder	17
Claude Nicollier	18
Sekretariat	20

In wenigen Worten

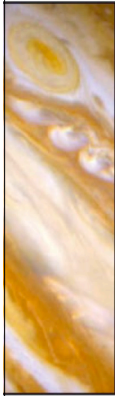
Die Schweizerische Raumfahrt-Vereinigung (SRV) hat zum Ziel, die aktive Beteiligung der Schweiz an der Erforschung des Weltraums und an seiner friedlichen Nutzung und des dauerhaften Wohlergehens für die Menschheit zu fördern.

Die Schweizerische Raumfahrt-Vereinigung (SRV) ist 1993 aus dem Zusammenschluss der vorhergehenden Organisationen (SVWT und SAFR) entstanden, deren Ursprung bis in das Jahr 1951 zurückgeht.

Auf höherer Ebene ist die SRV Mitglied der Internationalen Astronautischen Föderation (IAF), der weltweiten Hauptorganisation auf diesem Gebiet. Die SRV verfügt dort über ein besonderes Statut und gehört dem Expertenrat (Advisory Board) an.

Die SRV ist auch Mitglied der Schweizerischen Akademie der technischen Wissenschaften (SATW). Während der letzten Jahre hat sie von einer finanziellen Unterstützung dieser Institution profitieren können.

Konkret bietet die SRV seinen Mitgliedern und der Öffentlichkeit verschiedene Leistungen an. Sie arbeitet mit verschiedenen Kreisen der Schweizer Gesellschaft zusammen: Ausbildung, Forschung, Industrie, Administration, Jugend und breite Öffentlichkeit.

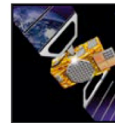


4

Die Ausbildungs- und Informationstätigkeiten werden durch die enge Zusammenarbeit mit den Schulen geführt. Es handelt sich dabei um Sekundarschulen und Gymnasien. Die fortgeschrittensten Aktionen visieren die technischen Fachhochschulen, die beiden polytechnischen Hochschulen und Universitäten an. Ein Weiterbildungskurs in Raumfahrttechnologie wird jedes Jahr in der Schweiz organisiert und ist für jedermann offen. Die SRV-Mitglieder profitieren von sehr vorteilhaften Bedingungen. Die Schweizer Hochschulen sind in einem Netzwerk zusammengeschlossen und gewährleisten allen Mitgliedern schnelle und wirksame, aktuelle Informationen aus der Welt der Raumfahrt und den Möglichkeiten in der Schweiz (in Form von Projektstipendien, Praktikumsplätzen, Arbeitsplätzen in der Industrie, etc.).

Das Büro für Weltraumangelegenheiten (Swiss Space Office), welches insbesondere die Schweizer Delegation der ESA umfasst, ist auch im SRV-Vorstand vertreten und dient als Verbindung zur Europäischen Raumfahrtagentur ESA (Stipendien für Studien, Ratschläge in aller Art).

Das Angebot der SRV bildet eine interessante Ergänzung durch geschaffene Mittel der spezialisierten Berufsverbände besonders der Raumfahrtgruppe der Swissmem-Vereinigung.



5

Vorstand

Ehrenpräsident :

Claude Nicollier

Ehrenmitglieder :

Fritz Casal
Viktor Dolder
Walter Fuchs
Robert Thürg-Bienz
Alfred Waldis

Vorstand :

Andreas Amrein, Oberkirch (Co-redakteur)
Ursula d'Aquino, Zürich (Schulkoordination, Space Forum)
Maurice Borgeaud, Lausanne (Space Center EPFL)
Ivo Cassani, Bern (Redakteur und Webmaster)
Marianne Cogoli, ETH Zürich (Vizepräsidentin, Koordination mit Universitäten, besonders der Deutschschweiz)
Jean-Daniel Dessimoz, Hes-so / EIVD, Yverdon-les-Bains (Präsident)
Daniel Neuenschwander, Swiss Space Office (Kontakte mit der ESA und der Administration)
Nicolas Produkt, Universität Genf / ISDC (Koordination mit den Universitäten, besonders der Westschweiz)
Jörg Sekler, FH Solothurn (Weiterbildungskurse)



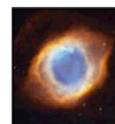
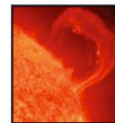
Nach Neuchâtel und Oensingen ist der Sitz der Vereinigung seit dem Jahr 2000 in Yverdon-les-Bains.

6

Zweck der SRV

Allgemein werden die Zielsetzungen des SRV in den Vereinigungsstatuten definiert und umfassen insbesondere die folgenden Punkte :

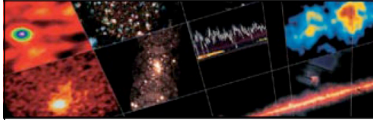
- Die SRV ermutigt die Entwicklung der Raumfahrttechniken und gewährt ihre Unterstützung, um jede Initiative in diesem Sinn zu koordinieren. Sie trägt zur Verbreitung des Wissens bei, um die Raumfahrtwissenschaften und -techniken populär zu machen und damit durch breite Schichten der Bevölkerung unterstützt zu werden.
- In der Festsetzung seiner Ziele beachtet die SRV solche Aktivitäten, die durch die anderen bestehenden Organisationen durchgeführt wurden, um Doppelspurigkeiten zu vermeiden.



7

Ausbildung / Kurse

Die SRV führt jährliche Einführungskurse, Seminarkurse und Ringvorlesungen über Raumfahrt und Raumfahrttechnik durch. Die Kurse finden jeweils an Fachhochschulen, Volkshochschulen und Mittelschulen statt. Alle Kurse sind der Öffentlichkeit zugänglich.



Die Programme sind wie folgt gegliedert:

Grundkurse:

- Bemannte und Unbemannte Raumfahrt
- Geschichte und Entwicklung
- Trägersysteme
- Startplätze und Orbitwahl
- Bodenstationen
- Satellitenprojekte
- Bemannte Raumfahrt
- Zukünftige Raumfahrtprojekte

Raumfahrt aktuell – Ringvorlesungen / Seminarreihen:

Auszug Kursprogramm im SS 2003 an der Hochschule für Technik und Architektur, Bern (Prof. J. Sekler)

- Begann das Leben im Weltraum?
- Mars Exploration Missions
- Antriebssysteme für Raketen und Sonden
- Outer Space and the Law
- Schweizer Industriebeiträge in der Raumfahrt
- Missionen zur Sonnenforschung im All
- Erdbeobachtung aus dem Weltraum
- Swiss Motors auf Mars
- Globale Satelliten-Kommunikation
- Zukunftsaussichten in der Raumfahrt

8

Forschung

Viele Forschungsgruppen (ca. 50) an Schweizer Hochschulen und Fachhochschulen sind vorwiegend im Rahmen der Programme der Europäischen Weltraumorganisation ESA aktiv und auf verschiedenen Gebieten der Weltraumforschung tätig. Viele dieser Forscher leisten einen wesentlichen Beitrag zum Verständnis des Weltalls oder zur Wirkung der Weltraumbedingungen (Schwerelosigkeit, kosmische Strahlung) auf lebende Organismen.

Einige der Gruppen oder Institute spielen weltweit eine führende Rolle. Dies sind u. a.:

- Die Universität Bern ist seit mehr als 30 Jahren massgeblich an verschiedenen wichtigen wissenschaftlichen Experimenten beteiligt, so unter der Leitung von Prof. Johannes Geiss 1969 am ersten Experiment auf dem Mond (Sonnenwindsegel), später unter Prof. Hans Balsiger beim Treffen der Weltraumsonde Giotto mit dem Kometen Halley, und nun bei der spektakulären Mission Rosetta mit Instrumentenexperiment Rosina, die im März 2004 mit Ariane gestartet ist und nach einer 10-jährigen Odyssee durch das Weltall den Kometen Churyumov-Gerasimenko untersuchen wird.
- Die Gruppe Weltraumbiologie der ETH Zürich unter Dr. Augusto Cogoli hat seit 1983 ca. 30 Experimente auf 9 verschiedenen Flügen des Space Shuttles, auf 6 Höhenforschungsraketen und auf der russischen Station Mir durchgeführt. Dabei wurde vor allem der Einfluss der Schwerelosigkeit auf weisse Blutkörperchen untersucht. Ausserdem hat die Gruppe in Zusammenarbeit mit der Schweizer Industrie und der Universität Neuchâtel (Prof. Nico De Rooij, IIT) einen kleinen Bioreaktor entwickelt, der drei Mal erfolgreich mit Hefezellen auf dem Space Shuttle geflogen ist.
- Neben den etablierten Teams haben verschiedene Studentengruppen an ESA-Programmen teilgenommen und ihre eigenen Experimente durchgeführt.



9

Industrie

Die Schweiz ist gut vorbereitet, eigenständige Beiträge im Raumfahrtbereich durch ihre traditionellen Kompetenzen in industriellen Qualitätsanwendungen insbesondere in den Bereichen der Präzision und Mikro-Technik zu leisten. Einige Beispiele: Zeitmessungen, Laserpunktion, rotierende elektrische Kontakte, Kraft- und Vibrationsdetektoren. Seit kurzem sind in den Bereichen der Biomedizin und den Humanwissenschaften neue Aufgaben erschienen (wie zum Beispiel: Mikro-Bioreaktoren).

Die Mehrzahl der aktiven Schweizer Unternehmen im Raumfahrtbereich ist mit einer spezialisierten Gruppe der Schweizer Maschinen-Vereinigung verbunden (www.swissmem.ch/ssg). Sie leisten breite und vernetzte Beiträge zu den Raumfahrttechniken: strukturelle Elemente, Elektronik, Empfänger, Software, Optik, Mechatronik und Instrumente. Sie arbeiten an Programmen von der Europäischen Raumfahrtagentur (ESA), Ariane-Space, oder bezüglich der internationalen Raumstation ISS.



Mitglieder der SWISSMEM-Gruppe für die Raumfahrttechniken (SSIG):

- AEO-Aerospace Engineering Office, Wangen
- APCO Technologies SA, Vevey
- Art of Technology AG, Zürich
- ASCOM Systec AG, Mägenwil
- CONDOR SA, Courfaivre
- CONTRAVES Space AG, Zürich
- CSEM Centre Suisse d'Electronique et de Microtechnique SA, Neuchâtel
- FISBA Optik AG, St. Gallen
- ITS AG, Wallisellen
- MECANEX SA, Nyon
- NEW AMBROSETTI TECHNOLOGIES SA, Manno
- RUAG Aerospace, Emmen
- SYDERAL SA, 2076 Gals
- VIBRO-METER SA, 1701 Fribourg

10

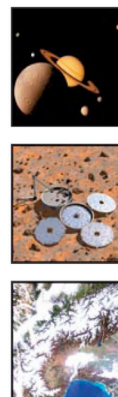
Wichtige Organisationen - SSO

Das Swiss Space Office (SSO) in Kürze

Die schweizerische Weltraumpolitik wird vom Bundesrat bestimmt. Innerhalb der Bundesverwaltung ist das Büro für Weltraumangelegenheiten (SSO) der Gruppe für Wissenschaft und Forschung mit der Vorbereitung, Planung und Umsetzung dieser Politik betraut. Das SSO trägt die Hauptverantwortung für die Teilnahme der Schweiz an den Programmen und Aktivitäten der Europäischen Weltraumorganisation (ESA) und vertritt die Schweiz im ESA-Rat und in den Komitees. Die ESA umfasst 15 Mitgliedstaaten und verfügt über ein Jahresbudget von 4.2 Mia. Franken. Der Hauptsitz befindet sich in Paris. Die Koordination der Raumfahrtinteressen und -tätigkeiten der sieben Departements wird durch den unter dem Vorsitz des SSO stehenden Interdepartementalen Koordinationsausschuss für Raumfahrtfragen (IKAR) sichergestellt. Die Bereiche Wissenschaft und Industrie werden durch die Eidg. Kommission für Weltraumfragen (CFAS) vertreten, die eine beratende Funktion ausübt.



