Technological and Professional Training Workshops

2020

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About ERM AUTOMATISMES

ERM provides technical systems and services in the fields of education, industry, robotics and energy. Founded in 1990 in southern France, ERM first focused on industrial automation. Overtaken by its educational culture, ERM quickly became the precursor of introducing industrial production lines within technical training institutions, then extended its offer to other areas, such as electrical engineering, power engineering and renewable energies.

Historique :

- **1990** Creation of ERM AUTOMATISMES INDUSTRIELS in Carpentras (84, France)
- **1995** Launching of Ermaflex concept, didactic factory
- **2000** Launching of Electrical engineering range of equipment
- **2005** Launching of Renewable Energies and Thermal engineering
- **2008** Creation of ERM Energies: dimensioning and supplying of wind generators and solar systems, off-grid and grid-connected
- **2010** Launching of Engineering Science range
- **2015** Creation of ERM Fabtest : equipment for Fablabs
- **2017** Launching of Industry 4.0 and Virtual Reality ranges

ERM is now a leading company in didactic solutions and systems for technological and vocational training, for public / private training institutions.

Today, ERM defines itself as an engineering company with an international vocation, specialized in technical assistance and professional training, focused on southern and emerging countries.

Approach proposed by ERM AUTOMATISMES

Throughout its 30 years of experience, ERM has equipped hundred of training centers and laboratories in Europe and Africa.

Thanks to this experience, we developed a comprehensive offer in consulting and engineering, whit the following services :

- **Sectoral analysis** & training needs
- **Professional skills testing**
- **Providing training equipment**
- **Selection** and **training of future training staffers and instructors**
- Setting up **training programs**
- **Monitoring and evaluation** of trainees

To meet the specific needs for the implementation of a technical training program, our method is structured around 3 stages:

- Stage 1 : **Training expertise** (Defining the needs, creating professional worksheets with related skills, Editing training programs, Identifying generic needs for equipment and training labs…)
- Stage 2 : **Fitting up buildings and supplying the training equipment** (correlation between local capabilities and needs identified on Phase 1)
- Stage 3 **: Training of instructors and training staff and setting up pedagogical sessions** with the equipment

Examples of Training Workshops

The following lists of equipment are just as an example.

The final list of equipment will depend on the results and conclusions of the Stage 1 (Training expertise), budget, number of trainees…

Examples of Technological and Professional Training Workshops

Electricity in buildings

Safety & Electrical installations	
Identification and analysis of LV electrical hazards	1
Safety awareness trainer for electrical and mechanical hazards	
Addressable stand-alone emergency lighting trainer	
3D scenario in virtual reality for electrician accreditation (B1V, BS, BR, B2/BC French regulations)	2
2D and 3D structure with electrical components for wiring activities (residential and commercial)	3
Theoretical and practical knowledge base in electrical engineering	
Electrical CAD software	
Electrical distribution	
LV electrical distribution cabinet (didactic)	4
Home automation and efficiency management	
KNX energy and efficiency management of a hotel	5
2D and 3D structure with KNX components for wiring activities	3
Monitoring, control and optimization of electricity consumption in the tertiary sector	
Self-generated electricity	
Modular system for off-grid solar study	
Photovoltaic and wind generator kit	6

Electricity in industries

Basics of industrial electricity	
Identification and analysis of LV electrical hazards	1
Safety awareness trainer for electrical and mechanical hazards	
Addressable stand-alone emergency lighting trainer	
Cabinet and components for industrial wiring	
Theoretical and practical knowledge base in electrical engineering	
Electrical CAD software	
Electrical distribution, Rotating machines, Speed drives	
LV electrical distribution cabinet (didactic)	4
Earthing systems bench (TT, TN, IT)	10
Motor starter pack (separation or isolation, control or switching, short-circuit and overload protection)	
Active load bench for rotating machines (asynchronous, synchronous, DC) and speed drives	7
Slat band chain conveyor with speed drive	
Automation & Electro-pneumatics	
Sensors test bench (11 different industrial sensor)	8
Smart sensors bench (industry 4.0)	
Automation platforms (Siemens S7-1200, S7-1500, Schneider M340, M241…) with HMI	9
Operating parts: Conveyor and Lift	9
Pneumatic and electro-pneumatic trainers	
Theoretical and practical knowledge base in engineering	

