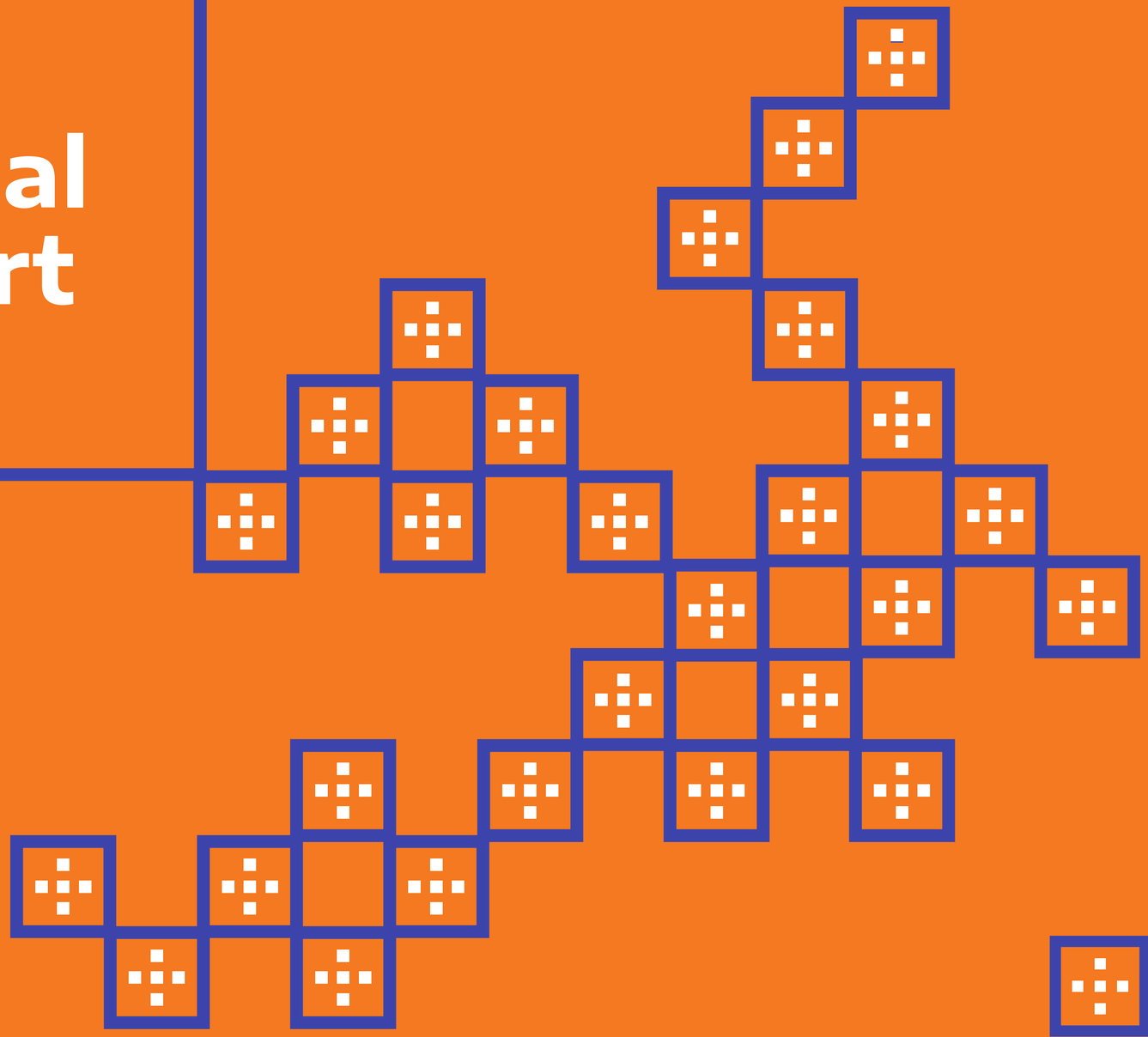
2020 Annual Report



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A word of appreciation goes out to all the teams of the 2017 and 2019 Exploratory Research Projects and of the 2019 Strategic Research Projects for their inputs to the sections in the report highlighting the Program's R&D portfolio as well as to everyone we relied on to coordinate and implement in 2020 the networking and training events described in the next pages.

Observation: Some photographs were collected from free-to-use image databases such as Pexels, Unsplash and others.

Published in March 2021

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Our People: Our Internal Stakeholders

01

To succeed, we rely on the commitment, expertise and accountability of many people.

We have in place a Governance Model that ensures good governance and a good blend between academia and industry. Represented bodies sit well with the Program's structure and intended beneficiaries and favor accountability, transparency, continued orientation towards excellence and alignment with predefined goals.

Governing Board

José Paulo Esperança
Chair of the Board,
FCT Representative

Robert A. Peterson
UT Austin
Representative

José Manuel Mendonça
Portuguese Universities
Representative

Célia Reis
Industrial Advisory Board
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External Review Committee

Peter Arzberger
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Area of Advanced Computing

Oliver Jäkel
Area of Medical Physics

Edwin L. Thomas
Area of Nanotechnologies

Alison Campbell
Area of Technology Innovation
and Entrepreneurship

Alfred Ng
Area of Space-Earth
Interactions

Board of Directors

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National Director
in Portugal

John G. Ekerdt
Principal Investigator at
UT Austin

Rui Oliveira
Co-Director in Portugal

Marco Bravo
Co-Principal Investigator and
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Bárbara Veloso
Impact Assessment in Portugal

Daniel Dantas
Communications Officer in Portugal

Rita Costa
Design and Multimedia in Portugal

Industrial Affiliates

abyssal

deimos elecnor group

EDISOFT DEFENCE & AEROSPACE TECHNOLOGIES

GRAPHENEST Advanced Nanotechnology

FHP Frezite High Performance

IBM

mnidea

PETsys Electronics

wavecom wireless experts

tekever

Message from the Leadership

02

José Manuel Mendonça
National Director Portugal

The year 2020 was enormously and unpredictably perturbated by the global pandemic, and the heavy travel restrictions brought many initiatives to a halt in a Program that has *working together* as its informal motto.

Nevertheless, intensive collaborative work pursued on both sides of the Atlantic and the Call for Strategic Research Projects was a great success. The excellence of the proposals submitted the year before resulted in eleven projects being selected for funding, representing the highest success rate from all FCT International Partnership Programs (as per the official results announced in April 2020). Our most sincere thanks are due to UT Austin for their efforts to ensure UT researchers' participation in all the unexpectedly high number of applications that deserved the approval of the international Evaluation Panel set up in 2019.

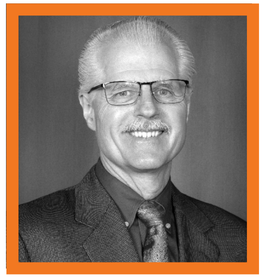
Great expectations have been placed in these projects, headed by leading innovative companies and addressing domains of strategic importance for Portugal in all scientific areas of the UT Austin Portugal Program.

The 2019 Call for Exploratory Research Projects, looking for more upstream research work, was also successful, with eight new forward-looking projects approved, covering all scientific areas as well.

Meanwhile, BOB, Portugal's first supercomputer, consolidated its operation for the benefit of Portuguese researchers and companies. It also helped prepare Portugal to become part of the EuroHPC JU network and bring, already in 2021, a young brother supercomputer that aims to be a green, zero emissions supercomputer, the Deucalion.

The Annual Conference and the associated Masterclasses, coordinated by our dedicated Area Directors, were the major events in 2020. Organized in a hybrid and full digital mode, respectively, they gave attendants from different geographies the chance to connect remotely with a panel of world-class speakers, discussants and moderators. Additionally, and for the first time since the Program's transition to Phase 3, two important bodies of the International Partnership's governance model had their annual meetings organized: the Governing Board and the External Review Committee.

Finally, the tireless, high-quality and very effective work of the Executive Directors, Andreia and Marco, and their teams, especially in the very difficult conditions prevailing almost all year round, has to be well acknowledged and thanked.



John Ekerdt
Principal Investigator UT Austin

This report marks the end of Year 2 of Phase III – a collaboration involving The University of Texas at Austin and several top-tier universities throughout Portugal and several research laboratories in the country.

While this year we all witnessed considerable stresses on all of society with the coronavirus pandemic infecting untold millions and causing the deaths in the 100's of thousands. It caused us to realign our modes of engagement from in-person meetings, workshops and research exchanges to virtual formats – with our collaborators reduced to tiles on a computer screen. Despite this, the UT Austin Portugal collaboration thrived.

The ground work and networking we did in 2019 led to the formation of extremely competitive Strategic Research Projects that are industry-led and involve research teams from UT Austin and from within Portugal. We had budgeted for five of these strategic projects to be recommended for funding and were surprised that eleven were ranked so highly by the independent review panel that the CoLab leadership in partnership with FCT rebudgeted funds from programs that depend on travel in personnel exchanges to stretch our collective resources and fund eleven three-year projects.

All four scientific areas (Nanotechnologies, Space-Earth Interactions, Advanced Computing, and Medical Physics) are represented within these eleven strategic projects. You will read about these projects that began in April 2020 in the report and we look forward to sharing their impact in next year's report.

We also had eight successful Exploratory Research Projects receive recommendations for funding – funding that began in the fourth quarter of 2020.

All of these collaborations are thriving and the energy present among the participants during our Annual Conference is a testament to the progress being made. We describe some of our training activities that we had to put on pause last year.

As domestic and international travel restrictions are relaxed over the coming year, we look forward to ramping up our research exchanges, advanced training projects that benefit from in-person experiences and translating technology into commercial applications and enterprises through the area of Technology Innovation and Entrepreneurship.

Introduction

03

The UT Austin Portugal Program is a partnership between the Portuguese Science and Technology Foundation (FCT) and The University of Texas at Austin (UT Austin).
For over a decade, these two long-standing transatlantic partners have thrived on the creation of a genuinely collaborative R&D ecosystem that brought together universities, research performing institutions and laboratories, technology transfer offices and companies in Portugal with UT Austin's counterparts. In the third Phase of the Partnership, collaborations go beyond Austin to encompass another world-class institution that is part of the University of Texas System: the MD Anderson Cancer Center, based in Houston.

Being publicly-funded (Figure 1), this International Partnership, which has been contributing to elevating Portugal's scientific and technological capabilities in areas of strategic national interest (Figure 2) is comprehensibly subjected to scrutiny. Hence, monitoring and regular reporting activities are deemed mandatory for the Program to give its key stakeholders and society at large a clear signal it has been worthy of public support. Written and published every year with the endorsement of the Program's Leadership both in Portugal and UT Austin, Annual Reports are but one outcome of such activities and the last milestone in the implementation of a full-year activity plan.

This year's Annual Report looks back on the activities undertaken in 2020 to show how the Partnership progressed towards its long-term goals and how far or closer it stood from implementing the Activity Plan approved in early January 2020 by its main sponsor, FCT, and the Governing Board.

Lines of Action

Education

- Advanced Training Programs
- Workshops
- Research Exchanges

Research

- Exploratory Research Projects
- Strategic Research Projects

Innovation

- Coaching & Mentoring
- Residency in Austin
- Industry Affiliates

The Program's journey

2007
Agreement closed between FCT and UT Austin (Phase 1)

2011
US Connect Pilot Program for Startups

2013
Agreement closed between FCT and UT Austin (Phase 2)

2018
Agreement closed between FCT and UT Austin (Phase 3)

2019
Inauguration of the Minho Advanced Computing Center (MACC)

2020
Start of 1st batch of Strategic and Exploratory Research Projects

2023
End of Phase 3

At that time, the Program committed to:

- diversifying its portfolio of educational and innovation activities;
- continuing to support competitive funding opportunities for transatlantic research consortia;
- taking more researchers in Portugal to benefit from immersive learning in UT Austin's thriving ecosystem;
- organizing more training and networking events while getting actors from the industrial and business sectors on board;
- steadily increasing the proportion of reporting related to impact.

Although the Program has existed since 2007, it was substantially re-envisioned and reconstituted in 2018, thus moving into a new Phase that aims at building intellectual capital through sustained collaborations in the frame of joint projects.

Implementing the established Plan amid a world pandemic has proved quite a challenge, but one that has attested to the Program's resilience, adaptiveness and sense of commitment to its ever more far-reaching community.

Activities contingent on international mobility were the most severely affected. Research exchanges and delegation visits either to Austin or Portugal had to be put off. On-site training, networking and other stakeholders' engagement events called for readjustments, throwing the team into a fast-paced learning process to ensure a seamless transition to hybrid or full-digital settings.

The pandemic did not hold the Program back from announcing the results of the 2019 Call for Strategic Research Projects nor bringing together in a virtual environment a panel of experts to evaluate the 54 exploratory projects deemed eligible, of which eight were awarded public funding. It prevented the Program from launching the 2020 Exploratory Research Call in the final quarter of the year as planned, though.

This report follows the same structure of the previous one to ensure consistency across editions, with the first part focusing on the Program's 2020 highlights and the second part, organized in the form of an Annex, containing detailed evidence of the Program's main and supporting activities and their respective outcomes. A novelty of this year's edition is the use of more infographics to single out key information about the Program's performance.

We hope you enjoy reading our Annual Report as much as we enjoy celebrating our accomplishments with you!

Funding Model (2018-2023)

Program's Budget in Portugal for Research and Innovation
(Sourcing of additional funding streams)

- Research Projects (Competitive calls with selected projects receiving grants directly from the sponsor)
- Innovation Support Activities (PT-Corps)

Sponsors: FCT; EU Funds; Industry self-funding; etc.

MATCHED FUNDING APPROACH

Management Budget in Portugal Management Contract between FCT and Host Organization (Every year)

- Management & Coordination
- Events
- Educational Activities, including Research Exchanges

Sponsor: FCT

Program's Budget at UT Austin Partnership Agreement between FCT and UT Austin (2018-2023)

- Management & Coordination
- Research Projects
- Educational Activities
- Innovation Support Activities

Sponsor: FCT

Figure 1: Funding Model 2018-2023

Knowledge Areas

Advanced Computing

Medical Physics

Nanotechnologies

Space-Earth Interactions

TIE | UTEN

Figure 2: Knowledge Areas

The 2019-2020 edition of the Texas Engineer Magazine was published in January 2020 and the UT Austin Portugal Program was invited to tell its story, reporting its successful relation with UT Austin's Engineering community. The article includes quotes from the leadership of the Program: José Manuel Mendonça, John Ekerdt and Marco Bravo.

A MEETING OF MINDS AN OCEAN APART

Positioned on the western edge of the Iberian Peninsula, Portugal has shielded its European neighbors from the unforgiving Atlantic Ocean waves crashing against its coastline for centuries. Back when people thought the earth was flat, they saw Portugal as the last port of call on the edge of their world — a theory the locals hoped to disprove in the 15th and 16th centuries, using their world-class engineering skills to design and build tools and ships so advanced that they helped establish the nation as one of the first true trans-Atlantic empires.

Five centuries later, the Portuguese are still seeking adventure, only this time the compass has led them to Texas. And thanks to a mutual love of science and exploring the unknown, an extraordinary partnership between the Cockrell School of Engineering and Portugal's homegrown science and engineering research community is thriving.

To understand how this unique relationship began, we don't need to go quite as far back as the 16th century. In 2007, the Portuguese government announced a long-term strategic plan to increase its STEM-based research output and jumpstart innovation through international research collaborations. Portuguese authorities encouraged top research universities in the U.S. and elsewhere to share mutually beneficial ideas and goals, which led to several collaborative agreements with U.S. institutions. UT was among the few selected.

The partnership, which was officially (and appropriately) named the UT Austin Portugal Program, initially began at the IC2 Institute before moving to the McCombs School of Business thanks to the enthusiasm of Marco Bravo, UT's executive director for the program. An engineer and entrepreneur, Bravo is also a Portuguese native, an expert in global technology commercialization and the co-founder of four companies. He has been the driving force behind the program, nurturing the ongoing research collaborations that have emerged over the past decade.

As the partnership progressed, sponsor and program managers both at UT and in Portugal noticed that many of the strongest research connections were being made in engineering. "It was clear then that, as we push forward and pursue new areas of innovation and research, the Cockrell School would have a larger role in defining things in the future," said Bravo.
And so a renewed partnership signed in 2018 by leaders from the Portuguese Foundation of Science and Technology (FCT) and UT Austin placed the research baton firmly in the hands of Texas Engineering.

Five key research areas are being funded during the current program cycle: advanced computing, nanotechnologies, space-earth interactions, medical physics and technology innovation and entrepreneurship. It is no coincidence that four out of the five themes chosen by the sponsor and UT Austin Portugal Program directors for this phase of the partnership happen to encompass

research fields where Texas Engineers are already leading the way in terms of innovation and thought leadership.

While Texas Engineering may have its fair share of leaders in specialized fields, there can only be one captain of the ship and, given the new emphasis on engineering, John Ekerdt, associate dean for research at the Cockrell School, will now be at the helm as the new principal investigator of the program from UT. “Partnerships between ourselves and other top-tier international research institutions provide numerous benefits for all involved,” said Ekerdt. “We already have ongoing research collaborations with Portuguese engineers, and, thanks to the renewed agreement, these collaborations will be allowed to grow alongside new partnerships. It’s a really exciting prospect.”
Ekerdt isn’t the only one who is optimistic about this unconventional partnership. The FCT —Portugal’s equivalent of the National Science Foundation — funds the entire UT Austin Portugal Program.
Last year the foundation decided to increase its investment from $20 million in the initial project to $50 million in this renewed project. This includes not only research collaborations but also student exchanges and various other activities over the five-year cycle of the program.

This major increase in available funds is significant for a number of reasons. Not only does it afford greater research scope and opportunities to researchers, it demonstrates how confident Portuguese authorities are that the partnership will produce long-term results.
“We expect this partnership with UT to result in real economic and societal benefit for Portugal. Impact in research is the goal of the program, which is aligned with the Portuguese government’s strategy and science policy,” said José Manuel Mendonça, the National Director of the UT Austin Portugal Program.

Aside from its economic ambitions, the UT Austin Portugal Program also provides invaluable opportunities for students to take classes while living in a foreign country, gain a broader perspective on the world and develop an edge over the competition when applying for jobs in various sectors.
“That kind of learning can’t happen in the lab,” Ekerdt said.

Likewise, faculty actively engage in international research collaborations because they can provide access to fresh ideas and different perspectives. But, there’s more to the UT Austin Portugal Program than just a sharing of ideas. Texas Engineers may be providing much of the expertise, but this program also provides our researchers with access to crucial resources and equipment. For instance, Portugal has over 1,000 miles of the aforementioned Atlantic coastline to explore, and, through this program, the Cockrell School’s world-renowned Center for Space Research will gain access to the Portuguese-owned satellite launch port located in the Azores Archipelago.

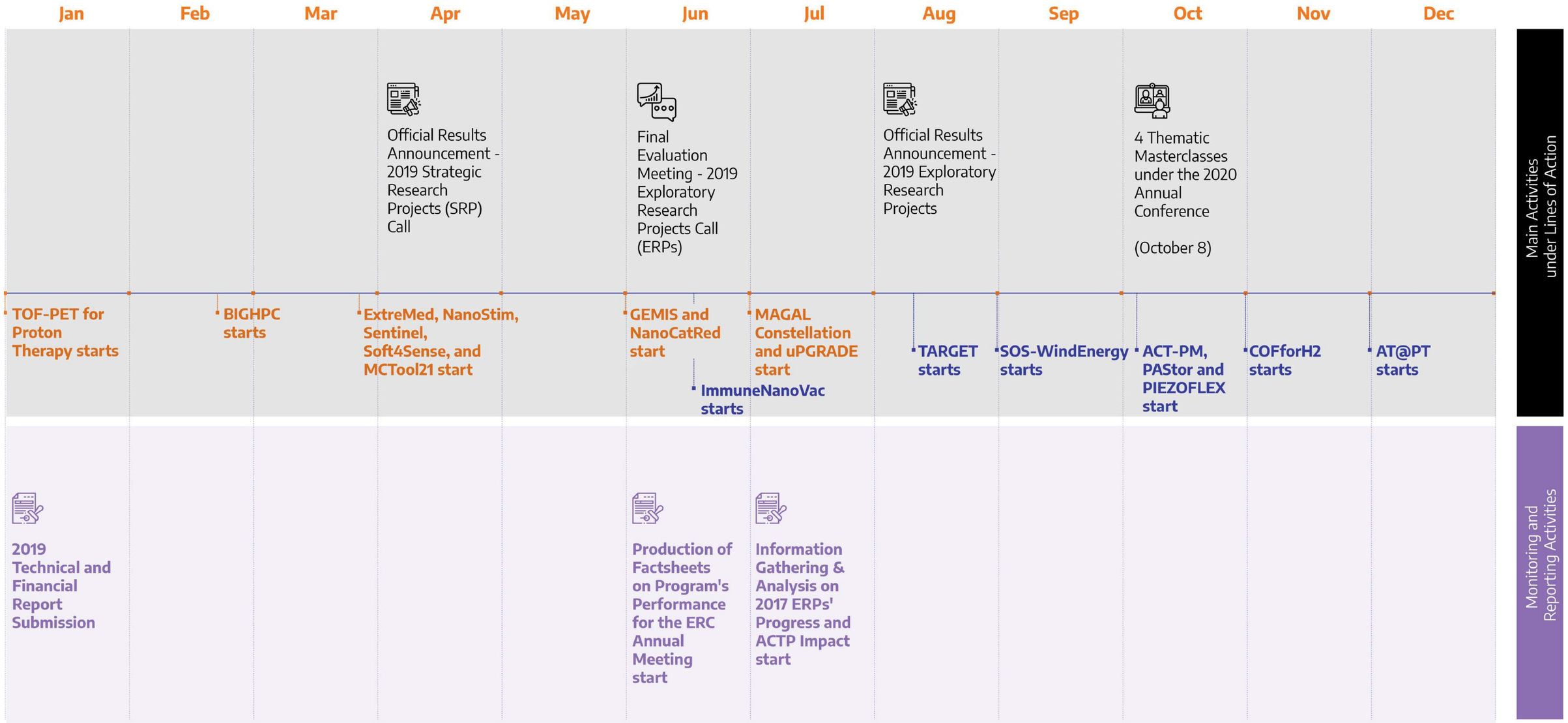
Even after a decade in partnership, Texas Engineers and their Portuguese counterparts continue to develop dynamic research agendas that not only feed intellectual curiosities but also align with the Portuguese government’s goals for long-term economic growth in key scientific and technological areas. The UT Austin Portugal Program is a true example of successful international STEM collaboration, and with the renewed partnership agreement and additional financial injection, its success seems likely to continue for a long time to come.

Source: Texas Engineer, 2019/2020

2020 Activity Report

04

2020 Work Plan (Implementation)



2019 Strategic Research Projects 2019 Exploratory Research Projects

2020 Work Plan (Implementation)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
 **Governing Board Meeting** (January 10)	 **Program's Leadership & PT Area Directors Meeting** (February 21)				**Call for Poster Proposals | 2020 Annual Conference** (June 9 – July 27) **Call for Cooperation Profiles | 2020 Annual Conference** (June 9 – September 30) **Meetings with Lead Beneficiaries of the 2019 Strategic Research Projects, MCTES, ANI, FCT and MCTES** (June 25 + June 26 + June 29)			**Preparatory Meeting for the ERC Annual Meeting** (September 10)	**2020 Annual Conference** (October 7 - 8) **ERC Annual Meeting** (October 8 + October 9)	**Ciência 2020** (November 3) **Meetings with Lead Beneficiaries of the 2019 Strategic Research Projects** (November 9-11)	
	 **Publication of UT Austin Portugal's 2019 Annual Report + Teaser Video** (February 18) **"Presentation of the 2020 Communication Plan"** (February 21)		**2020 Annual Conference Announcement (on-site event)** (April 30)		**Final version of "Short guide to acknowledge FCT and the International Partnerships"** (task assigned to the Program by FCT)	**Dissemination of "Quick Guide on Communication of R&D Projects"** (July 13) **UT Austin Portugal's Communication of R&D Projects Webinar - 1st Edition** (July 28)	**2020 Annual Conference *goes online* announcement** (August 5) 	**UT Austin Portugal's Communication of R&D Projects Webinar - 2nd Edition** (September 14)	**Premiere of 2019 Strategic Research Projects Video** (October 7)		
			Information Gathering and Development of Dedicated Webpages (2019 Strategic Research Projects)				**Information Gathering and Development of Dedicated Webpages** (2019 Exploratory Research Projects)				

Main Stakeholders' Engagement Activities

Main Communication Activities

4.1
2020 Main Highlights

The UT Austin Portugal Program has always looked to challenges as learning opportunities and good arguments for putting itself to the test. Self-improvement stems from the ability and willingness one shows to deal with whatever challenge comes their way.

The COVID-19 crisis has disrupted the way activities and projects are undertaken. The UT Austin Portugal Program has not been immune to this unprecedented situation. Due to its international nature, it has been certainly been more exposed to the pandemic's harsh effects than S&T partnerships acting at a local level.

For instance, the exchange of researchers from Portugal to UT Austin proved impossible due to the tight international travel restrictions that had been in place for almost the entire year. UT Austin faculty, which would come to Portugal every year to deliver on-site training, was subjected to a temporary travel ban imposed by the University as part of a package of measures to keep the virus off the campus. This travel ban explains why the Program's largest meeting of minds, the Annual Conference, had to be fully redesigned to move from a full on-site to a blended event and allow UT Austin speakers and the Program's U.S. Leadership to participate remotely.

At the height of Portugal's lockdown, in April, the Partnership announced its support to an elite of three-year-long industry-led consortia focused on delivering innovative science-based solutions to a range of application markets, from health to climate change, to automotive and aerospatial or high-performance computing infrastructures. Instead of five, eleven high-scored transatlantic projects were selected for funding thanks to the reinforcement of public budget on the Portuguese side. In the face of unexpected challenges, the Program demonstrated agility and flexibility, though. An example was UT Austin's pragmatic decision to use part of the Program's 2020 education budget (particularly associated with travel and subsistence of its staff and mentorship of Portuguese researchers at the American partner) to finance its eleven winning research teams following the doubling of funds in Portugal.

Amid the pandemic, the Program also worked with FCT to set up the evaluation process of the 2019 Call for Exploratory Research Projects, with the final meeting of a world-class panel of academics and researchers happening in June 2020 in a digital format. This resulted in eight high-risk/high-impact projects being granted funding to navigate unchartered territory in the scientific fields that make up the Program's knowledge portfolio.

Consequently, 2020 saw the initiation of nineteen new R&D projects from across the Program's key scientific areas, reflecting an integrated approach to the knowledge-to-value chain. Newcomers to the Program, these consortia were offered support and guidance from the very first moment, with the Program acting as a liaison office between them and their sponsors and also society at large. Two webinars on science communication were designed and delivered with the intent to raise awareness among project teams of the importance of (the right) approach to tackle communication and increase project visibility to generate further interest and commitment of target stakeholders.

The pandemic also prompted the Program to embark on the new digital adventure to keep the ball rolling as much as possible. On-site training and networking activities were forced to transition to a digital model. This shift threw the Program's team into a learning sprint about the do's and don'ts of digital events in order not to fail the 2020 Annual Conference edition. The Conference turned out to be a far-reaching event, with people from locations well beyond the geographic boundaries of FCT's joint venture signing up to watch it live. The two Keynote Sessions and the four e-Masterclasses that filled up the Annual Conference's programming afforded an opportunity to bring closer together participants with some of our community's sharpest scientific minds and other top-tier speakers affiliated to prestigious research and technology organizations outside of the Partnership. The Conference even staged an e-Poster Exhibition and e-Networking Corner for participants with registered cooperation profiles.

We built on previous successes and found new ways to connect and engage with our community in 2020.

“We will make all the possible efforts to go on nurturing a close relationship with its direct beneficiaries and key stakeholders and developing the right monitoring tools to collect evidence-based data that should be feeding into success stories illustrating what the impact of the Program really means.”

