



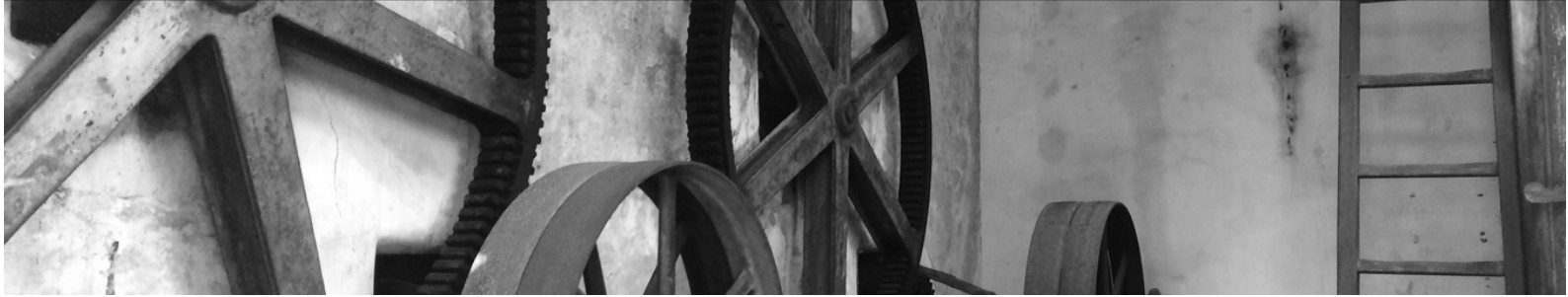
Big Stuff 2022

WORKING TOGETHER

Conservation and safeguarding of industrial and technological heritage

28th -29th September 2022
Seixal – Portugal and online





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BIG STUFF 2022 CONFERENCE

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The Big Stuff conference is now almost twenty years old. It began as a workshop attached to Metal 04, the International Conference on Conservation of Metals held in Canberra, Australia. It filled a gap in the heritage and conservation world that nothing else was addressing – the peculiar challenges of large, mostly metal assemblages of parts that we call machines. Often perceived as purely utilitarian, they are in fact entwined with vibrant intangible heritage cultures of work, life and practice, which depend upon continued operation of the machinery for their survival and transmission to future generations. The size of big machines; the role that changeability and movement plays in their essence, interpretation and conservation; their role in both industrial and domestic spheres of life; and the way that at the largest scales machines and buildings become indistinguishable parts of a whole – all these aspects act to disrupt traditional disciplinary boundaries such as materials conservation, built heritage conservation, industrial heritage and military heritage.

A passionate international community of scholars, practitioners, volunteers, and machinery owners has shaped Big Stuff over the ensuing five conferences, held in Germany, the United Kingdom, Canada, France and Poland. The opportunity to meet regularly with friends and colleagues, and to share ideas across disciplines to expand our knowledge and practice has been a constant pleasure and a driver of new ideas and collaborations. One challenge has always been to make the conference accessible to people who are unable to travel internationally to be with us, so the addition this year of the option for online participation is an exciting development. The program offered in 2022 in Seixal, Portugal is filled with innovative presentations and complemented with tours of some of Portugal's most interesting large technology sites, taking Big Stuff in exciting new directions.

I would like to thank Graca Filipe, Marta Manso and Isabel Tissot, the team whose vision and energy initiated Big Stuff 2022 in Portugal and have now made it a reality. Their drive, enthusiasm and expertise have been remarkable, and have led to one of the most exciting Big Stuff programs yet. I look forward very much to joining them, with all our in-person and online participants, for Big Stuff 2022 in Seixal, from 27-30 September.

Dr Alison Wain
Big Stuff Founder

Wednesday, 28 September

Location: Seixal Cultural Forum	
Presentation at venue and on-line	
08:30	Registration
09:00 – 09:30	Opening session Alison Wain – Big Stuff Founder and Scientific Commission representative José Manuel Lopes Cordeiro – National representative and board member of TICCIH José Paulo Santos – Big Stuff 2022 Organizing Commission representative Paulo Silva – President of the Municipality of Seixal
SESSION 1_Chair: Leonor medeiros – APAI (Portugal)	
09:30 – 10:00	Warning, may contain asbestos! Dangerous heritage in industrial museums in Belgium <i>Pieter Neirinckx and Joeri Januarius – Museum of Industry (Belgium)</i>
10:00 – 10:30	Rare and Vital Trades – keeping skills for the future <i>Alison Wain – University of Canberra; Jesse Adams Stein – University of Technology Sydney; Mitchell Cleghorn – Everick Heritage & Foundation (Australia)</i>
10:30 – 11:00	STICKing Together <i>Ellie Swinbank – National Museums Scotland (United Kingdom)</i>
11:00 – 11:30	Coffee break
SESSION 2_Chair: Ellie Swinbank – National Museums Scotland (United Kingdom)	
11:30 – 12:00	Safeguarding and Conservation of the Mining Cultural Landscape. Contributions to its documentation and digitization in the Chanza-Guadiana border territory. <i>Rui Carvalho (Portugal)</i>
12:00 – 12:30	Hazards and Hydropower: A Tale of an Industrial Collections Move at Ingenium <i>Jacqueline Riddle and Skye Marshall – Ingenium – Canada’s Museums of Science and Innovation (Canada)</i>
12:30 – 14:00	Lunch break
14:00 – 14:30	Is historic working machinery up to 21st century sustainability demands or are we stuck in time? <i>Rachel Rimmer – Science Museum Group (United Kingdom)</i>
14:30 – 15:00	How Lipman’s “Caring thinking” theory for human thought may encourage the industrial and technological heritage safeguarding <i>Konstantinos Stoupathis – MELMOFAKE Museum (Greece)</i>
15:00 – 16:00	FLASH POSTER PRESENTATIONS_Chair: José Manuel Lopes Cordeiro – TICCIH;APPI (Portugal)
	French submarine conservation: a multidisciplinary approach <i>Marie Fays and Jean-Bernard Memet – A-CORROS (France)</i>
	Conservation of a WWII Supermarine Spitfire wing <i>Elodie Guilminot, Eve Paillaux, Sotirios Bampitzaris, Cesar Escobar Claros, Jane Echinard – Arc’Antique (France); Magali Brunet – CEMES-CNRS (France); Luc Robbiola – TRACES UT2J (France)</i>
	Port-Jeanne-d’Arc, is conservation of an isolated site possible? <i>Marie Grima – TAAF</i>
	Return of the Space Hoppers – More measures on dH Comet G-BDIX <i>Thilo Buergel – National Museums Scotland (United Kingdom)</i>
	Deep Impact: Analyzing a De Havilland Comet’s Historic Paint Layers <i>Suncana Marochini – The Getty (United States); Lore Troalen – National Museums of Scotland (UK)</i>
	Water Museum – Research and preservation of Industrial Heritage <i>Bárbara Bruno – EPAL – Water Museum (Portugal)</i>
	Dilemmas in preservation of functional objects in museums: the role of documentation in safeguarding of musical instruments collections <i>Cláudia Furtado – NOVA FCSH (Portugal)</i>
	The preservation of two historic harbour cranes in Hamburg – an interplay of conservation and restoration <i>Eva Wentland – Freelance conservator /BAM – Federal Institute for Materials Research and Testing (Germany); Jaßmann Ronny – Freelance conservator (Germany)</i>

PROGRAMME

PAPER TRAILS: Post-industrial histories, technical memories and art practices in Tomar
A project to rescue the past of the paper industry
Renata Faria Barbosa – ISCTE-IUL, ISTAR, Techn&Art; Fernando Costa – Techn&Art, Instituto Politécnico de Tomar (Portugal)

Things rust but memories last forever. Creative Conservation in the industrial heritage
Ânia Chasqueira, Ricardo Triães and Ângela Ferraz – Techn&Art (Portugal)

Photogrammetric Model of the Mariana Paper Factory, graphic recording methodology for deactivated factories.

Renata Faria Barbosa – ISCTE-IUL, ISTAR, Techn&Art; Fernando Costa – Techn&Art, Instituto Politécnico de Tomar; Ruben Portinha – Instituto Politécnico de Tomar (Portugal)

The conservation process in an industrial context in Barreiro, the legacy of a past. The case of the Baía do Tejo

Ana Paula Gonçalves – Baía do Tejo S.A. (Portugal)

Big Objects, Big Training

Caitlin Walsh, Skye Marshall and Jessica Lafrance-Hwang– Ingenium (Canada)

16:00 – 16:30	Coffee break
16:30 – 18:30	Boat trip on the Tagus River in a <i>bote de fragata</i> (a traditional boat) and visit to the Corroios tide mill
18:30 – 18:40	Closing session – first day

Thursday, 29 September

Location: Seixal Cultural Forum	
<i>Presentation at venue and on-line</i>	
SESSION 3 Chair: Alison Wain – University of Canberra (Australia)	
09:00 – 09:30	Replacement of cast iron piers on an 1886 wrought iron truss bridge in New South Wales, Australia – the challenge of ensuring retention of heritage significance whilst undertaking major rehabilitation work on a heritage road bridge <i>Claire Everett – New State Environment and Heritage; Alexander Rosnell -NSW; Malcom Rankin – CDE Design Solutions (Australia)</i>
09:30 – 10:00	The Desert in the Dry Dock: Practicalities, Challenges and Environmental Sustainability of Desiccation on a Grand Scale <i>Nicola Grahamslaw – SS Great Britain Trust (United Kingdom)</i>
10:00 – 10:30	Conservation of 20th century artillery: An investigation into high performance coating systems <i>William Smith – Cardiff University; David Watkinson – Cardiff University; Paul Lankester – English Heritage; Nicola Emmerson – Cardiff University; David Thickett – English Heritage; Ian Leins – English Heritage (United Kingdom)</i>
10:30 – 11:00	Coffee break
11:00 – 11:30	The potential and limits of acoustic emission techniques as diagnostic tool for historical vehicles' engines <i>Laura Brambilla – HE-ARC, Neuchâtel (Switzerland); Brice Chalançon – Association de Gestion du Musée National de l'Automobile (France); Alejandro Roda Buch, Emilie Cornet, Guillaume Rapp – HE-ARC, Neuchâtel (Switzerland); Stefano Mischler – EPFL (Switzerland)</i>
11:30 – 12:00	The conservative restoration brings the 1907 Fiat 130 HP back on the track <i>Davide Lorenzone and Chiara Armigliato – Museo Nazionale dell'Automobile of Turin (Italy)</i>
12:00 – 12:30	A drive belt align machine and a former vaccine laboratory. A practical restoration report <i>Gesa Witt – TriKon Berlin (Germany)</i>
12:30 – 13:00	Transport to the Vale de Milhaços Gunpowder Factory
Location: Vale de Milhaços Gunpowder Factory	
<i>Presentation at venue</i>	
13:00 – 14:30	Lunch break
14:30 – 17:30	Accompanied visit to the industrial site by Graça Filipe and workshop "Musealisation project of the Vale de Milhaços Gunpowder Factory: heritage object re(definition) and methodological framework for heritage safeguarding and valorisation."
17:30 – 18:00	Closing session

Warning, may contain asbestos! Dangerous heritage in industrial museums in Belgium

Pieter Neirinckx and Joeri Januarius - Museum of Industry (Belgium)

“Suspicious or dangerous” products regularly appear in the collections of industrial museums. The harmful effects of some have been known for quite some time. In others, it only became clear in the long run. The Museum of Industry in Ghent (Belgium) was confronted, among others, with radioactivity in a collection linked to the production of incandescent gas mantles and the possible emission of lead vapors and lead dust during the demonstration of typesetting machines. Another aspect is the presence of asbestos. The dangers here have been known for some time since Europe already banned the marketing, use and re-use of this “wonderful mineral” since 2005. But within the museum world there is remarkably little knowledge about the presence, the number of applications, the danger or the risk to staff and public. Within the working collections of the Museum of Industry, asbestos was used, among other things, as thermal insulation and friction material on brake linings. But once attention is drawn to it, the problem turns out to be deeper than some superficial dust.

Since a couple of years, our Center for Industrial Heritage ETWIE (which is a part of the Museum of Industry) is working on a long-term project on dangerous or toxic industrial heritage in Belgium. The first case study focusses indeed on asbestos, the asbestos industry and its heritage. During this presentation, we will elaborate on the research on asbestos (in) heritage, the management process of this heritage and the training of professionals.

Research

Although Belgium never had an asbestos mine, the country was amongst the champions of the use of the mineral, specifically during the 1970s. After Ludwig Hatschek patented his invention, reinforced cement with asbestos in 1901, the company Eternit started its production and became one of the world leaders in asbestos products. With companies like Vynckier, Pol Madou, Scheerders Van Kerckhove e.a., the asbestos industry had a major impact on Belgian industry, not only in import, production numbers and workforce, but also on the local communities where the asbestos companies were located. Today, the impact of asbestos on public health is becoming more apparent every year, impacting a large number of former workers and local communities. Due to the long latency periods of asbestos-related diseases, the impact of asbestos exposure on health becomes apparent decades after exposure. Our research contributes to raising awareness that action needs to be taken immediately. Especially since it has become apparent in recent years, that after decades of use, the wear and deterioration of bound asbestos causes fibers to come loose with very high risk of them becoming airborne.