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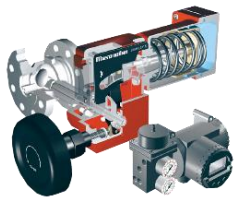
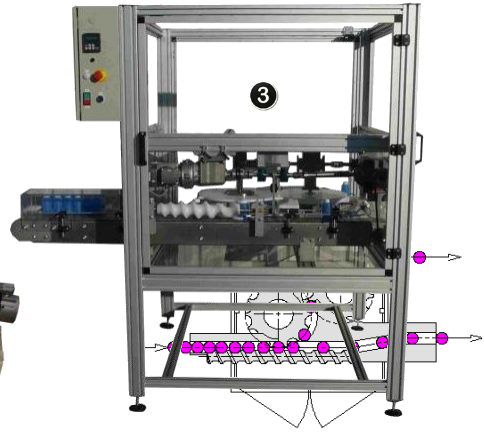
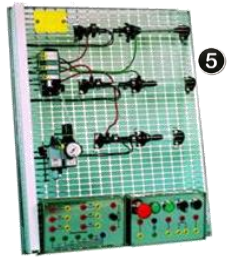
Examples of Technological and Professional Training Workshops

Industrial maintenance

Mechanical Maintenance	
Test bench for maintenance and tightness of industrial valves	
Study, maintenance and test bench of industrial pumps	1
Roller conveyor for maintenance and electrotechnics training	
Pallets stacking system (mechanical, electrical, hydraulic and pneumatic maintenance)	2
Ball bearing bench	
Alignments and transmissions bench	
Maintenance : Methods & Preventive	
Industrial training system for alignments and transmissions maintenance	3
Vibration study and shaft alignment bench	4
Belt tension and pulley alignment bench	
Thermal infrared camera	
Production Management and Maintenance Management (CAMM)	
Maintenance : Pneumatics & Hydraulics	
Pneumatic and electro-pneumatic trainers	5
Compressor and pneumatic energy test bench	6
Modular hydraulic trainer, On/Off and Proportional	7
3-axis hydraulic welding positioner	
Oil analysis kit, Oil filtration kit, Hydraulic measuring kit	8
Theoretical and practical knowledge base in hydraulics	
Maintenance : Electricity	
Identification and analysis of LV electrical hazards	
LV electrical distribution cabinet	
Earthing systems bench (TT, TN, IT)	
Active load bench for rotating machines (asynchronous, synchronous, DC) and speed drives	9
Slat band chain conveyor with speed drive	
Theoretical and practical knowledge base in electrical engineering	
Maintenance : Automation	
Smart sensors (industry 4.0) and industrial sensors trainers	
Automation platforms (Siemens S7-1200, S7-1500, Schneider M340, M241…) with HMI	10
Operating parts: Conveyor and Lift	
Theoretical and practical knowledge base in engineering	
Maintenance : Production	
Multi-format packaging unit (filling and capping of liquids and granulates in jars and bottles), with rotary table for jars distribution	11





