



PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA  
Ministry of Higher Education and Scientific Research



General Direction of Scientific Research and Technological Development

**Research Centre in Industrial Technologies**

**-CRTI-**

**CRTI INFO**

[www.crti.dz](http://www.crti.dz)

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**Research Centre in Industrial Technologies**

The Research Centre in Industrial Technologies (CRTI) is a Scientific and Technical Public Establishment with a human potential of 500 officials, including 230 permanent researchers, 270 technical and administrative staff and 150 experts and engineers from the Subsidiary CSC Expertise Spa.

The Centre head office, located in Cheraga (Algiers) represents one of five (05) other scientific poles. It is composed of five (05) research divisions namely:

- ✓ **Non Destructive Testing and Evaluation Techniques Division**
- ✓ **Welding and Joining Techniques Division**
- ✓ **Signal Processing and Imaging Division**
- ✓ **Mechanics and Materials Development Division**
- ✓ **Corrosion, Protection and Durability of Materials Division**

As far as the CRTI poles are concerned, they are located all over the country as it follows:

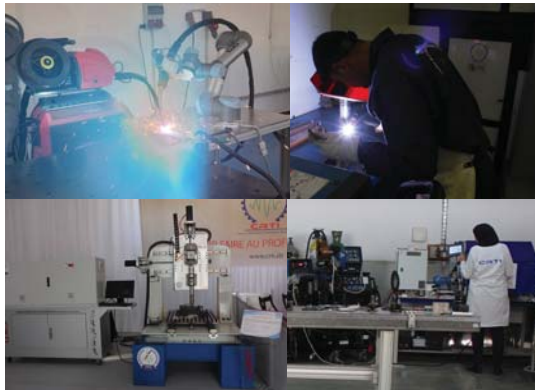
- ✓ **Mines and Metallurgy Research Unit:** located in Badji Mokhtar University Campus ( Annaba), composed of two (03) research divisions.
- ✓ **Additive Manufacturing Research Unit:** located in Ferhat Abbas University (Setif), composed of two research divisions.
- ✓ **The Intelligent Embedded Systems Technological Platform:** located at the industrial area of Bou-Ismaïl, Tipaza.
- ✓ **The Mechanical and Robotic Intervention Systems Technological Platform:** Located in Science and Technology Campus (Oran)
- ✓ **The Subsidiary CSC Expertise-Spa:** located in the industrial area of Bou-Ismaïl, Tipaza.

The CRTI is mainly responsible for:

- ✓ Research projects elaboration and industrial technologies implementation for the benefit of the industrial sector.
- ✓ Knowledge and expertise transfer to the industrial sector.
- ✓ Supporting and upgrading the industrial sector.

