International Center of Bioacoustics [ICoB]

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Summary

This "International Center of Bioacoustics" (ICoB) is located at the crossroad of environmental, human and technical sciences based on bioacoustics. ICoB is an international consortium of recognized partners (laboratories, private companies, NGO…), it gathers an interdisciplinary team of thirty experts in Toulon University (UTLN), and a group of fifty national and international experts and stakeholders, some having long term collaborations with UTLN. Currently, UTLN runs several projects on this topic for around 18 000 K€. ICoB runs 5 000 K€ of in-kind external human resources for the coming 10 years. The total requested grant of ICoB is 1 277 K€ on this PIA4 plus some Phd / Chair grants from the EUR of this PIA4.

ICoB, based on international skills in Research on Artificial Intelligence for machine listening, Embedded and low power AI, and Biocoustics and Robotics, aims at developing and stabilizing its strength. This Center will demonstrate within a unified methodology bioenvironmental effects of anthropic factors, such as anthropogenic impacts (noise pollution, ship collisions, terrestrial transport noise, restoration…) yielding to habitat and biodiversity losses, in a long term view as well as in very short term emergency situations. ICoB will research innovations to assess and regulate in all parts of the world these increasing troubles.

Main goals of ICoB

A key objective of ICoB is to become a strong center for professionalization in bioacoustical domain, and a whistleblower for long or short term environmental changes, or in emergency situations, having diagnostics based on state of the art tools for monitoring by bioacoustic and Artificial Intelligence.

ICoB will define its policy according to its consortium priorities, taking into account societal and environmental concerns, as well as technical possibilities. An important aspect of this center is that it will gather recognized partners in bioacoustics and connected environmental sciences, laws, economics, engineering sciences in order to define key objectives jointly in several fields : environmental of course, but also technical in order to push the boundaries of the state of the art in terms of monitoring and alerts, in order to make for example regulations evolve.

ICoB will help to maintain and develop the existing large collaborative working framework based on widely accepted standards and goals. It will also promote environmental protocols for external contributors such as citizen scientists forming a huge and particularly interesting

network, in order to make them able to contribute efficiently to science. Objectives will be proposed by the consortium, according to the state of art in measurement techniques and sensors. Moreover, desirable technical evolutions in sensing techniques will also be defined by ICoB and developed accordingly. These ones will focus on two main challenges :

- **Long term monitoring** : how to make long term reliable environmental monitoring, especially for building reference models that can be used in one or two human generations. This involves :
  - developing high performance (low noise, high fidelity) innovating very-long term recording hardware with extended capabilities such as focusing on defined species recognition in ultra-low power or tracking animals in a passive way using networks of ultra-low power sensors. This is based on electronics, embedded signal processing and ultra-low power artificial intelligence.
  - developing cheaper hardware for helping citizen scientists.
  - developing high performance offline classification techniques for better identifying animals. This is based on high classification performance artificial intelligence.
  - developing tools for deploying monitoring hardware efficiently, if possible at a low human and material cost. This is mainly based on robotic techniques.
  - developing or finding reliable and sustainable long-term database solutions for storing and organizing bioenvironmental data.
- **Surveillance :** monitoring of specific terrestrial areas (Nature Reserves, National Parks, other protected areas) to detect in real-time possible threats or illegal activities, such as hunting, unauthorized motor vehicles, illegal tree abatement by chainsaws.
- **Emergency monitoring** : how to monitor natural areas in the long term in order to detect abnormal behaviors or flash pollution, and how to deploy efficient measurement tools in emergency situations for evaluating the potential impact of these pollutants on the environment. This involves :
  - developing advanced collaborative human-robot techniques in hazardous environments (potentially underwater), and possibly bio-inspired techniques. This is mainly based on robotics, electronics and signal processing and AI for improving communication between humans and robots, and between robots and robots.
  - developing advanced intelligent ultra-low power embedded detection systems. This is mainly based on electronics and ultra low-power artificial intelligence.

Strengths and originalities of ICoB :

- Strong experience in cooperation at local and international levels, between bioacoustics, AI,electronics, technical scientists and researchers in economics and law.
- Experience in designing, defining and building innovative advanced scientific instrumentation for sound monitoring as shown since 5 year in SMIoT Toulon University. This includes low-power aspects, as well as embedded artificial intelligence capabilities, at an interesting quality-price ratio and a versatility of use[1].
- Experience in developing and maintaining IoT biodiversity stations in Med. Sea and Natural reserves, but also all over the world, as we did in CARIBBEAN CARIMAM, in several Fjords (Patagonia , Norway, Canada, Mediterranean Sea), forests as in Amazonia.
- Experience in monitoring the acoustic environment of Nature Reserves in Italy in cooperation with the Biodiversity Dept of Carabinieri, Italy.
- Experience in developing specific algorithms for acoustic analysis according to the needs of stockholders and constraints from the field.
- Experience in robotics for deploying measurement tools and cooperative robot swarms in hazardous environments.

