



# Wearable sensors and actuators

to monitor and promote physical and emotional wellbeing

## NEWSLETTER # 1

**BEWELL** project is about developing integration and manufacturing technologies needed for smart skin patch and wrist-device wearable electronics sensing and actuating products. BEWELL project is also about demonstrating three different application use cases.

Contract No. 825172  
Duration: 01/2019 – 12/2021  
Call: EU ICT 02 – 2018

Website: <https://h2020bewell.eu/>



<https://www.facebook.com/h2020BEWELL>

<https://twitter.com/h2020bewell>

<https://www.youtube.com/channel/UCRnLf7WgsNPZdQ2wTutN9A>

<https://www.linkedin.com/groups/12185056/>

### PROJECT INFORMATION

## BEWELL

Grant agreement ID: 825172

Status:

**Ongoing Project**

Start date: **1 January 2019**

End date: **31 December 2021**

5%



% Project progress

Funded under: **H2020-EU.2.1.1**. Overall budget: € 4 164 845 EU contribution: € 4 164 845

Coordinated by:

**Teknologian tutkimuskeskus VTT Oy, Finland**

Company	Country	EU Contribution, €
Teknologian tutkimuskeskus VTT Oy	Finland	802 785,00
COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France	705 873,75
INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM	Belgium	701 048,75
D. SWAROVSKI DISTRIBUTION GMBH	Austria	528 687,50
BEIERSDORF AG	Germany	403 750,00
POLAR ELECTRO OY	Finland	398 950,00
VARTA MICROBATTERY GMBH	Germany	372 500,00
HOCHSCHULE DER MEDIEN	Germany	251 250,00

# About Project

**BEWELL** project is about developing integration and manufacturing technologies needed for smart skin patch and wrist-device wearable electronics sensing and actuating products. BEWELL project is also about demonstrating three different application use cases.

Wearable electronics belongs to new age consumer electronics together with smartphones, gaming consoles and laptop/tablet computers. Key development focuses of the new devices are better humanmachine interfaces, improved connectivity, user-friendly form factors and convenience of use. Internet of things, connected living, quantified self and smart homes are identified as the driving trends of this evolution among which especially the quantified self is clearly driving the wearable electronics. Inside wearable electronics, wrist-worn devices have been the largest segment but body-worn and head-worn devices are expected to grow to similar sized segments.

Intimate skin contact is necessary for reliable sensing and actuation based on sensor results during different levels of activity of the users. Controllable skin contact would be a further improvement in sensing applications. The purpose can be to replace or supplement visual messaging. Therefore, skin patches and associated technologies to enhance the user-device interface also in other types of products such as the wrist-worn ones are of special importance. In BEWELL, we have identified commercially relevant future skin-patch products to be demonstrated. We have also identified a set of critical and versatile technologies that need to be developed for scalable manufacturing and integrated to realize these future products. In particular, the BEWELL project aims to unleash the potential of flexible and wearable electronics for physical and emotional wellbeing by advanced integrated technology components made in Europe.

## Results up to now

For the POLAR use case a design was defined, consisting of different modules in a bracelet which are connected and work together as a monitor.



Bracelet showing the POLAR use case, outer side (left) and inner side (right)

Beside different modules the outer sides show Solar Cells (SC), ECG electrodes (ECG1) for another hand and a display (MLCD) while the inner sides show Haptic elements (HAP1/2) for communication by vibration, PPG measurement interfaces (OHR) and ECG electrodes for the wrist (ECG2). All electronics (including MCU, memory, RF transceiver and battery) are assembled on Flexible Printed Circuit. Other technologies are possible to use also like printed electronics or textile wires for interconnections.



Swarovski skin patch designs of the appearance.

# Participants

**VTT Technical Research Centre of Finland Ltd** is a state owned and controlled non-profit limited liability company established by law and operating under the ownership steering of the Finnish Ministry of Employment and the Economy.

VTT is an RTO whose activities are focused on three areas: Knowledge intensive products and services, Smart industry and energy systems, and Solutions for natural resources and environment. VTT is impact-driven and takes advantage from its wide multi technological knowledge base to strengthen Finnish and European industrial competitiveness. VTT can combine different technologies, produce information, upgrade technology knowledge, and create business intelligence and value added for its stakeholders. VTT has a staff of 2128, net turnover in 2016 was 162,6M€ and other operational incomes were 86.4 M€. Over the years, VTT has gained vast experience from participation and coordination of numerous European projects including R&D Framework Programme projects and other thematic frameworks and programmes. VTT is ranked among the leading European RTOs.

**Swarovski** is the world leading manufacturer of premium crystal components, providing finest crystals since 1895. With more than a hundred and twenty years' experience of high-quality craftsmanship and mastery in cutting, Swarovski produces light-filled crystals of breathtaking range and brilliance. Swarovski means access to 15,000 loose crystals and another 400,000 forward-integrated elements. Apart from the main manufacturing site in Wattens (Austria) Swarovski operates a worldwide marketing, sales and distribution network. The business is divided in two main complementary parts:

- The crystal components business (Swarovski Professional), operates in B2B relations in the following markets: jewellery, textile, lighting, interior, packaging and electronics.
- The B2C business (Consumer Goods Business) is providing jewellery and gift solutions under the Swarovski brand.

