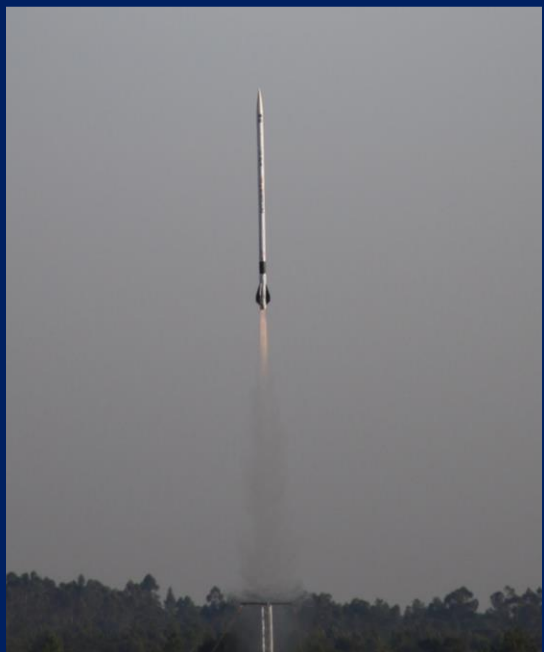


aris
space to grow

ARIS Annual Report 2020/21



“Contribute to the Advancement of Life and Take Part in Exploring its Origins by Developing Systems Meant for Space” - The ARIS Vision



inspire.

*Contribute to the
Advancement of Life and
Take Part in Exploring its Origins by
Developing Systems Meant for Space.*



engage.



build.



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Official Annual Report of ARIS for the fiscal year from October 2020 to October 2021

Issued by the ARIS association board on November 1st, 2021

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President

David Häusermann
Vice President

Cesare Primultini
Treasurer

Otso Gächter
Industrial Relations

Michael Kerschbaum
Academic Relations

Marco Trentini
Legal / Admin

Lukas Hauser
Strategic Development



2021 – Expanding towards new endeavors

EXECUTIVE SUMMARY

In September 2020, together with 150 ARIStronauts (increased to 300 in September 2021), we headed towards another highly exciting journey within the field of space research and exploration. We tackled exciting technical and organizational challenges, reaching remarkable milestones and laying the groundwork for exciting projects to come.

Within the cycle of 2020/21, we launched and successfully recovered two 4 kg payloads at the European Rocketry Challenge 2021 in Portugal. On the 13th of October 2021, we had two high-power rockets ready to launch within an hour. Two days later, on the 15th of October, we marked lift-off of the first sounding rocket propelled by an in-house developed hybrid rocket engine, reaching an apogee of 6'500 m. This flight was honoured by the jury of the European Rocketry Challenge 2021 with the first place in the category Hybrid, 30'000 ft.

Similar to our hybrid rocket engine development launched three years ago, we initiated the development of an autonomous guided recovery system for sounding rockets in September 2020. This newly-developed system showed highly promising results during a series of helicopter drop tests from heights of 800 m to 1200 m in Summer 2021.

On an academic side, we had the chance to participate in the panel of distinct lectures, highlighting the impact of women in space and science. This inspired the creation of an ETH lecture series named 'Space Research and Exploration' initiated by ARIS, hosted by Prof. Sascha Quanz and supported by Space Innovation. This series launched in September 2021 with more than 120 students from ETH Zurich and University of Zurich enrolled in the course.

In the upcoming year we will continue the sounding rocket development in the same format as in the past years. Additionally, the ARIS strategic development team defined and initiated three new path finder projects to launch in September 2021. We are proud to announce, that we aim to build and launch our first small-scale satellite 'SAGE' within the coming two years. Furthermore, we started the development of a small-scale liquid rocket engine for research purposes. Furthermore, we will investigate the exploratory part of space-related research by developing an autonomous underwater vehicle (AUV) targeting future space exploration missions.

Academic Partners

ETH zürich

Lucerne University of
Applied Sciences and Arts

**HOCHSCHULE
LUZERN**

Technik & Architektur

zhaw School of
Management and Law



University of
Zurich ^{UZH}

UZH Space Hub

OST
Ostschweizer
Fachhochschule



CHAS
lab
Laboratory of
Composite Materials
and Adaptive Structures



Universität
Zürich ^{UZH}
Physik-Institut

Industry Partners

Together
ahead. **RUAG**

maxon

Klein
we manage your IT

Werner Steiger Stiftung

VALISPACE

embotech

 SWITZERLAND
INNOVATION
PARK ZÜRICH

KIFA

twing

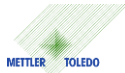
HOSTSTAR
GO LIVE.

 **Textil-Point**
print, stitch and more

Project Partners



Project Partners





1. ARIS Report of Activities in 2020/21





ARIS exhibition for visitors at our headquarters in Dübendorf

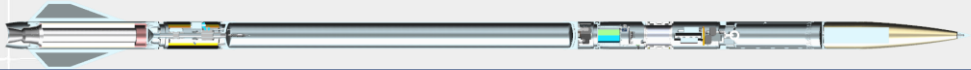
We look back at a cycle reflecting the evolution of ARIS in technical and educational direction.

On the technical side, in 2020/21 the development of two separate multi-year projects has been combined in the rocket PICCARD with its engine DAEDALUS. Additionally, we designed a guided recovery system for sounding rockets from scratch and we set the course for new groundbreaking projects that were launched in September 2021. At the kickoff 2021/22, our 300 active members started again the development of our next generation sounding rocket, its hybrid propulsion system and guided recovery. Furthermore, we are working on a small scale satellite (Cubesat), a liquid rocket engine and autonomous underwater vehicles.

We also further focused on our educational mission and with our engagement in the ETH webinar 'Women in Space and Science', we could share valuable insights into key milestones of research and engineering within an international audience of up to 200 participants. To continue this spirit, we initiated a full lecture series on 'Space Research and Exploration' with 120 ETH and UZH students enrolled in the first edition. The lecture is hosted by Prof. Quanz and supported by Space Innovation.

