



Magnetoelastic Energy Systems for Even More Electric Aircraft




A Project funded by the European Community under the Sixth Framework Programme for Research and Technological Development

-  Start date: 2004-01-01
-  End date: 2006-12-31
-  Duration: 36 months
-  Project Reference: AST3-CT-2003-502915
-  EC funding: 5.474.162 €
-  Type of project: SPECIFIC TARGETED RESEARCH PROJECT
-  Programme: 6th Framework Programme
-  Thematic area: Aeronautics and Space
-  Coordinator: University of Naples, Dept. of Aeronautical Engineering
-  18 Partners from 8 countries



PARTNERS I








	1	Università degli Studi di Napoli "Federico II" - Dipartimento di Progettazione Aeronautica <u>Uni-NA DPA</u>		I
	2	European Research and Project Office GmbH <u>EURICE</u>		D
	3	Universität des Saarlandes (Saarland University) <u>LPA-ZIP</u>		D
	4	Seconda Università degli Studi di Napoli - Dipartimento di Ingegneria Dell'Informazione <u>DII-SUN</u>		I
	5	Alenia Aeronautica S. p. A. <u>ALA</u>		I
	6	EADS Deutschland GmbH, Corporate Research Center <u>EADS-CRC</u>		D
	7	ZF-Lufffahrttechnik GmbH <u>ZFL</u>		D
	8	TACT Technology Ltd <u>TACT</u>		IRL
	9	CEDRAT Technologies S. A. <u>CED</u>	F	
	10	Chalmers Tekniska Högskola <u>CHALMERS</u>		S
	11	EUROCOPTER DEUTSCHLAND GmbH <u>ECD</u>	D	
	12	National Institute of Research and Development for Technical Physics <u>NIRDTP</u>		RO
	13	Kungliga Tekniska Högskolan <u>KTH</u>	S	
	14	Laboratory of Fluid Mechanics and Energy <u>LFME</u>		GR
	15	Mecel AB <u>MECEL</u>		S
	16	Newlands Technology Ltd <u>NEWLANDS</u>		UK
	17	Paragon Ltd. <u>PARAGON</u>		GR
	18	University of Salford <u>USAL</u>		UK

 MESEMA builds upon the success of previous EU projects with devotion to accomplish the objectives of the aeronautics priority through designing, producing, testing, under end-users specifications “innovative transducer systems based on active materials”.




 **Two top-level objectives identified in the Strategic Research Agenda and the Vision 2020 Report:**

-  To meet society's needs for a more efficient, safer and environmentally friendly air transport.
-  To win global leadership for European aeronautics, with a competitive supply chain, including small and medium size enterprises.


 **The MESEMA project is focused on the satisfaction of both objectives through the development of systems for fixed and rotary wing aircraft;**

-  technologies and systems for a more-electric aircraft (1.3.1.1f);
-  systems for application of “smart” materials and structures aimed to structural weight reduction (point 1.3.1.1e of the Aeronautics priority);
-  concepts, technologies and systems to suppress noise and vibrations in fixed and rotary wing aircraft (1.3.1.1i).
-  smart maintenance systems including self-inspection (1.3.1.1c);

PAST EU FUNDED R&D PROJECTS

-  ECAMMA (European Concerted Action on Giant Magnetostrictive Materials and Applications)
-  MADAVIC (Magnetostrictive Actuators for Damage Analysis and Vibration Control)
-  MESA (Magnetostrictive Equipment and Systems for More Electric Aircraft)









MAGNETOSTRICTIVE EQUIPMENT AND SYSTEMS FOR MORE ELECTRIC AIRCRAFT

-  Start date: 2000-02-01
-  End date: 2003-07-31
-  Duration: 36 months
-  Project Reference: GRD1-1999-10550
-  Project Funding: 1.800.000 €
-  Programme Acronym: GROWTH Project
-  Programme type: 5th Framework Programme
-  Coordinator: University of Saarland – LPA/ZIP
-  Partners: 14 from 6 Countries