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[1] http://sabiod.lis-lab.fr/pub/QHB.pdf

- Experience in perception, production and evolution of animal communication systems.
- Strong commitment in education and training.

- UTLN supports research, innovation and discovery with a view to respecting the environment and sustainable development for the preservation of marine ecosystems with more than 53 projects carried out by its laboratories in 2022, mostly dedicated to marine biodiversity in the Mediterranean, for a mobilization of 25 M€ over the last decade by funding and partnership. UTLN is notably the co-sponsor (Co-PI Glotin) of two PIA3 projects (TERRA FORMA and PSIBIOM) on the theme of biodiversity monitoring by bioacoustics and IA ADSIL Chair, as well as of 3 ANR projects (ULPCOCHLEA, SYLVANIA and SMILES) on Bioacoustic topic.

Outcomes for the Society at local and international levels :

- Building a recognized scientific trustable bioenvironmental whistleblower for long term bioenvironmental changes and emergency situations.
- Collaboration and involvement of recognised partners for paving the way toward innovating technologies to monitor and solve real problems, mainly related to the environment.
- Public awareness on the topics of the project : exhibits, websites, multimedia products.
- Development of citizen science thanks to improvements in cheap reference monitoring instruments and shared long term data storage.
- Formation and training for ONGs and for personnel of the Public Administration (Forestry Police, National Parks, Nature Reserves)
- Collaborative science advancement and diffusion (research, scientific papers, conferences, summer schools, divulgation papers, books)
- Education and formation of experts (Schools, Universities, PostDocs, PhDs, summer/winter schools)

Sub-objectives:

- Create and build advanced scientific instruments with very low power consumption, on-board computing capacity, good value for money and high versatility for sound monitoring at sea and on land, including a 10-fold reduction in the cost of systems offered by foreign monopolies. These innovations will be sold by the UTLN subsidiary to stimulate protocols and quality knowledge acquisition at low cost. This is the principle realized by SMioT TVT UTLN technic platform (> 100 K€ of turnover / year).

- Develop and execute new AI-specific algorithms for acoustic analysis in response to observed shareholder needs and field constraints. This will include representation learning as proposed in recent A+ publications of the group in the major conference in the field in collaboration with Rice University.
- Professionalize students in bioacoustics to best prepare them to respond to future environmental challenges on topics such as climate change monitoring, ecosystem fragmentation, ecosystem restoration and anthropizations (anthropophony), wildlife behavioural responses.
- Participate in the decision-making process of public policies by proposing state-of-the-art expertise on biodiversity issues through bioacoustics. To disseminate internationally the renowned know-how of UTLN in this field and to intensify a network of users and experts.

ICoB deals with the disturbances of wind turbines and transport on land or sea, answers to the DCSMM laws towards anthropophony. It is monitoring pollution correlated to biophony and noise recognized in environmental law and leading to a regulation of noise emissions. The tasks of ICoB are each linked to a cluster of training degree / master / doctorate, with request of our partners for internships in their company, and reciprocally request of lifelong learning of our partners. ICoB is based on 30 tenures of UTLN, including the team DYNI at LIS always evaluated A+ by HCERES since its creation 12 years ago. The excellence of the research and teaching in bioacoustics in ICoB

will still be evaluated by the standard of HCERES criteria, with regular auto evaluation and external evaluations by an international jury.

Indicators of success: ICoB will apply similar indicators as the CEDEX, regarding the professional integration of graduate students and their hiring after 18 months. The involved PhD grants will be monitored to check its progessive increase. External collaborations, consulting over 10 years shall increase by 20% as the co-funded research projects (CIFRE but also others). Two Chairs in bioacoustics will be created. Three International workshops organized by ICoB will have to be published in special issues of A rank international journal.

Associated partners: several ministries concerned with the subject (MTES, Min Mer, MI, MEAE); institutes CNRS (INSB, INEE, INSU, IN2SI), INRAE, INRA, Ifremer, laboratories such as UMR LAMFA at Jules Verne University in Amiens, UMR LEHNA Lyon, MNHN Paris, UMR MARBEC Montpellier, J. Rond d'Alembert center, Sorbonne University, IMBE IRD Avignon, CPPM AMU towards KM3Env obs., and UMR ENES St. Etienne. international labs: CIBRA (U Pavia, IT), U Acorez (Portugal), U Jamaica, U Conception and Patagonian center (Chile), Univ Norte (Brazil), U Thessalonike (Greece); U Tokyo (in convention towards Fukushima bioacoustic survey), AWI (De); industries : OSEAN, Seaproven, SemanticTS, Akvaplan (No), large groups (EDF, Engie, TotalEnergies, Naval Group, Fincantieri...). OceanoScientific; public establishments including PNPC, SHOM, Monaco Ministry of Environment, CapCors Park, DGA; ONGs e.g. CCS, Longitude181.

Impact on students: steady diversification in academic and applied job profiles, supported by positions and funding ; students to get involved in the international, national and local network that involves 80 professionals in research & development or stockholders.