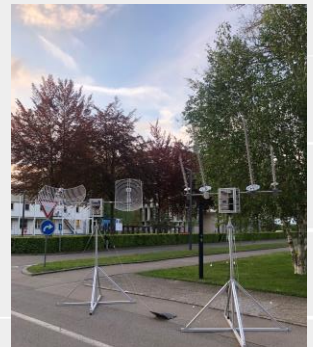
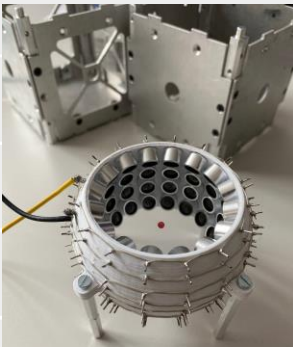
1.1 Project PICCARD

Building on the strong heritage of the previous sounding rockets TELL, HEIDI and EULER, project PICCARD strived towards the ambitious target of building ARIS' first hybrid-propellant rocket capable of reaching an apogee of 30'000 ft at the Spaceport America Cup 2021 and to recovery all parts safely. The engine development was carried out by the ETH focus project DAEDALUS. For the very first time, a joint venture between an academic project and a student freelancer project was successfully conducted through close collaboration on all levels of the organisation, with the common goal of having a rocket launch ready by Summer 2021. The payload was an acoustic levitation device, designed and developed by an ETH-spinoff, which grips small-sized objects by levitating them in the low-pressure regions of a non-audible acoustic field.



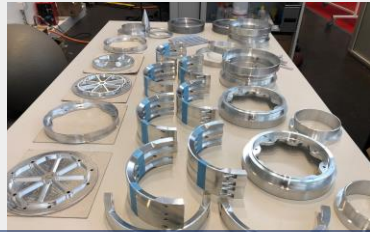
Project PICCARD – system overview

The team consisting of 45 students from 10 different fields of study and 14 different nationalities started into the project by thinking in-depth about the mission ahead and the requirements to the system which were presented at the System Definition Review (SDR) beginning of October 2020. During the subsequent design phase, concepts were evaluated and refined with a review board of experts from industry and academia during Preliminary and Critical Design Reviews (PDR and CDR) during the autumn semester. As a consequence of designing a rocket with a hybrid propellant engine capable of reaching new heights, a remote filling station was designed from scratch, as well as sophisticated ground trackers to follow the rocket from a large distance.



Payload, remote filling station and tracking station of project PICCARD

Over Christmas, the project went into the manufacturing phase. Aluminium parts were manufactured by external partners, while carbon and glass fibre fairings were produced in-house at ETH facilities. As this year's rocket stands at 6.3 m tall, the amount of parts as well as their required strength and rigidity had to be scaled up compared to previous years at ARIS. The avionics system, representing the brain of PICCARD, includes a CAN system which connects the engine main and venting valves with the on-board sensor boards and telemetry PCBs of the avionics stack, up to the recovery flight computers such that correct lift-off and apogee detection, as well as parachute deployment are ensured.



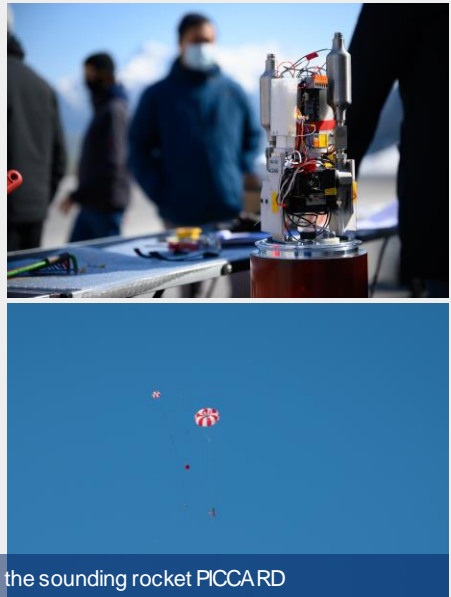
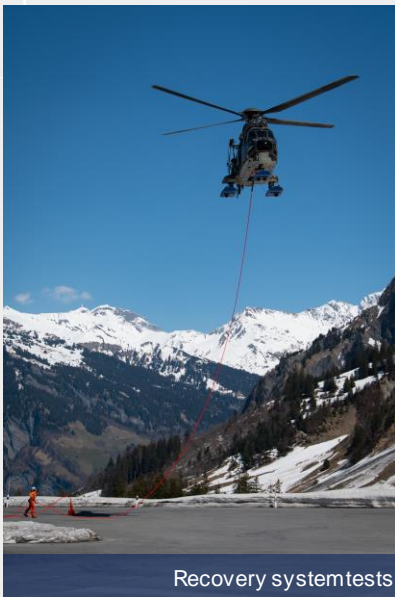
Key structural and avionics components of the sounding rocket PICCARD

After the winter break, the team was struck hard by the message from the Experimental Sounding Rocket Association (ESRA), which stated that the Spaceport America Cup would go virtual in July 2021. This meant, that the team would not be able to launch its rocket in the New Mexico desert and that the competition would be carried out remotely. Teams would be judged by their technical excellence based on their submitted technical reports and presentation of their systems online.



First integration test of the sounding rocket PICCARD

Subsequently, the team was still keen on launching the rocket in Switzerland before the Summer break in June, with the main focus on having a competitive system for the European Rocketry Challenge (EuRoC) in Portugal, an endeavour motivated by student rocketry organisations to create an alternative to the SA Cup on European soil. With regard to have the rocket launch-ready, subsystems had to be tested to their limits. Thanks to the focus project PHOENIX, the recovery team was given an opportunity to drop its system from a helicopter of the Swiss Armed Forces at 800 m height above ground level in Wichlen, Glarus – this proved as a valuable test in order to validate the interdependencies in the system and to increase the robustness against all possible failure modes before launching the rocket later in the year.



