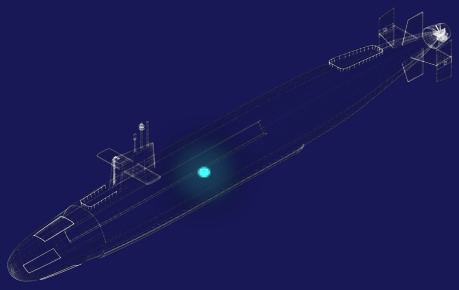
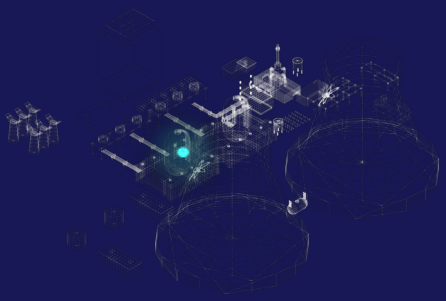
WIRELESS SYSTEMS
by ARCYS

Multi-application Wireless Network

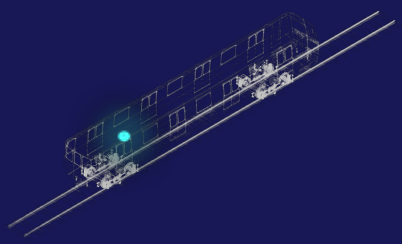
1. Localization
2. Communication
3. Instrumentation