Büro für Weltraumangelegenheiten (SSO)
Carmen Thiel, Administratorin
Daniela Baumann, PR
Hallwylstrasse 4
3003 Bern
Tel. 031 324 10 74
Fax 031 324 10 73
info@ssso.admin.ch
www.sso.admin.ch



11

Wichtige Organisationen - ESA

ESA - Fakten und Zahlen

Was ist die ESA?

Die Europäische Weltraumorganisation ist Europas Tor zum Welt- raum. Ihre Mission ist die Entwicklung von Europas Weltraumfähig- keiten und die Sicherstellung von Investitionen in die Raumfahrt, die den Bürgern Europas weiterhin Nutzen bringen.

Durch die Koordination der finanziellen und intellektuellen Res- sourcen ihrer Mitglieder kann die ESA Programme und Aktivitäten durchführen, die weit über die Möglichkeiten eines einzelnen euro- päischen Landes hinausgehen.

Was tut die ESA?

Die Aufgabe der ESA ist es, die europäische Raumfahrtplanung zu erarbeiten und umzusetzen. Die Projekte der Organisation sind dazu angelegt, mehr über unsere Erde, ihre unmittelbare Umge- bung, das Sonnensystem und das Weltall zu erfahren sowie sa- tellitengestützte Technologien zu entwickeln und die europäische Industrie zu fördern. Die ESA arbeitet ausserdem eng mit Weltraum- organisationen außerhalb Europas zusammen, damit die Erge- bnisse der Raumfahrt der gesamten Menschheit zugute kommen.

Wer gehört zur ESA?

Die 15 Mitgliedsstaaten der ESA sind Belgien, Dänemark, Deutsch- land, Finnland, Frankreich, Großbritannien, Irland, Italien, die Nie- derlande, Norwegen, Österreich, Portugal, Spanien, Schweden, Griechenland und die Schweiz. Kanada hat einen Sonderstatus und nimmt im Rahmen eines Kooperationsvertrages an einigen Projekten teil. Die Liste macht deutlich, dass nicht alle Mitgliedsän- der der Europäischen Union ESA-Mitglieder sind und umgekehrt nicht alle ESA-Mitgliedsstaaten Mitglieder der EU sind. Die ESA ist eine völlig unabhängige Organisation, die unterhält jedoch enge Bezie- hungen zur EU, mit der sie eine gemeinsame Raumfahrtstrategie verfolgt.



www.esa.int



12

Wichtige Organisationen - IAF

International Astronautical Federation (IAF)

The IAF encourages the advancement of knowledge about space and the development and application of space assets for the bene- fit of humanity. It plays an important role in disseminating informa- tion, and in providing a significant world-wide network of experts in space development and utilization.

It was founded in 1951, the IAF is a non-governmental association, with members drawn from space agencies, institutes and space research centers, learned societies, professional associations, schools and universities, space manufacturers and services pro- viders and users, specialized law and consulting firms related to the purposes of the IAF, from all over the world. Today, the IAF has 162 members from 45 countries.

Since October 2003, the Constitution of the Federation has exten- ded voting rights to all IAF members. This change introduces the necessary adjustments of its Constitution to face the challenges of the new times, where industries and space agencies play an important role in the space sector, together with the traditional actors – the research institutes and learned societies.

Together with its associates, the International Academy of Astro- nautics and the International Institute of Space Law, the IAF orga- nizes an International Astronautical Congress held each year in a different country. Selected papers of the Congresses are published in Acta Astronautica.

The International Astronautical Federation also organizes Sympo- sium, Workshops and Events around the world. In close co-operation with the United Nations, it organizes an annual Space Workshop for Developing Nations and seminars on space activities at mee- tings of the United Nations such as those at Unispace III in 1999.

Finally, the International Astronautical Federation together with the Committee on Space Research (COSPAR) and the In- ternational Institute for Space Law, de- velops an annual survey of Highlights in Space for the United Nations.

www.iafastro.com



13

Jugend

Ein grosses Anliegen der SRV ist es, die Jugend für den Bereich Raumfahrt zu interessieren und zu begeistern. Internationale und nationale Jugendprojekte werden ausgeschrieben, begleitet und unterstützt. Den Jugendlichen stehen eine SRV-Bibliothek und -Mediathek für Schüler- und Diplomarbeiten zur Verfügung. Auf jährlichen SRV-Veranstaltungen, wie z. B. das Space Forum, kön- nen sich Jugendliche aller Altersgruppen durch Vorträge, Präsen- tationen und durch Exponate auf Ausstellungen aktiv beteiligen. Die SRV bietet den Jugendlichen eine breite Informationsplattform im Bereich Raumfahrt an. Mittels dieser Plattform ermöglichen wir in- teressierten Jugendlichen, Kontakte zu Raumfahrtorganisationen, Raumfahrtindustrie, Wissenschaftlichen Raumfahrtprojekten inter- national wie auch national zu knüpfen. Dank guten Beziehungen zu Schulen und Universitäten in der ganzen Schweiz wird dieses Angebot rege benutzt.



Diverse Jugendprojekte

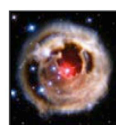
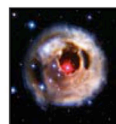
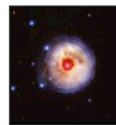
- Red Rover goes to Mars www.planetary.org
Aufsatz von Reto Trappitsch
- Eurisy www.eurisy.asso.fr

14

Informationen

Aufgrund ihrer Hauptfunktion als Bindeglied zwischen der Raumfahrt und Interessierten aus allen Bereichen, liegt ein Hauptaugenmerk der SRV auf der Information. Sie ist bestrebt, Fakten zu vermitteln und von Ereignissen zu berichten. Eine interne Veröffentlichung (SRV-Newsletter) spiegelt die derzeiti- gen Aktivitäten der Vereinigung wieder und informiert regelmäs- sig die Mitglieder über die wichtigsten Raumfahrtaktivitäten, die insbesondere in der Schweiz stattfinden.

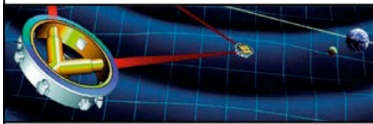
Die SRV benutzt auch die heutigen, modernen Mittel, die die Medienlandschaft im 21. Jahrhundert zu bieten hat; in Form von technisch hochstehenden Informationsanlässen (Space Forum), aber auch auf elektronischem Wege (E-Mail, PDF-Bro- schüren) sowie mit der laufend aktualisierten Website.



15

Veranstaltungen

Die SRV organisiert jährlich ein bis zwei öffentliche Informationsveranstaltungen über den gesamten Bereich der Raumfahrt. Diese Events werden gemeinsam mit verschiedenen Raumfahrtbehörden, der Wissenschaft und der Raumfahrtindustrie organisiert. An diesen jährlichen Veranstaltungen, z.B. das Space Forum und die Space Days, wird über bestehende und zukünftige Raumfahrtprojekte informiert. Bei den Veranstaltungen werden Vorträge und Präsentationen von namhaften Persönlichkeiten gehalten. Dazu gehören auch Diskussionsforen. Zusätzlich findet eine grosse Raumfahrt Ausstellung mit interessanten und aktuellen Exponaten aus allen Bereichen der Raumfahrt statt. Zu den Gästen zählen Astronauten und Kosmonauten, Vertreter der Raumfahrtindustrie und der Wissenschaft und für die SRV ein besonderes Anliegen, die Teilnahme der Jugend. Die Jugend hat die Möglichkeit, sich mit internationalen Jugendprojekten vorzustellen. Die Beteiligung der Schweiz an verschiedenen Raumfahrtprojekten wird bei diesen Veranstaltungen besonders hervorgehoben. Die Veranstaltungen sind der Öffentlichkeit frei zugänglich. Die SRV ermöglicht somit Raumfahrtinteressierten einen kontinuierlichen Informations- und Wissensaustausch.



16

swiss space Schweizerische Raumfahrt-Vereinigung
association Association Suisse d'Astronautique
 Associazione Svizzera d'Astronautica

Mitglieder

Die Mitglieder der SRV setzen sich aus den verschiedensten Bereichen des Lebens zusammen. Es sind Astronomen, Handwerker, Weltraumjournalisten, Schüler, anerkannte Wissenschaftler, Weltraumfans und mindestens ein Astronaut! Sie alle vereint das Interesse für Raumfahrttechnologie, und in der SRV finden sie den Ort, wo sie sich treffen können. Dort begegnen sie Verantwortlichen und direkt Beteiligten der Raumfahrtbranche und können sich über die Vorgänge sowie fachlichen Hintergründe informieren lassen, und dies in einer verständlichen Sprache, die den Weltraum ein wenig näher an die Erde heran bringt.



17

Claude Nicollier: Ein Schweizer in den Sternen

Von 1970 bis 1973 arbeitet Claude Nicollier als Wissenschaftler am astronomischen Institut der Universität Lausanne und am Genfer Observatorium. Danach tritt er in die zivile Flugschule in Zürich ein, um anschliessend für die Swissair die DC-9 zu pilotieren. Zwischenzeitlich nimmt er weiter an Forschungen des Genfer Observatoriums teil. Ende 1976 erhält er ein Stipendium der Europäischen Raumfahrtorganisation (ESA) für Raumwissenschaften in Noordwijk (Niederlande), wo er als Forscher an verschiedenen astronomischen Infrarot-Missionen arbeitet. 1978 wählt ihn die ESA in die erste Gruppe europäischer Astronauten. Im Rahmen eines Abkommens zwischen NASA und ESA kehrt er in den Kreis der Astronautenanwärter der NASA zurück, die im Mai 1980 als zukünftige Missionsspezialisten ausgewählt werden. 1988 besuchte er die Empire test pilots school von Boscombe Down (Grossbritannien), wo er im Dezember 1988 sein Testpilotenbrevet machte. Als Hauptmann der Schweizer Fliegertruppen flog er in seinen freien Zeiten in Bodenangriffs- und Luftunterstützungsübungen die Northrop F-5E und Hawker Hunter. Er verfügt bereits über eine Erfahrung von 5000 Flugstunden, davon 3500 mit Düsenflugzeugen. Obwohl Claude Nicollier an das Astronautenbüro von Houston (USA) abkommandiert ist, gehört er offiziell zum Astronautenzentrum der ESA in Köln (Deutschland).