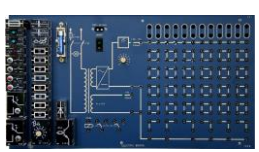






Examples of Technological and Professional Training Workshops

Electronics

Fundamentals of Electronics	
Electric board: Fundamentals of electrical engineering (electrical circuit, Ohm's law, electric power, resistors, voltage dividers, electric fuse, relay circuit…)	1
Basic analog functions board (stabilized power supply, amplifier, filters...)	2
Basic logic board (combinatory logic, sequential logic, flip-flops…)	
Analog-to-Digital converters board	3
Digital-to-Analog converters board	
Transformer board (no-load voltage, current and voltage ratios, transformer losses, autotransformer…)	
Power electronics	
Power electronics board (rectifier, inverter, chopper, PWM…)	
1-/3-phase rectifier / AC regulator board	
1-/2-/4-quadrant chopper / 1-/3-phase inverter board	
Multi-function IGBT converter with real-time control and acquisition box	4
Multi-function diode & thyristor converter	
Electronics prototyping & Mechatronics	
Ermaboard: electronic components for mechatronic projects (controllers, power supplies, sensors, communication, HMI, servo-motors, roller frame...)	5
ErmaBoard Arduino Starter pack (Arduino UNO, communication WiFi and OTA configuration, sensor kit, servo & motor kit)	
ErmaBoard Arduino Communications pack (RFID / Bluetooth / ZigBee / WiFi / IORA / GSM / GPS)	
ErmaBoard Arduino Sensors pack (temperature, light, infrared, capacitive, accelerometer, gyrometer, compass…) & Motors pack	
Motorized humanoid finger project (entering a code on a keyboard)	6
Humanoid robot 25 DOF with tactile sensors, microphones, cameras, inertial unit…	7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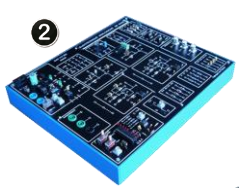
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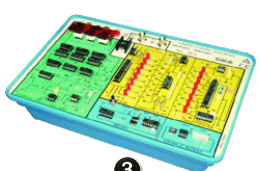
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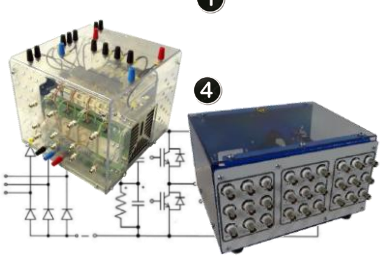
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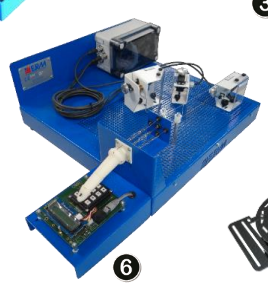
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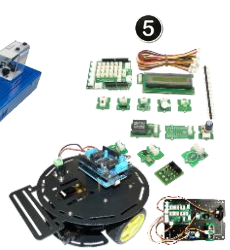
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Robotics

Control	
Training bench "Humanoid robot ankle" for position control, with logic analyzer	
Platform for DC, brushless and stepper motors study, and position, speed and torque control	
Ball and beam: 1 DOF control platform compatible with Labview	
Ball balancing table: 2 DOF control platform compatible with Python, MATLAB/Simulink, Labview	
Basics of robotics	
Delta Robot 3 DOF vision guided robotic platform compatible with Python, MATLAB/Simulink, Labview	1
Multi-functional desktop 4-axis robot arm, with accessories, camera, linear rail, conveyor…	2
Scara 4-axis collaborative robot arm with accessories, camera, conveyor…	3
Humanoid robot 25 DOF with tactile sensors, microphones, cameras, inertial unit…	7
Advanced robotics	
Training cell with 6-axis industrial Kuka robot, with accessories (grippers, industrial vision…) for pick&place, tool changer, line following… activities	
7-axis collaborative robot station with accessories (gripper, vision…)	
6-axis collaborative robot with AGV platform and accessories (grippers, vision…)	4
Robotic machining cells	
CNC machining center with 6-axis robot, motor spindle, turntable, safety enclosure, dust extraction system…	5

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Examples of Technological and Professional Training Workshops

