

# PRO TORPEDO RIJEKA

VII. MEĐUNARODNA KONFERENCIJA O INDUSTRIJSKOJ BAŠTINI  
posvećena temi

**TORPEDO – POVIJEST I BAŠTINA**

150. GODIŠNJICA IZUMA LUPPIS-WHITEHEADOVA TORPEDA

7<sup>th</sup> INTERNATIONAL CONFERENCE ON INDUSTRIAL HERITAGE

Thematically related to:

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## “MALA BIJELA FLOTA” – POSJET MORNARICE SAD-A TRSTU I RIJECI 1904.

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**Ključne riječi:** torpedo, Tvornica torpeda, flota SAD-a, Trst, Rijeka

Brodaska eskadra mornarice SAD-a pod komandom kontraadmirala Alberta S. Bakera posjetila je Mediteran u srpnju 1904. Ta je flota, koja se prikladno može nazvati „Malom bijelom flotom”, a prethodnica je „Velike bijele flote” iz 1907., trebala posjetiti Lisabon, Gibraltar, Pirej, Krf i Trst. Fiume/Rijeka dodana je popisu luka prije svega zbog Tvornice torpeda *Whitehead*. Flota je imala ukupno trinaest brodova, uključujući šest ratnih.

Prezentacija opisuje posjet flote lukama Austro-Ugarskoga Carstva Trstu i Rijeci uz pomoć slikovnih i povijesnih materijala, uključujući one o posjetu Tvornici torpeda te probnom ispaljivanju torpeda s ratnog broda USS *Kearsarge*.

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## “THE SMALL WHITE FLEET” – VISIT OF THE US NAVY TO TRIESTE AND FIUME IN 1904

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**Key words:** torpedo, Torpedo factory, US Fleet, Trieste, Fiume

A squadron of the US Navy under the command of rear admiral Albert S. Baker visited the Mediterranean in July 1904. This fleet, which may be aptly called the “Small White Fleet” – a forerunner of the “Great White Fleet” of 1907 was to visit Lisbon, Gibraltar, Piraeus, Corfu and Trieste. Fiume/Rijeka has been added to the list of ports, primary for the sake of the Whitehead Torpedo Factory. The fleet totaled 13 vessels, including six battleships.

The presentation describes the fleet visit to the ports of the Austro-Hungarian Empire – Trieste and Fiume on hand contemporary pictorial evidence and historical documentation, including the visit to the Torpedo Factory and test firings of torpedoes by the battleship USS *Kearsarge*.

## JOHANN/GIOVANNI LUPPIS – POGLED IZ BEČKOGA RATNOG ARHIVA (KRIEGSARCHIV)

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**Ključne riječi:** Giovanni Luppis, Fakultet ratne mornarice u Veneciji, Austrijska ratna mornarica, *Qualifikation list*

Vežano uz 150. godišnjicu proizvodnje prvog torpeda u Fiume/Rijeci usredotočit ćemo se na jednog od izumitelja torpeda, Giovannija/Johanna Luppisa. Rođen je 1813. u Fiume/Rijeci gdje se njegova obitelj preselila zbog posla, odnosno njihove trgovačke pomorske tvrtke. Budući da nema izvornih dokumenata, različita su mišljenja o pripadnosti plemstvu obje roditeljske obitelji. Iako neki izvori upućuju na to da je završio gimnaziju u Rijeci, u popisu kvalifikacija iz Državnog ratnog arhiva stoji da je završio pomorsku školu u Fiume/Rijeci. U jednoj datoteci iz bečkoga Državnog ratnog arhiva piše da je nastavio školovanje (dvije od pet godina) na Fakultetu ratne mornarice (Collegio Maritimo) u Veneciji gdje se 1835., kada je imao 22 godine, pridružio venecijansko-austrijskoj vojsci. Najneobičnije je to što se njegovo ime ne nalazi u knjizi studenata tog fakulteta (Matricola), u kojoj su imena svih studenata koji su ga ikad pohađali, bez obzira na njihove konačne rezultate. Luppis je proveo 25 godina u mornarici, postavši 1856. komandant fregate. Iste je godine postavljen za direktora Arsenala, brodogradilišta u Trstu, koji je bio u stečajnom postupku. Prema njegovim osobnim podacima, uhvaćen je u tajnoj aktivnosti „... od vrijednosti samo za njega”. Iako nije navedeno o čemu se radilo, može se pretpostaviti da je to bilo nešto povezano sa *Salvacostom*, njegovim izumom koji je prethodio torpedu. Njegovi su nadređeni osudili taj incident i spriječili njegovo napredovanje u mornarici. U njegovim posljednjim osobnim podacima stoji da nije imao sve kvalifikacije potrebne za komandanta ratnog broda pa je stoga 1861. napustio mornaricu.

## JOHANN/GIOVANNI LUPPIS – A SIGHT FROM THE WAR ARCHIVE (KRIEGSARCHIV) VIENNA

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**Key words:** Giovanni Luppis, Naval College in Venice, Austrian navy, *Qualifikation list*

With regard to the 150th anniversary of production of the first torpedo in Fiume/Rijeka, we will focus on one of his inventors, Giovanni/Johann Luppis. He was born in 1813 in Fiume/Rijeka, where his family had moved due to business, as they owned a commercial maritime company. As the original documents are missing, there is still some dispute about the nobility of both parental families. Though some sources indicate that he finished the Gymnasium in Fiume/Rijeka, the Qualification list in the War Archives states that he graduated from the Maritime School in Fiume/Rijeka. The file from the Viennese archive states that he continued his education for two (out of five) years at the Naval College in Venice (Collegio Maritimo), where he entered the Venetian- Austrian Navy in 1835, at the age of 22. The most peculiar fact about his naval career is that his name is missing from the School Registry (Matricola) that contains all the students that ever attended the school, no matter what their final results were. He spent 25 years in the navy, reaching the position of the commander of frigate in 1856. The same year he was appointed director of the Arsenal, the shipyard in Trieste that was in bankruptcy proceedings. According to the personal list he was caught in a secret activity described as “...valuable to his own sake”. Though it is not stated what that activity was, one might assume that there was something connected with “Salvacoste”, a forerunner of the future torpedo. Such an incident was condemned by his superiors and prevented his advancement in the navy. In his last personal list he was qualified as “not having all qualification for a commander of the battleship”, and therefore he left the navy in 1861.

## MODERNISTIČKI SKLOP ELEKTROINDUSTRIJE KONČAR U ZAGREBU (1945. – 1949., Stjepan Gomboš, Mladen Kauzlarić, Vladimir Juranović, Otto Werner)

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**Ključne riječi:** moderna arhitektura, urbani razvoj Zagreba, industrijski sklop, arh. Stjepan Gomboš i Mladen Kauzlarić

Industrijski sklop tvornice *Končar* na zagrebačkoj Trešnjevci ostvaren je neposredno nakon Drugoga svjetskog rata u sklopu inicijalno potrebne industrijalizacije i elektrifikacije ratom porušene zemlje. Djelo zagrebačkih arhitekata Stjepana Kauzlarića i Mladena Gomboša (s inženjerima Vladimirom Juranovićem i Ottom Wernerom) osvojilo je prvu nagradu na raspisanom javnom natječaju. Arhitektonsko rješenje dosljedno je zasnovano na temeljima hrvatske moderne arhitekture međuratnog razdoblja, a dosege realizacije toga modernističkog ostvarenja prezentira splet najviših strukovnih nagrada za arhitekturu, dodijeljenih koncem četrdesetih godina 20. stoljeća.

Velebni sklop elektroindustrije realiziran u tadašnjem jugozapadnom predgrađu Zagreba (ograničen, ali i povezan tadašnjom postojećom infrastrukturuom), anticipira urbanitet te rubne zone grada modernom arhitekturom s iznimnim konstruktivnim rješenjima. Postaje žarište rada za stanovnike grada i okolnog područja te dolazi do izgradnje pratećih objekata za stanovanje i školovanje koji se intenzivno ostvaruju sa svim popratnim društvenim sadržajima. Izgrađen kompleks tvornice djelovao je kao pokretač razvoja u tom području grada, istodobno potičući infrastrukturni razvitak koliko i socijalni.

Sama potreba za izgradnjom kompleksa industrijskih hala rezultat je transformacije i pojačane industrijalizacije nakon koje postojeća proizvodnja poprima novi oblik. Upravo je logika proizvodnje, kretanje proizvoda od početka do završetka njegove izvedbe, ključna za specifičnu organizaciju parcele tvorničkog kompleksa unutar granica ograničenog prostora. Rješenja nastala u kompleksu izraz su funkcionalnih veza industrijskog pogona – izraz proizvodnje. Položaj i oblikovanje arhitektonskih elemenata afirmiraju taj proces, a istodobno i ulogu industrije u razvoju i oblikovanju grada i društva. Urbanistička, arhitektonska i jedinstvena konstruktivna rješenja svjedoče o radikalnim promjenama nastalima zbog industrijalizacije na različitim područjima.

Uz navedene arhitektonske i urbanističke odrednice, značenje tvornice koja uspješno djeluje više od šezdeset godina, u danas deindustrijaliziranoj Hrvatskoj osobito dolazi do izražaja u socijalnom i gospodarskom kontekstu. Kompleks *Končar* danas predstavlja neprepoznatu vrijednost industrijske baštine kao dijela kulture društva.

## MODERNIST COMPLEX OF KONČAR ELECTROINDUSTRY IN ZAGREB (1945 – 1949, STJEPAN GOMBOŠ, MLADEN KAUZLARIĆ, VLADIMIR JURANOVIĆ, OTTO WERNER)

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**Key words:** modern architecture, urban development of Zagreb, industrial complex, architects Stjepan Gomboš and Mladen Kauzlarić

The industrial factory complex in Zagreb was built immediately after the Second World War, as part of the initial need for industrialization and electrification in a war-torn country. The work of the Zagreb architects Stjepan Kauzlarić and Mladen Gomboš (with engineers Vladimir Juranović and Otto Werner) won the first prize in a public competition. The architectural solution was based on the foundations of modern Croatian architecture between the wars, and the achievements of this modernist work is seen in a number of architectural awards given around the middle of the 20<sup>th</sup> century.

The magnificent industrial complex was built in the then western suburbs of Zagreb (in an area limited by, but also connected to the infrastructure). It anticipates the urbanity in the marginal area with modern architecture that includes exceptional constructive solutions. It became a central work area for the inhabitants of the city and its surrounding area. The construction of accompanying social contents and facilities around the industrial plot followed the construction of the factory complex; it included a number of schools and housing buildings, all built

for the employees of the factory. It was a development activator in this area of the city, encouraging the infrastructural advancement as well as the social one.

The need for the construction of the complex of the industrial halls is the result of the transformation and industrialization, after which the existing production takes on a new form.

It is the logic of production, the making of a product from its beginning to its final form, which is the key to the specific organization of the factory plot inside the limited area, defined by the existing infrastructure. Solutions created in this complex are an expression of functional connections inside the industrial process, i.e. the process of production. The position and design of architectural elements are an affirmation to this process, but also to the role of industry in the development and design of the city and society. Urban, architectural and unique constructive solutions testify of radical changes in various areas as a result of industrialization.

In addition to these architectural and urban elements, there is a specific importance of continuity in the company's successful activity for over 60 years, especially in today's social and economic context in Croatia. The Končar complex presents an unrecognized value of industrial heritage as a part of the culture of society.

## DOLINA U KOJOJ SE PROIZVODI MUNICIJA U SLOVAČKOJ (NEKAD I DANAS)

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**Ključne riječi:** proizvodnja municije, povijesna tehnička infrastruktura, arhitektonske i urbanističke vrijednosti, održivi razvoj, proizvodnja dijelova za torpedu u Slovačkoj

Infrastruktura triju glavnih proizvođača municije do današnjih se dana nalazi u dolini rijeke Váh u Slovačkoj. U 20. stoljeću njihova proizvodnja oružja i sastavnih dijelova predstavljala je znatan udio u izvozu roba Slovačke, uključujući i dijelove za proizvodnju torpeda.

Proizvodni pogoni u Trenčínu, Dubnici nad Váhom i Považská Bystrici izgrađeni su u trećem desetljeću 20. stoljeća. Zadobili su važan strateški položaj, uzevši u obzir stanje u Europi u to vrijeme. Proizvodnja u Dubnici nad Váhom bila je smještena u posebno zanimljivom kompleksu, djelomice pod zemljom, unutar planinskog masiva.

U ovom industrijskom području bila je izgrađena mreža dodatne infrastrukture. Poput prije navedenih tvornica, dio je slovačke industrijske baštine. Zahvaljujući toj proizvodnji izgrađeno je sasvim novo naselje, arhitektonski vrijedna rezidencijalna struktura Nová Dubnice. Intervencije poput ove bitno su utjecale na karakter regije i stvorile njezin *genius loci*.

Koje je sadašnje stanje tog sustava nakon što se proizvodnja smanjila? Kako odnos između rezidencijalne strukture i očuvane industrijske baštine može odgovoriti na zahtjeve održivog razvoja? Ovo izvješće predstaviti će procese vrednovanja raspoloživih lokacija (njihove kapacitete), identifikaciju njihova iskoristivog potencijala i stvaranje vizija za njihovo aktivno uključivanje u planiranje održivog razvoja regije.

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## VALLEY OF AMMUNITION INDUSTRY IN SLOVAKIA (ONCE AND TODAY)

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**Key words:** ammunition industry, historical technical infrastructure, architectural and urbanistic values, sustainable development, production of torpedoes components in Slovakia

Up to this day, an infrastructure of three major ammunition concerns can be found in the valley of the river Váh in Slovakia. In the 20<sup>th</sup> century their production of weapons and components represented a substantial portion of the Slovak export goods – including components for the manufacture of torpedoes.

The production sites in the cities of Trenčín, Dubnica nad Váhom and Považská Bystrica were founded in the third decade of the 20<sup>th</sup> century and gained an important strategic position considering the situation in Europe at that time. The site in Dubnica nad Váhom was a particularly interesting complex partially situated underground, inside a mountain massif.

A network of additional infrastructure was built in this industrial area, which, as well as the above factories makes part of the Slovak industrial heritage. Thus, in connection with industry the architecturally valuable residential structure of Nová Dubnica was built from scratch as an entirely new settlement. Interventions like these have influenced the character of the region significantly and generated its *genius loci*.

What is the current state of this system after the production has been scaled down? How can the relation of the residential structure and the preserved industrial heritage respond to the requirements of sustainable development? This report will introduce the processes of evaluation of available sites (their capacities), identification of their usable potential, and creation of visions for their active involvement in planning the sustainable development of this region.

## WHITEHEAD I UPOTREBA TORPEDA U SKANDINAVIJI 1875. – 1914.

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**Ključne riječi:** Whiteheadova torpeda, skandinavске mornarice, „nova škola”, strateška i taktička upotreba torpeda

U ovom radu opisat ću kako su Švedska, Danska i Norveška kupile Whiteheadova torpeda 1875. Prikazat ću kako su skandinavске mornarice stupile u kontakt s Robertom Whiteheadom, zašto ih je zanimala ta nabava te kako su odlučili kupiti ih u istom paketu.

Za male mornarice torpedo je bio otkriće. Slijedeći strategiju *la Jeune École*, bilo je to oružje koje se moglo suprotstaviti velikim brodovima značajnih pomorskih sila.

Prikazat ću kako su se te skandinavске zemlje na različite načine koristile torpedima u svojim mornaricama, dijelom na malim brodicama, dijelom na velikim ratnim brodovima.

Svaka od tih zemalja kupila je pravo da sama proizvodi i popravlja torpeda Whitehead-modela. Zahvaljujući tome razvoj torpeda bio je u svakoj malo drukčiji.

U ovom ću radu prikazati i na koji su se način te tri zemlje namjeravale koristiti torpedima, i strateški i taktički. Opisani razvoj slijedit ću sve do 1914.

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## WHITEHEAD AND THE IMPLEMENTATION OF TORPEDO IN SCANDINAVIA 1875 – 1914

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**Key words:** Whitehead torpedoes, Scandinavian Navies, *la jeune école*, strategic and tactical use of torpedoes

In the paper I will give an account of the purchase of Whitehead torpedoes by Sweden, Denmark and Norway in 1875. I will present how the Scandinavian Navies got in contact with Robert Whitehead, why they were interested in purchasing those torpedoes, and how they decided to buy them in the same packet.

For small navies the torpedo was a revelation. Following the philosophy of *la jeune école*, it was a weapon which could match the big ships of the great sea powers. Furthermore, I will present how it was in different ways that they implemented torpedoes in their respective navies, partly in small boats partly on big surface warships. Each of the countries also bought the right to produce and repair torpedoes of the Whitehead model. Due to this reason, the development was a little different in the mentioned Scandinavian countries.

The paper will also present in what way the three countries planned to use torpedoes both in the strategic and tactical way. The described development will be followed up to the year 1914.



## PODMORNICA P-913 ZETA U ZBIRCI PARKA VOJNE POVIJESTI U PIVKI (SLOVENIJA)

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**Ključne riječi:** podmornica, podmornička služba, *commando* podmornica, Park vojne povijesti, sjećanje na povijest

Podmornička služba duž istočne obale Jadranskog mora ima dugu i bogatu tradiciju koja je počela porinućem prvih dviju podmornica austrougarske vojske 1909. u Puli te je usprkos vladavini ovih ili onih zemalja nastavila djelovati do kraja stoljeća. Nakon gotovo stotinu godina tradicija podmorničke službe privedena je kraju zbog promjena u društvu i sigurnosnih uvjeta, a očuvanje sjećanja na povijest i bogato nasljeđe u rukama je muzejskih institucija. Godine 2011. *Park vojne povijesti*, glavni institucionalni vojnopovijesni muzej u Republici Sloveniji, uspio je dobiti jednu od podmornica bivše Jugoslavije, odnosno podmornicu P-913 Zeta, danas najzbudljiviji izložak u zbirci Parka.

P-913 Zeta pripada generaciji najmlađih jugoslavenskih podmornica, 911-tipa. Između 1983. i 1988. izgrađeno je šest takvih podmornica. To su *commando* podmornice, od kojih je svaka nazvana po jednoj od rijeka šest socijalističkih republika: Tisa, Una, Zeta, Soča, Kupa i Vardar. Projektirane su na zagrebačkom Brodarskom institutu i u Brodoprojekt u Rijeci, a izgrađene u Brodogradilištu specijalnih objekata u Splitu.

Jugoslavenske *commando* podmornice pokretale su se isključivo na struju. Baterije su se punile u bazi ili na drugim plovilima jer nisu imale svoje generatore. Slijedom toga, bilo ih je teško otkriti, bile su veoma tihe, magnetski neutralne i relativno samostalne pod vodom. Projektirane su za djelovanje u plitkim morima, s mogućnošću polaganja mina u blizini neprijateljskih luka. Podmornice su bile posebno namijenjene za prijevoz i razmjštaj mornaričkih komandosa; uz četiri člana posade mogle su primiti šest mornaričkih komandosa, zajedno s četiri podvodna skutera i drugom opremom.

*Park vojne povijesti* dobio je podmornicu P-913 kao donaciju Republike Crne Gore i prevezao je u Pivku uz pomoć donatora. Dobivanjem te podmornice, njezinim obnavljanjem i pripremom za muzejsku izložbu o podmorničkoj tradiciji, *Park vojne povijesti* uspio je sačuvati važan dio tehničke i povijesne baštine kojom se obnavlja vrijedno sjećanje na povijest.

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## THE P-913 ZETA SUBMARINE IN THE COLLECTION OF THE PARK OF MILITARY HISTORY IN PIVKA (SLOVENIA)

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**Key words:** submarine, submarine service, commando submarine, Park of Military History, historical memory

The submarine service along the Eastern Adriatic coast has a long and rich tradition, which began with the launch of the first two submarines of the Austro-Hungarian navy in 1909 in Pula and, despite countries coming and going and borders constantly moving back and forth, continued until the turn of the millennium. After almost one hundred years, the submarine service tradition was brought to an end due to the changes in society and in the safety conditions; the preservation of the historical memory and rich heritage thus lies in the hands of museum institutions. In 2011, the Park of Military History, the main military-historical museum institution in the Republic of Slovenia, managed to obtain one of the former Yugoslav submarines – the P-913 Zeta, today's most exciting exhibit in the Park's collection.

The P-913 Zeta belongs to the generation of the youngest Yugoslav submarines, the 911-type; between 1983 and 1988, six of these submarines were constructed. These are commando submarines, named after one of the rivers from each of the six socialist republics: Tisa, Una, Zeta, Soča, Kupa and Vardar. They were designed at the Zagreb Naval Institute (Brodarski inštitut Zagreb) and the Brodoprojekt Company from Rijeka, and constructed at the Special Vessels Shipyard (Brodogradilište specijalnih objekata) in Split.

The Yugoslav commando submarines were powered only by electricity. The batteries were recharged at the base or at other vessels as they did not have their own power generators. Consequently, they were hard to detect, they were extremely quiet, magnetically neutral, and relatively autonomous underwater. They were designed for operation in shallow seas with the capability of laying mines close to the enemies' ports. The submarines were specifically intended for the transport and deployment of naval commandos; apart from four crew members, they could accommodate six additional naval commandos together with four underwater scooters and other equipment.

The Park of Military History obtained the P-913 submarine as a donation of the Republic of Montenegro and transported it to Pivka with the help of the donor. With the obtainment of the submarine, its renovation and the preparation of the museum exhibition on submarine tradition, the Park of Military History managed to preserve an important part of the technical and historical heritage, which revives a valuable historical memory.

## HOLLANDROUTE

### MREŽA POVIJESNE BAŠTINE U AMSTERDAM METROPOLITAN AREA, REGIJI GRADA AMSTERDAMA

#### Hildebrand de Boer

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**Ključne riječi:** industrijska povijest, kulturne vrijednosti, Amsterdam, Holandska ruta, točke sidrenja, ERIH

Turistička mreža povijesne baštine pod nazivom *HollandRoute* (Holandska ruta) povezuje holandska mjesta povijesne baštine vezana za trgovinu, proizvodnju, tehniku, industriju, upravljanje vodom te infrastrukturu, a dijelom je europske rute industrijske baštine (ERIH).

Povijesni mlinovi, pumpne stanice, tvornice, utvrde i veliki posjedi stoljećima su oblikovali lice Holandije. Sad su opipljiva sjećanja na dugu industrijsku povijest regije grada Amsterdama (*Amsterdam Metropolitan Area*). Mnoge su točke na ruti pod nazivom *HollandRoute* zbog svoje velike kulturne vrijednosti već zaštićena mjesta, a stari kanali u Amsterdamu, kao i tvrđave oko glavnoga grada (Obrambena linija Amsterdam) proglašeni su UNESCO-vim mjestima svjetske povijesne baštine. Za ta mjesta, kao i za mnoge druge zanimljive točke na toj ruti, to znači početak novog života kao iznimno popularnih kulturnih odredišta i turističkih atrakcija. Tisuće turista otkriva regiju grada Amsterdama koristeći se tom rutom, s njezinih sedam sidrišnih točaka koje je odabrao ERIH (Europska ruta industrijske baštine) te čak 47 posebno odabranih točaka na njoj.

Osim *HollandRoute*, postoji više od 60 tematskih ruta u cijeloj regiji. S više od 700 kilometara biciklističkih i više od 200 kilometara pješačkih ruta, te tematske rute nude dodatni uvid u razne teme i područja. Tematske rute mogu se dobiti besplatno na internetskoj stranici *HollandRoute* kao i putem aplikacija.

Više od 60 ruta za pješčenje, vožnju biciklom, kao i vodene rute, savršen su dodatak *HollandRouti* i vode posjetitelje duž tisuću drugih točaka i regija prepunih posebne povijesti.

140 kilometara duga *HollandRouta* opremljena je standardiziranim znakovljem za motorna vozila. Ti znakovi ne samo da vode do mnogih glavnih sidrišnih točaka na ruti, već to čine duž mjesta sa savršenim pogledom i dubokim polderima. Zbog zbijene prirode regije grada Amsterdama do svih točaka na toj ruti može se lako doći javnim prijevozom.

Godine 2015. prvi je put organiziran Festival povijesne baštine unutar mreže *HollandRoute*. Odlučeno je da se taj Festival nastavi održavati kao dio programa te rute i 2016. te u sljedećim godinama.

Hildebrand de Boer prikazat će nastanak *HollandRoute* i pokazati u kojem se širem europskom kontekstu može promišljati ta ruta.

Osim same prezentacije mogla bi se organizirati posebna radionica o genezi i aspektima regionalnih turističkih mreža povijesne baštine.

## HOLLANDROUTE

### A HERITAGE NETWORK IN THE AMSTERDAM METROPOLITAN AREA

#### Hildebrand de Boer

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**Key words:** industrial history, cultural value, Amsterdam, *HollandRoute*, anchor points, ERIH

The touristic heritage network "HollandRoute" links Dutch heritage sites of trade, productivity, engineering, industry, water management and infrastructure, within the European Route of Industrial Heritage (ERIH).

Historic mills, pumping stations, factories, fortresses and estates have shaped the face of Holland for centuries. Now they are tangible reminders of the long industrial history of the Amsterdam Metropolitan Area. Many route points in the HollandRoute already enjoy protection due to their high cultural value: the old canals of Amsterdam, as well as the fortresses around the capital city (The Defence Line of Amsterdam) have been named UNESCO

World Heritage Sites. For these sites, as well as many other exciting route points found in the HollandRoute, this means the start of a new life as cultural hotspots and tourist attractions. Thousands of tourists discover the Amsterdam Metropolitan Area using the HollandRoute with its core 7 anchor points selected by ERIH (European Route of Industrial Heritage), and no less than 47 especially selected route points.

Aside from the HollandRoute, there are more than 60 theme routes available throughout the region. With over 700 kilometres of cycling routes and over 200 kilometres of walking routes, these theme routes offer further insights in various themes and areas. The theme routes are available for free on the HollandRoute website and app.

The more than 60 walking-, cycling- and water routes, form the perfect addition to the HollandRoute and guide the visitors along another 1000 waypoints and areas brimming with special history and unique character.

The 140-kilometre HollandRoute is furnished with standardized signage for motorized vehicles. These signs will not only guide to the many anchor points and route points, but also along spectacular views and deep polders on the way there. The compact nature of the Amsterdam Metropolitan Area, however, also allows for easy access to all route points by public transport.

In 2015 for the first time the Industrial Heritage Festival was organized, within the network of the HollandRoute. It is decided to continue this festival in the HollandRoute Programme for 2016 and the following years.

Hildebrand de Boer will present how the HollandRoute was established, and in which broader European context of touristic heritage networks the HollandRoute may be considered.

Besides the presentation, a special workshop might be organized about the genesis and aspects of touristic heritage regional networks.