Management and training

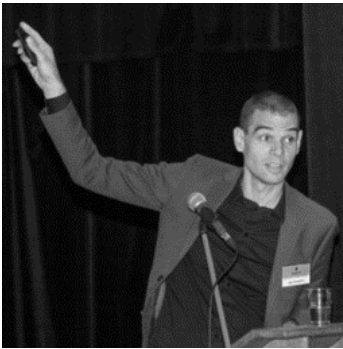
Looking at the known qualities of asbestos, it comes as no surprise that on industrial heritage sites, asbestos has been widely used, not only as a building material, but also in machines and technical equipment. Approximately 3500 asbestos applications have been identified by the public department of waste management OVAM. These applications have been collected as cultural heritage objects in museums or are a part of the industrial heritage site, often not knowing that these objects contain asbestos. Sometimes the asbestos is visible, and necessary measures can be taken to safely remove it. But in most cases collection and site managers do not recognize asbestos applications, certainly when it is hidden within the object, making it difficult to conduct a risk management assessment. During the project, a specific training program was created and tools have been developed for the management and acquisition policies of asbestos heritage (e.g. online database, flow charts for collection managers).

Keywords: Museum of Industry; Belgium; Dangerous heritage; Dark heritage; Asbestos; Management processes; Training of professionals; Research and communication

ABSTRACTS



Pieter Neirinckx studied Art science and Archaeology at the free University of Brussels (VUB) and Cultural Management at the Université Libre de Bruxelles (ULB). He published on the history of the Belgian Railway poster and works, as of 2006, for the Museum of Industry in Ghent. In addition to the research into the collection, his work area includes the museum's acquisitions and loans, restorations in collaboration with colleagues and volunteers, safety issues such as asbestos and radiation and the interaction between public and collection in industrial, technical and scientific collections.



Joeri Januarius holds a PhD in history on the topic of mining history and industrial heritage. As of 2015, he is the coordinator of the Flemish Heritage Center on Industrial Heritage (ETWIE, [www.etwie.be](<http://www.etwie.be>)), which is integrated into the Museum of Industry in Ghent (Belgium). Between 2015 and 2018, he was appointed as guest lecturer at the Free University of Brussels to teach the introductory course on industrial archaeology and industrial heritage to graduate students. Subsequently, in 2019 he was invited by the University of Antwerp to provide guest lectures on industrial heritage in Belgium. He has published several articles and books on the topics of industrial heritage, intangible heritage, the safeguarding of crafts and industrial techniques. In addition he is an editorial member of the Flemish-Dutch industrial heritage journal 'Erfgoed van Industrie en Techniek' and is both the president of TICCIH Belgium as well as the ERIH national representative.

Rare and Vital Trades – keeping skills for the future

Alison Wain - University of Canberra (Australia); Jesse Adams Stein - University of Technology Sydney (Australia); Mitchell Cleghorn - Everick Heritage & Foundation (Australia)

The trade and practical skills and knowledge required to maintain heritage machinery are often referred to with words like “lost”, “dying” or “forgotten”, words that have negative connotations of erosion, obsolescence and death. These words drive a perception that these skills are no longer relevant in the contemporary world or for the future, that they may be of esoteric historical interest but they are not worth supporting with viable training courses and funding for apprentices. Even more damagingly, terms such as ‘lost trades’ discourage potential apprentices from pursuing training in what they may see as a ‘dead end’ job with no further opportunities.

In fact many of these skills are still needed in contemporary industries, and are crucial for meeting the United Nations Sustainable Development Goals (SDGs), in particular Goal 9 to “promote inclusive and sustainable industrialization and foster innovation” and Goal 12 to “Ensure sustainable consumption and production patterns”. Practical trades from the past, centred on human knowledge, skills and intuition rather than machine learning and diagnostics, are more accessible to individuals, small businesses and regional and third world areas with minimal access to high tech diagnostic and development tools. They also promote well-being by empowering people with in-depth skills, and they facilitate processes of repair and re-use that are important in moving towards a circular economy (Hatta 2020). We therefore suggest that the name “Rare and Vital Trades” be adopted, and that we match traditional skills with modern needs and industries to underpin viable training options, providing potential apprentices with the confidence that they are learning skills for the future as well as the past.

One example of this is the trade of engineering patternmaking, a supposedly ‘dying’ trade that in fact provides apprentices with a broad range of relevant practical skills, materials literacy and production knowledge. Our research has shown that patternmaking skills continue to be in demand by employers (particularly foundries). Moreover, such skills can be applied to a wide variety of industries and applications, including repair, sustainable design and manufacturing, heritage machinery, construction, and industrial modelmaking (Stein 2021).

Teaching vital trades successfully and sustainably also means supporting the trainees and the trainers: apprentices need financial assistance while they study; employers need to be supported to take the time to teach them; and people moving across the country for apprenticeships and placements need emotional and accommodation support. Teaching quality and relevance requires a structure that provides stability but also allows flexibility and diversity in the skills taught, the number of students, and the opportunities for students to mix and match learning to develop niche skill sets. Long term viability, at least in the Australian teaching environment, depends on building small cohort courses and opportunities into larger but flexibly taught entities that can demonstrate impact, spread administrative and economic loads, and increase the potential to attract philanthropic or corporate sponsors.

In presenting these ideas we hope to stimulate discussion of relevant approaches to teaching used outside Australia, and the potential for developing co-operative international training networks and structures.

References:

Hatta, M. 2020. The Right to Repair, the Right to Tinker, and the Right to Innovate, *Annals of Business Administrative Science*, <https://doi.org/10.7880/abas.0200604a>

Stein, J. A. 2021. *Industrial Craft in Australia: Oral Histories of Creativity and Survival*, Palgrave Macmillan, Switzerland.

Keywords: Heritage machinery; Rare trades; Right to repair; Circular economy; Wellbeing; Training

ABSTRACTS



Alison Wain trained as an archaeological conservator before discovering a passion for large technology conservation, working with machinery collections at the Scienceworks campus of Museum Victoria and the Australian War Memorial and completing a PhD exploring the ways in which people value, use and care for large technology heritage. She is now Assistant Professor and Discipline Lead in Cultural Heritage at the University of Canberra teaching materials conservation and heritage practice. Her research is focused on the challenges of preserving and interpreting engineering, industrial and science heritage, and in particular on the importance of recognising the intangible heritage of culture, skills and changeability connected with and embodied in machinery heritage. She is also researching the use of laser cleaning as an environmentally sustainable technique for the conservation of industrial, engineering and machinery heritage.



Dr Jesse Adams Stein is a Senior Lecturer and ARC DECRA Fellow at the UTS School of Design, Faculty of Design, Architecture & Building, University of Technology Sydney (UTS). She is a design researcher and oral historian whose research shifts between historical and contemporary contexts and focuses on the quieter and less fashionable sides of design: industrial craft, manufacturing, repair and labour experiences in the face of economic and technological change. Stein is CI of the Australian Research Council funded project, Makers, Manufacturers & Designers: Connecting Histories, and is co-CI on the UTS Design Studies project Repair Design. She is the founder and co-convenor of the international cross-disciplinary symposium All Hands on Deck. Stein is the author of *Industrial Craft in Australia* (Palgrave Macmillan 2021) and *Hot Metal: Material Culture & Tangible Labour* (Manchester UP 2016). Stein is a regular public commentator on Australian skilled trades, manufacturing industry policy and the 'right to repair' in Australia. jesseadamsstein.com



Mitch is an experienced leader experience on major infrastructure and specialist heritage projects across Australia. Experience includes providing strategic advice on heritage management to major mining and resource sector clients, construction professionals and government bodies. He has previously served on the Executive Committee of Australia ICOMOS and is an expert member on the National Scientific Committee for Cultural Landscapes and Cultural Routes among others. He shares a co-convenorship of Applied Preservation Technology Australasia Chapter, and the Australia ICOMOS Heritage Skills Education Reference Group.

STICKing Together

Ellie Swinbank - National Museums Scotland (United Kingdom)

This talk considers the role of the Subject Specialist Network (SSN) in the industrial heritage sector through an examination of STICK, the Scottish Transport and Industrial Collections Knowledge Network.

STICK was formed in 2006 and has become one of Scotland's most successful SSNs. Its newsletter, social media and events bring together a range of organisations and individuals who share a common interest in transport and industrial collections and promoting their care and enjoyment. While a multi-disciplinary steering group drives it forward, STICK is its members and their passion and knowledge.

The talk will examine the ways in which STICK has facilitated shared learning and knowledge exchange among a community of heritage professionals working a range of organisations including national museums and government bodies, individual enthusiasts, independent practitioners and academics through projects, events and active communication that have drawn on the knowledge and expertise of participants to achieve the aims of the group which are defined as:

- Develop opportunities to advance acquisition, care, development, research and interpretation of transport and industry collections in Scotland
- Identify key issues facing the long-term stewardship and development of transport and industry collections and work together to tackle them
- Promote, encourage and advance access to Scottish transport and industrial collections through a variety of mechanisms
- Support informed, efficient and confident decision making in the acquisition and long-term care of transport and industrial heritage across Scotland

Using selected projects and events as case studies, ranging from practical engineering conservation training to virtual conferences, the talk will look at how STICK has identified and selected work that meets real needs, obtained funding, encouraged participation and ensured that a valuable legacy is maintained. It will highlight tangible contributions that the network has made to the industrial and transport heritage sector and will also look at challenges and lessons learned.

The talk will consider how STICK has developed in the 16 years since its conception, including the challenges and opportunities presented by the coronavirus pandemic, and how it is looking to use learning from its work to date along with the combined experience and needs of its steering group and members to continue to bring people together and achieve good outcomes for the sector in the future.

Keywords: Agents and processes for safeguarding and conservation; Training of professionals in conservation of industrial and technological heritage



Ellie Swinbank

I joined National Museums Scotland in 2018 and am responsible for the wide-ranging technology collections. These include objects relating to energy, industry, manufacturing and materials. The technology collection contains some of the Biggest Stuff in National Museums Scotland's care, such as the Boulton and Watt beam engine, the flare tip from the Murchison oil platform and Concorde.

My particular interest is in energy collections, having worked at the National Mining Museum Scotland for 8 years prior to starting at National Museums Scotland. I am interested in how our need for energy has shaped landscapes and communities and how this is memorialised both locally and in museums. I am also engaged in contemporary collecting around renewable energy and thinking about how our collections can be used to facilitate discussions around the climate emergency and energy in the future.

I have been involved with Big Stuff since 2016 and with the Scottish Transport and Industrial Collections Knowledge Network since 2010. I think that subject specialist networks at local, national and international levels are vital for sharing learning and ideas and for creating professional connections and a shared sense of purpose.

My previous roles have included working for the Science Museum Group, Tyne and Wear Archives and Museums and Lancashire County Museums Service. I have a degree in History from the University of St Andrews and a postgraduate degree in Museum Studies from Newcastle University. I am an Associate Member of the Museums Association.

Safeguarding and Conservation of the Mining Cultural Landscape. Contributions to its documentation and digitization in the Chanza-Guadiana border territory.

Rui Carvalho (Portugal)

The Cultural Landscape as a concept applicable to sites of cultural interest resulting from the end of the productive cycle of the mining industry, in the 19th and 20th centuries, allows us to broaden the scope of the approach to safeguarding and valuing urban historic centers, which had its heyday in the 80s and 90s of the 20th century in Portugal.

The process of dismantling and abandoning the extractive industry that has come to us since the Industrial Revolution has, as a rule, left a deep and prolonged mark, in space and time, on communities and their territory. A phenomenon that is followed by environmental regeneration and the valorization of cultural heritage that show the historical and identity legacy, material and immaterial, under the aegis of many disciplinary areas.

The renaturalization and patrimonialization of mining areas of historical and cultural value involve a set of themes and disciplinary areas that are poured into a vast laboratory of action for many sciences, in which are highlighted the Geology, Engineering, Urbanism, Sociology, Architecture, History, Archeology, Landscaping, Biology, among others.

The requalification and enhancement of these territories is currently a duty of retribution for society, but also a commitment to sustainability and climate action, in the face of local communities, the environment and biodiversity, which were strongly affected by the impacts of intensive extraction and subsequent dismantling.

Abandoned industrial spaces appear today, in post-industrial society, as an attractive, unique and potentially valuable resource for new uses and tourist, cultural, ecological, scientific, didactic and pedagogical activities.

The safeguarding and conservation of these spaces has its meaning as an instrument for the preservation of the historical legacy, but also as a means of cultural and scenic enhancement of a territory, along with the necessary environmental regeneration. This allows us to see this scope extended to the dimension of Cultural Landscape of Mining and thus justify the necessary compatibility of interests and uses with the broad concept of sustainability.

The mining complexes of the Mina de São Domingos and the Mina de Las Herrerías, in the SE-SW border territory of Portugal and Spain, come to this day as a historical and cultural legacy of industrial complexes in rural areas and as an integral part of the territory. of a Cultural Landscape of Mining. They form a paradigmatic set that reveals the importance and the economic and social dimension of the great mining enterprises of the 19th century. XIX, in the Iberian Pyrite Belt.

Within the scope of the research project “Cultural Landscape of Mining in the Chanza-Guadiana border territory”, we seek to identify contents and typologies in the field of architecture and urbanism that contribute to a heritage process, with reference to case studies declared world heritage. by UNESCO as a Mining Cultural Landscape.

The integration of this heritage in territorial planning and management instruments reinforces and clarifies the importance of its conservation and valorization in the sustainable development of the territories, as well as the inventory and characterization of its heritage elements. Through studies and mapping and digital recording methodologies, we seek to contribute to the process of regeneration and enhancement of the territory, favoring the preservation, dissemination and enjoyment of its heritage.