Industry 4.0

Modular and didactic factory 4.0

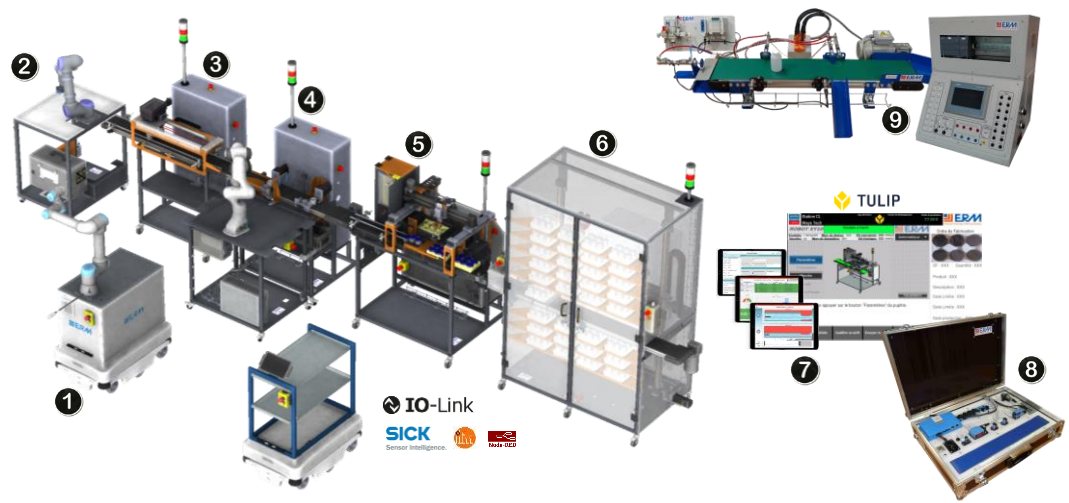
- Workstation #0 6-axis collaborative robot with AGV platform and accessories (grippers, vision…) ❶
- Workstation #1 6-axis collaborative robot on mobile platform ❷
- Workstation #2 Automated system for jars/bottles or boxes/trays filling in an uninterrupted production flow ❸
- Workstation #3 Robotic system (collaborative robot) for capping, controlling and customization of jars/bottles ❹
- Workstation #4 Automated system (XYZ Cartesian robot) for jars/bottles packing in carton boxes/trays ❺
- Workstation #5 Automated system for storage and order preparation (vertical lift magazine) for dynamical storage/picking of boxes/trays ❻
- Workstation #6 Order preparation & manual palletizing system with control and RFID traceability

Software 4.0

- Remote control and supervision of the production line
- Manufacturing app platform to improve productivity, quality and efficiency, by creating visual instructions, supervision, real-time production insights… ❼
- Production Management and Maintenance Management (CAMM, CAPM)

Automation 4.0 and Industrial IoT

- Study and implementation of a supervision with IoT gateway and smart sensors
- Smart sensors & IO-Link bench (industry 4.0) ❽
- Study and implementation of an IoT compatible communicating pneumatic and electric energy measurement system
- Automation platform 4.0 with PLC, conveyor, weight control, RFID, vision, lift… ❾



Virtual and Augmented Reality

Virtual training

- Virtual training in production monitoring and control ❶
- Virtual training in industrial maintenance and troubleshooting diagnosis
- Virtual training in electrical accreditation and safety in electrical work
- Virtual training in cooling fluid / refrigerant handling ❷
- Virtual training in HSE (Health, Safety and Environment) procedures and risks in industries, services, public institutions…
- Professional fire extinguisher training with a physical connected extinguisher

Job simulators

- Virtual painting simulator (spray painting, blasting) ❸
- Welding motion virtual trainer (MAG, MMA, TIG)
- Virtual training simulator for wood-cutting machines (band saw, dimensioning saw, planer and router)
- Construction equipment training simulators (earthmoving, crane and lifting) ❹