## RADIONICA – REGIONALNE TURISTIČKE MREŽE POVIJESNE BAŠTINE I HOLLANDROUTE PRAKTIČAN PRISTUP I POSTUPCI

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**Ključne riječi:** baštinska mreža, industrijska baština, slobodne aktivnosti, očuvanje baštine, regionalne mreže

Približiti ljudima povijesnu vrijednost i značenje njihove (industrijske) baštine pružanjem turističkih i ostalih zabavnih aktivnosti, cilj je regionalnih turističkih mreža (industrijske) povijesne baštine. Te aktivne mreže mogu postati gospodarski vrijedne platforme suradnje u očuvanju industrijske baštine, njezine prezentacije i promocije. Na radionici ćemo razmatrati relevantne elemente i postupke. Obratit ćemo pozornost i na neke učinke postojećih regionalnih mreža.

Atrakcije, rute, komunikacija i mreža sudionika spadaju u elemente regionalnih turističkih mreža povijesne baštine. U relevantne atrakcije spadaju sidrišne točke Europske rute industrijske baštine (ERIH), ostale točke rute (kao i naselja), točke za odmor (restorani, kafići i hoteli na mjestima baštine), točke s pogledom, povijesna infrastruktura i mjesta industrijskog turizma. Daje se glavna ruta, možda i glavna vodena ruta, zajedno s tematskim rutama za vožnju biciklom, pješaćenje i vodene sportove.

Nužna je učinkovita komunikacija i promocija. Među pomoćna sredstva spadaju internetske stranice, aplikacije te, ne manje važni, tiskani mediji i karte s povijesnom baštinom.

Potrebna je i aktivna i odgovorna mreža suradnje među mjestima povijesne baštine, kao u području *cross marketinga* kada je nužno jamčiti održivo ostvarivanje zadanih ciljeva.

Pri osnivanju mreže regionalne turističke baštine doći će do većih regionalnih razlika u postupcima, međutim naći će se i neke prepoznatljive crte postupaka koje treba zadovoljiti.

U tom smislu možemo razmotriti neke aspekte preliminarnog istraživanja, glavni plan, provođenje, pripremu službenog početka, upravljanje i daljnji razvoj mreže.

Sve u svemu, realizacija održive mreže turističke povijesne baštine golem je izazov, a istodobno i vrijedno gospodarsko ulaganje. Srećom, mogu se iskoristiti iskustva mreža iz raznih europskih zemalja.

Hildebrand de Boer organizirat će ovu posebnu radionicu o genezi i aspektima regionalnih turističkih mreža povijesne baštine.

## WORKSHOP REGIONAL TOURISTIC HERITAGE NETWORKS & HOLLANDROUTE A PRACTICAL APPROACH OF ASPECTS AND BUILDING STONES

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**Key words:** heritage network, industrial heritage, leisure activities, heritage preservation, regional networks

The purpose of the Regional Touristic (Industrial) Heritage Networks is to make people aware of the historical value and importance of their (industrial) heritage, through provision for tourism and other leisure activities. These active networks can emerge to economic valuable platforms of cooperation in the field of industrial heritage preservation, presentation and promotion.

During the workshop we will look at relevant ingredients and procedures. Also some effects of existing regional networks are paid attention.

Ingredients of Regional Touristic Heritage Networks are attractions, routes, communication and the network of participants. Relevant attractions are the ERIH Anchor Points, Route Points (also Settlements), Rest Points

(restaurants, cafes and hotels on heritage sites), Viewpoints, historic infrastructure and Industrial Tourism Sites. A Main Route and eventually a Main Water Route is provided, together with Theme Routes for biking, hiking and water sports.

Effective communication and promotion is indispensable. Helpful tools are websites, apps, and last but not least printed media and heritage cards.

Further an active and responsible network of collaborating site parties, i.e. in the field of cross marketing, is essential in order to guarantee a sustainable achievement.

The procedures to establish the Regional Touristic Heritage Network will vary regionally strong, but there might be some basic procedure lines recognizable, which have to be filled in.

In this respect we can consider the aspects of preliminary investigation, Master Plan, implementation, preparation of the official start, management and further development of the network.

All in all, the realization of a sustainable Touristic Heritage Network is a huge challenge and at the same time a valuable economic investment. Fortunately we can make use of experiences with regional networks in different European countries.

Hildebrand de Boer will organize this special workshop about the genesis and aspects of touristic heritage regional networks.

## MAŠTOVITA ŠPEKULACIJA ILI GEORGE READ MURPHY I VICTORIA TORPEDO

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**Ključne riječi:** torpeda upravljana s obale, Luppis, Murphy, Victoria, Whitehead

Usprkos tome što je George Read Murphy (1856. – 1925.) proveo većinu svoga radnog života u Viktoriji, malo je informacija o njegovu razmjerno kratkom boravku u Londonu između 1889. i 1890. Kažu za njega da je u to vrijeme napisao svoj prvi roman i izumio Murphyjev torpedo kojemu je poslije promijenjeno ime u *Victoria* torpedo.

Murphyjev ili *Victoria* torpedo bio je izmijenjeni Whiteheadov torpedo na kojem se smjerom putanje i brzinom upravljalo pomoću izoliranoga trodijelnog kabla koji je dolazio iz torpeda i broda ili stanice na obali s koje je bio lansiran. Giovanni Luppis (1813. – 1875.) predvidio je potrebu za upravljanje smjerom u svojim nacrtima za *Salvacoste* koje je predao Whiteheadu 1864. Whitehead je, međutim, odbacio takvo upravljanje u korist „ispali i zaboravi“ oružja koje je u teoriji putovalo u ravnoj liniji i unaprijed zacrtanom dubinom.

Godine 1890. osnovana je tvrtka *Victoria Torpedo Company Limited* koja je trebala iskoristiti Murphyjeve patente i osigurati prava na proizvodnju, održavanje i popravak Murphyjeva ili *Victoria* torpeda. Nakon što britanski Admiralitet nije prihvatio Murphyjev ili *Victoria* torpedo, tvrtka je zapala u financijske poteškoće tako da se 1891. govorilo da je samovoljno otišla u stečaj. Murphyjev ili *Victoria* torpedo nikada se nije proizvodio u širim razmjerima i ostaje inženjerska neobičnost 19. stoljeća.

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## FANCIFUL SPECULATION OR GEORGE READ MURPHY AND THE VICTORIA TORPEDO

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**Key words:** Controlled torpedoes, Luppis, Murphy, Victoria, Whitehead

Despite the fact that George Read Murphy (1856-1925) spent most of his working life in Victoria, we have very little in the way of information regarding his relatively short stay in London between 1889 and 1890. It was during this period that he was said to have written his first novel and invented the Murphy torpedo that was later, renamed the 'Victoria' torpedo.

The Murphy or 'Victoria' torpedo was a modified Whitehead torpedo, in which the direction of travel and the speed was controlled via an insulated three-core cable dispensed from the torpedo and the ship or shore station from which it was launched. Giovanni Luppis (1813-1875) had anticipated the need for directional control in his designs for the "Salvacoste" which he had submitted to Robert Whitehead in 1864. However, Whitehead discarded directional control in favour of a 'fire and forget' weapon that theoretically travelled in a straight line and at a predetermined depth.

The Victoria Torpedo Company Limited was formed in 1890 to exploit Murphy's Patents, and ensure the company's rights to the manufacture, maintenance and repair of the Murphy or 'Victoria' torpedo. Following the British Admiralty's failure to adopt the Murphy or 'Victoria' torpedo, the company ran into financial difficulties and in 1891 and there were reports that it was to go into voluntary liquidation. The Murphy or 'Victoria' torpedo never went into full-scale production and remains a nineteenth century engineering oddity.

## MUDROST I VRHUNSKA TEHNOLOGIJA – SVJEDOČANSTVA INDUSTRIJSKE BAŠTINE I OKOSNICA VENECIJANSKE LAGUNE

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**Ključne riječi:** Venecija, Arsenal, brodograditelji, laguna, industrijska baština, krajolik

Istraživanje odnosa između industrijske arheologije i strukture Venecijanske lagune koje traje već neko vrijeme, ali posebno namijenjeno Konferenciji u Rijeci, od početka 2015. bavi se arhivskom dokumentacijom, kartografijom i bibliografijom proizvodne strukture ratne mornarice u Veneciji, obuhvaćajući razdoblje od druge polovice 19. do prvih desetljeća 20. stoljeća. Cilj je objasniti i definirati monumentalne prostore za proizvodnju vojnog oružja, počevši od slavni stoljeća Mletačke Republike do razdoblja prevlasti Habsburga i Kraljevine Italije.

Prikazat će se ključna uloga venecijanskog Arsenala, jedinog brodogradilišta u Veneciji i sjedišta prestižnih brodograditelja, s posebnim naglaskom na proizvodnju vojne opreme, i tradicionalne i inovativne poput torpeda, u vremenu nakon ujedinjenja i u okviru novog ustrojstva talijanskih centara za vojnu proizvodnju.

S obzirom na tragove koji danas još uvijek postoje, definirat će se i precizna uloga arhitekture u proizvodnji vojnog oružja, kojoj je potrebna prepoznatljivost kao spomenika i krajolika u krajnje osjetljivom kontekstu kao što je Venecijanska laguna, s posebnim naglaskom na izložbenu funkciju Arsenala / otoka le Vignole u okviru Venecijanskog bijenala, te dati prikaz svih tehnoloških potencijala, tržišno usmjerenog i pomorskog iskustva koje je Veneciji dugi niz godina osiguravalo prevlast na morima.

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## WISDOM AND ART OF THE STATE: THE TESTIMONIALS OF INDUSTRIAL HERITAGE AND FRAMEWORK OF LAGOON OF VENICE

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**Key words:** Venice, Arsenal, shipbuilders, lagoon, industrial heritage, landscape

The research on the relationship between industrial archaeology and the structure of the Venetian lagoon, already in progress for some time but addressed more specifically to the Conference of Rijeka since the beginning of 2015, deals specifically with archival documents, cartography and bibliography of the production structure and Venetian maritime military, expected to range between the second half of the nineteenth century and the first decades of the twentieth. The aim is to clarify and define the monumental spaces for the production of military weapons, starting with the glorious centuries of the Republic of Venice to get to the period of the Habsburg domination and the Kingdom of Italy.

The key role of the Venetian Arsenale will be presented, the only shipyard in the state of Venice and seat of prestigious shipbuilders, with particular attention to the production of military equipment of the post-unification period, both traditional and innovative as the torpedo, which comes within the subsequent articulation of new Italian military production centres.

What will also be identified is the precise role of architecture in producing military weapons, in relation to the traces that still exist today and need a monumental and landscape recognisability in a highly delicate context as the Venetian lagoon, emphasizing in particular the role of the Biennale function of the Arsenale / Isle of Vignole, the account provided of all of the technological potentials, the market-oriented and the seafaring experience that for a long time assured Venice the supremacy on the seas.



## LUPPIS I WHITEHEAD – GRAĐANI RIJEKE, GRAĐANI SVIJETA

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**Ključne riječi:** Luppis, Whitehead, Sveučilišna knjižnica Rijeka, internetske baze, torpedistika

Organizacijom izložbe publikacija iz svoga fonda pod nazivom *Luppis i Whitehead – građani Rijeke, građani svijeta* Sveučilišna knjižnica Rijeka uključila se u obilježavanje 150. obljetnice izuma torpeda i 7. Međunarodne konferencije o industrijskoj baštini koja se održava u Rijeci od 19. do 21. svibnja 2016. Izloženom građom iz fonda Sveučilišne knjižnice ostvaren je pokušaj simulacije osobnih riječkih knjižnica Ivana Luppisa i Roberta Whiteheada predstavljajući izbor knjiga, časopisa i novina dostupnih u Rijeci u njihovo vrijeme. Izložbom se željelo ukazati na bogatstvo izvora za proučavanje industrijske baštine u Rijeci, s posebnim naglaskom na tehničko područje i područje torpedistike koje posjeduje Sveučilišna knjižnica Rijeka.

Osim s temama iz torpedistike, posjetitelji će se kroz novinske članke imati prigodu upoznati i s kronikom događanja u Rijeci u vrijeme suradnje Luppisa i Whiteheada pri usavršavanja izuma torpeda koncem 19. stoljeća. Putem navedenih izvora pokušao se opravdati i sam naziv izložbe zbog njihova izuma oružja svjetskog značenja za čije je usavršavanje i dovršavanje, nakon odbijanja podrške austrijskih vlasti i vojnih krugova, tadašnja Rijeka pružila sve potrebne uvjete i podršku.

Osim simulacije osobnih knjižnica Luppisa i Whiteheada, projekcijom najnovijih znanstvenih radova dostupnih u digitalnom obliku u internetskim bazama podataka na koje je pretplaćena Sveučilišna knjižnica Rijeka, nastojat će se dočarati i stručna knjižnica na temu torpedistike kako izgleda danas.

Izloženim izvorima o navedenim temama i ovom izložbom Sveučilišna knjižnica Rijeka dala je svoj doprinos očuvanju i promicanju bogate lokalne industrijske baštine i poticaj za daljnja istraživanja.

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## LUPPIS AND WHITEHEAD – CITIZENS OF RIJEKA, CITIZENS OF THE WORLD

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**Key words:** Luppis, Whitehead, Rijeka University Library, internet data bases, torpedo engineering

On the occasion of the 150<sup>th</sup> anniversary of Torpedo and the 7<sup>th</sup> International Industrial Heritage Conference, the University Library Rijeka got involved by organizing an exhibition of publications from its collection entitled “Luppis and Whitehead – citizens of Rijeka, citizens of the world”.

Through the exhibited materials from the University Library collection, a simulation of Luppis and Whitehead’s personal Rijeka libraries has been realized by presenting a selection of books, periodicals and newspapers available in Rijeka in their day. The exhibition aims to point out the abundance of sources available for research of industrial heritage in Rijeka, with a special emphasis on those concerning the technical sector and torpedo engineering owned by the University Library Rijeka.

Apart from becoming acquainted with topics concerning torpedo engineering, visitors will get an opportunity to familiarize themselves with a record of events which took place at the time during which Luppis and Whitehead collaborated on the project of perfecting the invention of torpedo at the end of the 19<sup>th</sup> century. These sources will stand to justify the exhibition title “Luppis and Whitehead – citizens of Rijeka, citizens of the world” due to the world-wide significance of the weapon for the perfection and final realization of which the then Rijeka offered all the necessary conditions and support, after the Austrian authorities and military circles refused to do so.

Apart from the simulation of Luppis and Whitehead’s personal libraries, we will try to present a specialized torpedo engineering library in its present form through a projection of the most recent scholarly work on that topic available in digital form through the Internet data bases to which the University Library Rijeka is subscribed.

Through the exhibition of sources on the aforementioned topics, the University Library Rijeka will make its contribution to the preservation and promotion of the rich local industrial heritage and provide an impetus for further research.

## PODMORNICA *PERAL*, STRATEŠKA VAŽNOST WHITEHEADOVA TORPEDA U IZUMU PODMORNICE

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**Ključne riječi:** *Armada*, podmornica *Peral*, Isaac Peral, Whitehead, Cartagena

Ovo je oružje osmislio kapetan Austrijske mornarice Luppis, a usavršio Whitehead, britanski inženjer iz tvornice u Rijeci, davši istodobno ime ovom sustavu pokretnih torpeda. Godine 1871. Njemačka je kupila patent ovog torpeda i unaprijedila ga izradivši ga iz fosforne bronce, uštedjevši tako na održavanju i produživši mu vijek trajanja izbjegavanjem erozije. Španjolska je ratna mornarica, *Armada*, 1880. poslala svoju delegaciju da ispita oba torpeda. Odabrali su torpedo tipa *Whitehead*, kupivši stotinu jedinica od proizvođača oružja *Schwartzkopff*.

Godine 1888. Isaac Peral, poručnik *Armada*, lansirao je svoju podmornicu koja je bila opremljena *Schwartzkopffovom* torpednom cijevi, kapaciteta tri torpeda tipa *Whitehead*. Već postojeći pokretni torpedo omogućio je izumitelju podmornice da napravi savršeno oružje za ove brodove.

Podmornica *Peral* bila je prva podmornice u povijesti koje je gađala torpedima. Dana 21. ožujka 1889. lansirala je jedan torpedo na površini, a 16. siječnja 1890. uronjena. Iste je godine, 7. lipnja, prvi put u povijesti, zaplovila uronjena 10 metara ispod morske površine. Isaac Peral bio je prvi koji je na podmornicu stavljao torpeda, a njegov sustav zadržao se i danas u modernim borbenim podmornicama. Stvorio je sustav kojim se mogu lansirati do tri torpeda ispod morske površine a da podmornica ne izgubi stabilnost.

Unatoč uspjehu tih testiranja Ratna mornarica odbila je taj projekt, a podmornica je bila rastavljena, napuštena i zaboravljena više od četrdeset godina u istom brodogradilištu, Arsenal de La Carraca (Cadiz), u kojem je bila porinuta 1888. Nakon četrdeset godina, morskim je putom odvučena do Cartagene gdje je najprije izložena u arsenalu toga grada, a poslije i u samome gradu. Godine 2013. obnovljena je i postavljena kao najznačajniji izložak u Mornaričkome muzeju Cartagena, zadobivši tako svoje pravo mjesto u povijesti mornarice.

## THE SUBMARINE *PERAL*, THE STRATEGIC IMPORTANCE OF THE WHITEHEAD TORPEDO IN THE INVENTION OF THE SUBMARINE

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**Key words:** *Armada*, Submarine *Peral*, Isaac Peral, Whitehead, Cartagena

This weapon was conceived by Captain Luppis of the Austrian Navy, and improved by Mr. Whitehead, a British engineer of the factory in Fiume, who gave his name to this system of torpedoes or locomotive torpedoes.

In 1871, Germany bought the patent of this torpedo and advanced them by making them in phosphor bronze, saving thus on maintenance and extending their operating life avoiding corrosion.

In 1880, the Spanish *Armada* sent a commission to examine both torpedoes, and chose the torpedo of Whitehead type, buying 100 units from the arms manufacturer *Schwartzkopff*.

In 1888, *Armada* Lieutenant Isaac Peral launched his submarine, which was equipped with the *Schwartzkopff* torpedo tube having a capacity of three torpedoes of the Whitehead type. The previous existence of the locomotive torpedo allowed the inventor of the submarine to have the perfect weapon for these ships.

The submarine *Peral* was the first submarine in history to shoot torpedoes. On March 21<sup>st</sup> in 1889, it launched one on the surface, while in immersion on January 16<sup>th</sup> in 1890. That same year, on June 7<sup>th</sup>, *Peral* made the first immersion navigation in history, 10 meters underwater.

Isaac Peral was the first to load aboard torpedoes in a submarine and his system remains today in modern combat submarines. He also designed the system to launch up to 3 torpedoes underwater without losing its stability.

Despite the success of the tests, the Navy rejected the project and the submarine dismantled, abandoned and forgotten for more than forty years in the same Arsenal of La Carraca (Cadiz), where she was launched in 1888. Some forty years later, it was towed by sea to Cartagena where it was first exhibited at the Arsenal of that city and then as a source motif for the next 80 years... Since 2013, it has been restored and displayed as the most important piece of the Naval Museum of Cartagena, thus regaining his place in naval history.

## NOSAČI TORPEDNIH ČAMACA

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**Ključne riječi:** stražarski čamci, torpedni čamac, matični brod

Čamci na paru koje su sredinom 19. stoljeća nosili veći ratni brodovi, dokazali su se kao „stražarski čamci” kružeći oko svoga roditeljskog broda i tako ga čuvajući na sidrištu, kao podrška pri oružanom iskrcavanju na kopno ili pak u osvajanju većeg broda, naoružani malim brzometnim topom. Uvođenjem mine na štapu ispred pramca, „stražarski čamci” zadobili su ulogu pomoćnih bojnih brodica koje su torpedirale neprijateljske brodove.

Kada se počeo upotrebljavati pokretan torpedo, stražarski čamci opremljeni su kolijevkama za lansiranje novog oružja. Ta rana torpeda malog kalibra i dalje su prevožena ratnim brodovima poput *HMS Dreadnoughta* kako bi se naoružavali stražarski čamci za djelovanje uz obalu. Brz porast veličine i dosega torpeda, međutim, doveo je do uvođenja prvih, posebno projektiranih torpednih čamaca.

Konkretni manevri koje su provodili Francuzi doveli su do neugodne spoznaje da njihova planirana jata torpednih čamaca nisu dovoljno plovna da bi sama provela presretanje onako kako su Francuzi očekivali. I dalje ih je trebalo prenositi do mjesta djelovanja. U samom početku bili su još dovoljno mali da bi ih jači mornari mogli prenijeti na brod, no uskoro su postali preveliki za to. Štoviše, nisu se više mogli sigurno podignuti i spustiti preko palube u more kada je brod bio na pučini.

Krajem 19. stoljeća dvije velike ratne mornarice eksperimentirale su s posebno projektiranim i opremljenim ratnim brodovima, matičnim brodovima čija je namjena bila prevoziti, održavati i lansirati na otvoreno more njihove flotile torpednih čamaca za napade u neprijateljskim lukama. Ako je to bilo potrebno, matični brodovi mogli su i intervenirati u bitci kako bi zaštitili svoje jato.

Te ću projekte detaljno ispitati i opisati njihovu konačnu sudbinu. Bavit ću se i pojedinostima manje poznatih nosača torpednih čamaca u Prvome i Drugome svjetskom ratu, od kojih su mnogi sudjelovali u bitkama.

Na kraju ću razmatrati neiskorišten potencijal ovih prvih matičnih brodova, rođenih pola stoljeća prije svoga vremena.

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## TORPEDO BOAT CARRIERS

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**Key words:** picket boat, torpedo boat, mothership

The steam launches carried on larger warships in the middle of the Nineteenth Century proved their value, as ‘picket’ boats circling around their parent vessel to guard her at anchor, or supporting armed landings or cutting-out expeditions, armed with small quick-firing cannon. With the introduction of spar torpedoes, the picket boats took on a new role, as auxiliary warships carrying out torpedo attacks on enemy ships.

When the locomotive torpedo came into use, the picket boats were fitted with carrying cradles to launch the new weapons. These early small calibre torpedoes continued to be carried on board warships such as *HMS Dreadnought* to arm their picket boats for inshore work. The rapid growth in torpedo size and range, however, led to the introduction of the first specifically-designed torpedo boats.

Realistic manoeuvres by the French led to the unpleasant discovery that their planned swarms of torpedo boats were not seaworthy enough to carry out by themselves the interdiction role the French had hoped. They still needed to be carried to the scene of the action. At first they themselves were still small enough to be carried aboard the larger men-of-war, but soon torpedo boats grew too big to be easily carried, and moreover, safely hoisted overboard when at sea.

Towards the end of the 19<sup>th</sup> Century two major navies experimented with specially-designed and equipped warships, motherships intended to carry, maintain and launch on the open sea their flotilla of torpedo boats, for attacks on enemy harbours. If necessary, the motherships could intervene in an action to protect their flock.

I will be examining these designs in detail, and will describe their ultimate fates. I will also detail the lesser-known torpedo-boat carriers of the First and Second World Wars, many of which ultimately saw action.

Finally I will ponder the wasted potential of these first motherships, born a half century before their time.

## REVITALIZACIJA LUČKIH STRUKTURA PUTEM NJIHOVIH KULTURNIH VRIJEDNOSTI NA PRIMJERU ZIMSKE LUKE U BRATISLAVI

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**Ključne riječi:** Zimska luka, Dunav, Bratislava, spomenici, očuvanje, revitalizacija

Zimska luka u Bratislavi dijelom je luke koja je u prvoj polovici 20. stoljeća spadala među najveće kopnene riječne luke u središnjoj Europi. Područje Zimske luke počelo se razvijati od 1897. kao mjesto na kojemu će brodovi prezimiti, a poslije je bilo povezano i s prekrcajem roba. Budući da je kompleks luke imao intenzivan transport, tehničke i gospodarske aktivnosti razvile su se izgradnjom dvaju umjetnih bazena u blizini plovidbenog toka rijeke Dunav. U drugoj polovici 20. stoljeća počele su se razvijati nove djelatnosti. Novi, tehnički i uslugom popravaka opremljen kompleks razvio se oko novoizgrađenih zgrada uz rijeku. Površine koje su pripadale pristaništu brodova Zimske luke sada preuzimaju nove rezidencijalne i komercijalne građevine, a povijesne lučke zgrade se ruše.

Nedavno je Slovački državni odbor za očuvanje spomenika odlučio neke zgrade Zimske luke staviti na popis nacionalnih zaštićenih spomenika. Vlasnici tih zgrada uložili su žalbu na tu odluku obrazlažući je time da napuštene zgrade nemaju kulturološku vrijednost i da njihovo očuvanje ograničava poslovni razvoj. Izrađena je stručna studija koja je potvrdila postojanje tih vrijednosti. Istodobno je napravljena studija o iskoristivosti tih povijesnih zgrada Zimske luke kako bi se sačuvala njihove kulturološke vrijednosti i to tako da se unaprijede i podrže turističke aktivnosti u kontekstu cijeloga grada Bratislave.

Ovaj rad prikazuje rezultate te studije nakon uključivanja obnovljenih povijesnih zgrada (Stara kuća pomoraca, Dvorana za popravak brodova, brodsko dizalo i teglenica Šturec) u revitalizaciju cijelog kompleksa Zimske luke kao aktivnog dijela razvoja turizma riječne plovidbe i obrazovno-rekreacijskih aktivnosti u skladu s razvojnim programom grada.

## REVITALISATION OF HARBOUR STRUCTURES THROUGH THEIR CULTURAL VALUES – THE EXAMPLE OF THE WINTER HARBOUR IN BRATISLAVA

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**Key words:** Winter Harbour, Danube, Bratislava, monuments, preservation, revitalization

The Winter Harbour in Bratislava makes part of the landing port that was among the biggest inland river harbours in Central Europe in the first half of the twentieth century. The area of the Winter Harbour was first used in 1897 with the purpose of being ships' wintering place, while later it was also used for the transloading of goods. As the harbour complex had extraordinarily intensive transport, technical and economic activities evolved when the two artificial basins were built in the immediate proximity of the navigable stream of the Danube. In the second half of the twentieth century, some new activities began evolving. A new technical and with repair services equipped complex has developed around the new buildings located by the river. Landing stages and surfaces of the Winter Harbour have begun to be taken over for the new residential and commercial construction; historical harbour buildings being demolished.

Not long ago, the Slovak National Board for Monument Preservation took the decision that some of the buildings of the Winter Harbour had to be listed as national monuments. The owners of these buildings protested defying that decision and raised the objection that the abandoned buildings do not have any cultural values while their preservation restricts the business development. Subsequently elaborated expert opinion confirmed the inherence of the noteworthy values. At the same time, a study of usability of historic buildings of the Winter Harbour in keeping with their cultural values was elaborated, in the way of supporting the tourism activities in the context of the whole town of Bratislava.

The paper presents the results of the study when the restored historic buildings (the Old Shipmen House, the Ship Repair Hall, a ship elevator and the towboat Šturec) became included into revitalization of whole complex of the Winter Harbour as an active part in the development of the river navigation tourism and for educational and recreational activities in line with development programme of the town.