Als Missionsspezialist hat er am Flug des Space Shuttles Atlantis teilgenommen. Im Verlauf der Mission STS-46 (31.7. - 8.8.1992) wurde die wiederverwendbare Instrumentenplattform EUREKA der ESA ausgesetzt, ausserdem wurden die ersten Versuche mit dem Kabelsatelliten (TSS) durchgeführt.

Vom 2. - 13.12.1993 nahm er an der Mission STS-61 mit der Endeavour teil, im Rahmen der das Weltraumteleskop Hubble (NASA/ESA) eingelangten und repariert wurde. Im Januar 1995 wurde Claude Nicollier für seine dritte Mission STS-75 ausgewählt. Während dieser 15-tägigen Mission (22.2. - 9.3.1996) fand der zweite Test des Kabelsatelliten (TSS) statt. Das Kabel riss, nachdem

der Satellit eine Distanz von 19.7 km zum Raumschiff erreicht hatte. Die Wissenschaftler konnten ihr Forschungsprogramm soweit revidieren, dass aus dem freien Flug des Satelliten noch Nutzen gezogen werden konnte. Die Astronauten konzentrierten daraufhin ihre Aktivitäten auf die Experimente mit der Nutzlast USPM-3.

Im August 1998 begann Claude Nicollier mit den Vorbereitungen zu seinem vierten Weltraumflug, der Mission STS-103 im November 1999. Während dieser dritten Mission zur Wartung des Weltraumteleskops Hubble hat Nicollier zum ersten Mal die Raumfähre verlassen. Er installierte neue Systeme und Instrumente, um die Leistungsfähigkeit des Weltraumteleskops zu erhöhen. Nach vier Raumfahrtmissionen (1992: STS-46, 1993: STS-61, 1996: STS-75 und 1999: STS-103) kann Claude Nicollier auf über 1000 Stunden im Weltraum zurückblicken, darunter ein Weltraumspaziergang von 8 Stunden und 10 Minuten.

Seit dem Juli 1996 ist Claude Nicollier Chef der Abteilung Robotik für das Raumschiff und der Internationalen Raumstation im Astronautenbüro der NASA/JSC in Houston.

In 2003 wurde er zum Extraordinarius der EPF Lausanne gewählt, ab dem Sommersemester 2004 hält Prof. Nicollier dort eine Vorlesung zum Thema „Techniques et Opérations Spatiales“.



18



Content

- Swiss Space (overview)
- Relevant international contexts
- Swiss specific aspects
- Conclusion

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

13/68



Relevant International Contexts

- WTO UNO IOC CERN ICRC IAF
- EU res. programs, ESA,
- International niches:
 - Novartis, Nestle, UBS, SwissRe, ABB, etc.
 - E.g. watch business turnover: 45% by 10/00
- Multicultural (Ge, Fr., It.; lunch in Paris?, München?, Milano?)
- 24% born abroad

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

15/68

ESA - The European Space Agency



ESA

- 17 State members & Canada
- Based in Paris
- Yearly Budget ~ 4.6 Mrd SwissFR
- Switzerland is a Founding member

Some other Space Organisations/Agencies



17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

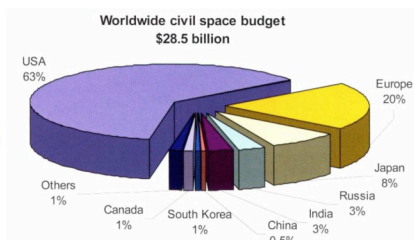
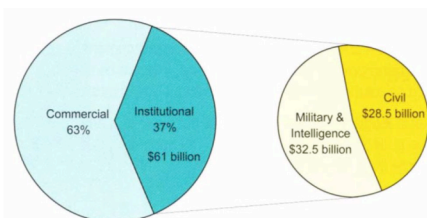
16/68

European Space Sector

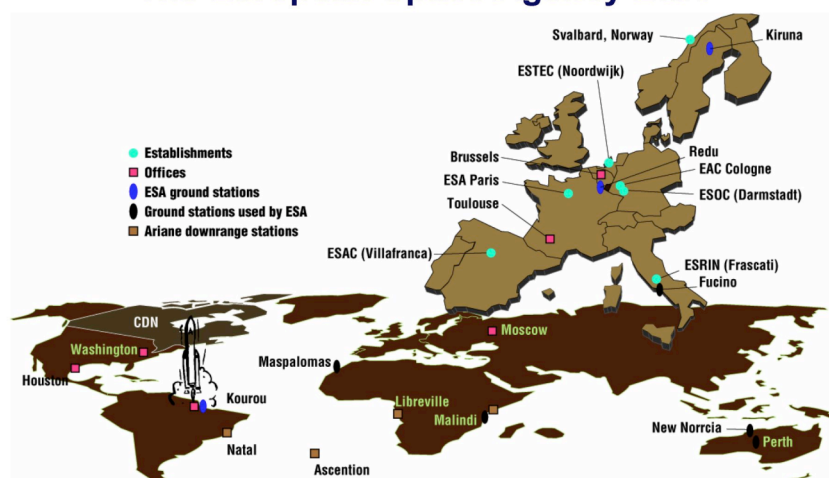
- 28 000 jobs (thereof 10 ESA astronauts)
- 250 000 jobs indirect
- 40% World Market (manufacturing, launching and servicing satellites)

Space Sector Worldwide

- ~ 170 Billion USD/yr



The European Space Agency ESA



European Space Policy



- ◆ User needs
- ◆ Operational services
- ◆ Infrastructure
- ◆ Legal framework
- ◆ Technology and system development
- ◆ Space research
- ◆ Space launchers

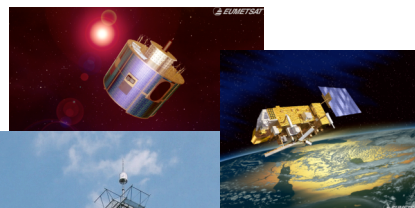
17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

19/68



- ◆ Created in 1986 as Interstate Organisation
- ◆ Operates European weathersatellites
 - geostationary
 - on polar orbit
- ◆ Swiss as Founding member



17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

20/68



17.11.2008

Jean-Daniel Dessimoz

Schweizerische Raumfahrt-Vereinigung
Association Suisse d'Astronautique
Associazione Svizzera d'Astronautica

Content

- Swiss Space (overview)
- Relevant international contexts
- Swiss specific aspects
- Conclusion

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

22/68

Swiss Specific Aspects - Overview

- Immigration and international aspects
- Stability and trust - Re 500yrs of security service
- Organisation for space matters
- Universities
- Industries
- Time
- Fairings
- Biology

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

23/68

Swiss Specific Aspects - Organisation

- Main agents
- Swiss Space Policy
 - Usefulness
 - Science
 - Niches
- Priority programs
 - GMES (Global Monitoring for Environment and Security)
 - ExoMars
 - Technology missions (Alphasat, SmallGeo, Formation flying, IXV): Inter Satellite Link, Laser optical terminals, GSEM, Small satellittes, etc.)

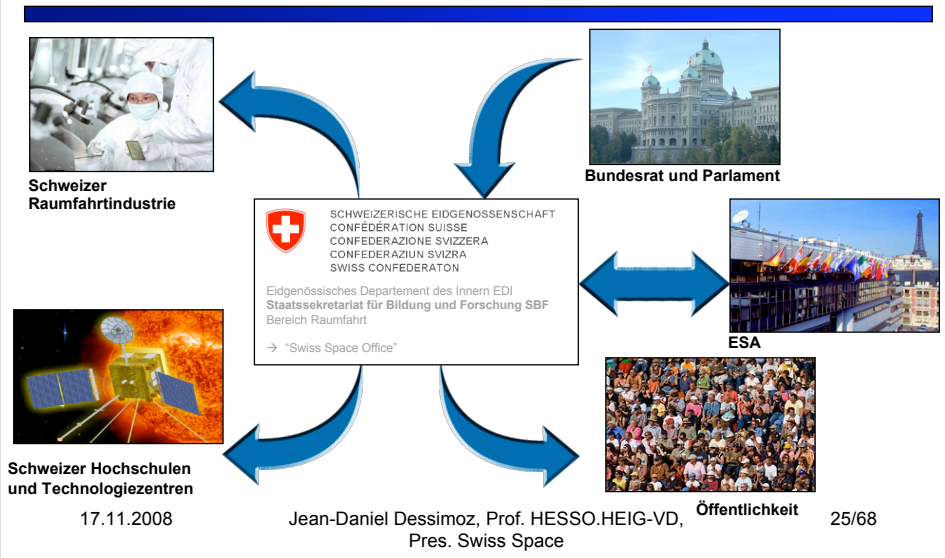


17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

24/68

Swiss Specific Aspects - Organisation

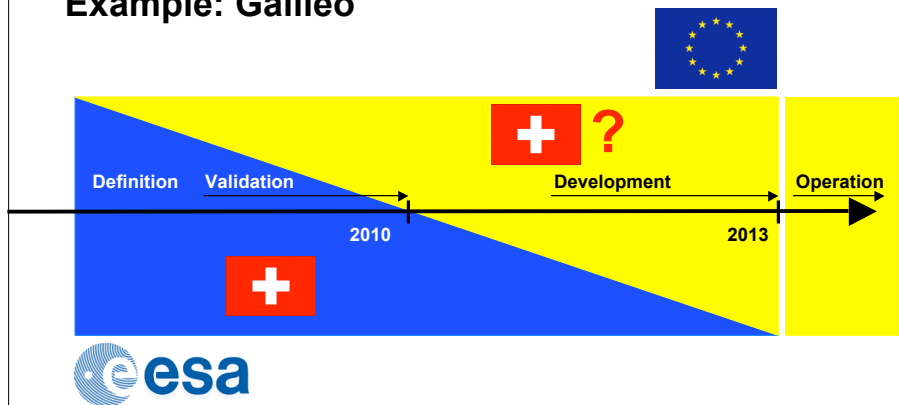


Financial Contributions and Returns



Swiss Specific Aspects - Organisation

Example: Galileo



17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

27/68

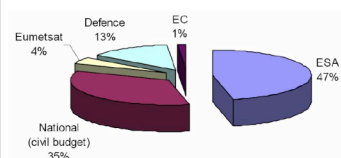
 SCHWEIZERISCHE EIDGENOSSENSCHAFT
 CONFÉDÉRATION SUISSE
 CONFEDERAZIONE SVIZZERA
 CONFEDERAZIUN SVIZRA
 SWISS CONFEDERATION
 State Secretariat for Education and Research SER