Recovery system tests for the sounding rocket PICCARD

The drop test PICCARD turned out to be successful as the system was able to separate and deploy the parachutes as required, however the timing of the nosecone main parachute deployment was earlier than expected due to imperfect line management. The learnings we were able to take away from all of our subsystem tests climaxed with a series of Cold Launches, where all launch operation procedures were trained, i.e. the rocket being transported, erected, filled and launched – all while only having the rocket filled with inert nitrogen instead of nitrous oxide. Finally, after improving all procedures for the Maiden launch, the team was ready to prepare for Switzerland's first launch of a hybrid rocket engine in Wasserfallen, Luzern.

Weeks after the Virtual Spaceport America Cup, where PICCARD was able to compete for three awards – the Payload Challenge, Technical Excellence as well as 30K SRAD Hybrid/Liquid competition category – the sought after Maiden Launch in Switzerland could not be carried out due to the fact that the weather conditions at the time were unfavourable, as well as stakeholders within government and civil aviation, who were not able to determine within the project timeframe if launches of both student associations EPFL Rocket Team and ARIS, would require full closures of large areas of Swiss airspace. After all, it was determined that the project goal of launching PICCARD to its highest potential converged to one, and final chance at EuRoC 2021 in Ponte de Sor in October.



PICCARD exhibition stand at EUROC 2021

Upon arrival in Portugal, the team was excited to connect with experts from various countries, as well as other student teams. As PICCARD was the largest rocket at the competition, it evidently caught the attention of everyone attending the event - and seeing it fly on the first launch day was not only in the interest of the team, yet also of all competitors and organisers. The first two days were dedicated to showcasing our rocket and passing a flight readiness review with a review board of experts and judges. With a just handful of minor of action items outstanding for the launch, the team passed test effortlessly.



Sounding rocket PICCARD being inspected by the jury of EUROC 2021

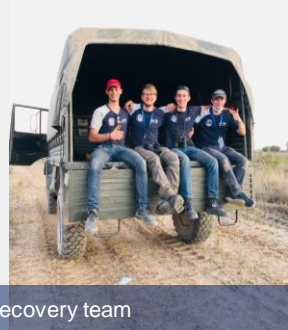
On the day of the second launch attempt, the preparations started off perfectly. The launch rail, as well as the remote filling station were ready to go, and as the team was able to go over their procedures the day before, the worries of two days prior were seamlessly eliminated. The schedule was identical to the first launch attempt, which gave the team enough breathing room to drink, eat and think through the next steps ahead. Nonetheless, a connector of the filling station, which attaches the filling line with the intermediate tank – responsible for filling up the oxidiser tank to its maximum capacity - was broken at its thread. Without any spare parts available and non-working quick fixes, it became apparent that a launch of PICCARD to its maximum capability was not an option. On top of that, minutes before countdown, the decoupling mechanism – responsible for disconnecting the rocket from the filling station – failed. Thanks to a pyrotechnical expert on site, the mechanism was manually disconnected. The adrenaline levels rose, as the system was fully armed, and the final countdown was announced over the microphones. In front of a vast group of people - which included all our ARIS members, the EPFL rocket team, the organisers and, Portuguese media, and the Portuguese Military, PICCARD rose to the sky, straight and soaring like a jet engine.



PICCARD launch preparations and launch

The emotions which came after the confirmation that the rocket was able to detect an apogee of 6.5 km, as well as the confirmation that the payload was successfully recovered were immense.

As at a later point it was confirmed that the main body did not open its parachutes, ground operations disarmed all systems and the recovery team escorted by military trucks went onto the search of all rocket parts. After all parts were found, the team conducted a debrief with the judges on what happened during flight. As today, the current working hypothesis is that the recovery system was not able to separate the nosecone after apogee, resulting into a brief ballistic flight, whereas the high roll rate caused the nosecone shear pins to break and shortly after, the parachutes being pulled and causing high loads on the main body, ripping out parts of the rocket airframe and hence causing a free falling rocket body to the ground.



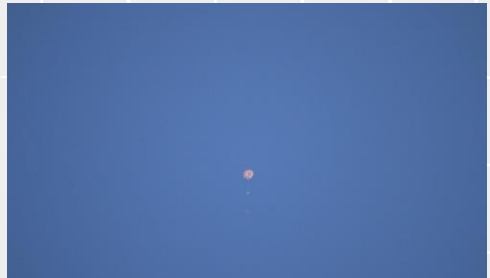
PICCARD post launch celebrations and recovery team



The Swiss representatives in Portugal – EPF Rocket Team and ARIS

The hypothesis will be carefully verified within the upcoming weeks and months by the team, such that future teams will be able to learn from PICCARD and apply those learnings for the next rocket competition.

After the first successful launch of a fully student-researched and developed rocket in ARIS' history, the team received the flight award in the Hybrid 9000 m category of EuRoC, which represents how far ARIS is today compared to other student rocketry associations within Europe.



Team PICCARD and EULER and the main parachute of PICCARD

To allow the next teams to build up on our learnings, several members of team PICCARD continue to support the upcoming ARIS projects either as coaches or technical advisors. This team learned how to overcome various obstacles by combining all efforts and strengths of every single member in order to reach the mission objectives during these turbulent times. Looking back, the experiences which were made brought forth engineers, scientists and leaders capable of excelling in various industries in the future – without a doubt.

Xeno Meienberg
 Dario Giardinelli
 Bryn Davies
 Hugo Umbers
 Stéphane Hentzen
 Benjamin Friedli
 Teodora Milankovic
 Fiona Konnerth
 Samuel Kurucz
 Naim Nahas
 Marcel Kraft
 Dimitri Lichtsteiner
 Leo Meili
 Giorgio Tonetti
 Marius Huber
 Kerstin Unmüssig
 Matthias Brandes
 Andrea Paris
 Alea Stricker
 Pit Reckinger
 Valerio Schelbert
 Noa Lévy
 Samuel Rüttsche



Simon Höhener
 Nicolas Maier
 Enea Baumann
 Till Aerni
 Anna Sulzer
 François Martin-Monier
 Victor Clasen
 Lukas Dinkelmann
 Miles Timpe
 Maxim Starodub
 Amane Zürrer
 Sebastian Graf
 Lars Horvath
 Dario Tscholl
 Adria Munoz
 Max Zappe
 Visnusuthan Vairavipillai
 Mathis Moes
 Elio Assaf
 Roman Scholz
 Marvin Harms
 Fabian Torgler



The first ARIS hybrid rocket lifting off – huge congrats team PICCARD!