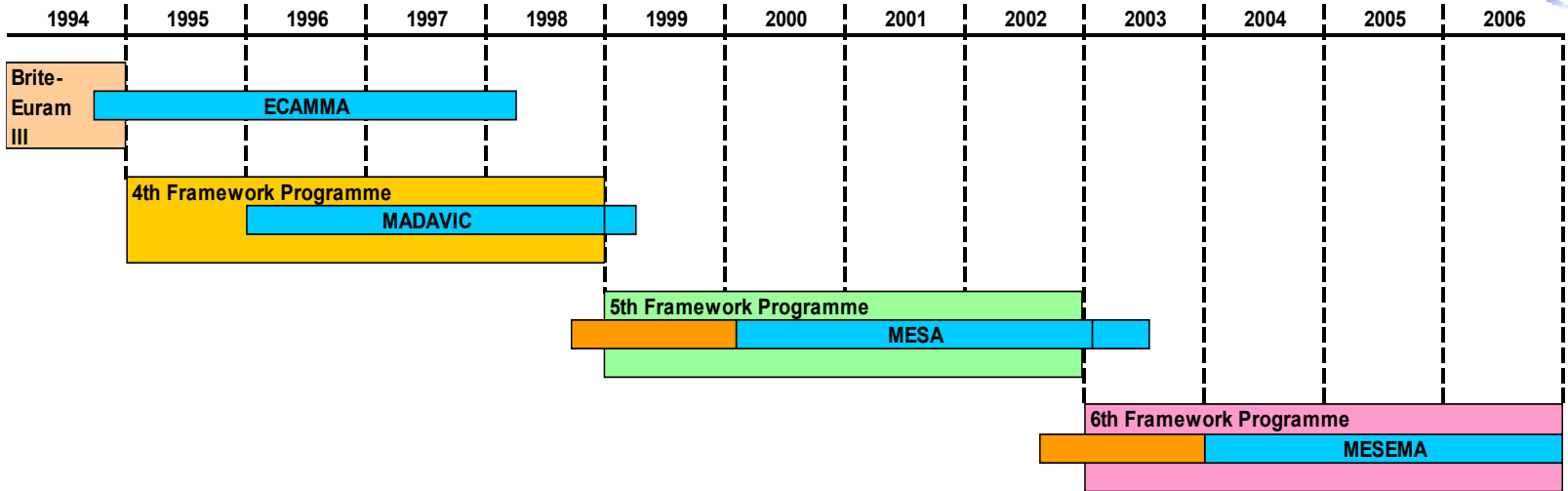
EUROPEAN CONCERTED ACTION ON GIANT MAGNETOSTRICTIVE MATERIALS AND APPLICATIONS

-  Start date: 1994-09-01 End date: 1998-08-31
-  Duration: 48 months
-  Project Reference: BRE20914
-  Project Funding: 380.000 ECU
-  Programme Acronym: BRITE/EURAM
-  Programme type: 3rd Framework Programme
-  Coordinator: AXON Consulting, Bremen, Germany
-  Third WP: Active Control and Damage Detection Using Magnetostrictive Devices
-  Partners: 5 from 4 Countries