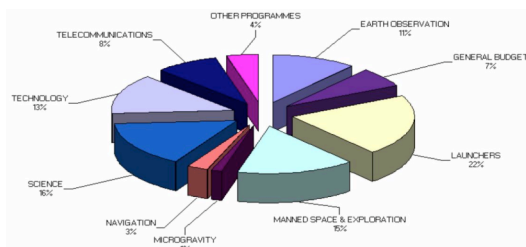
Swiss Activities

Switzerland has no National Programme

Public Spending for Space in Europe:



Swiss Activities within ESA Programmes

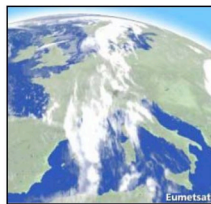


Applications

Navigation



Meteorology



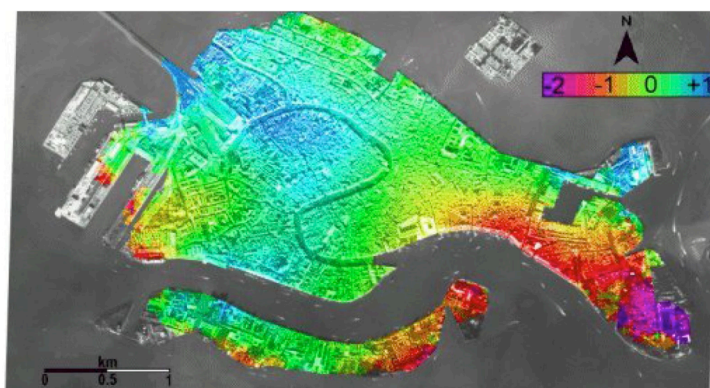
Telecommunication



Science



Applications: e.g. Earth Observation



Land subsidence rate of Venice [mm/year]

 **GAMMA REMOTE SENSING**

Swiss Specific Aspects - Universities

Universities and Institutes of Science and Technology

Examples:

- Uni Bern (Basic science, e.g. Huygens, Cassini, ...)
- ETHZurich/UniZ (Rover for ExoMars, Earth observation),
- EPFLausanne (Space Center),
- Uni Geneva (exoplanets),
- Uni Neuchâtel (time),
- HESSO-West Switzerland (microtechnologies)
- Etc.

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

31/68

Swiss Specific Aspects - Universities

Universities and Institutes of Science and Technology

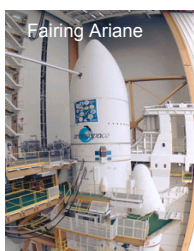
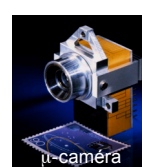
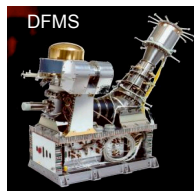


17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

32/68

Swiss Specific Aspects - Industries



Some Swiss Industrial Products for Space

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

33/68





Foreword from the chairman of the CFAS

Much is said about research and innovation these days, and their central role for our knowledge-based society as well as the importance of a fast transfer of ideas from academia to marketable products. This is exactly what the Federal Education-Research-Innovation Bill 2004 - 2007 aims for. It provides the federal authorities with the political instrument to foster research and innovation in Switzerland, and it governs also our participation with the European Space Agency ESA.

Switzerland participates in the Agency's programmes with its scientific as well as with its industrial community. Of all the industrial endeavours in Switzerland, space stands out as one of the most fascinating fields, where scientific imagination meets technical feasibility to probe the unknown realms of space. ESA is the institutional environment for Switzerland to participate in these challenging endeavours; it successfully aggregates the skills of the European space sector to exploit space for the welfare of our citizens: space technology provides access to knowledge to everybody thanks to the global reach of telecommunication satellites. Space assets contribute to security thanks to their ability to observe the Earth in day and night time. Space research helps to answering some of mankind's oldest questions on the origins of life here and beyond our Earth.

While our space industry does not rank on the front line regarding size, it stands out when it comes to technological innovation and product quality, the two very core ingredients of successful space products. That is what makes the following pages so fascinating: they provide insight into an attractive industrial sector which regularly sends the tokens of Swiss quality into the depths of the solar system.

The present brochure is intended to foster the dialogue with the federal authorities and the general public at large. It helps the Swiss Space Office of the State Secretariat for Education and Research to fulfil its challenging task to draft and implement our national space policy of which universities and industry are the key partners.

Peter Bärtsch
Peter Bärtsch
State Councillor and Chairman of the Federal Commission for Space Affairs

The Swiss engagement in ESA guarantees attractive, challenging high tech engineering jobs in Switzerland.

Introduction

The word from the chairman of the SSIG



Switzerland and space: two subjects with seemingly no commonality!

This, however, is not quite true: a handful of Swiss companies are well-known in the world space market - often better than in Switzerland - thanks to their successful commitment to this challenging field where only the best is just good enough.

The Swiss Space Industries Group SSIG, under the roof of Swisssem association, provides the Swiss space companies with a common identity to act as the industrial partner for the federal authorities, for the academic community and for the public at large when it comes to space affairs. Its mission is to foster the Swiss industrial participation in all fields of space activities, be it to explore the universe, to observe our Earth or to render all the services of which our society is daily taking advantage.

The traditional Swiss attributes like dedication, innovation, and reliability are the indispensable ingredients for successful space missions. As seen from this perspective, the Swiss involvement in space is nothing else than a logical consequence. Indeed, Swiss scientific institutes as well as Swiss space companies have acquired internationally acknowledged positions in the international space community as contractors for the European Space Agency ESA or as partners in international consortia. Switzerland and space are indeed two subjects with a surprising wealth of commonalities!

It is with pleasure that we present our readers with a portrait of the Swiss space industry and this edition of our brochure become a valuable bridge between all those who are interested in the Swiss space sector!

Umberto Somazzi
Umberto Somazzi
Chairman Swiss Space Industries Group



The Swiss space industry generates significantly more sales than the ESA contribution paid by Switzerland.



Company Activity

ACUTRONIC is the leading supplier of motion test and simulation systems for the Aeronautic, Space, Defence and Automotive markets. We support our customer through comprehensive maintenance centres and subsidiaries located in Europe, the United States and Asia. Our dedicated technical staff satisfies customer requirements by providing reliable hardware and software along with unrivalled customer support and service. ACUTRONIC's extensive experience with mechanical structures in combination with the ACUTROL® ACT3000 digital motion controller has established ACUTRONIC as today's preferred supplier of motion test and simulation systems.

ACUTRONIC offers a complete line of Inertia Guidance test systems (IGTS) for development, manufacturing, calibration and testing of inertial devices, components and assemblies. Test instruments have single or multiple degrees of freedom. Dynamic motion is enhanced with environmental simulation of temperature and pressure.

ACUTRONIC builds flight motion simulators for high fidelity Hardware-In-The-Loop (HWIL) simulations. HWIL-Instruments are optimized for minimum phase lag and amplitude distortion.

ACUTRONIC is ISO9001:2000 certified.

Space Activities

ACUTRONIC has delivered two- and three-axis simulators equipped with vacuum and temperature chambers to the major suppliers of the European, American and Asian space industries. The simulators are used for testing sun- and star tracker for satellite positioning purposes, as well as for Inertial Motion Units for the leading commercial launch vehicles.



Acutronic Switzerland Ltd.
Techecenter Schwarz
CH-8608 Bubikon (Switzerland)

Phone
Fax
E-Mail
URL

+41 55 253 23 23
+41 55 253 23 33
office@acutronic.com
www.acutronic.com



SOHO/VIRGO Cover Mechanism



Challenger's RMS unit for which AEO developed a kinematical model to analyse major operational/grasping SPAS01 Shuttle payload during proximity operations (Photo NASA)

Company Profile

AEO, located closely to Zurich, provides engineering consultancy in aeronautical and space, as well as other projects for more than 25 years. AEO covers a broad experience in an extremely wide field. AEO provides advanced FE analysis, space R & D, system engineering, mechatronic design, testing and software development. AEO is experienced in broad spectrum of hardware, especially advanced lightweight construction (space & vehicle structures, scientific experiments, mechanisms, etc.).



AEO - Aerospace Engineering Office
P.O. Box 310
CH-8855 Wangen SZ (Switzerland)

Phone
E-Mail
URL

+41 55 460 21 00
info@aeo.ch
www.aeo.ch

Activities

- System Engineering & Mechatronics
- Computational & Mathematical Methods
- Mech. Engineering (Development & Analysis)
- Testing
- Software Development (technical & scientific)

Some Space Contracts

ESA: CTS Solar Array, Space Debris Software, Launcher Dev. S/W, Advanced Design Verification, Design Sensitivity & Model Updating, Comprehensive Solar Array Analysis, Cover mechanism (BB & SM for SOHO/VIRGO), D & A for XMM-EDM Detector Box, NASA: RMS Kinematical Model, BAE: Large flexible solar array PILATUS: ARIANE Payload Fairing (Testing), PC-7 & PC-9 (Structural Analysis), DSES: STACE (Launcher System Development Software), RUAG (SF Emmen): SPACE LAB FOD, CSA: Structural Analysis of OTS, ARIANE Fairing, Inflatable Antenna Structure, ECS Yoke, ERS-1, DELTA Shroud, etc.



CTS Solar Array (Advanced Design Verification)



Space Activities

- Design, manufacture and testing of:
- Metallic Flight Structures
 - Scientific Instruments for S/C and mechanisms
 - Mechanic, Ground Support Equipment (MGSE)
 - Electromechanical Test Equipment and special production machines, jigs and tools
- As well as:
- Mechanical, dynamic and thermal analysis
 - On-site technical assistance, operation, maintenance and repair of ground equipment
 - Database development for space applications
 - Maintenance and exploitation of the EPCU S5 facilities at the CSG in Kourou (FG)

Company Profile

APCO Technologies SA is an independent company, specialised in the design and manufacture of high quality mechanical and electromechanical equipment for the space, and nuclear industries. APCO Technologies SA is strongly project oriented and provides innovative and competitive solutions to customers specific requirements in full compliance with the Company's ISO 9001-version 2000 Quality Certification.