Impact on academic community: interdisciplinary team, from sensors to decision, from acoustics to AI, from biophony to biodiversity.

Impact on the sector: Building a recognized scientific trustable environmental whistleblower for long term environmental changes and emergency situations. Collaboration and involvement of recognized partners for paving the way toward innovating technologies to monitor and solve real problems. Innovating advanced Machine listening by AI on missknown or endangered biodiversity. Deploy ICoB know-how in scaled projects as the PSSA opening in 2022 : the largest ZMPV in whole NW Med Sea ((FR, IT, SP, MO).

Impact on the territory: local and international network for efficient and competitive professionalization in bioacoustics, artificial intelligence and instrumentation for environmental monitoring; development of citizen science thanks to improvements in cheap reference monitoring instruments and shared long term data storage; training for ONGs and of Public Administration (Forestry Police, National Parks, Nature Reserves); collaborative science advancement and diffusion (research, scientific papers, conferences, summer schools, divulgation papers, books). Public awareness on the topics of the project: exhibits, websites, multimedia products.

Interactions "Maritime Horizons 2030": ICoB will provide scientific support to the Cedexes of the PIA4 and will feed the activity of the "Institut Jules Verne" scientific mediation center.

ICoB involves 80 Pr, MCF, Dr, or Ing, for a total of more than 5 000 K€ external in kind.

It is decomposed in 10 tasks as follows, with their priority level (A: high, B: medium), Milestone, in kind and requested budget.

Tasks, Milestone and requested budget PIA = 1 277 K€

(The budget is detailed in the annex).

T1 (A) Design and build advanced scientific instrumentation for sound monitoring, at low power with embedded computing capacity at a high quality price ratio and versatility, involving students

T1.1 Design of new advanced IoT protocols for Biodiversity survey

T1.2 Research and construction of advanced scientific low power IoT instrumentation over the 10 years

T1.3 Redex / evolution and distribution on many places, in sea and on earth of the systems

Milestones / deliverable = involve students into professionnalisation to innovate hardware architecture to measure and process / interact and assess novel knowledge and models, each two year, a novel main project and delivery of solutions. Students will be involved in the process of co creation, design, validation and calibration of the instruments and their applications ,with two main meetings a year in a form of hackathon on hardwares and competitions. 2 international A+ publications each year and internship for professionalization

T2 (A) : Field implementation, Develop and maintain community / networking for local, national and international IoT biodiversity stations in Med Sea and other oceans, and in Natural reserves, involving students

T2.1 Extension and reinforcement of CARIMAM network, in Bahamas, Jamaica, Bonaire, Guadeloupe, Martinique, StMartin, St Barthelemy, Dominique, Agua, St eustache, in biodiversity hot spot and / or where there is increasing ship traffic and an overlap with megafauna habitat

T2.2 Citizens science programs, link to school and university level : a big campaign every 2 years

T2.3 BOMBYX2 deployment in Med Sea :+2 sonobuoy per year ; stockholder network ; collaboration with the PREMAR, Monaco, Italy, Pelagos, Spain

T2.4 Reset of Caribbean 'CARIMAM' international network : updated material and 12 months recording, each 2 years, 5 times

T2.5 UTLN joint partner missions to deploy observations and actions, and networking (Med Sea, Arctic, Mozambic, Patagonia, Polynesia…). Sea and terrestrial missions 1 or two each year, 4 to 8 weeks x 10 times.

T2.6 Extension of the CIBRA-CNRS SABIOD-Italy monitoring project in Italy to include more sites, either terrestrial and marine, to cover a wider range of habitats; set up an online repository of recordings and datasets. Implementation of real-time access to data in selected sites.

T2.7 OceanoScientific Mission, for students and professionnal working together, with included inkind of 450 K€.

Milestones : internship for professionalization with key partners. These networked realizations will involve students and partners in collaborative professional projects and will give them an international skill in several related domains.

T3 (A): Develop and run novel specific algorithms in artificial intelligence for acoustic analysis according to the needs of stockholders and constraints from the field

T3.1 Research in specialized algorithm for Embedded detection, localisation, categorisation of sources : over the 10 years, new EC

T3.2 Research in decision making and interactive IoT : over the 10 years

T3.3 Involving students in AI, computer sciences robotics for biodiversity studies

Milestones : This task will strongly link the know-how in machine listening to the students, giving them professional skill in effective bioacoustics, with A+ publications and intense internship into companies and labs.

T4 (B) : Living, analog and numeric communication systems

T4.1 Living Communication : evolution, adaptation to noise

T4.2 Analogic communication and interaction systems for advanced robotics

T4.3 Biomimetic robotics

Milestones : international skill given to the student and A+ publications each year and internship for professionalization.

