



# AoT-News

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## Under the Microscope

Production Support as a service

## Tech-Corner

Re-design of a Medical Implant for CE-Certification

## Speed-Dating à la AoT

with Klaus Ruzicka

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## News & Events

AoT will be exhibiting at the following trade shows



23 – 26 January 2012  
Dubai International Convention & Exhibition Centre, Dubai, UAE



28 February – 01 March 2012  
Nuremberg Exhibition Centre, Nuremberg, Germany  
Hall 2, Stand Nr. 2-328



13 – 15 March 2012  
Stuttgart Exhibition Centre, Stuttgart, Germany  
Swiss Pavilion, Hall 4



# Under the Microscope

## Production Support

As a pure design house Art of Technology AG (AoT) does not have its own internal manufacturing capabilities, outsourcing all production activities to external partners. The variety of customer projects requires a correspondingly large diversity of partners.

Over the years, we have established a network of highly qualified manufacturers and service providers, mainly in Europe but also in USA and Asia. Depending on the requirements of each project, we select the most suitable partner, based on the capabilities described below.

These differ in 3 general areas of competence:	
Production volumes	Single pieces Small quantities up to a few thousand units Large volumes up to hundreds of thousands per month
Technologies	Substrate: Rigid and flexible laminates, ceramics, thin film, 3D-MID, special substrates  Assembly: SMD, THT, wire-bonding, Flip-Chip, 3D-Assembly, etc.  Components: Active, Passive, Mechanic etc.
Certification	Automotive, Aerospace, Commercial and Medical

With this knowledge we can offer our customers a tailor-made solution for the set-up and supervision of production, while taking into consideration the desires and preclusions of the customer. This is especially interesting when the concept, design and project development are part of the customer's internal core competences, but production and test need to be outsourced. In such instances, we can also assist with the selection of the technology, or indeed the mix of technologies required.

AoT can provide relief for your internal resources, even when more complex systems have to be produced by a combination of different manufacturers and co-ordination is complicated or time-consuming, or if the manufacturers have to stretch to the limits of the chosen technology. We ensure selection of the most suitable partners, co-ordination of inter-related tasks and ultimately "on-time" delivery. In the event that problems arise, we address the issues working closely with the manufacturers to find a solution, without unnecessarily burdening the customer.

With our experience and flexibility we can organise the entire production process from design or PCB layout, setup complex manufacturing and manage production from prototype to large volumes. If you are considering outsourcing the production or industrialisation of a product, contact us to explore how we can help optimise the process and reduce the pain.

For further information contact [paul.sphikas@aotag.ch](mailto:paul.sphikas@aotag.ch)

# ALFApump™ System

## Re-design of a Medical Implant for CE-Certification

Klaus Ruzicka

The ALFApump™ system from Sequana Medical (Switzerland) is a proprietary, battery powered, implantable pump, designed to remove excess abdominal fluid (Ascites), in patients suffering from liver cirrhosis. The system automatically and continually collects fluid as it forms in the peritoneal cavity, pumping it into the bladder where it is excreted during normal urination. The device received medical CE approval in July 2011, only 3.5 years after the start of development.

### ALFApump™ re-design

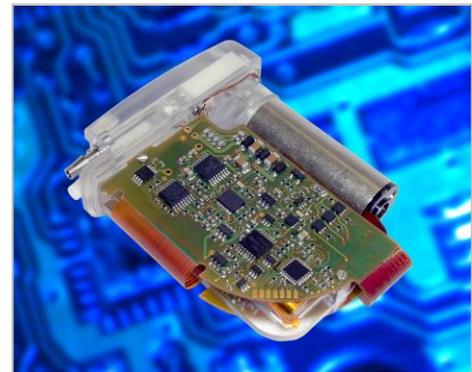
Art of Technology (AoT) was tasked with re-designing the original prototype used for animal trials, to improve reliability for human clinical trials and volume production. A major challenge was the very tight time schedule for a virtually complete system development. AoT started the re-design of the implant and development of a wireless charger in October 2007 and the first human implantation for clinical trials took place in December 2008.

Several improvements in the mechanics, electronics and control firmware were developed by AoT, together with Sequana, to improve the reliability and patient comfort.

The implant is designed to be in the human body for at least 2 years.

### Battery Powered Charger

The battery powered charger provides enough energy for two complete implant charging cycles. This allows, depending on the daily volume of ascites (up to 2 litres) to be pumped, up to one-week of independent operation between charges.



ALFApump™



Wireless Charger

*«Art of Technology understood our needs and critical requirements right from our very first meeting. I was impressed with their broad know-how of electronics technologies, system design, and specifically for our application, their expertise with design of medical products. They shared our sense of urgency and were able to meet our aggressive timeline with a product redesign that exceeded our expectations»*

Noel L. Johnson (Ph.D.)  
CEO, Sequana Medical AG



Most Significant Design Improvements of the Implant	
Mechanics	Introduction of rigid-flex PCB to avoid the need for mechanical connectors
	Integration of the charging coil (antenna), so there are no components outside the housing of the implant
	Biocompatible Parylene coating to protect the electronics and components and ensure protection against aggressive body fluids (and vice versa)
	Device completely potted using medical grade epoxy, to protect against aggressive bodily fluids and avoid the creation of hot spots, during charging of the implant's battery
Electronics	Additional motion and pressure sensors for better process control
	Brushless motor to minimise power consumption and electrical sparks, avoid particles caused by abrasion resulting in increased reliability
	Implementation of a two-processor solution consisting of motor controller and system processor, which controls and monitors the motor subsystem. In case of a failure the motor subsystem will be disconnected from supply after a few seconds in order to guarantee patient safety under all circumstances
	Efficiency of charging circuit significantly improved to avoid unnecessary heat generation and minimise recharging time, while optimising patient comfort and safety
Software	Development of a highly sophisticated motor control algorithm to "shake" the gears of the pump free should they become jammed in the extremely viscous fluids
	Motor control algorithm ensures safe running even if the motor-position-sensors are damaged
	Automatic logging of all important events such as the volume of fluid pumped and the surrounding conditions, allowing configuration to the individual needs of each patient (e.g. number and volume of pumping attempts, no pumping during night time, etc.)
	Safe data and disaster recovery (e.g. in the event of implant not being charged by the patient)
	Wireless interface to optimise parameter control (i.e. optimal charging efficiency and positioning of the charger by patient) and parallel downloading of data logs