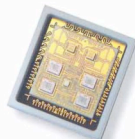
Some Space References

- Flight Hardware:
- PROBA 2 Primary and secondary structures
 - HERSCHEL PLM Crystal Vessel
 - SMART-1 S/C Primary and Second Structure
 - ISS CUPOLA Meteorite & Debris Protection
 - Reflectron-Time-of-Flight (RTOF) Mass Spectrometer for the ROSETTA Mission
 - X-Ray Multi Mirror Mission (XMM) - Satellite Mirror Module Structures
 - HUYGENS Probe - Back Cover
- Mechanical Ground Support Equipment:
- Full set of MGSE for the HERSCHEL S/C, the PLANCK S/C, the XMM S/C, the INTEGRAL S/C, the Automated Transfer Vehicle (ATV), the ROSETTA S/C
 - High Precision Positioner for the MERIS instrument
 - MGSE for the ASAR 4 and GOMOS instruments for ENVISAT
 - Full set of ARIANE 4, ARIANE 5 and ATLAS 5 Payload Faring MGSE

APCO Technologies SA

Av. de Corsier 1
P.O. Box 59
CH-1800 Vevey 1 (Switzerland)

Phone +41 21 922 11 22
Fax +41 21 922 11 26
E-Mail space@apco-technologies.ch
URL www.apco-technologies.ch



Company Profile

Since 1999 Art of Technology has been evolved to a widespread service provider of hardware and software development of embedded systems. Our flexible team allows short-time design and implementation cycles. The Art of Technology team holds both the theoretical and practical expertise to successfully solve extremely demanding tasks. It is Art of Technology's goal to provide its customers with easy access to up-to-date technologies. Services are tailored to the customer's specific needs - from single design steps to turn-key system development.

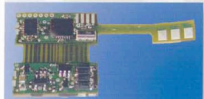
The integrated development of hardware, sensors, software and algorithms allows us to optimize the collaboration of all system components.

Activities

- Art of Technology main activities:
- Concept studies & packaging technology evaluation
 - Electronic system development & miniaturization
 - HW/SW co-design
 - Component procurement, layout & production preparation
 - Development of test infrastructure in HW & SW
 - Accompanying of production at partners

Specialities and Space Activities

A specialty of Art of Technology are the miniaturization technologies which are collated under



the term High Density Packaging (HDP). These technologies permit drastically size and weight reductions of electronic systems and therefore also to develop devices that have not been possible with conventional technologies. Increased reliability, decreased power consumption and cost reduction at system level can also be advantages of HDP-solutions. Therefore these technologies are well suited for building space electronics.

Art of Technology is an independent company holding partnerships and alliances with major manufacturers in the electronics industry that allow us to handle projects of all sizes and complexities. Our development processes according to GAMP and our certification according to ISO-9001 and ISO13485 guarantee highest quality.



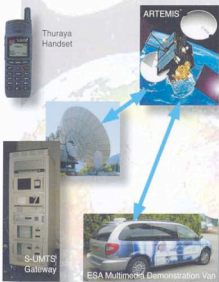
Art of Technology AG

Technoparkstrasse 1
CH-8005 Zürich (Switzerland)

Phone +41 43 311 77 00
E-Mail info@art-of-technology.ch
URL www.art-of-technology.ch

AR&T Profile

The Ascom Technology Group "Applicable Research & Technology (AR&T)" is working in the field of communications technology as well as in special niches of security solutions. The group has leading expertise in communications theory and system design, signal propagation and channel modelling, protocols and network design, RF and antenna design, and pattern recognition. This knowhow was built up over the last 15 years in numerous R&D projects in the fields of mobile radio, cordless telephony, military communications, satellite communications, navigation, wireless LAN and broadband powerline communications. The group has made substantial contributions to the development of various standards such as TETRA, GSM, UMTS, IMT-2000, and HIPERLAN.



Resources

To design, verify and realise advanced systems, AR&T has dedicated hardware and software engineers, simulation and development tools and facilities for fast prototyping based on state-of-the-art digital signal processing, VHDL/FPGA technology and protocol stack frameworks. AR&T is also involved in product industrialisation processes, standardisation, and project management. AR&T is ISO 9001 certified.

Space Communications Activities

Contracted by Hughes Network Systems, Ascom has developed and manufactured one of the world's smallest satellite phone handset (GMR Thuraya). As a key technology driver, AR&T has participated in several ESA and EC R&D programmes mainly in the field of third generation mobile satellite communications. The group has substantially contributed in the design and validation of the 3GPP W-CDMA based S-UMTS standard and in the demonstration of S-UMTS services and applications via the ARTEMIS LLM payload. Since 2001, AR&T has been contracted by Alcatel Alenia Space France in the field of Satellite Multimedia Broadcasting (SMB) for the physical layer design and propagation issues. AR&T developed the channel emulator subsystem of the SMB test platform. A replicated SMB test platform is now going to be delivered to one of the world's largest mobile operators.

Ascom (Schweiz) AG
Applicable Research & Technology
Gewerbepark
CH-5506 Mägenwil (Switzerland)

Phone +41 62 889 52 81
Fax +41 62 889 52 90
E-Mail sales.art@ascom.ch
URL www.art-solutions.ch



Company Profile

Clemessy Switzerland AG is based in Basel with a subsidiary in Geneva. It has been successfully contributing to many space programs and offers a wide range of services and solutions.

Company Activities

Support & Expertise for Electrical & Software Engineering

- SYCOE - Electrical Ground Support Equipment
- Solar Array Simulator
 - Battery Simulator & Conditioning
 - PCDU Simulator
 - Pyro Front End
 - MIL-STD-1553 Front End
 - Umbilical Interface / Launch Power
 - AIT Tools (Break Out & Fixture Box, Harness & Automated Harness Tester)

SYBENCH - Automated Test & Control Facilities

- Control & Monitoring
- Data Acquisition
- Realtime Engine
- Simulation
- Online & Offline Data Processing
- Bus Management
- Test Preparation, Log & Archiving

Maintenance & Operations



Programs

- Manned flights and orbital infrastructures: Eurobot, Inflatable Habitat
- Scientific: XMM, Integral, Mars Express, Rosetta
- Earth observation & Meteorology: Metop, Gocce
- Infrastructures: Large Space Simulator

Customers

- ALCATEL ALENIA SPACE
- EADS ASTRUM
- European Space Agency / ESTEC

Clemessy Switzerland

Güterstrasse 86b
CH-4053 Basel (HQ Switzerland)

Phone +41 61 205 31 50
Fax +41 61 205 31 51
E-Mail cys.ch@clemessy.com
URL www.clemessy.com



Company Profile

A Swiss firm founded in 1893 in Courfaivre (Swiss Jura), in the middle of a traditionally industrial region.

General Management

Managing Director
M. SANER

Space Activities

M. SANER
B. BORER

Structure and Activities

- Aeronautics
- Aerospace
- Defense technology
- Machine tool elements
- Vehicles

We are particularly well equipped for welded assemblies or sub-assemblies, which are machined with precision. We are certified ISO 9001. Condor SA utilizes a three-dimensional measuring machine MMZ 122010 (1200x2000x1000) which is equipped with a Zeiss Urmess program.

Main Aviation and Space Contracts

- Airbus 300/310 Crew seat elements
- Pilatus PC7/PC9 Nose landing gear
- Ariane 5 Engine supports



Condor SA
Rue Scheffer 6
CH-2853 Courfaivre (Switzerland)

Phone +41 32 427 01 01
Fax +41 32 426 72 10
E-mail contact@condor-sa.ch
URL www.condor-sa.ch



PLANCK Telescope

Company Activity

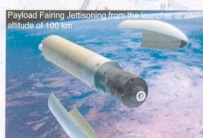
Contraves Space is the world's leading manufacturer of payload fairings for space launch vehicles in composite technology. In addition, the company serves the international space market with the development and production of spacecraft structures, high precision mechanisms for satellites, scientific instruments for space applications, as well as optical inter-satellite communication link systems.

Contraves Space AG has extensive know-how in the design, manufacturing and testing of large lightweight structures for space applications. Its competence is demonstrated by more than 35 spacecraft structures and over 170 payload fairings built for European and US customers. Contraves Space has, at its disposal, a broad range of engineering capabilities for mechanical, optical, electronics and software design, development, production and testing of complex systems for space applications.

Contraves Space employs approximately 300 staff, around half of whom are highly qualified mechanical engineers. Located in Zurich, the company is a division of the Swiss Unaxis Group and is fully owned by Unaxis Holding AG.

Applied Technologies

Complete Technology for Payload Fairings for Launch Vehicles and Spacecraft Structures. Cryo Technology for Subsystems and Instruments. Actuator Technology for High Precision



Payload Fairing Jettisoning from the launch vehicle at an altitude of 400 km

Mechanisms. Ultra High Vacuum technology for Scientific Instruments and new generation lithography components. Electro-optic Technology for Scientific Instruments and Optical Communication. Increasingly, the technologies developed for space programs are applied for industrial applications.

Actual Space Projects and References

At present Contraves Space is involved in all major programs of the European Space Agency (ESA).

- Payload Fairings for the European ARIANE 5 and VEGA as well as for the American ATLAS V-500 Launchers
- Spacecraft Structures for ADM Aeolus, METOP, PLANCK, SMOS, and the European Automated Transfer Vehicle ATV
- Scientific Instruments for Aladin Spectrometers on ADM Aeolus, and for BepiColombo Mission
- High Precision Mechanisms for Solar Array Drive Mechanisms-Low Power

The company furthermore develops Standard Radiation Environment Monitor (SREM) for space applications, as well as Standard Rack Systems in the frame of ESA's Automated Transfer Vehicle programme.

Contraves Space AG
Schaffhausenstrasse 580
CH-8052 Zurich (Switzerland)

Phone +41 44 306 22 10
Fax +41 44 306 29 10
URL www.contravesspace.com



Company Profile

CSEM (Swiss Center for Electronics and Microtechnology, Inc.) performs research and development work as well as small quantity production of components and systems for industry and government agencies. Space projects are carried out in the frame of an Aerospace programme.

Applications and Competencies

Applications for optical communication, earth observation instruments (ENVISAT MERIS, METOP IASI), scientific instruments (XMM), wavefront engineering, and hyperaccurate pointing optomechanisms or active damping mechanisms are realised, the integration being performed in 100-class clean room.

Furthermore, new instruments and microsystems relying on the extensive use of micro and nanotechnologies are being developed. Other activities include optical active pixel sensors (APS) and physical microsystems, microrobotics, data communication software, mobile wireless communication, communication protocols and ambulatory telemetry systems.

CSEM's approach is based on concurrent engineering. Modelling and simulation of smart structures are performed with a comprehensive CAD environment. Environment for the development of low-power analog and digital boards is available for advanced circuits. Fast prototyping of control engineering is used in conjunction with precision positioning ground support equipment.

ISO 9001:2000 certification



Vibration Damping



METOP IASI

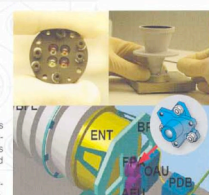
CSEM Swiss Center for Electronics and Microtechnology, Inc.
Rue Jaquet-Droz 1
CH-2007 Neuchâtel (Switzerland)

Phone +41 32 720 51 11
Fax +41 32 720 57 30
E-Mail info@csem.ch
URL www.csem.ch

Made-to-Measure Solutions by FISBA

FISBA OPTIK AG, established almost fifty years ago, has achieved a globally recognized top position in the manufacture of customized solutions for complex optical systems, assemblies and instruments.