2019 Annual Report

In the 2019 Annual Report, the Program made a forward-looking statement that it would be increasing the proportion of reporting related to impact in the forthcoming years. Such a commitment entails putting in place a monitoring and evaluation system that attests for the Program's learning and improvement culture and intention to disseminate and communicate the outputs and outcomes of its main activities. This system is also made of independent, highly experienced and reliable people who help the Program take the right pathways based on the progress made weighed against predefined goals.

In 2020, the Program convened, for the first time since the start of Phase 3, with its Governing Board, in early January, and with its External Review Committee, later on, in October. Both meetings allowed a review of the Program's journey, and a reflection on the future direction of the Partnership building on successes to date and expected challenges.

The Program also developed and implemented:

- A follow-up report template to understand the impact of the in-depth Advanced Computing Training Program on the professional development of participants one year after they had completed the experiential learning at UT Austin;
- A project report template to gain insights into the outputs and achievements recorded by the 2017 Exploratory Research Projects, all due to finish in 2020 following the granting of no-cost extensions by FCT;
- A project description template to collect relevant information at the start of projects with the intent of developing appropriate and factual content and materials for communication and dissemination purposes.

Over the next pages, we will provide you with a fine-grained review of the Program's 2020 highlights.

4.2
The Research Instrument in Action

The Program's Line of Action Research aims at selecting, funding and supporting collaborative transatlantic projects on emerging and transformative R&D topics with global resonance.
It is structured around competitive calls, managed by FCT alone or alongside other sponsors, and anchors on two different types of projects which ensure a wall-to-wall approach to the knowledge-to-value chain and the Program's strategic alignment with high-level long-term goals **(page 22).**
For the Program's 3rd Phase, the Partnership agreed on funding up to 23 Strategic Research Projects and 27 Exploratory Research Projects, i.e., a total of 50 joint teams.

In 2020, UT Austin Portugal announced the results of two calls for Exploratory and Strategic Research Projects launched the year before. Nineteen transatlantic consortia across all of the four knowledge areas of the Program were awarded public funding (Figure 3) to push the boundaries of science and generate impact both in theoretical development and applications to real problems of global magnitude.
The Program is building up a portfolio of projects (see page 21) where it is possible to see clusters of knowledge emerging around certain application markets/domains and setting up closer links with initiatives of national strategic interest. Moreover, some supported projects present a strong cross-fertilisation potential that should be closely monitored to ensure their full value realisation.

All projects had their grant agreement signed in the course of 2019 and were able to start promptly. The area of Nanotechnologies (Figure 4) recorded the highest number of projects selected for funding in 2020, which clearly shows its ability to build on the collaborations and intellectual capital developed throughout the previous editions of the International Partnership.

Fostering enduring, successful collaborations that outlive phases – that is what the Program also seeks to promote.

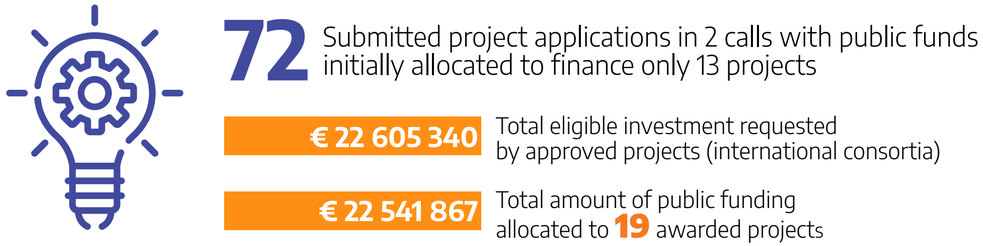


Figure 3: Total public funding awarded

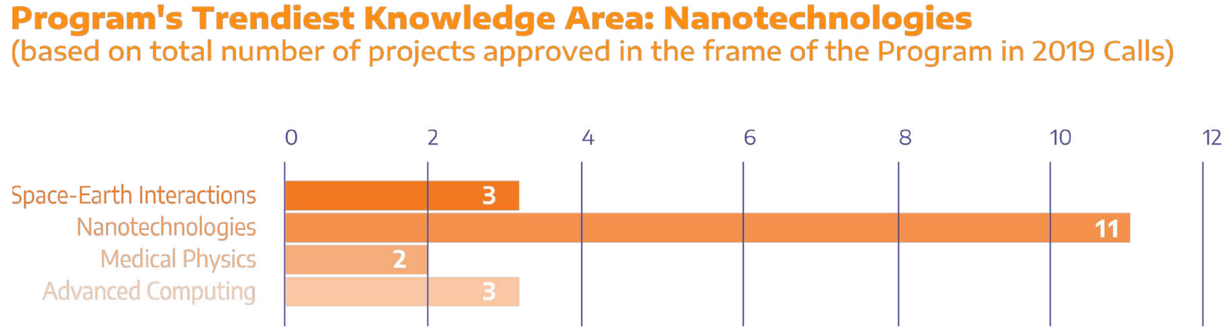


Figure 4: Number of funded projects per Program's Knowledge Areas (as per 2020 official results)

Projects Organized by Knowledge Areas

2019 Strategic Research Projects | 2019 Exploratory Research Projects | 2017 Exploratory Research Projects

ADVANCED COMPUTING

ACT-PM
BigHPC
PAStor
STREACKER

MEDICAL PHYSICS

AT@PT
TPPT

NANOTECHNOLOGIES

2DMS
BlueEnergy
COFforH2
CONTROLLUB
DREAM
Electrowave
Extremed
GEMIS
ImmuneNanoVac
MCTool21
MECHANO
MEPHEES
NanoCatRed
NanoStim
NANOTHER
PIEZOFLEX
SENTINEL
Soft4Sense
TARGET
UT-BORN-PT

SPACE-EARTH INTERACTIONS

DGCoast
I SEA
MAGAL Constellation
SOS-WindEnergy
STorM
uPGRADE

Projects Organized by Application Domains

2019 Strategic Research Projects | 2019 Exploratory Research Projects | 2017 Exploratory Research Projects

Computation

ACT-PM (ERP)
BigHPC (SRP)
PAStor (ERP)

Energy, Renewable Energy and Energy Harvesting

(Nano) BlueEnergy (ERP)
(Nano) MEPHEES (ERP)
(Space-Earth) SOS-WindEnergy (ERP)
(Nano) UT-BORN-PT (ERP)
(Nano) Electrowave (ERP)

Space-Earth-Ocean

Automotive, Aerospace, Electronics, Manufacturing

(Nano) TARGET (ERP)
(Space-Earth) DGCoast (ERP)
(Space-Earth) StoRM (ERP)
(Space-Earth) MAGAL Constellation (SRP)
(Space-Earth) uPGRADE (SRP)

Industrial Applications

Automotive, Aerospace, Electronics, Manufacturing

(Nano) CONTROLLUB (ERP)
(Nano) MCTool21 (SRP)
(Nano) Soft4Sense (SRP)
(Nano) TARGET (ERP)
(Nano) GEMIS (ERP)
(Nano) 2DMS (ERP)

Clean Tech

(Nano) COFforH2 (ERP)
(Nano) NanoCatRed (SRP)

Healthcare Technologies

Medical Applications and Diagnostics, Proton Therapy Equipment, Cancer Treatment and Surveillance, Rehabilitation

(Nano) ExtreMed (SRP)
(Nano) TARGET (SRP)
(Medical Physics) AT@PT (ERP)
(Medical Physics) TOF-PET (SRP)
(Nano) SENTINEL (SRP)
(Nano) DREAM (ERP)
(Nano) NANOTHER (ERP)
(Nano) MECHANO (ERP)
(Nano) NanoStim (SRP)
(Advanced Computing) STREACKER (ERP)
(Nano) ImmuneNanoVac (ERP)

ERP Exploratory Research Projects
SRP Strategic Research Projects

UT Austin Portugal Program - Decade long Objectives: 2018-2030

Technical Annex | UT Austin-Portugal 2018-2030: towards a new decade

Lines of Action or Instruments

Competitive funding for medium to large-scale collaborative research projects:
— Exploratory Projects
— Strategic Projects

Advanced training programs in topics at the forefront of knowledge:
— Explore possibility of implementing affiliated specialized post-graduate programs

Research exchanges of Portuguese and UT Austin faculty, researchers, and graduate students:
— Explore possibility of implementing a visiting affiliate faculty program

PT-Corps, Customer Discovery Residency in Austin and Mentoring of entrepreneurial projects

Initiative 1 "CoLab" Flagship Initiatives

Atlantic Interactions

Medical Physics for Emerging Cancer Therapies

High-Performance Computing, Data Analysis and Visualization

Nano Materials for New Markets

Initiative 2

UTEN

Program's Knowledge Areas - Phase 3

SPACE EARTH INTERACTIONS

MEDICAL PHYSICS

ADVANCED COMPUTING

NANOTECHNOLOGIES

TIE | UTEN

Main Activities

2018

2019

2020

2021

2030

1) 2 Strategic Research Projects approved and started
2) 1 Exploratory Research Project approved and started
3) 1 Masterclass on Platforms for global monitoring – Emerging capabilities and challenges at the Program's 2020 Annual Conference

1) 1 Strategic Research Project approved and started
2) 1 Exploratory Research Project approved and started
3) 1 Masterclass on The Challenges of Proton Therapy in Cancer Treatment at the Program's 2020 Annual Conference

1) 1 Strategic Research Project approved and started
2) 2 Exploratory Research Projects approved and started
3) 1 Masterclass on Emerging HPC Technologies at the Program's 2020 Annual Conference

1) 7 Strategic Research Projects approved and started
2) 4 Exploratory Research Projects approved and started
3) 1 Masterclass on Innovation in Biomimetic Materials at the Program's 2020 Annual Conference

1) 2020 Annual Conference on the topic of Innovation at the Intersection of Academia and Industry

Technical Annex Long-Term Strategic Objectives

- Development of computational and observational oceanography research
- Quantification of oceans and climate science
- Uncertainty characterization
- Development of risk assessment tools in oceans and climate science

- Installation in Lisbon of a protonics facility for advanced cancer therapies
- Start of an international advisory group
- Training of radiation oncologists at MD Anderson Cancer Center
- Development of a joint initiative on high-energy cancer therapies

- Installation of STAMPEDE 1 hardware from TACC in Portugal
- Installation of a new platform with higher capacity
- Increase the usage of advanced computing resources
- Implemention of a comprehensive teaching and support program

- Discovery and development of new nanomaterials
- Engagement of national research institutions and at UT Austin
- Engagement of leading industries in the area

- Development of PT-Corps
- Development of customer discovery residency in Austin
- Provision of mentoring and professional support

4.2.1

2019 Strategic Research Projects

Strategic Research Projects are large scale, cross-cutting 3-year-long projects that place Portuguese companies in tandem with research institutions in Portugal and researchers affiliated to UT Austin or the MD Anderson Cancer Center at the forefront of new research agendas with international reach.

The goal of this collaborative arrangement, which is a new addition to the third phase of the Program, is to increase the odds of research being turned into innovation with social impact and economic relevance, expanding the Program's ability to connect with society through science and technology directly.

In April 2020, the Program announced the funding of eleven projects through the GoPortugal: Global Science and Technology Partnerships Portugal initiative from the country's Ministry of Science, Technology and Higher Education; an outcome that was twice the number of projects expected to be awarded when the Call was published back in 2019.

The standard of excellence set by the applications received led the independent international panel of reviewers appointed by Agência Nacional de Inovação (ANI)[1] to single out eleven out of fourteen applications and recommend them for funding. Additional public funds were consequently mobilized to support projects which are likely to transform industries like automotive, space, health care and data science in the years to come. The outcome of this independent assessment process represented a proposal success rate of almost 80% for the Program which ultimately stood out as the best performer in relation to the two other FCT's transatlantic ventures with dedicated funding streams under the same competitive call – CMU Portugal and MIT Portugal (as per official results announced in April 2020).

[1] National Innovation Agency

> **"This is a testament to the outstanding faculty and quality projects proposed with collaborators in Portugal and to the close ties that have been forged between UT researchers and faculty and counterparts in Portugal."**
>
> John Ekerdt, Cockrell School Associate Dean for Research and Principal Investigator for UT Austin Portugal (UT Austin)
>
> Source: UT Projects Win $23.6M in R&D Funds as Part of Portuguese Government Technology Program

At UT Austin, such success came at the expense of reallocating the Program's budget to ensure support to the 22 Principal Investigators involved in the projects and their research teams and allow the transatlantic consortia to proceed.

> **"The approved projects will, undoubtedly, contribute to promoting and strengthening collaborations with UT Austin in high-level R&D matters with immediate transposition to various sectors of economic activity, several of which are critical to Portugal's competitive position at an international level."**
>
> José Manuel Mendonça, National Director for UT Austin Portugal (Portugal)
>
> Source: UT Projects Win $23.6M in R&D Funds as Part of Portuguese Government Technology Program

The elite of supported consortia – the large majority of them spearheaded by Portuguese Small and Medium-sized Enterprises (SMEs) - will work to shape new services, products and processes with strong global potential drawing on the resources and scientific, technological and business capabilities of Portugal and UT Austin. Many of these projects will address areas where Portugal, with the support of UT Austin, can make use of its competitive advantages stemming from its geostrategic position, natural resources and built-up know-how and capabilities to be at the forefront of innovation in a global setting.

The innovations expected to roll out of such projects include nanosatellites for earth observation; nanosensors for the rehabilitation of severe muscle injuries mostly affecting the ageing population; monitoring solutions for climate change; new coating systems to significantly improve the life cycle and performance of cutting tools for demanding industrial sectors; tools for the advanced management of HPC infrastructures and Big Data applications or the monitoring of post-operative cancer patients with high risk of relapsing.

Altogether, they are expected to create over **59 highly qualified science-based jobs in Portugal**. All projects kicked off in 2020 and are currently underway. Over the next pages, you will get to know each Strategic Research Project bearing the Program's seal.

2019 Strategic Research Projects

21,9 M€ to Fund a Batch of 11 Industry-driven Projects
Representing 40% of the public funds granted through this Call to PT Teams (*)

Representing a public contribution of approximately € 19 814 317 and an industry sponsorship of € 2 063 473

A mix of funding sources for orchestrated efforts
PT funding (public and private): 14,1 M€
UT Austin funding (through the Program): 7,8 M€

30 Participating Entities in PT
14 Companies | 10 Research & Interface Institutions | 6 Universities & Polytechnic Institutes

22 Principal Investigators at UT

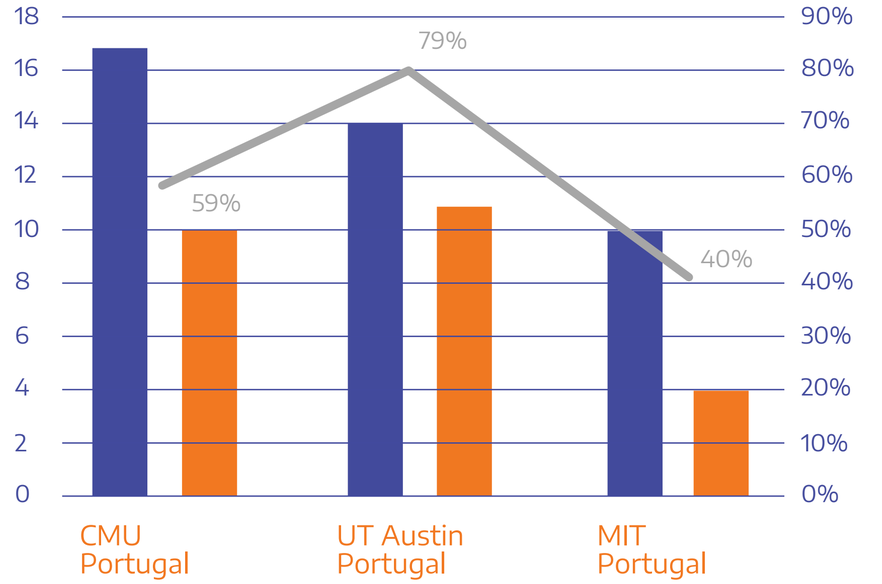
Projects in 4 Key Knowledge Areas
Nanotechnologies **6** | Space-Earth Interactions **2**
Medical Physics **1** | Advanced Computing **1**
Nanomaterials + Advanced Computing **1**

11 Companies leading 3-year projects
10 SMEs and 1 Large Company

11 Ground-Breaking Industry-Driven Projects
Out of a total of 25 awarded projects

(*) At the time of public announcement of results in April 2020

UT Austin Portugal's Performance – 2019 Strategic Research Projects Call (comparative analysis) *



(*) As per the official results announced in April 2020

2019 Strategic Research Projects

Ref.	Acronym	Project Title	Scientific Area	PT Partners	UT Partners	Start Date	Duration	PT Total Eligible Funding	US Total Eligible Funding
45924	BIGHPC	A Management Framework for Consolidated Big Data and HPC	Advanced Computing	Wavecom - Lead Beneficiary INESC TEC LIP - Laboratory of Instrumentation and Experimental Particle Physics	College of Natural Sciences, Department of Computer Science; Texas Advanced Computing Center	March 31 2020	36 months	EUR 1 183 678,08	USD 799 998,00
45904	TOF-PET FOR PROTON THERAPY (TPPT)	In-beam Time-of-Flight (TOF) Positron Emission Tomography (PET) for proton radiation therapy	Medical Physics	PETsys Electronics - Lead Beneficiary LIP - Laboratory of Instrumentation and Experimental Particle Physics ICNAS, Instituto de Ciências Nucleares Aplicadas à Saúde, University of Coimbra (UC); C2TN, Centro de Ciências e Tecnologias Nucleares, IST, University of Lisbon (ULisboa)	College of Natural Sciences, Department of Physics; MD Anderson Cancer Center, Department of Radiation Physics, Division of Radiation Oncology	January 1 2020	36 months	EUR 1 253 179,56	USD 849 987,00
45932	EXTREMED	Extreme Ultrashort Pulses for Advanced Medical Applications and Diagnostics	Nanotechnologies	Sphere Ultrafast Photonics - Lead Beneficiary International Iberian Nanotechnology Laboratory University of Porto	College of Natural Sciences, Department of Biomedical Engineering; Cockrell School of Engineering, Walker Department of Mechanical Engineering	April 1 2020	36 months	EUR 1 281 911,16	USD 800 000,00
45939	GEMIS	Graphene-enhanced Electro-Magnetic interference Shielding	Nanotechnologies	Graphnest - Lead Beneficiary International Iberian Nanotechnology Laboratory University of Minho	Cockrell School of Engineering, Department of Electrical and Computer Engineering and McKetta Department of Chemical Engineering	June 1 2020	36 months	EUR 1 175 623,04	USD 720 000,00
45940	MCTOOL21	Manufacturing of cutting tools for the 21st century, from nano-scale material design to numerical process simulation	Nanotechnologies	Inovatools Portugal - Lead Beneficiary University of Coimbra University of Minho	Oden Institute for Computational Engineering and Sciences; Cockrell School of Engineering, Walker Department of Mechanical Engineering and Department of Aerospace Engineering and Engineering Mechanics	April 1 2020	36 months	EUR 886 000,25	USD 791 736,00
45925	NANOCATRED	Novel metallic NANOparticles on NANOstructured supports for oxyanion CATalytic REDuction in water	Nanotechnologies	Adventech - Lead Beneficiary University of Porto International Iberian Nanotechnology Laboratory	Cockrell School of Engineering, Department of Civil, Architectural, and Environmental Engineering; College of Natural Sciences, Department of Chemistry	June 1 2020	36 months	EUR 858 499,56	USD 595 034,00
45908	NANOSTIM	Nanomaterials for wearable-based integrated biostimulation	Nanotechnologies	Increase Time - Lead Beneficiary University of Minho Polytechnic Institute of Bragança Impetus Portugal TEAandM Nelson Azevedo Terapias Globais	Cockrell School of Engineering, Walker Department of Mechanical Engineering; Oden Institute for Computational Engineering and Sciences	April 1 2020	36 months	EUR 1 279 266,58	USD 792 295,00
45914	SENTINEL	Novel injectable biosensor for continuous remote monitoring of cancer patients at high-risk of relapse	Nanotechnologies	Stemmatters - Lead Beneficiary International Iberian Nanotechnology Laboratory University of Minho Clinic Academic Center – Braga	Cockrell School of Engineering, Department of Biomedical Engineering	April 1 2020	36 months	EUR 1 372 554,92	USD 800 000,00

Ref.	Acronym	Project Title	Scientific Area	PT Partners	UT Partners	Start Date	Duration	PT Total Eligible Funding	US Total Eligible Funding
45921	SOFT4SENSE	Smart Surfaces for Reliable Tooling Integration	Nanotechnologies	TEandM - Lead Beneficiary Instituto Pedro Nunes International Iberian Nanotechnology Laboratory	Cockrell School of Engineering, Department of Aerospace Engineering and Engineering Mechanics and Center for Mechanics of Solids, Structures and Materials	April 1 2020	36 months	EUR 971 167,64	USD 792 144,00
45916	MAGAL CONSTELLATION	Setting the cornerstone of a future ocean and climate change monitoring constellation, based on radar altimeter data combined with gravity and ocean temperature and salinity measurements	Space-Earth Interactions	Efacec Energia - Lead Beneficiary CEiiA Omnidea CIIMAR Instituto Superior Técnico Instituto de Telecomunicações University of Beira Interior +ATLANTIC	Cockrell School of Engineering, Aerospace Engineering and Engineering Mechanics Department and Center for Space Research; Oden Institute for Computational Engineering and Sciences; Jackson School of Geosciences, Department of Geological Sciences	July 1 2020	36 months	EUR 1 894 540,39	USD 799 368,00
45927	UPGRADE	Miniaturized Prototype for GRavityfield Assessment using Distributed Earth-orbiting assets	Space-Earth Interactions	Spin.Works - Lead Beneficiary International Iberian Nanotechnology Laboratory Instituto de Soldadura e Qualidade University of Minho	Cockrell School of Engineering, Aerospace Engineering and Engineering Mechanics Department, Center for Space Research and Texas Spacecraft Laboratory	July 1 2020	36 months	EUR 1 943 732,13	USD 713 392,00

BigHPC

ADVANCED COMPUTING

A management Framework for Consolidated Big Data and HPC

The BigHPC's ambition is to simplify the management of HPC infrastructures supporting Big Data and parallel computing applications. The project will have a direct impact on science, industry and society, by accelerating scientific breakthroughs in different fields and increasing the competitiveness of companies through better data analysis and improved decision-support processes.

Start Date: 31-MAR-2020
Duration: 36 months
Keywords: Big Data, High Performance Computing, High Performance AI

Main challenge/problem the project seeks to address:

HPC infrastructures are increasingly sought to support Big Data applications, whose workloads significantly differ from those of traditional parallel computing tasks. However, coping with the heterogeneous hardware of these large-scale infrastructures and the different workload requirements raises new research and technological challenges. Namely, it becomes increasingly difficult to efficiently manage available computational and storage resources, to provide transparent application access to such resources, and to ensure performance isolation and fairness across the different workloads.

Proposed solution

A novel framework to efficiently manage parallel and Big Data workloads that:

- combines new monitoring, virtualization and software-defined storage components;
- can cope with HPC's infrastructural scale and heterogeneity;
- supports different workload requirements while ensuring holistic performance and resource usage;
- can be seamlessly integrated with existing HPC infrastructures and software stacks;
- will be validated with pilots running in both MACC and TACC supercomputers.

Innovative Potential

Nowadays there are no alternatives in the market offering a solution, such as the one to be developed in BigHPC, that enables companies and institutions to easily deploy and manage HPC and Big Data workloads in a consolidated fashion. This solution will be crucial for taking full advantage of the next generation of exascale HPC supercomputers.

Target beneficiaries

The BigHPC platform will be useful for companies and research centers aiming at supporting Big Data and traditional HPC applications on their infrastructures. A better and simplified management of HPC applications and infrastructural resources will have a direct impact on society, by accelerating scientific breakthroughs in different fields (e.g., healthcare, IoT, biology, chemistry, physics), and increasing the competitiveness of companies through better data analysis and enhanced decision-support processes.

Consortium

Portugal

Wavecom, Soluções Rádio S.A. (Lead Beneficiary)
INESC TEC, Institute for Systems and Computer Engineering, Technology and Science
Laboratory of Instrumentation and Experimental Particle Physics (LIP)

UT Austin Principal Investigators

Vijay Chidambaram, College of Natural Sciences
Todd Evans, Texas Advanced Computing Center

Partner

Minho Advanced Computing Centre (MACC)

Funding

$ 799 998,00
UT Austin
(UT Austin Portugal Budget)

€ 748 158,90
PT2020 Incentive

€ 233 311,17
FCT Incentive

€ 202 208,01
Business Self Funding

TOF-PET for Proton Therapy (TPPT)

MEDICAL PHYSICS

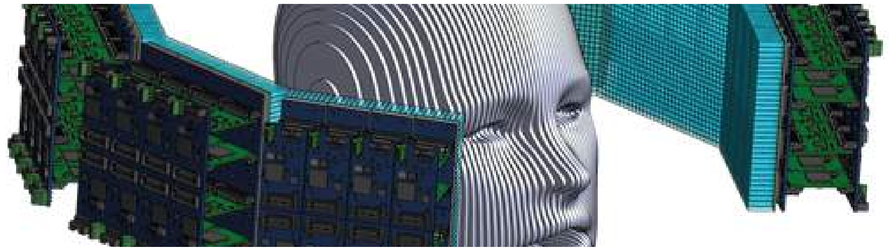
In-beam Time-of-Flight (TOF) Positron Emission Tomography (PET) for proton radiation therapy

The common gamma radiotherapy lacks accuracy when analyzing prostate, lung, head and neck, liver, esophagus and brain cancers. This project will show the benefits of using TOF-PET in Proton Therapy to increase the performance of Proton Therapy equipment in terms of an increased accurate radiation.

Start Date: 01-JAN-2020
Duration: 36 months
Keywords: Proton Therapy, TOF PET, Positron Emission Tomography, SiPM readout, TOFPET ASIC

Main challenge/problem the project seeks to address:

Proton therapy is the most advanced type of radiation treatment of prostate, lung, head and neck, liver, esophagus, and brain cancers. The reason is simple - unlike in common gamma radiotherapy, the proton energy destroying the tumor can be delivered with much better accuracy (by using the well-known 'Bragg peak' of the energy loss in the matter) thus minimizing the damage to the surrounding healthy tissue.
Due to geometrical constraints, the in-beam PET scanning in proton radiation therapy is very difficult since it is impossible to fully surround the patient with a ring of detectors as is normally required in PET scanning.



Proposed solution

A novel diagnostic tool based on Positron Emission Tomography, or PET, that is suitable for radiation monitoring of head and neck cancers. Once the PET scanner is built, the researchers will use phantom head models to ascertain and verify isotope production maps by a proton beam at MD Anderson. Computer simulations will predict the distribution of the positron annihilation events that should be observed. Any mismatch with the observation will provide feedback to adjust the beam.

Innovative Potential

The project will demonstrate the diagnostic value of the state-of-the-art PET scanner featuring excellent position resolution and Time-of-Flight (TOF) to register positron-emitting radionuclides during and immediately after the proton irradiation. The project will allow testing the system with phantoms and small animals at the Proton Therapy Center at the MD Anderson Cancer Center. Patient studies are not part of the present application but will be part of a follow-up project after the successful conclusion of the present project.

Target beneficiaries

The Proton Therapy Industry will be the target client.
People affected by cancer will benefit from getting more accurate radiation in the tumor cells preserving the surrounding tissues.

Consortium

Portugal

PETsys Electronics, Medical PET Detectors S. A. (Lead Beneficiary)
LIP - Laboratory of Instrumentation and Experimental Particle Physics
ICNAS, Instituto de Ciências Nucleares Aplicadas à Saúde, University of Coimbra (UC)
C2TN, Centro de Ciências e Tecnologias Nucleares, IST, University of Lisbon (ULisboa)

UT Principal Investigators

Karol Lang, College of Natural Sciences, Department of Physics, UT Austin
Narayan Sahoo, UT MD Anderson Cancer Center, Proton Therapy Center

Funding

$ 849 987,00
UT Austin
(UT Austin Portugal Budget)

€ 724 515,93
PT2020 Incentive

€ 258 648,81
FCT Incentive

€ 270 014,82
Business Self Funding

ExtreMed

NANOTECHNOLOGIES

Extreme Ultrashort Pulses for Advanced Medical Applications and Diagnostics

In neuroscience, medical imaging and clinical applications, fast non-invasive and non-destructive extraction of detailed cellular and functional behavior, of complex samples, are of particular importance. The scope of ExtreMed is to meet these demands by the use of proprietary and patented technologies to develop the SyncRGB-FLIM multi-color bioimaging technique, where the few-cycle ultra-broadband femtosecond laser promoted single-scan operation, results in advanced imaging with lowered photo-induced damage and extending deep tissue imaging capabilities.