(Carvalho, Rui) Doctoral candidate at the University of Seville, with a research project on “The Mining Cultural Landscape of the Chanza-Guadiana Border Territory”. Master degree in Spatial and Environmental Planning (Industrial Heritage and Territorial Development FCT-UNL 2009). Degree in Architecture and Postgraduate degree in Architectural Rehabilitation of Historical Urban Centers (FA-UTL 1995, 1999) and in Regional Economics and Local Development (FE-UALG 2007).

Keywords: Agents and processes for safeguarding and conservation; Experiences and methodologies for operational conservation of industrial objects



Rui Carvalho is an architect specialising in the rehabilitation of architecture and urban centres (FAUTL 1999); and he holds a postgraduate degree in regional economics and local development (FEUALG 2007) and a master's degree in spatial and environmental planning (FCTUNL 2009). He began his career as a freelancer architect and was coordinator of plans and projects for urban rehabilitation and the safeguarding and special valuing of architectural and heritage sites. Since 2004 he has been an architect in the Municipality of Mértola in Portugal. At the same time, he is dedicated to the study of architectural and urban heritage with a particular focus on the themes of industrial and mining heritage, viewing it not only as a historical legacy, but also as a spatial and narrative resource for tourism, cultural purposes, environmental and didactic reuses, and as it corresponds with the needs of contemporary society.

Rui prepared proposals for a plan to safeguard and value the historic mining urban core of the São Domingos Mine, in the Iberian Pyrite Belt, and to delimit and classify the respective deactivated mining and archaeological area, later classified as a property of public interest as a mining heritage. He is currently developing a research project in a doctoral programme at the University of Seville, entitled “The Mining Cultural Landscape in the Chanza-Guadiana Border Territory (PT-ES)” and has also participated in the publishing of some articles, presenting lectures and attending relevant conferences.

Hazards and Hydropower: A Tale of an Industrial Collections Move at Ingenium

Jacqueline Riddle and Skye Marshall - Ingenium - Canada's Museums of Science and Innovation (Canada)

In the autumn of 2020, a small team of conservation and collections staff began the task of assessing and moving one of Ingenium's heaviest, most hazardous collections. Ingenium operates three national museums in Ottawa: the Canada Museum of Science and Technology, Canada Aviation and Space Museum, and the Canada Agriculture and Food Museum. Since 2018, Ingenium has been undertaking a large collections move, consolidating artifacts from four warehouses into a purpose built storage facility. Collection hazards are being assessed, prioritised and treated according to Ingenium's comprehensive Collection Risk Management (CRM) program, which places health and safety at the forefront of collections and conservation work. This paper will present the preparation and move of the collection from one warehouse, the Building 2421 Reserve Collection, showing the challenges overcome to move a large industrial collection on a tight schedule and with limited staffing and resources. A selection of case studies will be presented, highlighting how teams worked together to complete this project on schedule.

The 2421 Reserve Collection building contained over 5500 large and small industrial artifacts, primarily from the Ontario Hydro Power Generation Collection - artifacts from electrical history acquired after the closure of the Ontario Hydro "Museum of Electrical Progress" in 1992. Comprising of generators, steam engines, a particle accelerator, and a wide variety of industrial manufacturing machinery, this collection is large in size, hazards, and grime. Conservators focused primarily on physical stabilisation and hazard mitigation prior to the move. New protocols and research projects were adopted for the testing and management of oil containing polychlorinated biphenyls (PCBs). Large scale asbestos remediation was performed by conservators or specialised environmental contractors where necessary. Significant volumes of mercury were discovered in electric components, and the need to assess thousands of electric meters became apparent as work progressed. In addition, new procedures were developed and executed for packing hundreds of radioactive artifacts. The new Ingenium Centre will utilize novel approaches to collections storage, including the use of radon sensors in radioactive storage spaces and developing plans for mercury vapour sensors in chemical storage. Artifacts were physically stabilised prior to moving using custom built supports, mounts, padding and palletisation as needed, representing a joint effort between artifact handling, mountmaking and conservation staff. After hazard mitigation and physical stabilisation, artifacts were moved to the new facility, taking into account their size and weight restrictions on forklifts, trucks, shelving, and flooring. The largest and heaviest artifacts were moved by contracted heavy machinery movers, in consultation with artifact handling staff.

The Building 2421 Reserve Collection was successfully moved to the new Ingenium Centre by December 2021. This project represented a comprehensive effort to improve our collections storage practices, safeguarding Canada's industrial and technological heritage for the future. As a result, Ingenium's artifact storage is both safer and more accessible for future researchers, staff, volunteers, and visitors.

Keywords: Hazards; Collections move; Electrical history; Asbestos; Polychlorinated biphenyls (PCBs); Mercury; Radioactive

ABSTRACTS



Jacqueline Riddle (she/her) is a conservator at Ingenium - Canada's Museums of Science and Innovation, where she currently works primarily on large artifact stabilisation and hazard mitigation during their collections move. She was previously a conservator at the Smithsonian National Air and Space Museum, where she treated artifacts as diverse as spacecraft, trophies and spacesuits. She holds an M.Sc. in Conservation Studies from University College London (UCL) campus in Doha, Qatar and a B.Sc. with majors in Chemistry and Art History from McGill University in Montreal, Canada. She has held advanced internships and temporary positions in conservation and scientific research at the Synchrotron SOLEIL particle accelerator in France, the Canadian Conservation Institute, the UCL Qatar Archaeological Materials Science Laboratory, the Department of Chemistry at McGill University, and in stone and masonry conservation at the West Block of Canadian Parliament. She presently serves on the Board of Directors of the Canadian Association of Professional Conservators.



Skye Marshall is an Assistant Conservation Technician with Ingenium – Canada's Museums of Science and Innovation. Ingenium is located in Ottawa, Ontario, and is comprised of three national museums and their collections; the Canada Science and Technology Museum, the Canada Aviation and Space Museum, and the Canada Agriculture and Food Museum. Skye completed an Advanced Diploma in Applied Museum Studies from Algonquin College, where she specialized in object conservation with an internship at the Canada Science and Technology Museum. She also holds a Bachelor of Humanities with combined honours in Humanities and Religion from Carleton University. Her research interests include hazardous materials in heritage collections and trauma informed conservation and museum practices. Skye recently presented at the 2022 CAC conference, where she co-presented, “‘Don’t you know that you’re toxic?’ Identification and hazard mitigation of Polychlorinated biphenyls (PCBs) during a large-scale collections move.”

Is historic working machinery up to 21st century sustainability demands or are we stuck in time?

Rachel Rimmer - Science Museum Group (United Kingdom)

The Science and Industry Museum, Manchester (part of the Science Museum Group) have embarked on an ambitious decarbonisation project to become net zero by 2030. As part of this plan, the Power Hall Gallery (national collection of working historic engines) is undergoing a significant redevelopment to improve and conserve the historic listed building, refresh the narrative and aim to run the engines more efficiently, cutting carbon emissions by 60% within this gallery alone.

The collection of historic engines pinpoint a pivotal moment in history, at a time during the birth of the steam engine and when fossil fuel ruled. But in the 21st century we are looking for ways to be more sustainable. The Science and Industry Museum have been working with external specialists and researching more efficient ways of running the historic steam engines. Looking at adapting how other types of engines run and applying this approach to the historic mill engines to run differently. Would they be able to withstand the change and adapt to cope with 21st century demand? Can the Science and Industry Museum balance sustainability with the care and preservation of the historic collection? Join us to hear how this project is progressing as we share the findings.

Keywords: Agents and processes for safeguarding and conservation, Experiences and methodologies for operational conservation of industrial objects, In-situ industrial heritage conservation processes



Rachel Rimmer is the Conservation and Collections Care Manager at the Science and Industry Museum, Manchester and has been since 2012, when the museum joined the Science Museum Group. She originally joined the museum in 2004 as Conservator and prior to this worked as Conservator for Clifton Park Museum, South Yorkshire since 2001. Rachel has an MA in the Conservation of Historical Objects from the University of Lincoln, and a BA in Furniture Conservation and Restoration from the University of Manchester, where she specialised in frames and gilded objects.

Rachel leads a busy team at the Science and Industry Museum; delivering several major collections store moves and improvements, major gallery redevelopments, and delivering a busy special exhibition programme. The collection at the museum is varied and covers areas such as archives, transport, science and medicine, industry, space, and technology. This varied collection and ambitious vision of the Science Museum Group means that no two days are ever the same and presents constant opportunities to develop and evolve.

One of Rachel's areas of responsibility is caring for the operating historic machinery. Working alongside the Technicians and Explainers this is a collaborative effort to strike the ethical balance between preservation of the material, preservation of the machines purpose and the experience of witnessing this sensation, and Health and Safety.

How Lipman's "Caring thinking" theory for human thought may encourage the industrial and technological heritage safeguarding

Konstantinos Stoupathis - MELMOFAKE Museum (Greece)

The purpose of this presentation is to contrast the "higher thinking" methodology of nursing and education with the "caring thinking" theory applied in industrial heritage conservation. "Caring thinking" is crucial to heritage conservation as does not only concern the treatment of the deteriorated parts of an industrial object but on the truth, the museological content that lies beyond the aesthetic or historical values; In the cases of industrial and technological heritage concerns the parameters of functionality and assessment before, during and after conservation.

Firstly, the basic principles of "caring thinking" are analyzed, as the philosophies for nursing and education of J. Tronto, N. Noddings and M. Lipman focus on the provision of human care through its altruistic aim; an action of reciprocal value, a cognitive process where people heal pain or solve ontological problems. The same happens for industrial heritage conservation as social or personal expectations relate to cure and safeguarding towards industrial collections. An ethical process, a moral obligation through any assessment of risks, conditions and perspectives. Most of these incentives for conservation include feeling as a major feedback that enhances safeguarding.

Secondly the presentation refers to modernism, where conservation is the action of surgery on a product produced by man, an artifact or artwork being manifested in the human consciousness, an action of "respect and care" (Brandi, 1957). Also the conservator has to fight against obsolescence in the cases where there is lack of spare parts at an industrial object. For new museology an industrial tool it is not just as a useful object of the past but a folklore, an ethnographic and a "sociologically involved object" that the contemporary museum has to display and extend its life-span through conservation.

Furthermore there is a need to make the objects operation feasible through reversible conservation materials and techniques. This assumption of healing of material deterioration, is contrasted with postmodern conservation ethics when Munoz-Vinas (2005) tries to tackle cultural management through the cessation of time; by talking about an "oxymoron" dimension of conservation as politics, treating heritage through trends, social-personal taste, intents, etc.

Taking all the aforementioned into consideration, the presentation refers to the museological adjustment of "caring thinking" of Lipman's philosophy to new decision-making models for conservation as complex-thinking tools that include: a)the active, b)the creative, c)the estimating, d)the affecting ways of thinking and mostly e) the empathy of the conservator for man's, human ingenuity, effort and expectations during the period of industrial revolution. The need of the industrial and technological heritages' conservator not only to extend the life span of the collections but strive to retain their intangible value and enhance the viewer's museological engagement with them.

Keywords: Caring thinking; Decision-making; obsolescence; Restoration theory; Code of Ethics; Empathy; Operation; Handling; Industrial revolution



Konstantinos Stoupathis graduated from the Department of Conservation of Antiquities and Works of Art of ATEI Athens (BA), specializing in the conservation of easel paintings, woodcarvings, portable works of art, murals and Museum archives. He is a Postgraduate Museologist (MA) from the Department of "Museum Studies" of the University of Athens. Also conducted his second Msc at the Nicosia University, on the Post-Modern Theory of Conservation of Contemporary Art. He has been working at the Hellenic Ministry of Culture and the Ministry of Education and Religious Affairs since 1999, at the Directorate of Antiquities and contemporary works of art and for the conservation of murals at the Numismatic Museum of Athens. As a conservator of archives, portable artworks, wood carvings and leather/paper shadow theater collections in the 20th Ephorate of Zakynthos, at the Museum of Greek Folk Art and the Greek Popular Musical Instruments Museum/ the Phoebus Anogeianakis Collection. Participated in 2017 in the Contemporary Exhibition of "Dokumenta 14" in Kasel of Germany on behalf of the Conservation Dept of the National Museum of Contemporary Art of Athens.

French submarine conservation: a multidisciplinary approach

Marie Fays and Jean-Bernard Memet - A-CORROS (France)

In recent years, A-CORROS has been involved in the conservation of a few examples of submarines listed as Cultural Heritage. Among them, the Espadon, a French submarine from the Narval series that sailed from 1960 to 1985, has been transformed into a museum in its home port of Saint Nazaire (France).

While listed submarines are industrial / military products by nature, as disarmed ships, they also are Cultural Heritage by use. No longer navy ships, neither traditional museum artifacts, their preservation requires custom-made methodologies at the crossroads of traditional maintenance and the conservation ethics of a living technical object.

A-CORROS is invested into guiding museum managers to take up the challenge of submarine preservation, gathering internal skills (corrosion engineering, metal conservation) and external skills, working together with a wide range of specialists: cathodic protection engineers, plastic / wood / leather conservators, shipyard workers, former submariners, the French Navy, and military museums. And then, how to conserve a submarine?

Floating but not sailing anymore, used every day but by visitors instead of submariners, looked after but not restored, authentic but aging, where to begin? To what extent and according to which guidelines should the preservation proceed?

Keywords: Submarine; A-CORROS; Conservation; Corrosion Engineering; Metal conservation



A-CORROS is a French company located in Arles, specialized in the diagnosis and treatment of metal corrosion. Created in 2007, the company has developed three main approaches: the diagnosis, expertise, and protection against corrosion in industrial contexts (metallic structures, bridges, train stations, pipes), the diagnosis and conservation of cultural heritage (sculpture, archaeology, historical objects, contemporary art, museum artifacts), and research and development of new processes (European projects, corrosion stabilization processes, sustainable development practices).