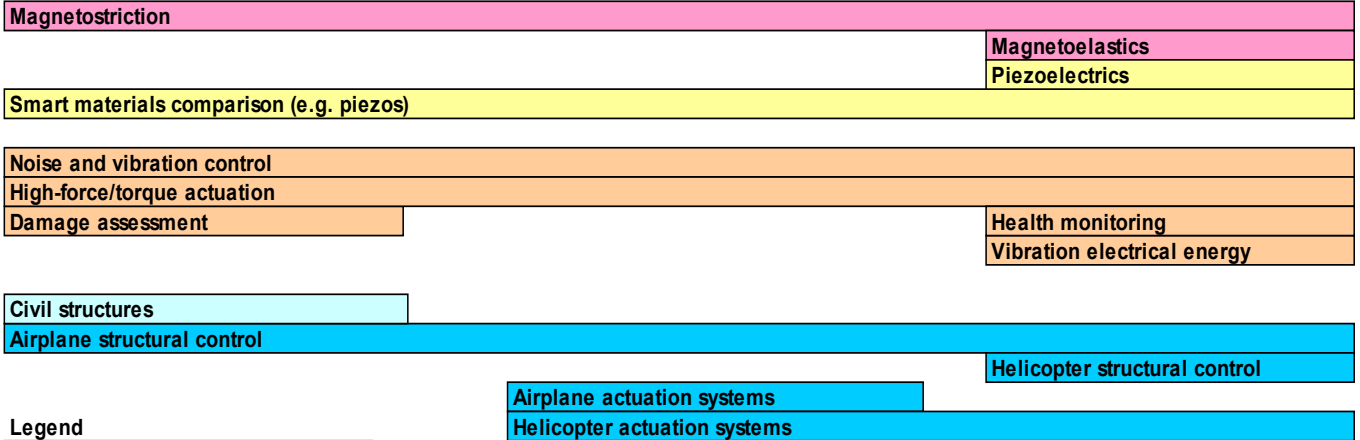
MAGNETOSTRICTIVE ACTUATORS for DAMAGE ANALYSIS and VIBRATIONS CONTROL

-  Start date: 1996-01-01 End date: 1999-03-31
-  Duration: 39 months
-  Project Reference: BE95-1372
-  Project Funding: 1.158.000 ECU
-  Programme Acronym: BRITE/EURAM
-  Programme type: 4th Framework Programme
-  Coordinator: UNINA_DPA; Dept. of Aeronautical Engineering – Univ. of Naples
-  Partners: 12 from 5 Countries

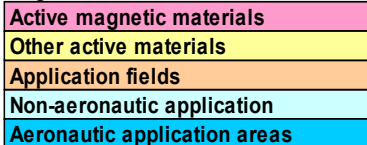
MESEMA - Project evolution: Activity fields