1.2 Project DAEDALUS reaches new heights

After an intense year of engineering and testing, October 15th 2021 marked the first hybrid flight in the history of ARIS. The engine lifting the PICCARD rocket up to the sky was the result of the second HRE focus project and the first student researched and developed engine to be implemented into an ARIS rocket. The DAEDALUS team, responsible for the development, consists of six mechanical engineering students, supervised by Prof. Lino Guzzella, Bruno Berger and five coaches.



Team DAEDALUS and hybrid rocket engine test firings

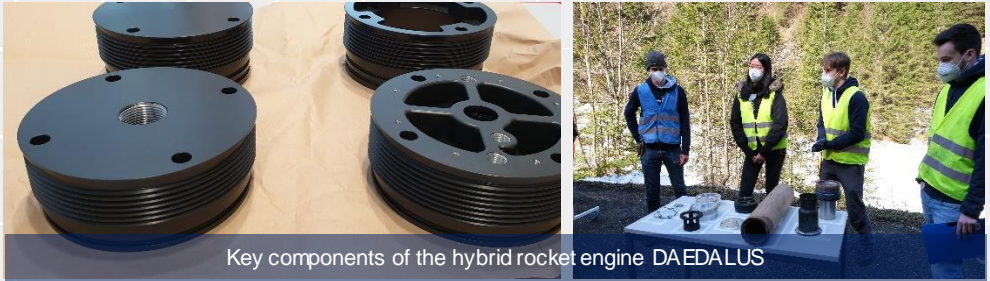
Building up on the heritage of the preceding projects IRIDE and RHEA, the team started their ambitious project with a clear goal: integrating a hybrid rocket engine into the in parallel developed PICCARD rocket. With only two years of theoretical knowledge gained in their studies and little practical experience, but with a lot of motivation, the team dove into hybrid rocketry.



System integration and team DAEDALUS

To ensure the successful design implementation, the team went through two extensive reviews in the first semester. During both the preliminary design review and the critical design review, the team received valuable feedback from an experienced review board consisting of many ARIS alumni as well as experts from industry and academia. Keeping this feedback in mind, the system was then designed in CAD and verified through FEA and further calculations.

Consequently, the parts were ordered and manufactured during the exam phase in the beginning of 2021. Excited for the new semester, the team assembled their system for the first time in early March. To prove the readiness of the system, a series of tests and a Readiness Review were conducted.



Key components of the hybrid rocket engine DAEDALUS

What followed was a very intense but successful testing campaign. In total, five cold flow tests with CO_2 and nine hot firings with N_2O were conducted. Hearing the engine roar for the first time made the team even more excited for PICCARD's maiden launch.



Hybrid rocket engine test stand

After the successful verification of the engine's function, integration into the rocket shifted into focus, and a much closer collaboration with the PICCARD team became crucial. Therefore, two full system assemblies and three cold launches were conducted, where especially the CAN bus communication, the interface to the launch rail and the ignition sequence were tested. In parallel, preparations for a maiden launch in Switzerland were in full swing. Unfortunately, this fell through in the end, due to repeating bad weather and a variety of other unlucky circumstances.



PICCARD fully assembled

As the main goal of the DAEDALUS project always was to bring the engine aboard the PICCARD rocket to the skies, the focus quickly shifted to the European Rocketry Challenge in Portugal, over summer.

In collaboration with the rocket team, preparations went smoothly, and soon after, the final assembly of the DAEDALUS engine was taking place.



Final launch preparations and PICCARD ready to launch

Seeing the engine propel the rocket to a height of 6.5 km, and feeling it's raw power, there's nothing quite like it!



Team exhibiting PICCARD and celebrating their successes



First place award in the category 9000 m, SRAD hybrid at EUROCC 2021

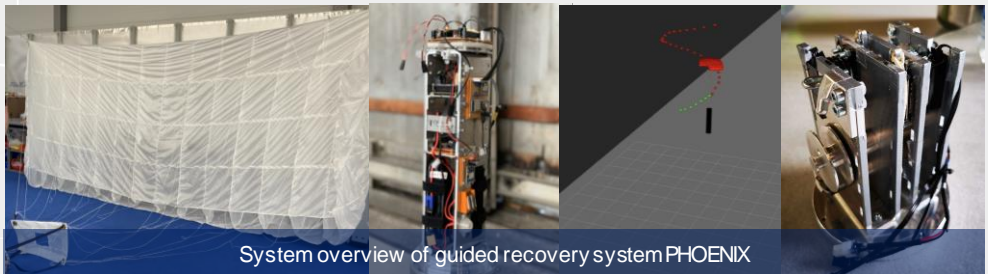
Aaron Ehrat
Adrian Fuhrer
Alex Brandes



Julian Frei
Leona Guo
Severin Meyer

1.3 Project PHOENIX lands softly

In September 2020, ARIS has launched its first guided recovery focus project at ETH Zurich under the supervision of Prof. Melanie Zeilinger from the Institute of Dynamic Systems and Control (IDSC). A focus project is an optional part of the final year in the mechanical and electrical engineering Bachelor's program at ETHZ. It consists of 8 engineering students working 10 months on a project and gaining practical engineering experience.



The project started with a clear goal: build a guided recovery system, capable of landing the future ARIS rockets at predefined locations. With only two years of theoretical knowledge and no practical experience, but with a lot of motivation, the team started by looking into current and past findings regarding the topic of a guided recovery or flight with a parachute. There are lots of papers out there proposing theoretical solutions without proving their reliability and feasibility outside lab conditions or outside the software simulation environment.

The first few weeks of the project were tough due to the slow progress we made. Since we were the first guided recovery project launched in ARIS not many prerequisites nor experience in this area existed. But this also gave us more flexibility and the freedom of designing our own system and laying the groundwork for future projects.