## GLOBALNO TRŽIŠTE ORUŽJA I IZAZOVI U PROIZVODNJI TORPEDA

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**Ključne riječi:** masovna proizvodnja, fleksibilna specijalizacija, Fiume, tržište oružjem, torpeda

Namjeravam napisati rad od 10.000 riječi, u kojem će se razmatrati tri teme – najprije o prirodi proizvodnje torpeda s težištem na Whiteheadov rad u Rijeci, nakon toga o proizvodnji torpeda koja je izazvala probleme s pravima za zaštitu intelektualnog vlasništva te o razlozima zbog kojih se proizvodnja torpeda, zajedno s vezanim problemima o pravima intelektualnog vlasništva, može smatrati početkom vojnoindustrijskog kompleksa. Moj će rad obuhvatiti neke od istih tema o kojima sam pisala u svojoj knjizi *Torpedo: Inventing the Military-Industrial Complex in the United States and Great Britain* (Torpedo: Stvaranje vojnoindustrijskog kompleksa u SAD-u i u Velikoj Britaniji), *Harvard University Press*, 2014., a sadržavat će i neke neobjavljene materijale o Whiteheadovim radovima.

U desetljećima prije Prvoga svjetskog rata val novih tehnologija preobrazio je strategiju i taktiku ratne mornarice. Torpedo je bio je među najznačajnijima tako da su se mornarice diljem svijeta natjecale kako razviti brže i preciznije verzije dužeg dometa. Zbog njegove složenost i troškova, međutim, tradicionalni načini nabave oružja postali su nemogući. Whiteheadov rad u Rijeci bio je središte međunarodnog rada na torpedu, međutim niz dobavljača iz privatnog sektora te nekoliko državnih vlada započeli su vlastito istraživanje, potaknuli razvoj i otvorili mogućnost proizvodnje unutar javnog sektora. Umjesto da sami izgrade torpeda za sebe ili da ih kupe kao gotov proizvod od privatnog sektora, što je dotad bilo pravilo, vlade su počele investirati u istraživanje i razvoj torpeda u privatnom sektoru. Zbog te suradnje između javnog i privatnog sektora u fazi istraživanja i razvoja otežano je utvrđivanje činjenice koja strana posjeduje posljedična prava intelektualnog vlasništva. Smatra se da je trud koji su uložile vlade i dobavljači za obranu kako bi upravljali ovim izazovima doveo do stvaranja vojnoindustrijskog kompleksa.

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## THE GLOBAL ARMS MARKET AND THE CHALLENGES OF TORPEDO PRODUCTION

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**Key words:** mass production, flexible specialization, Fiume, arms market, torpedo

I propose to write a 10,000-word paper exploring three themes: first, the nature of torpedo production, focusing on Whitehead's works in Fiume; second, the ways in which torpedo production created intellectual property rights problems; and third, the reasons why torpedo production, with its associated intellectual property rights problems, may be considered the start of the military-industrial complex. My paper will cover some of the same ground that I covered in my book *Torpedo: Inventing the Military-Industrial Complex in the United States and Great Britain* (Harvard University Press, 2014), and it will contain some unpublished material on Whitehead's works.

In the decades before World War I, naval strategy and tactics were transformed by a wave of new technologies. One of the most important was the torpedo, and navies around the world competed to develop ever faster, more accurate, and longer-range versions. However, the complexity and expense of the torpedo rendered traditional methods of weapons procurement impossible. Whitehead's works in Fiume were the center of international torpedo work, but there were a number of other private-sector suppliers, and several national governments established their own public-sector torpedo research, development, and production capabilities as well. Instead of simply building torpedoes for themselves or purchasing them as finished products from the private sector, as had been the norm, governments found themselves having to invest in private-sector torpedo research and development (R&D). This collaboration between the public and private sectors during the R&D phase made it difficult to establish which party owned the resulting intellectual property rights. Efforts by governments and defense contractors to navigate these challenges may reasonably be said to have created the military-industrial complex.

## TERMODINAMIKA POGONSKIH STROJEVA TORPEDA

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**Ključne riječi:** Whiteheadov torpedo, torpedo s grijanjem, naprava za izgaranje, torpeda s grijanjem i unutarnjem hlađenjem

U prvoj polovici 19. stoljeća bilo je više pokušaja izuma podvodne mine ili bombe koja se autonomno kreće prema cilju. Najvažnije tehničke karakteristike takva oružja bile su domet i eksplozivno punjenje, zajedno s pogonskim strojem koji je morao biti u stanju održavati željeni kurs i konstantnu dubinu kretanja.

Prvi koji su uspjeli konstruirati takvu napravu bili su Giovanni Luppis i Robert Whitehead 1866. Robert Whitehead ugradio je u torpedo pneumatski stroj čije je „gorivo” bio komprimirani zrak na 70 bara. Prvi torpedo imao je ukupnu masu od 264 kg, od čega je eksplozivno punjenje težilo 19,5 kg, a domet mu je bio između 200 i 300 m pri brzini od 19 čvorova. Krajem 19. stoljeća Whiteheadova torpeda imaju masu od 530 kg, tlak zraka u spremniku od 100 bara, domet između 800 i 1200 m i eksplozivno punjenje od 90 kg.

Nedostatak je ovog stroja bio nagla ekspanzija zraka koja je izazivala hlađenje i suženje presjeka zbog pojave leda u cijevi dovoda zraka, tako da se ta bojna naprava često nazivala i *hladnim torpedom*.

Energija komprimiranog zraka povećala se dodavanjem goriva koje zauzima manji prostor. Sada u pogonski stroj ulaze dimni plinovi izgaranja visoke temperature i tlaka. Nastali plinovi izgaranja služe za pogon torpeda koji se sada naziva *torpedo s grijanjem*. Povećanjem radne snage torpeda Whiteheadova se konstrukcija pogonskog stroja s tri cilindra trebala zamijeniti konstrukcijom s četiri cilindra. To je rezultiralo konstrukcijom naprave za izgaranje u *modernom torpedu s grijanjem i unutarnjim hlađenjem*.

## THERMODYNAMICS OF TORPEDO PROPULSION ENGINES

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**Key words:** Whitehead's torpedo, hot-running torpedo, combustion device, torpedo with heating and internal cooling

In the first half of the 19<sup>th</sup> century there were several attempts at the invention of underwater mines or bombs that could autonomously move toward the target. The most important technical characteristics of these weapons were the range and explosive charge, along with the propulsion system capable of maintaining the wanted course and constant depth of movement.

The first that managed to build such a device were Giovanni Luppis and Robert Whitehead in 1866. Robert Whitehead installed a pneumatic machine in the torpedo, which was “fueled” by compressed air at a pressure of 70 bars. The first torpedoes had a total weight of 264 kg, where the weight of the explosive charge was 19.5 kg, and its range was between 200 and 300 m at a speed of 19 knots. At the end of the 19<sup>th</sup> century, the new Whitehead torpedoes had a mass of 530 kg, an air pressure of 100 bars, a maximum range between 800 m and 1200 m, and with a warhead weight of 90 kg.

The disadvantage of this device was the abrupt expansion of air followed by cooling and ice formation causing obstruction in the air supply tube. Therefore, this torpedo is often referred to as *cold-running torpedo*.

The energy of compressed air was increased by adding fuel, which has higher energy density and occupies little space. The propulsion engines of these torpedoes works with combustion flue gases at high temperature and pressure. Since the combustion fuel gases are used to propel the torpedo, it is referred to as *hot-running torpedo*.

The increase of torpedo power required that the construction of the Whitehead's machine with 3 cylinders is replaced by a 4 cylinders design. This resulted with the construction of combustion devices used in the modern *torpedo with heating and internal cooling*.

## CARL PAUL GOTTFRIED VON LINDE – PIONIR TEHNIKE HLAĐENJA (1842. – 1934.)

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**Ključne riječi:** Carl Paul Gottfried von Linde, *Torpedo* Rijeka, ljevokretni kružni proces, ukapljivanje plinova, rashladni sustavi

Ljevokretni kružni proces termodinamička je osnova rashladne tehnike: rashladnih uređaja za hlađenje i tehnike grijanja dizalicom topline, rashladnih uređaja niskih temperatura i tehnike ukapljivanja plinova. Prve početke tehnike hlađenja vezujemo za sredinu 18. stoljeća i Williama Cullena, Benjamina Franklina i Johna Hadleya te prvu polovicu 19. stoljeća i Olivera Evansa, Michaela Faradaya, Jacoba Perkinsa... Krajem toga stoljeća jedan od pionira tehnike hlađenja Carl von Linde (1842. – 1934.) upotrijebio je u ljevokretnome kružnom procesu kompresor kojim se koristio Robert Whitehead za komprimiranje zraka za pogon pneumatskog stroja torpeda. Lindeov kružni proces ukapljivanja zraka bio je proveden 1895. u pogonima riječke tvornice *Torpedo*. Carl von Linde se kao dvadesetčetverogodišnjak zapošljava na *Polytechnischen Schule München*, s dvadeset šest godina postaje izvanredni profesor, a 1872. redoviti profesor konstrukcije motora. Na toj prestižnoj visokoj školi ustrojio je prvi laboratorij za toplinske strojeve. U to su vrijeme konstruirani prvi motori s unutarnjim izgaranjem pa je vrijedno spomenuti da je Carl von Linde bio profesor Rudolfu Dieselu, izumitelju diezelskih motora.

U radu se uz povijesni trenutak primjene riječkog kompresora za ljevokretni kružni proces Carla von Lindea, daje pregled razvoja rashladne tehnike, tehnike ukapljivanja plinova i tehnike grijanja i hlađenja do danas.

## CARL PAUL GOTTFRIED VON LINDE: PIONEER OF REFRIGERATION TECHNOLOGIES (1842 – 1934)

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**Key words:** Carl Paul Gottfried von Linde, *Torpedo* Rijeka, heat pump cycle, gas liquefaction, cooling systems

The heat pump cycle, sometimes referred as refrigeration cycle, is the basis of refrigeration thermodynamics, cooling devices and heat pump technology, low temperature refrigeration systems and techniques of gas liquefaction. The origination of cooling techniques can be traced to the middle of the eighteenth century: William Cullen, Benjamin Franklin, John Hadley; and in the first half of the nineteenth century: Oliver Evans, Michael Faraday, Jacob Perkins... At the end of the century, one of the pioneers of cooling technology, Carl von Linde (1842 – 1934), developed a novel application of the heat pump cycle by using the compressor previously used by Robert Whitehead for compressing air to drive pneumatic machine torpedoes. Linde's application developed with Whitehead's compressor resulted in a novel cascade cycle for liquefaction of air which was implemented in 1895 in the manufacturing facilities of the *Torpedo* factory in Rijeka. Carl von Linde at the age of 24 years began working at *Polytechnischen Schule Munich*, and with 26 years became associate professor, only in 1872 to become a full professor of mechanical engineering. At this prestigious Academy he established the first Laboratory for Heat Engines. It was at that time that the first internal combustion engines were designed; therefore it is worthwhile mentioning that Rudolf Diesel, the inventor of the diesel engine, was Carl von Linde's student.

This work provides an overview of this historically important moment of the application of Carl von Linde's liquefaction cycle, and also the development of heating and cooling systems to date.

## DEMISTIFICIRAJUĆI I „DEMITOLOGIZIRAJUĆI” RANU POVIJEST TORPEDA

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**Ključne riječi:** rana povijest torpeda, bibliografija o torpedu, hidrostaticka kontrola dubine, „tajni” uređaj, Whiteheadov torpedo

Ovaj rad prikazuje detaljno istraživanje literature koja obuhvaća povijest pomorskog torpeda. U stotinu pedeset godina povijesti torpeda mnogi su autori o tome napisali knjige i manuskripte koji su objavljeni na raznim jezicima. Njihov je doprinos sažet i analiziran kako bi se omogućila longitudinalna perspektiva ove tehnologije, a literatura daje bibliografiju rijetkih i korisnih tekstova za čitanje.

Ova je studija otkrila da rana povijest torpeda sadrži puno proturječja ili pogrešnih opisa, čak nekih mitskih događaja za koje se i danas smatra da su istiniti. Autor je analizirao više od stotinu artefakta kako bi identificirao relevantne izvore, riješio neka nepodudaranja i ispravio događaje koji se pobijaju mitovima, a odnose se na ranu povijest torpeda. U radu se prvi put otkriva u četiri koraka napravljen progresivan razvoj mehanizama hidrostaticke kontrole koji su bili specifični za Whiteheadova torpeda. Taj rezultat zasniva se na pomnom proučavanju jako oskudne literature u javnoj domeni, a tiče se „tajne”, uređaja koji održavaju dubinu na Whiteheadovim torpedima iz ranih dana.

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## DEMISTIFYING AND “DEMYTHIFYING” THE EARLY TORPEDO HISTORY

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**Key words:** early history of torpedo, torpedo bibliography, hydrostatic control of depth, “the secret” device, Whitehead’s torpedo

This paper reports on an in-depth study of the literature covering the history of the naval torpedo. The sources for the books and manuscripts examined encompass international authors, printed in a variety of languages, and published over the 150 years of torpedo history. The contributions are summarized and analysed to provide a longitudinal perspective of this technology and the references provide a bibliography of rare and useful readings.

This study revealed that the early history of the torpedo contains quite a few discrepancies or anomalous descriptions, and even some mythical events that are still perceived as the truth today. The author analyzed over 100 artefacts to identify pertinent sources, resolve some incongruities, and put straight the events riddled with myths related to the early history of the torpedo. The paper also uncovers for the first time a four-step progressive evolution of the hydrostatic control mechanisms that were unique to the Whitehead torpedoes. This result is based on a careful scrutiny of the very limited literature in the public domain concerning “The Secret” – the depth keeping devices of Whitehead’s torpedoes in the early days.



## „PROKLETA TORPEDA!” – ANALIZA SLUČAJEVA NEUSPJEHA TORPEDA

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**Ključne riječi:** neispravnost u radu torpeda, tehnička greška kod torpeda, gubitak podmornica, organizacijske pogreške

U podmorskom ratovanju torpeda su posljednjih stotinu pedeset godina postala rastuća sofisticirana prijetnja. Ljudska ingenioznost, kreativnost i napredak tehnologije rezultirali su jako složenim i inteligentnim sustavom. Ovaj rad analizira pet slučajeva neuspjeha torpeda i njihov utjecaj na korisnike ili platforme koje ih nose. Skorašnji gubitak ruske podmornice *Kursk* primjer ovoga drugog. Drugi slučajevi odnose se na njemačke i američke neuspjehe torpeda u Drugome svjetskom ratu, argentinski neuspjeh torpeda na podmornici *San Luis* za vrijeme Falklandskog sukoba 1982., a posljednji slučaj bavi se već više od četrdeset godina nagađanjima o tome što je uzrokovalo gubitak nuklearne podmornice *USS Scorpion* 1968. Za svaki slučaj navode se izvori korišteni u ovom istraživanju, opisuje problem, tehnički uzroci te organizacijski kontekst vezan uz pojedini neuspjeh torpeda. U radu se važnost ovih slučajeva iznosi u obliku upozoravajućih priča u kojima se neuspjesi uglavnom pripisuju neodgovarajućim sustavima inženjerske izvedbe i loše izvedbe pothvata tijekom različitih stupnjeva životnog ciklusa sustava. Iskustva dobivena iz tih neuspjeha danas se primjenjuju u industriji torpeda. Inteligentne tvrtke otkrile su da je odgovorno inženjerstvo sustava ključ za sigurniji i pouzdaniji razvoj proizvoda i njegova funkcioniranja.

## “DAMN THE TORPEDOES!” – TORPEDO FAILURES CASE STUDIES

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**Key words:** torpedo malfunction, torpedo technical failures, loss of submarines, organizational failures

Torpedoes in underwater warfare have become an increasingly sophisticated threat over the past 150 years. Human ingenuity, creativity and advancements in technology have resulted in a very complex and intelligent system in its own right. This paper examines five cases of torpedo failures and their impacts on the users or the carrying platforms. The recent loss of the Russian submarine *Kursk* is an example of the latter. The other cases deal with the German and American torpedoes' failures in World War II, the Argentinian torpedo failure on board the submarine *San Luis* during the Falkland conflict in 1982; the last case examines the over 40 years of speculation as to what caused the loss of the *USS Scorpion* in 1968. Each case references the sources used for the examination, and describes the problem, the technical causes, and the organizational context related to the respective torpedo failure. The paper derives the relevance of these cases as a form of cautionary tales, where the failures are largely attributed to inadequate systems engineering performance and badly executed enterprise performance during different stages of the systems' life cycle. Experiences gained from these failures are applied to the torpedo industry today; intelligent enterprises have discovered that responsible systems engineering provides the key to safer and more reliable product development and operations.

## TEŠKA BAŠTINA – DOKUMENTI O ARHITEKTURI NJEMAČKOGA VOJNOG KOMPLEKSA

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**Ključne riječi:** spomenici njemačke vojne proizvodnje, V2 proizvodnja u Peenemündeu, mjestu prisilnog rada, mornarički lokaliteti

U Njemačkoj je mnogo tvornica povezano s proizvodnjom oružja i ratnih vozila te mjestima za razvijanje vojne tehnologije i u Prvome i u Drugome svjetskom ratu. Postoje i tragovi rasta u proizvodnji nečega što ima „dvojnju upotrebu”, kao što je to čelik u industriji Ruhrgebiet regije. Od istaknutog je značenja veliki kompleks vojnog centra za istraživanje *Peenemünd* u kojem se razvijala V2 raketna tehnologija, područje u koje se „nije smjelo ići” od 1937. do 1990. (njemačka vojska, ruska vojska, vojska DDR-a). Drugi lokalitet „teškog tipa” su, naravno, mjesta prisilnog rada, tamo gdje su zatvorenici koncentracijskih logora bili prisiljeni raditi u njemačkoj vojnoj proizvodnji, poput logora Dora Mittelbau u kojem su se proizvodile rakete, ili ruševina tvornica aviona gdje su radili zatvorenici iz koncentracijskog logora Dachau pokraj Münchena.

Dugo nakon rata priznata je njihova nekadašnja namjena pa su u skladu s time i integrirani u projekte očuvanja i prezentacije. Mornarički lokaliteti još su jedan oblik industrijske baštine, poput novoobnovljenoga grada Wilhelmshavena koji je služio Njemačkoj mornarici od njezinih pruskih početaka od sredine 19. stoljeća, s brzim rastom nakon 1900. do kojega je došlo zbog rastuće važnosti njemačkog ratovanja na moru pod carem Wilhelmom II. Godine 1918., pobunom njemačkih mornara u Wilhelmshavenu, počeo je politički proces demokratizacije u Njemačkoj.

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## DIFFICULT HERITAGE – ARCHITECTURAL DOCUMENTS OF THE GERMAN MILITARY COMPLEX

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**Key words:** monuments of German military production, Peenemünde V2 production, places of forced labour, naval sites

In Germany, there are many factories linked to the production of weapons, vehicles for war use and development sites for military technology, both for World War One and World War Two. Also there are the traces of growth in the production of “dual use” stuff such as steel in the Ruhrgebiet industry. Prominent is the large-scale complex of Peenemünde” where the development of the V2 rocket technology took place, a “no-go” area since 1937 till 1990 (German Army, Russian Army, DDR Army). Another difficult type of site are of course the places of forced labour, where the inhabitants of concentration camps were forced to took part in German military production, such as the “Dora Mittelbau” site for the rocket production in Peenemünde in Thuringia or the remains of an aeroplane production site, using prisoners from the Dachau concentration camp near Munich.

Only long after the war, these places were acknowledged as what they had been and accordingly integrated in concepts of preservation and presentation. Naval sites form another part of the industrial heritage, such as the newly developed city of Wilhelmshaven to serve the German Navy since its Prussian origins after the mid 19th century with its rapid growth after 1900 caused by the growing importance of German naval warfare under emperor Wilhelm II. 1918 the mutiny of German sailors in Wilhelmshaven started the political process of democratization in Germany.

## IMA LI MJESTA ZA DIVERZANTSKU PODMORNICU VELEBIT P-01 U TEHNIČKOM MUZEJU NIKOLA TESLA? – Studija slučaja

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**Ključne riječi:** podmornica, kulturno dobro, tehnička baština, restauracija, muzej

Džepna (diverzantska) podmornica *Soča P-914* u sastavu bivše Jugoslavenske ratne mornarice iz druge polovice 80-ih godina 20. stoljeća redizajnirana je (produžena s poboljšanim karakteristikama) i preuzeta u flotu HRM-a 1996. pod nazivom *Velebit P-01*. Do 2001. bila je u sastavu Hrvatske ratne mornarice, kada je otpisana zbog isteka trajanja pogonske baterije za napajanje. Godine 2005. izvađena je iz mora na „suhi vez“ (kopno) u ratnoj luci Lora u Splitu. Projektirana je u Brodarskom institutu u Zagrebu, a sagrađena u splitskom brodogradilištu Brodosplit – BSO (izvorna i modificirana verzija). Podmornica *Velebit P-01* bila je namijenjena obavljanju diverzantskih zadataka: polaganju ležećih mina na dno, prijevozu diverzanata, obavljanju ophodnje i izvidničkih zadataka, površinskoj obuci mornara te različitim specijalnim zadacima.

Tehnički muzej *Nikola Tesla*, kao matični muzej za tehničke muzeje u Republici Hrvatskoj, zainteresiran je za trajno očuvanje podmornice *Velebit*, predstavnika visoke tehnologije hrvatske industrije i potencijalnoga tehničkog kulturnog dobra od nacionalnog interesa. Optimalan je smještaj za podmornicu *Velebit* zatvoreni prostor jer ju je na otvorenom prostoru moguće održati u zadovoljavajućem stanju, bez trajnih posljedica i devastacije, samo u ograničenome vremenskom razdoblju. U muzejima se često prisutne dvojbe o uvođenju velikih predmeta u funduse, za koje se ne mogu jamčiti odgovarajući uvjeti smještaja.

Godine 2010. razmatrana je mogućnost povećanja fundusa Tehničkog muzeja *Nikola Tesla* podmornicom *Velebit*. Provedenom analizom ustanovljeno je kako u zatvorenim prostorima stalnoga postava i depoa kojima se Muzej koristi nema slobodnog prostora za njezin trajan smještaj. Na otvorenim površinama Muzeja kao jedina moguća opcija utvrđen je uski pojas zelene površine između ograde muzeja (Tratinska ulici) i niske upravne zgrade. Za tu je lokaciju temeljem izrađenog projekta o smještaju podmornice *Velebit* ishoda protupožarna suglasnost, kao i suglasnost konzervatora.

Zbog prijeko potrebnih, izrazito velikih novčanih sredstava za demontažu, transport, montažu i konzerviranje podmornice *Velebit P-01*, moralo se, nažalost, odustati od njezina preuzimanja u fundus Tehničkog muzeja *Nikola Tesla*.

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## IS THERE ROOM FOR THE COMMANDO SUBMARINE VELEBIT P-01 IN THE NIKOLA TESLA TECHNICAL MUSEUM? – Case study

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**Key words:** submarine, technical heritage, restoration, museum

The midget (commando) submarine *Soča P-914* was made during the mid 80ies for the assembly of the former Yugoslavian Navy. In 1996 it was redesigned – extended with improved characteristics – and renamed *Velebit P-01* by the Croatian Navy Fleet. It was part of the Croatian Navy until 2001 when it was written-off due to the driving battery supply going out of date. In 2005 it was pulled out of the sea on the so called “dry berth” in the war harbour “Lora” in Split. It was designed in the “Brodarski institut” in Zagreb and built in “Brodosplit” – BSO shipyard in Split (both the initial and the improved version). The submarine *Velebit P-01* was intended for commando tasks: minelaying, transfer of commandoes, patrol and vanguard, surface training of the marines and other specialist tasks. The Nikola Tesla Technical Museum as the main museum of technology in Croatia is interested in the long term conservation of this submarine, for it represents the high technical accomplishment of the Croatian industry and the potential cultural heritage of national importance. The ideal storage for the *Velebit* submarine is a closed space. In the open space it can be stored for a limited time only, otherwise permanent devastation can occur. In museums there is often a dilemma about such large objects becoming a part of the permanent collection, as it is almost impossible to guarantee adequate storage conditions.

In 2010 it was considered for the Velebit submarine to become a part of the Nikola Tesla Technical Museum permanent collection. The implementing analyses established that within the closed spaces of the Museum permanent collection display as well as the storage area, there was no free space to accommodate the submarine. In the open space of Museum areas as an option identified was the green surface between the fence of the Museum towards Tratinska ulica (Street) and the administrative unit of the Museum. Based on the project elaboration for the accommodation of the submarine, the City Department fire and conservation permits were procured.

Dismantlement, transport, assembling and the conservation of the Velebit P-01 submarine would require exceptionally high financial funds. Hence, unfortunately, the Nikola Tesla Technical Museum had to decline taking over of the submarine for its permanent collection.

## RAZVOJ UPALJAČA WHITEHEADOVA TORPEDA 1866. – 1918.

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**Ključne riječi:** Luppis, Whitehead, torpedo, upaljač, nacrt

*Salvacoste*, izvorni koncept Giovannija Luppisa, plutajuća naprava bez ljudske posade kojom se se upravljalo s kopna, a bila je namijenjena uništenju brodova, dovela je do izuma podvodnog torpeda na vlastiti pogon. Bio je to kvantni skok u tehnologiji pomorskog oružja, koji je zauvijek promijenio pomorsku taktiku i strategiju. Brodovi više nisu morali tegliti eksplozivne naprave da bi ih izbacili na neprijateljske brodove poput Harveyeva torpeda ili zabili eksplozivnu glavu *Spar* torpeda u trup protivničkog broda. Godine 1866. Whitehead je izumio „lokomotivu” na vlastiti pogon ili „ribu torpedo” koja je imala unaprijed određenu putanju na unaprijed određenoj dubini, sve do mete.

Došavši do mete, uspješna detonacija oslanjala se isključivo na jednu ključnu komponentu, na upaljač ili detonator. Kao što je to slučaj s njegovim dvojnikom u artiljeriji, upaljač je jezgra projektila i upravlja eksplozijom. Bez pouzdanog mehanizma ispaljivanja/detonacije torpedo ne bi uspio u svojoj misiji, čime bi njegovo postojanje palo u zaborav.

Projektiranje upaljača torpeda doživjelo je radikalnu promjenu tako što je izvorni mehanizam upaljača na oprugu, zasnovan na naboju puške, zamijenjen jednostavnijim kontaktnim mehanizmom kada je jednom brzina torpeda dostignula točku na kojoj njegova inercija može izazvati detonaciju. Uvođenjem mehanizma sigurnosnog propelera, torpedo se mogao lansirati i upotrijebiti kao oružje tek na sigurnoj udaljenosti od broda.

Primjenjivali su se brojni nacrti upaljača kako bi se povećao „kut udara” i tako omogućio veći postotak uspjeha detonacije kad torpedo pogodi metu na njezinu rubnom području. Uvođenjem dodatnih poluga ili „mačjih brkova” upaljača, „kut udara” uspjelo se samo povećati do učinkovitih 30 – 35 stupnja izvan središta mete.