DEFENCE



CIVIL NUCLEAR



TRANSPORT

ARCYS

ARCYS
Electronic for a safer world

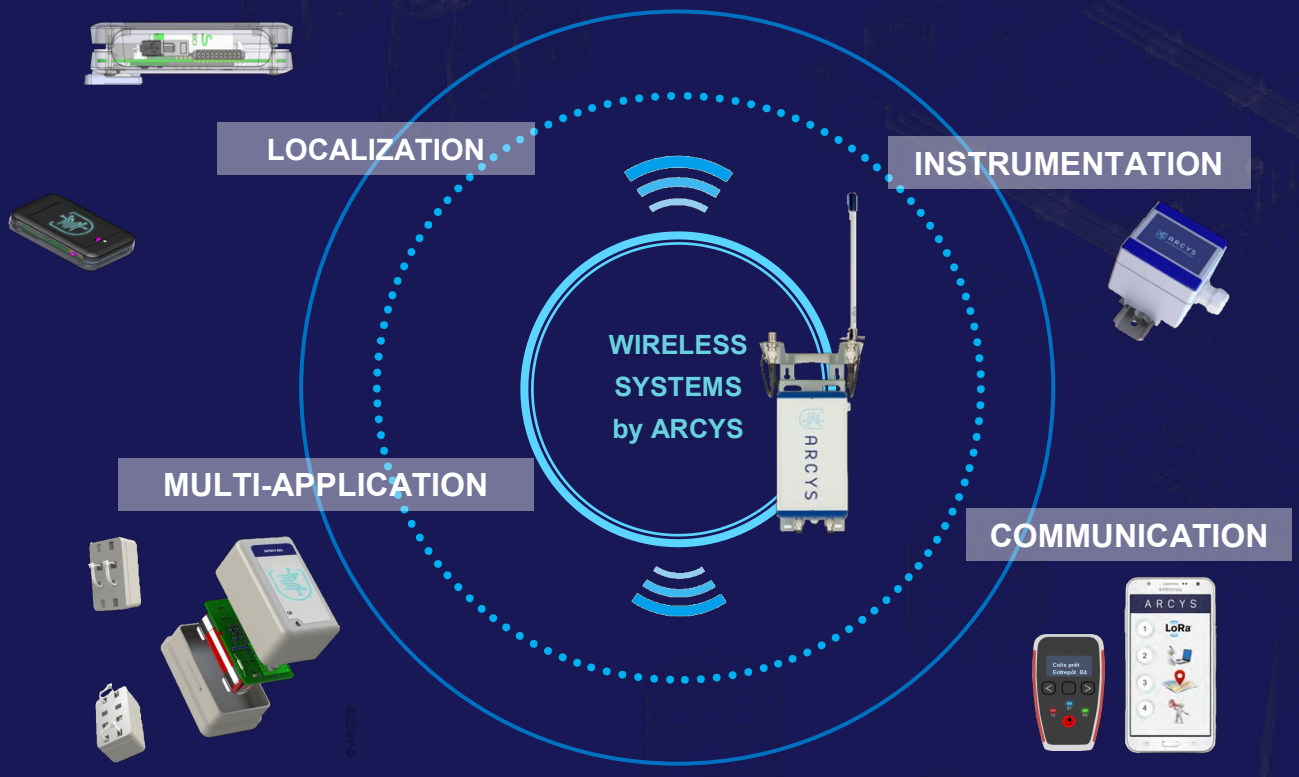
Wireless Systems for NPP

ARCYS industrialize a multi-applicative and secure Wireless Systems for Nuclear Power Plants.

This multi-applicative network allows NPP or nuclear installation to follow Key Process Indicators and On Time Delivery management.

We use LoRa™ technology integrated inside our solutions for light infrastructure (competitive solution for a global network coverage Indoor & Outdoor). Data transmissions are insure on long distance or throw armed wall, fire doors in Harsh Environment.

ARCYS brings his expertise in cyber-security, Instrumentation and MRO (maintain Repair in Operation).



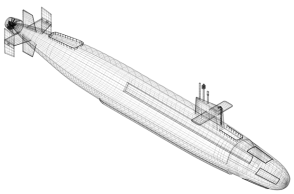
1 Localization of tools, equipment's, people indoor & outdoor : Logistic Monitoring, Lone Worker Protection (LWP) ==> Project management for OTD on New Build or Major retrofit on nuclear fleet “grand carénage in France”

2 Wireless Instrumentation : sensors, analog / digital signal (4-20mA, 0-10V, TOR, PT100, TK, Pressure, Level…) ==> Key process indicator for optimize production.

3 Communication Workers synchronization, Smart PAD, PAGER, Logistic monitoring and LWP.

ARCYS

ARCYS designs, develops, qualify and maintains safety elctronical equipements and instrumentation dedicated to harsh environment.



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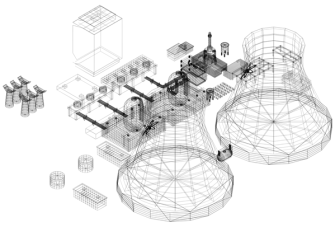

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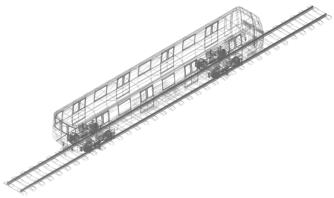


TRANSPORT

CONTROL COMMAND	INSTRUMENTATION	WIRELESS SYSTEMS	MRO

1975
CEIS founded
Safety electronic

1988
Instrumentation
CITA Founded

1998
ELTA founded
Merge of CEIS & CITA
Instrumentation and I&C

2008
I&C and Wireless Systems
Acquisition of SMP - AREVA EXPANSION

2017
ARCYS founded
TechnicAtome and Framatome
subsidiary

Our shareholding

EDF
9,03%
75,5%
TechnicAtome
framatome
51%
49%
ARCYS

Our main projects in nuclear industries

framatome

EDF PALUEL NPP with Framatome and Rolls Royce

NPP retrofit : asset management – equipment Localization

- More than 500 equipment's localization monitoring,
- 20 zones covered,
- Compete autonomous wireless network.

