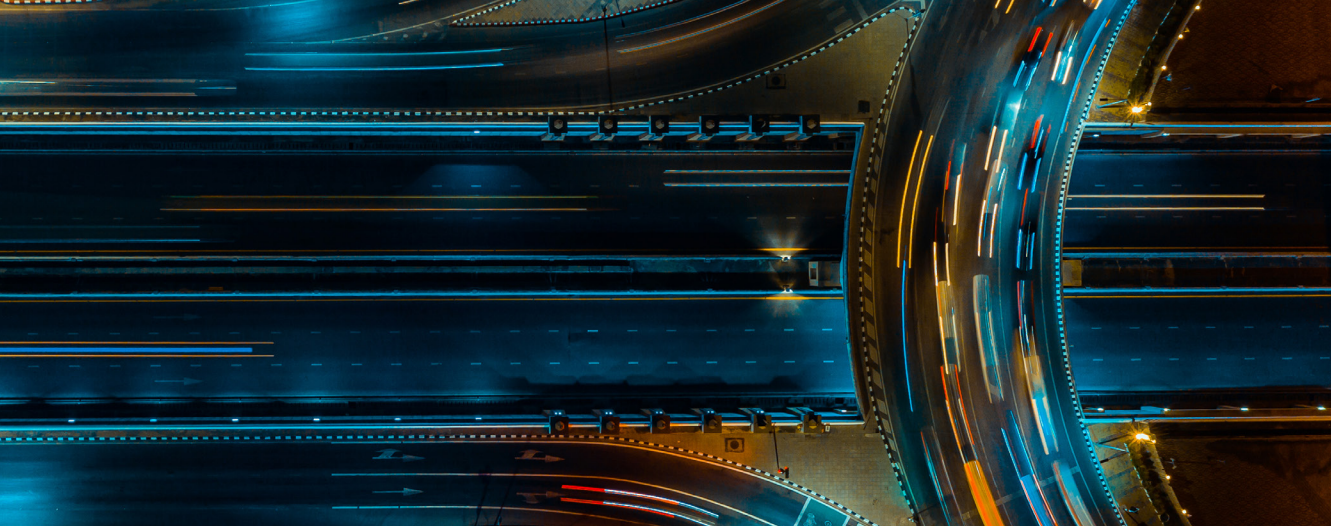# WASP

HIGHLIGHTS

2022

Preface

It is a pleasure for us to present you with the WASP 2022 highlights. As shown in the status update WASP is well under way to reach our ambitious main goals to graduate 600 top level PhDs and recruit 80 leading researchers, who are provided with resources to build outstanding research groups.

WASP is creating ample opportunities for Swedish companies to hire researchers graduating from WASP with internationally competitive competence in the strategic areas of AI, Autonomous Systems and Software. 2022 was the year when we were beginning to see the results in terms of PhDs. For a foreseeable future WASP will now graduate one PhD per week!

During the year the Knut and Alice Wallenberg Foundation has commissioned additional tasks to WASP. An initiative addressing the high priority area of Cyber Security was added to the WASP portfolio and will lead to calls for research on foundational aspects of Cyber Security. We were also allocated earmarked funding to collaborate with our sister program WISE (Wallenberg Initiative Material Science for Sustainability). The collaboration will be initiated during 2023 and is an example of the enabling role the technologies and methodologies developed in WASP will have for a sustainable future.

We hope that you will enjoy reading about our 2022 advances and our contributions to academic research with high societal and industrial relevance.

Anders Ynnerman, Sara Mazur

WASP Overview

Since its start in 2015, the Wallenberg AI, Autonomous Systems and Software Program (WASP) has been a major national initiative for strategically motivated basic research, education, and faculty recruitment in Sweden. The program has now been extended to 2031 and Cyber Security has been pointed out as a prioritized research area. In this annual report, highlights of the year 2022 are presented.

Vision
Excellent research and competence in artificial intelligence, autonomous systems and software for the benefit of Swedish society and industry.

Mission
Build a platform for world class academic research that interacts with leading companies and actors in Sweden to develop knowledge and competence for the future.