T5 (A): Professionalize students to bioacoustics to monitor Climate change, ecosystem fragmentation, ecosystem restoration & anthropizations (antropophony), behavioral responses of animals to anthropogenic noise

T5.1 Climate change

T5.2 Anthropisation & Fragmentation

T5.3 Ecosystem restoration

T5.4 Ethological and ecological responses to anthropogenic noise

Milestones : international A+ publications each year and internship for professionalization

T6 (A): Actions of regulation, legislation, for prevention / protections, produce expertises for the ministries MTES, Mer, Conservatoire du Littoral… Conservation strategies

T6.1 : Comparison of the results of the sound monitoring with the existing state of law (laws, regulations, principles, case law, etc.)

T6.2 : Proposal for regulations at International (International Maritime Organization), European (Maritime Spatial Planning) and National level (adaptation of strategies and regulations for the protection of marine mammals, the prevention of the risk of cetacean-ship collision, the limitation of harassment caused by pingers, etc.). Eolian survey.

T6.3 : Proposal for regulations for terrestrial anthropophony, and monitoring of biodiversity in Nature Reserves and National Parks versus anthropized and restored areas.

T6.4 : Actions with the National Parks and networks of Nature Reserves - e.g. EU Natura 2000 sites, ZMPV…

Milestones : international A+ publications each year and internship for professionalization

T7 (A): Offer personalized professionalization, all along the life, by and for research and development

ICoB allows the students to get involved in the international, national and local network of ICoB that involves nearly 90 professionals in research & development or stockholders. ICoB also proposes education and training all along the life to citizens with and citizens science programs for students at school and university level, ONG and PA personnel for

environmental monitoring and protection, because the thematic of biodiversity survey by bioacoustics and automatic machine listening at sea and on earth is constantly evolving.

The dense teaching and professional network of ICoB allows many courses including Phd programs that will allow the EUR of this PIA4, and also these relevant UE that do offer professional skill to the students :

Professionalization through and through research in ICoB will consist, for the partners, in more or less fully outsourcing activities for which skills they do not have are necessary. For the university, this professionalization also allows it to play a role in the public development policies of a territory on the strategic and operational plans. The strength of ICoB is a local and international network for efficient and competitive professionalization in bioacoustics, artificial intelligence and instrumentation for environmental monitoring.

It is based on the prestigious Erasmus Mundus scholarship that UTLN leads (R. Marxer and V. Hugel) : an international master's degree in excellence in intelligent marine and maritime robotics (MIR). This master will participate in training towards ICoB, along with other Masters.

Bioacoustics is the science of animal and environmental sounds, at sea or on earth. It is a booming scientific field, with very strong academic and applied career potential. As bioacoustics become used in a wider range of fields, new sub-disciplines are regularly emerging (e.g. eco-acoustics, animal / machine interactions, freshwater acoustics, welfare acoustics...) leading to a steady diversification in academic and applied job profiles, supported by positions and funding.

Due to its strong network, ICoB will help to coordinate several formations of Toulon with other existing recognized formations in France such as the leader St Etienne university (International master of Bioacoustics, Bioacoustics Winter School), and in Italy etc., resulting in a great opportunity for student professionalization in ICoB on bioacoustics and AI for bioacoustics, machine listening, instrumentation and decision :

Bachelor : UE B65 bioinformatics (2 ECTS). UE 23 Embedded systems (2 ECTS). UE 33 & 43 Embedded systems and Robotics (4 ECTS)

Seatech Sysmer : Electronics - Analog and digital (3 ECTS), RIE embedded electronics for robotics (3 ECTS). INCOM communications in embedded systems (3 ECTS). Real Time Operating Systems (3 ECTS). MICROC power electronics (3 ECTS), Embedded AI (3 ECTS).

Master BIOMAR Anthropic Pressure (IPA) : UE23 Marine organism adaptation and bioacoustics (3 ECTS). UE32 Population survey by bioacoustics (3 ECTS).

Master in computer sciences (DID) : UE12 data processing, signal processing Machine Learning (3 ECTS). UE22 Database, signal processing (3 ECTS). UE32 Automatic pattern recognition (3 ECTS). UE34 Research and professionnalisation (3 ECTS).

Master robotics (ROC) & SEATECH : UE11 Skills 1 (mutualized) : Collaborative project, English (2 ECTS). UE12 Robotic modeling : Modeling of mechanical systems, Modeling of marine systems (3 ECTS). UE14 Learning : Unsupervised learning, Supervised learning, Reinforcement learning (3 ECTS). UE15: Electronics & Telecommunication : Analog signal processing, Electronics for radiocommunication, Embedded digital electronics (3 ECTS). UE21: Skills 2 (mutualized) : Initiation to research (Documentary methodology), Collaborative project, English (2 ECTS). UE22: Mechanical robotics : actuation and perception chain, Biomechanics (3 ECTS). UE23: Optimal control : Optimization techniques, Nonlinear control theory (3 ECTS). UE24: Statistical deep learning : Vision-based deep learning, Multimodal perception (3 ECTS). UE25: Embedded and connected systems : Digital sensors and buses, Networks and wireless communication, Instrumentation and sensors (2 ECTS). UE31: English 3 & Job search techniques-Initiation to research (2 ECTS). UE32 Robotics and applied nonlinear control Underwater drones Bio-inspired robotics

Robotic control (3 ECTS). UE33 Applied artificial intelligence Simultaneous Localization and mapping - Behavior, decision-making and prediction (3 ECTS). UE34 Internet of Things-Connected objects & Real time systems (3 ECTS).