Konačno, uvođenjem upaljača inercijskog tipa, koji su projektirali *Universal Bell* i poslije *Universal Pendulum*, prevladano je oslanjanje na mehanizam upaljača koji se nalazio na vršku torpeda i započelo je vrijeme modernog torpeda.

Ovo istraživanje ranog projekta Whiteheadova upaljača omogućava uzbudljiv pogled u rani razvoj mehanizma upaljača, u njegovo mijenjanje kojim su prevladane prepreke, u izazove koji i danas postoje i napredna usavršavanja koja vode većoj pouzdanosti.

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## DEVELOPMENTS IN WHITEHEAD TORPEDO PISTOL DESIGN 1866 – 1918

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**Key words:** Luppis, Whitehead, torpedo, pistol, design

The original concept of Giovanni Luppis’s “*Salvacoste*” – a floating unmanned device controlled from land for destroying ships, eventually lead to the invention of the self-propelled underwater torpedo. It was a quantum leap in naval weapons technology, changing naval tactics and strategy forever. No longer did ships have to tow explosive devices such as Harvey’s Sea Torpedo into enemy ships, or ram the explosive head of a Spar Torpedo into an opponent’s hull. In 1866 Robert Whitehead invented the self-propelled “locomotive” or fish torpedo that traveled along a predetermined path at a predetermined depth to its intended target.

Upon reaching the target, a successful detonation relied solely on one key torpedo component – its pistol or fuze. As with its artillery counterpart, the fuze is the nucleus of the projectile and controls the explosion. Without a reliable firing /pistol mechanism, the torpedo will fail in its mission leading to its inevitable lost into oblivion.

The design of the torpedo pistol underwent radical re-design where the original spring pistol mechanism based on a rifle’s percussion design was replaced by a simpler contact one once the velocity of the torpedo reached a point where the inertia of the torpedo could detonate the explosion. With the introduction of safety fan mechanisms, the torpedo could be launched and only to be “armed” at a safe distance away from the ship.

Numerous pistol designs were implemented to increase the “angle of bump” providing a higher success rate of detonation if the torpedo struck the target at an off centre angle. The introduction of extended pistol levers or “whiskers” could only increase the “angle of bump” up to an effective 30-35 degrees from off centre.

Finally with the introduction of the Universal Bell and the later Universal Pendulum inertia type pistols, the final reliance on having a pistol mechanism solely attached to the tip of the torpedo was overcome and the era of the modern torpedo was born.

This research of early Whitehead Pistol Design takes an exciting look into the development of the early torpedo pistol mechanisms, how they evolved to overcome obstacles, ongoing challenges and the progressive improvements which lead to consistent reliability.

## MOGUĆNOSTI RAZVOJA INDUSTRIJSKOG TURIZMA GRADA RIJEKE

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**Ključne riječi:** industrijska baština, industrijska arheologija, turizam, specifični oblici turizma, turizam industrijske baštine, konkurentna prednost

Industrijska baština, popularno nazivana i *krajolikom nostalgije*, podrazumijeva zgrade, lokalitete i infrastrukturu bivše industrijske namjene, koji su vrijedan resurs za gospodarstvo i lokalno stanovništvo, ali i za turizam. To su zapravo ostaci industrijske djelatnosti koji posjeduju određeni tržišni potencijal, a prenamijenjeni su (ili mogu biti prenamijenjeni) u lokalitete od povijesne, tehnološke, socijalne, arhitektonske i znanstvene važnosti. Osim materijalnih, mogu sadržavati i nematerijalne elemente te zahtijevaju prilagođen znanstveni pristup poznat pod pojmom industrijska arheologija.

Kao posljedica razvoja turističkih aktivnosti na lokalitetima, zgradama i krajolicima vezanim uz povijesne industrijske procese nastaje turizam industrijske baštine, odnosno industrijski turizam. Razvojem industrijskog turizma postižu se višestruke prednosti poput povećanja prosperiteta uže i šire zajednice, poticanja revitalizacije vrijednih industrijskih spomenika i lokaliteta te postizanja konkurentne prednosti, čime se potiče razvoj selektivnih oblika turizma koji umanjuju negativne učinke sezonalnosti i diverzificiraju osnovni turistički proizvod destinacije. Značenje industrijskog turizma može se iščitati i iz podataka Odbora za promet i turizam Europskog parlamenta. Godine 2013. ostvareno je 18 milijuna noćenja i 146 milijuna posjeta industrijskim atrakcijama i ostvarena direktna turistička potrošnja od 9 milijuna €.

Zahvaljujući nekada uspješnoj riječkoj industriji grad Rijeka danas raspolaže bogatom industrijskom baštinom, što je osnovni preduvjet razvoja industrijskog turizma. Svoj puni potencijal razvoja grad Rijeka može postići jedino ako se adekvatno valorizira i revitalizira industrijska baština te stavi u funkciju, pri čemu se turizam industrijske baštine pojavljuje kao glavni pokretač razvoja destinacije.

U radu će se istražiti mogućnosti i potencijali razvoja industrijskog turizma grada Rijeke. Utvrdit će se model formiranja konkurentnog proizvoda industrijskog turizma. Analizirat će se prednosti i nedostaci razvoja industrijskog turizma, što će se detaljno prikazati kroz SWOT-matricu.

## POSSIBILITIES FOR INDUSTRIAL TOURISM DEVELOPMENT IN THE CITY OF RIJEKA

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**Key words:** industrial heritage, industrial archeology, tourism, selective forms of tourism, industrial heritage tourism, competitive advantage

Industrial heritage, popularly known as the 'landscape of nostalgia' refers to buildings and infrastructure of the former industrial purpose that represents a valuable resource for the economy, local population and also for tourism. These are actually the remains of industrial activities that have a specific market potential and are converted (or can be converted) to sites of historical, technological, social, architectural and scientific importance. Besides the tangible, they may include intangible elements that require a custom scientific approach known as the concept of industrial archeology.

Industrial heritage tourism or industrial tourism occurs as a result of the tourist activities at the sites, buildings and landscapes associated with the historical industrial processes. The development of industrial tourism can offer multiple benefits such as: increased prosperity of immediate and wider community, revitalization of valuable industrial monuments or sites and competitive advantages, all of which promote the development of selective forms of tourism that can reduce the negative effects of seasonality and diversify the basic tourist product of the destination. The importance of industrial tourism can be seen in the data of the European Parliament's Committee on Transport and Tourism. Industrial tourism generated 18 million overnight tourist trips plus 146 million day visits and a spending of almost €9 billion in 2013.

Thanks to the once successful industry, Rijeka has a rich industrial heritage, which is a basic prerequisite for the industrial tourism development. Its full potential in the city of Rijeka can be achieved only with adequately evaluated

and revitalized industrial heritage where the industrial heritage tourism emerges as the main impetus for the development of the destination.

This paper will explore the possibilities and potential of industrial tourism development in the city of Rijeka. A model of a competitive industrial tourism product will be determined. The advantages and disadvantages of the industrial tourism development will be analyzed and displayed through a detailed SWOT matrix.



## O BALISTICI U RIJECI, POTOM I U ZAGREBU DO 1956.

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**Ključne riječi:** povijest balistike, fizikalni i tehnički aspekti gibanja projektila

Kao znanstvene sredine, gradovi Rijeka i Zagreb odigrali su, svaki na svoj način, važne uloge u događajima povezanim s razvojem balistike (u vodi i u zraku). U Rijeci je povijest balistike pisana kao proces događanja u ustanovama i tvrtkama povezanim s vojskom i ta događanja imaju primat u Hrvatskoj i svijetu. Balistiku su razvijali Salcher i Whitehead – što je dobro poznato i iz prijašnjih konferencija. Razvoj balistike u Zagrebu odvijao se kroz sveučilišnu nastavu odgovarajućih kolegija poput mehanike fluida i mehanike – dinamike i kinematike krutog tijela (zvrkovi). Na taj je način došlo do promjene u načinu razmišljanja, što je dovelo do napretka znanosti o balistici. Temama bliskim balistici bavili su se Dvořák, Hondl, Vrkljan, Pejnović, Plotnikov, Prejac, Lopašić, Bazjanac – što je manje poznato. U sveučilišnoj nastavi počinju se rabiti zanimljivi obrazovni filmovi, što će biti predstavljeno i na konferenciji. Pritom ćemo se ograničiti na razdoblje do 1956. kada je od Tehničkog fakulteta u Zagrebu nastalo nekoliko samostalnih fakulteta tehničke naravi. Prikazat će se teme iz radova i predavanja spomenutih znanstvenika kroz matematička rješenja konkretnih problema. Raspravljat će se o učinku Coriolisove sile i otvoriti pitanje utjecaja Coriolisove sile na gibanje torpeda.

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## ON BALLISTICS IN RIJEKA, THEN ALSO IN ZAGREB, UNTIL 1956

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**Key words:** history of ballistics, physical and technical aspects of projectile motion

Rijeka and Zagreb, as two scientific centres, have played an important role in the events connected with the development of ballistics (in water and air). The history of ballistics in Rijeka mostly took place in firms connected with the military as the military events have priority in Croatia, as well as in the world. Ballistics was developed by Salcher, Whitehead and Luppis, which is well known from former conferences. The development of ballistics in Zagreb is closely connected with university teaching, within courses such as fluid mechanics and mechanics, especially dynamics and kinematics of solids (gyroscopes). Thus a change occurred in formulating the way to deal with ballistics, which resulted in an advancement of the science of ballistics. Topics closely related to ballistics were researched by Dvořák, Hondl, Vrkljan, Pejnović, Plotnikov, Prejac, Lopašić, Bazjanac, which is rather less known. Interesting educational movies began to be used, as will be presented at the conference. We will mainly be concerned with the time period until the year 1956 when the Technical Faculty of the Zagreb University divided into independent faculties of different technical disciplines. Some of the topics from the research and public presentations of the above mentioned scientists will be presented through mathematical solutions of specific problems. The Coriolis force effect will also be discussed and the question of its possible impact on the torpedo motion posed.

## O ZVRKU I NJEGOVU ZNAČENJU U TEHNICI I ZNANOSTI OPĆENITO

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**Ključne riječi:** zvrk, povijest istraživanja o zvrku u Hrvatskoj, precesija zvrka, primjena zvrka u balistici

Gibanje zvrka, u svom najopćenitijem obliku, jedno je od najtežih područja klasične mehanike.

Zna se da zvrk, kao osnovni giroskopski element, pomaže u uređajima za očuvanje stabilnosti putanje brodova i zrakoplova, kao i projektila (u vodi i zraku), a odnedavno se upotrebljava i u relativističkim giroskopskim satelitima. U radu se daju općeprihvatljive fizikalne osnove gibanja zvrka s osvrtom na neke primjene. Razmotrit će se i oblik putanje rotirajućeg projektila u zraku. Bit će prikazani i zanimljivi filmski isječci povezani sa zvrkom. Poseban naglasak u ovom radu stavit će se na naše znanstvenike i inženjere koji su se bavili tematikom proučavanja gibanja zvrka (Dvořák, Lopašić, Bazjanac, Pajić).

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## ABOUT GYROSCOPE AND ITS IMPORTANCE IN TECHNOLOGY AND IN SCIENCE IN GENERAL

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**Key words:** top, history of top and gyroscope research in Croatia, precession, top in external ballistics

The motion of gyroscopes (tops) in its most general form is one of the most involved problems in classical mechanics. It is well known that gyroscope is an essential element in components regulating stability of ships, air planes as well as projectiles (in air and water). Recently, it has been employed in relativistic gyroscopic satellites. In this presentation, a general theory of gyroscopic motion will be given and some of its applications will be discussed. Also the projectile motion in the air will be described, and some short movies concerning gyroscope experiments will be shown. In the presentation, emphasis is given to the works of our engineers and scientists who have devoted part of their research to gyroscopes (Dvořák, Lopašić, Bazjanac, Pajić).

## MACHOVO NASLJEĐE POD GORJANCI

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**Ključne riječi:** Johann Mach, Ernest Mach, Veliki Slatnik – Rijeka, Machovo nasljeđe, jamamay, *Machova obrazovna staza*

U mjesnoj zajednici Mali Slatnik prošle smo godine odlučili poduzeti važan korak – napraviti *Machovu obrazovnu stazu*. Sredinom veljače ove godine obilježavamo stotu godišnjicu smrti velikog fizičara Ernsta Macha. Jedno od njegovih najvećih postignuća bilo je stvaranje ultrabrze fotografije u riječkoj tvornici torpeda. Mach je povremeno živio i radio na imanju svoga oca u Velikom Slatniku, 75 kilometara sjeverno od Rijeke.

Njegov otac Johann Mach bio je humanistički obrazovan i poznavatelj znanosti. Godine 1858. sa svojom je moravskom obitelji došao u Novo Mesto gdje je kupio obiteljsku kuću. Kod kuće i na Machovu brijegu bavio se uzgojem svilene bube i obrazovanjem svojih suseljana. Krajem 19. stoljeća na njegovu je zemljištu osnovana djevojačka škola u Šmihelu. Tako je obitelj Mach indirektno pomogla u obrazovanju djevojaka Dolenjske.

Malo se zna o Machovoj obitelji iako se neki potrudili istražiti to ime. Godine 1995. grupa nadarenih studenata napravila je izbor Machovih djela, opsežan rad Udruge učitelja Dolenjske, u kojem je prikazan funkcionalan ciklus svilene bube *jamamay*, kao i tumačenje života i rada obitelji Mach.

Zacrtali smo Machovu stazu dolinom potoka Slatenska, oko Machova brijega, do obiteljske kuće u kojoj je Ernst Mach živio. Na točkama te staze nalaze se informacije vezane za pisca J. Trdinu i Wilheminu, nesretnu kćer Johanna Macha. Devet kilometara dugačka *Machova obrazovna staza* bit će označena informacijama o Machu. U tome nam pomaže *Institut za zaštitu kulturne baštine*, *Institut za očuvanje prirode Slovenije* i drugi stručnjaci. Velika nam je želja prenijeti znanje mladim generacijama i očuvati nasljeđe.

Prošle smo godine osnovali udugu *Machovo nasljeđe pod Gorjanci*. Marjan Hren napisao je knjigu *Dolina Slatenske i Mach – nasljeđe pod Gorjanci*, koja je u postupku izdavanja.

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## MACH'S HERITAGE UNDER GORJANCI

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**Key words:** Johann Mach, Ernest Mach, Veliki Slatnik – Rijeka, Mach's Heritage, jamamay, Mach's learning path

Last year, in the local community of Mali Slatnik, we decided to make an important step, i.e., to design the *Mach learning path*. In the mid February of this year we remember the 100<sup>th</sup> anniversary of the death of the great physicist Ernst Mach. One of his major achievements was to design the photography of supersonic motion in the Rijeka torpedo factory. From time to time he lived and worked on his father's farm in Veliki Slatnik, 75 km north of Rijeka.

His father Johann Mach was an educated humanist and connoisseur of science. In 1858, he and his Moravian family arrived in Novo Mesto, where he bought a mansion. At home and at Mach Hill he raised silkworms. He also educated his neighbor villagers. Towards the end of the 19th century, a girls' school was founded on his property in Šmihel, the family Mach thus having indirectly helped to educate Dolenjska girls.

Very little is known about the Mach family, although some people make every effort to shed light on this name. In 1995, a group of talented students produced the Mach's anthology, an extensive work of the Association of teachers of Dolenjska showing the functional cycle of the silkworm jamamay and the interpretation of life and work of the Mach family.

We designed the Mach Valley Routes along the Slatenska stream around Mach Hill to the mansion where Ernst Mach lived. The path points contain information related to the writer J. Trdina and Johann Mach's unfortunate daughter Wilhemine. The 9-km-long learning path will be marked with information regarding Mach. The promoters include the Institute for Protection of Cultural Heritage, the Institute for Nature Conservation of Slovenia and other experts. We operate with a great desire to enlighten young generations and to preserve the heritage.

Last year, we established the *Mach Heritage Society under Gorjanci*. Marjan Hren wrote the book *Slatenska Valley and Mach – Heritage under Gorjanci*, which is in the process of publication.

## PUNOM PAROM! – INDUSTRIJSKA BAŠTINA KAO ALAT U MUZEJSKOJ EDUKACIJI

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**Ključne riječi:** parni strojevi, industrijska baština, muzejski predmeti, održivost prezentacije, proširena stvarnost

Punom parom! je pilot-projekt – edukativna aktivnost koju smo počeli provoditi u Tehničkom muzeju *Nikola Tesla* u travnju 2015. Cilj je projekta što cjelovitija prezentacija nekih od strojeva iz naših zbirki. Riječ je o stručnim vodstvima kroz stalni postav tijekom kojih se pokreću pojedini izloženi strojevi i time zorno prikazuje njihova izvorna funkcija. S projektom smo započeli periodičnim pokretanjem novoobnovljenih, funkcionalnih parnih strojeva Odjela transformacija energije. U projekt su, uz kustosa, uključeni muzejski pedagog i restaurator te vodiči – demonstratori. Osim prezentacije funkcionalnog rada parnih strojeva najširoj javnosti, kako bi ih posjetitelji mogli doživjeti i upoznati u njihovoj cjelovitosti, cilj je bio ispitati održivost ovakve prezentacije tehničke baštine tijekom cijele godine. Tražili smo odgovor, koliko je to moguće i uputno s aspekta zaštite i konzervacije, kakve je posebne mjere zaštite potrebno poduzeti i slično. U planu je održati tridesetak prezentacija godišnje, otprilike svaki peti vikend i jedan radni dan u svakome petom tjednu. Rad parnih strojeva dokumentirat će se u filmovima koji će biti prikazani na tablet-računalima uz strojeve, putem aplikacije proširene stvarnosti (*Augmented Reality*). Tako će i korisnici koji ne mogu prisustvovati samoj demonstraciji pokretanja strojeva, moći posredno doživjeti taj aspekt njihove prezentacije. Dok je korištenje energije pare u pogonskim strojevima tvornica i prometlima (vlakovima, brodovima) sad već pitanje daleke prošlosti, veliki udjel proizvodnje električne energije koju danas koristimo generira se parnim turbinama (izumi *Sir Charlesa Parsonsa* davne 1884.) u termoelektranama te plinskim i nuklearnim elektranama. Prezentacijom kojom se predmete iz fundusa stavlja u suvremeni kontekst, posjetiteljima se ukazuje i na smisao muzejskih predmeta u stvarnom životu.

## FULL STEAM AHEAD! – INDUSTRIAL HERITAGE AS A TOOL IN MUSEUM EDUCATION

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**Key words:** steam engines, industrial heritage, museum objects, sustainability of demonstration, augmented reality

*Full Steam Ahead!* is a pilot project we started at the Technical Museum Nikola Tesla in April 2015. The aim is to communicate more fully to our visitors the story of some of our museum objects – engines from our collections; “More fully” meaning that where appropriate we started periodically using authentic museum objects for demonstration purposes. We started the project in the Energy Transformation Department, with a very valuable collection of steam engines (hence Full Steam Ahead!). The project is done in collaboration with the restaurateur, curator and museum educator of the Technical Museum Nikola Tesla. The idea behind the project is to test the possibilities of the new display of these recently restored museum objects. It includes demonstration of their functionality so that the visitors can see them in action and gain a unique experience. So far, following the guidelines of our Museum restaurateur, the demonstrations are performed every fifth weekend. During this year the plan is to continue with periodical demonstrations, but also to video record them. This is so that we can offer this experience to all our visitors, as in fact a very few can attend the actual demonstration. The film of the engines in action will be available alongside the steam engines displayed on tablets via Augmented Reality Application. Our

main concern is to bring into balance the benefit of our users – the demonstration of function which characterises objects, with the sustainability of such demonstrations – for them not to cause any permanent and irretrievable damage to the objects. While the use of steam in factories, on railways and roads is a matter of distant history, the electricity we use today is most often generated at power stations by modern steam turbines, invented by Sir Charles Parsons in 1884. The presentation that puts museum objects into contemporary context, interprets to the visitors the very importance of museum objects in contemporary world.

## RADNICI TORPEDA I RADNIČKA KLASA RIJEKE

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**Ključne riječi:** *Torpedo*, radnička klasa, radničke organizacije, socijalizam i komunizam

Ovim se radom želi razmotriti uloga radnika tvornice *Torpedo* u stvaranju i jačanju radničkog pokreta Rijeke. Historiografija tvrdi da su Whiteheadovi radnici bili uglavnom pasivni prema ideologiji klase i socijalizma zbog dobro organiziranog života oko tvornice, zbog toga što su bili vješti u radu, zbog visokih plaća te, općenitije, zbog Whiteheadova paternalizma. Iako se iznimka može lakše potvrditi nego osporiti, ulogu radnika *Torpeda* u pokretu radničke klase tek treba do kraja definirati.

Sporo širenje socijalističke ideologije na obalama mađarskog Jadrana bila je jedna od njezinih glavnih osobina. Objašnjenje te negativne karakteristike nije samo u očiglednim napetostima između nacionalnosti, već prije svega u pomankanju brojne radničke klase. Budući da je tvornica *Torpedo* bila jedna od najvećih u Rijeci, s velikim brojem zaposlenih radnika, želi li se istraživati socijalistička ideologija nužno je analizirati pitanja u vezi s radnicima te tvornice. Kao što je već rečeno, kasno stvaranje socijalističkog pokreta u Rijeci bilo je povezano s povoljnim položajem Whiteheadovih radnika. Međutim, prisutnost *Torpedovih* radnika u klasnim organizacijama prije socijalističkih sindikata, pokazuje vezu između radnika *Torpeda* i radničkog pokreta. Uz pomoć podataka koji se nalaze u Državnom arhivu Rijeke s obzirom na članove klasnih organizacija i socijalističkih organizacija, te policijskih popisa komunista, ovaj će rad pokušati pokazati kako su radnici *Torpeda* isto tako bili dijelom radničke klase Rijeke, a ne samo radnička elita.

## TORPEDO WORKES AND THE WORKING CLASS OF FIUME

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**Key words:** *Torpedo*, working class, workers organisations, socialism and communism

The aim of this paper is to discuss the role of *Torpedo* workers in the formation and consolidation of the labour movement of Fiume. Historiography claims that Whitehead's workers remained mostly passive towards class ideology and socialism due to the detailed organisation of life around the factory, their skillfulness, high wages and, more generally, Robert Whitehead's paternalism. Though the image of exception can be more easily confirmed that disputed, nevertheless the *Torpedo* workers' role inside the working class movement is yet to be fully defined.

The slow spread of the socialist ideology on the Hungarian Adriatic shores was one of its main features. An explanation of this negative characteristic was not only the apparent tensions between nationalities, but also primarily the deficiency of a large working class. Since the *Torpedo* factory was one of the largest industries in Fiume, which employed a number of workers, it is crucial for the study of socialist ideology to analyze the issues of its workers. As said above, certainly the late formation of the socialist movement in Fiume was in a relation with the advantageous position of Whitehead's workers. However, the presence of *Torpedo* workers in class organisations prior to the socialist controlled trade unions, demonstrates a connection between *Torpedo* workers and the labour movement. Thus, through data present in the State Archive of Rijeka regarding members of class organisations, socialist organisations and finally, police lists of communists, this paper will try to exhibit how *Torpedo* workers were also part of the working class of Fiume and not simply an elite above the rest of the labour force.

## VOJNOTEHNIČKI ZAVOD U KRAGUJEVCU

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**Ključne riječi:** vojska, industrijalizacija, Kragujevac, industrijski krajolik

Kulturno-povijesna cjelina Vojnotehničkog zavoda u Kragujevcu najstarija je sačuvana cjelina urbanog industrijskog krajolika u Srbiji. Prva zgrada u kompleksu VTZ-a bila je zgrada *Topolivnice* koja je sagrađena između 1851. i 1853. Kao najstarija tvornička cjelina u ovom dijelu Europe označila je početak industrijalizacije. Tvornica koja se prvobitno zvala Oružarnica, postaje najveća vojna tvornica. U drugoj polovici 20. stoljeća poznata je kao tvornica *Zastava Kragujevac* koja je bila najveći industrijski gigant bivše Jugoslavije.

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## MILITARY-TECHNICAL INSTITUTE IN KRAGUJEVAC

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**Key words:** military, industrialization, Kragujevac, industrial landscape

The cultural-historical complex of the Military-Technical Institute in Kragujevac is the oldest surviving entity of the urban industrial landscape in Serbia. The first building of the MTT's complex, *Gun Foundry Building*, was built in the period from 1851 to 1853. As the oldest factory complex in this region of Europe, it was a vestige of the beginning of industrialization. Armory factory in Kragujevac, as it was originally called, became the largest military factory. The factory from the second half of 20th century is well known as *Zastava Kragujevac*, one of the biggest industrial giants of ex-Yugoslavia.

## MORNARIČKO NASLJEĐE ZALJEVA BOKE KOTORSKE IZ 19. I 20. STOLJEĆA

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**Ključne riječi:** zaljev Boka kotorska, ratna mornarica, Arsenal Tivat, Kumbor, Shtumberger, Shterneck

Boka kotorska najveći je zaljev na Jadranskom moru i specifična kulturološka i geografska cjelina koja se nalazi u jugozapadnom dijelu Crne Gore. Značajne su njezine geomorfološke karakteristike i njezin strateški položaj.

Slijede karakteristike koje su Boku kotorsku označile kao važnu točku za ratnu mornaricu i njezinu industriju.

Od vremena Austro-Ugarske Monarhije (sve do 1918.) Boka kotorska je zahvaljujući svome geografskom položaju i morfologiji terena bila jedna od najvažnijih vojnih baza. Zadržala je status važne vojne baze i postala značajna strateška točka za bečki dvor. Posebno je to došlo do izražaja uoči Velikog rata (Prvi svjetski rat) kada je ovaj dio obale doživio bombardiranje Lovćena te bombardiranje s njega, lansiranje njemačkih i austrougarskih podmornica u misije po Mediteranu i veliku pobunu mornara 1918.

Turbulentna povijest karakterizira i razdoblje Drugoga svjetskog rata od samog početka (potapanje razarača *Zagreb*) sve do veličanstvene pobjede i oslobođenja. Socijalistička Jugoslavija dosljedno je nastavila razvoj mornaričke i civilne pomorske tradicije.

Izvorna mornarička baza i baza hidroaviona u Kumboru, kao i pomorski Arsenal u Tivtu, bili su odgovorni za industrijski, vojni i pomorski razvoj Boke kotorske od vremena Austrije do kraja socijalističke Jugoslavije. Njihov je uspjeh vezan za imena raznih ljudi poput Miroslava Shturmbegera, člana posade mornarice i graditelja torpeda i oružja s minama, Maximiliana Sternecka, admirala Austrougarske mornarice, čija je ideja bila osnivanje pomorskog Arsenala u Tivtu 1889., i mnogih drugih.