Start Date: 01-APR-2020
Duration: 36 months
Keywords: few-cycle ultra-broadband femtosecond lasers, advanced multiphoton microscopy, deep tissue bioimaging, lowered photo-induced damage

Main challenge/problem the project seeks to address:

Multi-photon microscopy has been extensively used in biological, pharmaceutical and medical applications due to its ability for detailed cellular and deep tissue imaging. For complex sample imaging and functional behavior mapping, repeated scans are required in standard multi-photon microscopy, increasing the total imaging time and photo-induced damage while fast processes, such as protein-protein interaction, can be missed or only partly imaged due to the narrow wavelength laser excitation per scan. Within the ExtreMed project, these limitations and challenges will be addressed by applying a state-of-the-art few-cycle ultra-broadband pulsed femtosecond laser together with advanced pulse shaping.

Proposed solution

- A fully operational and characterized few-cycle laser prototype;
- A broadband passive pulse shaper;
- A stand-alone SyncRGB-FLIM system with advanced scanning and data analysis software;
- An in vitro study using SyncRGB-FLIM on commercially available nanodrug delivery systems.

Innovative Potential

The application of ultrashort laser pulses and pulse shaping, within the ExtreMed project, aims to increase the amount of information extracted in a single scan with an enhanced deep tissue scanning capability and reduced photo-induced damage, thereby promoting this form of imaging and diagnostics. SPH, U.Porto and INL recently demonstrated for the first time that an ultra-broadband 7 femtosecond (fs) few-cycle laser can be used for multi-color nonlinear imaging, in a single channel detection geometry, when employing a time-resolved fluorescence detection scheme. The developed SyncRGB-FLIM multi-color bioimaging technique opens up the possibility of real-time protein-protein interaction studies, where its single-scan operation translates into reduced laser exposure of the sample, resulting in more photoprotective conditions for biological specimens.

Target beneficiaries

- Corporate and academic customers of the microscopy market;
- Laboratories and research centers;
- Manufacturing microscopy technology businesses interested in incorporating ultrafast lasers, d-scan, SyncRGBFLIM and pulse shaper technology into their products;
- Preclinical environments.

Consortium

Portugal
Sphere Ultrafast Photonics, S.A. (Lead Beneficiary)
International Iberian Nanotechnology Laboratory (INL)
University of Porto (UP)

UT Austin Principal Investigators
Andrew Dunn, College of Natural Sciences
Adela Ben-Yakar, Cockrell School of Engineering

Funding

$ 800 000,00	€ 945 843,69	€ 221 640,40	€ 114 427,07
UT Austin (UT Austin Portugal Budget)	PT2020 Incentive	FCT Incentive	Business Self Funding

GEMIS

NANOTECHNOLOGIES

Graphene-enhanced Electro-Magnetic interference Shielding

Electromagnetic interference (EMI) is considered a potential and major source of operating problems to electronic devices, as well as a cause of performance and lifetime reduction, especially in a world where electronic devices are increasingly ubiquitous. GEMIS aims to develop an advanced technological solution based on graphene liquid dispersions to address the issue of electromagnetic interference.

Start Date: 01-JUN-2020
Duration: 36 months
Keywords: Graphene, EMI, shielding, coatings, nanomaterial

Main challenge/problem the project seeks to address:

Current shielding materials used to protect electronic devices from EMI are based on heavy, brittle and expensive metals. Major EMI applications have a huge demand for flexible, additive, light, and inexpensive materials, though. Attending to these needs is of crucial importance for several vehicle industries, from hybrid and electrical cars to airplanes, where weight reduction is imperative to increase autonomy and reduce carbon footprint.

Proposed solution

The project proposes the development of a universal formulation for a liquid dispersion of graphene materials with highly effective EMI shielding, and the consequent production of two EMI shielding composites based on polymers and epoxies. Finally, custom-made equipment will be designed and fabricated to specifically apply the developed EMI shielding solutions on electric wires to be used in the automotive industry.

Innovative Potential

GEMIS' envisioned solutions are highly innovative in the combat against electromagnetic interference, which can disrupt circuits and cause devices to fail. Graphene and related materials are considered the most promising and effective candidates for effective EMI shielding due to their excellent electrical properties, extremely high specific surface area, and unprecedented strength to weight ratio.

Target beneficiaries

Industrial markets such as electronics (IT and sensors), telecommunication (space), transportation (aviation and naval sectors), and the Internet of Things market.

Consortium

Portugal
Graphenest, S.A. (Lead Beneficiary)
International Iberian Nanotechnology Laboratory (INL)
University of Minho (UMinho)

UT Austin Principal Investigators
Deji Akinwande, Cockrell School of Engineering
Brian Korgel, Cockrell School of Engineering

Funding

$ 720 000,00
UT Austin
(UT Austin Portugal Budget)

€ 865 012,92
PT2020 Incentive

€ 189 438,65
FCT Incentive

€ 121 171,47
Business Self Funding

MCTool21

NANOTECHNOLOGIES

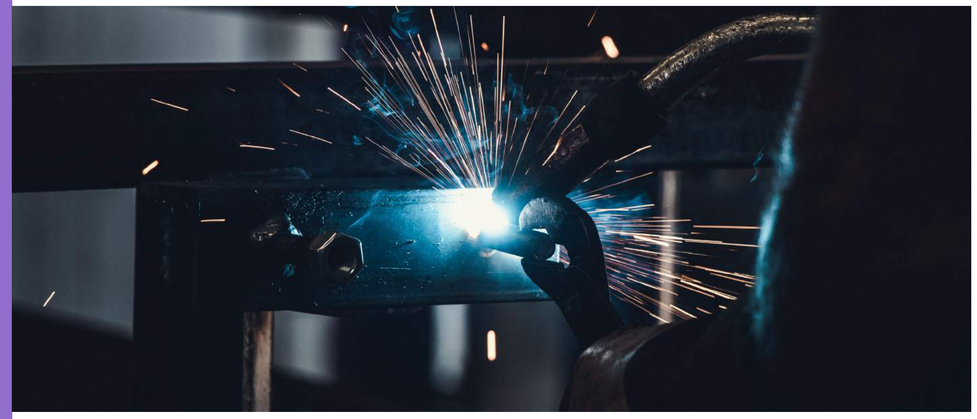
Manufacturing of cutting tools for the 21st century: from nano-scale material design to numerical process simulation

The premature degradation of cutting tool materials is one of the problems that the aerospace and automotive industries are now facing. The MCTool21 project will improve the machinability of alloys through an innovative optimized coating system and new simulation tools.

Start Date: 01-APR-2020
Duration: 36 months
Keywords: Cutting tool materials, coating systems, industry

Main challenge/problem the project seeks to address:

Fabricating parts of cars and planes are hard on cutting tools and tend to wear them down. Additionally, increasing requirements on high speed and dry cutting applications open up new demands on the quality of cutting tool materials. Several solutions have been tried to improve the machinability of these alloys, being the application of thin solid films by sputtering techniques the most promising. However, it still has a long way to go to meet the need for high-speed machining and green manufacturing.



Proposed solution

An optimized coating system which can be upscaled to industry and simulation tools to optimize the size, geometry as well as to predict the right machining parameters for improvement of the performance of the cutting tool directed to hard-to-machine materials.

Innovative Potential

The project will develop special cutting tools with new and significantly improved features such as adaptability during cutting operations that will reduce the wear and tear inflicted by hard-to-machine materials on such tools. The innovation brought about by MCToo21 will translate into an increase in productivity and a reduction of production and maintenance costs for customers. Additionally, these smart tools will be made to last longer and perform much better than the tools available in the market.

Target beneficiaries

Aerospace and automotive industries.

Consortium

Portugal
Inovatools Portugal, Unipessoal, Lda. (Lead Beneficiary)
University of Coimbra (UC)
University of Minho (UMinho)

UT Austin Principal Investigators
Gregory J. Rodin, Oden Institute for Computational Engineering and Sciences
Filippo Mangolini, Cockrell School of Engineering

Funding

$ 791 736,00	€ 647 849,94	€ 151 593,80	€ 86 556,51
UT Austin (UT Austin Portugal Budget)	PT2020 Incentive	FCT Incentive	Business Self Funding

NanoCatRed

NANOTECHNOLOGIES

Novel metallic NANOparticles on NANOstructured supports for oxyanion CATalytic REDuction in water

Several health risks have been associated with the occurrence of inorganic contaminants. Neither conventional nor advanced water treatment technologies have ticked in both efficiency and environmental criteria. NanoCatRed proposes the development of nanostructured catalysts to achieve a step-change in the performance of catalysts for hydrogenation of inorganic contaminants in water.

Start Date: 01-JUN-2020
Duration: 36 months
Keywords: Nanomaterials, catalytic hydrogenation, water treatment, inorganic contaminants

Main challenge/problem the project seeks to address:

Several health risks have been associated with the occurrence of inorganic contaminants such as bromate, nitrate and perchlorate at concentrations more substantial than the background levels in surface and ground waters. Conventional water treatment technologies are not efficient in the removal of these pollutants, whereas other advanced technologies, such as ionic exchange, reverse osmosis, or electrodialysis, albeit effective in their removal, lead to highly concentrated secondary waste streams.

Proposed solution

The NanoCatRed project is designed to take advantage of two different concepts in heterogeneous hydrogenation catalysts to achieve a step-change in the efficiency of water purification applications: new methodologies for fabrication of more active/less costly metallic nanoparticles, and new methodologies for fabrication of nanostructured supports that can enhance the activity/selective/stability of the active metal phase. The technologies the consortium will develop will be able to treat nitrate, perchlorate, and bromate in freshwater.

Innovative Potential

Catalytic hydrogenation is a promising technology for the removal of oxygen-containing anionic contaminants (oxyanions) such as bromate, nitrate, and perchlorate, from water, without generating concentrated secondary waste streams.

Target beneficiaries

The target market for the new technology includes the surface and groundwater treatment sector.

Consortium

Portugal
Adventech - Advanced Environmental Technologies, Lda. (Lead Beneficiary)
University of Porto (UP)
International Iberian Nanotechnology Laboratory (INL)

UT Austin Principal Investigators
Charles J Werth, Cockrell School of Engineering
Simon M Humphrey, College of Natural Sciences

Funding

$ 595 034,00
UT Austin
(UT Austin Portugal Budget)

€ 610 978,87
PT2020 Incentive

€ 151 083,88
FCT Incentive

€ 96 436,81
Business Self Funding

NanoStim

NANOTECHNOLOGIES

Nanomaterials for wearable-based integrated biostimulation

Motor deficiencies are one of the most severe diseases affecting the elderly, which results in high monetary and social costs. The NanoStim project will develop a wearable with integrated electro-stimulation that allows the rehabilitation of advanced muscle injuries or muscles affected by the lack of mobility and paves the way for a truly patient-centered medical device.

Start Date: 01-APR-2020
Duration: 36 months
Keywords: Nanomaterials, muscles, wearables, health

Main challenge/problem the project seeks to address:

Motor deficiencies are one of the most serious diseases affecting the elderly, as an elderly person with reduced mobility needs the support of others, resulting in large monetary and social costs. The accelerating aging of populations in advanced countries means that this problem will only increase in the coming decades.

Proposed solution

A high-performance system of dry and flexible (nano) sensors embedded into clothing that administer electrostimulation to severe muscle injuries or muscles affected by a lack of mobility. The system, which builds on Artificial Intelligence and can be remotely controlled by health professionals, represents the possibility of combining diagnosis, therapy and rehabilitation into a single, truly patient-centered medical device to be used anywhere.

Innovative Potential

Based on a biofeedback approach monitored at a distance by health professionals, NanoStim ensures a complete analysis therapy with the addition of real-time correction. This represents a truly innovative approach to the treatment of neurological and skeletal muscular diseases, whilst increasing the degree of freedom and comfort of the patient and decentralizing treatment and rehabilitation from health care centers. NanoStim allows the application of therapy at home, without the presence of medical staff or formal caretakers, hence reducing social and economic burdens.

Target beneficiaries

The team envisions its project as a tool mostly for elderly people, creating a mobile rehabilitation option for people who have trouble getting to a doctor's office consistently or want greater freedom to complete treatment anywhere. Additionally, the team recognizes the potential of derived applications for training high-level athletes as well.

Consortium

Portugal
Increase Time, S.A. (Lead Beneficiary)
University of Minho (UMinho)
Polytechnic Institute of Bragança (IPB)
Impetus Portugal
TEandM, Tecnologia, Engenharia e Materiais S.A
Nelson Azevedo Terapias Globais

UT Austin Principal Investigators
George Biros, Cockrell School of Engineering, and Oden Institute for Computational Engineering and Sciences
Michael A. Cullinan, Cockrell School of Engineering

Funding

$ 792 295,00
UT Austin
(UT Austin Portugal Budget)

€ 885 888,43
PT2020 Incentive

€ 110 324,88
FCT Incentive

€ 283 053,27
Business Self Funding

SENTINEL

NANOTECHNOLOGIES

Novel injectable biosensor for continuous remote monitoring of cancer patients at high-risk of relapse

Despite prostate-specific antigen (PSA) being the first approved cancer biomarker for diagnosing and screening prostate cancer, the benefits of PSA-based screening for prostate cancer do not outweigh its harms. SENTINEL aims at developing a minimally invasive and biocompatible implantable biosensor based on novel plasmonic particles and hydrogel-based formulations for early tumor surveillance in post-operative prostate cancer patients.

Start Date: 01-APR-2020
Duration: 36 months
Keywords: Cancer, biosensor, SERS, remote monitoring, artificial intelligence

Main challenge/problem the project seeks to address:

Worldwide, the estimated number of people alive within 5 years of a cancer diagnosis is 43.8 million. In these patients, with a high risk of relapse, early identification of cancer is limited by the sensitivity and specificity of tumor biomarkers, and by the accuracy of related assays. Despite PSA being the first approved cancer biomarker for diagnosing and screening prostate cancer, the benefits of PSA-based screening for prostate cancer do not outweigh its harms.

Proposed solution

SENTINEL proposes a radical new approach to remotely monitor patients with a high risk of cancer recurrence. This is provided by an injectable and hydrogel-based biosensor integrating plasmonic particles. The biosensor formulation enables a simple and affordable implantation procedure, which, after implantation, supports detection and monitoring of cancer biomarkers by label free surface-enhanced Raman scattering (SERS) spectroscopy. Using a handheld device, SERS spectra can be acquired and analyzed using machine learning methods. Artificial intelligence tools are adopted to automate data acquisition and generate personalized and high granular monitoring outputs with high positive predictive value (PPV) and specificity.

Innovative Potential

The SENTINEL project will contribute to the digital transformation of cancer care through a novel breakthrough platform, based on a plasmonic-based sensor and computational data analysis. SENTINEL's concept provides a new cost-effective monitoring paradigm, thereby benefiting clinical follow-up of high-risk profile cancer patients and increasing current predictive rates.

Target beneficiaries

SENTINEL potentially enables access to an untapped market segment related to remote monitoring of patients with a high risk of tumor relapse. Immediate target beneficiaries include:

- Prostate cancer patients
- Healthcare service providers (that implement the technology within their ecosystem)

Consortium

Portugal

Stemmatters, Biotecnologia e Medicina Regenerativa S.A. (Lead Beneficiary)
International Iberian Nanotechnology Laboratory (INL)
University of Minho (UMinho)
Clinic Academic Center, Braga, Association (2CA-Braga)

UT Austin Principal Investigator

James Tunnell, Cockrell School of Engineering

Funding

$ 800 000,00
UT Austin
(UT Austin Portugal Budget)

€ 1 062 217,26
PT2020 Incentive

€ 207 360,87
FCT Incentive

€ 102 976,79
Business Self Funding

Soft4Sense

NANOTECHNOLOGIES

Smart Surfaces for Reliable Tooling Integration

The measuring devices available in the market for manufacturing processes fail many times to accurately evaluate important process parameters due to positioning problems or deficient signal acquisition and transfer. The Soft4Sense project will create a new set of software to make it easier to layer thin films on top of equipment by providing the required data to avoid mechanical problems during installation.

Start Date: 01-APR-2020
Duration: 36 months
Keywords: Thin films, multilayer deposition, nanotechnology

Main challenge/problem the project seeks to address:

There is a bottleneck that has impeded the commercial application of thin-film devices, not just in Portugal but worldwide: their mechanical integrity. The construction of these films is based on the stacking of layers, each one with a specific role, requiring a suitable matching between them. The mechanical/electrical integrity of thin-film devices has to be improved and optimized to allow their reliable and reproducible production in order to be offered to the industrial market.

Proposed solution

Soft4Sense intends to create a software that will guide the deposition of layer thin films on top of equipment to avoid mechanical/electrical integrity problems during installation. The software will allow the extraction of reliable data on manufacturing processes. This simple program, with the information about the required characteristics of the stacking layers (e.g. residual stress level, defects density, electrical characteristics, hardness, Young's modulus), supplies the deposition conditions for stack fabrication.

Innovative Potential

Existing measure devices for manufacturing processes do not allow an accurate evaluation of important process parameters as a result of issues with sensors placement and their signal acquisition. Thin film technology loaded with sensors applied directly to the equipment looks promising but installation can be rather tricky. Soft4Sense's innovation potential lies on its software capable of providing the information needed to deposit the thin film device while mitigating the mechanical/electrical integrity problems. This will improve efficiency by reducing redundancies, time, effort and resources.

Target beneficiaries

Manufacturing Industry

Consortium

Portugal

TEandM, Tecnologia, Engenharia e Materiais S.A (Lead Beneficiary)
Instituto Pedro Nunes, Associação para a Inovação e Desenvolvimento em Ciência e Tecnologia
International Iberian Nanotechnology Laboratory (INL)

UT Austin Principal Investigators

Rui Huang, Cockrell School of Engineering and Center for Mechanics of Solids, Structures and Materials
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Funding

$ 792 144,00
UT Austin
(UT Austin Portugal Budget)

€ 727 142,94
PT2020 Incentive

€ 153 805,70
FCT Incentive

€ 90 219,00
Business Self Funding

MAGAL Constellation

SPACE-EARTH INTERACTIONS

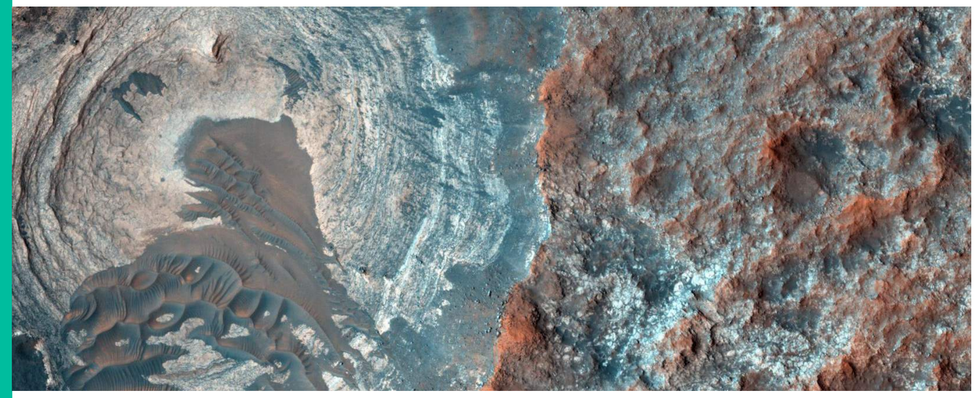
Setting the cornerstone of a future ocean and climate change monitoring constellation, based on radar altimeter data combined with gravity and ocean temperature and salinity measurements

Climate change is one of the critical issues of our time. Following global warming, climate and ocean variations have, undeniably, intensified over time. MAGAL Constellation will develop the next generation of radar altimeter instruments to be adapted for a future constellation of small satellites.

Start Date: 01-JUL-2020
Duration: 36 months
Keywords: Climate change monitoring, Earth dataset, ocean, global warming

Main challenge/problem the project seeks to address

The project seeks to understand long-term variability in local, regional, and global climate-induced by ocean steric (temperature and salinity) variations. Concurrent monitoring of land water storage (soil moisture, snow, surface water, and groundwater) needs to go hand-in-hand with the oceanic measurements. Innovative data assimilation techniques need to be developed with the state-of-the-art ocean and land modeling to provide a consistent and systematic Earth dataset.



Proposed solution

This project aims to develop the next generation of radar altimeter instruments and a series of small satellites to accommodate them. The project also includes a data processing and visualization system using advanced modeling, estimation techniques, statistical and scientific machine learning methods and error analysis.

Innovative Potential

Efacec has been developing an innovative radar altimeter technology since 2010, through two ESA contracts, and this is the most relevant experience from which the project was created. In addition, through the Consortium's extensive experience in multi-satellite and multi-variate data assimilation, MAGAL also includes an innovative data and information processing and visualization system, using advanced high-performance modeling, estimation techniques, statistical and scientific machine learning methods, and error analysis in data gathered from different sources.

Target beneficiaries

The Ocean has been assuming a more prominent role both as a mobilizer of technological, scientific, economic and social development, as well as a resource that must be protected and valued. One of the best ways to prospect, monitor and value the open ocean, in an economical and sustainable manner, is by leveraging on Space/Earth interactions, in line with the "Atlantic Interactions" research agenda and, at a global scale, the UN Sustainable Development Goals.

Consortium

Portugal
Efacec Energia, Máquinas e Equipamentos Elétricos, S.A. (Lead Beneficiary)
CEiiA, Centro de Engenharia e Desenvolvimento (Associação)
Omnidea Lda.
CIIMAR, Interdisciplinary Centre of Marine and Environment Research
Instituto Superior Técnico
Instituto de Telecomunicações
University of Beira Interior
+ATLANTIC, Associação para um Laboratório Colaborativo do Atlântico

UT Austin Principal Investigators
Byron D. Tapley, Cockrell School of Engineering and Center for Space Research
Patrick Heimbach, Jackson School of Sciences and Oden Institute for Computational Engineering and Sciences

Funding

$ 799 368,00
UT Austin
(UT Austin Portugal Budget)

€ 1 197 401,55
PT2020 Incentive

€ 283 077,39
FCT Incentive

€ 414 061,45
Business Self Funding

uPGRADE

SPACE-EARTH INTERACTIONS

Miniaturized Prototype for GRavity field Assessment using Distributed Earth-orbiting assets

The rate at which ice loss in polar caps is occurring is a key parameter that indicates how quickly sea levels will change over the next few decades as a result of global warming. uPGRADE aims at estimating how the water moves on the Earth's surface, at a regional scale, by searching for minute changes in our planet's gravitational field as measured from an orbiting CubeSat (at around 300-500km altitude).

Start Date: 01-JUL-2020
Duration: 36 months
Keywords: Earth observation, earth-orbiting, nanosatellites, IoT

Main challenge/problem the project seeks to address:

uPGRADE is an Earth Observation Cubesat for observing Earth's gravitational field variations and measuring the neutral thermosphere – along the line of past missions such as CHAMP (DLR), GRACE (DLR/ NASA) and GOCE (ESA). The project aims at the development, integration and preparation for the operation of a prototype demonstrator of a general-purpose CubeSat platform for commercial and scientific purposes, such as Earth observation, communications, land monitoring, support of distributed and/or fractionated constellations of nano-satellites and execution of missions in the cislunar and interplanetary space. The use of CubeSat technology for geophysical applications such as satellite gravimetry and thermospheric studies intends to demonstrate the capabilities of the satellite platform under demanding requirements for structural and thermal stability, power management, high volume data communication and accuracy of satellite orientation and position determination.

Proposed solution

Researchers propose to develop a nano-satellite prototype for studying gravitational fields. The main objective of this satellite will be the monitoring of large water reservoirs. The project will also develop a platform for future nano-satellite capabilities, including Earth observation, communications and exploration missions.

Innovative Potential

The innovative nature lies in the high-accuracy miniaturized accelerometer (based on MEMS technology), which will open up the potential in the future for adopting a distributed approach (up to 20 spacecraft) to measuring changes in the Earth's gravity field, as an alternative to using a single measurement system (GRACE/GRACE-FO were/are two satellites). This new satellite concept is designed to have no more than 1/1000 of the volume of its predecessors with about 1/100 of the cost.

Target beneficiaries

The commercial uses of a generic nanosatellite platform such as the one developed by uPGRADE extend from Earth Observation applications to Communications. Space exploration is another expected application, especially taking into account the ESA activities in which Spin.Works is often involved.

Consortium

Portugal
Spin.Works, S.A. (Lead Beneficiary)
International Iberian Nanotechnology Laboratory (INL)
Instituto de Soldadura e Qualidade (ISQ)
University of Minho (UMinho)

UT Austin Principal Investigators
Byron Tapley, Cockrell School of Engineering and Center for Space Research
Brandon Jones, Cockrell School of Engineering and Texas Spacecraft Laboratory

Funding

$ 713 392,00
UT Austin
(UT Austin Portugal Budget)

€ 1 395 328,52
PT2020 Incentive

€ 266 055,53
FCT Incentive

€ 282 348,08
Business Self Funding

4.2.2

2019 Exploratory Research Projects

Exploratory Research Projects (ERPs) are up to one-year, goal-oriented scientific projects on emerging and transformative R&D topics, which hold promise of moving into higher Technology Readiness Levels. This type of project is part of UT Austin Portugal's Research Instrument.

Due to their very blue-sky exploratory nature and timeframe, ERPs are not expected to achieve the fully developed and ambitious results that are typical of longer-term projects. Nevertheless, they must be able to demonstrate that the scientific pathway they are opening or pursuing combines high scientific ambition with concrete technological implications. This means they must go beyond the production of research papers and lead up to science-based solutions to real-world problems.

58 scientific project proposals were submitted between November 2019 and January 2020, mobilizing 30 different non-corporate research institutions in Portugal and 58 Principal Investigators at UT Austin and beyond [2]. Although this solicitation generated significant interest among the transatlantic community, the available budget was limited to eight successful applications, with the maximum eligible investment per project being set on € 50 000 for the Portuguese research team and complemented by an equivalent amount on UT Austin's side through the Program's budget at the American partner. In the second quarter of 2020, through an independent and transparent evaluation process, organized by FCT with the close support of the Program and involving fourteen renowned scientific experts from reputable organizations across Europe and the United States, eight projects covering the full spectrum of scientific areas of the Program were picked out for funding.

The area of Nanotechnologies aggregated the largest number of funded projects (four), followed by Advanced Computing (two). Exploratory topics range from nanomaterials to design new vaccine adjuvants to flexible materials for application as mechanical energy harvesters and sensors; programmable and adaptable storage for AI-oriented HPC Ecosystems, or automatic treatment planning for proton therapy, to list a few.

All projecs initiated in the second semester of 2020 and are currently underway. A brief description of each project is provided next.

58 Submitted applications

30 Participating institutions at application stage

8 Awarded projects across 4 Knowledge Areas

Total public funding allocated (FCT)

€ 727 549

Exploratory Research Projects Call
Evaluation Panel

Coordination
Glenn Lightsey
Georgia Tech Center for Space Technology, United States

Anna Fontcuberta
Swiss Federal Institute of Technology, Switzerland

Kevin M Ryan
University of Limerick, Ireland

John Hines
National Aeronautics and Space Administration (NASA), United States

Andrea Bondavalli
University of Firenze, Italy

Chris Bowen
University of Bath, United Kingdom

Yolanda Prezado
Institut Curie, French National Center for Scientific Research, France

Sara Bouchenak
Institut National des Sciences Appliquées de Lyon, France

José Fortes
University of Florida, United States

Kay-Uwe Kasch
University of Applied Sciences, Berlin, Germany

João Seco
German Cancer Research Center (DKFZ), Germany

Sergei Grudinin
CNRS French National Center for Scientific Research, INRIA, France

Simon Mcintosh-Smith
University of Bristol, United Kingdom

Marie-Paule Pileni
Sorbonne Université, France

[2] The University of Texas MD Anderson Cancer Center and the Texas Advanced Computing Center were deemed eligible on the US side.