Testing campaign of project PHOENIX

ARMED..3..2..1..RELEASE

On the day of our first droptest in Wichlen (GL) the tension was very high, but the team was ready and prepared. One half of the team listening eagerly to the helicopter radio and watching it from the ground station, the other half observing it from the watchtower with binoculars. Upon the call "RELEASE" the system started accelerating towards earth and a few seconds later we witnessed our first main deployment. The team was in awe... After the beautiful main parachute opening the system started behaving in a non-nominal way proceeding in a hard-right-spiral and finally crashing into the ground at 80 kph. The system was recovered, examined, tested, broken parts replaced, the root cause eliminated and then set up for the next droptest only 2 days later. Despite some external doubt the team was certain of a successful comeback. And indeed, the system has performed perfectly nominal, and the entire day was a huge success.



Onboard view of guided recovery system PHOENIX in action



In the big testing campaign between April and July 2021, a total of 10 droptests from different altitudes were conducted in collaboration with the Swiss Army. This iterative testing allowed project PHOENIX to improve the system step by step. The first few flights were used to test the deployment mechanism of the main parachute, as well as to test our sensor pipeline. It was crucial to collect as much data as possible to perform some system identification of our mathematical model. During the testing campaign, the team had to deal with various electrical challenges. Finally, the last 2 droptests were conducted closed loop, meaning fully guided with the goal of landing the system at the predefined location.

The last important milestone of the project, was the conclusion of the final report, laying the foundation for future guided recovery developments. Our successors, project PERIPHAS, the focus project which will build upon the PHOENIX system are working towards the integration into a testing rocket. We are confident that they will give their best and will succeed! Godspeed!

Pascal Sutter
Alexander Hansson
Maximilian Knill
Lukas Vogel



Jannes Hühnerbein
Sabrina Bodmer
Helvijs Kiselis
Ramon Epprecht

1.4 Educational outreach

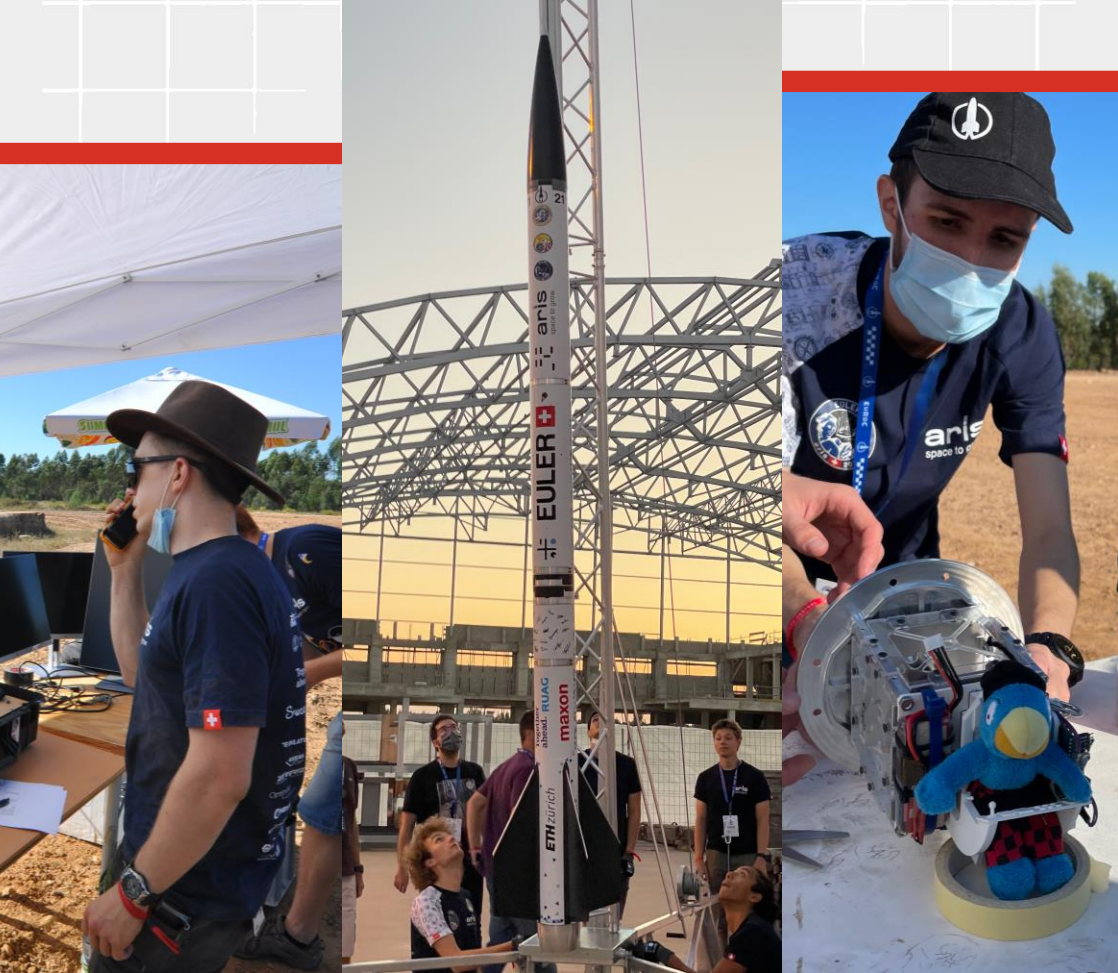
1.4.1 ETH Webinar ‘Woman in Science and Space’

ARIS actively participated in all three parts of the ETH Webinar Series ‘Woman in Science and Space’ organised by the ETH Rector Prof. Dr. Sarah Springman and astrophysicist Prof. Dr. Louise Harra. This was a great opportunity to share our excitement for space and encouraging woman to follow their passion. As part of the panel, our President Manuel Gerold represented the voice of approximately 300 space enthusiastic students from various universities across the German-speaking part of Switzerland.