Arsenal je bio izgrađen potkraj 19. stoljeću u Tivtu kao vojna baza, da bi se ojačala austrougarska flota u južnom Jadranu. Bila je to važna cjelina brodograđevne industrije u Mediteranu, a funkcija joj je bila izgradnja i održavanje vojnih plovila i njihovih sustava.

Baza hidroaviona u Kumboru izgrađena je 1913. Za vrijeme Prvoga svjetskog rata njezini su avioni letjeli iz izvidne misije i misije bombardiranja nad Crnom Gorom, Italijom i Albanijom. U Kraljevini Jugoslaviji tu je bila baza Treće komande hidroaviona, najjači dio Jugoslavenske ratne avijacije. Za vrijeme travanjskog rata 1941., avioni iz Kumbora napadali su neprijateljske baze u Albaniji i Italiji te brodove sila Osovine u južnom Jadranu.

Impresivna povijesna pozadina ovih kompleksa glavni je motiv i neiscrpan izvor novih, nadahnjujućih informacija iz područja pomorske povijesti Bokokotarskog zaljeva.

## NAVAL HERITAGE OF BAY OF BOKA KOTORSKA FROM THE XIX AND XX CENTURY

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**Key words:** Boka Bay, Military maritime, Arsenal Tivat, Kumbor, Shtumberger, Shterneck

Boka Kotorska is the largest bay in the Adriatic, and a specific cultural and geographic entity, positioned in the South Western part of Montenegro. Its geomorphological characteristics are significant, just like its strategic position.

The following characteristics marked Boka Kotorska as a significant point of military marine and military marine industry.

From the period of Austro-Hungarian monarchy (until 1918), Boka Kotorska was one of the most important military bases, thanks to its geographical position and morphology of the terrain. It retained the status of important military base and became a significant strategic point for the Vienne Court. This was emphasized on the eve of the Great War (World War I), when this part of the coast witnessed the bombing of Lovcen and from Lovcen, the



launching of the German and Austro-Hungarian submarines to missions across the Mediterranean and a great mutiny of the sailors in 1918.

A turbulent history characterizes, also, a period of WW II from the very beginning (sinking of the “Zagreb“ destroyer), to the magnificent victory and liberation. The Socialistic Yugoslavia consistently continued the development of naval and civil marine traditions.

The original naval and seaplane base in Kumbor, and the Naval Arsenal in Tivat, were responsible for industrial, military and maritime development of Boka Kotorska from the Austrian period to the end of the Socialist Yugoslavia. Their success is connected with the names of many people as Miroslav Shturmberger, submariner and constructor of torpedo and mine arms, Maximilian Sterneck, Admiral of the Austro-Hungarian Navy, whose idea was to establish the Naval Arsenal in Tivat (Teodo) in 1889, as well as many other people.

The Arsenal was constructed in the late 19th century in Tivat, as a military base, in order to strengthen the Austro-Hungarian fleet in the Southern Adriatic. It was an important entity of shipbuilding industry of Mediterranean, and its function was to supply and maintain military vessels and their systems.

The seaplane base in Kumbor was constructed in 1913. During WWI, its hydroplanes flew to the recon and bombing missions over the Montenegro, Italy and Albania. In the Kingdom of Yugoslavia, it was the base of the Third Seaplane Command, the strongest part of the Yugoslavian naval aviation. During the April war in 1941, the planes from Kumbor attacked the enemy bases in Albania and Italy and Axis' ships in the southern Adriatic.

The impressive historical background of these complexes, is the main motive and an inexhaustible source of new, inspirative information from the field of naval history of Boka Bay.

## UČITELJI SALCHERA I MACHA (U POVODU STOGODIŠNJE MACHOVE SMRTI)

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**Ključne riječi:** Peter Salcher, Ernst Mach, Karl Robida, Ruđer Bošković, supersonična fotografija u riječkoj tvornici *Torpedo*, povijest fizike

Salcher i Mach školovali su se u Unutrašnjoj Austriji i Beču. Mach je bio povezan i sa Sveučilištem u Pragu na kojemu je predavao zajedno sa svojim idolom Dopplerom. Machov otac studirao je u Pragu, podučavao Ernesta kao tinejdžera kod kuće i provodio s njim praznike na svojoj farmi u Velikom Slatniku. Tamo je Ernst razvio svoj praktički i eksperimentalni pristup, iako su mu majka i otac umrli u Slatniku prije Salcherovih mjerenja u tvornici *Torpedo*.

Za vrijeme svojih prijediplomskih i diplomskih studija Salcher je čuo gotovo suprotne opise fenomena topline. Njegov nastavnik fizike i matematike u gimnaziji u Klagenfurtu bio je benediktinac Karl Robida iz predgrađa Ljubljane, koji je kritizirao novu Clausisovu kinetičku teoriju plinova. Robida je otkrio Hertzove valove prije službenog otkrića, kao i Groveovo pucketanje te opisao paradoks reverzibilnosti sa zastarjelom vibracijskom teorijom topline. Jedini Salcherov učitelj teoretske fizike na njegovoj prvoj godini na fakultetu u Grazu bio je Robidov prijatelj Simon Šubic koji je odbacio raniju statističku mehaniku Robidova studenta Jožefa Stefana i Stefanova studenta Ludwiga Boltzmana. Druga međunarodna izložba o elektricitetu otvorena je u londonskom *Crystal Palace Chandelieru* 4. ožujka 1882. Stefan je bio tehničkoznanstveni voditelj Treće bečke međunarodne izložbe o elektricitetu održane 1883., na kojoj su Salcher, Mach i bivši Salcherov riječki asistent Julius Puluj izložili svoje instrumente. Do tada je Stefan već bio reformirao nastavni program fizike u Habsburškoj Monarhiji u kojoj su sve značajne katedre imali protivnici njegovih kinetičkih teorija. Stefanove pobjede ponovile su na taj način stotinu godina starije reforme Boškovićevih sljedbenika u istim školama Habsburške Monarhije u kojima su Boškovićeve sljedbenice zadržali svoje katedre čak i nakon zabrane Boškovićeve jezuitskog reda. Značajne iznimke obiju reformi bile su praške katedre Josepha Steplinga i Macha. Stefanov, Machov i Salcherov akademski prethodnik, habsburški pionir fotografije Andreas Ettingshausen, obrazovan je u bečkoj *Bombardierschule* u Boškovićevu duhu profesora Jurija Vege. Boškovićeve opća teorija privlačenja točaka sila razvila se u Stefan-Boltzmannova molekularno-kinetička suprotstavljanja s nekom vrstom produženoga Boškovićeve utjecaja.

## SALCHER & MACH'S TEACHERS (ON CENTENNIAL OF MACH'S DEATH)

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**Key words:** Peter Salcher, Ernst Mach, Karl Robida, Rudjer Bošković, Supersonic photography in Rijeka Torpedo Factory, History of Physics

Salcher and Mach were educated in Inner Austria and Vienna. Mach was additionally tied to the University of Prague where Mach and his idol Doppler taught. Mach's father studied in Prague, taught teenager Ernst at home, and welcomed Ernst's holidays in his farm in Veliki Slatnik. There Ernst developed his practical-experimental approaches although his mother and father died in Slatnik before Salcher's measurements in Torpedo Factory.

During his undergraduate and graduate studies Salcher heard almost opposite descriptions of the heat phenomena. Salcher's teacher of physics and mathematics in Grammar School of Klagenfurt was a Benedictine Karl Robida from Ljubljana sub-orb who criticized the new Clausius' kinetic theory of gases. He prematurely detected Hertz's waves and Grove's sputtering, and described the reversibility paradox with old-fashioned vibration theory of heat. Salcher's only teacher of theoretical physics in his first student year in Graz was Robida's friend Simon Šubic who rejected early statistical mechanics of Robida's student Jožef Stefan and Stefan's student Ludwig Boltzmann. The second international Electric exhibition was in Crystal Palace Chandelier, beginning on March 4, 1882. Stefan was the technical-scientific leader of 3<sup>rd</sup> Viennese international electric exhibition in 1883 where Salcher, Mach, and former Salcher's Rijeka assistant Julius Puluj exhibited their instruments. Up to that time Stefan already reformed physics curriculum in Habsburg Monarchy with almost all important chairs occupied by adversaries of his kinetic

theories. Stefan's victories repeated the century earlier reforms of Bošković's followers in the same schools of Habsburg monarchy where Bošković's fans kept their chairs even after the suppression of Bošković's Jesuit order. The notable exceptions of both reforms were Prague chairs of Joseph Stepling and Mach. Stefan, Mach, and Salcher's academic ancestor, the Habsburg pioneer of photography Andreas Ettingshausen, was trained in Viennese *Bombardierschule* in Bošković's spirit of professor Jurij Vega. Bošković's universal attraction theory of points-centers of force developed into Stefan-Boltzmann's kinetic molecular collisions with a sort of prolonged Bošković influence.

## ZNAČENJE POVIJESNOG I STRUČNOG ISTRAŽIVANJA PRI ZAŠTITI TEHNIČKE BAŠTINE

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**Ključne riječi:** konzervatorsko-restauratorski projekti, podmornica CB-20, korozija, EDS-analiza

Tema je ovoga rada utjecaj kvalitetnoga povijesnog i stručnog istraživanja na završne rezultate konzervatorsko-restauratorskih projekata pri zaštiti pokretne tehničke baštine. Svrha je promjena zatečenog stanja predmeta jer im se pri dobro planiranim i izvedenim zahvatima obnove vraća izvorni oblik i stanje iz vremena kada su bili proizvedeni, kao na primjeru podmornice CB-20.

Zbog neodgovarajuće pripreme za muzejsko izlaganje materijali u unutrašnjosti i izvana počeli su pokazivati znakove istrošenosti izazvane raznim čimbenicima (razne vrste korozijskih procesa uzrokovanih razlikom u potencijalima metala). Zbog toga je EDS-analizom provedena metalografska analiza materijala vanjskog trupa i zavarenih spojeva.

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## SIGNIFICANCE OF HISTORIC AND EXPERT INVESTIGATION DURING THE PRESERVATION OF MOVABLE TECHNICAL HERITAGE

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**Key words:** conservation-restoration projects, submarine CB-20, corrosion, EDS analysis

The topic of this paper is the influence of quality historic and expert investigation on the final results of the conservation-restoration projects during the preservation of movable technical heritage. The purpose of that is the change of the initial form and condition into the original look, form and condition from the time when the object was produced, on the example of the CB-20 submarine.

The unsuitable preparation of the CB-20's for its museum display has led to the wearing out of the interior and exterior materials due to various corrosion processes induced by the difference of materials' potentials. Because of that we provide the EDS analysis of the base hull material and the EDS analysis of the weld material.

## POLJSKA MORNARICA I RAZVOJ TORPEDA DO 1939.

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**Ključne riječi:** izgradnja mornarice, torpeda, zajam

Nakon 120 godina podjela i porobljavanja rođena je nova Poljska u kojoj je 1918. započeo spor i naporan proces izgradnje i rekonstrukcije mnogih grana ekonomije, industrije i ostalih područja. Bilo je to vrijeme jačanja granica i obnavljanja vojske. Usprkos mnogim preprekama došlo je do procvata Poljske ratne mornarice. Za njezino oživljavanje na dan 28. studenoga 1918. zaslužan je Józef Piłsudski.

Mornarica se izgrađivala uglavnom uz pomoć zajmova koje je Poljska dobila međunarodnim pregovorima. U to je vrijeme glavni zajmodavac Poljske i vojni partner bila Francuska. Tako su u Francuskoj naručeni prvi poljski ratni brodovi i topovi. Prve narudžbe bila su dva razarača i tri podvodna minopolagača te francusko oružje, topovi, artiljerija, mine i torpeda. Nova plovila izgrađena su i uz pomoć engleskih zajmova, iskorištenih za kupnju dva razarača i njihove opreme. Druga torpeda su tako kupljena u Velikoj Britaniji.

U ovom radu prikazane su neke pojedinosti u vezi s glavnim aspektima brodova i oružja u obliku torpeda u Poljskoj u tom razdoblju.

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## THE POLISH NAVY AND TORPEDO DEVELOPMENT TILL 1939

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**Key words:** Navy development, torpedoes, credit

In 1918, after 120 years of partitions and enslavement, a reborn Poland began; a slow and laborious process of rebuilding and reconstructing many branches of economy, industry, and other fields. It was the time of strengthening the borders and rebuilding the army. Despite many complications, the Polish Navy was in blossom. It had been brought to life by Józef Piłsudski on November 28<sup>th</sup> 1918.

The marine forces were developed mainly using loans which were given to Poland through international negotiations. At this time, Poland's main lender and army partner was France. It was there where our very first battleships and their cannons were ordered. The very first orders were two destroyers and three underwater minelayer as well as their guns, cannons and weaponry, in the sense of artillery, mine and torpedo weapon. The process of gaining new vessels was also built up by English loans, which were used to buy the next two destroyers as well as their equipment. Other torpedoes were thus bought in Great Britain.

In this paper we present certain details concerning the main aspects of the ships and torpedo weaponry in Poland in the given time period.

## ASTRONOMSKI OPSERVATORIJ U BEOGRADU, SRBIJA

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**Ključne riječi:** povijest znanosti, Astronomski opservatorij, kulturno-prostorna cjelina, stari znanstveni instrumenti

Kompleks građevina koje čine Astronomski opservatorij u Beogradu projektirao je arhitekt Jan Dubovi 1929. Građen je 1930. – 1932. Instrumenti su instalirani 1932. – 1934. Tada je izgrađena središnja zgrada s knjižnicom, satnom zonom i obrtnom kupolom sa Zeissovom „tražiocem kometa”, zatim paviljoni s kupolama velikog i maloga Zeissova refraktora, kupola s malim Zeissovim astrografom, paviljon s dva pasažna instrumenta Askania i, na kraju, zgrada s radionicama. Kompleks je projektiran i građen namjenski i s instaliranim uređajima čini kulturnopovijesnu cjelinu. U Zbirci se trenutačno nalaze 43 instrumenta i stroja koji su korišteni za promatranje nebeskih pojava i obradu dobivenih rezultata. Zajedno s arhivskom građom, knjigama i časopisima instrumenti čine cjelinu koja daje uvid u način rada Opservatorija i u duh jedne epohe.

Zajednički je imenitelj instrumentacije zatečene u kompleksu Opservatorija da su je izradili renomirani proizvođači početkom prošlog stoljeća te da je većinom u originalnom i radnom stanju. Veliki refraktor Zeiss 650 jedan je od najvećih koje je Zeiss napravio, a spada među dvadeset najvećih optičkih refraktora u svijetu koji su u radnom stanju.

Godine 1887. Ministarstvo prosvjete Kraljevine Srbije donijelo je odluku da se osnuje astronomski i meteorološki opservatorij. Inicijator tog prijedloga bio je profesor Milan Nedeljković budući da su već od 1884. astronomija i meteorologija bile sastavni dio plana i programa studija na Velikoj školi. Opservatorijem su upravljali ugledni profesori i znanstvenici, od 1948. do 1951. i Milutin Milanković. Proračunavanje njegovih formula klimatskih promjena obavljano je u knjižnici Opservatorija.

## ASTRONOMICAL OBSERVATORY IN BELGRADE, SERBIA

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**Key words:** history of science, astronomical observatory, cultural and spacial whole, old scientific instruments

The complex of buildings that constitute the Astronomical Observatory in Belgrade was drawn up by architect Jan Dubovi in 1929. The construction works were carried out from 1930 to to 1932, while the instruments were mounted from 1932 until 1934. It was at that time that the central building with the library, world time clock and refractor dome with Zeiss “planet searcher” was built, also the pavillions with the domes of the small and the big Zeiss refractor, the dome with the small Zeiss astrograph, the pavillion with two transit instruments Askania, finally also a workshop building. The complex was designed and constructed for the specific purpose of the Observatory so that together with the mounted instruments it makes a historical and cultural whole. The Collection consists of 43 instruments and devices that were used for observing events in the sky and the processing of the obtained data. Together with the archive material, books and magazines, the instruments make up a whole that provides insight into the activities of the Observatory and the spirit of an epoch. What is common to the instruments found at the Observatory complex is that they were made by renowned producers from the beginning of the last century, also that in the greatest part they are still in the original and working conditions. The big Zeiss refractor 650 is one of the biggest produced by Zeiss, among twenty biggest optical refractors in the world that are in the working condition.

In the year 1887, the Ministry of Education of the Kingdom of Serbia brought the decision to have the astronomical and meteorological observatory established. The proposal was initiated by Professor Milan Nedeljković as already since 1884, astronomy and meteorology made part of the study programme at the Higher Education School. The Observatory was run by distinguished professors and scientists, from 1940 until 1951 also Milutin Milanković. The calculations for his formulas of climatic changes were made at the Observatory Library.

## ŠVEDSKI MORNARIČKI ČASNICI I UVOĐENJE TORPEDA I TORPEDNIH ČAMACA

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**Ključne riječi:** Švedska, torpeda, torpedni čamci, vojna tehnologija, strategija

Godine 1875. Švedska je naručila prva torpeda od proizvođača Whiteheada iz Fiume/Rijeke. Nekoliko godina poslije odlučeno je da se izgrade specijalna plovila koja će prevoziti torpeda, torpedni čamci. Moj se rad usredotočuje na uvođenje torpeda i torpednih čamaca u Švedsku mornaricu od 1860. do 1900. Može se raspravljati o tome jesu li torpeda i torpedni čamci bili oružja koja su trebala odgovarati i Švedskoj mornarici. Bila je to mala i razmjerno siromašna ratna mornarica koja se nije mogla natjecati s većim i moćnijim mornaricama drugih zemalja koje su okruživale Baltik. Mala, relativno jeftina plovila mogla su uz pomoć torpeda prijetiti većim i jačim brodovima. Smatralo se je da bi ruska invazija preko Baltika mogla biti najveća moguća mornarička opasnost. Katkad se tvrdi da su i vojni i mornarički časnici konzervativni i da ne žele vidjeti promjene u načinu na koji obavljaju stvari. Stoga se govori da su oprezni kad je riječ o uvođenju nove tehnologije i novih oružja u njihove organizacije. Kako su švedski mornarički časnici tog vremena gledali na torpeda i torpedne čamce? Jesu li raspravljali o novom oružju ili su se suprotstavljali njegovu uvođenju u Švedsku mornaricu? Je li uvođenje torpeda i torpednih čamaca utjecalo na švedsku mornaričku strategiju? Ovaj rad analizira opću švedsku vojnu strategiju u to vrijeme, stajališta mornaričkih časnika o tada aktualnim i poželjnim budućim zadacima mornarice. Cilj je pokušati objasniti zašto su mornarički časnici mislili i djelovali tako kako jesu kada su torpeda i torpedni čamci uvedeni u Švedsku mornaricu.

Rad se zasniva na proučenim dokumentima iz arhiva Švedske mornarice, kao i esejima objavljenim u dva ugledna vojna časopisa koja su u to vrijeme čitali mornarički časnici.

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## SWEDISH NAVAL OFFICERS AND THE INTRODUCTION OF TORPEDO AND TORPEDO-BOATS

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**Key words:** Sweden, torpedoes, torpedo-boats, military technology, strategy

In 1875 Sweden ordered their first torpedoes from the manufacturer Whitehead in Fiume/Rijeka. A few years later it was decided to build special crafts to carry the torpedoes, torpedo-boats. My paper focuses on the introduction of torpedoes and torpedo-boats in the Swedish navy from 1860 until 1900. It could be argued that torpedoes and torpedo-boats were weapons which ought to suit the Swedish navy well. It was a small and relatively poor navy that could not compete with the bigger and more powerful navies of other states surrounding the Baltic. Small, relatively cheap vessels could with the help of torpedoes threaten bigger and stronger ships. A Russian invasion over the Baltic was seen as the biggest military threat.

It is sometimes claimed that military officers, not the least naval officers, are conservative and do not want to see changes in the way they handle things. Therefore, it is argued, they are cautious when it comes to integrating new technology and new weapons into their organizations. How did Swedish naval officers at the time regard torpedoes and torpedo-boats? Was there any debate regarding the new weapons or opposition to the integration of the new weapons into the Swedish navy? Did the introduction of torpedoes and torpedo-boats affect the Swedish naval strategy? The paper analyses the general Swedish military strategy at the time, naval officers' views on current and preferable future tasks of the navy. The aim is to try to explain why naval officers thought and acted the way they did when torpedoes and torpedo-boats were introduced into the Swedish navy. The paper is based on a reading of documents from the archives of the Swedish navy and essays published in two important military periodicals read by naval officers at the time.

## PROMJENE U WHITEHEADOVU TORPEDU (1864. – 1918.)

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**Ključne riječi:** uvodni rad, eksplozivni čamac, *stealth* pomorsko oružje, podvodna eksplozija, modularni dizajn, razvoj s tehničkim napretkom, izjednačivač sile za manje snage, odavanje priznanja: Luppis – Whitehead – Obry – Gesztesy, najsloženiji sustav naoružanja 19. stoljeća

Iako se Whiteheadov torpedo oblikom tek neznatno mijenjao tijekom nekoliko desetljeća, doživio je mnoge promjene u komponentama i u sustavu, koje su utjecale ili poboljšavale stupanj izvršenja i učinkovitost. Unapređivan je ne samo zbog nametnutih zahtjeva u konkurenciji s *teškim topom*, već usporedno s napretkom znanosti i tehnologije, pa je tako uvijek bio jako suvremen, ako ne i više od toga.

Zahvaljujući svojoj modularnoj konstrukciji i mogućnosti prilagodbe, znanost i tehnologija neprestano su se mogle primjenjivati na njegovoj metalurgiji, razvoju motora, unutarnjem transferu energije, propulziji, kontroli navigacije, eksplozivnom lancu i slično.

Brzina i domet ovisni su o volumenu rezervoara i o unutarnjoj snazi pokretača (pritiska, topline), a potajna i letalna podvodna eksplozija istinska su vrijednost torpeda. Zbog lagane i jeftine primjene sustava lansiranja uspio je ojačati i manje ratne mornarice i učiniti ih ravnopravnima s onima većima.

Ovaj rad, zamišljen kao uvod, ima namjeru prikazati veće promjene, počevši od mijenjanja Luppijeva eksplozivnog čamca u Whiteheadovo podmorsko oružje, kao i njegov daljnji razvoj. Svemu tome išli su na ruku međunarodni ogranci Whiteheadove tvrtke jer su se lokalne promjene i poboljšanja mogli odmah proširiti tvrtkom, dovodeći tako do prve međunarodne vojno-znanstvene suradnje i ostvarujući najsloženiji tehnički sustav 19. stoljeća.

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## THE MUTATIONS OF THE WHITEHEAD TORPEDO (1864 – 1918)

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**Key words:** introductory paper, explosive boat, Stealth naval weapon, subaquatic explosion, modular design, development with technical progress, force equalizer for minor powers, tribute to: Luppis – Whitehead – Obry – Gesztesy, most complex weaponry system of 19<sup>th</sup> century

Though the Whitehead Torpedo has only slightly differed in shape within decades, it has undergone many changes on component- and systems level, affecting / enhancing overall performance and efficacy. Not only because the requirements in competition with the Big Gun had been raised, but it had steadily advanced with the progress of science and technology, thus always representing an up-to-date state or even beyond.

Due to its modular construction and potential for adaptation current science and technology could continuously be applied for its metallurgy, engine development, internal power transfer, propulsion, navigational control and explosive train, etc.

Speed and range are interdependent on the tank volume and on the internal energy of the propellant (pressure, heat), while stealth and the lethal subaquatic explosion constitute the real asset of the torpedo. Due to the easy and cheap application of the launching system it turned into a naval force equalizer also up-rating minor navies.

This paper, meant as an introduction, wants to present the major changes, starting with the mutation of Luppis's explosive boat into Whitehead's submarine weapon and its further development. All that was facilitated by the international branches of the Whitehead Company, as local modifications and improvements were instantly communicated within the company, leading to the first international military-scientific collaboration and achieving the most complex technical system of the 19<sup>th</sup> century.



## ODBOR ZA INDUSTRIJSKU I TEHNIČKU BAŠTINU *EUROPE NOSTRE*

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*Europu Nostru* (EN) priznaje Europska komisija kao glas kulturne baštine u Europi, kojim se želi podržati i promicati zanimanje za industrijsku i tehničku baštinu diljem svijeta.

*Industrial & engineering Heritage Committee* (IEHC) – Odbor za industrijsku i tehničku baštinu osnovan je nakon godišnje skupštine *Europa Nostra* u Newcastlu 2008., čija je tema bila *Kako osigurati budućnost europskoj tehničkoj baštini*. Odbor želi promicati vrijednosti europske industrijske i tehničke baštine održavajući sastanke dva puta na godinu u odabranim gradovima Europe, pripremati radove i prezentacije za seminare te organizirati znanstveno razgledavanje lokacija industrijske baštine za delegate koji sudjeluju na godišnjim konferencijama *Europa Nostra*.

IEHC, isto tako, potiče predstavnike mjesta na kojima se nalazi industrijska i tehnička baština na sudjelovanje u programu dodjeljivanja nagrada EN-a. Njegovi članovi sudjeluju i u brojnim panelima i drugim tijelima koja dodjeljuju nagrade jer Odbor želi surađivati sa sličnim organizacijama kao što su TICCIH (The International Committee for the Conservation of Industrial Heritage – Međunarodni odbor za očuvanje industrijske baštine) i FEDECRAIL (The European Federation of Museum & Tourist Railways – Europska federacija muzeja i turističkih željeznica). Na poseban način podržava istraživanje, učene rasprave i širenje informacija o industrijskoj i tehničkoj povijesti i razvoju, primjerice sudjelovanjem na seminarima i konferencijama poput *Torpedo – povijest i baština*.

IEHC se sastoji od desetak volontera iz Belgije, Francuske, Italije, Nizozemske, Španjolske i Ujedinjenog Kraljevstva, koji pripadaju širem krugu industrijske i tehničke specijalizacije.

IEHC razmatra načine na koje može najbolje pomoći promicateljima, kustosima i voditeljima projekata industrijske i tehničke baštine, kao i samim lokacijama te baštine.

## EUROPA NOSTRA'S INDUSTRIAL & ENGINEERING HERITAGE COMMITTEE (IEHC)

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*Europa Nostra* (EN) is recognised by the European Commission as the Voice of Cultural Heritage in Europe and seeks to support and promote interest in it throughout the continents if not the world.

IEHC was set up following EN's Annual Congress in Newcastle in 2008, whose theme was "Securing the future of Europe's Engineering Heritage". The committee seeks to promote the values of Europe's shared industrial and engineering heritage, by holding meetings twice a year in selected cities around Europe, preparing papers and presentations at seminars, and organising study tours of industrial heritage sites for delegates attending EN's annual congress.

IEHC also encourages industrial and engineering sites to participate in EN Award Schemes. Its members also serve on a number of panels and other Awards bodies as it seeks to collaborate with similar organisations such as TICCIH (The International Committee for the Conservation of Industrial Heritage) and FEDECRAIL (the European Federation of Museum & Tourist Railways). In particular, it supports research, dissertation and propagation of information on industrial and engineering history and developments, for example by participating in seminars and conferences such as TORPEDO HISTORY AND HERITAGE.