orano

Orano Mining : Wireless Instrumentation

50 parameters monitoring throw 120 km²

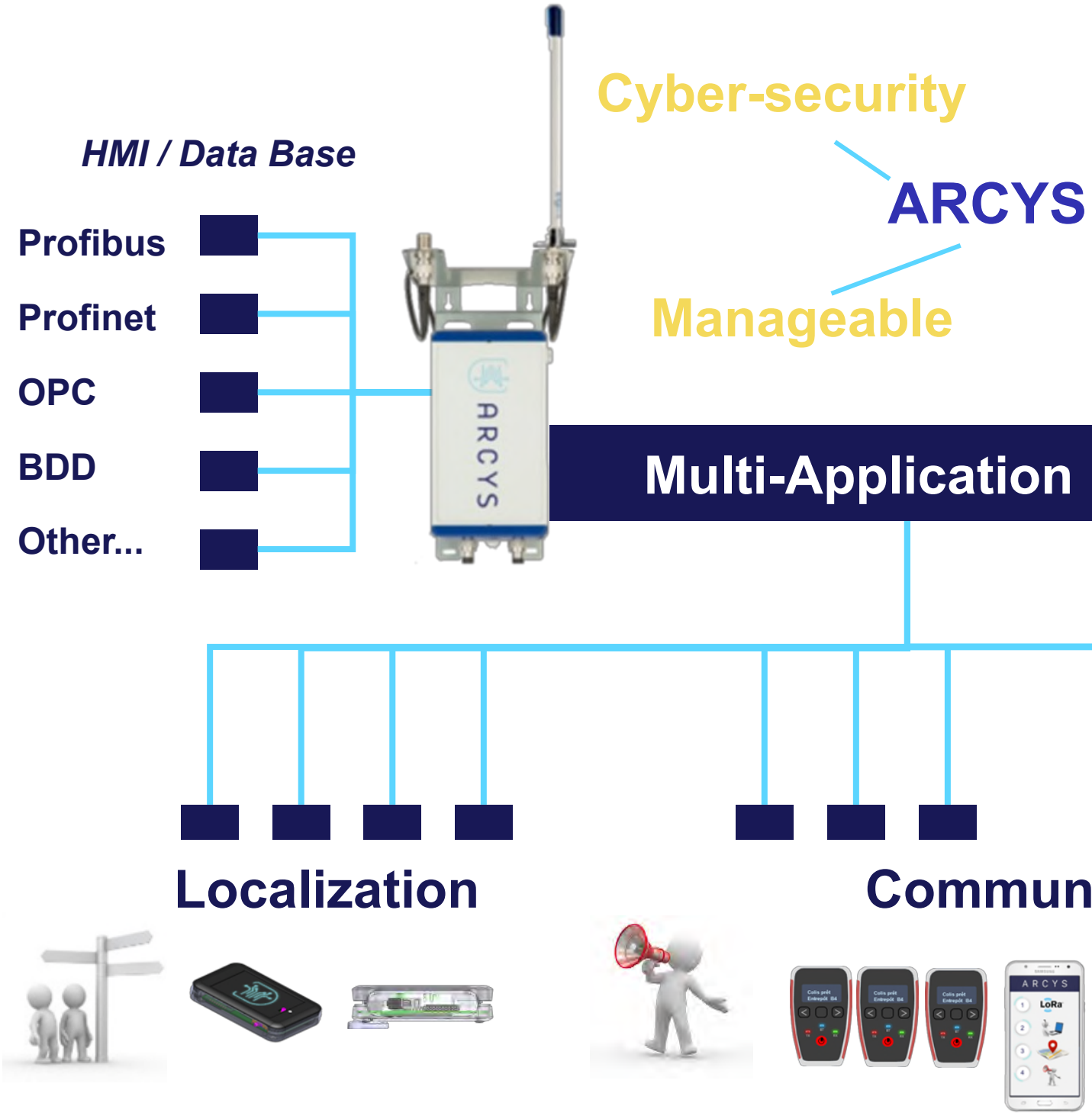
And future project for more than 2500 parameters

Orano La Hague : Post-Fukushima (ECS) Wireless Instrumentation, Localization and Communication

- **50 safety parameters monitoring**
- **Equipment localization**
- **Date Transmission**

WIRELESS NETWORK : Multi application & Cyber security

ARCYS with LoRa™ technology develop 2IOT for the 4.0 digital factory.