## Research Areas

### Welding and Joining Processes



### Non-Destructive Testing of Materials



### Materials Development and Characterization



### Corrosion and Materials Durability



## Research Areas

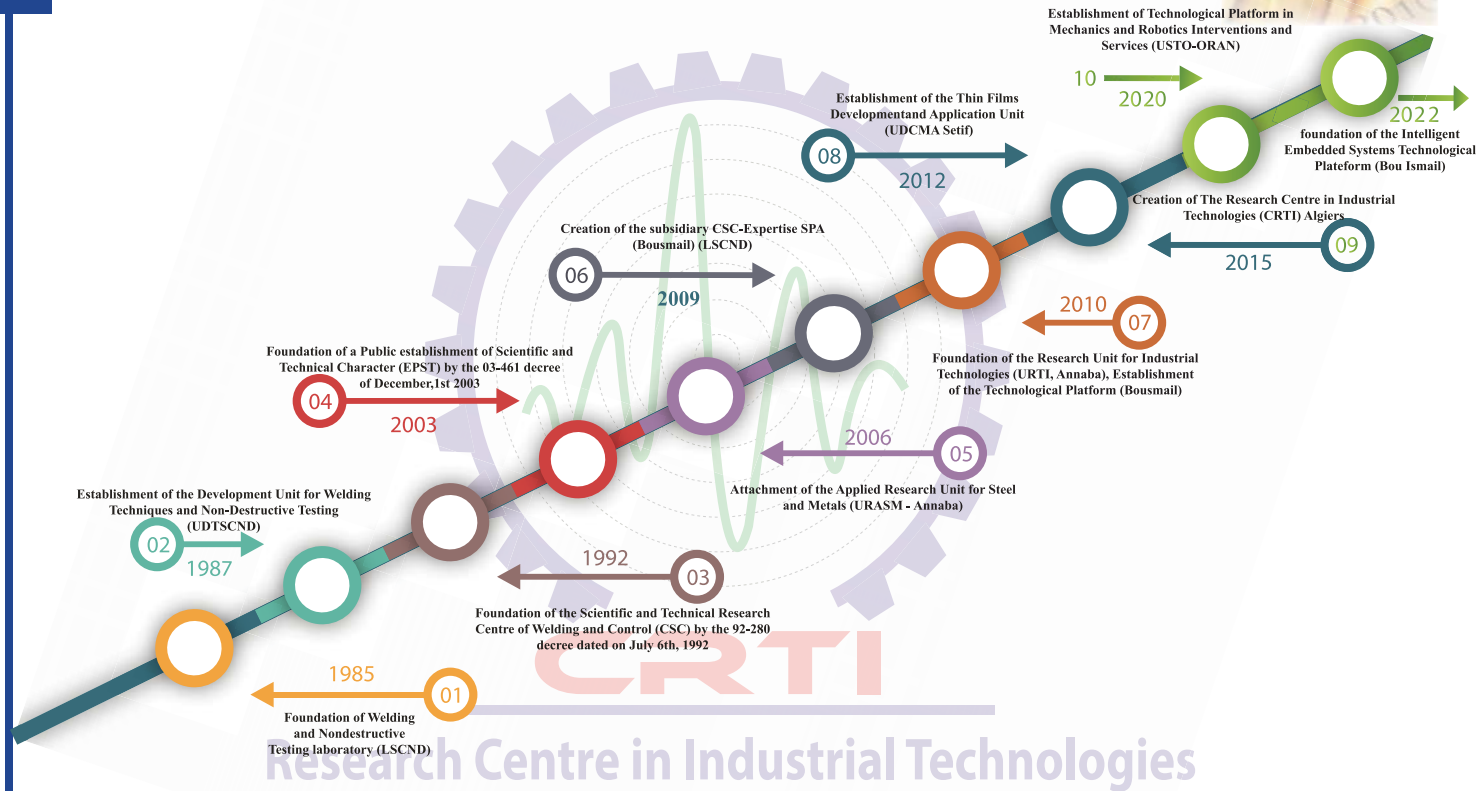
### Additive Manufacturing



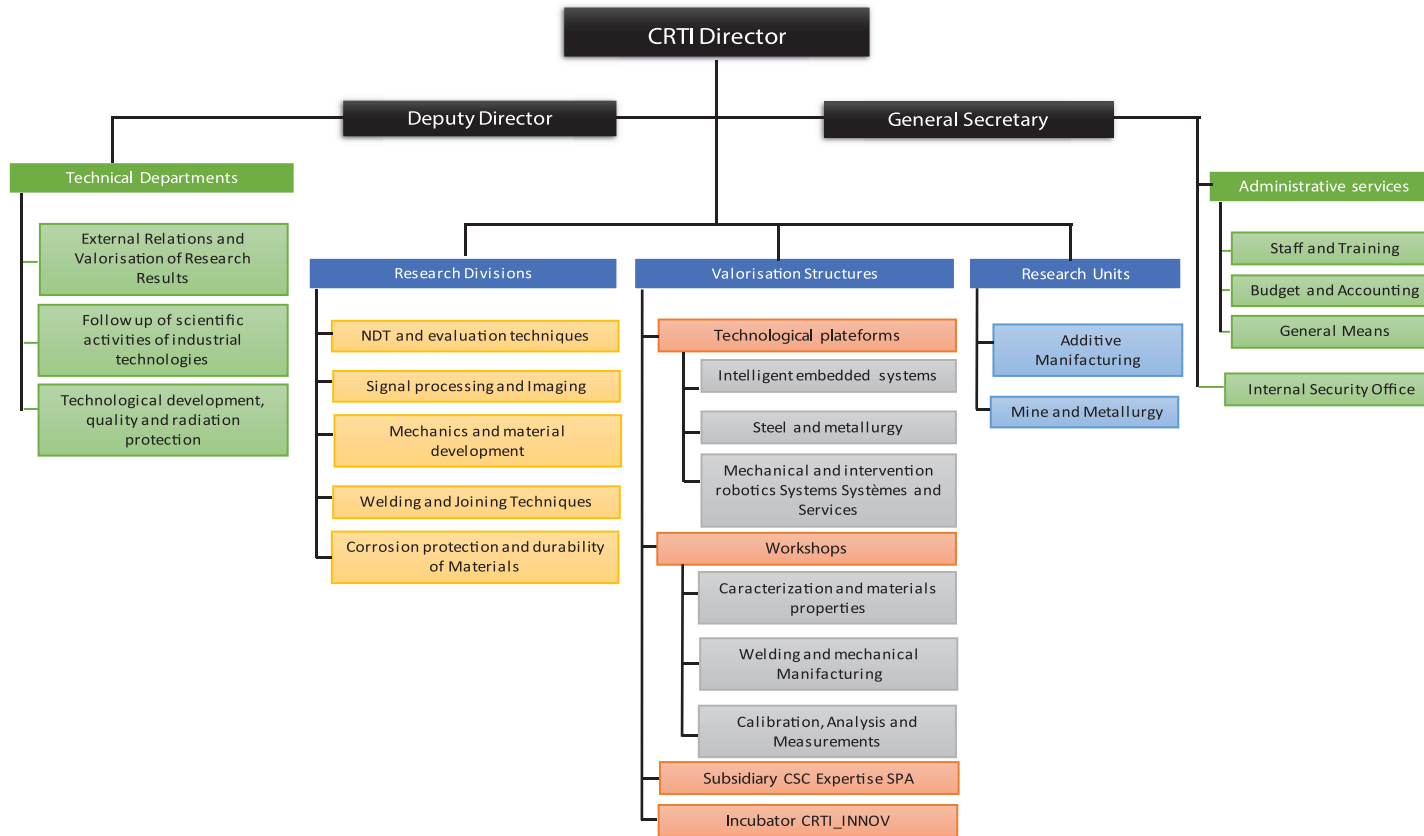
### Mines and Metallurgy



# CRTI Chronological History



# CRTI Organizational Chart



## WELDING AND JOINING PROCESSES DIVISION

Nowadays, applying high-tech technologies in the field of welding led to a quantum leap in the industrial sector. Thus, Welding and Joining Processes Division focuses on developing and implementing technological innovations and industrial systems in manufacturing.

It goes from arc initiation, arc diagnostic and welding arc control to phenomena that govern metal fusion and metal solidification by adopting several innovative automation and synergy steps for a better understanding of the welding processes.

The division main research activities rely on:

- ✓ Welding plasma diagnosis and spectroscopy.
- ✓ Command and control of welding installations.
- ✓ Industrial environment of welding processes.





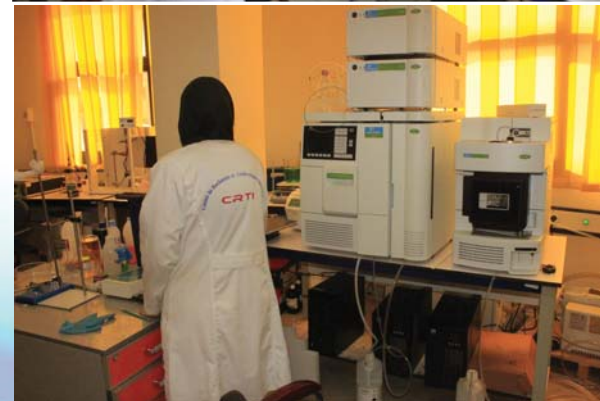
## CORROSION, PROTECTION AND MATERIALS DURABILITY DIVISION

Researches and studies on the various forms of corrosion, their mechanisms and behaviors in different environments are fundamental to preserve metallic materials and structures.

Corrosion, Protection and Materials Durability Division aims at developing techniques related to corrosion process, anti-corrosion as well as monitoring these phenomena.

Its major studies are focused on:

- ✓ Studying and mastering corrosion phenomena and their mechanisms;
- ✓ Controlling, evaluating and developing anti-corrosion protection processes;
- ✓ Controlling and optimizing active protection systems against corrosion;
- ✓ Supporting companies in carrying analysis and studies on corrosion phenomena, through tailor-made support;
- ✓ Carrying academic and qualifying training in corrosion.