IEHC comprises approximately ten volunteers from Belgium, France, Italy, Netherlands, Spain and the United Kingdom from a wide range of industrial and engineering specialism.

IEHC is also reviewing how it might best help the promoters, curators and directors of industrial and engineering heritage projects and sites on the ground.

## SIGURNOST NA MORU – TORPEDNO ORUŽJE U ZBIRCI MUZEJA RATNE MORNARICE U GDYNIJI

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**Ključne riječi:** torpedno oružje, muzejske zbirke, Muzej ratne mornarice u Gdyniji

Torpednim oružjem opremljeni brodovi Poljske ratne mornarice pojavili su se u razdoblju između dva rata. Od 1921. do 1939. Poljsku su iskorištavali francuski i engleski proizvođači torpeda, koji su ih isporučivali sve do 1952. Nakon Drugoga svjetskog rata prevladavaju ratni brodovi, međutim torpeda su sovjetske proizvodnje.

Torpedno oružje može se vidjeti u poljskim muzejima kao što su Vojni muzej u Varšavi, Muzej poljske vojske u Kolobrzegu te muzeju *Bijeli orao* u gradu Skarżysko-Kamienna. Međutim, najveća takva zbirka nalazi se u Muzeju ratne mornarice koji je utemeljen u Gdyniji 28. lipnja 1953. Zahvaljujući napornom radu nekoliko generacija povjesničara i kustosa mnogi zanimljivi izlošci iz Drugoga svjetskog rata i poslijeratnog razdoblja sačuvani su od zaborava sve do danas. U muzeju u Gdyniji posjetitelji se mogu diviti torpednom oružju u muzejskoj zgradi i izvan nje te na muzejskom brodu ORP *Błyskawica*.

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## MARITIME SAFETY – TORPEDO WEAPONS IN THE COLLECTIONS OF NAVY MUSEUM IN GDYNIA

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**Key words:** torpedo weapons, museum collections, Navy Museum in Gdynia

Ships of the Polish Navy equipped with torpedo weapons appeared in the interwar period. In the period from 1921 till 1939, Poland was exploited by French and English producers of torpedoes, which were supplied until 1952. After World War II, it is the navy ships that predominate; however, torpedoes are of the Soviet production.

In Polish museums, such as the Polish Army Museum in Warsaw, Museum of Polish Arms in Kołobrzeg and the Museum “White Eagle” in Skarżysko-Kamienna, we can see exhibits including torpedo weapons. However, the largest such collection is housed at the Naval Museum, which was founded in Gdynia on June 28<sup>th</sup> in 1953. Owing to the hard work of several generations of historians and museum curators, many interesting exhibits from World War II and the postwar period have survived from oblivion until today. In Gdynia, visitors can admire the torpedo weapon inside the museum building, outside of the museum, as well as aboard the museum ship ORP “Błyskawica”.

## OBITELJ LUPPIS – PODRIJETLO I DOLAZAK U RIJEKU

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**Ključne riječi:** Lupis, Nakovana, Pelješac, Vukić Petrov, izumitelj torpeda, Ivan Lupis Vukić

Obitelj Lupis iz koje dolazi izumitelj torpeda, potječe iz maloga sela Nakovana koje se smjestilo na samom zapadu poluotoka Pelješca u južnoj Dalmaciji. Prema legendi, rodonačelnik Lupisa bio je Cvitko po kojem se naziva središnji, ujedno najstariji dio Donje Nakovane – Cvitkovi dvori. Budući da se u ta vremena prezimena nisu ustalila, teško je pratiti obiteljski slijed i povezati nakovanske Lupise s drugim Lupisima koji se već u 12. stoljeću spominju u Dubrovniku i okolici.

Ono što se može ustvrditi jest da se u Nakovani spominje Vukić Petrov (1575. –1665.) i da od njega potječu svi nakovanski Lupisi i ogranci koji su se razvili u drugim mjestima nakon što su pojedini članovi obitelji odselili. Tako Lupise nalazimo po cijelom svijetu – bili su prvi Hrvati koji su naselili Novi Zeland, a prisutni su i u Australiji, Americi, Peruu, Argentini i dr. Jedan se ogranak iselio sredinom 18. stoljeća u Rijeku.

Nakon što se Luka Lupis doselio iz Nakovane u Viganj, njegov sin Jakov Lupis preselio se iz Vignja u Rijeku 1761., tu se oženio i imao sinove Frana Maksimilijana Saverija 1784. – 1874. i Ferdinanda Karla Ermenegilda. Ferdinand se oženio Ivanom Perić iz Dubrovnika i s njom imao sina Ivana Blaža Lupis-Vukića.

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## THE LUPPIS FAMILY – ORIGINS AND ARRIVAL TO RIJEKA

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**Key words:** Lupis, Nakovana, Pelješac, Vukić Petrov, torpedo inventor, Ivan Lupis Vukić

The Lupis family, which the inventor of the Torpedo comes from, originates from the small village of Nakovana that is situated in the western part of the peninsula Pelješac in the south of Croatia. According to the legend, the family progenitor was Cvitko, who the central and the oldest part of Donja Nakovana takes its name after, namely, *Cvitkovi dvori*. As in those times surnames were still not established, it is hard to follow the family succession and connect the Lupis family from Nakovana with other Lupis families that already in the twelfth century are mentioned in Dubrovnik and its surroundings.

What can be established is that Vukić Petrov (1575–1665) is mentioned in Nakovana, also that it is from him that all the Nakovana Lupis family members originate, as well as family branches that developed in other places after some family members had moved. Thus, it is all over the world that we can find the Lupis family members; they were first Croats that settled in New Zealand, present also in Australia, America, Peru, Argentina, etc. One of the family branches moved to Rijeka in the middle of the eighteenth century.

After Luka Lupis had moved from Nakovana to Viganj, his son Jakov Lupis moved from Viganj to Rijeka in 1761, married there and had sons, namely, Fran Maksimilijan Saveri (1784–1874) and Ferdinand Karl Ermenegild. Ferdinand married Ivana Perić from Dubrovnik and they had the son Ivan Blaž Lupis-Vukić.

## UZDIZANJE U UNIŠTENJE: PROPADANJE INDUSTRIJSKOG PEJZAŽA U LUKAMA JUŽNOG BRAZILA

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**Ključne riječi:** lučka baština, lučka industrija, industrijski pejzaž, Brazil, ruševine, industrijske predodžbe

Područja u kojima su luke povlaštena su arena društveno-ekonomskih interakcija, tehničkog razvoja i simboličkog prisvajanja, nudeći nekoliko mogućnosti za istraživanje industrijske baštine. Kao materijalnom prikazu tehnoloških i ekonomskih postignuća prošlih vremena, napuštenim lučkim strukturama ili napuštenim funkcijama dodjeljuje se vrijednost sjećanja, ne njihovu izvornom stanju, već prikazu vremena koje je prošlo od njihova osnivanja jer znakovi na pročeljima zgrada i struktura otkrivaju njihovu dob.

U tom svjetlu ovo istraživanje namjerava razmatrati posebnosti koje propadanja i razaranja, shvaćeni kao slične vrste procesa, ucrtavaju u devastirajuću dimenziju lučke baštine. Predmet je istraživanja industrijski kompleks zgrada koji je pripadao tvrtki *Indústrias Matarazzo* u obalnom gradu Antonina, u brazilskoj južnoj državi Paraná, koji ozbiljno propada još otkad je prestao biti u funkciji 1972., usprkos tome što je upisan u brazilski popis baštine još 2012. Teoretski, ovo istraživanje ima namjeru mobilizirati koncepte očuvanja i uništenja važnih za proučavanje višestrukih dimenzija industrijske baštine u južnom Brazilu te dati konkretan niz dokumentacije koja nam dopušta da kritiziramo propadanje i neizbježnost uništenja te ističemo značenje utvrđivanja tipoloških serija da bismo nijansirali industrijske i lučke pejzaže u predodžbama nasljeđa.

## RISE INTO RUIN: DECAY OF INDUSTRIAL LANDSCAPES BY THE PORTS IN SOUTHERN BRAZIL

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**Key words:** Port heritage, Port industry, Industrial landscape, Brazil, Ruins, Industrial imagery.

Port areas represent a privileged arena of socio-economic interactions, technical development and symbolical appropriations that offer several possibilities to the study of industrial heritage. As material representations of technological and economical achievements of past times, abandoned port structures or emptied function find themselves assigned a remembrance value that is attached, not to its original state, but to the representation of time elapsed since its establishment as marks on the buildings façade and structure denounce its age.

In light of the above, this research intends to ponder peculiarities that decay and destruction, understood as similar kinds of processes, imprints themselves to an entropic dimension of the port heritage, as we take as object of the analysis an industrial building complex that belonged to *Indústrias Matarazzo* in the coastal town Antonina, located in Brazilian southern state of Paraná, which, despite being inscribed in Brazilian national heritage list since 2012, experiences a severe state of decay since its deactivation back in 1972. As a theoretical instrument this research intends to mobilize concepts of preservation and ruin that are relevant to the study of multiple dimensions of the industrial heritage in southern Brazil, as well to develop a concrete documental series that allows us to criticize decay and the inevitability of ruin as well as emphasize the importance of establishing typological series with the intent to nuance industrial and port landscapes in heritage imagery.

## ALFA ROMEO 6C 2300 AERODINAMICA SPIDER

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**Ključne riječi:** braća Jankovits, Alfa Romeo 6C 2300 Aerodinamica Spider

U Rijeci je između dva svjetska rata, od 1934. do 1938., konstruiran Alfa Romeo 6C 2300 Aerodinamica Spider ili Alfa Jankovits, remek-djelo autoindustrije toga doba, a konstruktori i autori automobila su Riječani, braća Oscar i Gino Jankovits. Braća su bila sinovi Mattea Jankovitsa, službenog koncesionara Alfa Romea u Rijeci, te vlasnici polovnog automobila 6C Turismo Berlina iz 1934., broja šasije 700316. Od 1934. do 1937. konstruirana je trkaća šasija Alfe Jankovits i automobil je registriran u Rijeci registarskim pločicama 2757 FM. Jankovitsi su motor smjestili iza sjedišta automobila, a prvi nađeni nacrti upućuju na to da su braća konstruirala karoseriju koja je izvanserijsko remek-djelo aerodinamike. Cijeli je automobil vrlo lagan, ukupna masa iznosi 1150 kilograma, a postizao je brzinu od 225 km/h sa središnjim sjedalom za vozača. Mentor braće Jankovits bio je Vittorio Jano, proslavljeni talijanski dizajner automobila koji je tada već vrsnim studentima Politehničkog fakulteta u Torinu ustupio projekt za koji su braća Jankovitsi bili iznimno zainteresirani. Hvalevrijedno je spomenuti da je Oscar Jankovits u to vrijeme surađivao s najpriznatijim dizajnerima i konstruktorima automobila – Josefom Micklom, stručnjakom za aerodinamiku iz *Porshea*, Belom Barenjem, dizajnerom Volkswagena Beetlea iz 1925., te Paulom Jarayem, priznatim stručnjakom i pionirima za aerodinamiku automobila. Aerodinamičnu čeličnu karoseriju Alfe Jankovits konstruirali su radnici i sami autori u garaži u Rijeci između 1936. i 1937. Alfa Jankovits je svojevrsna skulptura autodizajna, aerodinamično tijelo i kompletna tajnovitost projekta Vittoria Jana i braće Jankovits uzdižu Alfa Romeo do unikatnog modela u povijesti automobilske industrije i automobilizma. Početkom Drugoga svjetskog rata automobil je spremljen na sigurno, do dolaska narodne vlasti u Rijeku. Konstruktori automobila braća Jankovits za narodnu su vlast bili buržoazija. Braća Jankovits prebjegli su u Italiju. Oscar i Gino Jankovits krenuli su Aerospiderom na Božić 1946., punim su gasom prošli granicu prema Trstu, što je izazvalo klasičnu reakciju vojnika narodne vlasti na prijelazu – pucanje. Uspjeli su proći, ali s rupama od metaka u karoseriji. Budući da nisu imali ništa i jedva spasili živu glavu, Alfu Aerospider su uskoro prodali časniku američke vojske i potom joj se gubi svaki trag. Pojavila se 1967. u New Yorku gdje ju je kupio stanoviti Colin Crabbe, sakupljač neobičnih automobila. Crabbe nije znao o kojem je autu riječ, ali ga je očaravao njegov oblik i napredna tehnička rješenja. Automobil je prepoznao Luigi Fusi, vrstan poznavatelj Alfi, koji ga je dva puta pokušao kupiti. Prvi put za braću Jankovits, drugi put za muzej Alfa Romea. Oba puta bez uspjeha. Auto je kasnih devedesetih došao u ruke talijanskog kolekcionara, a potom kod aktualnog vlasnika Georgea Gerbharda koji ga je prije dvije godine restaurirao. Danas je prava ikona među legendarnim automobilima.

Slijed konstrukcije automobila Alfa Romeo 6C 2300 Aerodinamica Spider:

- 1934. – 6C 2300 motor nadograđen trima Weberovim karburatorima, riješena transmisija i usavršen sustav kočnica
- 1935. – izrađena i usavršena prva verzija trkaće šasije automobila za brzine do 225 km/h
- 1936. – razdoblje testiranja i prilagodbe šasije, dizajniranje karoserije automobila
- 1937. – objedinjavanje šasije i karoserije automobila prilagođenog za automobilistička natjecanja
- 1938. – prilagodba automobila za cestovnu vožnju.

## ALFA ROMEO 6C 2300 AERODINAMICA SPIDER

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**Key words:** Jankovits brothers, Alfa Romeo 6C 2300 Aerodinamica Spider, Alfa Jankovits

In 1934, the chief engineer of Alfa Romeo, Vittorio Jano, of Hungarian descent, was in contact with two other men, also of Hungarian descent, Fiuman brothers Gino and Oscar Jankovits. They were brilliant students at the Polytechnic University in Jano's home town of Torino – Italy, where Fiat and Alfa Romeo recruited their technical staff. The brothers became Alfa Romeo concessionaires and owned the biggest garage in region, in Fiume, today called Rijeka. With their passion for race cars and the background of wealth, technical talent and the garage, they were excited at being able to participate in this project, and they financed it entirely. In 1934, Jano gave them a

powerful, naturally-aspirated 6C 2300 engine upgraded with three Weber carburettors. This would be the engine for the sports car project. Jankovits also got the transmission system, and a basic frame suitable for the 12C engine, to be modified for a mid-engined racing car. Other mechanical systems such as suspensions and brakes were designed by the development team and built at Portello. Each mechanical part produced for the new car was marked with a description and date of production, and with the position where it was to be mounted. The parts were then taken to Fiume, and between 1935 and 1936 were installed and tested by the Jankovits in a "running chassis". Depending on test results, improvements were made, regardless of cost, until the systems worked to their satisfaction. All parts of the chassis were constructed very solid with view to high speed trials over 250 km/h. The Aerospider's chassis was the most advanced of its time and anticipated later designs by Mercedes and Auto Union. It was the first car with a suspension designed with wishbones, hydraulic dampers, transverse leaf springs, radius arms and torsion bars. Other pioneering features were devices to eliminate overbraking and a sophisticated system of gear change with pre-selection.

The breathtaking aerodynamic shape of the car also anticipated the later high speed designs of Auto Union by 4 years. It was designed by Oscar Jankovits, who was probably in contact with Josef Mickl, Porsche's specialist of aerodynamics, and others of the former Habsburg Empire as Paul Jaray, the inventor of streamlined cars, and Bela Barenyi, the inventor of the "Volkswagen". The exceptional streamlined steel body was built by workers at the Jankovits Garage in Fiume between 1936 and 1937. The Aerospider was the first mid-engined and low drag racing car of modern design. The car had all the features of a high speed racing car together with a stunning appearance. The Aerospider was to have been fitted with the newly developed V12 engine (430 hp) of Alfa Romeo – a "12C Aerodinamica Spider" – which would have made it a serious competitor to Auto Union and Mercedes Benz. But in 1937, when the car was ready to make its public appearance, the project was abruptly stopped when Vittorio Jano was dismissed by Alfa Romeo. Jankovits could no longer get the 12 C engine. They mounted the 6C 2300 which they had got for the sports car project, and they made the prototype suitable for use on the road by adding user-friendly components such as a bigger windscreen, a heating system and bumpers. The car still has its original licence plate and documents of registration. Any public appearance of the futuristic looking Aerospider would have caused a sensation, but because of the secrecy surrounding the project, and then the onset of the war, the prototype remained hidden in the Jankovits' garage in Fiume, and was not seen by anyone from outside the garage. On Christmas Eve 1946, Gino Jankovits drove the Aerospider at full speed under the toll-bar of the closed communist controlled border into Italy. Border guards fired volleys of shots after him, but the low, streamlined body saved Gino's life. Only the rear tyres were destroyed by the bullets, which also caused some dents in the rear of the car's bodywork. To get money they had to sell their car to an Anglo-American officer. Then the Alfa disappeared for about 20 years until it was rediscovered in England. In 1978 the Aerospider was recognized by the well-known Alfa Romeo historian Luigi Fusi, who had worked with Vittorio Jano at the time of the Aerospider project. He wanted to acquire the car for the Alfa Romeo museum. The acquisition failed, but the prototype did eventually return to Italy, 30 years after its birth, to be restored at last to its original condition as a racing car.

Time frame of construction of the Aerospider:

1934 – construction of engine, transmission and frame

1935 – completion of first version of chassis

1936 – testing period, modifications of chassis, start of body making

1937 – completion of chassis and body for race car

1938 – modification into street car.

## NJEMAČKE STANICE ZA TESTIRANJE I PROBNO ISPITIVANJE TORPEDA U ZALJEVU PUCK – SAD I NEKAD

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**Ključne riječi:** probno ispitivanje torpeda, centri za istraživanje, poslijeratni razvojni problemi

Za razvijenu proizvodnju i znanstveno istraživanje torpeda (533 mm) s akustičnim sustavom za samovođenje, kakvim se koriste podmornice, potrebna su bezbrojna testiranja prototipa na moru. Jedan od centara za takvo testiranje bio je otvoren u regiji Oksywie koja danas pripada sjevernom dijelu grada Gdynia. *Torpedoversuchanstalt (TVA) Oxhoft* bio je ogranak istoimenoga znanstvenog centra sa središtem u gradu Eckernförde, u Njemačkoj. U tome znanstvenom centru razvili su velik broj nove opreme i mehanizama za torpedne ratne čamce koji su značili nove standarde i trendove u tom polju.

*Torpedowaffenplatz Gotenhafen – Hexengrund (TWP)* još je jedan centar za istraživanje i proizvodnju koji se nalazio u području današnjega grada Gdynia. I taj je centar bio smješten u Zaljevu Puck. Tamo se radilo na usavršavanju torpeda malog kalibra (450 mm) i na njihovoj prilagodbi za ispuštanje iz letjelica.

Nakon što je završen Drugi svjetski rat, oprema koja se koristila u oba centra prenesena je dalje na istok tako da su ostali samo zidovi platforme za torpedu u Zaljevu Puck, kao i njihovo zemljište.

U ovom je radu opisano ono što je ostalo od tih dvaju centara za testiranje, njihova poslijeratna upotreba te neke od novih ideja i kako ih ponovno iskoristiti.

Osnova za analizu bio je arhivski materijal iz njemačkih arhiva i drugi znanstveni radovi.

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## GERMAN TEST STATIONS AND TORPEDO TRIALS AT THE BAY OF PUCK – NOW AND THEN

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**Key words:** torpedo trials, research centers, post war development problems

Developed production and scientific research concerning torpedoes (533 mm) with the acoustic self-guide systems used by submarines, required countless prototype tests at sea. One of the test centers used for those particular reasons was brought to life in Oksywie region – which is nowadays one of the north districts of Gdynia. *Torpedoversuchanstalt (TVA) Oxhoft* was a branch of a scientific center of the same name, located in Eckernförde (Germany). A lot of new equipment and mechanisms used for the purposes of torpedo battleships which marked new standards and trends in that particular field were developed there.

Another research and production center, this time connected with the development of aviation torpedoes, was *Torpedowaffenplatz Gotenhafen – Hexengrund (TWP)*, located in the area of today's Gdynia as well. The center was also situated by the Bay of Puck, near the one mentioned above. This was where the works concerning the improvement of small-calibre torpedos (450 mm) and making them useful for the purposes of throwing them down from the aircrafts took place.

After the World War II war actions were over, the equipment used in both test centers was carried away to the East, and there was not much more than walls of the torpedo platform at the Bay of Puck left as well as land base of the two centers.

In the given work we describe what has been left of the test centers as well as their post-war use was described, as well as some of the modern ideas to make them useful again.

The basis for this analysis were the archive materials taken from the German archives as well as other scientific works.

## BRITANSKI RAZVOJ U ISPORUCI PROTUBRODSKIH TORPEDA 1880. – 1950.

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**Ključne riječi:** najranija torpeda, platforma za lansiranje torpeda, John Thornycroft, brzi ratni brodovi, Britanska kraljevska mornarica

Najranijim torpedima upravljali su iznimno hrabri ljudi koji su morali zanemariti vlastitu sigurnost ako su svoja oružja željeli dovesti dovoljno blizu cilja kako bi ga onesposobili. Torpeda koja su potopila brodove za vrijeme Anglo-američkog rata 1812. pokretala su se uz pomoć vjetra, pa čak i ručno. Nije preživjelo mnogo onih koji su uspješno rukovali tim oružjem, da bi o tome mogli govoriti. Pola stoljeća poslije pojavila su se prva torpeda na vlastiti pogon koja su postizala brzinu jedva iznad 5 čvorova. Za razvoj torpeda kao platforme koja bi se u obliku iznenadnih napada mogla poslati na neprijateljske ratne brodove te nakon toga brzo pobjeći u sigurnost prije protunapada, zaslužan je izum parne turbine Charlesa Parsonsa 1897. i njezina primjena na plovila.

Jedan drugi britanski inženjer, *Sir* John Thornycroft, utemeljio je 1866. malo brodogradilište na rijeci Temzi, zapadno od Londona, namijenjeno izgradnji parnih brodica. Brzo je predvidio mogućnosti koje lagane brodice na paru nude kao napadačka plovila. Iz njegove tvornice u Chiswicku isporučivao se cijeli niz malih ratnih brodica velike brzine Norveškoj mornarici, ali i drugim stranim mornaricama, kao i vlastitoj, Britanskoj kraljevskoj ratnoj mornarici. Njihova je konstrukcija varirala ovisno o uvjetima u kojima su trebali djelovati.

Ovaj rad ponudit će prikaz nekih značajnih inovacija u razvoju plovila koja su mornaricama diljem svijeta skrenula pozornost na imena britanskih inženjera brodogradnje i brodograditelja te imala odlučujući utjecaj na ishod pomorskih bitaka u oba svjetska rata.

## BRITISH DEVELOPMENTS IN THE DELIVERY OF ANTI-SHIP TORPEDOES 1880 – 1950

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**Key words:** early torpedoes, platform for deliveries of torpedoes, John Thornycroft, high speed warships, Britain's Royal Navy

The earliest torpedo-men needed exceptional courage and disregard for their own safety if they were to succeed in delivering their weapons close enough to their targets to disable them. Ships sunk by torpedoes during the Anglo-American War of 1812 were the victims of attacks propelled by the wind or even manually. Not many of those who successfully operated these weapons survived to tell the tale. Half a century later the first self-propelled torpedoes appeared, typically capable of a speed barely above 5 knots. The invention of the steam turbine and its application to marine propulsion by Charles Parsons in 1897 was significant for torpedo development in providing a delivery platform capable of surprise attacks on enemy warships and of rapid escape to safety as their larger opponents retaliated.

Another British engineer, *Sir* John Thornycroft, established a small shipyard on the River Thames west of London 1866 for the construction of steam launches. He rapidly foresaw the possibilities offered by lightweight steam vessels as attack vessels. From Thornycroft's Chiswick factory, a large variety of small high-speed warships were delivered to the Norwegian and other foreign navies as well as to Britain's own Royal Navy. Their design varied according to the local conditions in which they were expected to operate.

The paper will offer an account of some notable innovations in the development of the vessels that brought the names of British marine engineers and naval constructors to the attention of navies throughout the world, and which exercised a decisive influence on the outcome of sea battles in both World Wars.



## USPJEH UZ POMOĆ SMRTONOSNOG ORUŽJA – PRIMJENA TORPEDA U CARSKOJ I KRALJEVSKOJ RATNOJ MORNARICI U PRVOME SVJETSKOM RATU

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**Ključne riječi:** torpedo, Prvi svjetski rat, potopljeni/oštećeni brodovi, cijena ljudskog života, žrtve torpeda, Mediteran, Austro-Ugarska, Italija

Rad se bavi oružjem koje je izumljeno, usavršeno i proizvedeno u Rijeci te njegovom primjenom u Austrougarskoj mornarici u Prvome svjetskom ratu. Torpedni čamci, razarači i podmornice uspješno su se koristili torpedom na moru Mediterana. U prvoj godini rata u Jadranskom moru mala jedinica podmornica *K.u.K.* ratne mornarice potopila je ili uništila nekoliko ratnih brodova Francuske, Italije i Velike Britanije, što je većim dijelom rata držalo veće ratne brodove podalje od Dalmacije i Jadranskog mora. Nakon što je podmornica U5 potopila francusku oklopnu krstaricu *Leon Gambetta* 27. u travnju 1915. u Jonskom moru, kada je živote izgubio 681 mornar, to je veliko stradanje za francusku mornaricu držalo njezine ratne brodove i oklopne krstarice izvan Jadranskih voda. Važno je, jednako tako, izvući na svjetlo dana žrtve novoga smrtonosnog torpeda i imenovati nekolicinu u ovom radu.

Dat će se i popis uspjeha *K.u.K.* ratne mornarice u korištenju torpeda, uzimajući u obzir uništenu opremu, ali i broj ubijenih ljudi, koliko se zna. Sama je Rijeka zbog svoje tvornice torpeda, koja je izmještena iz grada za vrijeme rata, postala ciljem zračnih napada Saveznika.

U posljednjih dvanaest mjeseci rata Austro-Ugarsko Carstvo pretrpjelo je gubitke i ratnih i trgovačkih brodova zbog torpeda sa Savezničkih plovila. Potapanje ratnog broda *Szent Istvan*, inače sagrađenog u Rijeci, 10. lipnja 1918. zaustavilo je posljednje veliko djelovanje *K.u.K.* ratne mornarice, pri čemu je živote izgubilo 89 mornara i uništen moral Austrougarske mornarice.