Research, Development and Innovation forms the constitutive basis for future growth of the Swarovski Group covering a wide range of R&D topics from glass engineering, over light & optical engineering, glass cutting and polishing to refinement technologies (such as PVD, CVD, PECVD, sputtering, wet chemical coating, lacquering) as well as electronics development. Currently over 270 persons are employed in R&D in Wattens, Austria. The R&D spendings account for approx. 40

**POLAR:** In 1975, the idea of portable heart rate monitors came into existence on a skiing track. The idea came from a concrete user need to be able to measure heart rate during training. Now, over 40 years after that first moment of inspiration, the end user needs are still leading the innovations and Polar provides the most comprehensive product range in the industry. From basic models that help motivate and inform beginners and regular exercisers, to providing complete training systems for world champions across numerous disciplines.

Strong physiological research and state-of-the-art technological innovations are what best describe Polar R&D (mainly located in Finland). In the team we have world renowned, and well

published, physiology experts as well as Olympic level coaches and athletes who contribute to our product development.

Polar's in-house capabilities include for instance, sports science research, ASIC design, mechanical design, embedded design, software development, and manufacturing. This comprehensive knowledge makes Polar capable to design and manufacture training computers completely in-house from scratch. Polar also cooperates closely with leading universities, institutes, research centers, Olympic level athletes, and coaches.

**VMB Microbattery GmbH** is one of the most significant battery manufacturers of the world. With global production plants and distribution subsidiaries VMB Microbattery GmbH supplies customers in more than 100 countries with high quality battery products. Production plants all are ISO 9001 certified and numerous products possess UL recognition.

As an international operating venture VMB Microbattery GmbH worldwide maintains sales subsidiaries and affiliated companies. Head office same as research and development department are located in Germany, Ellwangen. The sales area office Germany is also situated here. For many years customers from Benelux, Germany, Austria and Eastern Europe are supplied from here with products from the extensive OEM product range. The OEM division of VMB Microbattery GmbH concentrates on further development of primary\*12 and rechargeable lithium cells and on NiMH-systems for mobile applications.

VMB Microbattery GmbH is the major player in the market for innovative lithium batteries for portable appliances. They entered into the market of Lithium Ion rechargeable batteries in the size range from 200 mAh to 1200 mAh in 1999. The products are well established now and cover a remarkable market share in the high quality niche markets. The VMB Microbattery development consists of 70 employees for development and implementation of new technologies in the production. In so far VMB Microbattery is able to contribute to the project by production oriented development of electrochromic cells

Website: (<http://www.VMB-microbattery.com>)

**Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA)** is a French research-and-technology organization with activities in energy, information technology, healthcare, defense and security. CEA-Tech which is one of its divisions, focuses on creating value and innovation through technology transfer to its industrial partners. It operates 8,000-m<sup>2</sup> of state-of-the-art clean room space on 200mm and 300mm wafer platforms and as well the printed platform called "PICTIC" dedicated to TOLAE activities. It employs 4,500 scientists and engineers including 300 Ph.D. students and 300 assignees from partner companies. CEA-Tech owns more than 2,200 patent families. The entity within the CEA LITEN institute involved in the BEWELL project is the Printed Devices lab with a team of more than 50 persons devoted to printing process development for organic devices (OTFT, OPD, sensors and actuators), ink formulation, organic device modeling and simulation and device characterization and reliability. This department operates the French printing pilot platform PICTIC.

**IMEC** is a world-leading independent research center in nano-electronics and nanotechnology. Its research focuses on the next generations of chips and systems, energy, electronics for

healthcare and life sciences, sustainable wireless communication, imaging and future 3D visualization, and sensor systems for industrial applications. IMEC's research bridges the gap between fundamental research at universities and technology development in industry. Its unique balance of processing and system know-how, intellectual property portfolio, state-of-the-art infrastructure with fully equipped 300 mm and 200 mm process lines and its strong network worldwide position IMEC as a key partner for shaping technologies for future systems. IMEC is headquartered in Leuven, Belgium, and has offices in Belgium, the Netherlands, Taiwan, USA, China, and Japan. As of October 1st 2016, iMinds, the digital research and incubation center has merged with IMEC into one high-tech research and innovation hub for nanoelectronics and digital technologies, under the name IMEC. IMEC's broadened research and collaboration offering makes it a unique and world-class research center in the field of nanoelectronics, excelling in software and ICT expertise. IMEC employs nearly 3500 researchers in various domains. Numerous residents and guest researchers are also part of IMEC research teams.

**(HdM) – Hochschule der Medien (research group IAD):** Since September 1st 2001, Hochschule der Medien has brought together the combined know-how of the former University of Printing and Media, an educational institution with over 100 years of tradition, and the University of Librarianship and Information whose history reaches back to 1942.

