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### Preserving contemporary science and technology heritage

The Musée des Arts et Métiers, located in the Conservatoire in Paris (CNAM), was established in 1794. It is a National Institution considered as a network leader for all the activities in the field of scientific and technical collections and heritage in France, on behalf of the Ministry of National Education and Research.

Similarly, the National Museum of Natural History (1793) is the head of the national network in the field of natural science collections and heritage. These two institutions are the first national science museums created during the French Revolution in the eighteenth century. The Louvre and the Museum of French Monuments were established at the same moment and they are dedicated to the arts.

During the nineteenth and twentieth centuries the overhaul of the administration system and of education, the development of sciences and at the same time the “industrial revolutions”, contributed to create science and technology collections and their museums. At the same time, major thematic universal exhibitions showed in dedicated places, often with pomp, technological innovations of the industry. Alongside the nineteenth century, a significant multiplication of small natural history museums or industrial and technical museums appear on the French territory, whose collections often come from associations and/or private industry collections. In most European countries the great museums of science and technology are created in the early twentieth century. They acquire objects part of which comes from Universal Exhibitions. The Museum of the Conservatoire becomes the Museum of Technique and finally the Musée des Arts et Métiers after its renovation and re-opening in 2000.

The collections presented in the galleries of the Musée des Arts et Métiers, especially in its permanent galleries, show inventions mainly from the 18th century until the years 1930-1950. The collections illustrating the post-war years to today are not very present. This can be explained in various ways: at the time of renewal, heritage professionals had little interest in this period still so close to the present; only few historians studied “contemporary” science and technology; but science and technology experienced a tremendous development in this period that some historians point out as a true scientific revolution (Robert Halleux). These reasons encourage the successive directors of the museum to “complete” the collections and to document the period of contemporary science and technology.

It is in this context that in the Musée des Arts et Métiers arised the idea of creating a National Mission of safeguarding and enhancement of the scientific and technological heritage of the past sixty years and to create a Network supported mainly by French public and private laboratories, by CNAM centres and science and technology museums located in the French regions. The Minister of Research entrusted this mission to the museum director in 2003, accompanied by a letter stating the objectives.

### **The state of the art in 1996**

The departure of retired scientists and their teams from their laboratories operates massively for more than fifteen years, potentially eliminating a whole section of contemporary research, leaving no physical

evidence or testimony to transmit to younger generations. At the same time, heritage professionals and historians of science and technology have little interest in these objects coming from public or private research of that period.

This lack of interest can be explained in several ways, among them: the large number of instruments created and/or used in laboratories over the last sixty years, and the lack of criteria of selection for the *patrimonialisation*, in this specific area. These scientific instruments are also often without aesthetic appeal and look like "black boxes". They are difficult to understand and to communicate for the uninitiated. These tools and knowledge are considered too recent to be interesting for the scientific and industrial world, which throws them away. All this brings to ask many questions about which knowledge to preserve, which scientific areas may be considered as major ones, which instruments to preserve and how, in order to reflect the dynamism of contemporary research of the twentieth and twenty-first centuries.

Between 1996 and 1999, at the start of the first safeguarding heritage mission located at the University of Nantes, Paolo Brenni, member of the scientific committee, emphasizes the scientific, historical and industrial interest that the rescue of these recent scientific devices presents: "[...] the study of instruments is no longer a discipline reserved to some collectors, but it is a branch of historical research that can provide information useful in a variety of disciplines". It is in this context of exploration and experimentation that this work on a new heritage sector has emerged.

#### **Why saving tangible and intangible heritage of contemporary science?**

After World War II, France has engaged in extensive research programs in many fields (nuclear, space, human biology), sometimes involving the use of heavy equipment, often expensive and large sizes, qualified as "Big science" by historians of science. The construction of the Large Hadron Collider - LHC - is a recent European example. This investment in public research contributes to change science and the scientific practices. Similarly, research organizes itself and, by 1960, science and technology are fully increasing, which brings to the development of laboratories, of research and teaching. The materials in laboratories gradually become teeming.

By the 1990s "national projects" for the scientific and technical heritage are created by the Ministry of Higher Education and Research. The desire to bring the scientific and technical museums closer to university research is materialized by the "REMUS" program in collaboration with the Ministry of Culture. Similarly, the ARISC program raises awareness on archives of contemporary science in the laboratories of the CNRS; or the project on "astronomical heritage of Observatories" with the description of instruments before 1950 and of the buildings. Generally, tools and skills in the field of instrumentation for private and public research of the second half of the twentieth century are not considered or studied and there is no (or little) literature or catalogues.