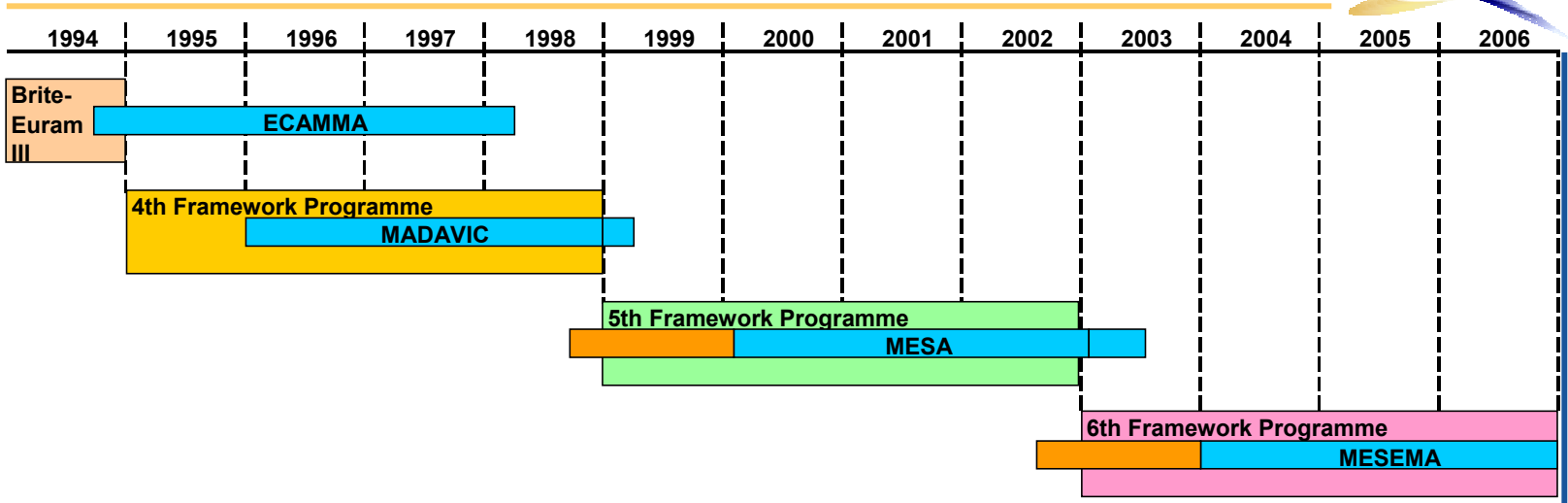
Project activity



Legend



MESEMA - Project evolution: Consortium



Consortium development







IT	UNI-Na DPA	
SE	KTH, Electrical Power	
DE	Saarland Univ. D*ASS/ZIP/LPA	
FR	TACT	
GE	Univ. Salford, Materials science	
FR	INPG-LEG	
GE	Univ. Hull, Physics	GB Newlands Technology
DE	DLR Ares	FR CEDRAT Recherche
IT	UNI-Na Physics	IT DII-SUN
FR	METRAVIB	IT Alenia Aeronautics
FR	STRAGO	DE ZF-Luftfahrttechnik
IT	CIRA	SE Saab Avionics
		SE Chalmers Univ., Machine
		GR Univ. Patras, LFME
		DE Eurocopter Deutschland
		DE Eurice
		SE MECEL Engine Systems
		RC NIRDTP
		GR PARAGON
		DE EADS Deutschland