Exploratory Research Projects

Ref.	Acronym	Project Title	Scientific Area	Principal Investigator in PT and Affiliation	Principal Investigator at UT and Affiliation	Start Date	Duration
UTA-EXPL/CA/0080/2019	ACT-PM	Automating Crash-Consistency Testing for Persistent Memory	Advanced Computing	Miguel Matos, Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento em Lisboa	Vijay Chidambaram, Department of Computer Science, College of Natural Sciences, UT Austin	October 1 2020	12 months
UTA-EXPL/CA/0075/2019	PASTOR	Programmable and Adaptable Storage for AI-oriented HPC Ecosystems	Advanced Computing	João Paulo, INESC TEC -Institute for Systems and Computer Engineering, Technology and Science	Weijia Xu, Scalable Computational Intelligence – Texas Advanced Computing Center, UT Austin	October 1 2020	12 months
UTA-EXPL/FMT/0079/2019	AT@PT	Automatic Treatment Planning for Proton Therapy: Investigations of Robustly Optimized Intensity Modulated Proton Therapy Incorporating LET/RBE Criteria and Physical and Biological Uncertainties	Medical Physics	Joana Dias, Institute for Systems Engineering and Computers at Coimbra	Radhe Mohan, Department of Radiation Physics, MD Anderson Cancer Center, UT	December 1 2020	12 months
UTA-EXPL/NPN/0055/2019	COFFORH2	Covalent organic frameworks as artificial metalloenzymes for hydrogen activation	Nanotechnologies	Laura Salonen, International Iberian Nanotechnology Laboratory	Michael J Rose, Department of Chemistry, College of Natural Sciences, UT Austin	November 1 2020	12 months
UTA-EXPL/NPN/0015/2019	PIEZOFLEX	High-performance piezoelectric flexible materials enabled by hierarchically porous graphite for application as mechanical energy harvesters and sensors	Nanotechnologies	Paula Ferreira, University of Aveiro	Donglei (Emma) Fan, Walker Department of Mechanical Engineering, Cockrell School of Engineering, UT Austin	November 1 2020	12 months
UTA-EXPL/NPN/0082/2019	IMMUNENANOVAC	Nanomaterials to design new vaccine adjuvants	Nanotechnologies	Luís Graça, Instituto de Medicina Molecular João Lobo Antunes	Nicholas A. Peppas, Department of Biomedical Engineering, Institute for Biomaterials, Drug Delivery and Regenerative Medicine Cockrell School of Engineering, UT Austin	October 1 2020	12 months
UTA-EXPL/NPN/0038/2019	TARGET	TeraHertz Sources using Graphene Field-effect transistor	Nanotechnologies	Alexandre Chícharo, International Iberian Nanotechnology Laboratory	Daniel Wasserman, Department of Electrical and Computer Engineering, Cockrell School of Engineering, UT Austin	August 18 2020	12 months
UTA-EXPL/IET/0111/2019	SOS-WINDENERGY	Sustainable Reuse of Decommissioned Offshore Jacket Platforms for Offshore Wind Energy	Space-Earth Interactions	José Correia, Faculty of Engineering of the University of Porto	Lance Manuel, Department of Civil, Architectural and Environmental Engineering, Texas Atomic Energy Research Foundation, Cockrell School of Engineering, UT Austin	September 1 2020	12 months

ACT-PM

ADVANCED COMPUTING

Automating Crash-Consistency Testing for Persistent Memory

Start Date: 01-OCT-2020
Duration: 12 months

Approved Funding

PT - EUR 49 752,45
UT - USD 49 200,00

Keywords

Persistent Memory, Crash Consistency, Application Observability, Fault Injection

Team

Principal Investigator in Portugal

Miguel Matos, Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento em Lisboa (INESC ID/INESC/IST/ULisboa)

Principal Investigator at UT Austin

Vijay Chidambaram, Department of Computer Science, College of Natural Sciences

Other team members

Rodrigo Rodrigues, Co-Principal Investigator, INESC ID/INESC/IST/ULisboa
Shady Issa, INESC ID/INESC/IST/ULisboa
João Paulo, INESC TEC, Institute for Systems and Computer Engineering, Technology and Science, and University of Minho
Fábio Coelho, INESC TEC, Institute for Systems and Computer Engineering, Technology and Science

Summary

Persistent memory (PM) is a recent technology that promises to deliver performance similar to DRAM combined with data persistency guarantees from disks. In the absence of crashes, PM offers the best of both worlds. However, upon machine or application crashes, the application state can get corrupted, causing applications to malfunction. Implementing crash tolerance techniques is difficult and error prone and, as a matter of fact, it has been shown that several PM applications do not always recover correctly from crashes.
The goal of ACT-PM is to automate the testing of crash-consistency for both PM as memory and PM as disk applications by conducting exploratory research in observability and fault-injection techniques tailored for PM applications. When successful, this exploratory project will advance the state of the art in the above areas and contribute to the development of PM applications and libraries with better crash-consistency guarantees.

Problem

The specificities of PM hardware make the development of PM applications especially challenging as it is not enough to simply move existing applications to the new hardware to reap the benefits of PM. In the same way that developers need to test regular applications to ensure they match the requirements when developing PM applications, it is fundamental to test their behavior upon crashes.
However, this is especially challenging due to the nature of PM hardware such as limited observability of application interactions with PM due to direct memory accesses that bypass the kernel, or reordering of write instructions. For completeness, one possible approach would be to crash the application at every possible state but this is impractical for all but toy applications. Other approaches rely on ad-hoc instrumentation which is error-prone and application-specific. The main challenge in testing PM applications is to have a complete and sound testing framework that intelligently prunes the search space such that applications under test are crash only at sensitive points that are likely to reveal bugs and failures.

Methodology

The key idea behind ACT-PM is to treat applications as a black-box and develop observability techniques that, while being agnostic of the application, still provide precise information about memory accesses. This entails developing offline/online tools to detect such accesses. ACT-PM will also develop fault injection techniques that, at runtime, leverage this information to judiciously inject faults at specific application points. Nonetheless, even equipped with these techniques, the search space, i.e. the points at which an application should be crashed, is extremely large. The key insight to overcome this challenge is to develop application models that help guide the fault injection such that faults are only injected at crash-sensitive points in the execution.

Game-changing potential

ACT-PM provides a novel point in the traditional memory hierarchy that promises to improve the performance and efficiency of applications. However, to fully exploit these capabilities, novel tools to assess the correctness of these applications under faults are needed. The research conducted in this project, and the resulting tools, will improve the workflow and efficiency of PM application developers to ultimately leading to safer and more performant applications that fully leverage PM capabilities.

Expected Key Outcomes

- Novel techniques for black-box observability and fault injection of applications that use PM either as memory or as a disk;
- Early research prototypes showcasing the developed techniques;
- Research papers in international venues.

PAStor

ADVANCED COMPUTING

Programmable and Adaptable Storage for AI-oriented HPC Ecosystems

Start Date: 01-OCT-2020
Duration: 12 months
Website: https://pastor-project.github.io

Approved Funding

PT - EUR 49 235,00
UT - USD 49 789,00

Keywords

High-Performance Computing, Software-Defined Storage, Artificial Intelligence

Team

PI in Principal Investigator in Portugal
João Paulo, INESC TEC, Institute for Systems and Computer Engineering, Technology and Science
Principal Investigator at UT Austin
Weijia Xu, Scalable Computational Intelligence, Texas Advanced Computing Center (TACC)
Other team members in Portugal
Ricardo Vilaça, Co-Principal Investigator, Minho Advanced Computing Center (MACC)
Other team members at UT Austin
Xinlian Liu, Hood College

Summary

High-Performance Computing (HPC) services are increasingly sought to meet the demands of Artificial Intelligence (AI) applications. While the processing capabilities offered by HPC infrastructures can scale and handle the computational requirements of AI applications, the same does not hold for the storage counterpart. Indeed, shared storage architectures quickly become a performance bottleneck when used by multiple instances of data-centric applications.
The PAStor project aims at providing a novel Software-Defined Storage (SDS) solution for HPC that can efficiently handle I/O flows from multiple AI workloads by automatically adjusting storage configurations and resources to dynamically meet application requirements. The proposed solution will be crucial to address the aforementioned storage performance bottleneck and fairness challenges of HPC infrastructures. The research output from PAStor will be released as an open-source prototype that will provide the first building block towards a novel storage architecture suited for the exascale computing infrastructure.
By gathering the expertise of researchers in the AI and distributed storage fields, and by including researchers from TACC and MACC with experience in managing HPC infrastructures, the project will produce new high-quality research findings and advance the state-of-the-art storage solutions currently deployed at HPC centers.

Problem

AI-oriented HPC services are redefining the way users leverage computational and storage resources offered by supercomputers. While a major focus has been drawn on improving the processing power of HPC-enabled AI platforms, storage solutions have reached a clear stagnation in terms of design. Indeed, storage performance is proven to be a major bottleneck in HPC infrastructures and a pressing research challenge. Current strategies to address this challenge include designing storage-oriented optimizations at the application level (e.g., caching, indexing, scheduling). However, for storage systems operating in a multi-tenancy model, application-level optimizations cannot ensure holistic performance guarantees and fairness, leading to high I/O interference and performance degradation among these applications.

Methodology

PAStor will redesign current storage solutions and propose a novel generation of programmable and adaptable software-defined storage (SDS) systems. The novel system can meet the performance and scalability requirements of complex HPC infrastructures and data-centric applications in a holistic fashion. This is an ambitious goal that will redefine the storage landscape of modern HPC infrastructures, open new research directions on the storage field, and directly impact related areas such as AI and HPC.

Game-changing potential

At the moment, a storage solution with characteristics similar to the ones offered by PAStor is unavailable in the HPC market. Moreover, the optimization of storage systems for AI workloads is a pressing research challenge. Also, PAStor is aligned with the Advanced Computing Portugal 2030 strategy. The outcomes of the project will enable MACC to gain access to highly innovative technology and to strengthen its position in the European HPC strategy. The findings identified through this project will help TACC optimizing the design, deployment and management of clusters aimed for exascale computing, a priority area in the US.

Expected Key Outcomes

- An open-source prototype that will provide the first building block towards a novel storage architecture suited for exascale computing infrastructures;
- Research outputs dissemination through top scientific venues in the HPC and storage fields.

AT@PT

MEDICAL PHYSICS

Automatic Treatment Planning for Proton Therapy: Investigations of Robustly Optimized Intensity Modulated Proton Therapy Incorporating LET/RBE Criteria and Physical and Biological Uncertainties

Start Date: 01-DEC-2020
Duration: 12 months

Approved Funding

PT - EUR 49 876,81
UT - USD 50 000,00

Keywords

Computer-Aided Inverse Planning, Radiotherapy, Protons, Robust Optimization

Team

Principal Investigator in Portugal
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Principal Investigator at UT Austin
Radhe Mohan, MD Anderson Cancer Center (MDACC)
Other team members in Portugal
Humberto Rocha, Co-Principal Investigator, Institute for Systems Engineering and Computers at Coimbra (INESC Coimbra)
Brígida Ferreira, Institute for Systems Engineering and Computers at Coimbra (INESC Coimbra)
Other team members in Texas
Wenhua Cao, MD Anderson Cancer Center (MDACC)
David Grosshans, MD Anderson Cancer Center (MDACC)

UTAustin Portugal

Summary

AT@PT proposes to investigate novel techniques for optimizing intensity-modulated proton therapy (IMPT) in the face of physical and biological uncertainties and improving the therapeutic potential of proton radiotherapy (PR).
PR has specific features that make it highly appropriate for the treatment of cancers as compared with a photon (x-ray)-based RT (XRT). However, PR is much more vulnerable to uncertainties, not only to inter and intra-fractional anatomic variations but also to the uncertainties in relative biological effectiveness (RBE). Moreover, tissue heterogeneities as well as anatomy variations in the beam path influence the proton range and, therefore, dose deposition. Continuing the conventional practice of defining safety margins around the tumor is not appropriate for PR and robust optimization (RO) of treatment plans is necessary. RO is much more relevant for PR than for XRT.
This project will apply robust beam angle and intensity modulation optimization methodologies to render radiation dose distributions less sensitive to uncertainties. Most of the existing RO approaches are of the “absolute-robust” type based on the “worst-case scenario”. However, “relative-robust” approaches can often present superior solutions. Secondly, for intensity modulation, procedures for the automatic definition of the parameters will be developed.

Problem

• To develop robust mathematical models and optimization algorithms, contributing to the automation of proton radiotherapy treatment planning, taking into account the unique physical and biological characteristics of protons and uncertainties inherent in them;
• To investigate the consequences of uncertainties and approximations, answering various unanswered questions and resolve controversies (e.g., the validity of dose-averaging of LET to estimate the biological effect, LET-based vs. RBE-weighted dose optimization, the safety of using RBE of 1.1 vs. variable RBE, etc.);
• To support the decision-making process regarding the choice of the best treatment modality for each patient, considering not only health outcomes but also social and economic criteria.

Methodology

AT@PT will develop novel relative-robust approaches to address uncertainties present in the treatment planning process. The approach will consider a sample average approximating approach based on Monte Carlo simulation. For investigational purposes, robust optimization models will be based on both fixed and variable RBE. For the latter, the models will be able to employ criteria based on LET or variable RBE computed using various RBE models. Being a completely novel approach, the main risks have to do with not being able to generate meaningful scenarios and the automated robust optimization procedure to be developed not being computationally fast enough.

Game-changing potential

The project aims at achieving treatment planning solutions that are scalable, reliable, fast and cost-effective. It will create opportunities to truly tailor radiation treatments to patients, potentially resulting in increased cure or reduced incidence of severe radiation-induced morbidity. The gain in treatment quality can even be obtained at a reduced cost due to automation, which can also support the selection of patients for novel expensive treatments. The outcomes of the research activities, leveraged by the collaboration of the two research teams, can result in knowledge transfer to industry and contribute to scientific jobs creation.

Expected Key Outcomes

• Algorithms developed for scenario generation, beam angle and intensity modulation optimization;
• Scientific production (two manuscripts, at least, will be submitted to international journals; presentations in, at least, three international conferences (highly dependent on the global evolution of the pandemic situation) and one M.Sc. thesis).

FCT Fundação para a Ciência e a Tecnologia
TEXAS The University of Texas at Austin

COFforH2

NANOTECHNOLOGIES

Covalent organic frameworks as artificial metalloenzymes for hydrogen activation

Start Date: 01-NOV-2020
Duration: 12 months

Approved Funding

PT - EUR 49 760,85
UT - USD 50 000,00

Keywords

Covalent organic framework, Nanozyme, Artificial metalloenzyme, Hydrogen

Team

Principal Investigator in Portugal
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Principal Investigator at UT Austin
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Other team members in Portugal
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Jenni Jarju, International Iberian Nanotechnology Laboratory (INL)
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Other team members at UT Austin
Sean Goralski, Department of Chemistry, College of Natural Sciences
Jordan Labrecque, Department of Chemistry, College of Natural Sciences

Summary

Hydrogen, H2, is an attractive energy source due to its high enthalpy of combustion and innocuous side products. Nature's H2 economy solution uses this molecule as an energy source in the form of hydrogenase enzymes, which are involved in complex chemical pathways, such as the conversion of CO2 to methane and nitrate to nitrogen. To realize these transformations, the enzymes rely on biologically available metal ions, iron and nickel. However, the industry often depends on critical metals, such as platinum, to catalyze hydrogenation reactions.
COFforH2 will draw inspiration from nature's low-carbon solution by developing artificial enzymes from nanomaterials, nanozymes, for H2 activation. These innovative nanomaterials will be based on covalent organic frameworks (COFs), crystalline nanoporous networks formed by self-assembly of purely organic building blocks. These materials offer an exceptional opportunity of design with atomic precision combined with high thermal and chemical stability, making them excellent candidates for nanozymatic conversions. Whereas the use of natural enzymes for large-scale production of chemicals is hindered by their high cost, narrow range of operation conditions, and low recyclability, our biomimetic nanozymes could function as stable and recyclable heterogeneous catalysts, which take advantage of natural enzymes' capacity to realize thermodynamically challenging transformations at ambient temperature and pressure.

Problem

In view of a future hydrogen society, it is of high interest to mimic and learn from nature's hydrogen economy solution to develop better catalysts for transformations involving hydrogen. In nature, the hydrogen economy is powered by the H2-processing enzymes, di- and mononuclear hydrogenases. They belong to the class of metalloproteins, which feature metal cofactors to catalyze thermodynamically challenging transformations, such as nitrogen reduction to ammonium or water oxidation, at ambient temperature and pressure, relying on abundant metals iron and nickel. Mimicking such enzymes offers a great opportunity for the replacement of rare and expensive platinum-group metals in catalytic conversions.

Methodology

Recently, the group of Rose at UT Austin reported for the first time the first functional small-molecule model complex of the mono-iron hydrogenase. In the beyond-the-state-of-the-art approach of this project, such model complexes will be incorporated into COFs to provide functional biomimetic nanozymes, which will carry out the transformations of the natural mono-iron hydrogenase. The preparation of the fully functional nanozymatic materials envisioned during this project presents a synthetic challenge.

Game-changing potential

Metalloproteins catalyze several chemically and thermodynamically challenging transformations at ambient temperature and pressure, such as oxidation of water or reduction of dinitrogen to ammonium. In contrast, the industry often requires harsh conditions and critical platinum-group-metal catalysts to carry out such reactions. Mimicking natural enzymes, which is proposed in this project, can therefore provide breakthrough biomimetic catalysts working at much milder conditions than currently available catalysts while featuring enhanced stability and wider condition-tolerance than natural enzymes. Ultimately, the results of this project will be an important milestone in the development of sustainable, biomimetic catalytic nanomaterials for industrially relevant conversions.

Expected Key Outcomes

- New nanomaterials based on COFs that mimic metalloenzyme activity for the activation of hydrogen;
- Publications in peer-reviewed scientific journals;
- The basis for a larger research project, which will be aimed at enhancing the technology readiness level of nanozymatic COF-based catalysts beyond this exploratory research project.

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TEXAS The University of Texas at Austin

PIEZOFLEX

NANOTECHNOLOGIES

High-performance piezoelectric flexible materials enabled by hierarchically porous graphite for application as mechanical energy harvesters and sensors

Start Date: 01-NOV-2020
Duration: 12 months

Approved Funding

PT - EUR 50 000,00
UT - USD 50 000,00

Keywords

Nanogenerator, Barium titanate, Sensor, Graphene

Team

Principal Investigator in Portugal
Paula Ferreira, University of Aveiro
Principal Investigator at UT Austin
Donglei (Emma) Fan, Walker Department of Mechanical Engineering, Cockrell School of Engineering

Summary

The goal of PIEZOFLEX is to explore an entirely original paradigm in the design and scalable fabrication of high-performance piezoelectric flexible materials enabled by hierarchically porous graphite. PIEZOFLEX will consist of a structure made of a graphene film as a current collector on the top, arrays of piezoelectric BaTiO3 nanoparticles in the middle, which directly grow on strategically designed multi-level porous graphite at the bottom. Besides, to serve as a counter electrode, the graphite will provide high mechanical flexibility and controllability in the growth of the piezoelectric BaTiO3 nanoparticles, finely tuning the size, orientation, and distribution of the particles, for optimal performance. If successful, an entirely new high-performance and manufacturable piezoelectric nanostructure will be realized. It will be integrated into lab prototype devices for both mechanical energy harvesting and motion sense.

Problem

Piezoelectric materials have the extraordinary capacity to convert mechanical stresses into electric voltage and vice-versa. Electric power can be harvested from vibrations resulting from e.g. human motion, working machines, wind and waves. The application of an electric field can mechanically actuate a system.
It is critical to get piezoelectrics sufficiently thinner and resistant to be deformed. Inorganic metal oxides are interesting materials due to their large piezoelectric charge coefficients, but they possess the drawback of being brittle. It is then time to develop a radically new scheme of producing high-performance piezoelectric flexible materials to offer high energy conversion efficiency and be suitable for applications as mechanical energy harvesters and sensors.

Methodology

The proposed PIEZOFLEX will be designed with a sandwiched structure made of a graphene type film, i.e. ~10 layers in thickness, conformably attaching to piezoelectric BaTiO3 nanoparticles, which directly grow on a hierarchically porous thin graphite film.
The rational and systematic approach encompasses:
1) Fabrication, processing, and characterization of the proposed flexible piezoelectric composites;
2) Systematic evaluation and understanding of structure-microstructure-property relationships that guide the optimization of the composite;
3) Assembly of prototype devices for testing in mechanical energy harvesting and sensing from human body motions.

Game-changing potential

The PIEZOFLEX, as an exploratory project, is expected to inspire advances in the concept, design, and fabrication of functional flexible and stretchable materials for wearable electronics and energy harvesting, opening avenues for more research in novel functional materials with high impact in many emergent fields.

Expected Key Outcomes

- Two laboratory prototypes;
- Scientific production (one M.Sc. thesis; one paper in an international journal, two communications in international and national meetings);
- A webinar/conference.

ImmuneNanoVac

NANOTECHNOLOGIES

Nanomaterials to design new vaccine adjuvants

Start Date: 01-OCT-2020
Duration: 12 months

Approved Funding

PT - EUR 50 000,00
UT - USD 49 998,00

Keywords

Antibodies, T cells, B cells, Nanoparticles, Immune regulation

Team

Principal Investigator in Portugal

Luís Graça, Instituto de Medicina Molecular João Lobo Antunes (IMM/FM/ULisboa)

Principal Investigator at UT Austin

Nicholas A. Peppas, Department of Biomedical Engineering, Institute for Biomaterials, Drug Delivery and Regenerative Medicine Cockrell School of Engineering

Other team members in Portugal

Helena Florindo, Co-Principal Investigator, iMed.ULisboa, Faculty of Pharmacy, University of Lisbon

Summary

Although vaccines are among therapies with the greatest impact on health, improved vaccines are needed for vulnerable groups with decaying immune function, such as the elderly. In this age group, the protection afforded by vaccination (namely against influenza) is important but still sub-optimal. ImmuneNanoVac proposes to exploit the team's results with the development of nanomaterials for cancer immunotherapy, as well as its expertise in germinal center (GC) biology to boost vaccine responses through the use of nanoparticles (NP) to deliver adjuvants and immunizing antigens. By advancing the knowledge on reprogramming host immune responses by nanoparticulate systems, this exploratory proposal will lead to the identification of optimal nanomaterials to improve vaccine efficacy in vulnerable groups.

Problem

The ImmuneNanoVac proposal addresses the need to improve vaccine efficacy in situations where a decaying immune function can lead to sub-optimal protection, namely among the elderly.

Methodology

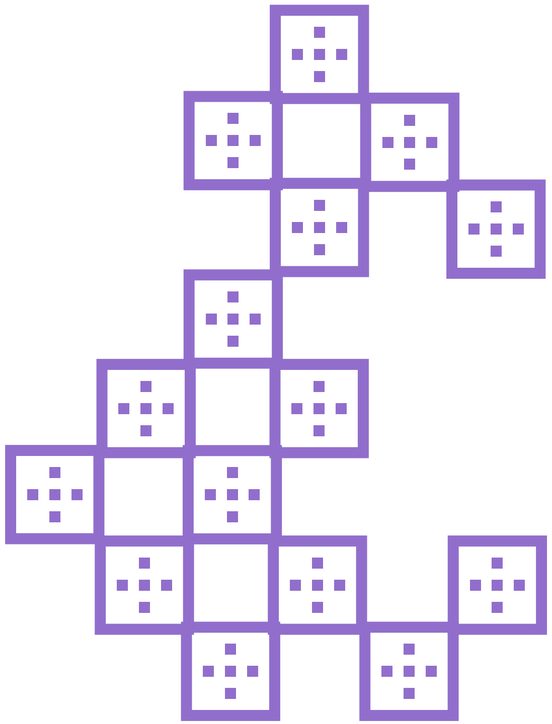
The research on adjuvants driving type-1 and type-2 immune responses led to the preliminary observation that the same adjuvants delivered while encapsulated in NP lead to more potent humoral responses. This exploratory proposal allows to: (1) investigate the ability of different classes of NP formulations to increase antibody production following immunization; (2) establish whether NP-based immunization can lead to B cell affinity maturation towards the production of high-affinity antibodies; (3) to generate preliminary data on the underlying mechanism explaining the increased effectiveness of NP-based immunization.

Game-changing potential

While vaccines have been one of the medical developments with the greatest impact in society, there is still a need to improve vaccine efficacy among vulnerable groups with decaying immune function. This research has the potential to increase vaccine efficacy among individuals that are more susceptible to severe consequences of infection (such as influenza or COVID-19).

Expected Key Outcomes

- New nanomaterials based on COFs that mimic metalloenzyme activity for the activation of hydrogen;
- Publications in peer-reviewed scientific journals;
- The basis for a larger research project, which will be aimed at enhancing the technology readiness level of nanozymatic COF-based catalysts beyond this exploratory research project.



TARGET

NANOTECHNOLOGIES

TeraHertz Sources using Graphene Field-effect transistor

Start Date: 18-AUG-2020
Duration: 12 months

Approved Funding

PT - EUR 49 941,61
UT - USD 49 999,00

Keywords

Graphene, Terahertz, Laser, Nanotechnology, Materials

Team

Principal Investigator in Portugal

Alexandre Chícharo, International Iberian Nanotechnology Laboratory (INL)

Principal Investigator at UT Austin

Daniel Wasserman, Department of Electrical and Computer Engineering, Cockrell School of Engineering

Other team members in Portugal

Hugo Terças, Instituto de Plasmas e Fusão Nuclear (IPFN)
Pedro Alpuim, International Iberian Nanotechnology Laboratory (INL)
Jérôme Borme, International Iberian Nanotechnology Laboratory (INL)
Chund-Da Liao, International Iberian Nanotechnology Laboratory (INL)

Summary

In the last three decades, the THz region of the electromagnetic spectrum has often been described as the final unexplored region of the electromagnetic wave spectrum. The technological importance of the THz is due to its non-ionizing nature and its ability to penetrate a range of materials that are opaque to visible and IR radiation. Therefore, the development of new THz sources could enable the significant growth in THz science and technology, making the THz a major field of applied research.

TARGET aims at developing next-generation THz emitters that can operate at room conditions, are miniaturized, easy-to-operate, and capable of integration with other devices. The project proposes a new THz emitter based on a graphene field-effect transistor. This opens the possibility for the development of an all-electric, low-power-consumption stimulated THz laser.

A promising way to create THz radiation sources in integrated-circuit setups stems from plasma instabilities proposed by IPFN at IST. Simulation results demonstrate the operation as a broadband THz light-emitting transistor. State-of-the-art device micro and nano-fabrication with high-quality graphene have been the focus of the 2DMD group at INL. Characterization of the THz sources is led by the Mid-IR Photonics group at UT Austin, with established extensive capabilities for measuring long-wavelength light.

Problem

Recent progress in graphene-based transistors paves the way for the possibility of all-electrical miniaturized devices and low power THz emission and detection. Yet, such integrated-circuit technology based on graphene is in its infancy. In particular, graphene is widely recognized as an ideal platform for strong light-matter interactions due to its excellent plasmonic response in the mid-infrared to THz spectral range. State-of-art simulation work, development of new nanofabrication protocols and materials, and finally, delicate THz emission characterization of the designed transistor is the core of the project's success.

Methodology

Based on these simulated THz source devices, the emission on a graphene-transistor is proposed using two structural designs towards this project goal: i) suspended graphene and ii) graphene on the substrate. The first proposed structure for the gated transistor comprises a suspended graphene monolayer placed between two metallic contacts, and subject to an electrostatic potential, imposed by a gate. A second structure envisioned would be to have graphene on top of hexagonal boron nitride serving as an insulator over an atomically smooth layer. Although graphene presents outstanding proprieties its manipulation and integration in devices is still a recognized challenge.