#### **Generalizing the approach**

Very quickly the local study of the University of Nantes becomes the subject of a new expanded mission at the regional level and for all educational and research institutions of the Pays de la Loire, in possession of collections and/or scientific instruments interesting for the project.

Meanwhile, a meeting in Orsay in 2001 between the director of the Musée des Arts et Métiers and the team of the regional mission of safeguarding the contemporary scientific and technical heritage of Pays de la Loire at a symposium on large scientific instruments allowed both parties to reflect upon the traces that

this period of contemporary research with leave in the future. Some time later, the will of the director to complete the collections of the Musée des Arts et Métiers beyond 1945 - particularly in the field of scientific instrumentation -materialized through the creation of a "National Mission for the safeguarding and promotion of the contemporary scientific and technical heritage ", entrusted in 2003 to the Musée des arts et Métiers by a letter from the Minister of Research.

The immensity of the task raised new questions and necessitated the establishment of ad hoc methods. The methods tested at the University of Nantes and its region have been naturally adapted and consolidated.

### **How to select?**

Of course, the collecting and selecting methodologies are issues facing all heritage professionals. About archaeological heritage, says Martin Roth, provocative and critically, the need is to bring different looks on the objects. He distinguished heritage interest and the one that takes into account the context of objects.

In the field of archives, the concept of evaluation of the documents always precedes the selection. This sorting is done under the direct responsibility of archivists, unlike the situation of museum professionals or experts outside the museum, especially for archaeological sites. Archivists well define their criteria. These methods are inspiring to a massive selection of objects.

With the support of a group of experts at national level, composed of internationally recognized scientists in their discipline, it was proposed to the members of the National Mission network to find several simple criteria to begin: the scientific interest, the historical interest, rarity (maquette, prototype, model, series of reference), a significant technological evolution, a variety of forms, the design and the symbolic criterion – along with oral testimonies. Obviously, these principles do not solve completely the problems of selection, but give a framework of sufficient perspective to explain the choice. Moreover, very often the safeguarding action is made in a hurry: a laboratory moving to another building, a director, an academic or a researcher who retires.

The objects of contemporary scientific and technical heritage, identified and inventoried as part of the National Mission, are mostly scientific equipment, instruments or devices that were used in research in the last sixty years. They are designed or purchased by their users. Records on the use of the instruments, photographs, and laboratory notebooks are collected. This information is supplemented by interviews with researchers and technicians - the users of these instruments - about processes, patents and know-how. All traces, material and immaterial, that help to know and understand the research and technological advances, are saved.

In this context the National Mission becomes a larger program of safeguarding of contemporary scientific and technical heritage, entitled **PATSTEC**, which is also the name of the website - [www.patstec.fr](http://www.patstec.fr) - and is developed to a national level.

### **The national organization**

The Mission developed a "national network" and each partner appointed a project manager in universities, museums, regional CNAMS, and local supporters of the mission. Their role is to raise awareness, save, preserve and highlight scientific and technical instruments and know-how (as films, interviews) of public and private research. Regional missions gradually grew over time (one to two regions per year since 2004) and were supported by scientific committees. For example, the regional mission Midi-Pyrénées is located in

the Federal University of Toulouse Midi-Pyrénées (COMUE) in Clermont-Ferrand, the mission is supported in the city by the Lecoq museum, in Aquitaine it is the Regional CNAM. But each regional centre joins groups of scientists, research organizations and universities, but also local cultural actors (museums, CCSTI, libraries, archives, associations) with the support of local authorities.

Today the National Mission organizes and develops a national network covering the whole country of France, with **21 regional partners**, plus members at a national level such as Météo-France, CNRS, CEA, CERN or industries such as Michelin, Essilor, EDF Foundation. Each regional partner is supported by a project manager and a scientific committee giving orientations about research topics and objects selection for the inventory. 18,000 objects are inventoried, photographed and scanned (60,000 media) in a database. Part of these data are transferred to the website [www.patstec.fr](http://www.patstec.fr)

With the new administrative division of France and its regions with the NOTRe law, the geographical configuration of Patstec partner regions will change. We'll probably see the effects from 2017.