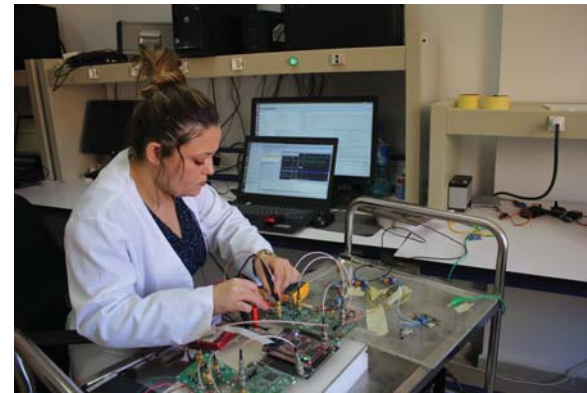


## SIGNAL PROCESSING AND IMAGERY DIVISION

This division focuses its efforts on developing and implementing signal and image processing based techniques in the field of Non-Destructive Testing (NDT). It aims at improving and promoting innovative systems that permit the automatic acquisition, processing and visualization of one or multidimensional signals, the reconstruction of 2D or 3D images as well as pattern recognition, image analysis and interpretation.

It is concerned with the following research activities:

- ✓ Processing techniques applied to NDT methods.
- ✓ Ultrasound and x-rays.
- ✓ Automation of NDT methods.
- ✓ Artificial intelligence in NDT.
- ✓ Advanced techniques in NDT.
- ✓ Tomography, guided waves and acoustic emission



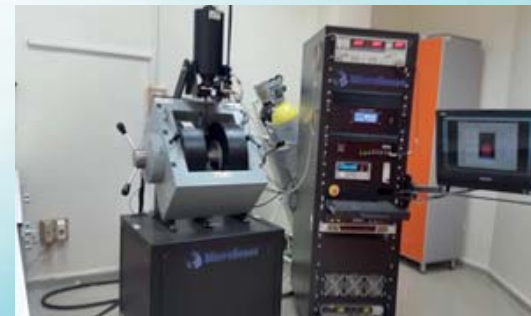
## NON-DESTRUCTIVE TESTING AND EVALUATION TECHNIQUES DIVISION

This division develops non-destructive methods by electrical, magnetic, optical acoustic waves processes and ionizing radiation applied to the characterization and evaluation of materials, defects and coatings.

In addition, it studies and optimizes equipments and softwares related to non-destructive testing by electrical, magnetic or acoustic processes.

Its major research fields concern:

- ✓ Non-destructive characterization of metallic materials, composites, nanostructures and others by: Ultrasound (volume waves, guided waves, LCR waves), eddy currents, microwaves, Barkhausen noise, high sensitivity hysteresis cycles, X-rays gamma rays ...;
- ✓ Acoustic wave propagation phenomena in materials.
- ✓ Mechanical spectroscopy of materials, vibrational spectroscopy (Raman, infrared ...);
- ✓ Sensors (ultrasonic, magnetic (eddy currents, electromagnet for Barkhausen noise), microwaves).



## MECHANICS AND MATERIAL DEVELOPMENT DIVISION

Through its research into advanced materials and processes, Mechanics and Material Development Division contributes on performing a multidisciplinary research on Process-Microstructure Properties relationships in Materials and industrial structures and components.

The diversity of research axes being undertaken in this division provides an overview of the different materials research areas that are strongly related to industry needs.

The division activities hinge on four thematic pillars:

- ✓ Thermal, mechanical and metallurgical phenomena induced in materials by various manufacturing processes.
- ✓ Tribology and friction of industrial materials and components.
- ✓ Materials reliability and machine elements,
- ✓ The development of new materials for diverse industrial applications.



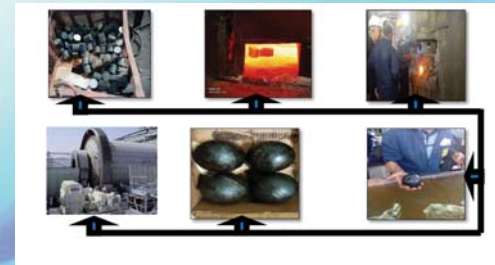
## Mines and Metallurgy Research Unit - CRTI Annaba -

Mines and Metallurgy Research Unit is an applied research structure whose main mission is the implementation of research programs related to industrial technologies development in fields of mines and metallurgy.

The research projects supported by this unit concern valorization and exploitation of raw material resources, extractive metallurgy, ceramics, metallurgy of ferrous and non-ferrous alloys, thermo mechanical treatments and surface engineering. Its activities extend to other areas such as: automation, monitoring and control of industrial systems and products.