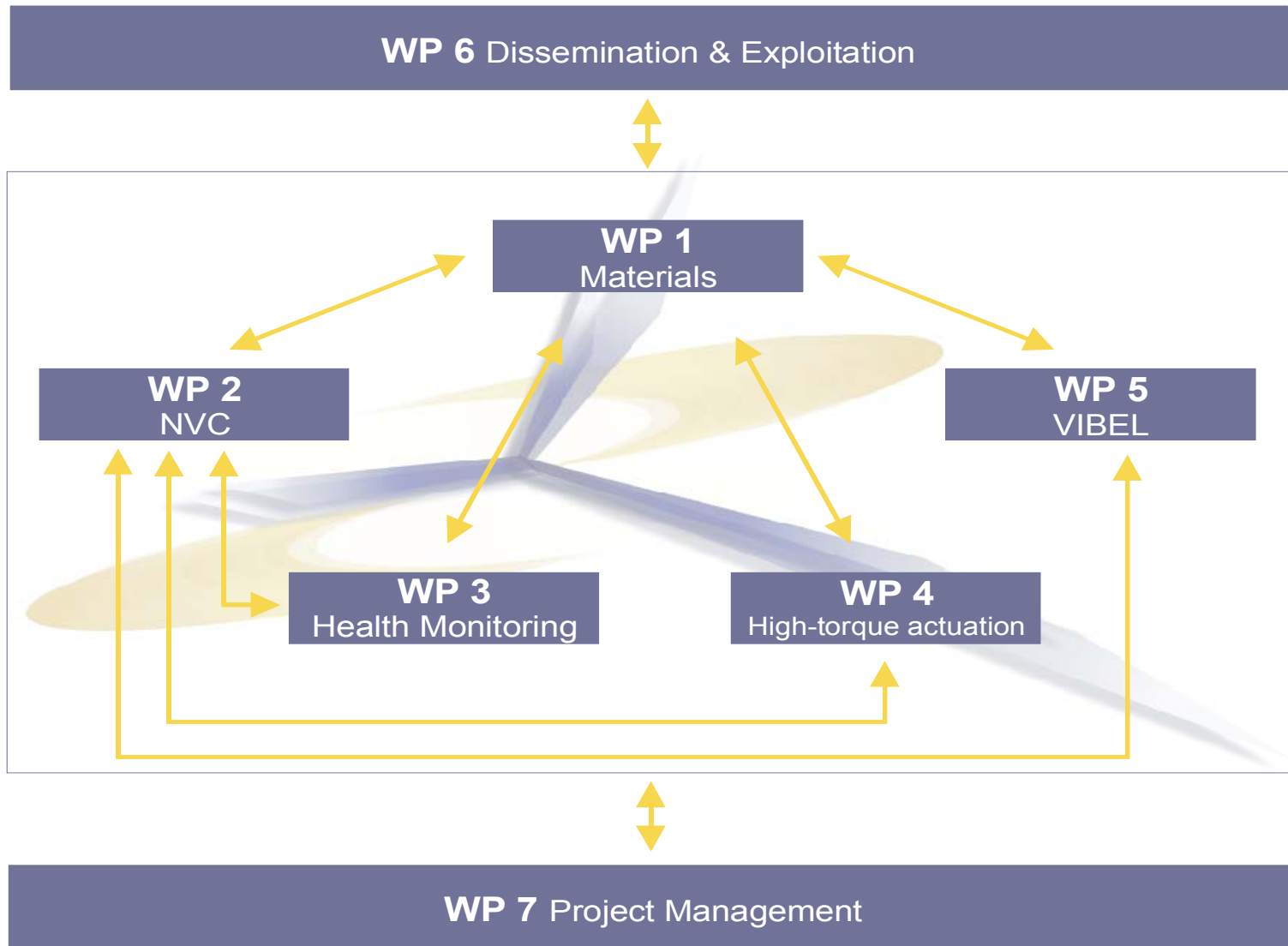
Legend

University institute
SME
Aeronautic company





The five objectives have, a common aspect that suggested their integration within this project: they all require the design and development of a dedicated actuation system (including control algorithms and driving electronics) providing dynamic displacement and force fields on a host structure.



-  The objectives consist mainly in the design and development of five systems, integrating vibration transducers, based on active components aimed at:
-  reducing the level of disturbance noise in turbofan aircraft,
 -  reducing the level of disturbance noise in helicopters;
 -  examining the health status of aircraft structural components;
 -  replacing the helicopter rotor blade pitch angle actuation systems;
 -  transforming mechanical energy related to vibration fields within aircraft into electric one (VIBEL).






Materials research and technology review (LPA-ZIP)

-  This is the basic research part of the Project aimed to maintain and advance the European technological competence in the field of magnetically-induced strain materials through research activities while remaining abreast of other active and “smart” material technologies such as piezoelectric ceramics, electro-active polymers as well as electro- and magneto-rheological fluids that may be applicable to solving some of the challenges within more-electric aircraft.
-  Furthermore, materials related developments in the areas of sensors and hysteresis compensation will contribute to the smart structure applications found in applied researches related work packages.





Noise and Vibrations control (DII-SUN)

-  Within the first activity (Noise and Vibration Control on Turbofan Aircraft) a noise & vibration control system using magnetostrictive actuators will be designed, developed and tested, with the goal of controlling noise & vibrations in a frequency range between 300 – 1000 Hz. The environmental noise & vibration excitations will be representative of a small/medium turbofan aircraft case.
-  Within the second activity (Vibration reduction on rotary wing aircraft) the HDVA concept, developed within the MESA project, will represent the starting point for the design of devices fulfilling the vibration reduction requirements typical of rotary wing aircraft.


Structural Health Monitoring (SHM) of aircraft fuselage components (UNI-Na DPA)

-  The objective of this application is the development and testing of SHM systems based on the analysis of variations in structural dynamic responses induced by damages.
-  This activity will benefit from most of the actuation technologies that will be developed for the Noise and Vibration Control on Turbofan Aircraft.
-  The main target will be the implementation of a HM system based on the same “hardware” in terms of actuators and sensors but characterised by dedicated analysis algorithms in order to develop and test innovative damage analysis approaches in a realistic environment at very low costs.

High Torque Actuation for Rotor Blade Root Control (ZFL)



-  Present helicopters use complex primary control systems that allow the pilot to manoeuvre the helicopter by adjusting the rotor blade pitch angle and hence rotor forces and moments.
-  This system is complex, heavy, causes drag, and requires periodical maintenance.
-  The focus will be put on the search for a suitable electro-mechanical concept which can fulfil the high torque requirements of the envisioned application as well as the reliability level which is required for the primary control function of a helicopter.
-  Within this task one or more concepts of actuation systems satisfying these requirements will be produced, including devices, power amplifiers and control systems.