Strategic Instruments

To meet the challenges in research and competence building, WASP acts through the following six strategic instruments:

1. A research program, aiming for disruptive developments
2. A national graduate school
3. Strategic international faculty recruitment
4. Research Arenas, where academia and industry meet
5. Internationalization by exclusive university partnerships
6. Communication, events and networking

WASP Status in December 2022

14 faculty recruitments in autonomous systems and software

9 top-level recruitments of Wallenberg Chairs,
whereof 4 guest professors

Recruitment of 34 assistant or associate professors in AI

A graduate school with 409 active PhD students,
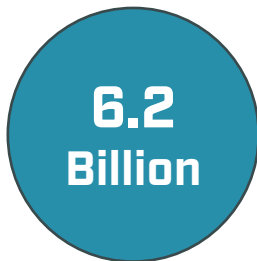including 100 within industry

72 graduated doctors
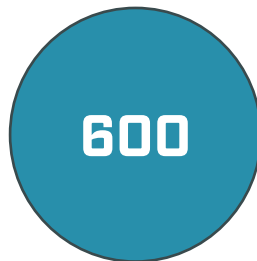
80 companies and agencies engaged

At present, 4 active research arenas within different fields

Formal collaboration with five excellent universities abroad:
Nanyang Technological University, UC Berkeley,
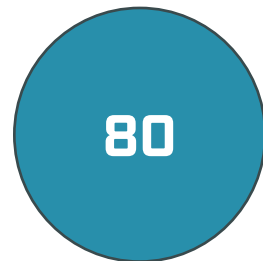Stanford University, MIT and Aalto University

WASP 2031 Targets

6.2 Billion

6,2 billion SEK
for 16 years

600

600 graduated
doctors

80

80 faculty
recruitments

WASP Highlights 2022

- WASP has been extended to 2031 with an additional research grant of 725 MSEK

- Cyber Security is highlighted as a priority research area, funded with 180 MSEK

- Luleå University of Technology is now represented within the program, through two Affiliated Groups of Excellence

- WASP-ED, a new national program for educational development in AI, has been launched

- Additional funds for collaboration with other Wallenberg programs, including DDLS and WISE

- WASP Research Arenas continuing to evolve

- Three Bridge projects completed and announcement of a new call

- Implementation of a unified graduate school with a joint curriculum

- Arrangements of high-profile events, including Industry Days and WASP4ALL

Cyber Security
A new priority research area

Research on Cyber Security has been highlighted as a new priority area within WASP, funded with 180 MSEK. The broad research in Cyber Security and its underpinning technologies within the program gives a unique platform to build upon. The donation makes it possible to promote new multidisciplinary collaborations, further strengthen the position in the field.

The initiative shows an enabling role in many critical applications in society and industry. With the help of the basic research within WASP, the effort will contribute to provision of long-term expertise in an area that is playing an increasingly important role in the rapidly changing global situation.

DDLS & WASP
Successful ongoing collaborations

In the light of 2021 year's successful cooperation, WASP and the SciLifeLab and Wallenberg National Program on Data-Driven Life Science (DDLS), announced their second joint project call in December 2022. The aim of the collaborative projects is to bridge the gap between data science and life science and create unique resources of competence and technical abilities, to solve ground-breaking research questions. In the first call, 15 applications were awarded grants for two-year projects, encompassing several research domains. Representatives from the granted projects participated in a kick-off in Stockholm on October 4th.

WASP-WACQT
Machine learning and quantum computing to advance chemistry

WASP and the Wallenberg Centre for Quantum Technology (WACQT) have launched a joint research project that combines expertise in machine learning, quantum computing, and chemistry. Main principal investigator of the project is Simon Olsson, assistant professor at the Department of Computer Science and Engineering at Chalmers University of Technology. Further principal investigators are Anton Frisk Kockum, quantum physicist and expert on iterative quantum algorithms, and Martin Rahm, chemist, and expert on quantum algorithms in chemistry, both at Chalmers. The interdisciplinary project aims to advance the abilities to calculate specific properties of molecules, for example their energy levels, that are important to know when designing new materials or drugs.