Virtual Reality creation

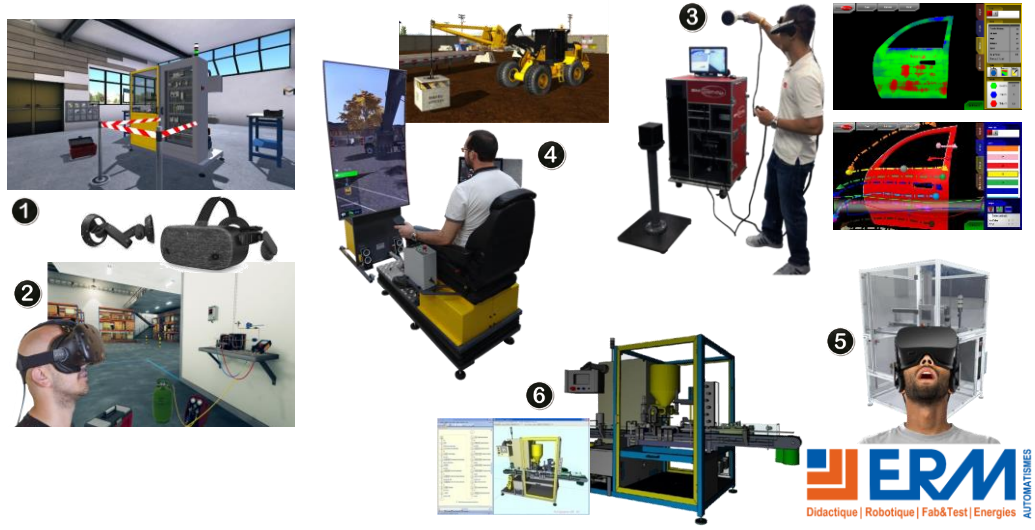
- Virtual Reality projects creation ❺

Augmented Reality

- Creation of content, projects, scenarios in Augmented Reality (digital work instructions, maintenance, quality & conformity control…)

Digital twin

- Programmable 3D simulator of ERM equipment (digital twin) ❻
- Modelling and simulation of systems in 3D



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Examples of Technological and Professional Training Workshops

Machining & Mechanical manufacturing

Prototyping	
3D Scanner	
3D FDM printer	
Conventional machining	
Manual press brake	
Conventional lathe with accessories	1
Universal milling machine with accessories	
Workshop hydraulic press	
Design, Prototyping & Mechanical manufacturing (Digital)	
Test bench for mechanical testing of materials 20kN (tensile, compression, hardness, flexure, shear, impact)	
3-axis CNC milling machine with accessories	2
CNC lathe with accessories	3
2-axis flat grinding machine	4
Metrology and quality control tools	5
Software	
Comprehensive G-Code verification software for CNC virtual machining, including machine simulation and toolpath optimization prior to transferal of code to CNC machines.	
CAD and CAM software	
Reverse engineering software	


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FabLab & Prototyping

Cutting - Processing	
Water jet cutting machine for any materials (steel, alloys, wood, glass, leather, rubber…)	
Laser cutting, engraving & marking machine, with fume extraction	6
CNC lathe with accessories	2
3-axis milling machine with accessories	3
3D printers	
FDM printer (thermoplastic filament)	11
FDM printer with specific materials or fiber insertion (Kevlar, carbon...)	7
Resin 3D printer with UV curing chamber	10
Ceramics 3D printer	
Metal 3D printer (additive manufacturing laser sintering) with sintering furnace	
UV curable inkjet 3D printer,10 million colors	8
Scanner	
Scanner with tripod, turntable and reverse engineering software	9
Others	
Thermoforming machine	
Plastic recycling equipment (shredder, granulator, filament maker)	
Tools, Micro sand blasting, Ultrasonic cleaner…	


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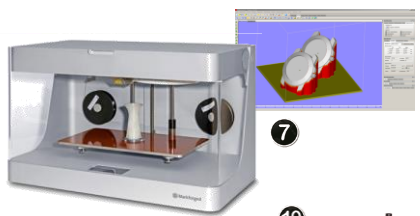
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Examples of Technological and Professional Training Workshops