Customers benefit from decades of expertise gathered by FISBA's dedicated team of specialists. Combining this knowledge with creativity, innovative strength and dependability is paramount in finding cost-efficient solutions for high-tech optical applications fitted to FISBA's customer's specific needs. This applies to FISBA's areas of competence such as optical systems and assemblies, laser systems and metrology. Being able to provide outstanding solutions to extensive optical requirements, FISBA has also gained a reputation in the field of space optics, providing miniature camera lenses for the Rosetta Mission in 2014, the Venus monitoring camera in the Venus Express Mission, scheduled for 2006, or the optical components for the altimeter of the Bepi Colombo Mission in 2012.



FISBA's Areas of Competence

- Customer-specific optical design backed by in-house production and assembly
- Research and development of micro systems with special emphasis on micro-optics e.g. used for space-borne laser instruments
- Design and production of subassemblies for optical communication in space
- Development and production of hybrid optics with refractive and diffractive optical elements (ROE, DOE) used for high-power beam shaping
- Experience in developing optical systems, specific lenses and mirror optics for the entire spectral range including visible (VIS), infrared (IR) and ultraviolet (UV) upon customer request
- Development, design and manufacturing of highly integrated optical products such as interferometers or high power diode laser systems

FISBA OPTIK AG
Rorschacher Str. 268
CH-9015 St. Gallen (Switzerland)

Phone +41 71 282 31 31
Fax +41 71 282 31 30
E-Mail info@fisba.ch
URL www.fisba.ch

Company Profile

HTS AG is a high technology company based near Zurich with a subsidiary in Dresden. The company was founded in 1992 and has been very successfully contributing to the European aerospace market since then.

HTS' core activities are the development, manufacturing, integration and qualification of:

- Mechanisms
- Experiment Facilities and Instruments
- Electrical Systems
- Primary and Secondary Structures

Since November 2000 HTS is part of the RUAG Group.



Rosetta HGA Major Assembly

Experience

HTS has been demonstrating its know-how in many projects as prime and subcontractor. These include: LISA Pathfinder, James Webb Space Telescope, Rosetta, Herschel, the European Robotic Arm (ERA), the FOTON-M3 mission, the Material as well as the Fluid Science Laboratory for the ISS, APEX and many others. Our main clients in the space market are ESA, EADS Astrium, EADS SPACE Transportation and Alcatel Alenia Space.



European Robotic Arm, ERA

This experience combined with the comprehensive arrangement of development and manufacturing facilities qualifies HTS as a systems house which is in the position to realise complex space projects containing mechanical, thermal, electrical and optical issues with challenging technical specifications.

Infrastructure / Equipment

HTS uses state-of-the-art software tools for design, engineering and analysis such as Catia, I-DEAS, Unigraphics and Nastran.

The metal manufacturing facility is well-equipped for the production of highly precise components. HTS' composite shop consists of high-tech equipment for filament winding, handlamination and sample testing.

HTS has cleanrooms (100 and 100 000 class) for the assembly and integration of flight hardware. Thermal, electrical and mechanical testing can be carried out in the own test laboratory.

HTS AG
Widenholzstrasse 1
CH-8304 Wallisellen / Zurich (Switzerland)

Phone +41 44 839 12 12
Fax +41 44 839 12 00
E-Mail hts@hts.ch
URL www.hts.ch

Company Profile

MECANEX, established in 1959, subsidiary of RUAG Aerospace since 2000, offers engineering, design, manufacturing, integration, assembly and testing of space hardware such as:

- Slipping-brush assemblies
- High performance mechanisms and
- Micro-systems

MECANEX is certified to ISO 9001:2000 with extended knowledge of ECSS standards.



Facilities

MECANEX performs the complete development and production cycle for space hardware in-house, from the establishment of requirement specifications to qualification and acceptance testing. Capabilities include:

- Project Management
- Design and Engineering are available (CAD/FEA)
- Precision Machining Workshop (CAM)
- Resin Moulding Facility (Thermal Chambers, Vacuum Chambers)
- Assembly (Laboratory or clean room environment, certified operators)
- Test (Functional, environmental)

Main space activities

Slipping-brush assemblies for SADM (LEO and GEO satellites) and instruments, including long life low wear rate slipping-brush assemblies. Rotating contactless power and data transfer devices are part of the current development activities.

Main space contracts

Telecom: Slipping-brush assemblies on more than 100 satellites in orbit since 1986. Course Pointing Mechanism for SILEX (ARTEMIS/SPOT4)

Space Station and Shuttle: Slipping-brush assembly for the ISS CAM. Pulling mechanisms for furnace (AGHF, MSL). Slipping-brush assemblies for NIZEMI, MEDEA, Bioractors (with IMT/ETHZ).

Scientific Missions: Slipping-brush assemblies for MicroWave Radiometer Instrument. Slipping-brush assemblies for SADM (SPOT, Envisat, ATV), Corner Cube Mechanism (IASIMETOP).

Inter-planetary missions: Precision mechanisms for ACP, Cassini, Huygens mission and ROSETTA DFMS.

Micro-rovers: SpaceCat and Nanokhod robot (with VHS and EPFL) ESA contract in collaboration with VHS and EPFL.



MECANEX S.A.
Vuarpilliere 29
CH-1260 Nyon (Switzerland)

Phone +41 22 361 77 33
Fax +41 22 361 67 52
E-Mail info@mecanex.ch
URL www.mecanex.ch

Company Profile

Production, maintenance and overhaul of landing gear systems, wheels and brakes for aircraft and helicopters.

Engineering and production of components for the aeronautical and space industry.

Production of high reliability fixtures for power plants, packing systems and machine tools.

Certificate

- ISO 9001 : 2000



NEW AMBROSETTI TECHNOLOGIES SA
CH-6928 Manno (Switzerland)

Phone +41 91 611 16 16
Fax +41 91 611 16 06
E-Mail info@newambrosetti-tech.com



Company Profile

RUAG Aerospace is a leading supplier and integrator of systems and components for civilian and military aerospace applications.

It is active in aircraft and space systems structures and mechanisms from detailed design to maintenance activities.

RUAG Aerospace belongs to the Swiss technology group RUAG Holding. HTS AG, Wallisellen and Mecanex S.A. Nyon are subsidiaries of RUAG Aerospace.



Space Activities

RUAG Aerospace develops, manufactures and tests components and equipment for satellites and space launchers as well as ground support equipment on the mandate of ESA, ESTEC, CNES or the industry. Prior to the homologation of the assemblies RUAG Aerospace performs intensive testing such as dynamic tests for deployment and separation of long umbilical cables, static tests, static vibration and fatigue tests as well as electrostatic tests.

In the ARIANE and ATLAS projects we perform the following work on the fairing under contracts with Contraves Space:

- Definition of the aerodynamic loads
- Integration of upper & lower ogive as well as extension modules
- Instrumentation including development, fabrication and testing of equipment
- Electrostatic protection and bonding
- Umbilical-cable and separation-systems
- Venting development and integration
- Painting of assembled fairing

RUAG Aerospace
P.O. Box 301
CH-6032 Emmen (Switzerland)

Phone +41 41 268 43 11
Fax +41 41 268 39 48
E-Mail marketing.aerospace@ruag.com
URL www.ruag.com

Company Profile

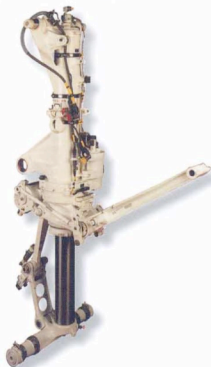
Production, maintenance and overhaul of landing gear systems, wheels and brakes for aircraft and helicopters.

Engineering and production of components for the aeronautical and space industry.

Production of high reliability fixtures for power plants, packing systems and machine tools.

Certificate

• ISO 9001 : 2000



NEW AMBROSETTI TECHNOLOGIES SA
CH-6926 Manno (Switzerland)

Phone +41 91 611 16 16
Fax +41 91 611 16 06
E-Mail info@newambrosetti-tech.com

Company Profile

RUAG Aerospace is a leading supplier and integrator of systems and components for civilian and military aerospace applications.

It is active in aircraft and space systems structures and mechanisms from detailed design to maintenance activities.

RUAG Aerospace belongs to the Swiss technology group RUAG Holding. HTS AG, Wallisellen and Mecanex S.A. Nyon are subsidiaries of RUAG Aerospace.

Space Activities

RUAG Aerospace develops, manufactures and tests components and equipment for satellites and space launchers as well as ground support equipment on the mandate of ESA, ESTEC, CNES or the industry. Prior to the homologation of the assemblies RUAG Aerospace performs intensive testing such as dynamic tests for deployment and separation of long umbilical cables, static tests, static vibration and fatigue tests as well as electrostatic tests.

In the ARIANE and ATLAS projects we perform the following work on the fairing under contracts with Contraves Space:

- Definition of the aerodynamic loads
- Integration of upper & lower ogive as well as extension modules
- Instrumentation including development, fabrication and testing of equipment
- Electrostatic protection and bonding
- Umbilical-cable and separation-systems
- Venting development and integration
- Painting of assembled fairing



RUAG Aerospace
P.O. Box 301
CH-6032 Emmen (Switzerland)

Phone +41 41 268 43 11
Fax +41 41 268 39 48
E-Mail marketing.aerospace@ruag.com
URL www.ruag.com

Company Profile

The company activities are to design, develop and produce electronic hardware and software for space systems.

Since 1965 SYDERAL SA, previously known as Alcatel Space Switzerland and CIR, has been extensively involved in ESA programs and has established scientific, technological and industrial co-operation with space agencies and industries.

On board Equipment

- Data Handling Equipment for Satellite Platforms
- Platform computer
- Remote Terminal
- Thermal Control Unit
- On-board Software

Data Management Equipment for Satellite Payloads

- Payload Processor
- Instrument Controller
- Mass Memory
- Payload Software

Microgravity and Space Station

- In Orbit Experiments
- Medical Instrumentation
- Data Management Systems
- On-board Software

Ground Equipment

- Unit Tester
- Satellite Test Equipment
- Ground Support Equipment
- Control Stations

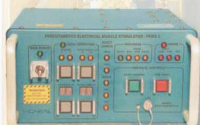
Main Space Contracts

SYDERAL SA has obtained contracts for almost all large European space programs such as Spacelab, Eureka, Meteosat, ERS, Olympus, Skyview 4, Ariane, Envisat, Syracuse 2 & 3, MIR station, Metop, various STS Shuttle missions, ERA, ATV, SARLUpe, GOCE, EXPRESS AM, International Space Station-ISS, NASA-HRF, AECOLUS.

The company is ISO 9001 : 2000 certified.

SYDERAL SA
Neuenburgstrasse 7
CH-3238 Gals (Switzerland)

Phone +41 32 338 98 00
Fax +41 32 338 99 34 or 36
E-Mail info@syderal.com
URL www.syderal.com



Temex Neuchâtel Time SA

is a dynamic and innovative company in constant progress in high technology.

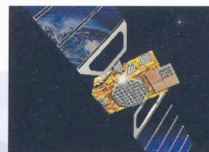
The TNT team mainly concentrates in the design, the manufacturing, the marketing and sales of Time and Frequency Products for industrial and space applications.