Over the past thirteen years, the National safeguarding mission of contemporary scientific and technical heritage - PATSTEC - opened many questions about the collection of this "new heritage". Some of these issues were addressed in working groups, including the legal aspects - such as the ownership of objects- or the communication and exhibition of these instruments often aesthetically difficult to present. A four years research project permitted to reflect about this new heritage field bringing together a community of heritage professionals, researchers from different disciplines, students and teachers and project managers responsible for PATSTEC missions in the partner regions. The quality of articles has resulted in the publication of a book published in 2016. This dynamic brings the desire to link preservation initiatives with those of communication and public exhibition.

### **The Mission's tools**

The main tools developed by the Mission in 2003 are a database and a website. They are used to identify instruments, machines and processes, mainly from the last 60 years, as well as associated media - photos, videos, animations, researchers' stories - available on the national website [www.patstec.fr](http://www.patstec.fr).

Originally developed as a tool for scientific and technical culture, the national database includes, in 2016, and after 13 years of existence, more than 18,000 items relating to 17 scientific domains and 125 scientific subdomains and 60,000 photographs, videos, texts and animations.

The national database is divided into as many bases as the partners network. The specificity of this domain led the coordination unit of the National Mission to define the name of the field of the national database, however, each partner is responsible and owner of the contents of its own database, called "local data base". Each partner sends to the National Mission site a copy of the records in accordance with the local project manager and the scientific and management committees.

Some work is being done in order to change the database, indexing inventory records, referencing visible items on the website and, more generally, open data. Indeed, the current indexing of records is done according to 3 levels: domains, sub-domains and keywords. It was constructed to meet the specific requirements of this unexplored heritage and of specific research areas of the laboratories, the services or the places using the instruments. A reflection on the authority lists will lead to a classification plan and a specific thesaurus.

Another problem facing the Mission is referencing inventory records by public search engines "Google like." The dynamic aspect of our database system raises difficulties to reference independently each of the 9500 inventory records visible on the website. The use of URIs could be used to overcome this difficulty.

Finally, the Mission has developed an export functionality of local data in XML format to allow partners project leaders to keep a backup locally. Similarly, a SQL transfer system will permit to transfer the contents developed by local partners with another management software. Studies are under way on the structuring of data including their description, according to the international standards of web data. These projects will facilitate transfers to platforms such as Europeana, Inventing Europe and Wikimedia France, or other structure such as the International Patent Classification.

The richness of the content of this national database of contemporary scientific and technical heritage is an important documentary and research material for researchers, educators, heritage professionals and historians.

Among current lines of thought, we can consider to study how to establish families of instruments typical of science and technology of the past 60 years, to work on technical development and industrial innovation of instruments, to study the evolution of manufacturers and distributors of this period or to study the constituent materials of such devices.

#### **Transmission and interpretation of this new heritage**

In 13 years the skills and working methods have emerged and asserted themselves and professionalized. The Mission's network now has a significant collective expertise, both in terms of identification and description of instruments, but also on the knowledge of their functioning "scientific principle".

"Reference instrument collections" are now created through the perseverance of regional missions. For example, the computer collection of the Aconite association - supporting the regional mission Rhône-Alpes - Grenoble Academy - is now recognized as one of the most comprehensive in France; another example is the anatomical models and the botany collection from the University of Dijon.

The Patstec missions, after years of experience, are protecting some "rare" pieces as historical monuments in order to ensure their durability. This is the case of the atom probe inventoried and enhanced by the Haute-Normandie mission, but also other objects, such as a transmission electron microscope in Michelin or an analogue computer in Grenoble. Furthermore, some dossiers are being created for a collection of physical instruments in Burgundy.

The skills used and developed as part of the mission led to the establishment of training and educational courses. These courses are dedicated to future heritage professionals, and aim to raise awareness among students about the problems of this heritage. At regional CNAM (Toulouse), at the Musée des Arts et Métiers within the Master of Museology of the National Museum of Natural History, in the training courses for the national exam for conservators, as well as in heritage interpretations modules in different universities. Moreover, the regional mission of the Loire built training modules for the website. They were offered in e-learning to future Algerians engineers as part of a training course entitled "htech" and carried by the Polytech School in Nantes.

Various interpretation and communication projects have been implemented by the regional partners, from simple exhibition of instruments to participation in cultural open days, the realization of multimedia tools and virtual exhibitions. An exhibition space dedicated to scientific and technical instruments is now

installed in the Museum Henri-Lecoq. The University of Rennes 1, meanwhile, offers tours in its storerooms during Heritage Days, the Science Festival or the Researchers' Night. Alternatively, in order to make the heritage known to other professionals or enthusiasts of museum, the mission Nord-Pas-de-Calais participates in Muséomix Nord, the annual event that proposes and produces innovative approaches to exhibitions and collections.