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## SUCCESS BY A DEADLY WEAPON – THE USE OF TORPEDO BY THE *K.U.K.* KRIEGSMARINE IN THE FIRST WORLD WAR

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**Key words:** torpedo, World War I, ships sunk/damaged, cost of human live, victims of torpedo, Mediterranean, Austro-Hungary, Italy

This paper deals with the weapon, which was invented, perfected and manufactured in Rijeka, and its use by the Austrian-Hungarian navy during the First World War. Torpedo boats, destroyers and submarines used the torpedo with good success in the Mediterranean Sea. In the first year of the war in the Adriatic Sea, the small submarine force of the *K.u.K. Kriegsmarine* sunk or damaged several warships of France, Italy and Great Britain. So this kept the bigger warships of the Allies away from the Dalmatian coast and out of the Adriatic Sea for most of the war. The sinking of the French armoured cruiser *Leon Gambetta* on 27 April 1915 by the submarine U5 in the Ionian Sea with the loss of 681 sailors was a disaster for the French Navy and kept the battleships and armoured cruisers out of the Adriatic waters. But it is also important to get the victims of the new deadly torpedo out of the dark and name a few of them in this paper.

A list of the successes of the use of torpedoes by the *K.u.K. Kriegsmarine* will be given, taking into account the equipment destroyed but also the number of people killed as far as known.

Rijeka itself, because of its torpedo factory, which was actually transferred from the city during the war, became the target of allied air raids.

And in the last twelve months of the war, the Austro-Hungarian Empire also suffered hard by losses of warships and merchant ships caused by the torpedoes from Allied vessels. On June 10, 1918, the sinking of the battleship *SZENT ISTVAN*, built in Rijeka, stopped the last big naval action of the *K.u.K. Kriegsmarine*, claimed the life of 89 sailors, and damaged the moral of the Austro-Hungarian Navy.

## OD SPASIOCA OBALE I LUPPIS-WHITEHEADOVA TORPEDA DO WHITEHEADOVA TORPEDA

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**Ključne riječi:** G. B. Luppis, R. Whitehead, *Kustenretter*, Luppis-Whiteheadov torpedo, Whiteheadov torpedo, torpedo

Primarni izvori o nastanku Luppisova (I. B. Vukić, J. B. Luppis) izuma *Spasioca obale* (*Kustenretter*, *Salvacoste*) vrlo su oskudni. Jedini izvorni materijalni trag tog izuma, drveni model veličine otprilike metar, nalazi se u Ratnome muzeju u Beču. Rekonstrukcijom tragova u sekundarnim pisanim izvorima doznajemo da je G. B. Luppis na ideju o novome pomorskom oružju došao oko 1860. Tijekom mornaričkog školovanja te u službi časnika Austrijske ratne mornarice bio je upoznat s uporabom „požarnih brodova” (*Brander*, *brulotto*) prema kojima je razvio svoj izum nazvavši ga je *Spasilac obale* (*Kustenretter*, *Salvacoste*). Nakon odlaska u mirovinu 1861., uporno ga je više godina pokušavao prodati Austrijskoj mornarici. Inženjerijska komisija austrijskoga Ministarstva rata razmotrila je njegov prijedlog i odgovorila mu da je ideje dobra, ali zahtijeva tehničku doradu.

Svojim skromnim novčanim sredstvima i oskudnim tehničkim znanjem G. B. Luppis nije bio u stanju svoj izum razviti u uspješno pomorsko oružje. Uz pomoć istaknutoga Riječanina G. Ciotte došao je u kontakt s direktorom Riječkoga tehničkog zavoda (*Stabilimento Tecnico di Fiume*) R. Whiteheadom koji je svojim radom i sredstvima usavršio njegovu ideju. Nakon dvije godine rada i mnogobrojnih pokusa u moru razvijeno je novo podmorsko oružje (*Minenboot*, *fish torpedo*).

Ugovorom sklopljenim između G. B. Luppisa, R. Whiteheada i G. Ciotte utvrđeno je da se to novo oružje nazove Luppis-Whiteheadov torpedo i da sve buduće isporuke ove konstrukcije torpeda nose to ime. Idućih nekoliko godina u ugovorima o isporukama torpeda iz riječke tvornice, kao i u onodobnim novinama i u literaturi redovito nailazimo na naziv Luppis-Whiteheadov torpedo.

Tek kada je R. Whitehead razvio nove modele torpeda te njih počeo isporučivati raznim ratnim mornaricama, naziv Luppis-Whiteheadov torpedo mijenja se u Whiteheadov torpedo. Malo poslije sva torpeda proizvedena u Rijeci ili u drugim tvornicama širom svijeta prema riječkoj ideji, nosila su samo naziv *Whitehead* i svima je bilo jasno da je riječ o riječkom torpedu.

## FROM COAST SAVER (*KUSTENRETTTER*, *SALVACOSTE*) AND LUPPIS-WHITEHEAD TORPEDO TO WHITEHEAD TORPEDO

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**Key words:** G. B. Luppis, R. Whitehead, *Kustenretter*, Luppis-Whitehead torpedo, Whitehead torpedo, torpedo

The original sources on how Luppis (I. B. Vukić, J. B. Luppis) invented the *Coast Rescuer* (*Kustenretter*, *Salvacoste*) are few. The only original material trace of that invention is a wooden model about a meter long in the War Museum in Vienna. By reconstructing traces of secondary written sources we find out that G. B. Luppis came upon the idea of the new naval weapon around the year 1860. During his naval education and afterwards as Austrian Navy officer, he became acquainted with the use of *fire-ships* (*Brander*, *brulotto*) and developed his invention naming it *Coast Rescuer* (*Kustenretter*, *Salvacoste*). Having retired in 1861, he kept trying to sell it to the Austrian Navy. The Engineering Committee of the Austrian Ministry of War considered his proposal and replied they thought it to be a good idea, though needing technical improvements.

Of meagre financial resources and insufficient technical knowledge, G. B. Luppis was not able to develop his invention into a successful naval weapon. With the help of G. Ciotta, a distinguished citizen of Rijeka, he was introduced to the director of Rijeka Technical Institute (*Stabilimento Tecnico di Fiume*) R. Whitehead, who, owing to his work and sources, succeeded in improving Luppis' invention. After a two-year work and numerous experiments in the sea, a new underwater weapon was invented (*Mineboot*, *fish torpedo*).

The contract signed by G.B. Luppis, R. Whitehead and G. Ciotta set out that the new weapon be called Luppis-Whitehead Torpedo and that all future supplies of this torpedo were to bear this name. In the following few years, we regularly find the name of Luppis-Whitehead Torpedo, be it in the Rijeka factory torpedo supply contracts or in the newspapers or literature of that time.

Only when R. Whitehead had developed new models of torpedoes and began delivering them to different navies, was the name of Luppis-Whitehead Torpedo changed into Whitehead Torpedo. A little afterwards, all the torpedoes produced in Rijeka or other world factories after the idea from Rijeka bore the name of *Whitehead* only, everyone aware of the fact that it was the Rijeka torpedo.

## ZASTUPLJENOST RIJEČKE TORPEDNE BAŠTINE U ENCIKLOPEDIČKIM IZDANJIMA

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**Ključne riječi:** Ivan Blaž Lupis, riječka torpedna baština, enciklopedija, Hrvatska tehnička enciklopedija

Doprinos Ivana Blaža Lupisa i Rijeke razvoju torpeda prema suvremenim je historiografskim spoznajama neupitan. U proteklih stotinjak godina, međutim, taj doprinos nije uvijek bio odgovarajuće vrednovan i prezentiran. Enciklopedička su djela dobri pokazatelji odnosa stručnjaka i javnosti prema nekoj temi budući da je njihova deklarirana objektivnost neizbježno podložna nacionalnim, ideološkim i drugim pristranostima. Ovaj će rad pokazati rezultate komparativne analize i epistemološke evaluacije članaka objavljenih u svjetskim enciklopedijama koje obrađuju povijest torpeda, s naglaskom na prikaz Lupisova doprinosa njegovu nastanku. Analizirali smo starija i novija izdanja velikih svjetskih enciklopedija (*Encyclopaedia Britannica*, *Brockhaus Enzyklopädie*, *Enciclopedia Italiana di Scienze, Lettere ed Arti*, *Grand Larousse encyclopédique*, *Boljšoja sovjetskaja enciklopedija*), nacionalnih, općih i strukovnih enciklopedija. Analizirane enciklopedije, i opće i specijalizirane, u određenoj su mjeri sudjelovale u procesu okrupnjavanja i organizacije znanja povezanoga s tehničkom baštinom, kao i u njegovoj diseminaciji korisnicima. Uočene razlike u obradi riječke torpedne baštine u korelaciji su s nacionalnom i ideološkom pripadnosti te razdobljem nastanka enciklopedija. Posebna će se pozornost posvetiti ulozi digitalnih tehnologija u diseminaciji znanja o riječkoj torpednoj baštini. Digitalne su tehnologije utjecale na postupnu pretvorbu tradicionalnih enciklopedija u kolaborativne *online* enciklopedije otvorenoga pristupa, omogućujući na taj način prodor manje poznatih ili neobrađenih tema. Donijet će se i uvid u valorizaciju Lupisova djela u novopokrenutom projektu *Hrvatske tehničke enciklopedije*. Zahvaljujući inovacijama na području umrežavanja znanja, ova će enciklopedija omogućiti nadilaženje nedostataka tradicionalnih enciklopedija u pogledu objektivnosti i sveobuhvatnosti obrade.

## REPRESENTATION OF RIJEKA TORPEDO HERITAGE IN ENCYCLOPEDIA EDITIONS

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**Key words:** *Ivan Blaž Lupis, Rijeka torpedo heritage, encyclopaedia, Croatian Technical Encyclopedia*

According to the contemporary historiographic insights, the contribution of Ivan Blaž Lupis and Rijeka to the development of the torpedo is unquestionable. However, this contribution was not always adequately evaluated and presented in the past hundred years or so. Encyclopaedic works are good indicators of the relation of experts and the public toward a topic as their declared objectivity is unavoidably subject to national, ideological and other biases. This paper will present the results of the comparative analysis and epistemological evaluation of articles published in world encyclopaedias that deal with the torpedo history, with emphasis on presenting the contribution of Lupis in its very beginnings. We analysed older and newer editions of great world encyclopaedias (*Encyclopaedia Britannica*, *Brockhaus Enzyklopädie*, *Enciclopedia Italiana di Scienze, Lettere ed Arti*, *Grand Larousse encyclopédique*, *Boljšoja sovjetskaja enciklopedija*), national, general and specialised ones. The analysed encyclopaedias, be they general or specialised, to a degree have taken part in the process of expanding and organising knowledge regarding technical heritage, also in its dissemination to the users. The observed differences in the interpretation of Rijeka torpedo heritage are in correlation with national and ideological affiliation and the period in which the encyclopaedia emerged. Special attention will be devoted to the role of digital technologies in the dissemination of knowledge on Rijeka torpedo heritage. Digital technologies have made impact on the gradual transformation of traditional encyclopaedias into collaborative online ones of open access, enabling in this way the breakthrough of lesser known or uncovered topics. What will also be presented is the insight into the valorisation of Lupis' work in the newly started project of the Croatian Technical Encyclopedia. Owing to innovations in the field of knowledge networking, this encyclopaedia will enable the surpassing of shortcomings of traditional encyclopaedias regarding the objectivity and comprehensiveness of analysis.

## TRGOVAČKA DEREGLIJA NA RIJECI SANI

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**Ključne riječi:** mala brodica, prijevoz, lokalno graditeljstvo, konstrukcijske proporcije

Od središnjeg toka rijeke Sane, Une, Savom su do Beograda plovile dereglije (drvena riječna teglenica). S tim su malim brodicama prevoženi razni poljoprivredni proizvodi. S obzirom na lokalne graditelje, pri izradi dereglija moguća su karakteristična odstupanja. U *Zborniku krajiških muzeja*, I., 1962., str. 181–191. pod naslovom *Saobraćaj na Sani i Uni* navodi se nosivost i dimenzije tih brodica. Podatci se razlikuju od vremena gradnje i naručitelja. Prema originalnim fotografskim zapisima i skicama analizirani su karakteristični detalji. Rezultati analize prikazuju se tabelarno, iz čega se raspravom dolazi do zaključka. Vežano uz pridržavanje osnovnih graditeljskih proporcija i maksimalno dopustiv gaz, postojale su razlike u nosivosti dereglija. Zabilježena je i upotreba jelove građe za gradnju vlastitih brodica.

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## TRADING FLATBOAT ON THE SANA RIVER

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**Key words:** small boats, transportation, local construction, constructional proportions

From the middle stream of the Sana and Una River, trading flatboats floated over the Sava River all the way to Belgrade. It was different agricultural products that were transported by these small boats. With regard to local constructors, characteristic variations are possible in the constructing of these flatboats, i.e., according to the capacity and size of the boat, as quoted in the Proceedings of the Krajina Museums, I, 1962, pages 181-191, in the article entitled *Traffic on the Sana and the Una*. These data differ depending on the period of construction and the client. Characteristic details were analyzed according to the original photographic records and sketches. Analysis results are presented in tables, thus leading to the conclusion. With regard to complying with basic construction proportions and the maximum permissible draught, there were differences in the capacity of these trading flatboats. What has also been noted is the use of fir-timber for the construction of proper boats.

## TRAGOVI TRGOVAČKOGA NEKLASIFICIRANOGA VODNOG PUTA RIJEKE SANE

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**Ključne riječi:** vodni put, dereglja, nosivost, porinuće, gaz

Istraživanje je provedeno na 112 kilometara vodotoka, neklasificiranoga plovnog puta (50 kilometara) rijeke Une od Hrvatske Dubice do Bosanskog Novog i (62 kilometra) rijeke Sane od ušća u rijeku Unu.

U radu je analizirana trasa vodnog puta rijeke Sane nakon stotinu godina od prestanka plovidbe.

Istraživanje tragova trgovačkih vodnih putova na rijeci Uni i Sani (desnim pritokama Save u Bosni) dovode nas do naziva malih destinacija kao što su Popov brod, Delića brod te naziva „splavište”. Fotografije i razglednice koje su nastale prije stotinu godina dokumentiraju korištenje trasa rijeka kao trgovačkih vodnih putova.

Od galija koje je nizvodno nosila riječna struja, a uzvodno vukli snažni galijoti, prva moderna, manja drvena plovila bez palube – dereglje – izgrađena su prije 1871. za potrebe transporta niz rijeku Sanu. To su plovila s ravnim dnom i zakošenim pramcem i krmom, nosivosti do 60 tona, duljine do 20 m, širine do 4,5 m, gaza do 1 m i bez vlastita pogona pa su se uzvodno teglila ili vukla.

Posebno je zanimljiva konfiguracija terena i pejzaži kojima prolazi trasa iznimno čiste rijeke. S obzirom na obvezu očuvanja prirodnog nasljeđa ovog ekološkog revira, nužno je istaknuti potrebu zaštite kulturnog dobra „trgovački vodni put rijeke Sane”, s afirmacijom svih turističkih potencijala koji se tu mogu prepoznati.

## TRACES OF COMMERCIAL UNCLASSIFIED WATERWAY OF THE SANA RIVER

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**Key words:** waterway, Trading Flatboat, capacity, launching, draught

The study was conducted on 112 kilometres of watercourses, unclassified waterway (50 kilometres) of the Una River from the Croatian Dubica to Bosanski Novi and (62 kilometres) from the estuary of the Sana River into the Una River.

The study analyses the route of the waterway of the Sana River 100 years after the termination of river navigation.

The survey tracks commercial waterways on the Una and Sana (right tributaries of the Sava in Bosnia), leading us to the names of some small destinations such as “Popov brod” (Priest’s Ship), “Delića brod” (Delić’s Ship) and the name of “splavište” (Raft). Photographs and postcards which were created 100 years ago document the use of the route of the river as a commercial waterway.

From galleys which were taken downstream by the river current while upstream dragged by strong galley-slaves, the first modern small wooden boats without decks were built before 1871, called Trading Flatboats (*dereglja*) and used for the transport down the Sana River. These boats are flat-bottomed while the bow and stern are slanted. Their load capacity is 60 tons and the length up to 20 m, the width up to 4.5 m, draught up to 1 m and without their own propulsion and upstream hauling or pulling.

What is particularly interesting is the configuration of the terrain and landscapes along the route, also extremely clean river. With regard to the obligation of preserving the natural heritage of this ecological area, it is necessary to emphasise the need to protect the cultural property of the “commercial waterway of the Sana River” with the affirmation of all its tourism potential, that can be recognised here.

## FRANZ I SILVIUS MORIN, ČASNICI C. I K. RATNE MORNARICE

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**Ključne riječi:** torpiljarka, brod, Pula, torpedni čamac, ratna mornarica

U C. i k. ratnoj mornarici bilo je više braće s uspješnim karijerama. Ipak braća Franz i Silvius Morin rijetki su čiju karijeru možemo povezati s torpedom.

Kraj Prvoga svjetskog rata Franz Morin dočekuje u zvanju kapetana fregate, zapovjednika II. flotile torpiljarki. Kao član „ratnog štaba flote”, član je predstavnika C. i k. ratne mornarice 31. listopada 1918. pri predaji flote hrvatskome Narodnom vijeću.

Mlađi Silvius Morin krenuo je sasvim drugim putem. Posvetio se tehničkim naukama da bi završetkom školovanja pristupio Ratnoj mornarici u struci brodograđevnog inženjera.

Prvi svjetski rat proveo je u Mornaričkom odjelu ministarstva rata u Beču u zvanju *Schifbau Ober ing* 1. klase (brodograđevni glavni ing. 1. klase). Konstruirao je prototip torpednog čamca.

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## FRANZ AND SILVIUS MORIN, AUSTRO-HUNGARIAN NAVY OFFICERS

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**Key words:** torpedo boat, ship, Pula, Navy

In the Austro-Hungarian Navy there were a number of brothers with successful careers, however, brothers Franz and Silvius Morin are the rare ones whose careers are connected with the torpedo.

At the end of World War I, Franz Morin is the Commander of the Second Flotilla of torpedo boats. As member of “the fleet war headquarters”, he was one of the K.u.K Navy representatives who turned the fleet over to the Croatian National Committee on 31<sup>st</sup> October 1918.

The younger brother, Silvius Morin, followed another path, devoting himself to technical studies. Once he graduated he joined the navy as naval architect.

He spent World War I in the Navy Department of the War Ministry in Vienna as *Schifbau Ober ing 1*, the main naval architect of class 1. He designed a prototype of the torpedo boat.

## TORPEDNA ŠKOLA C. I K. RATNE MORNARICE

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**Ključne riječi:** škola, torpedo, brod, Pula, ratna mornarica

Uvođenjem torpeda u upotrebu u C. i k. ratnu mornaricu 1869., brod *See Hund* preuređuje se u torpedni brod. Torpedna škola otvara se 10. ožujka 1876. U početku djeluje na prvome torpednom brodu *See Hund*, da bi joj 1878. bio dodijeljen i brod *Velebich*. Godine 1888. *See Hund* se briše iz flotne liste i umjesto njega školi je dodijeljen brod *Alfa*, koji je u službi do raspada mornarice, a od 1897. do 1912. i brod *Zara*. Prema potrebi angažiraju se i drugi brodovi, ponajprije torpiljarke.

Uređenjem uvala u Fažanskoj luci škola nastavlja s radom u sklopu minersko-torpedno-telegrafске škole u kojoj se održava teoretska nastava, a praktična se nastava održava u Fažanskom kanalu.

Škola se u pravilu održava dva puta godišnje, odvojeno za štabne i niže časnike te za mornare rukovaoce i radnike za održavanje torpeda. Uz školu se organiziraju i razni tečajevi vezani za održavanje i upotrebu torpeda.

Važnost torpedne škole pokazuje se u Prvome svjetskom ratu kada osnovnu operativnu snagu C. i k. ratne mornarice čine flotile torpiljarki i flotila podmornica. Plovilima čije je glavno naoružanje torpedo, zapovijedaju sposobni, školovani časnici.

U pulskome pomorskom arsenalu održavaju se i ispituju torpeda, izrađuju planovi te grade i održavaju torpiljarke. Sama ratna luka i Fažanski kanal zaštićeni su pred početak rata protutorpednim čeličnim mrežama, a na Malom Brijunu sagrađena je aktivna torpedna rampa.

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## AUSTRO-HUNGARIAN TORPEDO SCHOOL

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**Key words:** school, torpedo boat, Pula, Navy

With the introduction of torpedoes to the Austro-Hungarian Navy, the ship "See Hund" was changed into a torpedo boat in 1869.

The torpedo school opens on 10<sup>th</sup> March in 1876. In the beginning, the school works on the first torpedo boat, the "See Hund", later in 1878, the ship "Velebich" is assigned to the school. In 1888, the "See Hund" is deleted from the fleet list, when the ship "Alpha" becomes assigned to it instead, in service until the disintegration of the Navy. From 1897 to 1912, the ship "Zara" is also in service with the school. When needed, other ships become engaged, torpedo boats in the first place.

After the regulation of the Fažana Bay, the school continues to work within the mining-torpedo-telegraphy school, where theory classes take place, while the practice is held in the Fažana Channel.

The school courses generally take place twice a year, separately for staff officers and junior officers, and separately for operators on torpedo boats and workers that maintain torpedoes. In addition to the school, various courses are organised regarding the maintenance and use of torpedoes.

The importance of torpedo school is manifested in World War I when the basic operational strength of the Austro-Hungarian Navy flotilla consists of torpedo boats and a flotilla of submarines. Officers in charge of vessels the main armament of which is torpedo are highly capable trained officers.

At the Pula maritime arsenal, torpedoes are maintained and tested; they are also designed and constructed. The naval port and the Fažana Channel were protected before the war by anti-torpedo steel nets, while an active torpedo was built on the island of Mali Brioni.



**DOCK – CULTURE****PRIJEDLOG ZA PRENAMJENU PLUTAJUĆEG DOKA SAGRAĐENOG U DOBA AUSTRO-UGARSKJE U NOVU URBANU PLATFORMU ZA KULTURU, KREATIVNE INDUSTRIJE I TURIZAM****Bojana Vuksanović**, ing. arh.

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**Ključne riječi:** plutajući dok, kultura, Austro-Ugarska, Cres, revitalizacija, urbana platforma, urbana integracija

Projekt ocrtava način na koji bi dok mogao biti transformiran, nanovo promišljen arhitektonski i kroz predloženu promjenu namjene integriran u okviru grada kao urbani sloj, artefakt koji prenosi autentičnu priču u sklopu kulturne povijesti.

Dok je zamišljen kao plutajući „živući muzej”, objekt sam po sebi povijesni centar za posjetitelje, predstavljajući istodobno novu platformu za raznovrsne dodatne sadržaje.

Prezentiran je potencijal za integraciju ovoga povijesnog objekta, u nanovo promišljenoj arhitektonskoj formi, u urbanu strukturu grada Cresa ili, alternativno, premještaj na drugu lokaciju.

Važno je razmotriti značenje plutajućeg doka 9 u Cresu kao kulturnoindustrijskog nasljeđa ne samo na lokalnoj razini, već u širim okvirima Hrvatske.

Dok 9, konstruiran za Austrougarsku ratnu mornaricu početkom prošlog stoljeća, ne samo da je najstariji, već je i zadnji postojeći primjerak takva objekta koji je preostao u Hrvatskoj iz toga doba.

Dan je opći pregled ključnih trenutaka povijesti doka 9, o čemu ima vrlo malo dokumenata s obzirom na to da je objekt ostao vojna tajna sve dok ga 1983. nije kupila JRM.

Studija ima primarnu namjeru povećati svijest o jedinstvenoj kulturnopovijesnoj i arhitektonskoj vrijednosti ovog objekta razumijevanjem kojega će se povećati mogućnost da ovaj posebni objekt, koji sada zaboravljen pluta u Creskom zaljevu, dobije nov život, očuva se kao dio kulturnog nasljeđa i ostane u središtu sadašnjega kulturnog života.

**DOCK – CULTURE****A PROPOSAL FOR CONVERSION OF AUSTRO-HUNGARIAN BUILT FLOATING DOCK INTO A NEW URBAN PLATFORM FOR CULTURE, CREATIVE INDUSTRIES AND TOURISM****Bojana Vuksanović**, B.Arch.

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**Key words:** floating dock, culture, Austro-Hungarian, Cres, revitalization, urban platform, urban integration

The project outlines how the dock could potentially be transformed, re-invented architecturally and through a proposed change in use, integrated as a layer within the city, as an artefact that tells an authentic story within the cultural history.

The dock is envisaged as a floating “living museum”, the object itself a historic “visitor centre”, simultaneously providing a platform for various additional proposed usages.

What is presented is potentiality for the integration of this historic object, newly redesigned architecturally, in the urban matter of the city of Cres, or alternatively, its relocation elsewhere.

Consideration should be given to the significance of the floating dock-9 object in Cres in terms of cultural-industrial heritage, not solely at the local level, but within the broader context of Croatia also.

Dock-9 that was constructed for the Austro-Hungarian navy at the beginning of the last century, is not only the oldest, but it is also the last remaining representative object of this typology left in Croatia from that era.

An overview of key points in Dock-9 history is given, as very little is documented, considering the dock had remained a military secret until it was bought from the JRM in 1983.

The work has been done with the prime intent of raising the awareness of the dock’s unique cultural-historic and architectural value, the realization of which might increase the chances for this rare object, that now, unfortunately, is forgotten and floats in the bay of Cres, to be given a new life, preserved as a part of culture, and remain central to the current cultural life.

## EVOLUCIJA TORPEDA

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**Ključne riječi:** torpedo, bojna glava, zračni motor, propeler i mornarica

Za vrijeme Napoleonskih ratova Robert Fulton eksperimentirao je s brodskom minom nazvavši je torpedo po ribi koja pri dodiru može prouzročiti šok iznenađenja. Tako je prvi torpedo bio plovilo ispunjeno eksplozivnim punjenjem koje bi pri sudaru eksplodiralo. Poslije se to ime upotrebljavalo za bilo koje eksplozivno sredstvo koje bi se stavilo na metu bez upotrebe oružja.

Prvi pokretni torpedo izumio je 1865. Johann Luppis, kapetan Austrougarske ratne mornarice. Taj je izum imao satni mehanizam kojim se upravljalo konopcima za navođenje. Želeći usavršiti izum, Luppis se obratio svome prijatelju Robertu Whiteheadu. Whitehead je proizveo oružje oblikovano poput vretena, 4,2 metra dugačko, promjera 35,5 centimetara, za koje nisu bili potrebni kontrolni konopci. Austrijska vlada, kojoj je taj izum prikazan, smatrala je da ga treba preuzeti Austrijska ratna mornarica.

Komandant John Fisher bio je tada važna osoba u Britanskoj kraljevskoj mornarici. Potaknuo je Admiralitet da osnuje posebno povjerenstvo koje je trebalo „postaviti osnove teorije i prakse torpeda”. Godine 1872. dodijeljen je ratnom brodu (Njezina Kraljevskog Veličanstva) *Excellent* kako bi ispitivao torpeda i eksperimentirao njima. Fisher ja poslije postao admiralom Ratne mornarice.