This unit is responsible, in particular, of:

- ✓ Carrying out research projects on the optimization of treatment and recovery processes for ores and industrial co-products;
- ✓ Studying, developing and elaborating new high-performance materials and alloys for various industrial applications;
- ✓ Developing approaches and methods of automation, control, diagnosis and maintenance of industrial installations;
- ✓ Quality control of steel and mining products.



## Additive Manufacturing Research Unit

Additive Manufacturing Research Unit aims at conducting studies and research development programs on:

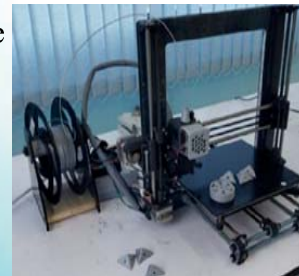
- ✓ Developing materials in relation to Additive Manufacturing.
- ✓ Applying Additive manufacturing processes in the industrial sector.
- ✓ Integrating artificial intelligence in designing, modeling and optimizing the production of complex pieces.
- ✓ Quality control of pieces produced by additive manufacturing .

This unit is structured into two divisions namely:

- ✓ Division of Metallic Additive Manufacturing
- ✓ Division of Non Metallic Additive Manufacturing .

Moreover, it contains:

- ✓ Reverse engineering workshop.



## Welding and mechanics workshop

This workshop conducts engineering activities and develops techniques thanks to its multi-skilled team as it provides a joint service for the research field, as well as provides the social and economic sector with all its needs related to welding and mechanics. In addition, it also supports research and training in joining techniques and mechanical manufacturing.

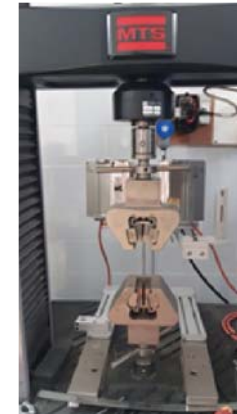


## CHARACTERIZATION AND MATERIAL PROPERTIES WORKSHOP

This workshop is created to support researchers carrying out their research works related to the centre activities and to meet the needs of professionals in the socio-economical sector. The workshop supports the study, analysis and characterization of different materials. It has conventional and specific equipment for sample preparation (cutting, coating and polishing), chemical analysis and observation at different scales (optical microscopy, scanning electron microscopy, atomic force microscopy, spectrometer and carbon-sulfur analyzer), crystallographic or texture analysis as well as residual stress measurements (EBSD, X-ray diffraction) and determination of mechanical properties of metallic materials (Tensile test, bending test, impact test, hardness test and fatigue test).

The workshop is composed of three laboratories:

- ✓ Mechanical testing laboratory
- ✓ Metallographic preparation laboratory
- ✓ Materials analysis laboratory.





## Calibration, Analysis and Measurement Workshop

With an experience of more than twenty (20) years in the field of non destructive testing instruments, the CRTI established a workshop for calibration and characterization activities in the field of NDT and Metrology, along with material testing and analysis.

The workshop is composed of two laboratories:

### ✓ NDT Calibration and Verification Lab

This Lab offers calibration and verification services for inspection bodies operating in Algeria using NDT instruments and maintaining standards of a high quality.

In 2018, the lab has accredited its ultrasonic activities according to ISO/CEI 17025 standard. The scope of this accreditation is: ultrasonic testing instruments. For other NDT equipments, the lab provides calibrations using standards traceable to the International System of Units (SI)

### ✓ Metrology Lab

This laboratory is responsible for calibration, verification and adjustment of test and measurement equipment in variant temperature range and especially in pharmaceutical field and food processing.



## Steel and Metallurgy Technological Platform

Steel and Metallurgy Technological Platform is a framework for experimentation, demonstration, applied research, technical assistance and advice for the benefit of economic companies. It offers practical trainings for improvement and recycling for university students and industrials in the socio-economic sector. The main missions of this platform mainly concern:

- ✓ Developing and manufacturing raw metal parts for various industrial applications.
- ✓ Valuation of mining deposits.
- ✓ Controlling industrial processes and installations.
- ✓ Production of prototypes (products, devices, etc.).
- ✓ Offering qualifying training and practical internships for the benefit of the industrial and university sector.
- ✓ Supporting the socio-economic sector.

This Platform includes the following sections:

- ✓ Elaboration and development of metallic materials
- ✓ Minerals
- ✓ Industrial control.