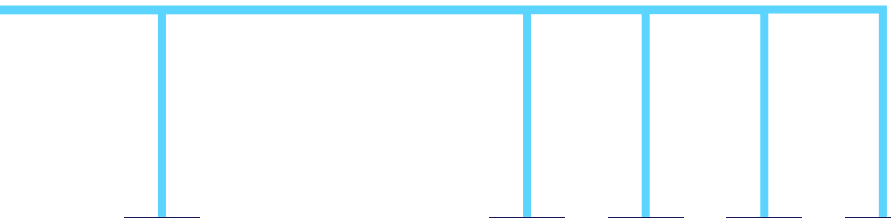
Wireless Network for a CyberSecure IIOT solution

LoRaWAN compliant

Protocol — QoS

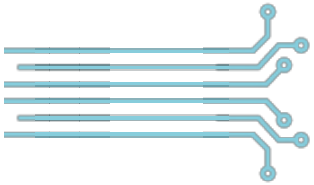
Multi-applicative

LoRa™ Gateway



ication

Instrumentation



COMMUNICATION

ARCYS LoRa™ Network can transmit datas throw the long range network (Short messages, Lone Worker Protection).

Gateway

INNOVATIVE SOLUTION

It's a stand-alone and secure **communication system** based on **LoRa™ technology**.

ARCYS designs a multi-applicative protocol to provide a **manageable communication system**: **A** Pager/Smartphone for short message system, **B** connected to E-Mail, **C** localization for **Lone** Worker Protection, **D** voice in half duplex mode. Wireless Systems by ARCYS can integrate LoRaWAN products.

Deux alarmes sont retransmises en salle de commande et avertissent les opérateurs d'un dépassement de seuil. Le seuil 2 provoque l'inhibition des compresseurs TEG.

Une alarme dysfonctionnement est également présente pour alerter les opérateurs en cas de débit trop faible ou d'un paramètre anormal (température, pression, défaut d'étalonnage).

APPLICATION

Target: **logistics** market for inside or outside environment,

Operators can communicate using a Pager in order to improve the working flow in warehouses and on time delivery (OTD).

A major retrofit "Grand Carénage" generates an increase of activities in NPPs, means of communication are limited and quickly saturated. This system provides a **stand-alone communication infrastructure, easy to implement and requiring few equipment.**

ADVANTAGES

Provide **a stand-alone communication system**. LoRa™ technology integrated in the system uses a **light infrastructure** covering a NPP outdoor and indoor. The inside of buildings is covered by autonomous repeaters.

LoRa™ technology provides long distance communication through walls and firewall doors of buildings.

Pager

Smartphone

ARCYS LoRa™ Network can transmit sensor signal

INNOVATIVE SOLUTION

Wireless instrumentation using LoRa™ technology.

The system is autonomous and secured, based on **LoRa™ technology**. Thanks to LoRa™ wireless technology (Long Range) large areas are covered with only few pieces of equipment. Information are transmitted through thick walls and firewall doors.

Analogue End Point
4-20mA PT100...
Digital RS232

APPLICATION

ARCYS's solution for a wireless instrumentation covers many applications, such as:

-During test phases (hydraulic tests, sensors qualification phases…) the **wireless sensor network** can be quickly implemented, it is autonomous, moreover saving kilometres of cables,

-In **mining industries** sensors are used in pipes which can be spread over large areas. Data can be collected wireless over large distances using a light infrastructure,

-**Post-accident conditions**: thanks to this system, sensors are equipped with a wireless, energy self-sufficient network used to collect information.

Your benefits at a glances : Provide a wireless instrumentation system with simple infrastructure thanks to LoRa™ technology:

- **Light Infrastructure (few equipment),**
- **Low power consumption,**
- **Fast implementation,**
- **Stand-alone system,**
- **Or can be connected to industrial network.**

INSTRUMENTATION - Analog / Digital wireless End-Point

ENDPOINT V2

ARCYS LoRa™ end-point for wireless transmission of analog or digital sensors.

The Challenge

On installed base, many sensors are used to monitor important parameters for site control. The post Fukushima measures highlights the need to transmit information to crisis management base (ECS program in France).

PASSPOINT : Fully integrated wireless transmitter for analog or digital sensors

The Solution

ARCYS has developed End Point integrating analog or digital inputs for a secure wireless transmission.