Game-changing potential

The success of TARGET would have a groundbreaking outcome for society and markets. The access to easy-to-operate THz emitters is a bottleneck for upcoming applications, as currently they are bulky and require low temperature for operation. Therefore, with the demonstration of new sources, the trend of THz science and development of technology expects a huge growth, becoming one of the major fields of applied research. Main applications of this technology include imaging in astronomy, spectroscopic techniques, security screening applications, detection of explosives, larger broadband wireless data communication, dry food inspection, biosensor devices, new cancer treatments, etc.

Expected Key Outcomes

- Modeling and simulation of possible nanofabrication devices;
- Development and demonstration of a prototype, leading to progress of enhanced devices and subsequent patent application;
- Scientific production (M.Sc. and Ph.D. dissertations to younger scientists and scientific papers).

SOS-WindEnergy

SPACE-EARTH INTERACTIONS

Sustainable Reuse of Decommissioned Offshore Jacket Platforms for Offshore Wind Energy

Start Date: 01-SEP-2020
Duration: 12 months

Approved Funding

PT - EUR 41 803,50
UT - USD 50 000,00

Keywords

Offshore wind turbines, Renewable energy, Requalification, Fatigue, Metocean climate

Team

Principal Investigator in Portugal

José Correia, Faculty of Engineering of the University of Porto (FEUP)

Principal Investigator at UT Austin

Lance Manuel, Department of Civil, Architectural and Environmental Engineering, Texas Atomic Energy Research Foundation, Cockrell School of Engineering

Other team members in Portugal

Francisco Pinto, Co-Principal Investigator, Faculty of Engineering, University of Porto
Rui Calçada, Faculty of Engineering, University of Porto
José Castro, Faculty of Engineering, University of Porto
Xavier Romão, Faculty of Engineering, University of Porto
Paulo Santos, Faculty of Engineering, University of Porto

Other team members at UT Austin

Bitna Seo
Jinsong Liu

Summary

Planet Earth is composed of land and water, respectively, 29.2% and 70.8%, where approximately 97.5% of the water is in our seas and oceans. The ocean is the least explored resource on our planet. In 2010, the European Science Foundation's Marine Council predicted that, by 2050, Europe will supply up to 50% of its electricity needs from marine renewable energy. Thus, offshore renewable energy presents challenges and opportunities in particular for Portugal, with its significant resources in one of the largest sea areas in Europe. The SOS-WindEnergy project intends to evaluate metocean (meterological and oceanographic) environment conditions and modelling of its variability using “environmental contour” approaches that will rely on measured waves and wind data in Portuguese offshore sites being considered for renewable energy generation. The analysis of specific foundations and wind turbine support structures will be based on metocean modelling. Fatigue performance assessment of decommissioned jacket platforms to support offshore wind energy equipment is proposed. The past loading history of the elements of these structures previously used in the oil and gas industry will be taken into account in this sustainable reuse analysis.

Problem

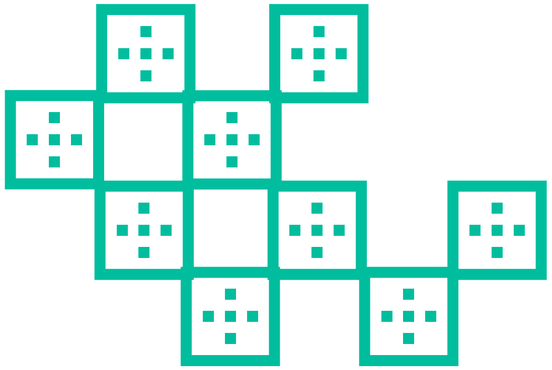
In general, site-specific measurements, in the offshore environment, may not be available, particularly during the early planning phase. Metocean parameters are required to describe wind and wave conditions as well as atmospheric and physical conditions of the ocean environment. In addition, the fatigue assessment of offshore structures is carried out using the Palmgren-Miner rule that relies on the uncertain history and usage. A methodology for evaluating the fatigue performance of offshore platforms based on local approaches, using metocean variability, is to be developed. The service life and history of the decommissioned structures used in the oil and gas industry, to be retrofitted so as to support wind turbines, will be considered.

Game-changing potential

It is anticipated that this proposed work can serve a pilot study for planned reliability analyses, using metocean data for fatigue performance assessment, of decommissioned jacket platforms and consideration for their future use in wind energy generation in an offshore environment. The benefits to the environment are obvious; such reuse plans reduce waste and the intended future use also contributes to cleaner and more responsible energy generation and less harm to the environment.

Expected Key Outcomes

- A methodology for fatigue performance evaluation of jacket platforms;
- Publications in specialized journals and print/electronic media;
- Activities such as two planned workshops for academic and non-academic attendees.



4.2.3
2017 Exploratory Research Projects

In Phase 3, UT Austin Portugal continued to support projects financed under Phase 2 while it transitioned to a new agenda and initiatives. It is worth noting that only fourteen out of 47 proposals submitted to the 2017 ERP Call moved forward to sign a grant agreement in 2018 with FCT, which allocated a total of € 1 400 000 to Portuguese research institutions.

For matching purposes, the Program's budget at UT Austin set aside 75% of the corresponding FCT's contribution in Portugal for the American teams. Each project, with an expected length period of twelve months, involved, at least, two research teams from different research institutions in Portugal and a research team from the University of Texas at Austin. Only one selected project has been abandoned, but no funds have ever been transferred to the team.

In 2020, all ERPs were still active since they had been authorized a no-cost extension by FCT the year before. However, the pandemic impeded the PIs of several of these projects to complete their revised work plans within the extended timeline, resulting in eleven requests for additional no-cost extensions, ten of which were granted by the sponsor, with a few adjustments in some cases.

Average Duration of 2017 ERPs: 22 Months[3]

As part of its culture of monitoring and reporting, the Program designed a short form/survey that was sent over to the Portuguese Principal Investigators in July 2020. At that time, only four projects had been concluded. The main goal was to collect inputs for the ERC Meeting, planned to happen later that year, in October. Only one PI did not report the progress to the Program in due time. At the end of November, the same forms were sent back to the PIs so that they could update any previous information resulting from projects' further progress towards their end. The analysis that follows draws on the results of this monitoring exercise initiated in the second semester of 2020.

2017's ERPs have been mostly contributing to value creation upstream the innovation value chain, with 118 papers published or in the pipeline for submission to peer-reviewed journals or international peer-reviewed (proceedings) Conferences.

[3] Excluding abandoned project MUSAS

This represents an average of 9 publications per project. Additionally, 69 students were mobilized and carried out research in the course of these projects (with a total of 2/3 attributable to research activities in Portugal) and 13 mobility schemes were supported, with researchers traveling to UT Austin or Portugal to either participate in project meetings or conduct joint R&D activities. 7 prototypes were developed and 1 patent was filed. The PIs of 2/3 of the projects funded through the 2017 call wished to either pursue further developments to the research work carried out or support the translation of outcomes into practical applications by requesting additional funding through new projects applications. 75% of these projects did actually submit new applications involving the same institutions participating in the 2017 ERPs.

The next pages provide an overview of the projects transitioned from Phase 2. By the time the call was launched, the Program was not yet structured around the knowledge areas that have been center stage since 2018. Nevertheless, the topics selected by the call to define the scope of project proposals show evidence of a progressive convergence towards the areas that are at the basis of Phase 3's foundational knowledge.

100 papers published in peer-reviewed journals or conferences at the time of publication of this report

69 students in Portugal and at UT Austin with research works related to the 2017 ERPs

7 Prototypes

1 Patent Filed

11 Honours and Awards received,
4 of which have been granted outside the Program's geographic scope

13 Mobility schemes supported

Project Continuity

8 out of 14 2017 ERPs have led to new project funding applications

2 have been awarded further funding:

- Controllub through the UT Austin Portugal Program's 2019 Strategic Research Projects Call with the project MCTool21.
- MECHANO through the Marie Skłodowska-Curie Innovative Training Networks (Horizon2020) with the project ASTROTECH.

2017 Exploratory Research Projects

Ref.	Acronym	Project Title	Scientific Area	Principal Investigator PT and Affiliation	Principal Investigator UT Austin and Affiliation	Start Date	End Date	Duration	Approved Funding PT	Approved Funding at UT Austin
UTAP-EXPL/CA/0065/2017	STREACKER	Skeletal Tracking Enhanced with Anatomically Correct Kinematics for Exergames and Rehabilitation	Advanced Computing	Daniel Simões Lopes, Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento, Lisbon (INESC ID/INESC/IS T/ULisboa)	Richard Neptune, Walker Department of Mechanical Engineering, Cockrell School of Engineering	October 1 2018	March 31 2020	18 months	EUR 93 576,00	USD 74 029,00
UTAP-EXPL/NTEC/0046/2017	2DMS	Two dimensional magnetic semiconductors	Nanotechnologies	Joaquín Fernández-Rossier, International Iberian Nanotechnology Laboratory (INL)	Xiaoqin Li, College of Natural Sciences	September 1 2018	August 31 2020	24 months	EUR 99 550,00	USD 86 812,00
UTAP-EXPL/NTEC/0021/2017	BLUEENERGY	Large scale blue energy harvesting using hybrid triboelectric/photovoltaic systems for the long term deployment of Autonomous Underwater Vehicles	Nanotechnologies	João Oliveira Ventura, Faculty of Sciences of the University of Porto (FCUP)	Edward Yu, Department of Electrical and Computer Engineering, Cockrell School of Engineering	October 1 2018	March 31 2020	18 months	EUR 99 737,00	USD 121 575,41
UTAP-EXPL/NTEC/0107/2017	CONTROLLUB	Self lubrificant coatings for high temperature applications with controlled released of the lubricious agent	Nanotechnologies	Albano Rodrigues Carvalho, University of Coimbra (UC)	Yuanyue Liu, Walker Department of Mechanical Engineering, Cockrell School of Engineering	November 1 2018	September 30 2020	23 months	EUR 99 571,00	USD 74 635,00
UTAP-EXPL/NTEC/0015/2017	DREAM	Drug delivery nanosystem for HPV infection therapy Nanotechnologies	Nanotechnologies	Carla Cruz, University of Beira Interior (UBI)	Andrew Ellington, College of Natural Sciences	November 5 2018	December 31 2020	26 months	EUR 99 994,00	USD 86 077,00
UTAP-EXPL/CTE/0064/2017	ELECTROWAVE	ELECTROWetting heat pipes for cooling Applications in Electric Vehicles	Nanotechnologies	Ana Sofia Moita, Association of Instituto Superior Técnico for Research and Development (IST-ID)	Vaibhav Bahadur, Walker Department of Mechanical Engineering, Cockrell School of Engineering	December 1 2018	November 30 2020	24 months	EUR 98 475,00	USD 48 420,00
UTAP-EXPL/NTEC/0057/2017	MECHANO	From the mechanobiology of the glial to the management of multiple sclerosis	Nanotechnologies	Ana Paula Pêgo, Institute of Biomedical Engineering (INEB)	Laura Suggs, College of Natural Sciences	November 1 2018	October 31 2020	24 months	EUR 99 212,00	USD 74 246,00
UTAP-EXPL/CTE/0008/2017	MEPHEES	Nanostructured transition Metal Phosphides for Electrochemical Energy Storage	Nanotechnologies	Lifeng Liu, International Iberian Nanotechnology Laboratory (INL)	Guihua Yu, Walker Department of Mechanical Engineering, Cockrell School of Engineering	November 1 2018	February 15 2020	16 months	EUR 99 865,00	USD 86 350,00
UTAP-EXPL/NTEC/0038/2017	NANOTHER	TAMs-targeted and externally controlled nanotheranostics of triple-negative-breast-cancer	Nanotechnologies	Manuel Bañobre López, International Iberian Nanotechnology Laboratory (INL)	Zhengrong Cui, Dell Medical School	November 1 2018	December 31 2020	26 months	EUR 98 550,00	USD 85 691,00
UTAP-EXPL/CTE/0050/2017	UT-BORN-PT	Unconventional Thermoelectrics Based on Self-Organized Binary Nanocrystal Superlatices	Nanotechnologies	Yuri Kolen'ko, International Iberian Nanotechnology Laboratory (INL)	Brian Korgel, McKetta Department of Chemical Engineering, Cockrell School of Engineering	November 1 2018	April 30 2020	18 months	EUR 98 881,00	USD 85 593,00
UTAP-EXPL/MAT/0017/2017	DGCOAST	Modeling and Analysis of Coastal Hydrodynamics and Erosion	Space-Earth Interactions	Juha Hans Videman, Mathematics Department of Instituto Superior Técnico, University of Lisbon (IST/UL)	Clint Dawson, Department of Aerospace Engineering and Engineering Mechanics, Cockrell School of Engineering and The Oden Institute for Computational Engineering and Sciences	November 1 2018	October 31 2020	24 months	EUR 98 750,00	USD 70 000,00

Ref.	Acronym	Project Title	Scientific Area	Principal Investigator PT and Affiliation	Principal Investigator UT and Affiliation	Start Date	End Date	Duration	Approved Funding PT	Approved Funding at UT Austin
UTAP-EXPL/CD/0106/2017	I SEA	Immersive virtual reality environments to evaluate audience attitudes about science communication projects: a pilot study of deep sea ecosystems	Space-Earth Interactions	Carla Morais, Faculty of Sciences of the University of Porto (FCUP)	Lucy Atkinson, Stan Richards School of Advertising & Public Relations, Moody College of Communication	November 1 2018	October 31 2020	24 months	EUR 99 860,00	USD 79 000,00
UTAP-EXPL/OSC/0115/2017	MUSAS	Mapping of Underwater Soil of the Azores using Sdr based in-sas Ocean Science	Space-Earth Interactions	Sérgio Reis Cunha, Faculty of Engineering of the University of Porto (FEUP)	Preston Wilson, Walker Department of Mechanical, Cockrell School of Engineering	January 28 2019	Abandoned	Abandoned	Abandoned	Abandoned
UTAP-EXPL/EAC/0056/2017	STORM	Atmosphere – Ocean – Solid Earth Coupling: Seismic Tools to Explore and Monitor the Oceans	Space-Earth Interactions	Susana Custódio, FCiências.ID – Associação para a Investigação e Desenvolvimento de Ciências	Tan-Bui Thanh, Department of Aerospace Engineering and Engineering Mechanics, Cockrell School of Engineering; Oden Institute for Computational Engineering Sciences	November 6 2018	May 5 2021	30 months	EUR 99 984,00	USD 75 000,00

STREACKER

ADVANCED COMPUTING

Skeletal Tracking Enhanced with Anatomically Correct Kinematics for Exergames and Rehabilitation

Start Date: 01-OCT-2018
Duration: 18 months
Keywords: Skeletal Tracking, Kinect Sensor, Vector Orthogonalization, Machine Learning
Website: streacker.inesc-id.pt/home/

Some indicators:

10 Published papers in peer-reviewed Journals and Conferences
1 MSc. student funded
1 Mobility exchange supported
1 Scientific event organized
1 Computational application developed

Team

Principal Investigator in Portugal
Daniel Simões Lopes, Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento em Lisboa (INESC ID/INESC/IST/ULisboa)
Principal Investigator at UT Austin
Richard Neptune, Walker Department of Mechanical Engineering, Cockrell School of Engineering
Other partner organizations
Mechanical Engineering Institute (IDMEC)
Hospital Professor Doutor Fernando Fonseca, EPE

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

This project aimed at developing and implementing a machine learning algorithm capable of estimating anatomically correct body segment rotations based on minimal marker-sets, namely, stick-figures acquired from motion capture systems such as the Kinect sensor, Qualisys or Vicon. More specifically, the ill-posed problem at hands consisted of estimating the 6th degree of freedom (rolling angle) from only 2 non-coincident points that belong to a rigid body (body segment).

The main outcome of STREACKER was the positive results obtained from the machine learning algorithm: through a supervised learning approach, the team was able to estimate the longitudinal rotation angles that revealed to be, in general, anatomically correct with a maximum error that is near 10 degrees.

The developed machine learning algorithm is expected to augment current motion capture systems that are used not only in Gait Labs, but also in exergames and rehabilitation settings. In particular, motion capture systems that are 'markerless' (VicoVR, Kinect) or perform full-body tracking with a single RGB-camera (PoseNet), which do not require placing optical markers upon the user, will benefit to a great extent from STREACKER's algorithm as they resort on a minimal set stick-figure model that is similar to the one the team has considered.

The potential economic value of the technology resides mostly in the video game and fitness industries as well as rehabilitation and motion capture laboratory niches.

Highlights

• A motion database;
• A machine-learning algorithm to estimate anatomically correct longitudinal rotations;
• Marker set protocol, experimental acquisition model, and biomechanical model.

Scientific Outputs (Examples)

-Duarte, Stéphane, **Compreender o Processo de Adoção de Tecnologias Interativas em Centros de Reabilitação**, Department of Computer Science and Engineering, Instituto Superior Técnico, Universidade de Lisboa, 2019 (Masters' Dissertation)

- S.F. Paulo, F. Relvas, H. Nicolau, Y. Rekik, V. Machado, J. Botelho, J.J. Mendes, L. Grisoni, J.A. Jorge, D.S. Lopes, **Touchless interaction with medical images based on 3D hand cursors supported by single-foot input: A case study in dentistry**, Journal of Biomedical Informatics, Volume 100, 103316, 2019. https://doi.org/10.1016/j.jbi.2019.103316

- Daniel Simões Lopes, Sara M. Pires, Carolina D. Barata, Vasco V. Mascarenhas & Joaquim A. Jorge, **The hip joint as an egg shape: a comprehensive study of femoral and acetabular morphologies**, Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization, 2020. https://doi.org/10.1080/21681163.2019.1709902

- T. Alves, H. Carvalho, D.S. Lopes, **Winning Compensations: Adaptable Gaming Approach for Upper Limb Rehabilitation Sessions based on Compensatory Movements**, Journal of Biomedical Informatics, 2020 (accepted for publication, in press)

STREACKER

ADVANCED COMPUTING

Skeletal Tracking Enhanced with Anatomically Correct Kinematics for Exergames and Rehabilitation

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

- D. S. Lopes, A. Faria, A. Barriga, S. Caneira, F. Baptista, C. Matos, A.F. Neves, L. Prates, A.M. Pereira, H. Nicolau, **Visual Biofeedback for Upper Limb Compensatory Movements: A Preliminary Study Next to Rehabilitation Professionals**, EuroVis 2019, DOI: https://doi.org/10.2312/eurp.20191139

- D.S. Lopes, F. Relvas, S. Paulo, Y. Rekik, L. Grisoni, J.A. Jorge. 2019. **FEETICHE: FEET Input for Contactless Hand gEsture Interaction.** In The 17th International Conference on Virtual Reality Continuum and its Applications in Industry (VRCAI '19), November 14–16, 2019, Brisbane, QLD, Australia. ACM, New York, NY, USA, 10 pages. DOI: 10.1145/3359997.3365704

- Afonso Faria, Stephane Duarte, Daniel Simões Lopes, Hugo Nicolau, **Proximity-aware Interactive Displays For Rehabilitation Centres,** Proceedings of the 4th International Congress of CiiEM - Health, Well-Being and Ageing in the XXI Century, June 2 to 5, 2019, Lisboa, Portugal

- Alexandre Gordo, Inês Silva, Hugo Nicolau, Daniel Simões Lopes**, On The Potential Of Virtual Reality For Locomotion Rehabilitation**, Proceedings of the 4th International Congress of CiiEM - Health, Well-Being and Ageing in the XXI Century, June 2 to 5, 2019, Lisboa, Portugal

- Nuno Vaz Matias, Ivo Roupa, Sérgio Gonçalves, Miguel Tavares da Silva, Daniel Simões Lopes, **Estimating Anatomically Plausible Segment Orientations using a Kinect One Sensor,** Proceedings of the 4th International Congress of CiiEM - Health, Well-Being and Ageing in the XXI Century, June 2 to 5, 2019, Lisboa, Portugal

- Ivo F. Roupa, Sérgio B. Gonçalves, Miguel Tavares da Silva, **Inverse Kinematic Analysis of Human Movement using Fully Cartesian Coordinates with Mixed Coordinates,** Virtual Physiological Human Conference (VPH 2020), 26-28 August 2020, Paris, France

- I. Roupa, S.F. Paulo, S.B. Gonçalves, M. Tavares da Silva, D.S. Lopes, **Estimation of Lower Limb Segment Orientation using Motion Envelopes: A Preliminary Study**, Annual Meeting of the European Society for Movement Analysis in Adults and Children (ESMAC 2020), 11 – 16 October 2021, Odense, Denmark

2DMS

NANOTECHNOLOGIES

Two dimensional magnetic semiconductors

Start Date: 01-SEP-2018
Duration: 24 months
Keywords: 2D Materials, Diluted Magnetic Semiconduct, Synthesis, Magnetic and Optical Properties

Some indicators:

17 Published papers in peer-reviewed Journals
1 (review paper) Jointly authored (PT-US) in preparation at the time of data collection
1 MSc. and **3** Doctoral students involved in research work
2 Mobility exchanges supported
2 Awards granted to members of the research team
Prof. Allan MacDonald - Wolf Prize in Physics 2020;
Prof. Xiaoqin Li - Peter O'Donnell Award by the Academy of Medicine, Engineering and Science of Texas
1 New funding application deriving from 2DMS project

Team

Principal Investigator in Portugal
Joaquín Fernández-Rossier, International Iberian Nanotechnology Laboratory (INL)
Principal Investigator at UT Austin
Xiaoqin Li, College of Natural Sciences
Other partner organizations
University of Minho (UMinho)

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

The original goal of this project was dual. First, to explore the synthesis of a new class of 2D materials that are at the same time semiconductors and ferromagnetic, by doping a well-known class of 2D semiconductors, transition metal dichalcogenides, with magnetic atoms such as Fe. Second, to anticipate the magneto-optical properties of this class of compounds, paying attention to the challenging problem of probing magnetism in 2D Materials.

The overarching long-term goal of this research line was to explore ferromagnetic 2D materials that could be integrated into vertical stacks with other 2D materials to produce functional devices, such as spintronic devices.

In the short run, the impact belongs to the fundamental research area. Given the very high interest of this field of magnetic 2D materials, the project has already led to publications in journals with high visibility (Science, Nano Letters, Andgewandte Chemie, 2D Materials). In the long run, the results of the project could set the foundations of a new class of functional materials. In order to maximise the impact of the project, the INL and UT partners at the time of data collection for this report were writing a review paper on the state-of-the-art of the emerging field of 2D diluted magnetic semiconductors.

Highlights

- Publication in 2D Materials of the theory of MOKE for diluted magnetic 2D dichalcogenides;
- Invited Science paper;
- Invited review paper in Nano Letters;
- Publication in Nature Communications.

Scientific outputs (examples)

- **Interplay between spin proximity effect and charge-dependent exciton dynamics in MoSe2/CrBr3 van der Waals heterostructures,** TP Lyons, D Gillard, A Molina-Sánchez, A Misra, F Withers, PS Keatley, A Kozikov, T Taniguchi, K Watanabe, KS Novoselov, J Fernández-Rossier, AI Tartakovskii Nature Communications 11, 6021 (2020)

- **Magnetic Two-Dimensional Chromium Trihalides: A Theoretical Perspective** D. Soriano, M. I. Katsnelson, and J. Fernández-Rossier, Nano Letters 2020 20 (9), 6225-6234, https://arxiv.org/abs/2008.08855

- **Topological Magnons in CrI3 monolayers: an itinerant fermion description** A. Costa, D. Santos, N. M. R. Peres, J. Fernández-Rossier 2D Materials (September 22 2020)

- **Magneto-optical response of Chromium trihalide monolayers: chemical trends** A. Molina-Sánchez, G. Catarina, D. Sangalli, J. Fernández-Rossier, Journal of Materials Chemistry C, https://doi.org/10.1039/D0TC01322F

- **Magneto-optical Kerr effect in spin split two-dimensional massive Dirac materials** G. Catarina, N. M. R. Peres, J. Fernández-Rossier, 2D Materials 7, 025011 (2020)

2DMS

NANOTECHNOLOGIES

Two dimensional magnetic semiconductors

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- **Excitonic magneto-optical Kerr effect in 2D transition metal dichalcogenides induced by spin proximity** J. C. G. Henriques, G. Catarina, A. T. Costa, J. Fernández-Rossier, N. M. R. Peres Physical Review B 101, 045408 (2020)

- **Quantum confinement of Dirac quasiparticles in graphene patterned with subnanometer precision** E. Cortés-del Río, P. Mallet, H. González-Herrero, J.L. Lado, J. Fernández-Rossier, J.M. Gómez-Rodríguez, J-Y. Veuille, I. Brihuega Advanced Materials June 22 2020;

- **Collective All-Carbon Magnetism in Triangulene Dimers** S. Mishra, D. Beyer, K. Eimre, R. Ortiz, J. Fernández-Rossier, R. Brger, O. Gröning , C. A. Pignedoli, R. Fasel, X. Feng, P. Ruffieux Angewandte Chemie International Edition 59, 12041-12047 (2020) https://doi.org/10.1002/anie.202002687

- **Exchange rules for diradical Pi-conjugated hydrocarbons** R. Ortiz, R. A. Boto, N. García-Martínez, J. C. Sancho-García, M. Melle-Franco and J. Fernández- Rossier Nano Letters 19, 5991 (2019)

- **Interplay between interlayer exchange and stacking in CrI3 D**. Soriano, C. Cardoso, J. Fernández-Rossier Solid State Communications 299, 113662 (2019)

- **Imaging magnetic 2D crystals with quantum sensors** J. Fernández-Rossier Science 364, 935 (2019)

- **Hybrid plasmon-magnon polaritons in graphene-antiferromagnet heterostructures** Y. V. Bludov, J. N. Gomes, G. A. Farias, J. Fernández-Rossier, M. I. Vasilevskiy, N.M.R. Peres 2D Materials, 6 045003 (2019)

- **Dehydropeptide-based plasmonic magnetogels: a supramolecular composite nanosystem for multimodal cancer therapy,** S.R.S. Veloso, J.A. Martins, L. Hilliou, C.O. Amorim, V.S. Amaral, B.G. Almeida, P.J. Jervis, R. Moreira, D.M. Pereira, P.J.G. Coutinho, P.M.T. Ferreira, E.M.S. Castanheira, J. Mater. Chem. B, 8, 45 (2020)

- **Magnetoliposomes Containing Calcium Ferrite Nanoparticles for Applications in Breast Cancer Therapy**, DSM Pereira, BD Cardoso, ARO Rodrigues, CO Amorim, VS Amaral, BG Almeida, MJRP Queiroz, O Martinho, F Baltazar, RC Calhelha, ICFR Ferreira, PJG Coutinho, SEM Castanheira, Pharmaceutics, 11 (9), 477 (2019)

- **Development of Multifunctional Liposomes Containing Magnetic/Plasmonic MnFe2O4/Au Core/Shell Nanoparticles**, Ana Rita O. Rodrigues, Joana O. G. Matos, Armando M. Nova Dias, Bernardo G. Almeida, Ana Pires, André M. Pereira, João P. Araújo, Maria-João R. P. Queiroz, Elisabete M. S. Castanheira, Paulo J. G. Coutinho, Pharmaceutics, 11, 10 (2019)

- **Magnetoliposomes containing magnesium ferrite nanoparticles as nanocarriers for the model drug curcumin,** B.D. Cardoso, I.S. R. Rio, A. R. O. Rodrigues, F. C. T. Fernandes, B. G. Almeida, A. Pires, A. M. Pereira, J. P. Araújo, E. M. S. Castanheira, P. J. G. Coutinho, Royal Society Open Science, 5, 181017 (2018)

- **Functionalized magnetic composite nano/micro ibres with highly oriented van der Waals CrI3 inclusions by electrospinning**, Vahideh B. Isfahani, João H. Belo, Loukya Boddapati, Anabela G. Rolo, Rosa M. F. Baptista, Francis Leonard Deepak, João P. Araújo, Etelvina de Matos Gomes, Bernardo G. Almeida, Nanotechnology 32 145703, (December 2020); DOI: 10.1088/1361-6528/abd4a3

BlueEnergy

NANOTECHNOLOGIES

Large scale blue energy harvesting using hybrid triboelectric/photovoltaic systems for the long-term deployment of Autonomous Underwater Vehicles

Start Date: 01-OCT-2018
Duration: 18 months
Keywords: Energy Harvesting, Triboelectric Nanogenerators, Solar Energy, Autonomous Underwater Vehicles

Some indicators:

5 Published papers in peer-reviewed Journals and Conferences
1 Book accepted for publication
2 PhDs, **3** MSc. and **4** Undergraduate students involved in research work
3 Scientific events organized
2 Prototypes
- Dry bench testing system
- Bluetooth datalogger

Team

Principal Investigator in Portugal
João Ventura, Faculty of Sciences of the University of Porto (FCUP)
Principal Investigator at UT Austin
Edward Yu, Department of Electrical and Computer Engineering, Cockrell School of Engineering
Other partner organizations
INESC TEC - Institute for Systems and Computer Engineering, Technology and Science

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

BlueEnergy proposed to develop the first hybrid energy harvesting system to be installed in the ocean and enable the long-term deployment of Autonomous Underwater Vehicles. Such an achievement was expected to foster the continuous monitoring of environmental and human activities in remote oceanic locations, a key objective of the Azores International Research Center.