## INTELLIGENT EMBEDDED SYSTEMS TECHNOLOGICAL PLATFORM

Intelligent Embedded Systems technological platform constitutes a space for innovation, experimentation, applied research, technical assistance and advice for the benefit of the socio-economic sector. It supports the emergence of many strategic sectors in Algeria such as health, industry and agriculture, with regard to the use of new technologies, especially artificial intelligence. This space also contributes to the practical training of students as well as their development and retraining.

Its missions are:

- ✓ Carrying out innovative projects in the fields of embedded systems for various applications (industry, agriculture, health, etc).
- ✓ Designing and producing prototypes of intelligent embedded systems according to specifications.
- ✓ Implementation of Artificial Intelligence (AI) in embedded systems for different fields of application.
- ✓ Technical assistance and advice.
- ✓ Development of training actions by welcoming and supervising trainees



## Technological Platform in Mechanics and Robotics of Interventions and Services (SMRIS)

This technological platform constitutes the building block that proceeds prototyping. It is concerned with developing new methods and techniques when manufacturing machines and applying robotics for the benefit of the industrial sector.

It revolves around:

- ✓ Detection of business and training needs,
- ✓ Technology transfer,
- ✓ Technological innovation in the company,
- ✓ Improvement of productivity,
- ✓ Production of prototypes and products.

The SMRIS technological platform is designed to provide businesses and universities with a complete and versatile range of workshops such as:

- ✓ Fast prototype.
- ✓ CNC machining.
- ✓ Automatic and robotic.





## CSC Subsidiary Expertise SPA

*Accredited according to ISO 17020 norms*

The CRTI , through its Common Services, (CSC) Expertise Spa subsidiary and workshops contributes to the national industry in areas of inspection, expertise, skills training and companies support in terms of quality process as repositories ISO regulations.

The subsidiary CSC Expertise Spa, is the only company according to the higher education and the scientific research sector accredited according to ISO 17020.

It activates on the national territory and represents a key partner of national strategic companies (SONTRACH, SONELGAZ) and multinational companies.

### Areas of Intervention

- ✓ Work inspection and supervision
- ✓ Expertise
- ✓ Non Destructive Testing (NDT)
- ✓ Radiography X and Gamma
- ✓ Ultrasound
- ✓ Penetrant testing
- ✓ Magnetic testing
- ✓ Eddy currents
- ✓ Qualification of welding procedures and welders
- ✓ Mechanical and fatigue tests
- ✓ Cathodic protection
- ✓ Corrosion measurement and soil resistivity
- ✓ Study and monitoring of achievements



## Socio-Economic Impact

### MAIN PROJECTS



**SONATRACH TRC-DRC**  
Surface facilities inspection



**SH-HOUDH BERKAOUI**  
Surface facilities inspection



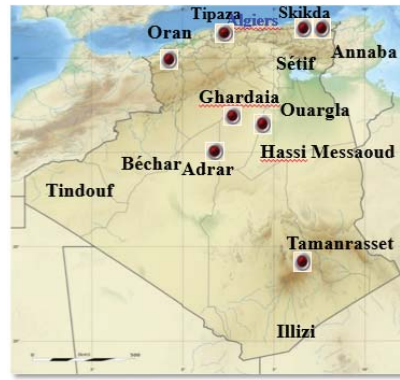
**SONATRACH SOMIZ**  
New constructions and maintenance of refineries



**SONELGAZ (GRTG)**  
Maintenance of installations & inspection of gas constructions and training



**Groupement SH-ENI**  
Maintenance of gas installations



**SH-ENAFOR/ENTP**  
Welders training & qualification and Metrology



**SONELGAZ - ETTREKIB**  
Power stations



**SH-CP1Z ARZEW & FERTIAL**  
ISO 17025 support

**SH-ENGCB**  
NDT of New SH Oil Field Installations



## Selected patents

### Friction Stir welding machine (2015)

The invention is related to a friction stir welding machine of a portal type with 4 degrees of freedom. It allows to carry out complex joining operations by FSW. It consists of three essential parts: (i) a Base, (ii) a Portal and (iii) a Tool holder. This machine is intended for the permanent assembly of parts made of heterogeneous materials or parts that are difficult to weld using standard techniques (as fusion welding).