The End point is easy to install and send in LoRa™ sensors signals (T°, TK, P, Level….). End Point may be installed on electric cabinet.

The wireless transmission is directly operated between the End Point and a Gateway (LoRa™ wireless access point). ARCYS wireless solution is a multi-featured platform (localization, instrumentation and communication) with QoS and an high cybersecurity level.

The wireless transmission with LoRa™ allows long range performance for industrial application submitted to harsh environment conditions (transmission barriers). Large areas can be covered by few pieces of equipment, data are transmitted through thick walls and firewall doors.

TECHNICAL FEATURES

(not contractual data)

Main characteristics :

Analog inputs :

- **4-20 mA (16 bits)**
- **0-10V (16 bits)**
- **On-Off control**

Or

- **PT100 (± 0.2°C TBC)**
- **TK (± 0.5°C TBC)**

Or Digital inputs:

- **RS232 / RS485**

Acquisition : 30s to 10 minutes (depends of end-point density and network)

Operating conditions :

- **IP 68**
- **ATEX zone 1 and zone 2 (in progress, on demand)**
- **Temperature : -20°C to +40°C**

Communication :

LoRa 868 MHz or 915 MHz,

LoRa ARCYS (multi-application, cybersecurity & QoS) or LoRaWAN compliant (on demand).

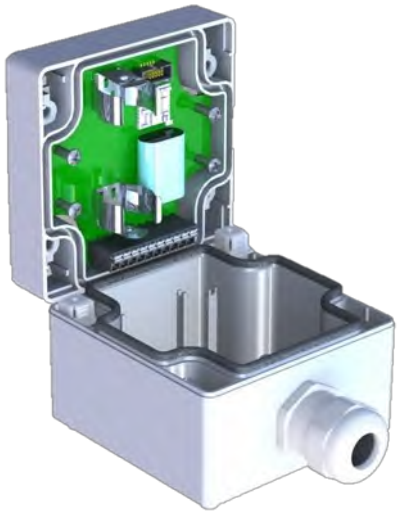
Autonomy : Up to 5 years (depends of end-point configuration)

Fastening: DIN supported. (Other fastening system on demand : screws, rivets, magnetics pads, adhesive, hose clips…).

Proven Technology

The detection components are reliable and robust. All the components have been selected for their minimum power consumption and a power management system provides a high level of autonomy .

The wireless transmission with LoRa™ allows long range performance for industrial application submitted to harsh environment conditions (transmission barriers). All communications are encrypted (minimum 128bits AES).



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PASSPOINT use Case

Mining industry

- Wireless instrumentation,
- Data transmission for dispatch.

Civil Nuclear

- Monitoring of main parameters,
- Functional Tests (Temperature, Pressure).

Oil & Gas

- Data monitoring in harsh environment

Your benefits at a glance

- Wireless Transmitter for all type of sensors,
- Accurate, reliable and robust,
- Easy to install,
- Long Range transmission with LoRa™.

INSTRUMENTATION - Motion sensor for valve monitoring

SPINTAG

SPINTAG is a LoRa™ motion sensor for industrial application.

The Challenge

Either in the installed base, or the new build in commissioning phase, a great number of manual valves are safety-relevant or are critical for the plant reliability, availability and profitability. A wrong position may cause severe damages and delays. Currently the valve line-ups is checked by operators which increase the risk of errors.

Within the industry, valve monitoring is a key solution to solve various problems induced by wrong valve line-ups.

©ARCYS - Photos non contractuelles

SPINTAG : Fully integrated wireless motion sensor

TECHNICAL FEATURES

Main characteristics :

- 3-Axis tilt & orientation (+/- 5° TBC),
- Maximum 90 laps (90 x 360°),
- Temperature measurement +/-2°C,
- Battery voltage measurement,
- 1 LED,
- ISM equipment: 868 MHz or 915 Mhz,
- Autonomy: 1 year with 1 keep alive every hour and 5 valves status change per day (To be confirm). 5 years with 1 keep alive every day and 1 valve status change per week (To be confirm).