Working in France and abroad, A-CORROS has completed more than 1050 contracts in more than 20 countries during its 15 years of operation and its team has grown to 9 permanent members.

Submarines, pharaohs' sarcophagi, train stations, archaeological canons, Tinguely machines, shipwrecks and liturgic bronze, all missions as diverse as they are challenging. A-CORROS shares its experiment through training programs for students (conservators, material engineers) and professionals (archaeologists, collections managers).

Marie Fays has been part of the team as a metal conservator since 2019, following her conservation master's degree (Institut National du Patrimoine) and bachelor's degree at the Ecole du Louvre. She mainly works on industrial and historical heritage as a conservator, but also as a project manager. She participates in conservation projects, condition reports, restoration, collection assessments and research projects. The global project of the conservation of the 1970s submarine Espadon involved both the industrial and cultural heritage sectors and is an excellent example of skill-sharing at A-CORROS.

Conservation of a WWII Supermarine Spitfire wing

Elodie Guilminot, Eve Paillaux, Sotirios Bampitzaris, Cesar Escobar Claros, Jane Echinard - Arc'Antique (France); Magali Brunet - CEMES-CNRS (France); Luc Robbiola - TRACES UT2J (France)

The Second World War (WWII) is often considered the golden age of military aviation, but the war in the air has left a large number of remains in the European soil and in the sea. This massive commitment has caused considerable human and material losses. Even if WWII aircraft heritage has an undeniable historical and emotional value for Europeans, it is only recently that these remains have officially entered the field of archaeology and cultural heritage conservation. Most of the time, volunteers and associations operate on the field to recover and look after the wrecks. Some wrecks are eventually exhibited in museums, but they are not the main part of the collections.

In the European project PROCRAFT, which connects multiple actors in the operational chain from recovery to exhibition, in France, Italy and Czech Republic, the challenge is to propose innovative procedures and solutions for the conservation and protection of this specific heritage. The PROCRAFT project is particularly interested in the conservation of aircraft wrecks from crashes. Aircraft wrecks components are mainly made of aluminum alloys, particularly Al-Cu alloys, which are affected by corrosion, and even more strongly when they come from the sea.

This presentation focuses on the conservation of a WWII Supermarine Spitfire aircraft wing, which was found in 1988 at sea less than 3 miles from the French coast (in the Channel). This object was saved from destruction thanks to a volunteer who kept it for over thirty years in his garden. Thanks to the PROCRAFT project, this object will be highlighted to serve as a memorial to the pilot who died during his mission.

The main goal of the project is to assess the industrial value of this remain and to adapt our archaeological conservation-restoration process to this object. This aircraft wing presents a really worrying condition, choices to conserve, preserve or remove part of original elements have to be made.

The second objective is to build a protocol based on the results of the studies carry out in PROCRAFT project mainly on cleaning treatments for Al alloy surfaces with paint remains.

This example would like to illustrate the implementation of the results of a European project in a conservation-restoration process and the application of industrial conservation theory to archaeological artefacts.

Keywords: WWII cultural heritage; Aluminium alloys; Supermarine spitfire; Cleaning treatment; Conservation-restoration

ABSTRACTS



Guilminot Elodie. I completed my engineering diploma at Polytech Nantes (France) in 1996 and obtained a PhD in electrochemistry at the Institut National Polytechnique de Grenoble (France) in 2000. Since my studies, I have sought to associate science with the conservation of cultural heritage. My PhD thesis focused on the conservation of waterlogged wood/metal composites in collaboration with the French conservation-restoration laboratories Arc'Antique and ARC-Nucléart. I joined the Arc'Antique laboratory (Nantes, France) as conservation scientist in 2006 to conduct and coordinate research projects. My research interests include the corrosion of metals and the development of restoration treatments. I am interested in the heaviest metals by studying defixion tablets (Pb tablets with engraved magic spells) as well as in the lightest metals by studying the conservation of aluminium alloys in WWII aircraft. Since 2020, I coordinate the European project JPI-CH Procraft on the conservation of WWII aircraft. I founded with 2 conservators, Manuel Leroux and Aymeric Raimon, a participative research project on the use of gels for metals, since 2018. Through these studies, but also through the organisation of national conferences and workshops, I wish to bring together scientists and conservators.



Sotirios Bampitzaris. Born in Athens, Greece in 1992. Studied Conservation of Antiquities and work of Arts in the University of West Attica, with a specialty in metals. Due to growing up in an environment of car mechanics and artist, he grew very fond to the taste of the arts and the curiosity of the engineering world giving him the basic skills for the world of conservation. Hobbies include cooking, exploring the unknown, crafting, painting and photography.



Cesar Escobar Claros is a postdoctoral researcher at the Arc'Antique laboratory in Nantes-France. He works in the European Project PROCRAFT - Project Protection and Conservation of Heritage Aircraft. He received his dual doctoral degree in Materials Science and Engineering from Université Grenoble Alpes in France and Universidade Federal de São Carlos in Brazil. His research interest focus on the corrosion resistance, fatigue behaviour and tribological properties of metallic materials.

Jane Echinard is head of Arc'Antique laboratory, a French studio held in Nantes, specialized in terrestrials and submarines conservation artefacts. She is herself a metal archaeological conservator-restorer, specialized in preventive conservation. She spent 8 years in an archaeological conservation lab from 2004 to 2012, before taking a master's degree in preventive conservation at Sorbonne University. For 2 years, she altered private practice as preventive consultant and teaching before joining the Institut National du Patrimoine (National Heritage Institut) in 2014. For almost five years she was in charge of coordinating the teaching program of student conservators as deputy director of studies. The Inp propose a 5-year training programme that leads to a master's degree in conservation-restoration. For the last 3 years, she is in charge of managing Arc'Antique activities: conservation-restoration practice, research's program, on going teaching and preventive conservation advising within a team of 14 professionals. With Elodie Guilminot, she oversees the coordination of PROCRAFT European project, that aim to explore conservation of aluminium aircraft from World War II

Magali Brunet is a CNRS research scientist in materials science and since 2015 a member of the Cultural and Industrial Heritage Materials team of the CEMES. She studies the manufacturing processes and alterations of historical aluminium alloys, using physicochemical analysis techniques (mainly electron microscopy SEM/TEM, spectroscopies and diffraction techniques). She holds a PhD in microelectronics engineering from Cork University Ireland (2003) and a master's degree in conservation and restoration of cultural heritage from Paris 1 –Sorbonne University (2015).

Port-Jeanne-d’Arc, is conservation of an isolated site possible?

Marie Grima – Terres australes et antarctiques françaises (TAAF)

Port-Jeanne-d’Arc was the only whaling station of France and one of the rare pieces of evidence of industrial seal activity in the sub-Antarctic. The mission undertaken between October 2020 and April 2021 focused on the diagnosis of Port-Jeanne-d’Arc metal remains.

Based in Kerguelen, in the French subantarctic lands. It was built in 1908 by the Norwegian company Storm, Bull & Co on the order of the Bossières brothers. The station dealt with sea mammals, mainly elephant seals but also whales. The oil thus produced was used for street lighting in Europe and North America. The overall result of the project was poor, and the station was closed in 1926.

In conservation terms, Port-Jeanne-d’Arc raises several concerns:

- First, despite the uniqueness of its heritage, the site exhibits typical conservation issues:
 - o The destruction of the site comes from the natural degradation of its materials accelerated by the harsh environment and from looting and vandalism.
 - o The lack of continuity of the heritage missions within the TAAF makes the exploitation of the documentation and the follow-up, difficult.
- Second, the site has the particularity of being located on a nature reserve classified as an UNESCO World Heritage Site:
 - o What are the possibilities of enhancing an isolated site classified as a nature reserve, with limited visitor numbers (less than 50 tourists per year)?
 - o Organising large-scale operations would imply significant logistics, which goes against the desire for a minimum impact on the environment of these preserved territories.
- Finally, the remoteness of the territory does not make it easy to foresee any conservation operation.

The issues raised by Port Jeanne d’Arc appear to be classical industrial heritage issues. It appears that to answer the question of promoting the heritage of the Austral Islands, the conservation of the material itself must be abandoned. Alternative tools should be considered, such as 3D scanning. We also insisted on the need to study the site in all its aspects before its final disappearance. Specific areas of research have been raised and are awaiting a response, particularly on the behaviour of puddled iron, massively used in the base construction.

Keywords: Southern; Whaling; Remoteness site



Marie Grima. From August 2022, Marie Grima will be part of the National Museums Scotland (NMS) as an aircraft conservator at the National Museum of Flight in North Berwick.

Formerly, she developed her skills as a metal conservator in the private company A-corros in Arles, France. A-corros provide a corrosion expertise in the two fields of industry and heritage. A wide range of object types are dealt with: archaeology, industrial heritage, monumental sculptures, contemporary art.

She started focusing on the industrial heritage during a conservation campaign in the Kerguelen archipelago (Terres australes et antarctiques françaises (TAAF), in the Southern Ocean) with the assessment of two industrial sites and the objects collection.

She was trained at the metal workshop of the Institut national du Patrimoine (INP) / National French Institute in Paris, France.

Return of the Space Hoppers – More measures on dH Comet G-BDIX

Thilo Buergel - National Museums Scotland (United Kingdom)

In 2018 National Museums Scotland (NMS) set a development in motion at its National Museum of Flight (NMoF) with the aim to display the three outdoor aircraft, Avro Vulcan XM597, BAC 1-11 GAVMO and de Havilland Comet G-BDIX indoors, the airliners in a new, environmentally controlled hangar and the Vulcan in the existing Hangar 4.

If the development had gone according to plan, all aircraft would have gone undercover by April this year. Due to planning permission issues and the pandemic the project got delayed, with the opening date of the new facility currently unknown.

At Big Stuff 2013 I gave a presentation about short-term emergency measures we carried out on our dH Comet. At the time, we concentrated on making the passenger cabin watertight and rectify damage caused by water ingress and constant use by visitors.

The delay in building a new hangar and thus protecting the outdoor aircraft from the harsh Scottish climate lead to the need to carry out more work on the outside of the aircraft. It also provided the opportunity to take a closer look at the work we carried out on the dH Comet in 2012/13.

In July 2020 we carried out work on the upper fuselages of all three outdoor aircraft, sealing leaks with sealants and aluminium foil adhesive tape.

In November of the same year we applied new bird spikes to the aircraft fins in an attempt to slow down the degradation of the aircraft skins by bird droppings.

As the permanent assistant conservator post at the National Museum of Flight has been deleted in 2015, a temporary, six-months post was created in 2021.

My new colleague Suncana Marochini and I started by removing and re-sealing the Comet's passenger cabin windows whose seals had failed again over the last ten years. Retro space hoppers were taken out of retirement to act as temporary window blanks again.

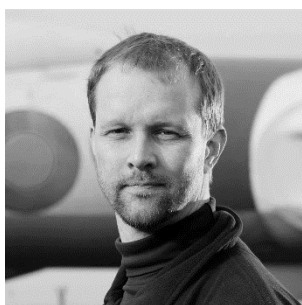
In the 1980s, bitumen based and aluminium foil adhesive tape had been applied to the upper surfaces of the wings to cover gaps and access hatches. We started to replace failing and missing tape with new aluminium tape.

When the weather was not suitable to carry out work on the outside of the aircraft, we carried out conservation work on the interior of the dH Comet. Suncana removed mould from the Cockpit seats and corrosion beneath the windows caused by water ingress into the cockpit. In the passenger cabin seat pockets we restored by replacing worn or torn bungee cords.

For the purpose of developing educated treatment proposals in the future we analysed paint samples of the exterior of the Comet. Details of that analysis are the topic of Suncana's presentation.

This year the museum recruited a fixed-term, two-year conservator post. Together we continue the external and internal work on the Comet, as well as carrying out corrosion treatment on the undercarriage legs of the Vulcan and BAC 1-11 as part of the preparation to move the aircraft into a new hangar, hopefully in the near future.

Keywords: Aviation; Aeroplane; Industrial



Thilo Buergel. My career as a conservator started in 1997 with a two-year internship at the Ethnological Museum in Berlin/ Germany, working mostly on East Asian and African collections. From 1999 to 2005 I studied conservation of technical heritage at the University of Applied Sciences in Berlin. Alongside my studies I completed two internships, one at the German Mining Museum in Bochum and the other one at the War Museum in Thessaloniki/ Greece. In Bochum I participated in a test series for conservation coatings for metals. In Thessaloniki I started to set up a conservation lab at the war museum and preserved an Italian WW2 helmet. Since 2005 I am working at the National Museum of Flight in Scotland, the first three years as an Assistant Aircraft and Technology Conservator and since 2008 as an Aircraft and Technology Conservator. My work consists mainly of conserving and maintaining aircraft and aviation related objects but at times of working on other technology objects, like lighthouse optics and typewriters.

Deep Impact: Analyzing a De Havilland Comet's Historic Paint Layers

Suncana Marochini - The Getty (United States); Lore Troalen - National Museums of Scotland (UK)

A De Havilland Comet is one of three aeroplanes exhibited outdoors at the National Museum of Flight (Scotland), which has created different conservation challenges over the years, as the aeroplane is subjected to a harsh and uncontrolled environment. Unfortunately, a plan to relocate the Comet indoors had to be postponed, leaving conservators with only the option to maintain the condition of the aeroplane in situ. However, due to the rapid deterioration of the aeroplane's exterior, the question of the sustainability of current practices and acceptable invasiveness of future treatment has been posed.