Master Law : UE6 International law in sea, state regulation, learn fondamental in law in sea domain, and economical development blue growth (3 ECTS).

Master Economy : UE32 Risk and environment at sea (3 ECTS).

Master international MIR MUNDUS UTLN, Norway, Spain, Portugal : UE Perception and Manipulation (4 ECTS), UE Multi-robot systems (previously cooperative robotics) (4 ECTS), UE Cognitive processes (4 ECTS), UE Underwater wireless communication (4 ECTS), UE Robotic Intelligence (4 ECTS), UE Transversal skills (4 ECTS), UE Optimization and algorithms (4 ECTS), UE Decision systems (4 ECTS), UE Autonomous systems (4 ECTS), UE Embedded Computational Systems (4 ECTS), UE Distributed Real Time Control Systems (4 ECTS), UE Telecommunication Networks (4 ECTS), UE Entrepreneurship, Innovation and Technology Transfer (4 ECTS).

University Diploma : Bioacoustics Summer school (BSS) in the continuity of UTLN's ERMITES summer school (2006 to 2016), will be opened by ICoB in complement to the Bioacoustical Winter School of St Etienne / ENES. BSS will focus on marine bioacoustics, with field training and Artificial intelligence for machine listening and also instrumentation of bioacoustics and embedded electronics. It will last 2 weeks (6 ECTS).

St Etienne univ. partner : The International Master of Bioacoustics (MoBi https://www.masterofbioacoustics.com/), is a unique one year international and excellence training programme entirely taught in English. It welcomes French and international students from diverse academic backgrounds: acoustics, ethology, ecology, biological conservation, evolution, neuroscience, informatics, signal processing… The aim of the MoBi program is to provide thorough knowledge and skills for students aspiring to access doctoral training in bioacoustics-related fields, or environmental consultants aiming to incorporate bioacoustics in their skillset. CoOrganized by Nicolas Mathevon and David Reby (ENES lab, both IUF senior professors), it is a highly competitive international graduate course. It is structured according to the European Credit Transfer System over two semesters of full-time studies (60 ECTS).

MoBi corresponds to a second year in the French master curriculum (M2). It is currently a pathway (parcours) of the Master of Ethology of the University of Saint-Etienne and of the International Master of Acoustics of the University of Lyon. However, it is not necessary to have followed the M1 of the Master of Ethology or the M1 of the international master of Acoustics to apply. MoBi leads to the award of the French national master's degree in Ethology (bioacoustics pathway) as well as the University Diploma in Advanced Bioacoustics of the University Jean Monnet.

The master MoBi comprises 10 one-week taught modules (3 ECTS each) + an empirical project (6 ECTS) + a six-months internship (24 ECTS) : Bioacoustics in the field (3 ECTS), Comparative bioacoustics I Birds and Reptiles (3 ECTS),Comparative bioacoustics II Terrestrial Mammals (3 ECTS), Eco-acoustics 1 (3 ECTS), Comparative bioacoustics III: Marine Mammals (3 ECTS), Eco-acoustics 2 (3 ECTS), Underwater bioacoustics (3 ECTS), Temporal structures and Rhythm – Insect and amphibian bioacoustics (3 ECTS), Welfare & Laboratory (rodents) Bioacoustics (3 ECTS), Human Vocal Communication (3 ECTS), Empirical project finalization: open door week & technological fair, Empirical project assessment - oral presentations (6 ECTS), Internship (24 ECTS).

University Diploma : "Bioacoustics winter school" (BWS) opened in 2016 at the University of Saint-Etienne. It is a training opportunity in Bioacoustics, to get expertise. It is a highly popular University Diploma organized over two weeks each January, (6 ECTS).

Sorbonne univ : international workshops, DCLDE, as in Waikiki on the Island of Oahu, March 2022. As with previous workshops, common data is provided to allow participants to directly

compare algorithms and methodologies to involve professionals. This workshop series has been successful in advancing the field by providing a forum for researchers to share/compare methods, and build collaborations. The series has also served as an entrance point for students and researchers new to the field.

Pavia Univ, Italy : UE Bioacoustics (6 ECTS), UE Applied Ecology for the Master Degrees "Nature Sciences" and "Experimental and Applied Biology", Bioacoustic laboratory for MS Thesis preparation (3 ECTS), UE in the LIFE Project ESC360 (2019-2021): Lectures in international masters. Teaching and tutoring in ERASMUS and ERASMUS+ (4 ECTS).