Operating conditions :

- IP 66 case (69mm x 45mm x 37.5mm),
- IP 68 on demand,
- ATEX zone 1 et zone 2 (in progress, on demand),
- Temperature: -20°C to +40°C.

Communication protocol :

- ARCYS Protocol (multi-applicative, cybersecurity & QoS) or LoRaWAN Protocol compliant on demand.

Fastening:

- Bi axis with plastic clamp,
- Other fastening system on demand (screws, rivets, magnetic pads, adhesive, hose clips…).

The Solution

ARCYS has developed SPINTAG integrating accelerometer, gyroscope and wireless LoRa™ module.

The SPINTAG sensor is easy to install and send in LoRa™ the status of valves (open/closed, angle, position). SPINTAG may be installed on multi-turn or quarter-turn valves.

The wireless transmission is directly operated between the SPINTAG and a Gateway (LoRa wireless access point). The ARCYS gateway is a multi-featured platform (localization, instrumentation and communication) with QoS and an high cybersecurity level.

We work on new features for SPINTAG : cask container tracking and preventive/predictive maintenance.

Proven Technology

The detection components are reliable and robust. All the components have been selected for their minimum power consumption and a power management system provides a high level of autonomy .

The wireless transmission with LoRaTM allows long range performances for industrial application submitted to harsh environment conditions (transmission barriers). Large areas can be covered by few equipment, data are transmitted through thick walls and firewall doors.

SPINTAG use Case

VALVE MONITORING (actual version)

- **Line-ups,**
- **Orientation.**

SOON NEW FEATURES (Contact us)

Cask monitoring / Assets management

- ♦ **Shock detection,**
- ♦ **Vibration,**
- ♦ **Tracking.**

Preventive and predictive maintenance

- ♦ **Vibration analysis.**

© ARCYS

Your benefits at a glance

Non-intrusive sensor (without qualification impact),

Accurate, reliable and robust,

Easy to install,

Long Rang transmission with LoRa™.