Two recent complementary developments motivated the project's ambitious goal. The first is the realization of triboelectric nanogenerators (TENGs), a novel technology that can efficiently harvest low amplitude, low frequency wave energy. This marks a rupture from present wave farms based on low performance electromagnetic generators. The triboelectric effect is related with the build-up of static charges when two materials are rubbed together. By contacting and separating materials with oppositely charged surfaces, power densities above 500 W/m2 can be generated. The second is the discovery that motheye structures (arrays of vertical nanopillars), besides functioning as broad-spectrum, omnidirectional antireflective surfaces that increase the performance of photovoltaic cells by over 1.5x, also result in a high degree of hydrophobicity.

TENGs were developed based on state-of-the-art materials and nanofabrication techniques, including by doping and texturizing with nano-features to enhance the generated electrical output. Ocean-adapted photovoltaic technology was developed based on large-area, motheye-textured surfaces produced by nanosphere lithography, allowing the development of hydrophobic antireflective surfaces. Dedicated power conditioning and remote measurement electronics for the harvesting modules were developed for a maritime context.

This exploratory project, which highlighted emerging areas of interest in micro- and nanomaterial transport phenomena, including spintronics, represents an important first step towards the implementation of large networks of hybrid generators to act as distributed power sources for autonomous Ocean technology.

Highlights

• Enhanced and scalable triboelectric materials to be used in salt water environments by functionalizing and texturing their contact surfaces using nano-patterns;
• Photovoltaic modules involving nanostructured motheye glass packaging that are corrosion-resistant, hydrophobic and self-cleaning;
• Power conditioning electronics and dedicated power management systems able to cope with these energy harvesting technologies involving novel TENG prototypes generating electrical energy from wave motion;
• One book to be published by Elsevier: Transport phenomena in micro and nanoscale functional materials and devices, J. B. Sousa, J. Ventura, A. M. Pereira.

Scientific outputs (examples)

- **Transport phenomena in micro and nanoscale functional materials and devices**, J. B. Sousa, J. Ventura, A. M. Pereira., Elsevier (publication due in March 2021)

- **Emerging Triboelectric Nanogenerators for Ocean Wave Energy Harvesting: State of the Art and Future Perspectives**, C. Rodrigues, D. Nunes, D. Clemente, N. Mathias, J.M. Correia, P. Rosa Santos, F. Taveira-Pinto, T. Morais, A. Pereira, J. Ventura, Energy &

BlueEnergy

NANOTECHNOLOGIES

Large scale blue energy harvesting using hybrid triboelectric/photovoltaic systems for the long-term deployment of Autonomous Underwater Vehicles

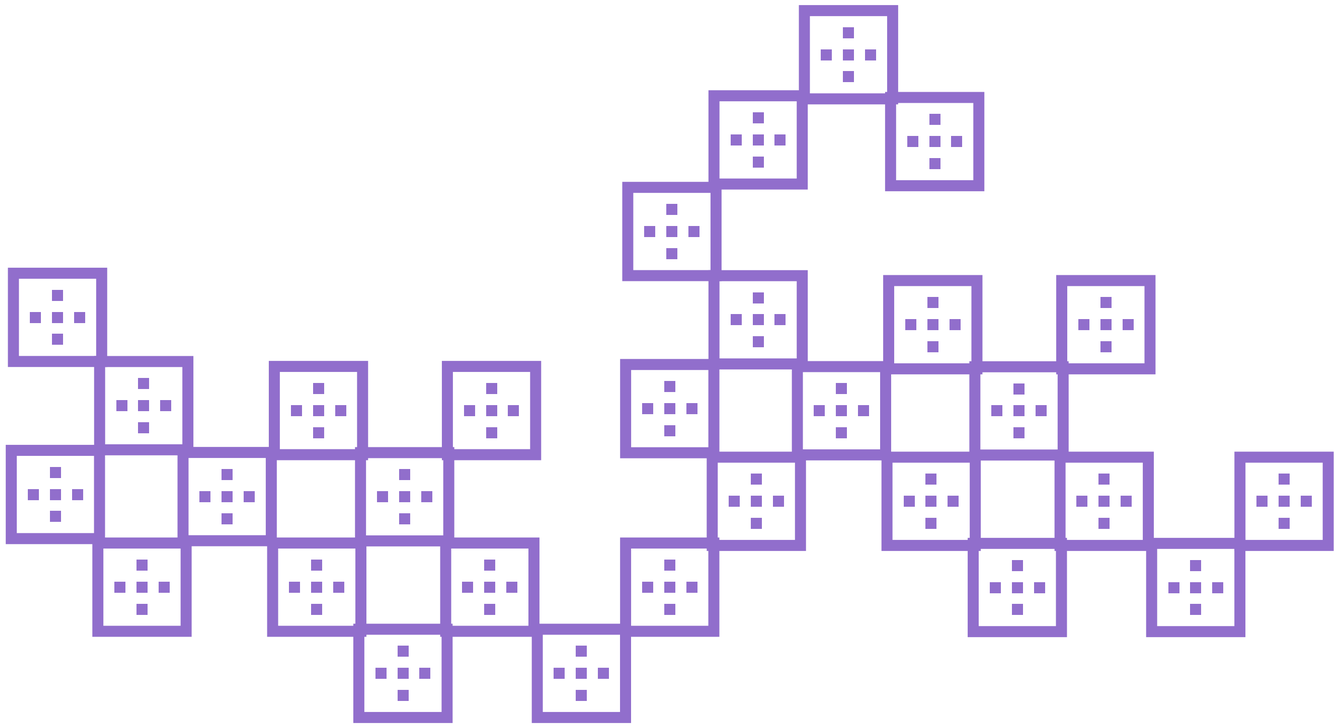
Environmental Science 13, 2657-2683 (2020).

- **Zeta Potential Dependent Self-Assembly for Very Large Area Nanosphere Lithography**, Gabriel Cossio, Edward T. Yu, Nano Lett. 20, 0c01277 (2020).

- **Triboelectric energy harvesting in harsh conditions: temperature and pressure effects in methane and crude oil environments**, C. Rodrigues, M. Kumar, M. P. Proenca, J. Gutierrez, R. Melo, A. Pereira, J. Ventura, Nano Energy 72, 104682 (2020).

- **Power-Generating Footwear Based on a Triboelectric-Electromagnetic-Piezoelectric Hybrid Nanogenerator**, C. Rodrigues, A. Gomes, A. Ghosh, A. Pereira, J. Ventura, Nano Energy 62, 660666 (201 9).

- **Experimental Evaluation of TENGs for Energy Harvesting in Maritime Applications**, Ricardo Esteves, Catia Rodrigues, Joao Ventura, Andre Pereira, Candido Duarte, Vasco Correia, Luís Pessoa, OCEANS 2019 Marseille, Marseille, France, 2019, pp. 1-4, doi: 10.1109/ OCEANSE. 2019.8867376.



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CONTROLLUB

NANOTECHNOLOGIES

Self-lubricant coatings for high-temperature applications with controlled release of the lubricious agent

Start Date: 01-NOV-2018
Duration: 23 months
Keywords: Self-lubricant coatings, Ag control release, Kinetics of Ag diffusion, Atomistic simulation of Ag ions release

Some indicators:

10 Published papers in peer-reviewed Journals and Conferences
1 Jointly authored (PT-US) at the time of data collection
2 PhD and **2** Msc. students involved in research work
6 oral communications abroad
1 Strategic Research Project granted 3-year funding

Team

Principal Investigator in Portugal
Albano Cavaleiro, Faculty of Sciences and Technology, University of Coimbra (UC)
Principal Investigator at UT Austin
Yuanyue Liu, Walker Department of Mechanical Engineering, Cockrell School of Engineering
Other partner organizations
University of Minho (UMinho)

UTAustin Portugal

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TEXAS The University of Texas at Austin

Summary

Self-lubricant coating systems with the release of the lubricous species have enormous potential to be used in the protection of surfaces of components working in extreme conditions of wear. However, the rapid release of the lubricious agent and, consequently, its total depletion from the coating, has delayed the transfer of these coatings to the industry, not being still an alternative to existing solutions.

This project focused on the development of a new class of thin films with the capacity to control the lubricious metal release, to get a proper long-term solid lubrication at high-temperature conditions. Nanocomposite TiSiN films composed by nanograins of TiN imbibed in a Si-N matrix was the solution proposed to control the lubricious Ag ions to reach long term lubrication. In fact, Si-N phase is well known to have anti-diffusion properties which, if proper tailored (thickness and distribution), can control the lubricious agent release.

Therefore, the project sought to explore the benefits of this nanocomposite structure with high dense interfaces as a tool to control the diffusion of silver (Ag) which the team wanted to use as a lubricious agent at high temperatures. A proposed synergy between atomistic simulations with experimental research was implemented towards the success of the work plan.

The newly developed films are expected to disrupt manufacturing by providing additional functionality, increase lifetime and reliability of components for several industries (e.g. machining, stamping, forming, automotive, aerospatial), while reducing energy consumption, CO2 emissions, maintenance and avoiding of the use of hazards lubricants, having, thus, direct impact on society and economy. Breakthroughs in simulation aspects, deposition technologies and films will expand knowledge beyond the present state of the art.

The results of this 2017 ERP are now being further exploited in the frame of the 2019 industry-driven MCTOOL 21 project | "Manufacturing of cutting tools for the 21st century: from nano-scale material design to numerical process simulation" (reference: POCI-01-0247-FEDER-045940), co-financed by the European Regional Development Fund, through Portugal 2020 (PT2020), and by the Competitiveness and Internationalization Operational Programme (COMPETE 2020).

Highlights

- Newly self-lubricant coatings with proper control release of the lubricious phase which can provide long-term lubrication at high temperature;
- Deposition of hard and dense nanocomposite Ti-Si-N(Ag) films by high power impulse magnetron sputtering working in deep oscillation mode without the need for energetic bombardment;
- Main mechanisms governing Ag diffusion in bulk TISiN materials uncovered, with silver transport being mediated by vacancy and not interstitial defects;
- Energy barrier for Ag diffusion in Duffy-Tasker Grain boundaries as low as 0.2 eV, supporting the evidence of GBs as one main path for Ag diffusion in TiN;
- Corrected forcefield for molecular dynamics simulation of TiN: Ag-based materials.

CONTROLLUB

NANOTECHNOLOGIES

Self-lubricant coatings for high-temperature applications with controlled release of the lubricious agent

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Scientific outputs (examples)

- D. Cavaleiro, S. Carvalho, A. Cavaleiro, F. Fernandes, **TiSiN(Ag) films deposited by HiPIMS working in DOMS mode: Effect of Ag content on structure, mechanical properties and thermal stability**, Applied Surface Science, 478 (2019) 426-434. January 2019. https://doi.org/10.1016/j.apsusc.2019.01.174

- D. Cavaleiro, A. Cavaleiro, S. Carvalho, F. Fernandes, **Oxidation behaviour of TiSiN(Ag) films deposited by high power impulse magnetron sputtering**, Thin Solid Films, 688 (2019) 137423. July 2019. https://doi.org/10.1016/j.tsf.2019.137423

- F. Fernandes, S. Calderon V., P.J. Ferreira, A.Cavaleiro, J.C. Oliveira, **Low peak power deposition regime in HiPIMS: Deposition of hard and dense nanocomposite Ti-Si-N films by DOMS without the need of energetic bombardment**, Surf. Coat. Technol., 397 (2020) 125996. https://doi.org/10.1016/j.surfcoat.2020.125996

- D. Cavaleiro, D.Veeregowda, A. Cavaleiro, S. Carvalho, F. Fernandes, **High temperature tribological behaviour of TiSiN(Ag) films deposited by HiPIMS in DOMS mode**, Surf. Coat. Technol, 399 (2020), 126176. https://doi.org/10.1016/j.surfcoat.2020.126176

- A. Al-Rjoub, A. Cavaleiro, F. Fernandes, **Influence of Ag alloying on the morphology, structure, mechanical properties, thermal stability and oxidation resistance of multilayered TiSiN/Ti(Ag)N films**, Materials & Design, 192 (2020) 108703. https://doi.org/10.1016/j. matdes.2020.108703

- F. Fernandes; A. AL-Rjoub; D. Cavaleiro; T. Polcar; A. Cavaleiro. **Room and High Temperature Tribological Performance of Multilayered TiSiN/TiN and TiSiN/TiN(Ag) Coatings Deposited by Sputtering**. Coatings 10 (2020) 1191. https://doi.org/10.3390/coatings10121191

- (Proceedings) International, (oral presentation) - D. Cavaleiro, S. Carvalho, F. Fernandes, **Influence of Ag content on the mechanical, structural and oxidation behaviour of TiSiN(Ag) thin films deposited by HiPIMS**, ICMCTF 2019, May 19-24th, San Diego, USA.

- (Proceedings) International, (oral presentation) - F.Fernandes, D. Cavaleiro, S. Carvalho, A. Cavaleiro, **Influence of Ag content on the high temperature tribological behavior of TiSiN(Ag) films deposited by HiPIMS**, AEPSE – The 12th Asian-European International Conference on Plasma Surface Engineering, September 1-5, Jeju Island, Corea.

- (Proceedings) International (invited presentation) - A. Cavaleiro, **The use of the nanocomposite concept in hard coatings for improving the friction performance**, AVS 66, Columbus, USA, October 2019

- (Proceedings) International, (oral presentation) - D. Cavaleiro, F. Fernandes, S.Carvalho, D. Veeregowda, A. Cavaleiro, **High temperature tribological behaviour of TiSiN(Ag) films deposited by HiPIMS in DOMS mode**, ECOTRIB 2019, Vienna, Austria, 12-14 June 2019

DREAM

NANOTECHNOLOGIES

Drug delivery nanosystem for HPV infection therapy Nanotechnologies

Start Date: 05-NOV-2018
Duration: 26 months
Keywords: AS1411 derivatives G-quadruplex, Nucleolin, Vehicles-drugs, HPV

Some indicators:

14 Published papers in peer-reviewed Journals
1 Doctoral, **4** MSc. and **4** Undergraduate students involved in research work
2 Awards in Portugal
- **Best Oral Communication Award** - XIV Annual CICS-UBI Symposium 2019, Covilhã, Portugal;
- **Best Poster Award in IPVC 2020** - The 33rd International Papillomavirus Conference, Virtual Conference.

4 events organized in Portugal

Team

Principal Investigator in Portugal
Carla Cruz, University of Beira Interior (UBI)
Principal Investigator at UT Austin
Andrew Ellington, College of Natural Sciences
Other partner organizations
HPRD Health Products Research and Development Lda (HPRD)
Association of Instituto Superior Técnico for Research and Development (IST-ID)
Center for Nuclear Sciences and Technologies (C2TN)
Hospital Center of Cova da Beira (CHUCB)

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TEXAS The University of Texas at Austin

Summary

Human papillomaviruses (HPVs) are largely accepted as major etiologic agents for cervical cancer. The implementation of screening and vaccination programs for HPV have reduced cancer incidence and mortality. Although there is still a need to treat patients infected and in the precancerous state, able to clear HPV infection in the early stages of the disease.
Nanotechnology has emerged as a potential therapeutic approach to viral infection and cancer treatment, specifically, DNA-based nanoparticles for antiviral and/or anticancer drugs greatly enhance their bioavailability and increase their target specificity. AS1411 is a G-quadruplex (G4)-forming DNA oligonucleotide that functions as an aptamer of nucleolin (NCL), a protein overexpressed in cancer cells. Two preliminary studies showed the involvement of NCL in the expression of HPV18 oncogene after oligonucleotide binding and HPV16 genome stability.

AS1411 has been used as a drug delivery system and has cellular internalization and anticancer activity by interfering with NCL oncogenic functions. Clinical trials of AS1411 have indicated that it is well tolerated with evidence of therapeutic activity, but improved pharmacology and potency may be required for optimal efficacy. Since G-rich regions have been found in HPVs (LCR, E1, E4 regions) such potential anticancer/antiviral ligands may be a promising new therapeutic strategy against HPV infection. The development of improved AS1411 derivatives, and association with nanoparticles augments available technological approaches to cancer treatment, as does the development of new screens for quadruplexes and the development of cell-penetrating aptamers. The improvement of the ligands' selectivity to HPV infected cells obtained through the conjugation with the AS1411-gold nanoparticles demonstrates the ability of these systems to improve the selectivity of potential anticancer/antivirals that, in normal situations, cannot be applied due to their toxicity in healthy tissues. Through their conjugation with the nanoparticles, this roadblock was overtaken, though.

This is an important finding that can be implemented in the pharmaceutical industry because the preliminary ex vivo permeation studies demonstrated the efficacy of the formulation in penetrating and accumulating the nanosystems in the target cells. The micelles were also able to penetrate cervix tissue biopsies of patients with HPV infection in precancerous stages, demonstrating the potential of this system to treat HPV infection in its latent stage, preventing oncogenesis and cervical cancer progression. The administration route of the drug-loaded nanosystems was also addressed. The C8-loaded micelles were formulated as a gel for local application in the female genital tract, specifically tissue with precancerous lesions and/or HPV infection.

Highlights

- Biopsies of patients with HPV infection (low and high grade) provided by the CHUCB hospital and IPATIMUP expressed high levels of NCL;
- Ethics Committee approval from CHUCB study number 92/2018 to manipulate biological material from women infected with HPV;
- Establishment of stable organotypic cultures with episomal high risk HPVs 16 and 18 providing new collaborations;
- Development of drug-loaded AS1411-functionalized micelles, and their local administration in vaginal tissue using gel formulations;
- Conjugation of AS1411 with the gold nanoparticles improved the selectivity of the cervical cancer cells.

Scientific outputs (examples)

- Carvalho, J., Mergny, J.-L., Salgado, G. F., Queiroz, J. A. and Cruz, C. **G-quadruplex, Friend or Foe: The Role of the G-quartet in Anticancer Strategies**. Trends in Molecular Medicine, 2020. https://doi.org/10.1016/j.molmed.2020.05.002;

DREAM

NANOTECHNOLOGIES

Drug delivery nanosystem for HPV infection therapy Nanotechnologies

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- Lopes-Nunes, J., Carvalho, J., Figueiredo, J., Ramos, C. I. V., Lourenço, L. M. O., Tomé, J. P. C., G.P.M.S. Neves, M., Mergny, J.-L., Queiroz, J. A., Salgado, G. F., Cruz, C. **Phthalocyanines for G-quadruplex aptamers binding**. Bioorganic Chemistry 103920, 2020. https://doi.org/10.1016/j.bioorg.2020.103920;

- Carvalho, J., and Cruz, C. **Forster resonance energy transfer for studying nucleic acids denaturation: A chemical and biological sciences laboratory experiment**. Biochemistry and Molecular Biology Education, 2019. https://doi.org/10.1002/bmb.21353;

- Eddahmi, M., Moura, N. M. M., Bouissane, L., Faustino, M. A. F., Cavaleiro, J. A. S., Paz, F. A. A., Mendes, R. F., Figueiredo, J., Carvalho, J., Cruz, C., Neves, M. G. P. M. S., and Rakib, E. M. **Synthesis and Biological Evaluation of New Functionalized Nitroindazolylacetonitrile Derivatives**. ChemistrySelect 4, 14335–14342, 2019. https://doi.org/10.1002/slct.201904344;

- Santos, T., Pereira, P., Queiroz, J.A., Cruz, C., Sousa, F. **Plasmid production and purification: An integrated experiment-based biochemistry and biotechnology laboratory course**. Biochemistry and Molecular Biology Education, 2019. https://doi.org/10.1002/bmb.21290;

- Santos, T., Pereira, P., Campello, M.P.C., Paulo, A., Queiroz, J.A., Cabrita, E., Cruz, C. **RNA G-quadruplex as supramolecular carrier for cancer-selective delivery**. European Journal of Pharmaceutics and Biopharmaceutics, 142, 473-479, 2019. https://doi.org/10.1016/j.ejpb.2019.07.017;

- Figueiredo, J., Lopes-Nunes, J., Carvalho, J., Antunes, F., Ribeiro, M., Campello, M.P.C., Paulo, A., Paiva, A., Salgado, G.F., Queiroz, J.A., Mergny, J.-L., Cruz, C., 2019. **AS1411 derivatives as carriers of G-quadruplex ligands for cervical cancer cells**. Int. J. Pharm. https://doi.org/10.1016/j.ijpharm.2019.118511;

- Carvalho, J., Santos, T., Carrilho, R., Sousa, F., Salgado, G.F., Queiroz, J.A., Cruz, C., 2019. **Ligand screening to pre-miRNA 149 G-quadruplex investigated by molecular dynamics**. J. Biomol. Struct. Dyn. https://doi.org/10.1080/07391102.2019.1632743;

- Carvalho, J., Paiva, A., Campello, M.P.C., Paulo, A., Mergny, J.-L., Salgado, G.F., Queiroz, J.A., Cruz, C., 2019. **Aptamer-based targeted delivery of a G-quadruplex ligand in cervical cancer cells**. Sci. Reports. https://doi.org/10.1038/s41598-019-44388-9;

- Carvalho, J., Lopes-Nunes, J., Lopes, A.C., Campello, M.P.C., Paulo, A., Queiroz, J.A., Cruz, C., 2019. **Aptamer-guided acridine derivatives for cervical cancer**. Org. Biomol. Chem. https://doi.org/10.1039/C9OB00318E;

- Ramos, C.I.V., Almeida, S.P., Lourenço, L.M.O., Pereira, P.M.R., Fernandes, R., Faustino, M.A.F., Tomé, J.P.C., Carvalho, J., Cruz, C., Neves, M.G.P.M.S., 2019. **Multicharged Phthalocyanines as Selective Ligands for G-Quadruplex DNA Structures**. Molecules. https://doi.org/10.3390/molecules24040733.

Electrowave

NANOTECHNOLOGIES

ELECTROWetting heat pipes for cooling Applications in Electric Vehicles

Start Date: 01-DEC-2018
Duration: 24 months
Keywords: Electrowetting, Heat pipes, Cooling applications, Electric vehicles

Some indicators:

11 Published/accepted papers in peer-reviewed Journals and Conferences
2 Jointly authored (PT-US) at the time of data collection
1 Book chapter published
3 MSc. students involved in research work
1 Patent filed (UT Austin research team)
1 Experimental prototype (research team in Portugal)
2 New funding applications deriving from Electrowave project

Team

Principal Investigator in Portugal
Ana Sofia Moita, Association of Instituto Superior Técnico for Research and Development (IST-ID)
Principal Investigator at UT Austin
Vaibhav Bahadur, Walker Department of Mechanical Engineering, Cockrell School of Engineering
Other partner organizations
Faculty of Engineering of the University of Porto (FEUP)

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TEXAS The University of Texas at Austin

Summary

The Electrowetting Heat Pipe (EHP) is a new cooling technology capable of transporting high heat loads over long distances. The working fluid evaporates in the evaporator (which is in contact with the heat source), thereby removing heat. This vapor then condenses in the condenser (cold region) and the condensate is returned to the evaporator. Conventional heat pipes are limited in their ability to transport high heat loads over long distances.

The EHP solves this issue acting disruptively in two ways: i) using electrowetting-based pumping to move the condensate back to the evaporator, and ii) utilizing electrically enhanced evaporators to enhance heat transfer and prevent dry-out in the evaporator. In this project, the heat transfer enhancement in the evaporator was studied via experiments and numerical analysis.

The project mainly showed that evaporation characteristics can be increased by further enhancing the wetting properties of the evaporator surface (working as the dissipator). The model further provided interesting features on the boiling regime and on the mechanisms explaining such heat transfer enhancement. The results also show that the use of nanofluids offers a potential increase to the boiling heat transfer. However, stability issues limit the concentration of the nanoparticles to be used, thus limiting the enhancement effects. On the other hand, the team at IN+/IST-ID could develop (in collaboration with FEUP) and characterize new sets of stable nanofluids, with potential use in the heat transfer enhancement for several cooling applications. Finally, from the practical side, model and experiments suggest that this heat pipe configuration can be used for cooling purposes in the electric motorizations and in the batteries.

This work is now expected to enable future development of a new class of heat pipes with much higher performance than current heat pipes, with a very low power consumption. This can favourably impact the energy efficiency in many thermal systems. One of the major goals of Electrowave was to evaluate how this disruptive technology could be used in the thermal management of electric vehicles. In fact, efficient thermal management in these vehicles, particularly considering batteries is a real obstacle towards their broader implementation in the mass mobility market, given the current limitations in fast charging. Electrowave showed that such EHP technology is able to cope with the specific thermal management requirements of this important market.

Highlights

• Project of new EHP based on an original patent;
• New nanofluids prepared and characterized, that can be applied in a much broader range of applications, opening a new market opportunity;
• Work presented at the 16th UK Heat Transfer Conference was selected as a highlight and invited to a full publication (in JBE).

Scientific outputs (examples)

- Maia, I., Rocha, C., Pontes, P. Cardoso, V., Miranda, J.M., Moita, A.S., Minas, G., Moreira, A.L.N., Lima, R. (2019) **Heat transfer and fluid flow investigations in PDMS microchannel heat sinks fabricated by means of a low-cost 3D printer**. In: "Advances in Microfluidic Technologies for Energy and Environmental Applications", IntechOpen, (In press). https://dx.doi.org/10.5772/intechopen.89735

- Lima, R., Vega, E.J., Moita, A.S., Miranda, J. M., Pinho, D., Moreira, A.L.N. (2020) **Fast, flexible and low-cost multiphase blood analogue for biomedical and energy applications. Experiments in Fluids**, 61:231 (11 pages). https://doi.org/10.1007/s00348-020-03066-7

Electrowave

NANOTECHNOLOGIES

ELECTROWetting heat pipes for cooling Applications in Electric Vehicles

- Panão, M.O., Moita, A.S., Moreira, A.L.N. (2020) **On the statistical characteristics of sprays**. Applied Sciences, 10:6122. https://www.mdpi.com/2076-3417/10/17/6122

- Figueiredo, M., Marseglia, G., Moita, A.S., Panão, M.R.O., Ribeiro, A.P.C., Medaglia, C.M. Moreira, A.L.N. (2020) **Thermofluid characterization of nanofluid spray cooling combining phase doppler interferometry with high-speed visualization and time-resolved IR thermography**. 10.3390/en13225864

- Pontes, P., Cautela, R., Teodori, E., Moita, A.S., Georgoulas, A., Moreira, A.L.N. (2020) **Bubble dynamics and heat transfer on biphilic surfaces: experiments and numerical simulation**. Journal of Bionic Engineering, published online on the 25th June 2020. https://doi.org/10.1007/s42235-020-0064-x

- Pontes, P., Cautela, R. Teodori, E., Moita, A. S., Georgoulas, A., Moreira, A. L. N. (2019) **Bubble dynamics and heat transfer on biphilic surfaces.** 16th UK Heat Transfer Conference, The University of Nottingham, 8-10 September, Nottingham, UK.