Within the HdM the research group Innovative Applications of Printing Technologies (IAD) deals with questions in the area of functional printing. The focus here is not on the information transfer (graphical applications), but on the functionality of the print products. Usually the electrical conductivity of the printed materials is the foremost property. However, other functionalities such as haptics or electrochemical properties (for the printed batteries), as well as physical and chemical properties of printed structures are target of the research. In the field of functional printing, the screen printing is used as the preferred printing process.

The research group IAD is one of the profile-building research centers (so-called lighthouses) that further improve the visibility and competence of the HdM.

The main research topics at the IAD during the past ten years, were the printing technology of antenna structures for different frequency ranges, the realization and characterization of fully printed, portable primary and secondary batteries as well as in the area of "energy harvesting" printed thermogenerators that work on the principle of the Seebeck effect. Printed sensors with different operating principles are investigated and developed in cooperation with industrial partners. Website: <https://www.hdm-stuttgart.de/iad>

**Beiersdorf** is a DAX listed worldwide leading manufacturer of cosmetic and self-adhesive products. Its brands include amongst others NIVEA, the most valuable cosmetic brand worldwide, Eucerin, La Prairie, Hansplast/Elastoplast and tesa. We have two business segments, consumer business (5,800 Mio € turnover 2017) and tesa business (1,250 Mio € turnover 2017). With almost 19,000 employees and more than 160 affiliates we are close to our consumers all around the world. Founded in 1882, we have more than 130 years of experience in skin care and self-adhesive products. Research and Development has always played a key role at Beiersdorf. In cooperation with our Research & Development Center in Hamburg, our Regional Development Laboratories in Mexico, China and India, develop products specifically tailored to local skin care needs. Today, almost 1,300 employees worldwide are working in Research & Development. In 2017 more than 1,750 consumer studies have been conducted, 200 Mio € have been invested in R&D and 85 patents have been filed.

Website: <https://www.beiersdorf.com/>

# Blog

## BEWEL project has started

[February 1, 2019, January 1, 2019](#) by [BEWELL](#)

With 8 partners from 5 nations BEWELL project has started from the 1st of January 2019.

BEWELL project is developing wearable sensors and actuators to monitor and promote physical and emotional wellbeing. BEWELL project is focusing on integration and manufacturing technologies needed for smart skin patch and wrist-device wearable electronics

## BEWELL kickoff meeting

[February 1, 2019, January 15, 2019](#) by [BEWELL](#)

On 15 January 2019, the first meeting in BEWELL (H2020- ICT-02-2018 Flexible and Wearable Electronics) project has been held with all project participants in Oulu, Finland. The meeting was hosted by the coordinator, VTT Finland. Participants have discussed the project goals, needs and individual expectations and started the first tasks.

## BEWELL meeting

On 22-23 May 2019, the second meeting in BEWELL (H2020- ICT-02-2018 Flexible and Wearable Electronics) project was held with all project participants in Stuttgart, Germany. The meeting was hosted by HdM. Technical developments were reviewed and demonstrator concepts detailed.

# BEWELL presented at LOPEC 2019

March 20 - 21, 2019, by BEWELL

At the LOPEC 2019 (<https://www.lopec.com/general/impressions/photo-gallery/index.html>) BEWELL was presented at several places. One of them was the booth of VARTA Microbattery:

**Partner of Project**

**BEWELL**

**Project Number 825172**  
**Duration 1.1.2019 – 31.12.2021**

Funded by European Commission

**Wearable sensors and actuators to monitor and promote physical and emotional wellbeing**

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**Realization of Printed Batteries**  
Variations of serial and parallel connections

Single cell	2s configuration	Np configuration
Nominal Voltage: 2.0V (max), 1.1V	Two cells in series	N cells in parallel
Typical Capacity: 100mAh	Double voltage	Increases capacity

**VT** **VARTA** **SWAROVSKI**

**POLAR** **Beiersdorf**

**c2a** **imec** **IMPREGNE DES MEDIER**

[www.h2020bewell.eu](http://www.h2020bewell.eu)

The poster showing the objective and more information at the VARTA booth at LOPEC2019



The BEWELL team at LOPEC 2019

The response was outstanding high. More than 30 contact to persons and companies who are interested in printed Smart Objects were collected.

## Future dissemination activities



At the ISFOE 19 a talk will be held by Martin Krebs, VARTA, about the progress in different funded projects about printed batteries and their application. A special focus will be placed on the BEWELL project.

## SAVE THE DATE for the European Commission Workshop on 'Smart Bioelectronic and Wearable Systems'

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The EC workshop, addressing smart systems across **Key Digital Technologies**, including [bio-electronics](#), [bio-photonics](#) and [flexible and wearable electronics](#), will take place on the **22<sup>nd</sup>** and **23<sup>rd</sup> October 2019** at **0/S1, Avenue de Beaulieu 25, Brussels, Belgium**.

Building on the success of previous events on Micro-Nano-Bio Systems [MNBS](#), [Biophotonics](#) and [Flexible & Wearable Electronics](#), it will bring together EC-funded projects and stakeholders to share technology and innovation progress, and address future challenges. The event will address the value chain, from Laboratory research to Fabrication and validation in Applications, such as health & biomedicine, food, environment, safety & security.