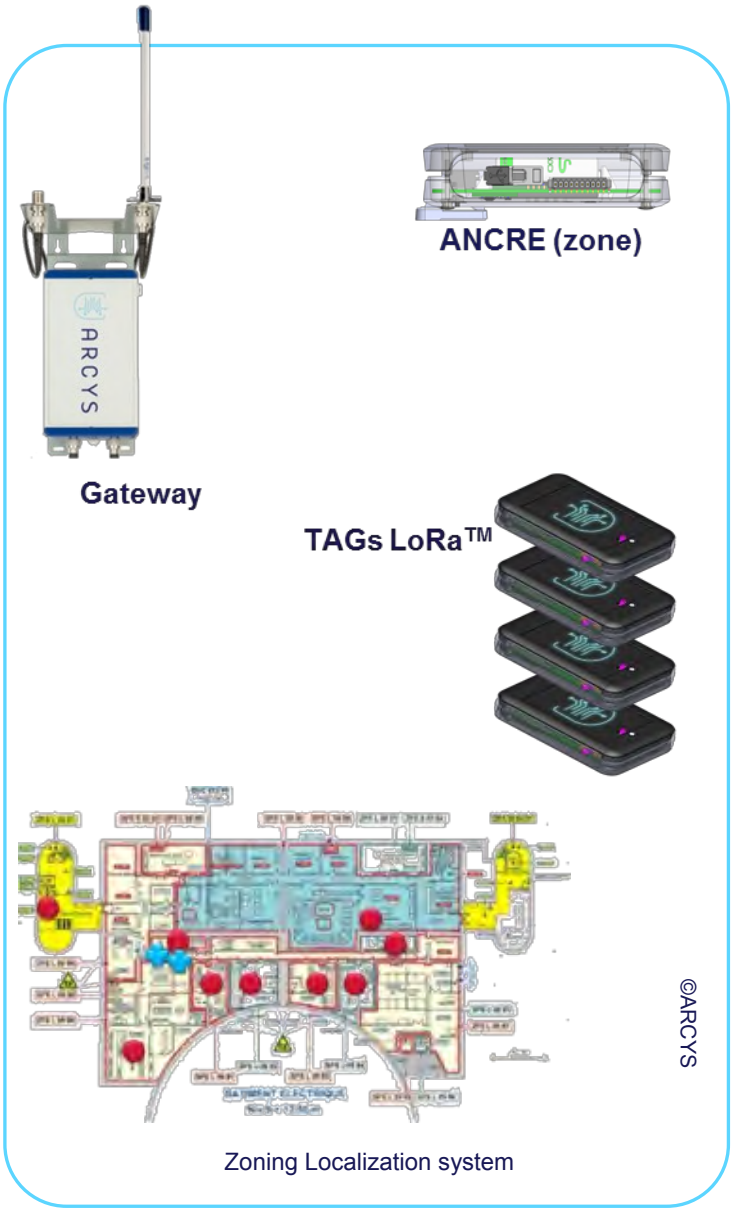
LOCALIZATION

ARCYS use zooning technology with LoRa™ to localize people and equipment

System for equipment and people localization by indoor/outdoor zoning.

The system is based on LoRa™ technology. LoRa™ (Long Range) wireless technology is designed to cover a large area with few equipment and to transmit information through thick walls and firewall doors.

We use ANCRE for zoning location and mobile TAGs for equipment or operators.



Zoning Localization system

Zoning Localization

You can create zone with ARCYS ANCRE. ANCRE is an autonomous equipment witch communicate in LoRa with the ARCYS wireless multi-application Network.

When a mobile TAG enter in the zone the localization system detect the position of the TAG.

Other Technologies for Localization

In specific use case ARCYS integrate a GPS/LoRa solution for indoor/outdoor localization (truck or cask monitoring).

For high level localization, we used triangulation for warehouse application.

Application

A major retrofit in NPPs generates an increase of activities, logistics tasks for large operations such as M2C, RGV, etc. require to know the logistic state of the plant before launching the operations, (the equipment delivered on site is tracked easily) and supervise the progress (check of dismantling, mounting, validation steps).

The system can also locate people indoor: Lone Worker Protection.

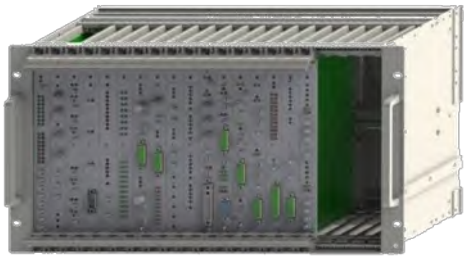
Your benefits at a glance : Provide a localization system using the simplified ARCYS Network with LoRa™ technology:

- **Light infrastructure (few equipment needed for your own network),**
- **Low energy consumption,**
- **Fast implementation,**
- **Stand-alone system or can be connected to industrial network.**

CC

CONTROL COMMAND

ARCYS's skills in secure electronics allowed us to respond to our shareholders. This is the case of the UNICORN project, an engineering contract signed between our two shareholders (TechnicAtome and Framatome) and EDF NNB for which ARCYS has developed and qualified 16 cards.



NCSS (UNICORN)

This analog safety control-command makes it possible to meet the requirements of the British Safety Authority. These backup systems are intended for reactors and cooling installations. They must be able to guarantee safety in case of failure of the main Digital system.

These systems will be based on the UNICORN technology platform developed by TechnicAtome and ARCYS since 2012 on behalf of Framatome and NNB, EDF's UK subsidiary and future operator of the Hinkley Point C EPR reactors in the United Kingdom.

The RCCE K3 qualification for this equipment has been completed and production start in 2018.

ARCYS is also working with Framatome (EDF subsidiary) on the new generation of digital control. This program named "Safety 3G I & C" represents the 3rd generation of digital control program. Design is underway with ARCYS in Toulouse (France), Framatome in Erlangen (Germany) and Paris, particularly around FPGA technologies.