A recent paint analysis using digital microscopy, SEM-EDS, and micro-FTIR revealed the presence of well-defined historical paint layers on the Comet. However, as a direct consequence of its exposure to the elements, the underlying metal substrate was rapidly degrading and visibly affecting the paint layers.

These revelations posed a question of which approach should be taken in the future, as conservators will have to choose whether to prioritize the Comet's long-term stability, its aesthetic, or its historical values.

With no updated plans for moving Comet to an indoor controlled environment, options to slow down the degradation process seemed to be more in favour of stripping the paint and creating a good substrate for newly applied primer and aviation-grade paint. Although this would provide a more sustainable option in the long term by preventing the loss of substrate, implementing this treatment option would not allow for the historic layers to be preserved. Therefore, the option of preserving a small section of the fuselage of the aeroplane to showcase the historic layer was offered as a solution. This case study hopes to showcase the importance of analysis when planning future treatments and to initiate a discussion of difficult decision-making involved in the future treatment of Comet.

Keywords: Paint analysis; Outdoor heritage; Decision making; Aeroplane; Exterior deterioration; SEM-EDS; Micro-FTIR; Paint layers; Aviation collection



Sunčana (Sunny) Marochini completed her BA in Conservation of Metal Artefacts at the University of Dubrovnik (Croatia) before moving to the UK to complete her MA in Principles of Conservation and MSc in Conservation for Archaeology and Museums at University College London. During her undergraduate studies, she participated in a foreign exchange semester at the Technological Educational Institute of Athens (Greece) and attended metal conservation classes at the Palazzo Spinelli Group in Florence (Italy). She took part in field schools, archaeological projects, and internships in Stobi (Republic of North Macedonia), Sanisera (Spain), Sarouq Al-Hadid (United Arab Emirates), and the American School of Classical Studies in Athens (Greece). During her MSc, she completed a one-year internship at National Museums Scotland, where after graduating, she worked as an Assistant Engineering Conservator at the National Museum of Flight. Recently she completed her one-year graduate internship at the Antiquities Conservation Department at the Getty Villa (United States). She is very fond of archaeological conservation, with a great interest in modern conflict archaeology, and conservation of difficult heritage, dynamic objects and industrial heritage.

Lore Troalen holds a PhD in analytical chemistry from the University of Edinburgh and has been working as an Analytical Scientist at National Museums Scotland since 2005. She has expertise in the applications of non-invasive and micro-destructive techniques for the study of museum's collections.'

Water Museum – Research and preservation of Industrial Heritage

Bárbara Bruno – EPAL – Water Museum (Portugal)

The role of water supply infrastructures is critical to the development of modern societies. With a historical chronology attested by a diversified and surprising collection, the history of water supply in Lisbon is made of advances, setbacks and adversities. This history is gathered at the Barbadinhos Steam Pumping Station, the headquarters of the Water Museum, whose mythical strength comes from this same history, identity and patrimonial authenticity and is shaped in the building, the machine, the sound, the color and the smell. Hardly, any building would be more appropriated to embody the memory of water in Lisbon.

The Barbadinhos Steam Pumping Station was projected to elevate the waters of the Alviela river. It was inaugurated on the 3rd of October of 1880 and it was deactivated in 1928 when the new electric pump was inaugurated.

In 1918, when the department of "drawing, archive, library and museum" was created and in 1950 when the noble body of The Barbadinhos Pumping Station was preserved, Companhia das Águas de Lisboa was already giving steps to safeguard the building and the memory of water. In 1990 the preservation of this collection was awarded by the Council of Europe and, in 2010, Barbadinhos was classified as a Public Interest Set (CIP).

In 2014, the noble building of Barbadinhos suffered some rehabilitation works and some problems that had been previously detected in the walls and ceilings of the noblest area, namely: infiltration's, ink detachments, stains and dirt, were solved in the intervention performed, improving the energy efficiency of that space. Issues such as oxidation of metal parts, lubrication and cleaning of machines and the treatment of metal elements were not addressed because specialized work was considered.

The awareness that these values cannot and should not be neglected led the Water Museum to seek a company specialized in Industrial Heritage Conservation and in daily maintenance of buildings and museum facilities.

In 2017, aiming to return the steam engine to its structural integrity, the Water Museum contracted Versatile - Industrial Archaeology and Museum Maintenance, a company with extensive experience in the area of conservation of buildings related to industrial heritage.

The interventions, carried out between 2018 and 2021, detected anomalies resulting from deterioration processes suffered over time, either due to natural damage or from accident or misuse. The anomalies identified were related to several pathologies of degradation of materials that constitute them and that presented themselves as harmful.

The fundamental objective of the conservation process, was to return the structural and aesthetic integrity to the machine, preserving the marks of use as a testimony of the time of operation.

Therefore, all the work carried out on noble metals (copper and brass) and in glass and wood, was prioritized, highlighting the beauty and aesthetics of the machine.

Keywords: Water; Museum; Industrial Heritage; Lisbon; Preservation



Bárbara Silva Bruno. Graduated in History, Master in Heritage Studies and PhD student in Contemporary History at the Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa.

She works in the Water Museum since 1998 as a researcher and an educator regarding the water heritage. She was part of the team who made the application for the Águas Livres Aqueduct attempt list for World heritage. Vice-President of APAI - Portuguese Association of Industrial Heritage. Associate Researcher at the Institute of Contemporary History of the Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa. Author of several papers on topics in which she develops her professional activity.

Dilemmas in preservation of functional objects in museums: the role of documentation in safeguarding of musical instruments collections

Cláudia Furtado - FCSH-UNL (Portugal)

The conservation of scientific and technological objects is still a recent practice when compared with other heritage disciplines. In this paper, it will be considered that musical instruments are, in general, functional objects with similar preservation and documentation problems as other industrial and technological heritage. Musical instruments are functional objects - and by that term "functional", it means these objects were made to be used - they have a practical function. Musical instruments were not designed to be looked at, but to produce some sort of vibration that creates sound and music. Inside of museological context, this primary purpose can be momentarily recovered when the musical instruments are played at concerts.

According to J. R. Watson, in 1993, "there exist two opposing views about the use of preservation of antique musical instruments." Four years later, in Robert L. Barclay's book "The Care of Historic Musical Instruments", we found a first chapter dedicated to the ethics and use of instruments, with guidelines that define under what conditions an instrument should be played. Further ahead, in the same document, the criteria that make up the basic maintenance of played instruments are presented.

This problem is not recent, despite the current discussions centered on the theme - twenty years later and the same dilemmas are discussed at international conferences. In 2017, in a CIMCIM Bulletin, Arnold Myers argued that "the use of musical instruments for concerts or other types of events that involve the music reproduction is not sustainable in the long term", and it is also true that it constitutes "a unique experience - both for those who play it and for the audience - promoting the intangible dimension of musical instruments". Three years later, the International Committee of Museums and Collections of Instruments and Music (CIMCIM) and the International Committee for Museums and Collections of Science and Technology (CIMUSET) organized a conference about "Playing and Operating: functionality in museum objects and instruments" which brought together a series of articles on the ontology and interpretation of functional objects, good practices and risk management, and finally, the functionality of objects in the 21st century. The main objective of this collaboration between the two committees was to define guidelines for the conservation and access of musical instruments permitted to be played.

When a museum decides to use some of the musical instruments of their collections to be played, the documentation procedures to deal with the management of conservation processes and experts reports becomes particularly important. These procedures should be capable of gathering in one place all the information considered relevant, which is necessary to record under what circumstances the decision to play the musical instrument was taken. According to Myers, the documentation that comes from these activities - concerts or other events - should be "used as part of the instrument's history, being easily lost if not properly recorded".

For this communication, it is proposed to present the two points of view and the latest opinions of specialists - conservators, musicologists, historians - and how documentation can be imperative to prevent the loss of irretrievable information.

Keywords: Documentation; Conservation; Museums; Musical instruments; Functionality; Musical heritage



Cláudia Furtado was born in Barreiro in 1995. She graduated in Art and Heritage Sciences in 2017, at Faculty of Fine Arts, University of Lisbon (FBAUL). In 2021, took the Master's in Museology at Faculty of Social and Human Sciences, New University of Lisbon (FCSH-UNL), with the presentation of a project work entitled "Documentation and inventory of the musical instruments collection of the Museu Nacional da Música: diagnosis and contributions to the development of a procedures manual from the perspective of an integrated information system".

While studying for her master's degree, she successfully completed the MOOC type course "Essential Digital Skills for Museum Professionals" and, in 2020, the specialization course in curating digital collections, both promoted by the Mu.SA - Museum Sector Alliance Project. In this same year, she collaborated with the Museu Nacional da Música, in the documentation and inventory of the instrumental collection, to develop the review and application of the procedure manual in the context of work.

Currently, she is a PhD student and FCT fellow in Art History - Specialty in Museology and Artistic Heritage, at FCSH-UNL. The investigation is still based on the collections of musical instruments, focusing on the challenges of documenting musical instruments used in performance initiatives promoted by museum institutions.

The preservation of two historic harbour cranes in Hamburg – an interplay of conservation and restoration

Eva Wentland – Freelance conservator /BAM – Federal Institute for Materials Research and Testing (Germany); Jaßmann Ronny – Freelance conservator (Germany)

The subjects of this contribution are two historic cargo cranes from 1939. They are located at the waterfront of the river Elbe in Hamburg directly opposite of a highly modern container terminal. This opens a beautifully anachronistic picture, emphasizing the immense technical and logistical progresses which have led to the global phenomenon of containerization. The type of historic cargo crane has built the foundation for Hamburg's reputation of a "fast harbour". Constructed shortly before the outbreak of World War II, they hold all the technical refinements of their time even though they seem crude to us today. The efficiency of the design is also reflected in their mass production: several hundred cranes of this type were working to load and unload cargo vessels in the 1930s.

These two specimens have been in service until the mid-1980s.

The concept of preservation for the technical monuments followed two lines.

The inside – engine house and driver's cabin – was conserved following the ethical ideas of authentic conservation processes. Traces of decay and neglect were taken back as far as possible. The aim was to achieve a well-kempt authentic appearance, which helps to transfer the observer directly into the past. The surfaces of metal and wooden objects were cleaned and conserved, loose coatings were readhered and consolidated, findings were secured – such as a set of liquor glasses, coke cans or leather boots. The outside metal surfaces had to be repainted, as demanded by the foundation of historic museums Hamburg. Thus, a reconstructive restoration was carried out by overcoating. However, the overcoating of historic structures poses critical problems as riveted structures always comprise of lap joints between the constructive components. They act as focal points for corrosion mechanisms as they suck up water by capillary action, saving it in the hydrophilic structure of the corrosion products leading to severe crevice corrosion. As a consequence, we applied a system comprising of a dewatering fluid and a cross-linking oil-based alkyd in order to deeply penetrate into lap joints, conserving them from the inside. Based on this foundation a pigmented coating system was applied following the recommendations of German standard DIN 12944.

To ensure permanent corrosion protection critical interventions into the original substance had to be made. For example, the bottom 30 cm of the strongly corroded steel sheet cladding of the revolving superstructure were opened in order to inspect the statically important steel framework. It was cleaned, toughened, and conserved before the cladding was closed again.

Keywords: Industrial Heritage; Conservation and restoration; Overcoating; Harbour crane; Dewatering fluids

The conservation process in an industrial context in Barreiro, the legacy of a past. The case of the Baía do Tejo.

Ana Paula Gonçalves - Baía do Tejo S.A. (Portugal)

Baía do Tejo was born from a group of companies that were once large industrial complexes and that had a strong impact on the Portuguese economy during the 20th century. In the particular case of Parque Empresarial do Barreiro, namely with the business groups C.U.F. and Quimigal, the on site conservation process takes place while still in industrialized territory. From the awareness of the value of the property, to the processes of conservation and safeguarding, it is possible to make a chronological journey with regard to some objects, without forgetting their stakeholders. As it was a territory that housed different types of industries - including the basic industries (fertilizers and oils) -around which these different branches of activity were developed which resulted in numerous objects currently on display in the Industrial Museum. What were the selection criteria? What has been preserved? Who saved and how? What was exposed? The aim of this communication is to chronologically understand the facts, methodologies and criteria that have brought the Industrial Museum to the present day, taking as one of the examples the textile exhibition area, without forgetting the historical facts and the processes of change that this territory was targeted.

Keywords: Industrial heritage; in-situ conservation; Territory; Industrial complex; Musealization



Ana Paula Gonçalves. Professional Experience: 2014-Present- Museology Technician- Baía do Tejo. 2010-2013- Museology and Heritage Technician - Castelo de S. Jorge. 2007-2008- Internship in Museu Nacional de Arte Contemporânea (Museu do Chiado).

Academic Education: 2015-2018- Master's Degree in Museology- Faculdade de Ciências Sociais e Humanas at Universidade Nova de Lisboa. Work project entitled "Baía do Tejo Industrial Museum, Barreiro: Diagnosis of the permanent exhibition and reprogramming proposal". 2004-2008- Graduation in Art History- Faculdade de Ciências Sociais e Humanas at Universidade Nova de Lisboa. 2007- Erasmus- Università Degli Studi di Parma/ Lettere e Filosofia, Parma. 2003-2004- Attended Visual Arts, 1 year in Sculpture- Faculdade de Belas Artes at Universidade de Lisboa.