Renewable Energy

Photovoltaics

- Modular system for off-grid solar study (comparison of 4 different solar panels, 3 different controllers and 2 inverters) ❶
- Photovoltaic off-grid kit (500Wp) with datalogger, batteries, inverter, controller…
- Photovoltaic self-consumption system with micro-inverters and Cloud datalogging ❷
- Grid-tied photovoltaic system (1500Wp to 3000Wp) with datalogging, supports, inverter…
- Solar streetlight system with pole, photovoltaic module, LED, controller, batteries, measuring board ❸

Wind generation

- Wind generator (1300W to 5000W), off-grid, with datalogging, batteries, pole, inverter, controller…
- 3,5kW grid-tied wind generator characterization bench ❹

Hybrid systems

- Off-grid hybrid system Photovoltaic (400Wp) / Wind (400W) with data logging, batteries, supports, pole, inverter, controller… ❺
- Off-grid hybrid system Photovoltaic (2500Wp) / Wind (3000W) with data logging, batteries, supports, pole, inverter, controller…

Solar water heating

- Instrumented domestic solar water heater
- Automated solar parabolic concentrator 3000W for water heating ❻

Software

- Software for calculation and dynamic simulation of photovoltaic systems (dimensioning, performance and efficiency of grid-connected and off-grid photovoltaic systems)

Refrigeration & Air conditioning

Basics of refrigeration

- Refrigeration assembly trainer ❶
- Demonstration of the refrigeration cycle
- Virtual training in cooling fluid / refrigerant handling ❷

Air conditioning

- Monosplit reversible air conditioner with inverter bench
- Monosplit reversible air conditioner with inverter (to be assembled)

Positive and Negative refrigeration

- Positive refrigeration trainer (food preservation at positive temperatures) ❸
- Positive cold room (to be assembled)
- Negative refrigeration trainer (food preservation at negative temperatures)
- Negative cold room (to be assembled)
- Transcritical refrigeration trainer with CO2, positive (Mono- or Bi-split) and negative (Mono-split)
- Study of a didactic ice machine

Diagnosis & Refrigeration system maintenance

- Failure simulation on a refrigeration system
- Study and configuration of controllers (chiller, refrigeration unit, autonomous refrigeration unit) ❹
- Interactive training software to understand, fix and maintain air conditioners
- Handbook on refrigeration, air conditioning, electricity and hydraulics repairing

Industrial refrigeration units

- Commercial / industrial refrigeration bench (multi-compressor system with several refrigeration units) ❺

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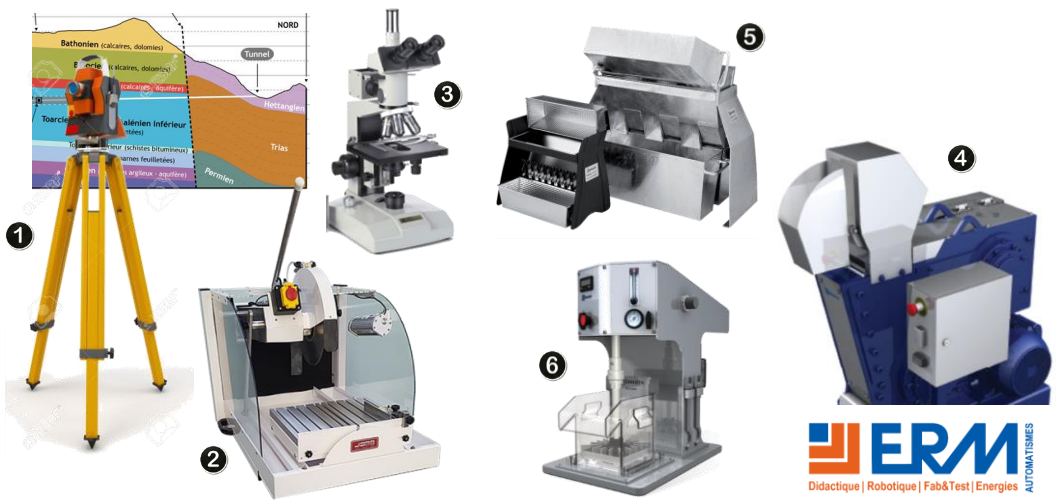
Examples of Technological and Professional Training Workshops