T8 (A): Meetings and coordination of the project, coordination

T8.1 International workshop, 1 / year " Instrumentation, AI, acoustics and ethology for climate and anthropic pressure ". Will invite professionals in bioacoustics and biodiversity monitoring, labs and students to meet and get involved in common projects. These meetings will be jointly organized with our national and international partners and will in majority be placed in TOULON campus. Movies and Radio programs will run with journalists to demonstrate these activities (cf http://sabiod.org/tv). This is also linked to Jules Verne PIA4 center; T8.2 Management and communication : 1 permanent Ing R. 100%. ; T8.3 "Prime Charge Administrative" for Principal Investigator to manage the project :10 years 64 HETD.

ICoB GANTT: Creation in spring 2022. Innovation of instrumentation by cycle of two years. Field deployment each year, followed by the processing and dedicated algorithms. Embedding of the algorithms in a second series of instrumentation. Analyses to the stockholders and ministries, each two years during symposium. Teaching at each step of the whole process.					

Task \ Y	Y1	Y2-3	Y4-5	Y6-9	Y10
T1 Scient. instrument	🟩	🟩		🟩	
T2 Deployment	🟩	🟩	🟩	🟩	
T3 AI listening	🟩	🟩	🟩		🟩
T4 Analog comm.			🟩	🟩	
T5 Ecosystem & bioac.		🟩		🟩	🟩
T6 Laws			🟩	🟩	🟩
T7 Professionalisation	🟩	🟩	🟩	🟩	🟩
T8 Meetings & coord.	🟩	🟩	🟩	🟩	🟩

Links to the other UTLN PIA4 components and existing projects at UTLN

- Links of ICoB to the other parts of the PIA : the complementarity with the Littoral CEDEX is natural, as ICoB provides efficient methods and analyses to produce advanced index on the
- Links with the EUR of the PIA4
- ICoB as a CEDEX will drive formation and professionalization towards local and international applications.

- EquipEx PIA3 TERRA-FORMA will benefit from advances in scientific instrumentation and AI for machine listening from ICoB
- The Chaire IA ADSIL at UTLN (ending 2024) will benefit from the start of ICoB. ICoB will allow us to maintain and reinforce the know-how in AI and machine listening of biodiversity.
- EquipEx PIA3 GAIA DATA: ICoB will be a study case for GAIDATA.
- ANR projects SYLVANIA, ULPCOCHLEA, have been evaluated A+ at the first round by ANR and start in 2022 for 4 years. They will develop DIFFERENT and complementary systems than ICOB. ICOB will benefit from these projects and will extend at international scale their innovations for advanced bioacoustics in many parks around the globe.
- Pona and Monaco Compagnies will help the deployment and professionalization of ICOB students by taking them onboard and running intensive field lessons.

Collaborations

87 partners are now identified and involved, including 57 external : 5 420 K€ in equivalent external man month.

Partner, institution	Task number	#man month per year	
30 in UTLN lab (2 645 K€)			
Hervé Glotin, Pr, LIS	all	5	410
Valentin Gies, HDR, IM2NP	all	2	130
Ricard Marxer, HDR, LIS	2,3,4,7	2	120
Frédéric Schneider, MCF, CERC	2,6,7	1	60
Vincent Hugel, Pr, COSMER	3,4,7	1	80
Hervé Barthélémy, HDR, IM2NP	1,4,7	1	80
Sébastien Paris, MCF, LIS	1,3,4,7	2	130
Adeline Paiement, HDR, LIS	1,3,4,7	1	120
Joseph Razik, MCF, LIS	3	1	120
Pascale Giraudet, Dr, LIS	2,3,4,5,7	1	130
Thierry Soriano, Pr, COSMER	3,4,7	1	80
Cédric Anthierens, MCF, COSMER	3,4,7	1	65
Mathieu Richier, MCF, COSMER	3,4,7	1	60
Claire Dune, HDR, COSMER	1,3,4,7	1	60
Valentin Barchasz, ING R, IM2NP	1,3,5,7	1	55
Julien Seinturier, MCF, LIS	1,2,3,7	1	120

Name	Tasks	Duration	Cost (K€)
Marion Poupard, Post doc, ADSIL Chair, 12 months tot., LIS	2,3,5,6,7	1 y	50
Nicolas Thellier, Phd student, ADSIL Chair, 12 months tot, LIS	2,3,5,6,7	1 y	35
Pierre Mahe, Post doc ADSIL Chair, 12 months in tot., LIS	2,3,5,6,7	1 y	50
Post-doc ADSIL to be hired ANR, UTLN	1,2,3,5,6	2 y	100
Post-doc ULPCOCHLEA ANR UTLN	1,2,3,5,7	2y	100
Laurent-Stéphane Didier, Pr, IMath	1,3,7	1	80
David Reymond, MCF, HDR, IMSIC	2,4,6,7	1	60
Jean-Marc Robert, MCF, IMath	1,3,7	1	70
Christophe de Luigi, MCF, MIO	1,2,5,6,7	4	280
Jean-Marc Prévot, InG R, DSIUN, LIS	1,2	1	60
Sébastien Boutellier, InG E, DSIUN LIS	1,2	1	50
Nathalie D'Alvise Prévot, MCF, NRS MIO	2,4,5,7	2	140
Franck Malige, Dr, Lycée V. Hugo & LIS	1,2,3,4,6,7	2	90
Julie Patris, Dr, AMU & LIS	1,2,3,4,6,7	2	90
TOTAL			