1.4.2 ETH Lecture Series ‘Space Research and Exploration’

Following up on the great interest of the ETH webinar, we initiated a lecture series at ETH giving students at master level the chance to get a glimpse of the variety of ‘Space Research and Exploration’. The lecture is hosted by Prof. Sascha Quanz and supported by Space Innovation. With 15 distinct speakers amongst which we had leading researchers and industry experts as well as two former astronauts and a Nobel laureate, we could share fascinating insights into past, current and future developments within the space domain. In this first edition of the course, we had more than 120 students signed up and are looking forward to continue with a second edition with many more exciting speakers in the fall semester of 2022.





2. ARIS Financial Close Report 2020/21



2.1 Financial Report Executive Summary

We are proud to inform you that ARIS is yet again in a good fiscal shape and has achieved all its financial goals.

The emergency funds have been further increased by 50% from CHF 10'000 to CHF 15'000.

ARIS **started the 2020/21 cycle with a net margin of CHF 61'682**. This amount was introduced by and used to cover the expenses of the 2019/20 project EULER for its pushed back participation at EUROCC 2020.

The **total revenue of the 2020/21 cycle was CHF 177'651.75** an increase by 40% compared to the prior cycle. The **total cash expenses for 2020/21 amount to CHF 218'987.25**.

This leads to a net closing of the financial cycle of 2020/2021 with a loss of CHF -41'335.50 which is imputable to the opening and closing date of the cycle. Adding up the financial results of 2019/20 and 2020/21 leaves the association budget with a **net margin of CHF 20'346.54 to start the 2021/22 cycle**. One of ARIS' primary goals is to ensure its non-profit nature. Hence, this amount will be used to kick-off the 2021/22 projects.

Project PICCARD closes the year with expenses amounting to CHF 25,826.21, with expected upcoming expenses, already provisioned, of approximately CHF 24'496.83 in the next financial cycle, which is entirely imputable for PICCARD's participation in EUROCC 2021. This value is significantly less than budgeted, which amounted to CHF 142'800, due to the high amount of value-in-kind sponsoring and the fact that Maiden Launch has been cancelled.

Project EULER has continued during this last year. After the first EUROCC in October 2020, the team has been able to obtain the funding to participate again at the EUROCC competition in October 2021, together with Project PICCARD. A total of CHF 23,426.36 has been spent by the EULER team, with another CHF 14'560.67 already provisioned for the upcoming expenses for EUROCC 2021. The overall expenses include both EUROCC participations since next year's provisions are already counted as expenses for the 2020/2021 cycle.

Project DAEDALUS contributes to the ARIS cycle 2020/2021 with almost CHF 12'785.88 spent and with another CHF 9'782.10 provisioned for the participation in EUROCC with PICCARD's rocket.

Project PHOENIX spent CHF 5'764.92 for the development of their project.

The upcoming financial year starts with CHF 77'163.69 already allocated for the upcoming expenses and CHF 9'000 are currently free to spend for the next year teams.

The following activities come up on the horizon:

- Keep increasing the emergency provisions fund. The goal for the next financial cycle is to reach CHF 20,000 in emergency provisions. The long-term goal is to set aside about CHF 30,000-50'000 which relates to approximately 10 % of the annual budget which will be considered as reserves but exceptional payments.
- Plan budgets more accurately, ideally exploiting the actual expenses from past years as a benchmark. Create a standard template that will be used every year.
- Starting to understand, by working closely with the engineering members, the whole value of the association including value-in-kind sponsoring, tools and other assets. In order to have a complete and trustworthy financial overview.
- Coordinate a meeting with KPMG, which has already offered to audit our financial books in order to improve our accounting and best practices.
- Continue automating the reimbursement process, in order to achieve higher efficiency and reduce errors to zero.

2.2 Overview

2.2.1 The ARIS Finance Unit

The finance unit of ARIS aims to make cash-flows smooth, simple and clear for ARIS and external reviewers. Members of both the finance unit and the association board oversee the finances to ensure that the basic principles are fulfilled.

01	Tracking financial resources	Transparency	01
02	Managing cash flow and liquidity	Accuracy	02
03	Determining financial needs	Completeness	03
04	Executing transactions	Consistency	04
05	Reporting	Stability	05

2.2.2 Process and Oversight

The ARIS board and internal auditor provide financial oversight through 4 cycles:

- Weekly review of team needs as part of the association management meeting
- Bi-weekly financial report for the approval by the association board
- Quarterly budget, approval by the association board
- Bi-yearly book auditing, approval by two internal auditors selected by the general assembly

#Weekly	Team-needs cash	Provision
#Biweekly	Financial report	Board approval
#Quarterly	Budgeting	Board approval
#Yearly	Internal audit plus approval by the General Assembly	Closing of the year

2.3 Financial Statements

ARIS is fiscally healthy and has achieved all its financial goals.

These goals include the ability to reimburse the EuRoC member commitment fees after the General Assembly in November 2021, provisions for the coming cycle, a limitation of our net profits to ensure that our association maintains its non-profit structure, and an increase of the emergency funds. In the pas cycle ARIS conducted two engineering projects in parallel, both cases coming in under budget thanks to the extraordinary effort of the project teams to close additional material sponsoring deals.

2.3.1 Statement of Financial Position

<u>ASSETS</u> 1.10.2020-30.09.2020	CHF
Bank account CHF	112'021.17
Cash on hand CHF	125
Cash on hand USD	364.06
Total Assets	112'510.23
Emergency Provisions	15'000

Emergency provisions are stored on the ARIS bank account and, thus, are included in the total association assets.



2.3.2 Profit and loss statement

The profit gained over the financial cycle 2019/20 has been used to cover the expenses associated with the EuRoC 2020 and 2021 participation resulting in a loss over the past financial year (2020/21). Our overall profit evaluated over ARIS's lifecycle amount to CHF 20'346.54.