- (Accepted) Pontes, P., Freitas, E., Cautela, R., Moita, A.S., Miranda, J., Lima, R., Ribeiro, A.P.C., Moreira, A.L.N. (2022) **Pool boiling of nanofluids on biphilic surfaces**. To be presented at the 3rd Int. Conf. on Interfacial Phenomena and Heat-Mass-Transfer, 5-9 July, Marseille, France.

- Bohinikova, A., Maia, I., Smieskova, M., Buganova, A., Moita, A.S., Cimrak, I., Lima, R. (2020) **Assessment of computational cell mode benefits for optimization of microfluidic devices.** 13th International Joint Conference on Biomedical Engineering Systems and Technologies, Biodevices 2020, 24-26 February, Valletta, Malta. DOI: 10.5220/0009173202800287

- (Accepted) Pontes, P., Moita, A. S., Moreira, A.L.N. (2021) **Design optimization of microchannel geometry using a genetic algorithm parallel with Openfoam.** Accepted to be presented at the 15th Int. Conf. on Heat Transfer, Fluid Mechanics and Thermodynamics, 20-22 July, Amsterdam, Netherlands

- Ferrão, I., Silva, A., Moita, A. S., Mendes, M., Costa, M. (2020) **Single droplet combustion of aluminum nanoparticles added to a biofue**l. ILASS-Asia 2020, 23-26 October, Zhenjiang, China (online conference). Lista de publicações · Ana Sofia Oliveira Henriques Moita (ulisboa.pt)

- Freitas, E., Pontes, P., Cautela, R., Bahadur, V., Miranda, J., Ribeiro, A.P.C., Souza, R.R. Oliveira, J.D., Copetti, J.B., Lima, R., Pereira, J.E., Moreira A.L.N., Moita, A.S. (201) **Nanomaterials, Pool boiling of nanofluids on biphilic surfaces: an experimental and numerical study**. Nanomaterials, 125(11):1-23. https://doi.org/10.3390/nano11010125 (open Access)

- Freitas, E., Pontes, P., Cautela, R., Moita, A.S., Bahadur, V., Miranda J., Lima, R., Ribeiro, A.P.C., Moreira, A.L.N. **Pool boiling of nanofluids on biphilic surfaces.** Eurotherm 2020 – 8th edition of the European Thermal Sciences Conference, Lisbon Portugal (postponed)

- Master thesis (Concluded) Freitas, Eduardo Jorge Pereira (2020) **Pool boiling of nanofluids using biphilic surfaces**. University of Minho (Final grade 20/20).

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

MECHANO

NANOTECHNOLOGIES

From the mechanobiology of the glial to the management of multiple sclerosis

Start Date: 01-NOV-2018
Duration: 24 months
Keywords: Nanomedicine, Molecularly Designed Hydrogels, Mechanobiology, Bioprinting

Some indicators:

3 Published papers in peer-reviewed Journals and Conferences
3 Doctoral students and **2** MSc. students involved in research work
1 Bioprinter prototype (IPLeiria – PT)
1 Mobility exchange supported
2 Awards granted to members of the team

Best elevator pitch award given to Eva Carvalho (INEB - PT) with the work: Carvalho ED, Araújo MA, Hubbe H, Mendes E, Barrias CC, Pêgo AP. "***Mechanosensing the demyelinating lesions' environment - Impact of environmental mechanostimulus on oligodendrocyte differentiation and myelination***". XXIII School of Pure and Applied Biophysics – Emerging Tools in Biomechanics: from tissues down to single molecules. 4-8 February 2019, Palazzo Franchetti, Venice, Italy.

Best Oral presentation award given to Eva Carvalho (INEB – PT) with the work: Carvalho ED, Araújo M, Barrias C, Pêgo AP "***Towards the development of biologically relevant platforms to study glial cell mechanotransduction: an alginate-based approach***". 3rd Doctoral Congress in Engineering (DCE 2019), Faculdade de Engenharia, Universidade do Porto, June 27-28, 2019, Porto, Portugal.

Team

Principal Investigator in Portugal
Ana Paula Pêgo, Institute of Biomedical Engineering - INEB
Principal Investigator at UT Austin
Laura Suggs, College of Natural Sciences
Other partner organizations
Polytechnic Institute of Leiria (IPLeiria)
Nanohmics (Nanohm)

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

With over 700,000 affected patients in the EU, Multiple Sclerosis (MS) represents the most frequently occurring demyelinating disease of the central nervous system (CNS). Remyelination can be observed in MS plaques. But as the disease progresses this regenerative capacity of oligodendrocyte progenitor cells (OPCs) stops. What are the reasons underneath this change? One accepted reason is the formation of the scar tissue, which is seen as a hostile terrain in the context of CNS regeneration. Although the process is inexorable, it is mutable in time. Can we use this knowledge as an opportunity to manage the disease progression?

There is growing evidence that matrix rigidity plays a key role in the process of OPC differentiation and oligodendrocyte myelination by unbalancing the intra/extracellular forces. Recent studies have established the effect of biophysical properties of the extracellular matrix (ECM) on these processes, pointing to the importance of ECM stiffness and topography, strain forces and spatial constraints. Based on current knowledge, our working hypothesis is that by tuning mechanosensing processes one can promote remyelination.

This innovative approach aimed to develop a biomimetic lesion microenvironment to function as a platform to allow the identification of molecules/mechanisms regulating OPC differentiation and study the impact of the mechanical properties on MS progress and prognosis, thus ultimately contributing to the development of new therapeutic approaches to treat MS.

The proposed tissue-engineered system should mimic the ECM features at the relapse and remitting stages of the disease, where a therapeutic intervention at the OPC level could promote a pro-regenerative response. Furthermore, the team aimed to miniaturize and automatize the screening process, by developing a custom-made bioprinter, to allow performing these studies on a high-throughput basis, thus reducing costs and increasing the power of analysis.

The proposed tunable TE-scar represents a revolutionizing attractive system that can be explored in the context of other neurological disorders or even neurodevelopmental studies. Furthermore, the bioprinter prototype can find application in many other uses in biomedicine.

Highlights

- Phototunable RGD-alginate hydrogels that allow the culture of macroglia cells (astrocytes, OPCs and oligodendrocytes);
- An in vitro platform that allows the live follow up of the processes of (re)myelination;
- A bioprinter able to print cell-laden hydrogel microarrays;
- The postgraduate training of young researchers in the field of emerging technologies.

Scientific outputs (examples)

- Moreno PMD, Ferreira AR, Salvador D, Rodrigues MT, Torrado M, Carvalho ED, Tedebark U, Sousa MM, Amaral IF, Wengel J, Pêgo AP. **Hydrogel-assisted antisense LNA gapmer delivery for in situ gene silencing in spinal cord injury.** Mol Ther Nucleic Acids. 2018; 11:393-406. https://doi.org/10.1016/j.omtn.2018.03.009.

- Carvalho ED, Araújo MA, Hubbe H, Mendes E, Barrias CC, Pêgo AP. **Mechanosensing the (de)myelinating environment: development of a novel 3D tissue-engineered platform**. Proceedings of the XIV European Meeting on Glia Cells in Health and Disease 2019, July 10-13

MECHANO

NANOTECHNOLOGIES

From the mechanobiology of the glial to the management of multiple sclerosis

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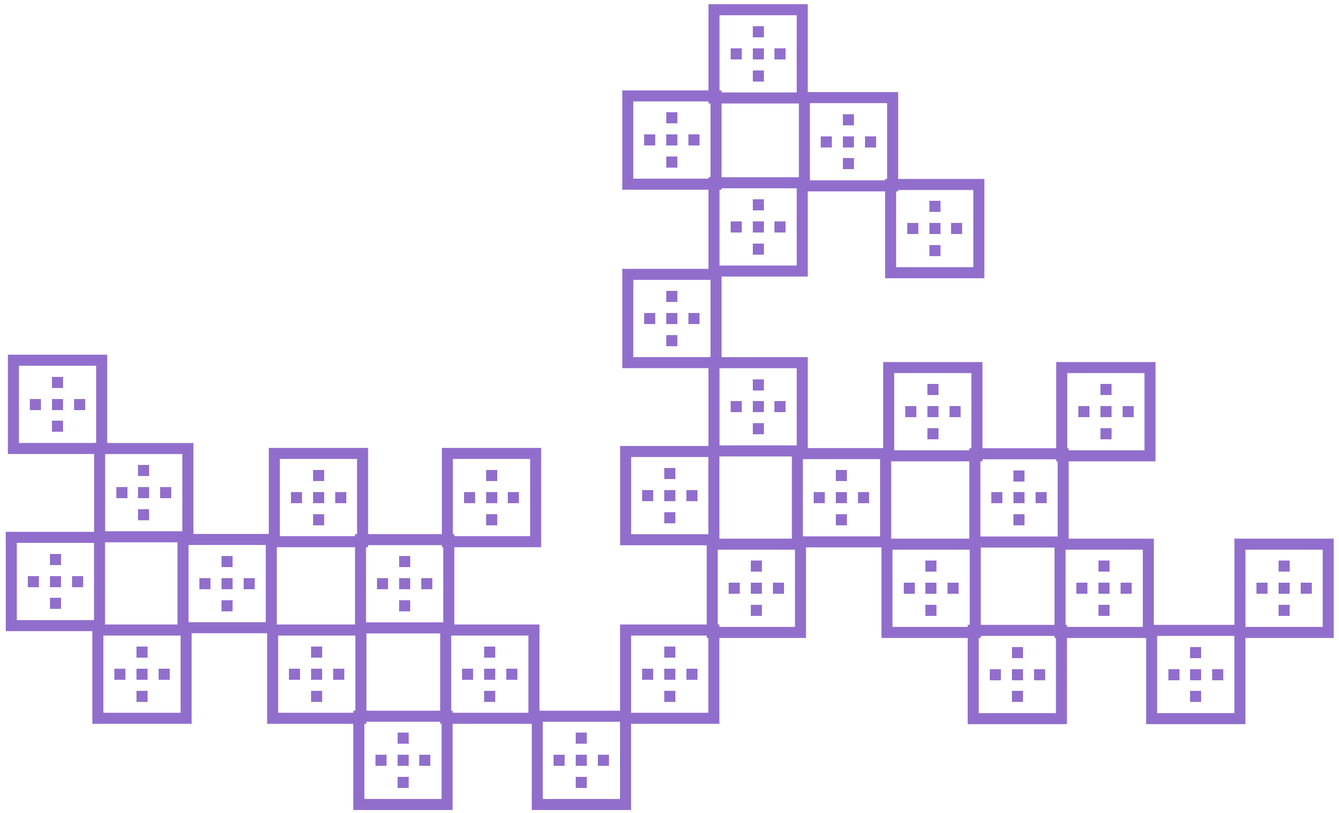
2019, Porto, Portugal. GLIA 67: E475 (2019)

- Allen SC, Widman JA, Datta A, Suggs LJ. **Dynamic Extracellular Matrix Stiffening Induces a Phenotypic Transformation and a Migratory Shift in Epithelial Cells.** Integr. Biol. Integrative Biology, Volume 12, Issue 6, June 2020, Pages 161–174, https://doi.org/10.1093/intbio/zyaa012.



MEPHEES

NANOTECHNOLOGIES

Nanostructured transition Metal Phosphides for Electrochemical Energy Storage

Start Date: 01-NOV-2018
Duration: 16 months
Keywords: Transition metal phosphide, Nanostructure, Electrochemical energy Storage Battery

Some indicators:

3 Published papers in peer-reviewed Journals and Conferences
2 Jointly authored (PT-US) at the time of data collection
4 Doctoral students and **2** MSc. students involved in research work
2 Mobility exchanges supported
1 New funding application deriving from Mephees project
4 Awards granted to the Project's PIs:

Lifeng Liu (PI of the PT team) was selected in 2019 as "Emerging Investigator" by the journal "Chemical Communications" published by Royal Society of Chemistry, UK, for his contribution to transition metal phosphide studies.

Prof. Guihua Yu (PI at UT Austin) has been awarded with two significant awards/honors in 2019, including election to Fellow of Institute of Physics (IOP) and being named as Young Innovator in Nano Energy by Springer Nature journal, Nano Research, for his outstanding contributions to developing novel nanostructured materials for energy storage and conversion. Prof. Yu is also ranked as one of top Highly Cited Researcher in Materials Science by Thomson Reuters in 2019.

Team

Principal Investigator in Portugal
Lifeng Liu, International Iberian Nanotechnology Laboratory (INL)
Principal Investigator at UT Austin
Guihua Yu, Walker Department of Mechanical Engineering, Cockrell School of Engineering
Other partner organizations
University of Aveiro (UA)

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

The widespread deployment of intermittent renewable energy depends critically on the development of energy storage technologies. Batteries and supercapacitors are energy storage devices that play important roles in both stationary and mobile applications. Storing renewable energy in rechargeable batteries is one of the few viable solutions. For large-scale deployment, however, the storage performance of batteries must be improved and costs reduced. It is critically important to develop new electrode materials that can provide high storage capacity, excellent rate capability, and long cycle life.

More recently, transition metal phosphides (TMPs) have emerged a promising class of electrode materials for use in lithium-ion batteries and supercapacitor, because TMPs are metalloidal and thereby have a high electrical conductivity. Moreover, TMP reacts with lithium during the conversion reaction forming superionic lithium conductor Li3P (>100 uS/cm at 300 K), which can serve as a matrix to disperse metal nanoparticles and maintain the reaction activity of electrode materials. Therefore, it is expected that TMP based electrodes could offer improved rate capability.

The MePhEES project aimed to develop new nanostructured transition metal phosphides (TMPs) and investigate their electrochemical performance for use as anode materials in Lithium-ion/Sodium-ion batteries (LIBs/SIBs).The project was aligned with the AIR Centre – "Clean Energy Tech". Obtained results are of interest to electronic & energy industries, having a large potential to bring economic returns.

Highlights

- Papers published in high-impact journals;
- Training opportunities offered to postdoc researchers and pre-doctoral students;
- Exchange visits.

Scientific outputs (examples)

- N. Zhang, J. Y. Xu, B. Wei, J. J. Li, I. Amorim, R. Thomas, S. M. Thalluri, Z. C. Wang, W. Y. Zhou, S. S. Xie, Lifeng Liu, **Mille-Crêpe-Like Metal Phosphide Nanocrystals/Carbon Nanotube Film Composites as High-Capacitance Negative Electrodes in Asymmetric Supercapacitors** ACS Appl. Energy Mater. 2020, 3, 4580.

- N. Zhang, Y. F. Li, J. Y. Xu, J. J. Li, B. Wei, I. Amorim, R. Thomas, S. M. Thalluri, Y. Y. Liu, G. H. Yu, Lifeng Liu, **High performance flexible solid-state asymmetric supercapacitors based on bi-metallic transition metal phosphide nanocrystals** ACS Nano 2019 13, 10612.

- N. N. Wang, Z. C. Bai, Z. W. Fang, X. Zhang, X. Xu, Y. Du, Lifeng Liu, Shixue Dou, Guihua Yu, **A general synthetic strategy for pomegranate-like transition metal phosphide@N-doped carbon nanostructures with high lithium storage capacity** ACS Mater. Lett. 2019, 1, 265.

NANOTHER

NANOTECHNOLOGIES

TAMs-targeted and externally controlled nanotheranostics of triple-negative-breast-cancer

Start Date: 01-NOV-2018
Duration: 26 months
Keywords: Triple-negative-breast Cancer, Nanotheranostics, Magnetic Resonance Imaging, Hyperthermia-induced Drug Delivery

Some indicators:

9 Published papers in peer-reviewed Journals and Conferences
1 Jointly authored (PT-US) at the time of data collection
5 Doctoral students and **1** MSc. students involved in research work
1 Prototype (Available water-dispersion of pH-responsive magnetic nanocomposites showing theranostic properties)
2 Scientific events organized
1 Award

(Feature cover award - Carolina L. de Moura, Juan Gallo, Lorena García-Hevia, Otilia D. L. Pessoa, Nagila M. P. S. Ricardo and Manuel Bañobre-López. **Magnetic Hybrid Wax Nanocomposites as Externally Controlled Theranostic Vehicles: High MRI Enhancement and Synergistic Magnetically Assisted Thermo/Chemo Therapy** Chem. Eur. J. 2020, 26, 4531 – 4538. COVER FEATURE 20/2020. – PT team – International publication)

Team

Principal Investigator in Portugal
Manuel Bañobre López, International Iberian Nanotechnology Laboratory (INL)
Principal Investigator at UT Austin
Zhengrong Cui, Dell Medical School
Other partner organizations
Life and Health Sciences Research Institute (ICVS), University of Minho (UMinho)

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

Triple-negative breast cancer (TNBC) represents 20% of the 3 million breast cancers diagnosed in women worldwide every year. In Portugal, the incidence of breast cancer is 118.5 women per 100000 population, which represents 30% of the newly diagnosed cancer cases in women every year and continues to show a high mortality rate.

The only systemic therapy currently available for patients with TNBC is (neo)adjuvant therapy with various cytotoxic chemotherapeutic agents. However, the lack of targeted therapeutic options, together with the limited efficacy of current treatments as well as the adverse effects associated with them, demands an urgent effort to develop novel targeted therapies and early diagnostic methods.
Triple-negative breast cancer (TNBC) is often among the highest-grade and poorer prognosis breast cancers, mainly because targeted therapy is not available. Therefore, there is an urgent demand to discover specific targets and develop novel targeted therapies as well as early diagnostic methods.

The main objective of this project was to ameliorate the prognosis of TNBC through the preparation and preclinical validation (in vitro plus in vivo) of a targeted theranostic nanoparticle/probe that is able to specifically recognize tumor-associated macrophages (TAMs), offering a non-invasive imaging capability by MRI together with a synergic magnetic hyperthermia (MH)and chemotherapy treatment against TNBC.
This initiative represents an innovative and ground-breaking use of tailored hybrid nanocomposites as an innovative and tangible solution in the field of targeted drug delivery against cancer, TNBC in particular. The lack of targeted therapeutic options against TNBC, the limited efficacy of current treatments and the well-known secondary effects of conventional chemotherapeutic treatments open the gate to develop novel targeted therapies as well as early diagnostic methods. Imaging and externally controlled drug delivery capabilities, in combination with magnetic hyperthermia and active targeting, will be integrated into one single platform.

The scientific advances brought about by the project should contribute to the ultimate clinical translation and a wide-range of innovations with potential to impact the triple-negative breast cancer therapy, being also a step forward on the way to targeted, image-guided therapies of cancer.To the best of the team's knowledge, there is no one single theranostic nanomedicine that made it into the clinics. Also, the clinical translation of developed controlled drug delivery systems is very limited and just a few examples can be found in the market, which is fully dominated by the small molecule drugs. Thus, the combination of a not yet existing market of 'theranostic medicines' (estimated in 20 bn) and that of controlled drug delivery (70bn) constitutes a new medical framework and market opportunity for specific theranostic systems with proved targeted, imaging and therapeutic efficiencies.

Highlights

• Synthesis of biocompatible water-dispersable theranostic DOX-loaded magnetic wax formulations with magnetic and pH-responsiveness, offering contrast enhancement by MRI and combinatorial thermochemotherapy outcomes;

• Functional performance validation: T2-MRI contrast enhancement, high magnetic hyperthermia efficiency and controlled DOX release;
• Active targeting to M2-type tumor-associated macrophages at the acidic pH found in the tumoral microenvironment;
• In vivo results show a preferential accumulation of the nanoformulations in the tumor tissue. Also, antitumor efficacy studies revealed an efficient reduction of the tumor volume (comparable to that of free drug administration) but with a complete reduction of systemic toxicity;
• Furthermore, control (non-functionalized) formulations were demonstrated to be suitable MRI contrast agents in vivo when administered systemically, as per the relaxation time shortening observed in the tumor area, rendering these magnetic formulations excellent theranostic agents for cancer management.

NANOTHER

NANOTECHNOLOGIES

TAMs-targeted and externally controlled nanotheranostics of triple-negative-breast-cancer

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Scientific outputs (examples)

- Julia Jiménez-López, Lorena García-Hevia, Consolación Melguizo, Jose Carlos Prados, Manuel Bañobre-López and Juan Gallo. **Evaluation of novel magnetic wax nanocomposite vehicles as cancer combinatorial therapy agents**. Pharmaceutics (in press).

- Yong Sze Ong, Manuel Bañobre-López, Sofia Costa Lima, Salette Reis. **A multifunctional nanomedicine platform for co-delivery of methotrexate and mild hyperthermia towards breast cancer therapy.** Materials Science & Engineering C (in press).

- Cátia Rocha, Milene Silva, Manuel Bañobre-López and Juan Gallo. (Para)**Magnetic hybrid nanocomposites for dual MRI detection and treatment of solid tumours**. Chem. Comm. (in press).

- Carolina L. de Moura, Juan Gallo, Lorena García-Hevia, Otilia D. L. Pessoa, Nagila M. P. S. Ricardo and Manuel Bañobre-López. **Magnetic Hybrid Wax Nanocomposites as Externally Controlled Theranostic Vehicles: High MRI Enhancement and Synergistic Magnetically Assisted Thermo/Chemo Therapy**. Chem. Eur. J. 2020, 26, 4531 – 4538. COVER FEATURE 20/2020.

- J Wang, Y Peng, H Xu, Z Cui, RO Williams III. **The COVID-19 vaccine race: challenges and opportunities in vaccine formulation**. APPS PharmSciTech. (in press).

- Lorena García-Hevia, Manuel Bañobre-López and Juan Gallo. **Recent progress on manganese-based nanostructures as responsive MRI contrast agents**. Chem Eur J 2019, 7;25 (2), 431-441.

- Lorena G. Hevia, Stefania Scialla, Jieliang Wang, Efres Belmonte, I. Casafont, M. L. Fanarraga, Juan Gallo, Zhengrong Cui and Manuel Bañobre-López. **Magnetic Hybrid Nanocomposites as theranostic platform for cancer theranostics**. Conference: Nanomed Europe 2019. Place and date: Braga, June 17th, 2019.

-J Wang, MS Hanafy, J Leal, H Xu, D Ghosh, RO Williams III, HDC Smyth, Z Cui*, **Aerosol performance of thin-film freeze-dried and spray-dried TNF-alpha siRNA-solid lipid nanoparticles for potential pulmonary delivery**. 16th Annual Louis C. Littlefield Celebrating Pharmacy Research Excellence Day in Professional, Graduate, and Postgraduate Programs. April 15, 2020, Virtual in Austin, Texas (Abstract # 56).

-J Wang, AM Aldayel, HL O'Mary, H Xu, Z Cui*, **The aerosol performance of TNF-a siRNA solid lipid nanoparticles for potential pulmonary delivery.** AAPS PharmSci 360. San Antonio, TX, Nov 3-6, 2019.

UT-BORN-PT

NANOTECHNOLOGIES

Unconventional Thermoelectrics Based on Self-Organized Binary Nanocrystal Superlatices

Start Date: 01-NOV-2018
Duration: 18 months
Keywords: Self-assembly, Nanocrystal superlattices, Nanostructured thermoelectrics, Transport properties

Some indicators:

5 Published papers in peer-reviewed Journals and Conferences
2 Undergraduate students involved in research work
1 Mobility exchange supported
1 New funding application deriving from UT-BORN-PT (H2020)

Team

Principal Investigator in Portugal
Yury V. Kolen'ko, International Iberian Nanotechnology Laboratory (INL)
Principal Investigator at UT Austin
Brian Korgel, McKetta Department of Chemical Engineering, Cockrell School of Engineering
Other partnerorganizations
University of Minho (UMinho)

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

Alongside alternative clean energy sources, energy recovery and conversion will play an important role in addressing future technologies, especially for autonomous devices. Thermoelectric devices convert temperature gradients into electric power and vice versa have been actively investigated to enhance existing technologies for heat/power recovery and conversion.

They are reliable, non-polluting, require minimal maintenance, and can be operated over a wide range of temperatures. If it were not for its currently low efficiency, thermoelectric energy conversion could revolutionary replace thermomechanical conversion in many applications. The performance of thermoelectric materials is expressed by the dimensionless figure-of-merit, zT, which is about 1.2 for materials currently used in thermoelectric devices. For wide adoption, the zT needs to reach a value of three, a goal that has been pursued for over 50 years. Recent record zT values approaching two are driven in part by nanocrystals self-precipitated in bulk, even though control and understanding of nanocrystal formation remain elusive in these systems.

UT-BORN-PT aimed at significantly increasing zT values of thermoelectrics by nanostructuring thermoelectric materials into nanocrystal solids that can offer high electrical conductivity while dramatically lowering the thermal conductivity. The project proposed an approach to creating completely new high-zT thermoelectrics via the bottom-up assembly of thermoelectric nanocrystals.

Thermoelectric generators (TEGs) interconverts heat and electrical energy, and are energy recovery and conversion devices with enormous potential to harvest the dissipated heat from power plants, automotive engines, housing heating systems, and even electronic devices for micro-power generation applications.

The synthesized BNSLs based thermoelectric materials have led to the development of next-generation of thermoelectrics and concurrently will provide a fundamental breakthrough for simple, scalable and low-cost processing of high-performance TEGs.

Highlights

- Scalable thermochemical alloying route for synthesizing chalcogenides nanocrystals;
- Cumulative temperature dependence approach for estimation of realistic thermoelectric performance;
- Bulk nanostructured n-type alloys with ZTavg≈0.7 with an estimated thermoelectric conversion efficiency of approx. 5-6%;
- Bulk p-type nanocomposite with ZTavg≈1.2 for low-temperature thermoelectric application;
- Ligand engineered phase-pure 150 nm thick films of oleate-capped PbTe NCs with reduced thermal conductivity.

Scientific outputs (examples)

- Piotrowski, Marek, et al. **Probing of thermal transport in 50 nm thick PbTe nanocrystal films by time-domain thermoreflectance.** The Journal of Physical Chemistry C 122.48 (2018): 27127-27134.

- Piotrowski, Marek, et al. **Template-directed self-organization of colloidal PbTe nanocrystals into pillars, conformal coatings, and self-supported membranes.** Nanoscale Advances 1.8 (2019): 3049-3055.