EPR HPC

I

INSTRUMENTATION

ARCYS develops, manufactures & maintain instrumentation for NPPs

ARCYS expertise & skills :

Technological expertise & Human Resources:

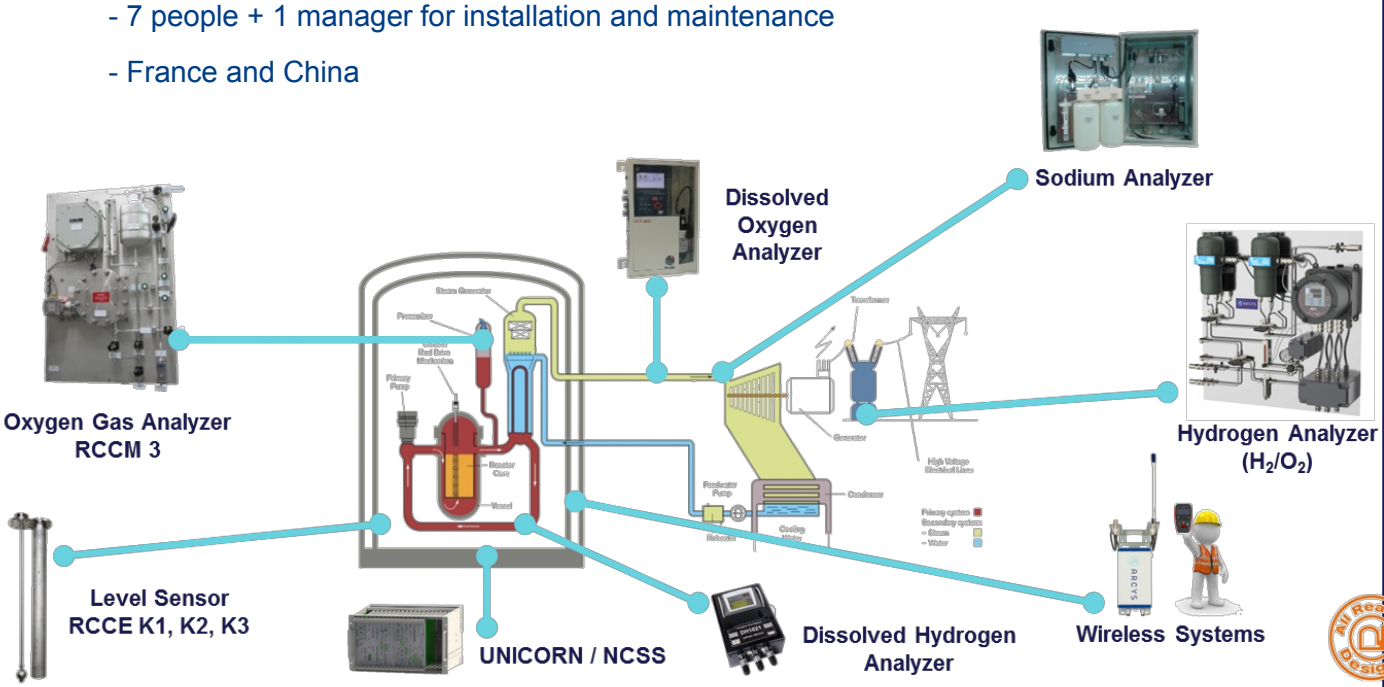
- Physics, Electrochemistry & Optical
- Electronic, Mechanic & Fluidic

Capacity to develop, qualify & manufacture:

- Sensor or OEM sensor integration
- Analyzers (Sensor + Fluidic + Transmitter)
- RCC-E, RCC-M

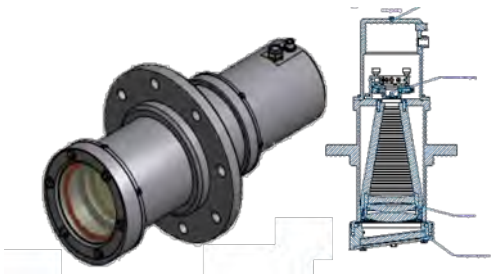
On site Installation & Maintenance Team

- 7 people + 1 manager for installation and maintenance
- France and China



New Level Sensor development:

With Optical / LIDAR Technology,
K1 Qualification 2018.



New Sodium meter for NPP:

Sodium measurement
in secondary circuit

Notes

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