PAPER TRAILS: Post-industrial histories, technical memories and art practices in Tomar. A project to rescue the past of the paper industry

Renata Faria Barbosa - ISCTE-IUL, ISTAR, Techn&Art; Fernando Costa - Techn&Art, Instituto Politécnico de Tomar (Portugal)

The industrial importance of Tomar was highlighted in 1971 by João Miguel dos Santos Simões, former owner and technical director of the Real Fábrica de Fiação, who tried to create a Historical Museum at the factory (FILIFE, 2019). Between the end of the 19th century and the middle of the 20th century, the industry reached its peak in the county, driven by its strategic location (CAMPOS, 1947). Many of the industries were specialized in paper production and they used cotton waste from the Real Fábrica de Fiação and the Nabão River as a source of energy production (BARBOSA, et al., 2019) (DIAS, 2019).

In 1978 the 1st Industrial Archeology Exhibition took place in Tomar at the Power Station Building (SEIXAS, et al.) (CUSTÓDIO, et al., 1986); in this exhibition references were made to the importance of the industrial paper mills heritage of the Prado, Marianaia, Sobreirinho and Porto de Cavaleiros (FOLGADO, (s.d.)) (GUIMARÃES, 1985). Despite the efforts made since the 1970s to maintain Tomar's industrial heritage, many of the industrial buildings are deactivated, which goes against today's policies of industrial architectures' reconversion for tourism and cultural development of the region (BARBOSA, 2015).

The International Project PAPER TRAILS: Post-industrial histories, technical memories and artistic practices in Tomar, proposed to bring together a group of specialists, artists, researchers, representatives of local authorities and representatives of the local population to promote the debate on deindustrialization, in particular the Closing of the paper mills in Tomar. The project proposal aims at organizing a joint Symposium by TECHN&ART, an R&D belonging to the Polytechnic Institute of Tomar (IPT - PORTUGAL), and by the École de design et Haute école d'art du Valais (EDHEA SWITZERLAND) focusing on post-industrial sites in a transdisciplinary environment. Given Tomar's industrial past and EDHEA's experience with the project Art Work(ers) (<https://edhea.ch/en/projets/art-workers>), which examines possible exchanges between industrial economy, heritage(s) and certain artistic practices, the possibility to further and jointly explore this research interest would be welcome.

In line with the International Symposium, we seek to explore a plurality of voices, former members of the workforce, former factory managers and representatives of local associations through the creation of a documentary to be shown in May 2022 together with the International Symposium.

An online course on industrial histories and artistic practices was created in partnership with EDHEA, with guests specializing in conservation and restoration, museologists and plastic artists. The first course was exclusive to EDHEA and IPT students, with the possibility of a second cycle.

And finally, the project also includes the publication of a special issue of the specialized magazine GE-Conservación, where it will be possible to reflect at the most academic level on the subjects covered in the Symposium, documentary and course on industrial heritage and the most creative forms of intervention of the same.

The Paper Tralis Project, which began to be developed in June 2021 and ends in July 2022, has a multidisciplinary team associated with Techn&Art and EDHEA. The expected social results of the project are to raise awareness for the protection of industrial heritage, showing similar solutions in obsolete infrastructures that have been reconverted. Giving voice to former workers through cinema and interviews, inviting them to relive industrial memories. Reviving the debate on deindustrialization and its local consequences, calling on the population to participate in the construction of solutions.

Keywords: Pos-industrial histories; Technical memories; Art practices; Paper factories; Participatory project

ABSTRACTS



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Things rust but memories last forever. Creative Conservation in the industrial heritage

Ânia Chasqueira, Ricardo Triães and Ângela Ferraz - Techn&Art (Portugal)

This paper aims to discuss how the Creative Conservation methodology can be applied in the preservation of industrial heritage. This methodology aims to contribute with an innovative perspective for the preservation of equipment and industrial buildings. Adequate preservation planning is a complex task as a consequence of its multiple meanings and values. Old factories are landmarks in the urban landscape, recalling a lost past and are symbols of the labour which took place there. They are part of the collective memories and identity of a town, a village, or a former industrial area. In this way, industrial heritage conservation must address the complexity of these collective cultural memories. The ongoing research, about Companhia Nacional de Fiação e Tecidos de Torres Novas (Torres Novas Nacional Spinning & Weaving Co., Portugal), aims to understand the needs for its preservation. What memories remain after a decade its closure? What values does the community intend to defend and how? What is important to preserve? What is most important to the community? From the factory assets that are still preserved, a project involving the local community will be created. Knowing that cultural memory is an ongoing process of remembrance and forgetting, in which individuals continue to recreate their relationship to the past and, in this case, to reposition themselves in relation to the old industrial places, this project aims to creatively contribute to the conservation of both: cultural memories and industrial heritage.

Keywords: Industrial heritage; Creative conservation; Preservation; Community

ABSTRACTS



Ânia Chasqueira is a researcher at TECHN & ART (IPT, Portugal) with a PhD research grant funded by the Portuguese National Funding Agency for Science, Research and Technology (FCT; UI / BD / 151231/2021). She is a PhD student in Heritage Studies at the University of Algarve. She is currently dedicated to the study of Intangible Heritage and research on sustainable development and creative conservation.



Ângela Ferraz has a degree in Conservation and Restoration (2001) from the Polytechnic Institute of Tomar (IPT), a Master in Museology and Cultural Heritage (2009) from the Faculdade de Ciências Sociais e Humanas - Universidade NOVA de Lisboa (FCSH-UNL), and a PhD in Conservation and Restoration of Cultural Heritage - specialisation in Theory, History and Techniques, from the Faculdade de Ciência e Tecnologia - UNL. He is currently visiting professor at FCSH-UNL and researcher at TECHN & ART (IPT, Portugal).



Ricardo Triães has a PhD in Geotechnologies. He is an Adjunct Professor at IPT in the Department of Archaeology, Conservation and Restoration and Heritage. He is an integrated researcher and member of the Board of TECHN & ART (IPT, Portugal). He is director of the Conservation and Restoration Laboratory (LCR.IPT), director of the Conservation and Restoration Degree at IPT, and is responsible for classes in conservation and restoration of ceramics, archaeological materials, and integrated heritage.

Photogrammetric Model of the Mariana Paper Factory, graphic recording methodology for deactivated factories.

Renata Faria Barbosa - ISCTE-IUL, ISTAR, Techn&Art; Fernando Costa - Techn&Art, Instituto Politécnico de Tomar; Ruben Portinha - Instituto Politécnico de Tomar (Portugal)

Until the 20th century, the municipality of Tomar had an expressive industrial dynamic. We can mention factories of national importance such as the Royal Spinning Factory of Tomar, Mendes Godinho Industrial Group or Prado Paper Company, among others (FRANÇA, 1994). Many of these factories influenced urban development and territorial occupation (DIAS, 2017).

The industry in Tomar had different typologies, spinning, mills, electricity production, etc. Paper production stood out quantitatively in the territory. There were five paper mills along the Nabão River, all of which are currently deactivated. One of these factories is in Marianaia and belonged to Companhia de Papel do Prado. In 1874, the Count of Vila Nova da Rainha was administrator of the Marianaia Paper Factory, where 66 women and 36 men worked (ROSA, 1982). In 1940, it had 110 workers and produced 500 tons of paper and cardboard, ending in 1971 (ROSA, 1982).

This building complex is located on a plot of 11.79 hectares with eight independent buildings, on the left bank of the Nabão River (BARBOSA & GENIN, 2019). The main building, where two hydraulic wheels worked and where the pulp preparation tanks still exist, has about 1200m². This scenario of large buildings located on large land is very common in the study of industrial heritage, which characterizes a great difficulty at the time of registration or intervention of these buildings.

Photogrammetry can be a great ally in registering large structures more efficiently and more economically than laser scanners, since a camera and a computer are more accessible resources. In this way, the study intends to explore the methodology used to create the three-dimensional model of the Marianaia Factory, so that it can be replicated in other deactivated industrial contexts and thus be intervened, inventoried and/or safeguarded.

For the study we explored open-source software; Meshlab, Freeware and 123D Catch and others with paid licenses such as Agisoft Metashape or 3DF Zephyr, however the methodology used for gathering and processing information is similar in all software. The results obtained with the study were point clouds of the entire building, from which several relevant information were extracted, such as orthophotos of the land and the building's implantation, rectified photographs of the elevations, cuts that help the understanding of the building, etc. There are countless possibilities for studying the morphology of the construction through the three-dimensional model created.

It is hoped that this study will create an efficient methodology for the study, diagnosis and documentation of large buildings, such as those existing in the industrial heritage. This documentation can be used for registration, but also as a basis for possible interventions.

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Keywords: Photogrammetry; Graphic documentation; Three-dimensional registration; Industrial buildings; Architectural morphology

ABSTRACTS



Renata Faria. Architect and urbanist from Mackenzie Presbyterian University, São Paulo. She also holds a European Master in Prehistoric Archaeology and Rock Art, sponsored by an Erasmus Mundus Scholarship. She is currently a PhD Student in Architecture of Contemporary Metropolitan Territories, ISCTE - Lisbon University Institute/ ISTAR-IUL with an FCT Grant SFRH / BD / 129702/2017, and is developing a thesis titled: Diagnostic Survey and Rehabilitation of Tomar Industrial Heritage. She is a Collaborating researcher at TECHN&ART and prior to that, she worked at the National Historical and Artistic Heritage Institute - IPHAN / SP 2004-2007. Her research is related to cultural heritage and industrial heritage in Brazil and in Portugal.

Big Objects, Big Training

Caitlin Walsh, Skye Marshall and Jessica Lafrance-Hwang– Ingenium (Canada)

Ingenium operates Canada's Museums of Science and Innovation - three national museums in Ottawa: the Canada Museum of Science and Technology, Canada Aviation and Space Museum, and Canada Agriculture and Food Museum. The national collection comprises over 85,000 objects representing Canada's technological and industrial history. In the midst of our multi-year collections move, our department welcomed two conservation interns. Deciding to take a different approach than in the past, we committed to improving our current training program for emerging conservators with a larger goal of becoming a center for professional development.

We facilitate the growth of emerging professionals through supervised treatments of a wide variety of objects. Working with a high level of independence, they investigate complex condition and ethical issues that are unique to industrial and technological collections. They explore the objects and recommend their own treatment pathways. All of this assists them in building and owning their professional confidence, creating a great foundation for work in any area of conservation. With experiences as diverse as the collection itself, their training proved to be meaningful and immensely rewarding for everyone involved;

As an intern, Skye Marshall worked on remediating hazardous material on oversized industrial machinery and preparing the medical and dental collections. Her internship included conversations about emotionally sensitive materials in the collections. Continuing beyond her internship to research how emotional accessibility and trauma informed practice has a role in conservation, Skye has observed how the culture has changed as the department shifts to a more human-centered approach. The confidence she gained as an intern enabled her to pursue this research, while also taking on complex projects as part of the collection move, including research regarding PCBs in museums, radioactive storage, and large object treatments such as the drummondville transmitter.

Caitlin Walsh began her internship working on small treatments, and preparing sensitive composite objects for cold storage, creating new protocols for different material types. Looking to the future, she conducted research regarding the preservation of digital objects. With the help of Skye's research, Caitlin also dealt with the human nature of wax moulages and how these objects can be approached through the lens of human conservation. As a result of the experiences during her internship, Caitlin has gained the confidence to make complex ethical decisions while dealing with objects from industrial disasters. She has also updated hazard management protocols to keep the collection safe and accessible. Caitlin continues to work in the industrial collection by preparing objects and completing hazard mitigation and remediation as a part of the move.

Hosting and working with interns has allowed our established conservators to revisit everything they know about their trade, giving them the opportunity to reframe their work and decision making. We are inspired to go bigger with our training - our collection is filled with objects created from big ideas, why not allow people to create in our space? By expanding what Ingenium can offer, with a diversity of people and ideas, we hope to broaden the profession and continue to establish our institution as a center for research and innovation.

Keywords: Training; Research; Innovation

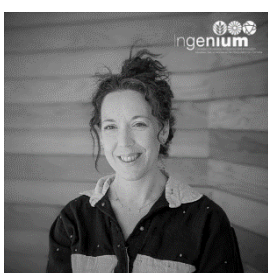
ABSTRACTS



Caitlin Walsh is currently an Assistant Conservation Technician with Ingenium – Canada’s Museums of Science and Innovation. Ingenium is comprised of three national museums and their collections, the Canada Science and Technology Museum, the Canada Aviation and Space Museum, and the Canada Agriculture and Food Museum. Caitlin is an emerging conservator with an Advanced Diploma in Applied Museum Studies from Algonquin College, Canada, where she specialized in object conservation with an internship at the Canada Science and Technology Museum. She also holds an Honours Bachelor of Social Science in Anthropology and History from the University of Ottawa, Canada. Caitlin’s areas of interest include all types of objects conservation, with a specific focus on hazard mitigation, modern materials and composite objects. Throughout her time at Ingenium, Caitlin has completed treatments on composite objects, created cool storage protocols for modern materials, updated hazard management storage requirements, and liaised with other institutions on hazard management. As a part of the collection relocation project, Caitlin has assessed over 10,000 objects, identifying over 700 hazards including asbestos, pesticides, cadmium, lead, biohazards, radiation and PCBs.



Skye Marshall is an Assistant Conservation Technician with Ingenium – Canada’s Museums of Science and Innovation. Ingenium is located in Ottawa, Ontario, and is comprised of three national museums and their collections; the Canada Science and Technology Museum, the Canada Aviation and Space Museum, and the Canada Agriculture and Food Museum. Skye completed an Advanced Diploma in Applied Museum Studies from Algonquin College, where she specialized in object conservation with an internship at the Canada Science and Technology Museum. She also holds a Bachelor of Humanities with combined honours in Humanities and Religion from Carleton University. Her research interests include hazardous materials in heritage collections and trauma informed conservation and museum practices. Skye recently presented at the 2022 CAC conference, where she co-presented, “‘Don’t you know that you’re toxic?’ Identification and hazard mitigation of Polychlorinated biphenyls (PCBs) during a large-scale collections move.”