Civil Engineering

Materials: properties and tests	
Test bench for mechanical testing of materials 20kN (tensile, compression, hardness, flexure, shear, impact)	1
Resistance of structures	
Resistance of beams and structures test bench	
Materials and structures test bench (resistance on simple and complex structures)	2
Seismic bench with datalogging	
Concrete and Aggregates	
Electromechanical sieve shaker	3
Testing equipment for aggregates	4
Concrete compression test machine	5
Equipment for concrete specimen preparation and conservation	6
Concrete specimen facing equipment	
Fresh concrete testing equipment	7
Tools and equipment	
Instrumentation, tools, software…	

Geology

Geological reconnaissance	
Positioning, Measuring and Sampling equipment (GPS, compass, hammer, aplanatic magnifier…)	
Topography equipment (total station, level….)	1
Geophysics equipment (magnetometer, resistivimeter, seismograph…)	
Samples preparation	
Litho-lamelling equipment (cutting, polishing, thin sections...)	2
Samples mechanical preparation equipment (crushing, grinding, sieving…)	
Laboratory testing	
Microscopes for practical work and research	3
Physics, chemistry and rock mechanics equipment (conductivity, magnetometer, press…)	
Pedology equipment (sieve shaker, sedimentometer, pH analyzer…)	
Geochemical analysis equipment (spectrometer, scale, hot plate, agitator…)	
Minerallurgy	
Handling equipment (pallet truck scale, crane, stacker)	
Mechanical preparation equipment (crushing, grinding, scales)	4
Sampling equipment (vibration table, divider, sieve shaker)	5
Equipment for upgrading ores (concentrator, X-ray analyzer, flotation cell…)	6
Technical software	
Graphics / Cartographic data processing (SIG) and topography / Exploration data processing / Project management…	



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Mobile Vocational Training Workshops - MVTW

Key issues of the Mobile Vocational Training Workshops

The Mobile Vocational Training Workshops proposed by ERM AUTOMATISMES meet several issues :

- **To train quickly**, near construction and operation sites, a skilled and qualified workforce.
- **To propose practical training**, corresponding to a list of skills that meets specific needs.
- **To be able to move the training workroom from a site to another** to match with the specific needs of each site.
- **To enhance the investments** in training, increasing the percentage of use of the equipment, the training quality and therefore the productivity of technicians.

Design of the Mobile Vocational Training Workshops

The MVTW are the result of many years of experience, co-operation with vocational institutions in Europe and Africa.

Our action is organized in two phases, to ensure a high level of quality :

- The **Audit phase**, that leads to recommendations.
- The **Setting up phase**, based on the results of the first stage, covering the various jobs and training areas to set up.

Equipement and Training

Containers and equipment: We prepare customized containers, used as training laboratories, classrooms, stores and changing rooms, allowing a quick implementation and easy moving.

Training of instructors: In order to transfer skills, we do recommend to train the local instructors that will then be able to train the technicians in a sustainable and economical way.

Supply of external instructors: We also provide qualified trainers and resources, to settle training programs, alone or supporting the local trainers.

Containers

A MVTW is considered as a learning and exercising place. It consists of several containers, equipped, used as laboratories, workshops, classrooms, pratical workshops, storage, changing rooms...

These units will operate as a network, improving the use of **resources and didactic equipment**, and making **communication** and technological exchange easier.

There are many advantages in using the containers: easy to move and transport, wear and intrusion resistant, easy setting on a site...