Affiliated Groups of Excellence
at Luleå University of Technology

During 2022 Luleå University of Technology (LTU) became represented within WASP, through two affiliated research groups led by George Nikolakopoulos and Marcus Liwicki.

George Nikolakopoulos is Professor and Head of Subject for Robotics and Automation at the Department of Computer Science, Electrical and Space Engineering, LTU. His research group focuses on the utilization of robots in real life conditions, with the vision in bringing robotics into people's everyday life, creating a continuous impact in humans' well-being.

Marcus Liwicki is Professor and Head of Subject for Machine Learning at the Department of Computer Science, Electrical and Space Engineering, and also Deputy Vice Chancellor in Applied AI, at LTU. The research of his group has the general aim of Machine Learning for the welfare of the society, focusing on sustainability goals.

WASP-ED
Aiming to provide the educational foundations for AI

In January 2022, WASP together with the sister program in Humanities and Society, WASP-HS, launched a new national program for educational development in AI, referred to as the Wallenberg AI and Transformative Technologies Education Development Program, WASP-ED. The background is a donation of SEK 18.6 million from the Marianne and Marcus Wallenberg Foundation.

The purpose of WASP-ED is to increase the capability and capacity of Swedish universities in providing timely, relevant, and scalable education in AI and other transformative technologies. As the need for competence spreads from the experts developing the technology to much broader ranges of professions and disciplines, a main objective is the introduction of AI in education beyond only the specialized education programs for technical experts.

Linköping University will be the host of WASP-ED, with Fredrik Heintz, Professor at the Department of Computer and Information Science (IDA) as Program Director.

WARA
WASP Research Arenas

WASP Research Arenas is an instrument where academia and industry share infrastructures and competence to conduct joint in-depth projects and demonstrations. The arenas entail significant integration efforts at the intersection between industrial and academic interests. At present, there are four active WARAs.

WARA Public Safety

WARA Public Safety explores and develops collaborative systems of systems with heterogenous agents inheriting a various degree of autonomy. The systems interact in a distributed context with humans in the loop. During 2022 the community has grown into a full triple helix, with an expanding resource pool including more autonomous vehicles and systems to promote availability and testing in virtual environments.

WARA Media and Language

The mission of WARA Media & Language is to build a multidisciplinary ecosystem around Media AI and Natural Language Processing. In 2022, they have among other things worked on the large Swedish language model GPT-SW3 together with partners, gotten access to NVIDIA NeMo LLM Service, and engaged in the NEST-project STING. They launched the podcast WARA Media & Language Podden with guests from academia and industry, and hosted a WASP Summer School with several speakers and international guests.

WARA Robotics

WARA Robotics is a physical and digital testbed including robots, materials and other resources needed to deploy research in a multitude of aspects related to robotics for manufacturing. In 2022, both labs have been launched and the first projects are now ongoing.

WARA Operational Data

First announced in late 2022, WARA-Ops is a new Research Arena that marks an evolution from the former WARA-Common (active since the start of WASP). WARA-Ops seeks to bring together academia and industry to solve state-of-the-art challenges in data-driven operational research. It is developing an advanced data storage and processing infrastructure to enable users to interactively store, annotate, process, and visualize large operational datasets, and – importantly – will provide a collaborative environment that will allow users to interact, share data and results, and set challenges and research questions.

Industry Bridge

The Bridge initiative aims to facilitate support for initial steps of research collaborations between industry and academia. The first round of three bridge projects is now completed.

AD-EYE
Improving functional safety of intelligent transportation systems

> AD-EYE is a testbed for Automated Driving and Intelligent Transportation Systems, developed and maintained by the Division of Mechatronics and Embedded Control Systems at KTH Royal Institute of Technology, initiated by Naveen Mohan and Professor Martin Törngren. Several milestones have been accomplished, including the acquisition of a loaned vehicle to be used as an Autonomous Vehicle platform as well as purchasing and integration of new sensors in the vehicle. In addition, the WASP Industry Bridge has enabled new collaborations with industrial partners and has now led to a follow up WASP Industry Bridge project to start 2023.