Admiralitet je kupio prava za proizvodnju, a to priznanje koje je Whiteheadovu torpedu iskazala najveća pomorska sila u svijetu dovelo je do narudžbi iz Francuske, Italije, Njemačke i drugih zemalja, sve dok se sve važne mornarice svijeta nisu počele koristiti tim torpedom.

Za vrijeme Prvoga svjetskog rata Britanija je uz pomoć snažne britanske Velike flote koja je bila stacionirana u pomorskoj bazi Scapa Flow i druge flote stacionirane u Portlandu provela blokadu Sjevernog mora na kojemu je došlo do zastoja. Njemačka flota bila je opkoljena u Kielu. Frustracija njemačkih pomoraca do koje je došlo zbog nedostatka djelovanja, dovela je do pobune Njemačke mornarice, koja je pak pridonijela uspostavi primirja kojim će završiti rat.

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## THE TORPEDO'S EVOLUTION

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**Key words:** torpedo, warhead, air motor, propeller and navy

During the Napoleonic wars, Robert Fulton experimented with a naval mine and called it a torpedo after a fish that is able to give an immobilising shock simply by being touched. Hence the first torpedo was an explosive moored charge that would detonate on impact. Later that name was given to any explosive device, which could be laid right against the target without the use of a gun.

The first locomotive torpedo was invented in 1865 by Captain Johann Luppis of the Austro-Hungarian Navy. This was clockwork device, guided by steering lines. Luppis turned to his friend Robert Whitehead to improve the device. Whitehead produced a spindle shaped weapon 4.2 metres long by 35.5 cm. diameter that required no control lines. It was demonstrated to the Austrian Government who considered it should be adopted by the Austrian Navy.

An important figure in the Royal Navy was Commander John Fisher. He urged the Admiralty to set up a special committee to 'establish the theory and practice of torpedoes'. In 1872 he was appointed to HMS *Excellent* experimenting and testing torpedoes. Fisher was later to become Admiral of the Fleet.

The Admiralty bought the rights of manufacture and recognition of the merits of Whitehead's torpedo by the greatest sea power in the world brought orders for torpedoes from France, Italy, Germany and other nations, until every navy of importance in the world was using the Whitehead torpedo.

During WWI Britain operated a blockade of the North Sea and there was a stalemate with the strong British Grand Fleet stationed at Scapa Flow and a second stationed at Portland. The German Fleet were bottled up at Kiel. The frustration of the German sailors caused by inactivity brought about the German naval mutiny that helped in bringing the armistice to end the war.

## UVOĐENJE TORPEDNIH ČAMACA

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**Ključne riječi:** revolucija torpeda, torpedo, bojna glava, zračni motor, propeler i mornarica

Uvođenjem pogona na paru način ratovanja na moru iz temelja se promijenio. Plovilima se sada moglo manevrirati po želji jer više nisu ovisila o diktatima vjetra. Uvođenje topa sa žljebovima koji gađa eksplozivnim granatama, značilo je da se brodovi mogu boriti na udaljenosti. To je dovelo do temeljne promjene strategije. Brodovi su postali dulji i brži kad su se počeli graditi od željeza, tako da je rođena nova vrsta ratne mornarice. Godine 1859. brodograditelj John Scott Russel zacrtao je što se od mornarice traži: ratnik (bojni brod), brod s jednim velikim topom (uvođenjem torpeda koji je zamijenio top – torpedni čamac) te krstarica s više velikih topova (ratna krstarica).

Yarrow je konstruirao prvi torpedni čamac koji je razvio iz brzih riječnih čamaca koje je izgradio. Bili su to mali čamci II. klase, brzine 14 čvorova za zatvorene vode te duži čamci I. klase, brzine 17 čvorova za oceane. Ti su se najprije prodavali Argentini, a poslije i drugim svjetskim ratnim mornaricama, posebno Rusiji. Britanska kraljevska mornarica bila je spora u prihvaćanju torpednih čamaca, međutim 1889. posjedovala ih je već 156. Ratne mornarice u svijetu imale su ukupno 1248 čamaca. Yarrow je uvijek bio na prvome mjestu po izgradnji torpednih čamaca.

Godine 1893., usprkos snažnoj francuskoj konkurenciji, Yarrow je za Francusku ratnu mornaricu izgradio dva čamca II. klase. Da bi uštedio na težini, izgradio ih je od aluminijske. Francuska brodogradilišta žalila su se svojoj vladi govoreći da su ih oni mogli izgraditi, ali su dobili odgovor da nisu ponudili čamce od aluminijske.

Bilo je potrebno vrijeme da se razvije konačan način lansiranja torpeda. U početku su ih ispuštali s neke vrste dizalice za čamce. Tek je 1880. došlo do izuma torpedne cijevi. Čak i tada su ispaljivani na tradicionalan način, s boka čamca. Prošlo je trideset godina prije nego što se shvatilo da je lansiranje čišće, lakše i bolje ako se obavlja preko pramca.

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## INTRODUCTION OF TORPEDO BOATS

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**Key words:** The torpedo's revolution: Torpedo, Warhead, Air motor, Propeller and Navy

With the introduction of steam power, naval warfare changed dramatically. No longer under the dictates of the wind, vessels could manoeuvre at will. The introduction of rifled cannon firing explosive shells meant that ships could fight from a distance. This caused a major change to the strategy. The introduction of iron ships allowed them to be longer and faster, so a new type of navy was born. In 1859, the naval architect John Scott Russell outlined its requirements as: – The Man of War (Battleship), The Single Great Gun Boat (with the introduction of the torpedo to replace the gun – the Torpedo-boat) and The Many Large Gunned Cruiser (Battle Cruiser).

Yarrow designed the first torpedo-boat, developed from the fast river launches he built, small class-II boats, speed 14 knots for sheltered waters and longer class-I speed 17 knots for ocean use. These were sold firstly to Argentina, but later to the world's navies, especially Russia. The Royal Navy was slow in adopting torpedo-boats but by 1889 it possessed 156 boats. The total of the world's navies was 1248 boats. Yarrow was always the foremost torpedo-boat builder.

In 1893, against strong French competition, Yarrow built two class-II boats for the French Navy. To save weight he built them of aluminium. French shipyards appealed to their government that they could have built them, but the reply was that they had not offered aluminium boats.

The final means of launching torpedoes took time to develop. Initially they were dropped from a davit type arrangement. It was not until 1880 that torpedo tubs were invented. Even then they were fired in the traditional broadside manner. It was almost thirty years before they realised that over the bow gave a cleaner, easier and better launch for small ships.

## PULSKI PLUTAJUĆI SUHI DOK – DOK KOJI NIKAD NIJE STIGAO U PULU

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**Ključne riječi:** Austrougarska mornarica, Pula, golemi suhi dok od 46.000 tona, djed, inženjer brodogradnje John Henry Wilton, brodogradilište

Austrougarska mornarica nije djelovala samo u Rijeci u kojoj se testirao torpeda, već i u Puli gdje je bila njezina glavna baza i brodogradilište i gdje se osjećala sve veća potreba za dokovima za ratne brodove. Tako je 1913. naručen poseban plutajući suhi dok, tako velik da se nije mogao u izgraditi, već jedino u inozemstvu, odnosno u njemačkom brodogradilištu *Blohm & Voss* u Hamburgu. Dovršen je u svibnju 1915., prekasno da bi se teglio morskim putom do Pule zbog izbijanja Drugoga svjetskog rata godinu dana prije, tako da tamo nije nikad ni stigao. Golem suhi dok od 46.000 tona, u to vrijeme jedan od najvećih na svijetu, ostao je u Hamburgu neiskorišten, ali ga ni rat nije oštetio, sve do 1920.

U igru tada ulazi moj djed, inženjer brodogradnje John Henry Wilton, koji je u to vrijeme bio vlasnik i upravljao (zajedno s dva svoja brata) brodogradilištem *Wilton Shipyards* u Rotterdamu, već tada najvećim nizozemskim brodogradilištem. Uz novčanu pomoć glavne brodarske kompanije u Rotterdamu the *Holland Amerika Lijn*, moj je djed kupio pulski suhi dok 1920. i dao ga tegliti od Hamburga do Rotterdama rijekama Rajnom i Maas, utrostručujući tako jednim udarcem kapacitet doka. Otad je brodogradilište *Wilton* popravljalo i gradilo i najveće oceanske linijske i ratne brodove u samoj Nizozemskoj, umjesto da ih da izgraditi u Engleskoj ili u Njemačkoj. Pulski suhi dok korišten je za podizanje mnogih poznatih brodova u brodogradilištima *Wilton-Feyenoord* u Schiedamu dugo nakon smrti moga djeda (1934.) i oca (1955.), a prodan je Turskoj tek prije nekoliko godina. Odrastao sam u brodogradilištu svoga oca i kao dječak igrao se u pulskom doku, naravno samo tijekom vikenda i kada u njemu nije bilo broda. Ali još uvijek osjećam njegov miris.

## POLA FLOATING DRYDOCK – THE DOCK THAT NEVER GOT TO POLA

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**Key words:** Austro-Hungarian Navy, Pola, immense drydock – 46,000 tons, grandfather naval engineer John Henry Wilton, shipyard

It was not only in the Rijeka area with its torpedo tests where the Austro-Hungarian Navy deployed its activities at the time, but also more to the south in Pola (Pula), where its main Navy-base and shipyards were located and where a growing need for docking facilities for battleships was felt. So in 1913, a special floating drydock was ordered, so big that it could not be built locally, only abroad, and that was at the German shipyard Blohm & Voss in Hamburg. It was complete in the May of 1915, too late to be towed by sea-tugboats all the way to Pola because of the outbreak of World War I a year earlier, and therefore it never got there. The immense drydock of 46,000 tons, at the time one of the largest in the world, stayed in Hamburg idle but unharmed by the war till 1920.

Enters my *grandfather*, naval engineer John Henry Wilton, who at the time owned and ran (with his 2 brothers) Wilton Shipyards in Rotterdam, then already Holland's largest shipyard. With the financial support from the main shipping company in Rotterdam, the *Holland Amerika Lijn*, my grandfather *bought* the Pola Drydock in 1920 and had it towed from Hamburg up the Rhine/Maas river to Rotterdam, tripling Wilton's docking capacity in one stroke; from now on Wilton had the facilities to repair and build even the largest ocean liners and warships in Holland itself instead of having it done in England or Germany.

The Pola drydock was in use for lifting many of famous ships at Wilton-Feyenoord Shipyards in Schiedam long after the death of my grandfather (1934) and father (1955) and was sold to Turkey only a couple of years ago. I grew up at my grandfather's shipyard and played as a young boy in the Pola dock, only at weekends of course, and then only when there was no ship in it. But I can still smell it.

## UTJECAJ DJELOVANJA TORPEDA NA PODMORNICU

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**Ključne riječi:** podmornice, skladištenje torpeda/rukovanje, torpedne cijevi, sustavi otpuštanja torpeda, sustavi podmornice namijenjeni torpedu

Ova prezentacija iznosi sustave i njihovu strukturu koje podmornica treba imati kako bi se osiguralo djelovanje torpeda. Prikazani su tipovi i organizacija sustava za lansiranje, a razmatraju se prednosti i nedostaci raznih rješenja. Opisuju se mogućnosti za postavljanje torpeda u torpedne cijevi te u trup podmornice pod pritiskom, a opisano je rukovanje torpedima za manje i veće podmornice. Prikazuje se nacrt karakteristika torpednih cijevi, uključujući poklopce za cijevi, naprave za prilagodbu i vođenje te objašnjavaju načela za protok i otpuštanje torpeda. Hidraulički sustavi koriste se ako su potrebne velike sile i zakretni moment, a trebaju se izbjeći emisije buke, primjerice pri djelovanju zakrilca (*mouth flaps*) ili rukovanju rezervnim torpedima.

Torpeda svojim djelovanjem utječu i na samo plutanje podmornice. Potrebni su uređaji za kompenzaciju težine i trima putem odgovarajućih volumena i strukture regulirajućih/kompenzirajućih tankova, trim i torpedo tankova. Za upravljanje vodom između tih tankova potrebna je pomoćna oprema poput pumpi, zračnih kompresora, uređaja za pumpanje i otjecanje vode.

Električni sustav napaja se raznim, o zraku ovisnim (generatori na dizel) i zraku neovisnim (nuklearna snaga, posebni motori, gorive ćelije) generatorima struje putem akumulatora podmornice. U kontekstu ove prezentacije potreban je sustav za električni pogon pumpi, kompresora, naprava za paljenje, naprava za kontrolu i kontrolnih kanala. U sobi za djelovanje, konzole trebaju biti integrirane tako da zapovjednik uvijek ima dobar pregled cijele operativne situacije. Posebno se trebaju razmotriti opažanja senzora kao i aktualni podaci o pogonu podmornice (kurs, brzina, dubina) te „na vrijeme“ napraviti nužne kalkulacije.

Sadržaj prezentacije prikazan je uz pomoć devet slika.

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## THE INFLUENCE OF TORPEDO OPERATION ON SUBMARINE

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**Key words:** submarines, torpedo storage/handling, torpedo tubes, torpedo discharge systems, submarine systems for torpedoes

The presentation sets out the systems and arrangements which have to be provided on board of submarines to enable the operation of torpedoes. The types and arrangement of the launching devices are shown and the advantages and disadvantages of the different solutions are discussed. The possibilities for the placement of the torpedoes into the torpedo tubes and the pressure hull and as well their handling are described for smaller and larger submarines. The design features of torpedo tubes including the tube closures, adjustment and guiding devices are set out and the principles for torpedo flow respectively torpedo discharge are explained. Hydraulic systems are used if large forces and torques are required and noise emissions to be avoided, e.g. for the operation of mouth flaps or the handling of spare torpedoes.

The operation of torpedoes affects also the floating behavior of the submarine. What is needed are facilities for weight and trim compensation through appropriate volumes and arrangement of regulating/compensating tanks, trim and torpedo tanks. For the water management between these tanks more auxiliary equipment, such as pumps, air compressors, pumping and drainage facilities are needed.

The electrical system is fed by various air dependent (diesel generators) and air independent (nuclear power, special motors, fuel cells) power generators via the batteries of the submarine. In the context of this presentation the system is needed for electric drive of pumps, compressors, switching devices, controllers and control channels.

In the operations room, the consoles shall be so integrated that the commanding officer has always a good overview of the entire operative situation.

In particular observations by the sensors as well as the actual drive data of the submarine (course, speed, depth) are to be considered and the necessary calculations to be performed “in time”. The content of the presentation is demonstrated by 9 pictures.

## SPOMENICI INDUSTRIJSKE BAŠTINE U NACIONALNOM PARKU KRKA – ARHEOLOGIJA, KONZERVACIJA, PREZENTACIJA

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**Ključne riječi:** baština, Nacionalni park Krka, arheologija, konzervacija, prezentacija

Koncem 19. i početkom 20. stoljeća rijeku Krku zahvatio je val industrijalizacije. Duž njezina toka izgrađene su od 1895. do 1911. četiri hidroelektrane koje su električnom energijom opskrbljivale grad Šibenik i novosagrađene tvornice i industrijske pogone, u prvom redu SUFID u Šibeniku (Crnica) i ugljenokope u Siveriću. To su HE Krka (1895.) i HE Jaruga na Skradinskom buku (1904.), HE na Roškom slapu (1911.) i HE Miljacka (1907.) na slapu Miljacka. U planu je bila izgradnja još dviju hidroelektrana koje nikada nisu realizirane (Skradinski buk i Bilušića buk). Tri od četiri hidroelektrane i danas proizvode električnu energiju i dio su jedinstvenoga elektrifikacijskog sustava Republike Hrvatske.

Najstarija HE Krka izgrađena je i puštena u pogon u kolovozu 1895. u svrhu postavljanja električne rasvjete na izmjeničnu struju u Šibeniku koji ju je, zahvaljujući njezinim graditeljima, dobio prije mnogih europskih gradova. Inženjer Vjekoslav Meichsner izradio je projekte za izgradnju hidroelektrane, dalekovoda za prijenos električne energije i gradske mreže za rasvjetu. To je ujedno bila i prva elektrana u svijetu s cjelovitim zatvorenim sustavom proizvodnje, prijenosa i distribucije izmjenične struje. Prestala je s radom i zatvorena je početkom Prvoga svjetskog rata kada je rashodovana u vojne svrhe zajedno sa starim dalekovodom. Zgrada elektrane ostala je u cijelosti sačuvana do 1945. kada je razorena.

U proljeće 2006. započela su sustavna arheološka istraživanja i konzervatorski radovi na ostacima hidroelektrane Krka, čemu je prethodila detaljna izrada dokumentacije. Istraživanja su otkrila izvrsno sačuvane prostorije za smještaj turbina te odvodne kanale za vodu ispod njih. U tijeku su konzervatorsko-restauratorski radovi i djelomična rekonstrukcija elektrane, a potom će slijediti njezina prezentacija. Zbog svoga povijesnog značenja te kao spomenik industrijske arhitekture, ova je elektrana zaštićena kao kulturno dobro Republike Hrvatske.

Tijekom 2015. započet je projekt istraživanja i digitalizacije arhivskoga gradiva o industrijskim postrojenjima na rijeci Krki.

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## MONUMENTS OF INDUSTRIAL HERITAGE IN THE KRKA NATIONAL PARK – ARCHEOLOGY, CONSERVATION, PRESENTATION

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**Key words:** industrial heritage, the Krka National Park, archeology, conservation, presentation

Towards the end of the 19<sup>th</sup> century, the water power of the Krka was used for first industrial plants – hydroelectric power plants. Four hydroelectric power plants were built from 1895 to 1911 along the Krka River. These are: HEP Krka (1895) and HEP Jaruga at Skradinski buk (1904), HEP at Roški slap (1911) and HEP Miljacka (1907) at Miljacka waterfall. Two other hydroelectric power plants were planned, but never built (at Skradinski buk and Bilušića buk). Three out of four hydroelectric power plants are still in use and make part of the electrification system of the Republic of Croatia.

The oldest HEP Krka was built and put into operation on the 28 August 1895, followed by the installation of electric lighting in the alternating current in Šibenik. The engineer Vjekoslav Meichsner made the projects for the hydroelectric power plant, transmission lines for power transmission and public lighting of Šibenik. It was also the first integral alternating current electroenergetic system with the long-distance power transmission in the world.

At the beginning of World War I, military authorities destroyed the facilities in the old hydroelectric power plant Krka as well as two copper conductors in order to use the material for warfare purposes. The building itself remained fully preserved until 1945 when it was destroyed at the end of the Second World War.

In the spring of 2006, the systematic archaeological research and conservation work began on the remains of hydropower plant Krka, preceded by detailed technical documentation. During the archaeological excavations the perfectly preserved rooms for turbines and drains for the water beneath them have been found. Ongoing conservation and restoration works and partial reconstruction of the plant aim to present this unique object of the industrial heritage in Croatia. Because of its historical significance as a monument of industrial architecture, the remains are officially protected as cultural heritage.

The project on research and digitization of the archival documents on industrial heritage on the Krka river, began during the year 2015.



## ZAŠTITA I KORIŠTENJE BAŠTINSKE DOKUMENTACIJE TEHNIČKE, VOJNE I INDUSTRIJSKE PROVENIJENCIJE: PITANJA, IZAZOVI I MOGUĆNOSTI

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Cilj je ovog rada predstaviti probleme, izazove i mogućnosti vezane uz zaštitu baštinske dokumentacije iz vojnih, industrijskih i tehničkih područja. Sama dokumentacija u mnogočemu je najvažniji izvor informacija za znanstvenike i istraživače vojne, industrijske i tehničke povijesti, a koristi se i u mnoge druge svrhe. U modernim vremenima „na mreži”, od velike je važnosti osigurati trajnu zaštitu dokumentacije u tiskanom i digitalnom obliku. Ovaj rad će se usredotočiti na objašnjavanje problema vezanih uz vojnu, industrijsku i tehničku baštinu iz perspektive informacijskih znanosti, počevši od hipoteze da sva dokumentacija vojne industrijske i tehničke provenijencije mora biti dostupna kroz kataložne popise i digitalizaciju, i korištena ponajprije u neprofitne i istraživačke svrhe. Da bi se to moglo postići, potrebna je suradnja između svih institucija koje osiguravaju zaštitu tih područja baštine.

Najvažnija istraživačka pitanja u ovom radu jesu: 1. Gdje se i kako može pristupiti dokumentaciji vojne, industrijske i tehničke provenijencije? 2. Kako je takva dokumentacija opisana, organizirana, zaštićena i prezentirana? 3. Koliko je važan legislativni okvir u zaštiti dokumentacije?

Problemi i smjernice prezentirane u radu mogu se iskoristiti kao osnova za unaprjeđivanje mogućnosti zaštite i korištenja vojne, industrijske i tehničke dokumentacije. Ti problemi bit će predstavljeni na primjeru torpeda.

## PRESERVING AND USING HERITAGE DOCUMENTATION OF TECHNICAL, MILITARY AND INDUSTRIAL PROVENIENCE: ISSUES, CHALLENGES AND POSSIBILITIES

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**Key words:** industrial heritage, preservation, heritage documentation, military heritage, technical heritage

The goal of this paper is to present issues, challenges and possibilities regarding the preserving of heritage documentation originating in military, industrial and technical fields. In many regards, the documentation is often the most valuable source of information for scientists and researchers of military, industrial and technical history, besides it being used for other purposes. In today’s “online” age it is of utmost importance to ensure the continuous preservation of documentation in both printed and digitized form. This paper will focus on explaining the issue of military and technical heritage from the information science perspective starting from the hypothesis that all documentation of military, industrial and technical provenience should be freely accessible through the catalogue descriptions and digitisation, and used primarily for non-profit and research purposes. In order to achieve that, cooperation between all relevant institutions that safeguard such heritage must be ensured.

Most important research questions regarding these issues will be discussed, as follows: 1) Where and how can we access documentation of military, industrial and technical provenience? 2) How is such documentation described, organized, preserved and presented? 3) How important is the legislature in terms of document preservation?

Issues and guidelines presented in this paper could be used as a basis to improve the possibilities of preserving and using military and industrial heritage documentation. The above mentioned issues will be reflected through the example of the torpedo.

## TVORNICA NA KRAJU GRADA

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**Ključne riječi:** Rudolf Fizir, Tvornica motora Zagreb, TMZ, moped, skuter, *Švrća*, Dubrava, *Savica*

Tvornica motora Zagreb nastala je iz male radionice koju je 1948. osnovalo tadašnje Ministarstvo industrije NRH. Nekolicina entuzijasta, s inženjerom Rudolfom Fizirom na čelu, ručno je izradila prvi motocikl domaće proizvodnje u novoj Jugoslaviji. Izradili su četiri prototipa, zapravo kopije predratnog BMW motocikla sa 750 ccm. Taj „domaći” uradak javnosti je ponosno predstavljen već 1948. na prvomajskoj paradi u Zagrebu. TMZ službeno djeluje od 1949. s lokacijom na zagrebačkom Žitnjaku. Prvi zadatak Fizirowa tima bila je izrada malolitražnih benzinskih motora za pogon traktora, plugova, kopačica, motornih kosilica, motora za motorne pile, pa čak i za pogon manjih ribarskih čamaca. Tako se 1952. na tržištu konačno pojavila *Savica 285* kao potpuno domaća konstrukcija i proizvodnja, slijede *Savica 175* i *Dubrava 175*. U TMZ-u su proizvodili reduktore te tri tipa centrifugalnih pumpi C-1, C-4 i X-100 koje, spojene s motorom *Savica 285*, čine pumpne agregate AMS-C1, AMS-C4 i AMS-X-100. TMZ je 1957. sklopio licencni ugovor s austrijskom tvornicom HMW, prema kojem je preuzeo od Austrijanaca svu tehničku dokumentaciju za proizvodnju mopeda, budućega TMZ 50 SL. Godine 1959., nakon dvije godine razvoja, predstavljen je i *Švrća*, skuter nazvan po legendarnom liku Walta Disneya. S početnih 77 radnika 1950., u tvornici je 1954. radio 191 radnik, a na vrhuncu proizvodnje 1957. bilo je 215 zaposlenika. Proizvodne su mogućnosti tvornice 1960. s dvjestotinjak zaposlenih iznosile 2700 mopeda i skutera, oko 3000 stabilnih motora i 500 malih poljoprivrednih traktora, o čijoj je licencnoj proizvodnji TMZ pregovarao s francuskom tvornicom *Staub*. Preuzimanjem TMZ-a od strane Prvomajske 1961. realiziran je prvi dio plana s ciljem likvidacije tvrtke. Moped i *Švrća* prvi su na udaru i staje njihova proizvodnja. Stabilni motori proizvode se dalje do 1963. kada su kompletni alati, strojevi i zalihe dijelova preseljeni u tvornicu *Progres* u Mali Zvornik (Srbija). Bio je to konačni kraj proizvodnje motora i motocikala u Zagrebu.

## FACTORY AT THE END OF THE TOWN

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**Key words:** Rudolf Fizir, Zagreb Motor Factory, TMZ, moped, scooter, *Švrća*, Dubrava, *Savica*

The Zagreb Motor Factory developed from a small mechanical workshop, which was established by the Ministry of Industry of the NRC in 1948. A few enthusiasts headed by the engineer Rudolf Fizir made by hand the first locally produced motorcycle in the new Yugoslavia. They developed four prototypes, actually copies of the pre-war BMW 750 ccm motorcycle. That “domestic” product was presented proudly at the 1948 the first of May parade in Zagreb. The Zagreb Motor Factory started to work officially in 1949, with the location in the Zagreb Žitnjak. The first task of the Fizir team was the making of a small engine petrol motor for the drive of tractors, ploughs, digging machines, mowers, chain-saw motor, even for the drive of smaller fishing boats. Thus, finally, in 1952, *Savica 285* appeared on the market as a completely domestic construction and production, followed by *Savica 175* and *Dubrava 175*. The TMZ produced reducers and three types of centrifugal pumps C-1, C-4 and X-100, which, connected with the *Savica 285* motor make pump aggregates AMS-C1, AMS-C4 and AMS-X-100. In 1957, the TMZ signed the license agreement with the Austrian factory HMW, according to which it took over from the Austrians all the technical documentation for the moped production, the future TMZ 50 SL. In 1959, following a two-year development, *Švrća* was presented, a scooter named after the legendary Walt Disney character. Beginning with 77 employees in 1950, in 1954 there were 191 of them, while at the peak of production in 1957, there were 215 employees. The production capacities of the factory in 1960, with around 200 employees, amounted to 2,700 mopeds and scooters, around 3,000 stable motors and 500 small agricultural tractors, the license production of which the TMZ negotiated with the French *Staub* factory. TMZ being taken over by the *Prvomajska* factory in 1961, marked the first part of the plan to put the TMZ out of business. Moped and *Švrća* were the first to be hit so that their production stops. Stable motors continued to be produced until 1963, when all of the tools, machines and spare parts’ stock were moved to the *Progres* factory in mali Zvornik (Serbia). It was the final end of the motor and motorcycle production in Zagreb.

# PRO TORPEDO RIJEKA

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