57 External partners ; Inkind (in Man Month) and k€ equival = 5 420 K€, **Institutions are in BOLD**			
			Equiv. salary cost (K€) on the 10 years of ICoB
12 ext. Laboratories (french) (2 150 K€)		MM	k€
Bastien Mérigot, MCF, Univ. Montpellier, **CNRS MARBEC**, FR	2,4,5,6,7	4	260
Mark Asch, Pr, Univ Jules Verne, **CNRS LAMFA**, FR	3,4,6,7	4	320
Thierry Lengagne, CR, HDR, **CNRS LEHNA**, Lyon, FR	2,3,4,5,6,7	3	220
Romain Garrouste, CR, **MNHN Paris**, ISYEB, FR	2,3,5,6,7	2	140
Paul Cristini, CR, HDR, **CNRS LMA**, Marseille, FR	3,4,6,7	1	90
Adam Olivier, Pr, **CNRS J. Rond d'Alembert**, Sorbonne univ., FR	3,4,5,6,7	2	160
Frédéric Sèbe, MCF, **ENES team, CRNL INSERM CNRS, St Etienne**, FR	1,2,3,4,5,6,7	4	240
Vincent Médoc, MCF, HDR, **ENES team, CRNL INSERM CNRS, St Etienne**,FR	2,3,4,5,6,7	2	120
Nicolas Mathevon, Pr, IUF, **ENES team, CRNL INSERM CNRS, St Etienne**,FR	1,2,3,4,5,6,7,8	2	160

Amandine Gasc, CR, **IRD,** IMBE, Aix-en-Provence, FR	2,4,5,6,7	2	120
Sebastian Marzetti, Dr, IM2NP, **ISEN,** Toulon, FR	1,2,3,4,7	3	180
Vincent Bertin, Dr, **CNRS CPPM, AMU**, FR	1,3,5	1	70
Pascal Coyle, Dr, **CNRS CPPM, AMU**, FR	1,3,5	1	70
10 international labs / research (1 280 K€)			
Cláudia Oliveira, Dr, IMAR, **Univ. of the Azores**, Portugal	2,3,5,6,7	2	50
Christine O'Sullivan, Dr, **Univ. of Technology, Jamaica**	2,3,5,6	4	200
Susanna Bucchan, MCF, **Univ. de Conception, Chili**	2,3,5,6	1	40
Renata Sousa Lima, Pr, **Univ Norte, Brazil**	2,3,5,6,7	1	80
Hill Kobayashi, Dr, **Univ Tokyo, Japan**	2,3,4,5,6,7	3	200
Daisuke Shimotoku, Ing. R, **Univ Tokyo, Japan**	2,3,5,6	3	200
Elena Schall, Dr, **AWI. Allemagne**	2,3,4,5,6	1	40
Gianni Pavan, Pr, CIBRA, **Pavia Univ, Italy**	1,2,3,4,6,7,8	5	300
Sarah Manuel, Dpt Envir.& Natural Resources, **Bermuda Gov**	2,3,4,6,7	1	50
Alex Papach, Dr, **Aristotle University of Thessaloniki**, Faculty of Agriculture, Greece	2,3,4 5,6,7	3	120
14 Industrials : (1 290 K€)			
Olivier Philippe, ING R, Osean SAS, Toulon, FR	1,2,3,5	1	90
Nathan Jallet, ING E, Osean SAS, Toulon, FR	1,2,3,5	2	120
Antoine Thibault, INGR, SEAPROVEN SAS, Laval, FR	1,2,3,5	1	50
Fabien de Varenne, INGR, SEAPROVEN SAS, Laval, FR	1,2,3,5	1	50
Martin Guillaume, IngR, Green Praxis, FR	1,2,3,5	1	50
Jérôme Di Giovanni, Dr, Green Praxis, FR	1,2,3,5	1	40
Claire Noël, Dr, SemanticTS, Toulon, FR	1,2,3,5	1	50
Philippe Cosentino, CosPhylog, Toulon, FR	1,2,3,5	1	40
Maxence Mercier, Msc, TripinLab, Lavandou, FR	1,2,3,5	2	60
Stephane Granzotto, InG, S Granzotto, Lyon, FR	2,3	2	80
Rodolphe , Valhalla, Tromso, FR et Norvège	2,3	2	80
Ponan, exploitation du CHARCOT pour expédition arctique 4 mois	2,3,7	4	100