Since 1997, TNT has developed several space-qualified clocks, as the Ultra Stable Oscillator (USO) based on a SC cut quartz, Rubidium Atomic Frequency Standard (RAFS) or Space Passive Hydrogen Maser (S-PHM). The RAFS was developed in the frame of the GALILEO Navigation Satellite.

Over the last two years, six RAFS Flight Models have been produced and delivered for integration at GALILEO payload level and fourteen USO Flight Models have been delivered for different space programs in Europe, USA and India.

In 2005, two S-PHM Physics Packages Flight Models were delivered for integration at instrument level and have been successfully qualified. One of them will fly early 2006 with the first GALILEO experimental satellite.

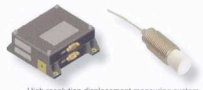
In addition, after year 2000, TNT has increased its involvement in space system definition by its participation in the early phases of several ESA projects both on ground and space segments. The TNT expertise and production capability in the "Time and Frequency" domain is unique in Europe.



Temex Neuchâtel Time SA
Vauseyon 29
CH-2000 Neuchâtel (Switzerland)

Phone +41 32 732 16 66
Fax +41 32 732 16 67
E-Mail mail@temextime.com
URL www.temextime.com

Vibro-Meter



High resolution displacement measuring system
(range 1 to 9 mm) (sensor shown enlarged)

About Vibro-Meter
Vibro-Meter specialises in the design and manufacture of high-reliability sensors and systems for monitoring critical machinery on land, sea and air. The Fribourg headquarters houses over 400 staff and includes extensive research, development and engineering facilities, as well as production, sales and customer support functions. Others facilities are located in Europe and the USA.

Space Experience
Since 1987 Vibro-Meter has been actively involved in space projects, beginning with proximity probes for testing components of the first Vulcain engine. Today the range of space products has evolved to include sensors and systems for measuring displacement, relative and absolute vibration, rotational speed and dynamic pressure. Many are flight qualified for Ariane 5. Vibro-Meter products operate in the most harsh environments such as the liquid oxygen and hydrogen turbopumps, pyrotechnic devices, and the gas-generator and output nozzle - a temperature range from -253 to +780°C, pressure up to 350 bar and vibration up to 10,000g.

Vibro-Meter is qualifying the High Resolution Standard Proximity Sensor (HRSPS) for use in satellite mechanisms and monitoring systems. The development was funded by an ESA GSTP contract. Contracts for Flight Models for ISS applications have been awarded.

Vibro-Meter SA
Rte de Moncor 4
P.O. Box 1616
CH-1701 Fribourg (Switzerland)

Phone +41 26 407 11 11
Fax +41 26 402 36 62
URL www.vibro-meter.com

Swiss Space Industries Group

Swiss Space Industry Capabilities

Acadron AG
AFC Aerospace Engineering Office
APCO Technology AG
Ascom Syntec AG
Clemensy
Contra SA
Contraves Space AG
CSEM Centre Suisse d'Electronique
FISBA OPTIK AG
HYS AG
M&M SA
NEW AMBROSETTI TECHNOLOGIES SA
RUAG Aerospace
Sydral SA
Terres Neuchâtel Time SA
Vibro - Meter SA

Main Space Activities & Services

- Research
- Engineering
- Software Development
- Manufacturing
- Testing
- Overhaul

Major Subsystems & Products

- Structures for S/C & Launchers
- MGSE
- EGSE
- Electric Motors & Actuators
- On-board Electronics
- On-board Software
- Scientific Instruments
- Earth Observation Sensors
- Optics
- Telecommunication
- Equipment & Pumps
- Electrical Systems
- Instrumentation
- Mechatronics
- Mechanical Components
- Data Processing
- Application Software

Facilities

- Manufacturing Plant
- Test Site

swiss space

association

Schweizerische Raumfahrt-Vereinigung
Association Suisse d'Astronautique
Associazione Svizzera d'Astronautica

Industries

Swiss Specific Aspects - with ESA contracts

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

46/68

Swiss Specific Aspects - Time

- **Watches**
 - Re. Turnover at world level
 - For space people: USA(Omega-SMH), Russia (Fortis)
- **Galileo:**
 - Extraordinary accuracy:
 <1second error / 2.7 million years!
 - http://a1862.g.akamai.net/7/1862/14448/v1/esa.download.akamai.com/13452/podcast/Galileo_POD_04-06-08.mp4
 - **Temex, then 2007... Orolia (F) - SpectraTime (F, CH, USA) ...**

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

47/68

Galileo



Swiss Specific Aspects - Time



Galileo, time and space

9 June 2008

With the recent launch of the GIOVE-B satellite, Europe is today demonstrating its mastery of broadcasting time signals with unprecedented accuracy.

[XML](#) [Vodcast](#)

[Play now](#) | [Download](#)

The Galileo constellation will be the world's most reliable global navigation system. The technologies that have been developed to achieve such precision will also provide data for use in many other fields, such as oceanography and meteorology.

The Galileo system will also open new horizons in fundamental sciences. The extremely small differences in timekeeping between the satellite clocks moving in orbit and their Earth-bound counterparts will lead scientists to a re-evaluation of the nature and influence of gravity in the Universe.



17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

49/68

Swiss Specific Aspects - Time

The Space Review

essays and commentary about the final frontier



The more precise timekeeping system planned for Galileo could prove to be a major competitive advantage for the system over GPS. (credit: ESA)

EU-US chronowar

by Taylor Dinerman
Monday, January 16, 2006

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

50/68

Swiss Specific Aspects - Time

The Europeans, who are building their program from scratch, understood, and intend to exploit, the promise of hydrogen masers. They are going to be launching an experimental one on their Giove-B satellite later this year. Their system is partly based on technology they obtained from Russia, which has long experience with masers. Made by a cooperative venture between Italy's Galileo Avionica, which provides the electronics, and the Neuchatel Observatory and the company Temex Neuchatel Time, based in Switzerland's traditional watch-making region, who are building the core. They hope to succeed in building and space-qualifying a passive hydrogen maser that will weigh less than 15 kilograms.

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

51/68



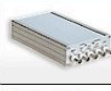
SPECTRATime
iPrecision Timing Solutions®

[Products](#)
[Solutions](#)
[Tech Support](#)
[Design Help](#)
[中文](#)
[About Us](#)
[Contact Us](#)

Search [Go!](#)

Our Mission

To be the world's leading supplier of smart, low-cost, high-performance Swiss-quality clock source and test set solutions for the industries we serve.

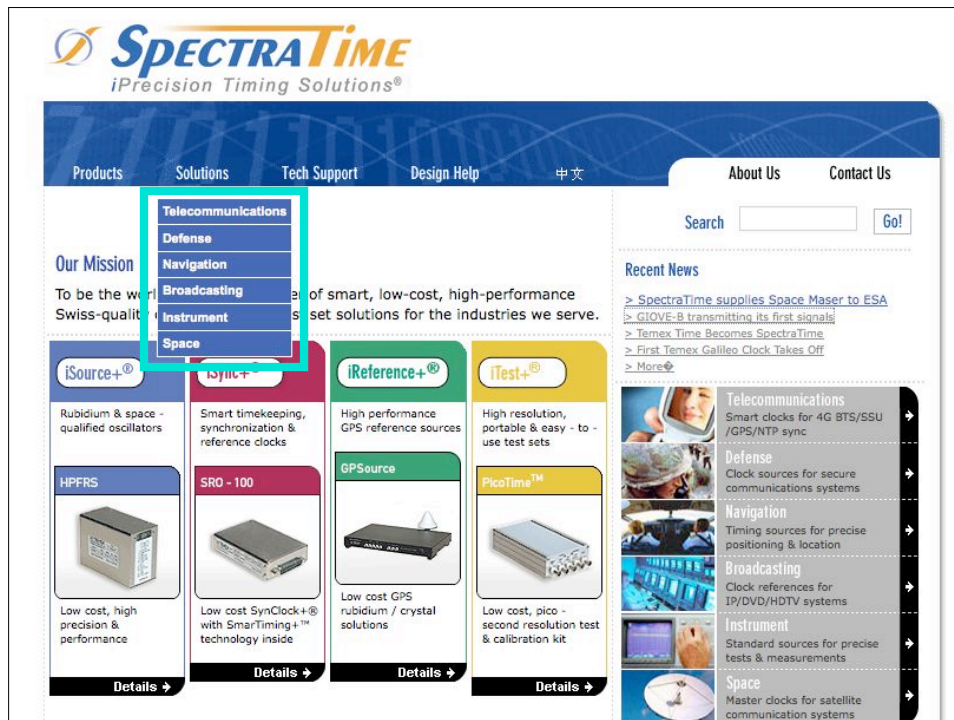
iSource+® Rubidium & space - qualified oscillators  Low cost, high precision & performance Details >	iSync+® Smart timekeeping, synchronization & reference clocks  Low cost SyncClock+® with SmartTiming+™ technology inside Details >	iReference+® High performance GPS reference sources  Low cost GPS rubidium / crystal solutions Details >	iTest+® High resolution, portable & easy - to - use test sets  Low cost, pico-second resolution test & calibration kit Details >
---	---	---	---

Recent News

- > [SpectraTime supplies Space Maser to ESA](#)
- > [GIOVE-B transmitting its first signals](#)
- > [Temex Time Becomes SpectraTime](#)
- > [First Temex Galileo Clock Takes Off](#)
- > [More >](#)

- Telecommunications**
Smart clocks for 4G BTS/SSU /GPS/NTP sync
- Defense**
Clock sources for secure communications systems
- Navigation**
Timing sources for precise positioning & location
- Broadcasting**
Clock references for IP/DVD/HDTV systems
- Instrument**
Standard sources for precise tests & measurements
- Space**
Master clocks for satellite communication systems

©2006 SpectraTime. Site Designed by xMedia. Privacy policy | Legal | Site Map



swiss space  Schweizerische Raumfahrt-Vereinigung
association Association Suisse d'Astronautique
 Associazione Svizzera d'Astronautica

Swiss Specific Aspects - Fairings

- Fairings
 - Oerlikon: since 1979- (« 30 years of op. EU, USA, ... »)
 - 100% reliability
- Fairings and other structural elements

17.11.2008 Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
 Pres. Swiss Space 54/68

Swiss Specific Aspects - Fairings



headquarter

[ABOUT SPACE](#) [PRODUCTS & SERVICES](#) [FIELDS OF COMPETENCE](#) [FACILITIES](#) [MEDIA](#) [CONTACT](#) [CORPORATE](#)



Products

- Spin-off products
- **Payload fairings**
 - Design
 - Production
 - Integration
 - Testing
 - Launch Support
 - Key figures
- Ultrastable structures
- Precision Mechanisms
- Electro-optical systems
- Standard Rack Systems
- Scientific experiments
- Contact

Payload fairings



Satellites are carried into space by launch vehicles. The payload is fastened at the top of the launcher under the payload fairing, which shelters the satellites before and during the start and on their flight through the atmosphere from thermal, aerodynamic and acoustic effects, and provides the launcher with an aerodynamically optimised shape. The payload fairing is jettisoned as soon as the launcher has left the atmosphere at a height of about 120 km.