Jessica Lafrance-Hwang (she/her) is a CAPC accredited Conservator specializing in Objects. She holds a Master of Art Conservation (M.A.C), Queen’s University Conservation (2013); BSc Conservation of Objects in Museums and Archaeology, Cardiff University (2007); and Diploma in Applied Museum Studies, Algonquin College (2005). Jessica is experienced in treatment, technological, scientific and industrial collections, hazard management, modern materials, and collection relocation.

Replacement of cast iron piers on an 1886 wrought iron truss bridge in New South Wales, Australia – the challenge of ensuring retention of heritage significance whilst undertaking major rehabilitation work on a heritage road bridge

Claire Everett - New State Environment and Heritage (Australia)

The Namoi River Road Bridge at Manilla in NSW is a rare and state significant heritage wrought iron lattice truss road bridge designed by the eminent colonial bridge engineer John A McDonald. The bridge represents a significant engineering achievement and financial investment for the Colony of NSW at a time when the vast majority of road and rail bridges were constructed from timber and all wrought iron had to be imported.

The bridge is a large, high-level crossing over a wide river with a severe flood regime. It is an 11 span lattice truss structure with five main spans and six approach spans supported on cast iron piers. The five approach span piers have a history of settlement, with routine bridge inspections recording general differential settlement and pier rotation and cracking at the cross brace connections between the pier cylinders since 1949. A bridge load performance test undertaken in 2017 found that the pier foundations were insufficiently firm, that there was settlement-related cracking in the pier columns and the diagonal braces on all the approach span piers and that some structural steel members were unduly loaded because of differential settlement. The differential vertical settlement also resulted in variations to the alignment of the approach span undertrusses and an uneven ride on the bridge deck. It was recommended that Piers 1-5 be underpinned to prevent further settlement, that the original vertical alignment of the piers be restored and that all damaged pier elements be repaired or replaced.

The underpinning was successful, however given the extent of cracking observed in the pier columns whilst attempting to restore the vertical alignment, a decision was made to fully replace the damaged piers.

This paper explores how the need to repair the bridge in order to maintain a vital piece of road infrastructure was balanced against the need to respect the heritage significance of the structure and to undertake the work in such a way that the bridge could continue to operate without load restrictions, halt the ongoing settlement of the piers and return the approach spans to their original alignment, and incorporate new elements into the structure without compromising its heritage significance.

Keywords: Bridge; Conservation; Repair

ABSTRACTS



Claire Everett BA (Hons), M. Environmental Planning, is the Director of New State Environment and Heritage. Claire is a heritage and planning consultant with over 20 years' experience in the management of heritage issues relating to the maintenance, upgrade and repair of heritage transport infrastructure, in particular bridges.



Alexander Rosnell B.Eng (Hons) is a Project Manager with Transport for NSW. Alexander has 11 years' experience with Transport for NSW, with the past 9 years spent developing and delivering bridge maintenance and upgrade works including works on timber, concrete, steel and wrought/cast iron bridges within Northern NSW. Alexander is interested in practical solutions to extend the operational life of bridge structures whilst being cognisant of their surrounding technical and environmental significance.



Malcolm Rankin B.Eng (Hons), is a Structural Design Engineer at CDE Design Solutions with a broad interest and experience in bridge design and rehabilitation of bridges to extend their lifespan. Now retired.

The Desert in the Dry Dock: Practicalities, Challenges and Environmental Sustainability of Desiccation on a Grand Scale

Nicola Grahamslaw - SS Great Britain Trust (United Kingdom)

Launched in 1843, Isambard Kingdom Brunel's SS Great Britain was the first ocean-going vessel to be driven with a screw propeller and the first to be made from iron, allowing her to be significantly larger than had previously been possible. She survived being run aground early in her career and went on to enjoy an extraordinarily long working life, thanks to the strength and longevity of this exciting new shipbuilding material and technique. Salvaged from the Falkland Islands in 1970, she was returned to the original Bristol dry dock in which she was constructed, the combination of ship and dock creating a site of international importance which has since been almost continuously accessible to the public.

On her return to Bristol, the SS Great Britain was cared for by traditional engineers but corrosion, accelerated by chlorides in the wrought iron structure, meant that without intervention the ship would soon become structurally unsafe and original fabric irretrievably lost. Research commissioned at Cardiff University determined that by keeping the surrounding air at 20% relative humidity the aggressive chloride-accelerated corrosion could be controlled.

Between 1997 and 2005 an award-winning, first-of-its kind conservation system was developed, converting the dry dock and ship's interior into a climate-controlled envelope to preserve the most vulnerable parts of the wrought iron hull while allowing visitor access. A water-covered glass "sea" at waterline level creates a seal, with two bespoke desiccant dehumidifiers treating the air inside and underneath the ship. By "slowing down time" in this way, the curator-led multi-disciplinary conservation and engineering project has extended the life of the ship to more than 100 years.

Since 2018 a new programme of work has been underway to review and optimise the effectiveness of the complex environmental control system that secures the conservation of the SS Great Britain. The practicalities and challenges of maintaining a controlled environment on a 100-metre scale, allowing the ship to be preserved in-situ, are being addressed. Upgrades to the desiccation plant's controls and instrumentation have provided new insight into the system's behaviour, allowing both the performance and reliability to be improved.

The conservation system relies on natural gas for the drying action of the dehumidifiers, and electricity for the fans circulating the air. With the SS Great Britain Trust declaring a climate emergency and committing to become carbon neutral by 2030, the carbon footprint of the system is now also being targeted for reduction. Tasked with the challenge of making conservation more environmentally sustainable, the Ship's Conservation Engineer leads a programme of research, adaptation and optimisation to reduce energy and fossil fuel usage, while reviewing the feasibility of alternative energy sources for the longer term. Cross-disciplinary collaboration with climate action groups across the city and the sector working towards a common goal has allowed progress to be accelerated.

The dehumidifiers have been retro-fitted with new energy-efficient fan and heat recovery technology. Combined with optimisation of the controls, these improvements have both directly reduced emissions and altered the heat demand profile of the desiccant drying system. This change is particularly significant because it introduces the possibility of the system overcoming reliance on natural gas, becoming a candidate for future electrification and hence decarbonisation.

Placed on display as a key aspect of the visitor experience, the ship's continuing innovative conservation is becoming part of her engineering story. Conservation develops a synergy with the ship that effectively contributes to preservation costs by enhancing visitor numbers. Audience and stakeholder engagement is being harnessed to secure support for future conservation activities.

Keywords: Maritime heritage; Ship; Dry dock; Industrial Heritage; Carbon Neutral; Heritage Science; Engineering; Engineering Heritage; Corrosion; Public Engagement; Collaboration; Controlled Environment; Decarbonisation; Environmental sustainability; Energy efficiency

ABSTRACTS



Nicola Grahamslaw is a chartered Mechanical Engineer, working as a design analyst and project engineer in the aerospace and nuclear energy industries prior to her recent move into heritage conservation. In 2018, she was appointed to the newly created "Ship's Conservation Engineer" post at Brunel's SS Great Britain in Bristol. In this role she is reviewing the effectiveness of the ship's current conservation system, first put in place in 2005, and developing a sustainable conservation strategy for the future care of this unique object. This role includes helping the museum become more environmentally sustainable by improving energy-efficiency and reducing emissions. A Member of the Institution of Mechanical Engineers and the Women's Engineering Society, Nicola volunteers as a speaker at schools and events, and as a mentor providing guidance on career choices and professional development. Nicola was named one of the Telegraph's "Top 50 Women in Engineering" in 2018, and the Institution of Mechanical Engineers "Young Member of the Year" in 2019.

Conservation of 20th century artillery: An investigation into high performance coating systems

William Smith - Cardiff University; David Watkinson - Cardiff University; Paul Lankester - English Heritage; Nicola Emmerson - Cardiff University; David Thickett - English Heritage; Ian Leins - English Heritage (United Kingdom)

As a small island nation, Great Britain historically concentrated military architecture along the coastline, designed to resist invasion, support out going military ventures, and commercial trade interests. Many of these sites have been fortifications since the Iron age with much of the current defences built in the 1500's. After the retirement of coastal defences in the 1960's many were turned over to English Heritage to manage, maintain, and ensure the retention of their history and appeal to visitors. Since this time English Heritage has also cared for many ordinance pieces relevant to these sites, from wrought iron cannons of the 16th century to modern artillery pieces of the First and Second World Wars. The location of the sites leaves these pieces vulnerable to an aggressive coastal environment, or within old buildings with no environmental control. The historical significance that the guns both gain and give to the sites, through their shared history, means that relocation to a more stable and controlled museum environment at another location would damage the tangible and intangible aspects of the site. A Collaborative Doctoral Project (CDP), Co-supervised by English Heritage and Cardiff University, is focussed on the 20th century ordnance pieces managed at English Heritage coastal sites. These are split into three groups based on their function; coastal guns, anti-aircraft guns, and field guns. These are predominantly used to tell the story of the sites through the Second World War, and their significance during the battle of Britain, and the invasion of Normandy. The PhD study will focus on their composition, historical context, significance, and condition, while also assessing English Heritages current maintenance practises, and the protective coating systems used to protect them from the aggressive environment.

Over the years a number of systems have been used across the collection, with different sites having different preferences for contractors and systems. Many of the systems used were selected due to anecdotal assessments of their performance and previous experience of the heritage professionals involved. The projects aim is to offer more tangible, evidence-based guidelines for treatment by combining management variables and restrictions with experimental data, generated in field and laboratory experimentation on selected coating systems applied to analogues.

Field experiments will see analogues exposed at two coastal sites, physical and chemical properties will be tested after measured intervals. The same testing will be carried out on analogues exposed to accelerated aging, allowing for comparison and prediction of future deterioration. The analysis methods will include pull-off testing, gloss measurements, colourimetry, Fourier transform infrared spectroscopy, Raman spectroscopy, oxygen consumption, and Electrochemical Impedance Spectroscopy.

The results of the performance of the coating systems, along with the assessment of the condition of the guns will be used as the bases of a guide for English Heritages Conservators. Rather than being strict guidelines it will create room for modification based off the sites needs, allowing for pragmatic and nuanced recommendations to suit English Heritages corporate structure while still providing evidence-based treatment plans. This may modify recommendations when compared to using only experimental data.

It is assumed that the best performing coating in terms of longevity will often be preferred, however other factors and restrictions will need to be considered to best meet the end user needs. These will include cost benefit, ease of application and maintenance, cost of treatment, and site location and accessibility. Overall, this research will begin to provide English heritage with resources to develop more standardised and evidence-based strategies, with flexibility to modify with future data. The conference presentation will examine the methodology of the study and report initial data.

Keywords: Ferrous corrosion; Coating systems; In-situ; Accelerated Aging; Oxygen consumption; Pull-off; Electrochemical Impedance Spectroscopy; Treatment development; Collection management; Polyurethane coatings; High performance coatings; Coastal environment; 20th Century; Historic context; Object significance

ABSTRACTS



William Smith has a background of training in Objects Conservation, completing a BSc in 'Conservation of Objects in Museums and Archaeology' (2015-2018) and an MSc in 'Professional Conservation' (2018-2019), both from Cardiff University. In 2020 William Started a Collaborative Doctoral Project with Cardiff University and English Heritage. This PhD project, supervised by Paul Lankester and Ian Liens from English Heritage, and David Watkinson and Nicola Emmerson from Cardiff University, aims to investigate a series of high performance coatings systems to evaluate their suitability for English Heritages collection of 20th century coastal artillery.



Professor David Watkinson teaches and researches conservation theory and practice at Cardiff University, with a research focus on heritage metals. Over a 20 year period the Cardiff University Heritage Metals Research Group has extensively researched the corrosion and treatment of ferrous metals, quantifying corrosion rate of archaeological iron and the effectiveness of iron desalination, latterly publishing guidelines on desiccation procedures for corrosion control. Current research includes a PhD team studying copper alloy stability and the performance of protective coatings on iron. Other research has encompassed consolidants, identifying organic residues, glass decay and public perception of objects. Work on the desiccated storage of unstable iron underpinned the conservation of Brunel's iconic steamship ss Great Britain, which won the Gulbenkian Museum prize in 2006. In 2010 he was awarded the Plowden Medal for his innovative research and for his contributions to the conservation profession. He has been a Council Member of the International Institute for Conservation, Chair of the UKIC Archaeology Group and he has served widely on committees and grant awarding bodies.

Dr Paul Lankester is a conservation scientist at English Heritage, primarily looking after the historic collections in our care. His role has three main aspects, the day-to-day management of the environment at properties across the country, providing advice to projects and colleagues in relation to environmental management, ranging from specifying parameters for a new heating system to monitoring vibration during construction or events. The third aspect is scientific research; Paul's primary research area is preventive conservation. His PhD research investigated the impact of climate change on historic interiors, and he is currently supervising a collaborative doctoral partnership student from Cardiff university who is researching high performance coating systems for English Heritages modern artillery collection.



Nicola Emmerson. Trained at Cardiff University in Conservation and Archaeology, I now teach at research at the university focusing on conservation science and management of metallic heritage. I work with museums, cultural heritage institutions and an international group of corrosion researchers with the aim of improving preservation of metals, from archaeological small finds to historic wrought iron bridges and ships. My focus on historic wrought iron has led to close collaboration with heritage ironwork practitioners and bodies such as the National Heritage Ironwork Group and the British Artist Blacksmith Association.