REVENUES	CHF
Membership & commitment fees	13'620.00
Cash sponsoring	122'303.50
Merchandising	8'042.00
Other revenue (Provisions corrections)	33'686.25
Total Revenue	177'651.75

EXPENSES

Overall Provisions	77'163.69
Operations	7'610.18
Marketing	13'415.61
Events	377.45
Strategic Development	195.43
Board	10'109.67
Academic Relations	1'339.02
IT	280.06
PICCARD Team	25'826.21
EULER Team	23'426.36
DAEDALUS Team**	12'785.88
PHOENIX Team**	5'764.92
IRIDE Team	20'602.14
Other Expenses	20'090.63
Total Expenses	218'987.55
PROFIT (LOSS)*	(41'335.50)

**for the period of 1.10.2020 - 30.09.2021*

***ETH focus projects act as financially independent.*

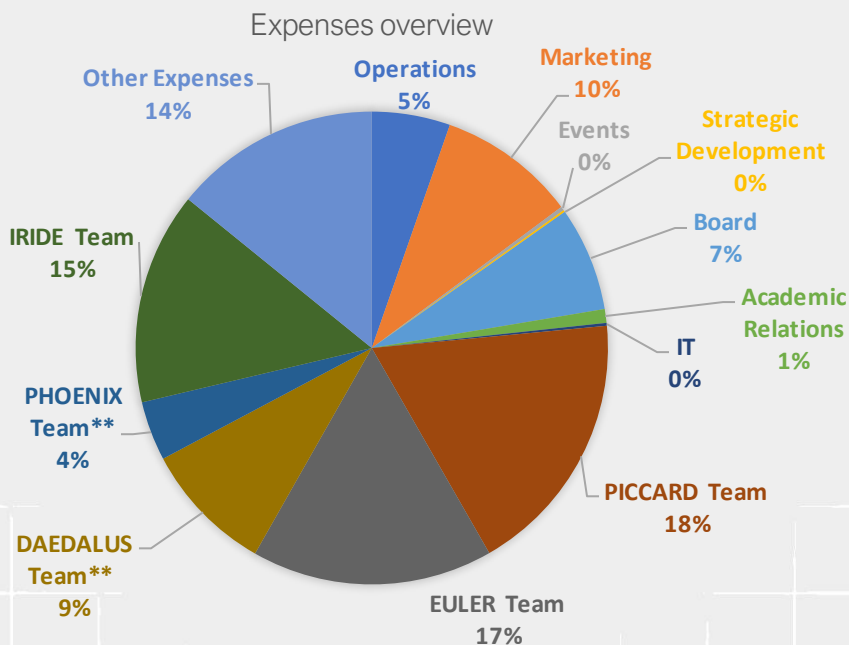
OVERALL PROFIT (ARIS Lifetime)

CHF

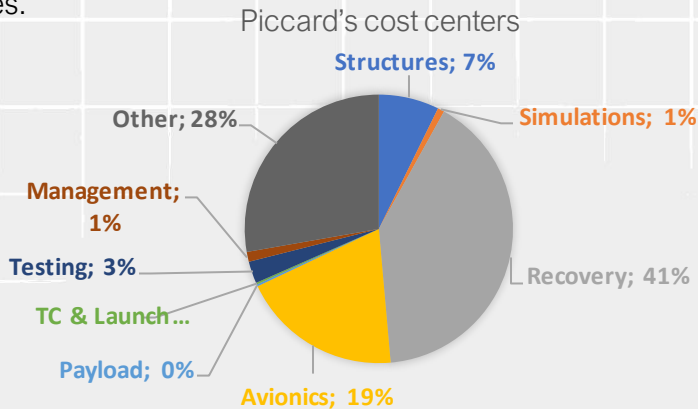
Cumulated profit carried forward	61'682.04
Current year profit (loss)	(41'335.50)
Overall Profit	20'346.54

2.3.3 Financial Breakdown

63% of total ARIS cash is associated with engineering project teams, half of which only to the two main rocket projects, EULER and PICCARD. In the past year, a substantial amount has been invested in the marketing sector. Overall, CHF 33'327.42 (23%) have been necessary to run the association and to cover the expenses of the insurance, operations and other business teams. Due to COVID-19, most of the ARIS events were transferred online, which kept our expenses for events extremely low. The following graph does not consider the CHF 77'163.69 already provisioned for the upcoming expenses of the teams.



Past cash expenses of project PICCARD amount to CHF 19'942, whereof CHF 18'544.86 (93%) were spend on activities related to developing and contracting the rocket, while other 7% contributes to the management expenses.



2.4 Outlook

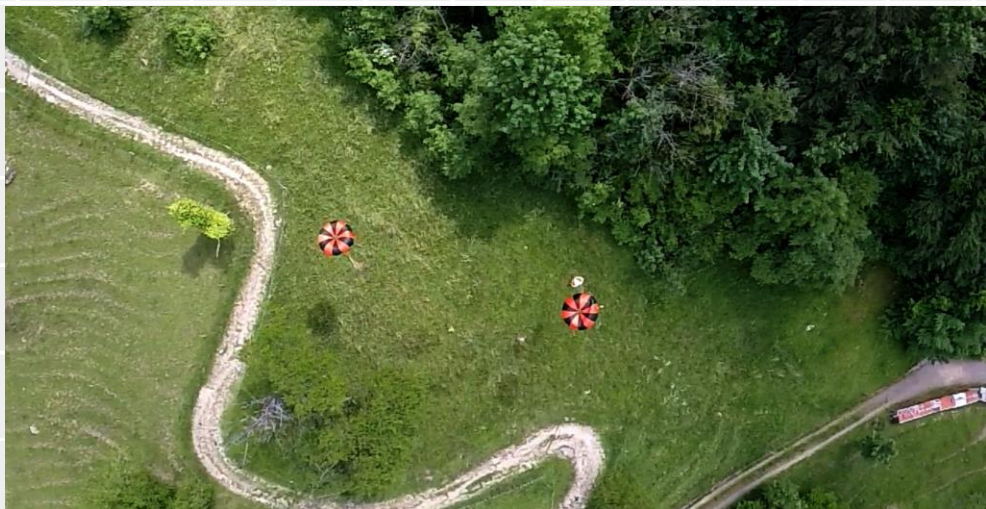
2.4.1 Key Learnings

Improvements on the accounting and budgeting side have been done, especially in these 4 categories:

- The standardization and implementation in SharePoint of the reimbursement form for all the teams.
- A new accounting software, namely BEXIO, has been set up. It ensures much higher automation and error avoidance.
- All the receipts and invoices are now safely sorted and stored in both SharePoint and BEXIO, which ensures a double layer of security.
- Automatization and standardization of procedure is key to reduce mistakes and waste less time.