DARMA Bridge
Robotic simulation moving to real-world scenarios

> DARMA (DAta-driven foundations for Robust deformable object MAnipulation) aims at developing learning-based control strategies for robotic manipulation of deformable objects. The project is led by Florian Pokorny, Associate Professor at KTH and Yiannis Karayiannidis, Associate Professor at Chalmers. As a part of the project, the team created a complete experimental setup that includes a workspace for demonstrating cable manipulation and cable routing problems, which are of high industrial interest.

WCIB
Portal for live cloud facility operations data

> Through the WARA Common Information Bridge (WCIB) project, Associate Professor Paul Townend and researchers at Umeå University and Ericsson Research have created the largest source of live operational data center data anywhere in the world. The WCIB portal (and its backend services) allow users to search, view, and extract metric and log data from a live Cloud facility. The project has attracted much TV and Radio interest and is complete; access to the portal is available to all members of WASP. Furthermore, the technology developed is also being integrated into the new WARA-Ops research arena.

A New Industry Postdoc Program

Within WASP, there are several activities facilitating cooperation between industry and academia. The industrial PhD student program in WASP promotes exchanges between academia and industry, both in terms of relevant research results and access to expertise. A new WASP industry postdoctoral program will further encourage this collaboration. The industrial postdoc initiative is primarily aimed at recently graduated PhDs who are considering a career in industry or at PhDs who are already employed at a company and engaged in research.

WASP Alum of the Year 2022
From academia to tech start-up

Through the Alumni of the Year award, WASP acknowledges individuals who have excelled within WASP by generating outstanding scientific impact as well as contributions to the program by engagement in the WASP community. Linnea Persson, former WASP PhD student in Autonomy and Control at KTH, today employed at the start-up company AirForestry received the award 2022 with the following motivation:

"As an excellent role model for doctoral students, Linnea Persson has demonstrated how many of the WASP instruments, such the WASP Research Arenas, can be of benefit to the community. Furthermore, Linnea has demonstrated how to harmonize education and research, and with her domain expertise, demonstrated how research in AI and Autonomous System can be used in a socially relevant context."

Graduate School and Alumni

The WASP Graduate School provides unique opportunities for PhD students to achieve international research excellence with industrial relevance.

Two summer schools in Norrköping

During 2022, two summer schools were organized, one for new students and another for 2nd year students and above, both courses co-located in Norrköping at the Visualization Center C. Newcomers to the WASP Graduate School spent the week getting introduced to each other and the program. Students in their later years took part in a thematic summer school on the Synthesis of Human Communication organized by WARA Media & Language.

WASP bus tour through southern Sweden

Close to 30 doctoral students went along on the five-day WASP Bus Tour in September 2022. The tour started in Stockholm with a visit at Ericsson. It continued to ABB in Västerås, Epiroc in Örebro, Asta Zero proving ground outside of Gothenburg, to finally reach Lund and the European Spallation Source (ESS) facility.

WASP study trip to the UK

Robotics and aircraft integration research were included on the agenda when 50 PhD students spent a packed and memorable week in the UK. The trip took place mid-October and included visits to Kings College London, Cambridge, Oxford, Imperial College London, and Cranfield University.

WASP study trip to Finland

The WASP study trip to Finland included a broad range of activities, all aimed to promote international networking and opportunities for collaboration. The program took place in November and the group of more than 50 students was based in the area of Aalto Campus in Helsinki. The program included participation at AI Day – the biggest annual event highlighting the leading AI research in Finland.

WASP Dissertations during 2022

In 2022, 35 PhD students in the WASP Graduate School defended their doctoral thesis:

Iulia Bastys
Chalmers University of Technology

Joakim Johnander
Linköping University

Apostolia Tsirikoglou
Linköping University

Rasmus Ros
Lund University

Sarit Khirirat
KTH Royal Institute of Technology

Ivo Batkovic
Chalmers University of Technology

Shervin Parvini Ahmadi
Linköping University

Håkan Carlsson
KTH Royal Institute of Technology

Wito Engelke
Linköping University

Timotheus Kampik
Umeå University

Nicolas Harrand
KTH Royal Institute of Technology

Alvin Jin
KTH Royal Institute of Technology

Alexandre Martins
Lund University

Erik Jakobsson
Linköping University

Xuhong Li
Lund University

Georgia Tsaloli
Chalmers University of Technology

Tommi Berner
Lund University

Colin Desmarais
Uppsala University

Joel Scheuner
Chalmers University of Technology

Péter Várnai
KTH Royal Institute of Technology

Mina Ferizbegovic
KTH Royal Institute of Technology

Sule Anjomshoae
Umeå University

Rui Filipe De Sousa Oliveira
KTH Royal Institute of Technology

Caroline Swahn
Linköping University

Christopher Blöcker
Umeå University

Martin Larsson
Lund University

Jonas Krook
Chalmers University of Technology

Karin Stacke
Linköping University

Johan Ruuskanen
Lund University

Long Zhang
KTH Royal Institute of Technology

Mattias Tiger
Linköping University

Hamed Sadegh
Lund University

Lissy Pellaco
KTH Royal Institute of Technology

Claudio Mandrioli
Lund University

Pegah Nikbaht Bideh
Lund University

Events and Networking

Communication, events and networking are means used to build an active WASP community and to engage with the external society.

WASP4ALL 2022
Software Powering the Digital Future

On May 30th, WASP hosted the virtual conference WASP4ALL 2022, attracting 266 participants. The conference provided a great opportunity to learn more about academia-industry knowledge transfer and the building of excellence that WASP is achieving in the area of software research.

WASP Industry Days

WASP Industry Days is an annual event aimed at promoting exchanges between the WASP research community and Swedish business. The WASP Industry days 20-22 September 2022, encompassing 300 participants, highlighted how autonomous systems, AI and software augment different aspects of human intelligence and capabilities.

Workshop on Diversity

On October 27th, the WASP Diversity and Inclusion Group (DIG) arranged a workshop on diversity, open for the WASP Community. A keynote presentation was held by Joycelyn Longdon, University of Cambridge with the title: Making climate conversation more accessible and diverse. This was followed by a presentation by Mary Sheeran and short presentations and panel discussions on How to work with Diversity held by Zahour Al-Islam, Paul Townend, Rocío Mercado, and Miriah Meyer.

WASP Winter Conference

To conclude WASP year 2022, more than 460 people from the WASP community gathered in Norrköping for the WASP Winter Conference January 10-12, 2023. While the plenary sessions aimed at informing about the goals and current status of WASP, the poster sessions and cluster meetings gave ample time for networking and discussions.

WASP Recruitments 2022

The international recruitment program is intended to build competence, establish new research areas and to reinforce existing strengths in Sweden. This is being achieved by offering packages that are attractive by international standards.

Magdalena Ortiz
Umeå University

Matias Vestberg
Uppsala University

Bastian Wandt
Linköping University

José Nunes-Yanez
Linköping University

Gabriel Eilertsen
Linköping University

Axel Flinth
Umeå University

Mantas Simkus
Umeå University

Guest Researcher Program

Tamara Rezk, Research Director at French Institute for Research in Computer Science and Automation (INRIA) has received a WASP grant as a guest researcher at Chalmers University of Technology. Her main expertise is Cyber Security and privacy.

Repatriation

Rebekka Wohlrab, Assistant Professor at CTH is the first WASP PhD returning to a position at a WASP university after pursuing a two-year WASP International Postdoctoral visit.

Distinguished Guest Professor Program

Ana Paiva, Professor at the Department of Computer Science and Engineering, University of Lisbon, Portugal, has been awarded a position as WASP Distinguished Guest Professor 2022. The position will be shared between Örebro University and Umeå University.

The Wallenberg AI, Autonomous Systems and Software Program (WASP) is a major national initiative for strategically motivated basic research, education and faculty recruitment in artificial intelligence, autonomous systems and software development. WASP was initiated in 2015 and its mandate extends to 2031. WASP is mainly funded by the Knut and Alice Wallenberg foundation.

Knut och Alice Wallenbergs Stiftelse

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Affiliated Groups of Excellence at
Luleå University of Technology, Uppsala University and Örebro University

WASP | WALLENBERG AI,
AUTONOMOUS SYSTEMS
AND SOFTWARE PROGRAI