Accueil d'étudiants en bioacoustique Oceano Scientific Monaco	2,3,5,7	6	250
Luca Tassara, MSc, Akvaplan, Norvège	1,3,4,5,6,7	1	60
Sofia Aniceto, Dr, Akvaplan, Norvège	2,3,4,5,6,7	1	60
Lionel Camus, Dr, Akvaplan, Norvège	2,3,4,5,6,7	1	70
10 institutions / Collectivities / ONG (700 K€)			
François Sarano, Dr, ONG Longitude 181, FR (ex Cousteau Scien. Dir)	2,3,5,6,7	3	100
Véronique Sarano, Dr, ONG Longitude 181, FR	2,3,5,6,7	3	100
Alexandre Viller, OFB, FR	2,3,5,6,7	1	60
Cathy Lacourbas, Guadeloupe, FR	2,3,6,7	1	50
Marion Peirache, Dr, PNPC, FR	2,3,6,7	1	60
Tomasini, Ms, Parc Cap Corse, FR	2,3,6,7	1	60
Bazile Kinda, Dr, SHOM, FR	2,3,6,7	1	70
Sylvain-Pierre, GALLIANO, IngR, DGA, Toulon, FR	1,2,3,6	1	70
Mickael DIJOUX, IngR, DGA, Toulon, FR	1,2,3,5,6	1	60
Odile GERARD, Dr, DGA, Toulon, FR	1,2,3,6,5	1	70

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Financing plan

Equipment	unit cost > 4000 HT						
Description		**Unit cost incl. VAT**	**Quantity**	**Total Cost**	**Subsidy request**	**UTLN contribution**	**External contribution Local authorities/companies**
T3 : Computing and Storage Machine - Develop and operate new specific artificial intelligence algorithms for acoustic analysis based on shareholder needs and field constraints.				75 000	75 000		
T1: Bombyx buoys				200 000	150 000	50 000	
Total Equipment				275 000	225 000	50 000	0

Staff								
Staff UTLN or to be recruited	**Position**	**Type of contract**	**Basis expenditure (Annual loaded cost 2021)**	**Quantity**	**Total cost**	**Subsidy request**	**UTLN contribution**	**External contribution Local authorities/companies**
To be recruited Position	T8: IGE for ICOB animation and interaction with partners		40 000	100%	400 000	400 000		
Administrative Burden Allowance PCA Director	Equivalent 64 HETD/year				32 000	32 000		
French research professors					2 800 000		1 500 000	1 300 000
External international teaching researchers					1 000 000			1 000 000
Industrials					1 100 000			1 100 000
Administration and monitoring of the international center					60 000		60 000	
Staff of institutions/communities/NG					500 000			500 000
Total staff					5 892 000	432 000	1 560 000	3 900 000

Operation							
Type	**Description**	**Unit cost incl. VAT**	**Quantity**	**Total Cost**	**Subsidy request**	**UTLN contribution**	**External contribution Local authorities/companies**
External costs	T1: Operation to Design and build advanced scientific instruments for sound monitoring, low power with built-in computational capability, with high cost effectiveness and versatility, involving students.			200 000	200 000		
	T3 : Operation to develop and exploit new specific algorithms in artificial intelligence for acoustic analysis according to the needs of the shareholders and the constraints of the field			75 000	75 000		
	T4 : Operation for live, analog and digital communication systems			50 000	50 000		
	T5 : Operation to professionalize students in bioacoustics to monitor climate change, ecosystem fragmentation, ecosystem restoration and anthropizations (antropophony), animal behavioral responses to anthropogenic noise			10 000	10 000		
	T6 : Publication and communication for regulatory action, legislation, for prevention / protection, produce expertise for the ministries MTES, Sea, Conservatoire du Littoral ... Conservation strategies.			30 000	30 000		
	T8 : Symposiums and conferences			50 000	25 000	25 000	
Total external costs (1)				415 000	390 000	25 000	0
Missions	T5 : Missions to professionalize students in bioacoustics to monitor climate change, ecosystem fragmentation, ecosystem restoration and anthropization (antropophony), behavioral responses of animals to anthropogenic noise			40 000	20 000	20 000	
	T6 : Missions for regulatory action, legislation, for prevention / protection, produce expertise for the ministries MTES, Sea, Conservatoire du Littoral ... Conservation strategies.			20 000	10 000	10 000	
Total Missions (2)				60 000	30 000	30 000	0
Provision of external services	T2: Purchase of services for international partners for the maintenance and installation of measuring systems.			200 000	200 000		
	Provision of boat and crew for oceanoScientific expeditions			450 000			450 000	Half of the sum is valued by Oceanoscientific for the expeditions from 2021 to 2026 with the provision of boat and crew. The other half goes to Intelligence SEA. Letter in progress
Total external services (3)				650 000	200 000	0	450 000
Total Operation (1+2+3)				1 125 000	620 000	55 000	450 000
TOTAL				7 292 000	1 277 000	1 665 000	4 350 000
					17,51%	22,83%	59,65%