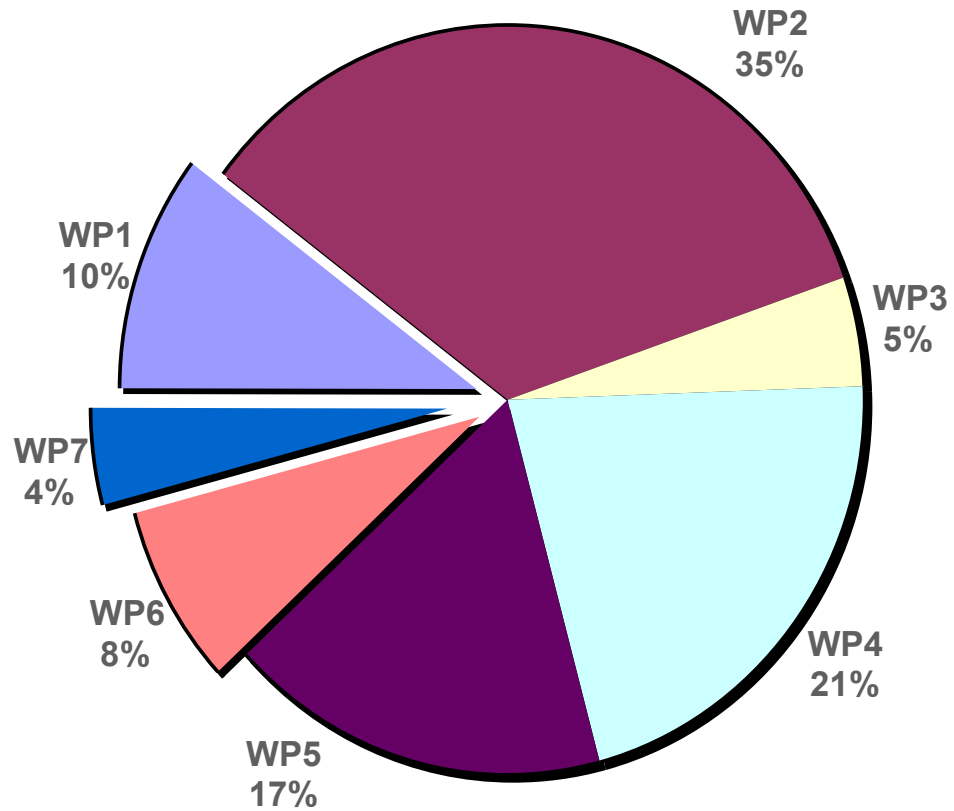
Vibration (elasto-magnetic) energy conversion using high efficiency giant magnetostriction alloys (VIBEL) (TACT)

-  The objective of the VIBEL technology is to recover part of the vibration energy losses into useful electrical energy thanks to elasto-magnetic energy coupling within giant magnetostriction Terfenol alloys.
-  The MESEMA project will investigate and analyse the underlying physics of mechanical to electric magnetoelastic energy conversion, providing the basis for efficient engineering exploitation of these effects.
-  Several VIBEL prototypes will be adapted and optimised for electrical energy generation at selected positions onboard an aircraft and helicopter.

WORKPLAN Distribution



-  Total person-months: 791.4
-  Overall budget: €7.633.149,00



Project Co-ordination:

Università degli Studi di Napoli Federico II
Dipartimento di Progettazione Aeronautica

Co-ordinator: Prof. Dr. Leonardo Lecce

Email: leonardo@unina.it

Via Claudio, 21
I-80125 Napoli

For scientific matters please contact:

Dr. Ernesto Monaco (Co-ordinator)

Phone: +39 081 76 83 572

Fax: +39 081 62 46 09

Email: ermonaco@unina.it

For administrative matters please contact:

Ms Corinna Hahn

Phone: +49 681 95 92 33 62

Fax: +49 681 95 92 33 70

Email: ch@eurice.de