The **containers can be electrically powered from the power grid,** or be autonomous (off-grid solar system, power generator).

The containers equipment is made in France by ERM AUTOMATISMES and its partners. The containers are carried to the site, then installed in an area previously prepared and fitted out, depending on the chosen configuration. This logistics plan allows the fast setting up of a training center.

Example: MVTM for Production & Industrial Maintenance

The equipment will fit in 6 containers :

- Container 1: **Mechanical Maintenance**
- Container 2: **Pneumatic and Hydraulic Maintenance**
- Container 3: **Electrical Maintenance & Automation**
- Container 4: **Manufacturing & Mechanical repair**
- Container 5: **Storage**
- Container 6: **Classroom & meeting place**

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Some international references

Colombia
Centre de Formation en Energies Renouvelables (Bogota)

Mexico
Lycée Franco Mexicain (Mexico DF)

Belgium
Centre de Formation Forem Maintenance (Dinant)
CTA Véhicules Ecologiques (Mons)
CTA Domotique – Immotique (Charleroi)
CTA Sciences Appliquées (Saint Servais)
CTA Mécanique appliquée (Charleroi)
CTA Maintenance de systèmes automatisés industriels (Virton)
CTA Maintenance des équipements énergétiques (Ath)
Institut Don Bosco (Bruxelles)
Institut Notre Dame (Anderlecht)
Institut Technique (Namur)
Toyota Motor Europe (Zaventem)
Technocampus (Gosselies)
Université du Travail (Charleroi)

England
School of computing and engineering, University of Huddersfield

Switzerland
CEFF Industrie (Saint-Imier)
Ecole des Métiers de Lausanne (Lausanne)
Haute École du paysage, d'ingénierie et d'architecture, HEPIA (Genève)

Mauritania
Centre de Formation et de Perfectionnement Professionnels (Nouakchott)
Faculté des Sciences et Techniques (Nouakchott)

Morocco
Lycées Techniques
École Nationale des Sciences Appliquées (Agadir, El Jadida, Khouribga)
ENSAM (Casablanca, Meknès)
École Supérieure de Technologie (Casablanca, Berrechid)
Faculté des Sciences (Rabat, Casablanca)
Faculté des Sciences et Techniques (Fès, Mohammedia, Settat)
Institut Agronomique et Vétérinaire (Rabat)
Université Internationale de Casablanca, UIC
Université Internationale de Rabat, UIR

Tunisia
École Nationale d'Ingénieurs (Tunis, Gabès, Sousse)
Institut Supérieur des Sciences et Technologies, ISSTE (Gafsa)
Institut Supérieur des Etudes technologiques, ISET
Institut Préparatoire aux Etudes d'Ingénieur (Tunis et Bizerte)
Institut Supérieur des Sciences Appliquées et de Technologie (Gabès)

Gabon
École Normale Supérieure de l'Enseignement Technique (Libreville)
Lycée Scientifique et Technologique Paul Kouya (Koulamoutou)
Institut de Technologie Avancée, ITA (Libreville)

Togo
Université Catholique de l'Afrique de l'Ouest UCAO UUT (Lomé)
Centre de Formation des Métiers de l'Industrie CFMI (Lomé)

Burkina Faso
Institut Supérieur de Génie Electrique, ISGE (Ouagadougou)
Ecole Nationale Supérieure de l'Ingénieur, ENSIF (Fada N'Gourma)

Cameroun
Institut Supérieur de Technologie Avancée et management, ISTAMA (Douala)

Côte d'Ivoire
Lycée Technique d'Abidjan (Abidjan)
Lycée Technique Yopougon (Abidjan)

Algeria
Université de Médéa (Médéa)
Ecole Nationale Polytechnique (Alger)
Université de Bordj Bouariridj

Slovakia
Université de Trnava et Bratislava

Vietnam
Université des sciences et des technologies de Hanoï

China
Haining Technician Institute

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