2.4.2 Emergency Provisions

ARIS has planned to establish an emergency reserve fund to cover unexpected necessary spending that would be increased year by year. The long-term goal is to set aside from CHF 30'000 to CHF 50'000. At the end of the 2020/2021 financial year, ARIS has succeeded to double further increase the provisions to CHF 15'000.



2.4.3 Budgeting and Tracking

The budget for the 2021/2022 financial cycle has been completed by all teams and will need to be double checked with the sponsoring team.

TEAMS	TOTAL COSTS, CHF	VALUE IN KIND
Board (<i>Insurance</i>)	9'000	-
Operations	2'500	-
Marketing	10'000	-
Strategic Development	2'000	-
Academic Projects	2'500	-
IT	2'000	-
HELVETIA	183'000	32%
ASTREA*	188'000	69%
SAGE	40'000	52%
LEA	150'000	43%
NAUTILUS	15'000	-
PERIPHAS*	66'500	62%
Expected Total (CHF)	670'500	of which ViK: 315'000

*ETH focus projects act financially independent.



3. ARIS Organizational Changes



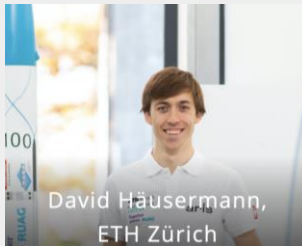
3.1 ARIS Association Board 2020/21

ARIS is a non-profit association and a board is legally required. It consists of seven members which are overseeing all association activities by leading the association executively and strategically. Since September 2020, several alterations took place at an Exceptional General Assembly on April 6th, 2021:

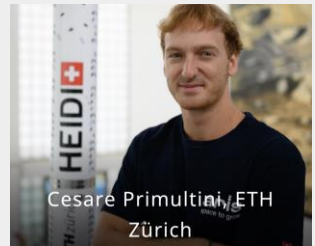
- Evgeniya Vorobyeva, former Financial Manager and Treasurer, left the board and Cesare Primultini, former Financial Manager, was elected as new Treasurer.
- Andrea Schom, Testing Engineer of project RHEA and in charge of Academic Relations, left the board and Michael Kerschbaum, System Engineer EULER, was elected as Head of Academic Relations.
- Lukas Hauser, Propulsion Engineer of project RHEA and member of the Strategic Development team was elected as Head of Strategic Development.



President



Vice-President



Treasurer



Head of Legal/Admin



Head of Industry Relations



Head of Academic Relations



Head of Strategic Development

3.2 ARIS Association Board 2021/22

At the general assembly on November 1st 2021 Manuel Gerold, David Häusermann, Cesare Primultini and Otso Gächter have stepped back from their roles within the association board. We warmly thank them for their commitment. The following members have been elected board members:

- Michael Kerschbaum – President
- Adrian Fuhrer – Vice President
- Marco Trentini – Treasurer
- Aaron Ehrat – Head of Legal/Admin
- Alex Brandes – Head of Industry Relations
- Xeno Meienberg – Head of Academic Relations
- Lukas Hauser – Head of Strategic Development



President



Vice-President



Treasurer



Head of Legal/Admin



Head of Industry Relations



Head of Academic Relations



Head of Strategic Development

3.3 The ARIS vision and our projects

In 2020 we set our objective to revise the common vision within ARIS. Together, we defined the statement: 'Contribute to the Advancement of Life and Take Part in Exploring its Origins by Developing Systems Meant for Space'. Following this vision, we established a dedicated interdisciplinary strategic development team. Their mission was and is to guide the existing projects towards further development and define new projects that align with our overall objective. The extraordinary General Assembly from Spring 2021 also decided to dedicate a position within the board to guide these developments. This new role is called 'Head of Strategic Development'.

This fruitful addition to the ARIS organisational structure supported the launch of three new projects supplementing the existing ones. Whilst we currently run four distinct projects focusing on sounding rocket development, we also look ahead towards farther pathfinding missions with our new developments. At the core of the sounding rocket development stands again the world's largest rocketry competition, the Spaceport America Cup in New Mexico, USA. Our team HELVETIA develops the payload, rocket fairing and recovery system based on the learnings of project PICCARD and ASTREA builds up on the know-how of project DAEDALUS to propel the payload and rocket to its targeted apogee of 30'000 ft using an internally developed hybrid rocket engine. In parallel project PERIPHAS and project LEA develop a guided recovery system and a liquid rocket engine, respectively. These systems are planned to be implemented in future generations of ARIS sounding rockets.



ARIS project kickoff with approx. 100 members meeting for the first time at our headquarters at IPZ

3.6 ARIS Roadmap – Sounding Rocket Development and Beyond

The project cycle 2020/2021 was an extremely successful one for our association. With the first ever launch of an in-house developed and built rocket engine and the first test of guided recovery system, we showed that we are ready for the next step towards reaching the first milestone we set ourselves four years ago – to build a sophisticated, fully student researched and developed sounding rocket flying to altitudes beyond 10 km, featuring an internally developed hybrid rocket engine and a guided recovery system.

For 2021/2022 ARIS achieved a further diversification of its project portfolio, attracting by now more than 300 students. With new teams working on liquid rocket engines, CubeSats and autonomous underwater vehicles we want to establish our association as the key academic driver within the Swiss space environment.

With all our projects on track, our objectives for the coming years remain unchanged: to launch a fully integrated sounding rocket system featuring an in-house developed hybrid rocket engine and guided recovery system at the Spaceport America Cup 2023.

What comes after 2023 for ARIS? That will be for another day. We will only say this much: rest assured that ARIS will continue reaching for space and beyond... and that quite literally.

***Contribute to the
Advancement of Life and
Take Part in Exploring its
Origins by Developing
Systems Meant for Space***

- The ARIS Vision



aris

space to grow

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