The first payload fairing designed by Oerlikon Space was for the European Ariane 1 launcher, which made its successful debut on 24 December 1979. More than 160 payload fairings aboard European and US-American launch vehicles have been

Contact

Sales & Marketing
 T: +41 44 306 2200
 F: +41 44 306 2210
sales.space@oerlikon.com

Oerlikon Space AG
 Schaffhauserstrasse 580
 8052 Zurich
 Switzerland

Product Development Payload Fairings
 T: +41 44 306 2262
 F: +41 44 306 2028
[send e-mail](#)

Oerlikon Space AG
 Schaffhauserstrasse 580
 8052 Zurich
 Switzerland

17

Language English

Swiss Specific Aspects - Fairings

Design

Key figures

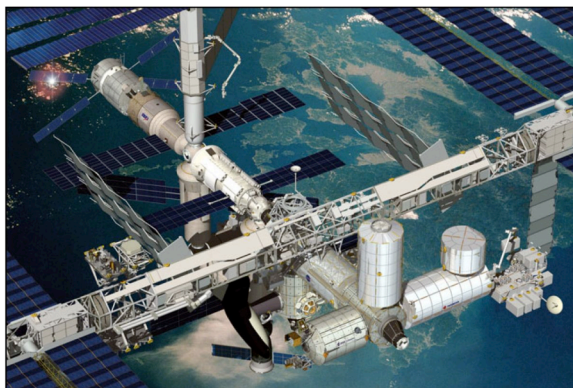


Since their introduction in 1979 the payload fairings from Oerlikon Space have become a world benchmark in the market thanks to their unrivalled 100% reliability. Many different types of launchers have been equipped with Oerlikon Space payload fairings.

Permanent product and production process improvement efforts as well as co-operative partnership agreements with the international customers constitute the basis for this outstanding success.

Oerlikon Space has designed and manufactured payload fairings for the whole range of small to heavy launch vehicles:

Fairings and Swiss Specific Aspects - ATV components

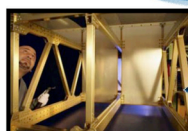
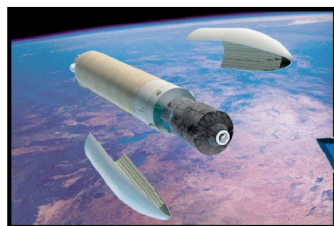


17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

57/68

Fairings and Swiss Specific Aspects - ATV components



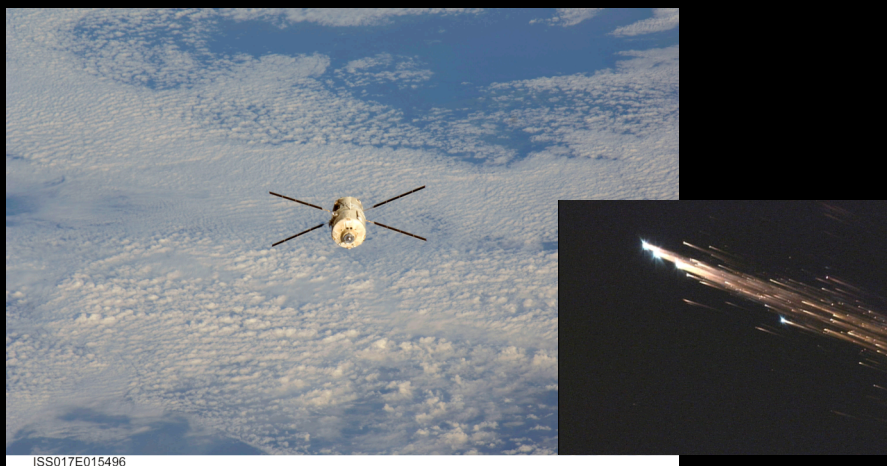
oerlikon
space

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

58/68

Swiss Specific Aspects - ATV components



Swiss Specific Aspects - Biology

- **Biocompanies and Pharmaceuticals are strong in Switzerland (Novartis, Clariant, Roche, Syngenta and Ciba, previously also known as Ciba, Geigy, Sandoz et Hoffmann-La Roche; and others); microtechnologies as well**
- **Many biology missions from Zurich**
- **BioTeSC - Support center for biology related experiments on ISS**
- **ExoMars and Life on Mars?**
- **Manned missions and Claude Nicollier**

Swiss Specific Aspects - Biology



17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

61/68

Swiss Specific Aspects - Biology

The 4.5-metre cylinder, which cost an estimated \$1 billion (SFr1.1 billion), houses five so-called racks, each roughly the size of a telephone booth. Each of these is in fact an autonomous laboratory, given over to research in a particular field.

The Biolab, which will handle biological experiments on Columbus, will be monitored in part by researchers from Zurich's Federal Institute of Technology.

These experiments will try to understand what role weightlessness plays at all levels of an organism, from the effects on a single cell up to those on humans.

The Biotesc team of the institute's space biology group is acting as the facility support centre for Biolab, as well as taking responsibility for the Swiss user support for ISS operations

The ISS is a joint project between the space agencies of the United States, Russia, Japan, Canada and Esa.

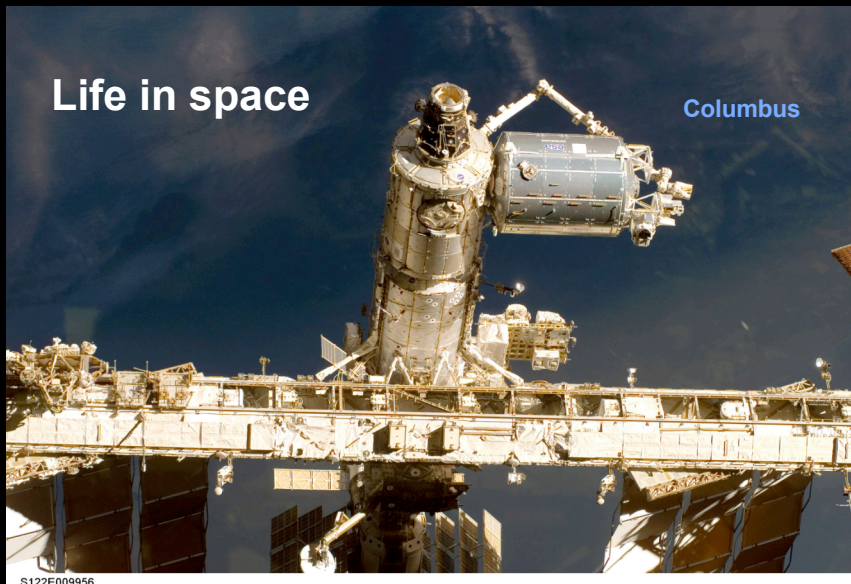
17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

62/68

Life in space

Columbus



Biolab

17.11.2008

swiss space
associates

ESA - Human Spaceflight and Exploration - International Space Station - Biolab

http://www.esa.int/esahs/ESABEGOVMOOC/iss_1.html

Les plus visités - Popu U B Y E SMI SMibis DJIA DJbis gaps-Réseau gaps-lara CAPS CFF LaRA webmail-heig-vd Reverso RoboCup@Home TC...

ETH - Space Biology Group - R... ESA - Human Spaceflight and E...

esa International Space Station Human Spaceflight and Exploration European Space Agency

ESA Home International Space Station Exploration Research Astronauts Education Business

17-Nov-2008

Article Images

Biolab

Back to article



Download: **HI-RES JPEG** (Size: 3366 kb)

Biolab (artist's impression). Biolab is a facility designed to support biological experiments on micro-organisms, cells, tissue cultures, small plants and small invertebrates. The major objective of performing Life Sciences experiments in space is to identify the role that weightlessness plays at all levels of an organism, from the effects on a single cell up to a complex organism including humans. The Biolab facility will be launched inside the European Columbus laboratory.

Credits: ESA - D. Ducros

Last update: 23 July 2008

Copyright 2000 - 2008 © European Space Agency. All rights reserved.

Columbus facilities

- European Drawer Rack (EDR)
- European Physiology Modules (EPM)
- European Transport Carrier (ETC)
- Fluid Science Laboratory (FSL)
- Microgravity Science Glovebox (MSG)

External payloads

- European Technology Exposure Facility (EuTEF)
- SOLAR

Human Spaceflight
SPACE FOR LIFE

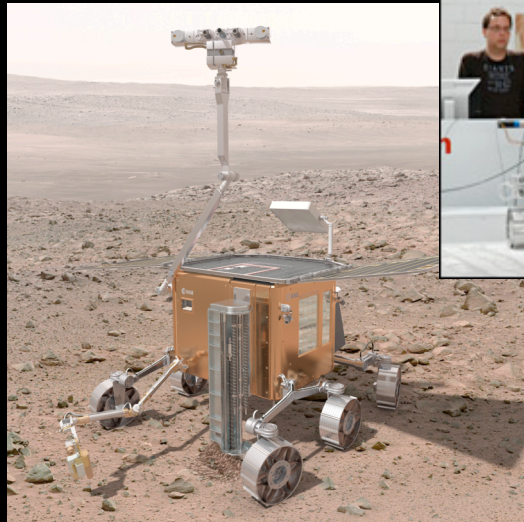


Photo: Swiss Space



Photo: Swiss Space

Content

- **Swiss Space (overview)**
- **Relevant international contexts**
- **Swiss specific aspects**
- **Conclusion**

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

67/68

Conclusion

- **Swiss Space involves various society segments**
(science, industry, education, administration, youth and general public)
- **Relevant international contexts** (ESA, IAF, EU, UNO, WTO)
- **Swiss specific aspects** (international elements, niches, time, fairings, biology and biomedical applications/markets)
- **China-Switzerland and the future?**
 - Swiss time-basis for a future Chinese mission?
 - Nestlé and rice or tea derivatives for space??
 - Various initiatives are already underway
 - Enjoy your visit in CH and EU!

17.11.2008

Jean-Daniel Dessimoz, Prof. HESSO.HEIG-VD,
Pres. Swiss Space

68/68

Credits

- ◆ Daniel Frei, Peter Erni, Urs Frei, Lino de Faveri
 - Staatssekretariat für Bildung und Forschung (SBF)
 - Bereich Raumfahrt
 - (Fuerst_erni.pdf, Presentation SO SRV .ppt)
- ◆ SSIG (brochure)
 - http://www.oerlikon.com/ecomaXL/index.php?site=SPACE_EN_products_payload_design
 - (Situation villa Sarrazin: aéroport derrière halle 1 palexpo)
 - (cf. also Axel Deich/Oerlikon; Ursula d'Aquino/Cluster Aviatik; Hervé Dedieu; Maurice Borgeaud; Philippe Willekens/IAF; Yang Junhua (China Soc. of Astronautics & IAF Policy Advisory Committee steering group); and others)