Main Design Features of the Wireless Charger	
Mechanics	Charging antenna utilises commercially available off-the-shelf components
Electronics	Power transmission optimised using feedback from implant
	Full-Speed USB (4kV, medical isolated), to enable configuration of charger and implant as well as simultaneous, fast download of data by physician
	Basic user interface with 3 LED's and 1 buzzer, to allow initial patient trials within the timescale required. The CE approved device features a small graphical OLED display to increase usability and patient's comfort (i.e. placement of the charger)
Software	Back-up mechanism to guarantee safe and optimal charging in the event of a breakdown of wireless communication
	Implant log-data downloaded and stored locally on SD/MMC compatible memory during the charging process
	Synchronous logging of charger and implant data (3 month archive) Mechanism to auto-correct bad system time to avoid pumping during night time
	The use Aot's SAM7/SAM3 software framework allowed fast and fail-safe medical class "C" software development <ul style="list-style-type: none"> <li>- Clock Control (use 32kHz mode whenever possible to save energy)</li> <li>- ADC (measure charger's parameters, implant charging control)</li> <li>- PWM (control charging subsystem)</li> <li>- SPI, Dallas One Wire (sensor communication)</li> <li>- USB (communication to doctors PC)</li> <li>- Memory Card (storage for log data and configuration)</li> <li>- Radio, Hardware/Software Timer , Key, Watchdog and many more</li> </ul>

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# Speed-Dating à la AoT

with Klaus Ruzicka

## What motivates you?

A Challenge, I like it when things start to work.

## How do you spend your free time?

First at home with my family, then at the Fire Brigade and when there's time, I like taking photos.

## Why did you join the local Fire Brigade?

I live in a small village, where everybody knows each other and participation in village life is inevitable. It's fun and brings a lot; we practice assessing difficult situations (and life) quickly. Someone's life may depend on it and we want to help protect people.

## Could you rescue me from the 3rd floor of a building?

You'd be a challenge and you certainly wouldn't enjoy it, but I'd get you out...☺

## What do you like to photograph?

I like to photograph the cities or nature trips I've visited. My last outing was a walk through the "Via Mala" gorge.

## Which hobby would you never do voluntarily?

B.A.S.E. Jumping: Jumping off a cliff face with a parachute. If it went wrong, my colleagues in the fire brigade would have to scrape me off the ground.

## What things do you definitely want to do in Life?

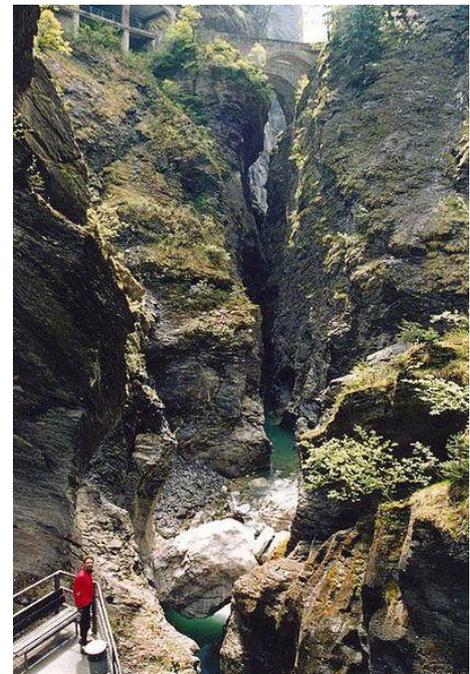
I have already achieved the things that are important to me: plant a tree, build a house and raise a child.

## Which profession would you not want to do?

In today's environment, I wouldn't want to be a doctor even though it is an interesting profession. I see friends, and the circumstances they have to work under (i.e. 12 hours service followed by 12 hours on-call). Which patient wants a doctor that's so tired and which doctor wants such a responsibility?



Age	43
Profession	Senior HW/SW-Engineer
With AoT	since 2008
Star sign	Scorpion





Assuming heaven exists, what would you like to hear God say to you when you arrive at the pearly gates?

That reminds me spontaneously of a quote from one from the detective novels by the Austrian author Alfred Komarek.

The police officer Simon Polt is always greeted the same way, by his friends during his investigation in the cellar of a wine-growing region: "Hi Simon, let's drink something?"

Something in this direction would be pretty good.

Describe yourself in a few words?

I see myself more as a quiet person, even a little bit stubborn, especially if I want to achieve something. Occasionally, I like to tease people, but try not to get too personal.

What upsets you?

It's difficult to upset me. I moan sometimes, but try to suffer!

Which Superstrength would you like to have?

I'd like to be able to fly (from a cliff face?)

You're invited to a Costume Party; how would you disguise yourself?

As a catholic Priest.

What sound or noise do you love?

The turning of a page (in a book); it exudes cosiness.

Your favourite word?

Forty-Two (Hitchhikers Guide to the Galaxy).

Your favourite expletive?

Oh God, please let it rain brain!