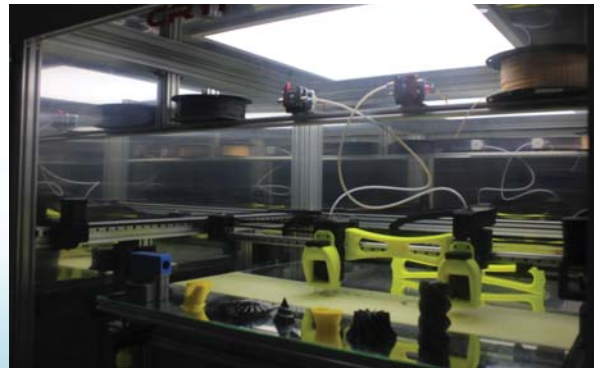
The machine carries a very sophisticated tool, which is kept in contact with the two parts to be joined thanks to a significant forging force provided by the Gantry. The tool under pressure and in rotation on the surfaces to be welded, generates, the heat necessary for penetration into the material which is in a pasty state. The tool moving in translation along the weld joint mixes the borders from the two materials to be joined, which allows obtaining a quality weld bead. This invention, with a direct and immediate impact on the industry, will essentially serve to introduce and popularize the innovative joining technique by the FSW process in the national industrial sector.



## Selected patents

### Fast multi-head industrial 3D printing machine under controlled atmosphere

Fast multi-head industrial 3D printing machine allows manufacturing spare parts, everyday objects or even prototypes in short period of time and low costs. The main manufacturing parameters for these parts are the creation or recovery of a 3D model, i.e. defining the model to be printed. The next step is slicing the STL file and exporting it to G-Code: this is the phase of transforming the chosen model into data usable by our system. After that, the results are gone through transmission to the electronic card of the machine using an SD card or a USB cable connected to the computer. Finally, the 3D printing is launched.





## Selected patents

### Designing and building ultrasonic sensors applied to non-destructive testing of materials (2020)

The use of sensors in NDT (non-destructive testing) provides data that allows characterizing the internal condition of industrial structures, without degrading them, either during production or in use.

The aim of the invention is to build an ultrasonic sensor which enables the generation and reception of ultrasonic waves applied to the detection of defects in materials. The choice of sensors is important for non-destructive evaluation of materials. There are several types of sensors based on different physical principles such as piezoelectricity or electromagnetism.



### Experimental prototype for manufacturing composite material plates by Liquid resin infusion process (2020)

The aim of the invention is to produce a mobile experimental prototype for the manufacture of composite material plates by the Liquid Resin Infusion process (LRI). This process, which has not been yet introduced in the national industry allows to produce lightweight composite plates with good mechanical properties.



## Selected patents

### 20 Kn mini tensile testing machine (2022)

The invention relates to a 20 KN Mini Tensile Testing Machine which allows to carry out tensile tests that would be used to determine the elastic behavior, thus, measuring the degree of fracture resistance to rupture of a material under uniaxial loading state. This machine can reach a maximum load of 20 KN with a travel stroke of 250 mm. It is suitable for testing several types of materials such as metal alloys, plastics and composites. It can be used in various fields of application such as:

- Scientific research: characterization of new materials
- Research laboratories: in the context of practical work on the characterization of materials.



## Selected patents

### Intelligent, multi-purpose liquid solutions dispenser (2022)

The intelligent multi-use liquid solutions dispenser is an equipped tank of 3 liters of capacity that allows delivering around 1000 fast doses of hydro-alcoholic gel. This dispenser is very distinguished from other dispensers as it is useful and effective in matter of reducing the crowding of people in one spot for sterilization thanks to its non-contact fast infrared sensor, thus, it prevents and combats biological risks such as the Corona Virus.

It could be fixed to the wall and / or be held by its mobile support that allows it to be easily moved between different areas. It is also equipped with a liquid level detection system so as not to wear out the dispenser pump, as well as a manual emptying system for greater flexibility and ease of use.



## INFO CRTI

The content of this booklet is devoted to Research Centre in Industrial Technologies (CRTI). It presents succinctly the organization, missions and objectives of the centre. Its purpose is to highlight the involvement of the CRTI in the industrial world and its important contribution in the field of scientific research and technological development of our country.



Research Centre in Industrial Technologies

**Mailing address:** CRTI, Dely Brahim Road, P.O. Box 64 Cheraga, 16014 Algiers, Algeria

phone/Fax: +213 23 14 14 47

Contact: [direction@crti.dz](mailto:direction@crti.dz)

Website: [www.crti.dz](http://www.crti.dz)