I supervise a cohort of PhD students and teach conservation, heritage science research methods and analytical techniques. To support these activities, I developed and manage a suite of analytical laboratories linked to climate simulations, corrosion rate determination, microscopy, FTIR and Raman spectroscopy and sample preparation.

I am the Chair of the Institute for Conservation Metals Committee and Assistant Coordinator of the International Council for Museums Committee for Conservation Metals Working Group.

The potential and limits of acoustic emission techniques as diagnostic tool for historical vehicles' engines

Laura Brambilla – HE-ARC, Neuchâtel (Switzerland); Brice Chalançon - Association de Gestion du Musée National de l'Automobile (France); Alejandro Roda Buch, Emilie Cornet, Guillaume Rapp – HE-ARC, Neuchâtel (Switzerland); Stefano Mischler – EPFL (Switzerland)

Acoustic Emission (AE) techniques, belonging to the class of non-destructive testing (NDT), are widely used in the industrial field as part of ordinary and extraordinary testing of structures and mechanisms, due to their non-invasive nature. They are based on the principle that any release of energy inside a material can be captured by piezoelectric sensors thanks to the propagation of energy inside the material itself in the form of elastic waves. AE is used to detect and monitor the formation or presence of corrosion, cracks and hits. In the field of cultural heritage, it has been already used with success to monitor artefacts such as buildings, wall paintings, music instruments, enamels, furniture, just to cite some examples [1].

In the field of automotive industry, AE is used to verify the performances of recently produced engines, by combining the mechanical and combustion signatures of the engines themselves [2]. The ACUME_HV project (Acoustic Emission Monitoring of Historical Vehicles' engines) was the first project aiming at applying such techniques to technical heritage, in order to perform a diagnostic of the engines before their reactivation. The sensors are simply placed in contact with the engine and they allow to perform a diagnostic of the state of conservation of the artefact in a totally non-invasive and non-destructive way.

The project was structured around different phases, including:

- Select and test of the most appropriate locations around the engine for positioning the AE sensors, in order to record the signals produced by the moving parts, while minimizing the noise.
- Record and compare the characteristic mechanical signatures of selected historical engines.
- Simulate typical failures commonly occurring in historical vehicle's engines and confirm that AE techniques are able to detect and recognize them.

The recorded signals were firstly characterized using their Root Mean Square level every 10 ms as feature, as it is related to the energy of the physical phenomena generating AE signals. Those results showed that AE is able to characterize the different phases of the engine thermodynamic cycle, to define the functioning state of the engine itself as well as to detect some common malfunctions of this type of mechanism.

The AE signals were then transformed in the frequency domain using a Wavelet Packet Decomposition and analyzed using non-supervised and supervised machine learning techniques. The non-supervised solution based on the T-SNE algorithm, showed that it is possible to use AE signals to cluster together motors in similar conditions. The supervised algorithms were developed to predict which engine a signal belongs to, whether the engine in question had its spark plugs or not and whether it had an anomaly or not, and the kind of anomaly. The best algorithm achieved an overall accuracy of 73%. For the simpler task of detecting if a motor had a normal or an anomalous behavior, the accuracy improved to 93%.

The project team was highly interdisciplinary, including mechanical engineers and technicians, conservators, data scientists, conservation scientist and museum specialists as the methodology developed for the monitoring requires the combination of different expertise.

The results are promising and, if properly developed, the technique can be applied to other types of industrial or technical mechanisms.

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Keywords: Acoustic Emission; Historical Vehicles; Engines

ABSTRACTS



Laura Brambilla is associate professor at HE-Arc Conservation-restauration in Neuchâtel, Switzerland where she works since 2013. Her research interest focuses on all aspects of metal artefacts investigation and conservation. After having carried out a PhD thesis on bronze and gilded bronze artefacts in Italy, she joined the research team of the conservation department at HE-Arc and she was the leader of the CANS project. More recently her interest moved towards technical heritage with mechanisms and the use of non-invasive techniques, in particular Acoustic Emission, for the diagnostic of these artefacts prior to their reactivation. In addition to that, she is currently working on archeological iron artefacts and imaging techniques for the documentation of cultural heritage.

The conservative restoration brings the 1907 Fiat 130 HP back on the track

Davide Lorenzone and Chiara Armigliato - MAUTO - Museo Nazionale dell'Automobile of Turin (Italy)

The Fiat 130 HP, from the collection of the MAUTO – Museo Nazionale dell'Automobile of Turin, was the protagonist of the 1907 Grand Prix of the Automobile Club of France. Driven by the Turinese pilot Felice Nazzaro, it won the Dieppe circuit. The car boasts a four-cylinder, two-piece block engine of over 16 liters of capacity, famous for its overhead valves arranged in a 90° V shape. The engine has a power of 130 HP, and weight 1,025 kg. Thanks to a 4-speed gearbox it can reach 160 km/h, with peaks of up to 200 km/h. The cooling system consists of an impressive radiator with more than 8000 brass tubes through which water passes moved by a centrifugal pump located on the lower right side of the engine casing. The engine lubrication system is of the mixed type; the oil is sent by gravity onto the various bushings by means of a mechanical pump consisting of several pumping elements placed inside a tank on the dashboard.

The car was donated to the Museum in 1956 and between 2019 and 2021 a careful restoration brought it back to its original splendor. The works, coordinated by the MAUTO Restoration Center and carried out by artisans in the sector, involved both the mechanical part, which required profound interventions, including the reconstruction of structural parts of the engine, and the body. Thanks to scientific studies and analyzes it was possible to trace the car's original color and correct those elements on the body which had undergone numerous alterations over the years.

Research was carried out before the restoration work: historical documents preserved at the MAUTO Documentation Center and the Fiat Historic Center were carefully analyzed. Numerous original drawings emerged, essential for the reconstruction of the severely damaged mechanical parts.

The biggest intervention involved the rebuilding of the complete crankcase which suffered strong damages and twisting that can no longer be recovered. The aluminum itself was no longer able to withstand repairs. It was therefore decided to create the new parts starting from the measurement of the originals and comparing them with the drawings. With rapid prototyping, new 2D and 3D drawings were obtained, used to prepare the core for casting the new parts. However, many original mechanical parts have been preserved, as evidenced by the engravings with the initials of Felice Nazzaro found during the intervention. This determines the incredible authenticity of the car.

Once the restoration was completed, the engine was tested for over 40 hours in order to carry out the stability tests and final adjustments. Subsequently, all the mechanics were reassembled on the restored chassis and the car was tested numerous times on the road and on the circuit.

Thanks to the two-year-long restoration work, the Museum consolidated a new restoration method that considers vintage cars as real works of art. The cars must be studied, analyzed and restored with scientific methods and at the same time be functional on a mechanical level in order to allow visitors, on special occasions, to experience the same emotions as the spectators of the epic races that took place at the beginning of the twentieth century.

Keywords: Restoration; Conservation; Car; Fiat; Engine; Grand Prix; Museum

ABSTRACTS



Davide Lorenzone. I'm a 39-year-old, civil engineer, Curator and Head of the Restoration Center of the National Automobile Museum "Avv. Giovanni Agnelli" in Turin. Since I was a boy, I started, for passion to collect machinery and documentation on industrial steam engines, agricultural and tractors and today the collection has been included in the list of Museums and National Collections of the ASI (Automotoclub Storico Italiano) - National Agency for the protection of the Italian historical motoring heritage, as one of the most important collections at national level of steam engines. Thanks to the experience accumulated over the years I have become a point of reference for collectors and industrial historical associations. I am a member of the scientific commission of the Museum of Agriculture of Piedmont and Technical Commissioner of the Agricultural and Industrial Machinery Commission of the ASI. As Head of the Mauto Restoration Center, together with my collaborators, we wanted to dedicate ourselves to studying a new restoration methodology that considers vintage cars as works of art. Until the thirties of the twentieth century the vehicles could be customized according to the needs of the client; it was therefore possible to find standard chassis but with unique bodies and finishes for each vehicle. It is therefore essential to be able to preserve and study these authenticities that are characteristic of works of art and enhance them in the most significant aspects that represent them.



Chiara Armigliato. In 2016, I graduated at the University of Turin in Conservation and Restoration of Cultural Heritage, specializing in ceramic, glass and metals.

I worked for a year at the "Centro per la Conservazione ed il Restauro dei Beni Culturali – La Venaria Reale" foundation, where I restored the Pisa Baptistery's glass windows, two majolica stoves located in the Castle of Moncalieri and I conducted the conservative study of ceramic, glass and metal artworks at the Royal Palace of Turin. Since 2017, I have been working as a restorer at MAUTO - National Automobile Museum of Turin. I take care of the vehicles of the collection: I assess the state of conservation and draft Condition Reports, I carry out ordinary and extraordinary maintenance, I organize and execute restoration interventions. In addition to the practical activities, I am the leader of several training projects, from work-school with high schools to teaching hours for professionalizing courses related to the restoration of vintage cars.

My goal is to create an ad hoc restoration method for vintage cars by combining the method used in the conservation of works of art with the interventions carried out on vehicles.

In addition to my professional profile, I am a very cheerful girl who likes to travel, discover new places and meet new people. In my life I have practiced several sports but skiing and skating have never abandoned me.

A drive belt align machine and a former vaccine laboratory. A practical restoration report

Gesa Witt – TriKon Berlin (Germany)

In both articles presented here, the restoration work is not only aimed at long-term preservation of the objects, but also tries to make the function of the objects easier to recognize for the viewer/visitor. The results of the work on the two objects are presented one after the other.

The drive belt align machine

It is located in the outdoor area of the Hagen Open-Air Museum, the State Museum for Technology and Crafts. The museum consists of a wide variety of workshops in which trained employees practice various trades in practice. In this way, the visitor can observe and experience historical handicraft techniques and machines in operation. Transmissions were used in many manufacturing trades in order to be able to operate several machines with one energy source. The so-called drive belts were needed for transmission. A drive belt is an endless loop made of a leather belt, which had to run as straight as possible in order not to wander off the drive wheels. The purpose of the drive belt align machine was to stretch the pre-produced drive belts, tare them and straighten them so that they ran straight.

The practical restoration includes the cleaning and derusting of the object. Previously bare parts such as the drums, chains and sprockets were gently sandblasted and then coated with a temporary anti-corrosion agent.

The Vaccine Laboratory

In the course of the conversion and renovation work in 2015 in Barrack 5 of the Documentation Center for NS Forced Labor in Berlin, it was decided to retain a room from the former GDR vaccine institute. Since 1945, part of the barracks was used by the private "vaccine plant Dr. Belian". From 1947 until reunification, the GDR Vaccine Institute carried out research and produced in the barracks. The buildings were expanded, repurposed, some even rebuilt and demolished again. After reunification in 1989/90, the Vaccine Institute became part of the Federal Health Office or Robert Koch Institute, which moved out in 1995. Half of the camp, which was federally owned, stood empty for a good 10 years before it was converted into a documentation center.

The room and the inventory, consisting of chemical equipment, were cleaned and conserved. Before the restoration work, the vessels were opened and examined for pollutants. As part of the restoration, the function of the equipment and its technical structure should also be clarified.

Summary

Both objects were processed through the restoration work and the documentation for the visitor. The drive belt align machine can now be understood again as a formerly functional machine ensemble. The visitor has the feeling that the machine could have been in operation until recently. He sees a well-kept condition and can mentally integrate the object into the active machine park of the workshops.

In the vaccine laboratory, the viewer's focus is now more on the equipment and no longer on the unkempt room. Thanks to the graphic mapping, the process of producing ultrapure water can be understood even by non-professionals.

Keywords: Gentle sandblasting with glass beads; Temporary preservation of bare metal parts; Visualization of chemical processes

VALE DE MILHAÇOS GUNPOWDER FACTORY

The Gunpowder Circuit through the Vale de Milhaços Gunpowder Factory focuses on the buildings, infrastructures, machinery and other objects that document this industrial activity and the technologies applied in producing gunpowder in the period between 1896 and 2001.

This cultural heritage has been preserved in situ with its incorporation into the Seixal Municipal Ecomuseum beginning in 2001.

In 2012, the site was classified as a Monument of Public Interest.

Of the industrial factory built in 1898, the Vale de Milhaços gunpowder circuit features over two dozen of the buildings, among which stand out:

- The central set for the production of thermal and mechanical steam energy with the adjoining metal workshop;
- The carbonisation workshops (wood distillation) for the production of one of the raw materials, charcoal;
- The raw material processing and gunpowder production workshops, set off by tree-lined areas for reasons of safety in case of any accident;
- The raw material warehouses (potassium nitrate/saltpetre, charcoal, sulphur) and other products;
- The magazines (gunpowder warehouses);
- The office and some other support buildings.

With a longitudinal layout, there is a safety barrier between the central buildings for producing energy and the gunpowder factory workshops, which proceeded via a discontinuous process.

In the workshops, there is also a separation between the compartments for machines and the mechanical energy transmission systems connected by aerial cables to the central buildings.

Accompanying the layout of the workshops, a Décauville type railway line served for the transport of products in drays moved by the workers over the course of about one kilometre.

Every object at the Vale de Milhaços Gunpowder Factory with recognised heritage value was documented, inventoried and conserved at the Seixal Municipal Ecomuseum.

As part of the musealisation programme, Vale de Milhaços Gunpowder Factory priority was assigned to in situ conservation of heritage in general and to operational conservation of the steam energy system.

After the visit, to recognize and interpret the Vale de Milhaços Gunpowder Factory in situ industrial heritage, the workshop participants will be invited for a debate on two main topics: the (re)definition of the heritage object and the methodological framework for safeguarding and enhancing heritage in this specific project.



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