Virtual recovery of this "future heritage" is assured through the website of the National Mission, but also by interfaces developed by partners, such as "researchers' careers" in Pays de la Loire. The Midi-Pyrénées mission reused the concept to enhance the career of eight scientists from the region. Other concepts have been implemented, always by Mission Pays de la Loire, such as the creation of "Stories of instruments", "Stories of laboratories", "Business Stories" and "Collections of objects". The Rhône-Alpes mission (Grenoble) has created virtual exhibitions of instruments from their information collection.

Finally, we are developing other collaborative projects. For example, the Auvergne mission presented an exhibition in 2008, with over a hundred instruments from nine regional missions of the network. The regional mission Pays de la Loire was asked to set up an historical collection of electronic games consoles and computer in the "Ultima" exhibition in Nantes, in the summer of 2015. This event comes from the *MuséoGames* exhibition in 2008 at the Musée des arts et Métiers.

Similarly, several thematic work groups – on the use of the database, on sorting and selection of objects, on communication – involve members of the national network with the aim of developing common and collaborative projects. The diversity of profiles of network members (scientists, librarians, museologists and curators, educators, mediators ...) allows building on existing vocational skills and ensures the wealth of exchanges. Geographical distance requires a proactive and unifying role from the national coordination cell to support initiatives and monitor projects. Creating a collaborative space, a mailing list as well as mail alerts, and the bi-annual meeting of the network, the annual professional National Day, are some of the methods used to maintain this dynamism.

Moreover, from 2012 to 2015, one scientific committee organized a research project entitled "Contemporary Heritage: Science, Technology, Culture & Society" with the aim to bring together a community of people interested in this heritage.

### **Opening up to international networks**

Specific projects have been conducted in response to European calls for tenders as the "Thinkmotion" project (2012-2013), the results of which are visible on Europeana platform, with over 200 instruments and devices from the French Institute of Advanced Mechanics - Clermont-Ferrand with the collaboration of the Auvergne regional mission.

But thinking beyond the scale of France, it seemed essential to create a European network in collaboration with other colleagues and institutions.

In recent years, under the leadership of the directors of the Musée des Arts et Métiers (Daniel Thoulouze, 2001-2007, Serge Chambaud 2007-2015 and today Yves Winkin), this safeguarding action gained an international dimension through regular meetings with major European museums of science and technology such as Milan, Munich, London, Leyden, Liège (17) in the network called **ESTHER - European scientific and technical heritage** – but also developed relations with Boston (MIT) and Ottawa (Museum of

science and technology). This internationalization is developed also within existing networks of experts such as Artefacts (Academic conference of scientific museums), SIC (International Symposium Commission), UMAC (University Museums and Collections) and Universeum (European Academic Heritage Network). We are working on an exchange agreement between France and Canada.

## Conclusion

Over the past thirteen years, the national safeguarding mission of contemporary scientific and technological heritage - PATSTEC - opened many questions about this "new heritage". Some of these issues were discussed in working groups, others relating in particular to the selection of "representative" objects of XX and XXI centuries are being clarified. The main question remains: which material and immaterial traces can witness the science and technology of this period, the research processes and the major scientific and technological breakthroughs?

Our experience permits us to have safeguarding policies that can support a reasoned selection. However, the creation of this heritage still implies more perspective on selection criteria. Therefore, my reflection here is largely exploratory. The development of historical criteria, the issue on the evolution of the instruments and the concept of innovation are key elements for these choices, before converting these materials into objects of heritage. Robert Halleux explains: "...finally we will focus on the infrastructure and on the laboratory activity. An isolated device does not make much sense. The ideal would be to keep all the equipment that was used to develop a particular invention. This is utopian. Many devices, such as computers, are standard serial machines and it is futile to keep many copies. For example the idea of a European register of large computing machines is gradually gaining ground in the field of information heritage..."(18).

The experience on the collection and inventory description of these scientific instruments, of material and immaterial documents, show that this future heritage fits well into a wider heritage and confirms the need to safeguard these objects not only regionally and nationally, but also internationally. The importance of elaborating choices indicates the need for methods on collecting and on conservation and communication in general, as well as to take into account the evolution of scientific and technological knowledge that allows the interpretation of scientific practices of yesterday, today and tomorrow.

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