UT-BORN-PT

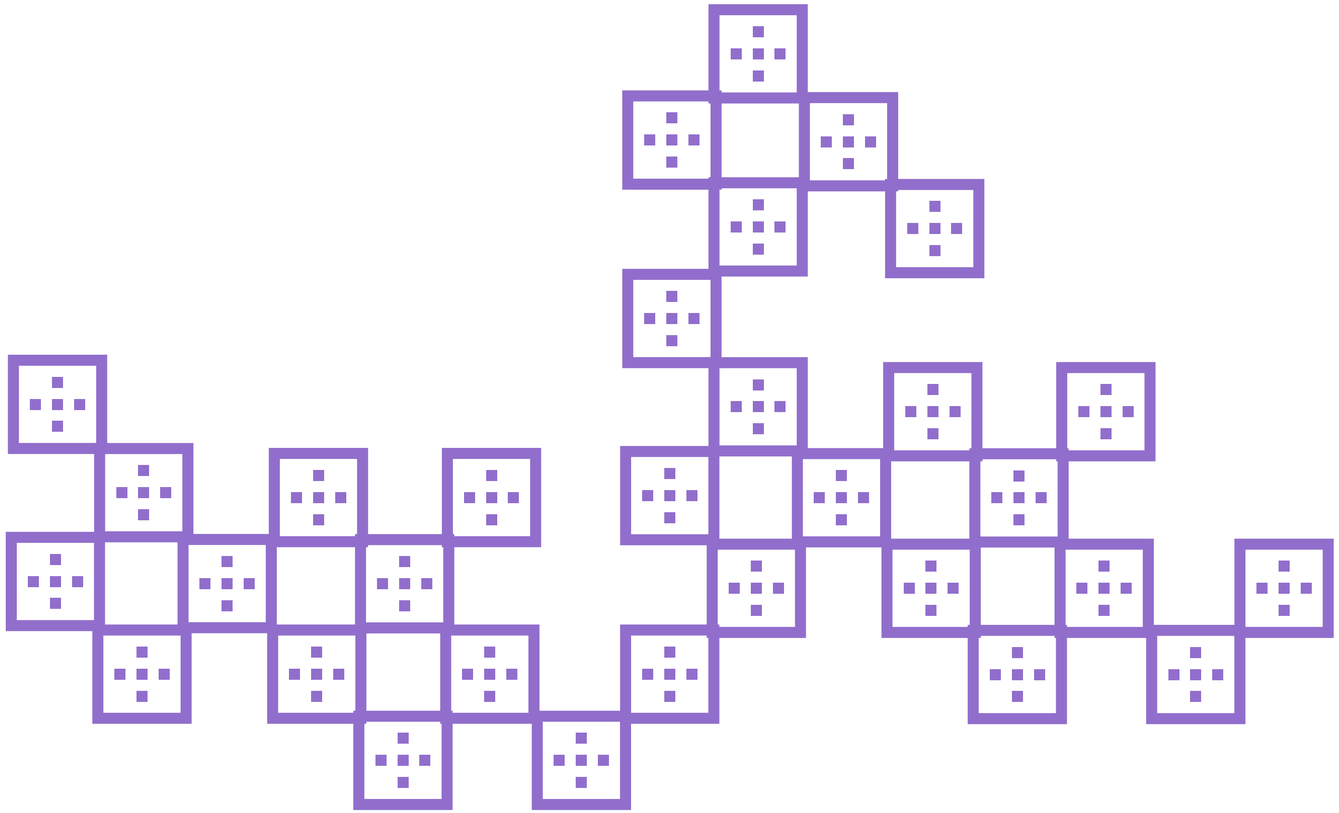
NANOTECHNOLOGIES

Unconventional Thermoelectrics Based on Self-Organized Binary Nanocrystal Superlatices

- Chauhan, Nagendra S., et al. **Spinodal decomposition in (Ti, Zr) CoSb half-Heusler: A nanostructuring route toward high-efficiency thermoelectric materials.** Journal of Applied Physics 126.12 (2019): 125110.

- Chauhan, Nagendra S., et al. **Defect Engineering for Enhancement of Thermoelectric Performance of (Zr, Hf) NiSn-Based n-type Half-Heusler Alloys.** The Journal of Physical Chemistry C 124.16 (2020): 8584-8593

- Upadhyay, Naval Kishor, et al. **Facile bulk synthesis of high-performance B-Zn4Sb3 for thermoelectric applications.** Materials Letters 265 (2020): 127428.



UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

DGCOAST

SPACE-EARTH INTERACTIONS

Modeling and Analysis of Coastal Hydrodynamics and Erosion

Start Date: 01-NOV-2018
Duration: 24 months
Keywords: Hybridized discontinuous Galerkin Method, Coastal Erosion, Dispersive waves, Green-Naghdi Flow

Some indicators:

12 Published/Accepted papers in peer-reviewed Journals
1 Jointly authored and accepted for publication (PT-US) at the time of data collection
2 Doctoral and **1** Undergraduate students involved in research work
2 Mobility exchanges supported
11 Communications outside Portugal

Team

Principal Investigator in Portugal
Juha Hans Videman, Department of Mathematics, Instituto Superior Técnico, University of Lisbon (IST, UL)
Principal Investigator at UT Austin
Clint Dawson, Aerospace Engineering and Engineering Mechanics, Cockrell School of Engineering and The Oden Institute for Computational Engineering and Sciences
Other partner organizations
University of Coimbra (UC)

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

Coastal ocean regions around the world are hubs of transportation, zones of rich mineral resources, fisheries and recreation, and home to billions of people and diverse ecosystems. Many such regions are threatened by a variety of factors and the increasing risk and associated impacts have catalyzed efforts to increase our understanding of the coastal ocean environment - in particular, the impacts of currents, waves and rising water levels on coastal flooding and/or the transport and erosion of coastal sediments - and our ability to make quantitative predictions of coastal hydrodynamics.

Accurate modelling of coastal ocean processes requires mathematical models which go beyond the traditional shallow water equations typically used to model long-wave ocean currents. In addition, understanding the true impacts of processes such as the sea-level rise and severe storms requires coupling such models with transport models of sediment erosion/deposition.

DGCOAST proposed to build a numerical code based on hybridized discontinuous finite element methods for studying complex coastal hydrodynamics and sediment erosion with specific emphasis on regions of the Texas-U.S. and Portuguese coasts. Our numerical model shows a lot of promise to be used in studies of coastal hydro-morphodynamics driven by dispersive water waves. In fact, the numerical results highlighted in the attached file show the ability of the Green-Naghdi equations to capture hydrodynamics more accurately than the nonlinear shallow water equations in situations where dispersive wave properties are prevalent.

The hydrodynamic part of the model not only resolves accurately the water motion and the dispersive wave effects but also provides the ability to ignore the dispersive terms where needed, e.g. in surf zones, and includes wetting-drying, breaking wave detection, and slope-limiting features. The morphodynamic part can already capture the major features of bed erosion and deposition.

Moreover, our preliminary experiments indicate that the model reduces substantially the computational effort required to perform the numerical simulations and has thus a great potential to be used in modelling hydro-morphodynamic processes caused by dispersive waves in large coastal areas such as the Ria Formosa lagoon.

The DGCOAST numerical code will be of open access and thus available for researchers working on hydro-morphodynamic modelling of coastal circulation. The software is under development but can be accessed at www.github.com/UT-CHG/dgswemv2.

Highlights

• A successful implementation of a dispersive wave hydrodynamic model based on hybridized discontinuous Galerkin finite element method over unstructured grids and development of a massively parallel solver which can execute numerical simulations of water waves using both discontinuous Galerkin discretizations of the nonlinear shallow water and the dispersive Green-Naghdi equations;
• Coupling the Green-Naghdi equations (the hydrodynamic part) with the sediment continuity Exner equation (the morphodynamic part);
• Capacity of the model to capture hydrodynamics more accurately than the nonlinear shallow water equations in situations where dispersive wave properties are prevalent and to estimate sediment erosion and deposition amounts due to suspended and bedload transport;
• Validation of the model with numerical experiments in the Ria Formosa lagoon area.

DGCOAST

SPACE-EARTH INTERACTIONS

Modeling and Analysis of Coastal Hydrodynamics and Erosion

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Scientific outputs (examples)

- Kazhyken, J. Videman and C. Dawson, "**Discontinuous Galerkin methods for a dispersive wave hydro-morphodynamic model with bed-load transport**", Computer Methods in Applied Mechanics and Engineering, Volume 375, 1 March 2021, 113592, https://doi.org/10.1016/j.cma.2020.113592

- F.S. Cal, G.A.S. Dias, B.M.M. Pereira, J H Videman, **Trapped modes in a multi-layer fluid**, The Quarterly Journal of Mechanics and Applied Mathematics, 2021;, hbaa019, https://doi.org/10.1093/qjmam/hbaa019

- G.E. Pires, K.R. Rajagopal and J.H. Videman, **On the derivation of Reynolds-type equation for flows through porous media due to pressure gradients**, Journal of Porous Media 23(12), 1137-1151 (2020)

- T. Gustafsson, R. Stenberg, and J.H. Videman, **On Nitsche's method for elastic contact problems**, SIAM Journal Scientific Computing 42(2) (2020), B425-B446. (in press). https://arxiv.org/abs/2007.00403

- L. Caffarelli, R. Teymurazyan and J.M. Urbano, **Fully nonlinear integro-differential equations with deforming kernels**, Communications in PDEs 45(8), 847-871 (2020).

- E.A. Pimentel and J.M. Urbano, "**Existence and improved regularity for a nonlinear system with collapsing ellipticity**". The Annali della Scuola Normale Superiore di Pisa, Classe di Scienze, 2020, https://arxiv.org/abs/2007.08462

- N. Diehl and R. Teymurazyan, **Reaction-diffusion equations for the infinity Laplacian**, Nonlinear Analysis 199 (2020), 111956.

- T. Gustafsson, R. Stenberg, and J. Videman, **Error analysis of Nitsche's mortar method**, Numerische Matematik., 142(4), 973-994 (2019).

- M.D. Amaral, J.V. da Silva, G.C. Ricarte and R. Teymurazyan, **Sharp regularity estimates for quasilinear evolution problems**, Israel Journal of Mathematics 231 (2019), 23-45.

- B.M.M Pereira, G.A.S Dias, J.H. Videman, F.S. Cal, F.S. and K.R. Rajagopal, **Lubrication Approximation for Fluids with Shear-Dependent Viscosity**, Fluids, 4(2), 98 (2019).

- G.C. Ricarte, R. Teymurazyan and J.M. Urbano, **Singularly perturbed fully nonlinear parabolic equations and their asymptotic free boundaries**, Revista Matemática Iberoamericana, 35 (2019), 1535-1558.

- Samii, K. Kazhyken, C. Michoski, and C. Dawson, **A Comparison of the Explicit and Implicit Hybridizable Discontinuous Galerkin Methods for Nonlinear Shallow Water Equations**, Journal of Scientific Computing 80, 1936–1956 (2019). https://doi.org/10.1007/s10915-019-01007-z

I SEA

SPACE-EARTH INTERACTIONS

Immersive virtual reality environments to evaluate audience attitudes about science communication projects: a pilot study of deep-sea ecosystems

Start Date: 01-NOV-2018
Duration: 24 months
Website: https://www.fc.up.pt/isea/
Keywords: Digital Media, Immersive Virtual Environment, Science Communication, Evaluation methods

Some indicators:

9 Oral Communications
1 Book published
1 Book chapter published
1 Doctoral, **4** MSc. and **2** Undergraduate students involved in research work
1 Mobility exchange supported
2 Prototypes (digital and physical)
1 New funding application deriving from I SEA project
1 Summer School organized in PT

Team

Principal Investigator in Portugal
Carla Morais, Faculty of Sciences of the University of Porto (FCUP)
Principal Investigator at UT Austin
Lucy Atkinson, Stan Richards School of Advertising & Public Relations, Moody College of Communication
Other partnering organizations
Faculty of Engineering of the University of Porto (FEUP/UP)
ESAD-Idea, Association for the Promotion of Research in Design and Art
Centro de Astrofísica da Universidade do Porto (CAUP/UP)
Sociedade Afonso Chaves (SAC)
ENIGMA VIRTUAL, LDA

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

The evaluation has moved up the agenda in Science Communication. However, some procedures, while available, may be too obtrusive to use recursively in science centers and/or conflict with science center visitors' agendas. I SEA's goal was to develop a non-obtrusive, valid and replicable method to evaluate audience attitudes about science communication projects through an immersive virtual reality environment that could improve exhibitions while educating and empowering citizens.

The project embraced the Azores International Research Center agenda, specifically, deep-sea ecosystems sustainability, by producing new digital content and carrying out pilot studies in local and national science centers. This approach aimed at filling a gap in existing models that 1) failed to account for self-generated visitor narratives about their science center experiences; 2) ignored the role of the visitor in the evaluation process itself; and 3) disregarded the effects of test-enhanced learning in the transferability of knowledge to other contexts. The project consisted of a pilot study on deep-sea ecosystems, using immersive virtual reality environments to understand and evaluate the audience's attitude towards Science Communication project.

Results obtained seem to support I SEA's main goal, that is, to validate a non-invasive replicable method of evaluating science communication, as the majority of participants responded to an automatic interview embedded in the VRE, making sense of the experience. In addition, information collected through the I SEA's Analysis System (AS) correlate with information from in-person interviews and questionnaires. For example, participants' choice of character (i.e. environmental activist, economist or scientist) in the VRE partially mirrors their attitudinal position towards the deep sea's preservation, and its economic or scientific exploration. On the other hand, results also ask for the development of new, VRE integrated measures of science communication evaluation.

The results of the previously mentioned research suggest that virtual reality (as an emerging technology) is objectified in specific equipment like headsets and anchored to computers and games, associated with immersion and interactivity. Virtual reality appears to be a promising symbol for the technology of the future. However, the risk mentioned by the participants and the disadvantages presented in the form of illusion, alienation, falsity and addiction, underlines the tension between potentialities and threats. The triangulation between these preliminary results and the set of interviews highlighted the potential for acceptance of the project's major technological and communication outcomes.

Highlights

• Development of the narrative to enrich the virtual reality immersive experience, attending to three fundamental points of the transformative game model;
• Delimitation and development of a whole set of data collection instruments which allow the team, in a non-obstructive way, to obtain indicators about participant awareness, understanding, and engagement with deep-sea ecosystems;
• Perception of directors, monitors, and visitors of the Planetarium and Expolab Centers on how the non-obtrusive digital evaluation method, directly integrated into an exhibition, would work in a real context. That led the team to carry out a significant number of interviews, followed by transcription and intensive content analysis to make sense of the wealth of data collected;
• Usability studies focused on the technological development and capsule design options used in the virtual reality experience, taking into account necessary adjustments. Production of one animated infographic and two roll-ups that scientifically portray the water column and the entire ecosystem of deep-sea hydrothermal vents, reinforcing the increased output of content to support the project;
• Development of the digital prototype in virtual reality environments. Production of the physical prototype. The two physical prototypes were installed as planned at Expolab and Planetarium of Porto. Pilot studies for the individual and collective conditions were carried out. The team found out that the exhibition effectively communicated important knowledge about the deep sea.

I SEA

SPACE-EARTH INTERACTIONS

Immersive virtual reality environments to evaluate audience attitudes about science communication projects: a pilot study of deep-sea ecosystems

UTAustin Portugal

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TEXAS The University of Texas at Austin

Scientific outputs (examples)

- Morais, C., Coelho, A., Jacinto, A., & Varzim, M. (2020) (Eds.). **The I SEA Project: Digital Publications.** Porto: Faculdade de Ciências da Universidade do Porto, Faculdade de Engenharia da Universidade do Porto, Escola Superior de Arte e Design. ISBN: 978-989-746-279-5. DOI: https://doi.org/10.24840/2020/978-989-746-279-5 ; http://www.emultimedia.com.pt/publications_fct_2020/D2.pdf

- Morais, C., Paiva, J. C., Moreira, L., Aguiar, T., & Teixeira, A. (2019). **Non-invasive and replicable method for evaluating science communication activities: Contributions from I SEA project**. VII Congreso de Comunicación Social de la Ciencia (CCSC19) (p. 78), Universidad de Burgos and Asociación Española de Comunicación Científica, Burgos, Spain.

- Morais, C., Paiva, J. C., Moreira, L., Aguiar, T., & Teixeira, A. (2019). **I SEA project: challenges from science communication and evaluation methods using virtual reality in non-formal contexts.** In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.), ICERI2019 Proceedings (pp. 4690-4699). Seville: IATED. DOI: https://doi.org/10.21125/iceri.2019.1155. ISBN: 978-84-09-14755-7.

- Morais, C., Paiva, J. C., Moreira, L., Aguiar, T., & Teixeira, A. (2019). **Communicating cutting-edge marine science through immersive virtual reality: Contributions from I SEA project**. Abstract Book 7th European Marine Science Educators Association Annual Conference (EMSEA2019) (p. 21), EXPOLAB, São Miguel, Azores, Portugal. http://www.emultimedia.com.pt/publications_fct_2020/A4.pdf

- Simões, R., Morais, C., & Moreira, L. (2019). **Multimedia and virtual reality into communication practices of science centers: A social representations perspective.** In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.), ICERI2019 Proceedings (pp. 4746-4752). Seville: IATED. DOI: https://doi.org/10.21125/iceri.2019.1165. ISBN: 978-84-09-14755-7. http://www.emultimedia.com.pt/publications_fct_2020/A6.pdf

- Vieira, J., Nóbrega, R., Pereira, V., Coelho, A., Jacinto, J., & Morais, C. (2019). **Knowledge Analysis Automatic Evaluation in Virtual Reality Immersive Experiences.** In International Conference on Graphics and Interaction (ICGI) (pp. 122-129). IEEE. DOI: https://doi.org/10.1109/ICGI47575.2019.8955099. ISBN: 978-1-7281-6378-9. http://www.emultimedia.com.pt/publications_fct_2020/A7.pdf

- Morais, C., Paiva, J. C., Moreira, L., Teixeira, A., & Aguiar, T. (2019, October). **Discovering social representations of deep-sea, virtual reality and science communication: Contributions from the project I SEA**. In International Congress on Technology, Science and Society. Madrid, October, 3-4, 2019.

- Pereira, L., Morais, C., & Moreira, L. (2019, October). **Reshuffling virtual reality and science communication: Synergies based on the transformational play**. In International Congress on Technology, Science and Society. Madrid, October, 3-4, 2019.

- Coelho, A., Morais, C., Atkinson, L., Jacinto, A., Nóbrega, R., Varzim, M., Paiva, J. P., Moreira, L., Aguiar, T., Teixeira, A., Vieira, J. & Coelho, D. (2019). **I SEA – Virtual reality to evaluate audience attitudes about science communication**. UT Austin Portugal Program' 2019 Annual Conference, Braga, Portugal.

- Morais, C., Atkinson, L., Coelho, A., Jacinto, A., Nóbrega, R., Varzim, M., Paiva, J. C., Moreira, L., Aguiar, T., Teixeira, A., Vieira, J., & Coelho, D. (2020). "**Immersive virtual reality environments to evaluate audience attitudes about science communication projects: A pilot study of deep-sea ecosystems**". UT Austin Portugal's 2020 Annual Conference: Innovation at the Intersection of Academia and Industry, October 7-8 2020.

STorM

SPACE-EARTH INTERACTIONS

Atmosphere – Ocean – Solid Earth Coupling: Seismic Tools to Explore and Monitor the Oceans

Start Date: 06-NOV-2018
Duration: 30 months
Keywords: Atmosphere-ocean dynamics, Earth Imaging, Geophysical tools, Uncertainty in Inverse Problems

Some indicators:

1 Published paper in peer-reviewed journals
2 Doctoral, **2** MSc. and **6** Undergraduate students involved in research work
3 Mobility exchanges supported

Team

Principal Investigator in Portugal
Susana Custódio, FCiências.ID, Associação para a Investigação e Desenvolvimento de Ciências
Principal Investigator at UT Austin
Tan Bui-Thanh, Department of Aerospace Engineering and Engineering Mechanics, Cockrell School of Engineering and The Oden Institute for Computational Engineering and Sciences
Other partnering organizations
Fundação Gaspar Frutuoso, FP
Portuguese Institute for Sea and Atmosphere, I. P. (IPMA, IP)

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

Summary

The North Atlantic region plays a rather special role in the global climate, by being a preferred location for the development of major atmospheric storms, at both tropical and extra-tropical latitudes, and by its potential control of the deep ocean circulation. Atmosphere-ocean processes occurring in that region affect climate in a large domain, especially in Europe and North America, and their sensitivity to climate change is a major concern. Ocean regions, which remain largely uncharted domains even in the satellite era, represent a fundamental piece in the puzzle of global Earth dynamics. The limited knowledge of ocean processes is a direct consequence of observational challenges.

This exploratory project proposed to use unique ocean and land-based seismic datasets, collected in and around the North Atlantic, both on the seafloor, ocean islands and margins, to study ocean processes and the internal structure of the Earth. The work plan aimed at proving concepts that, if successful, could later be applied to larger datasets and/or be used for operational/monitoring purposes.

The project was structured around three main tasks:
1) Using seismic data to image ocean storms, assessing its results against meteorological reanalysis;
2) Evaluating the impact of the steep topography of ocean islands on the microseismic wavefield, with impact on imaging the sub-surface;
3) Using OBS data as a proxy for ocean bottom currents.

The aims of the project were deemed relevant to the mission of the Azores International Research (AIR) Center, in particular to understand climate change, ocean processes and imaging sub-surface georesources in oceanic domains. STorM sought to explore innovative seismology-based tools to observe the oceans, in parallel with state-of-the-art meteorological reanalysis, bringing together knowledge from atmospheric, ocean and solid earth science. At the time of publication of this report, the project was still ongoing.

Highlights

- Map identifying the oceanic sources of seismic noise in the Cape Verde archipelago, central Atlantic;
- New empirical transfer functions that allow predicting ocean activity at a given location in the ocean given seismic data recorded on a point on land;
- Documentation of the effect of the oceans in seismic data recording in the ocean bottom;
- Preliminary success of developing machine learning method (deep neural network and recurrent neural networks) on some historical data.

The project is currently working on improving ocean storm imaging using machine learning techniques.

Scientific outputs (examples)

-Rodrigues, Diana, **Characterization of microseismic noise in the Azores and its relationship to ocean activity**, MSc in Ciências Geofísicas, FCUL, PT team (Dissertation).

- J. F. Carvalho, G. Silveira, M. Schimmel, and E. Stutzmann. **Characterization of microseismic noise in Cape Verde**. Bulletin of the Seismological Society of America, 109(3):1099–1109, May 2019. https://doi.org/10.1785/0120180291

4.3
The Education Instrument in Action

Education is one of the three core instruments of the UT Austin Portugal Program and encompasses short-term to long-term training actions, combining theoretical with practical, hands-on approaches and ranging from lectures and thematic workshops to advanced training courses and research exchanges on cutting-edge science topics covered by the areas of the Program.

Educational activities with the seal of the Program can take place both in Portugal and Austin. They always entail mobility of talent, either of faculty and researchers from UT Austin who come to Portugal to deliver talks, conduct Masterclasses, give hands-on training or of researchers moving from Portugal to Austin to learn and develop new skills and capabilities.

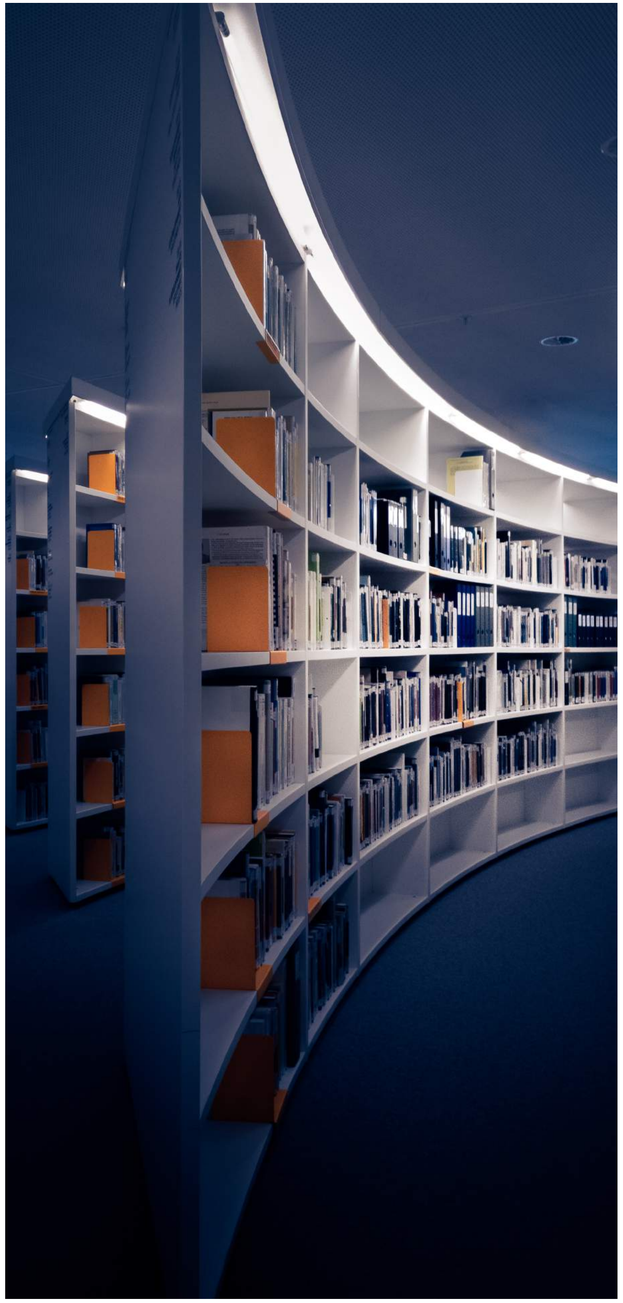
Short-term training activities have proved well-suited to address very targeted, narrow topics and subtopics related to the knowledge areas of the Program and to bring closer together participants with top-tier speakers and experts from Portugal, The University of Texas and in some cases, even beyond. Attendees from academia remained the primary beneficiaries of these short training activities. Still, with the Strategic Research Projects moving along, the Program expected to be able to also cater to highly qualified staff from industry and businesses.

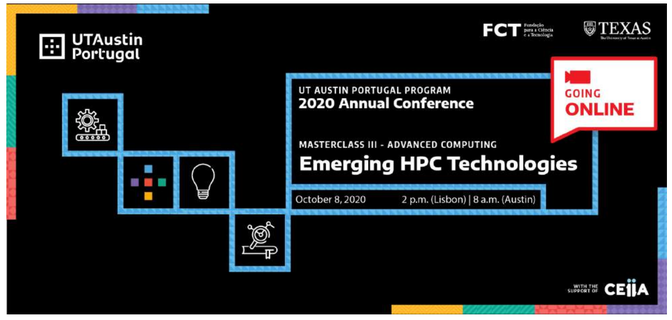
There was a slowdown of the Program's overall activity in 2020 that is attributable to the COVID-19 crisis. This trend was most noticeable in educational activities and the first semester of the year when everyone was trying to navigate through the uncertainty brought by the unknown and keep the pace with the new reality. At some point, with international travel severely restricted, the Program made the conscious decision to turn to digital and concentrate its educational efforts towards the organization of the Annual Conference, which has a strong learning component associated to Masterclasses. In the 2020 edition of the Program's largest networking and knowledge-sharing event, four thematic Masterclasses covering the four areas of the Program were put together by Area Directors with the support of distinguished experts and speakers and live-streamed thanks to online platforms. Transition to a digital setting turned out to be a true learning process for the Program's Team, and a turning point regarding the way we set up training initiatives. The Program remains committed to ensuring continuous learning by harnessing the power of digital in tandem with conventional yet highly efficient approaches to deliver high-quality learning content across its knowledge areas, thus reaching a broader audience and diversifying learning experiences.

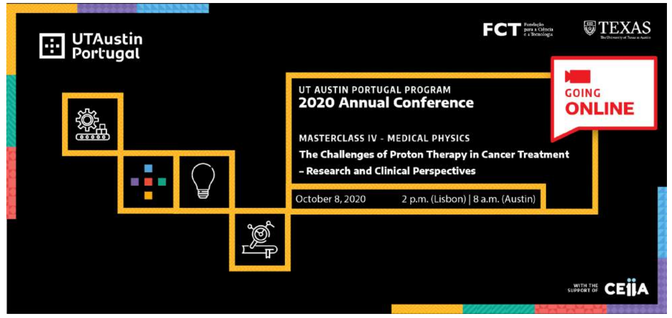
In 2020, the Program carried on demonstrating its commitment to understanding the impact of its initiatives to pursue self-improvement and earn and build public confidence in its work.
As mentioned previously, it was not possible to take researchers to UT Austin in the frame of research exchange schemes due to international travel restrictions affecting the Partnership's geographic scope. Almost one year on since the last researcher admitted to the Advanced Computing Training Program (ACTP) returned to Portugal after spending a few months at the Texas Advanced Computing Center with the Program's support, it was important to hear from all participants what this experience abroad had meant to them in practice, i.e., how it impacted on their research work and career development. To this end, the Program asked all nine trainees to fill out another follow-up report, i.e., an impact questionnaire. The results of this short survey, which are presented next, will be considered when designing new international mobility schemes with the seal of the Program.

4.3.1
Masterclasses

Thematic and highly-specialized masterclasses remained a central part of the Annual Conference agenda.
In 2020, the Program, with the support of its Area Directors, set up four Masterclasses, this time in a full digital setting, covering topics related to the knowledge areas of Advanced Computing, Nanotechnologies, Medical Physics and Space-Earth Interactions and featuring renowned experts.
Framed by the Conference's underlying theme, Innovation at the Intersection of Academia and Industry, Masterclasses gave participants the chance to find out more about the latest research and innovation trends in the selected topics.







Masterclass I - Innovation in Biomimetic Materials

NANOTECHNOLOGIES

Summary

Nanotechnology is undeniably a very comprehensive area from the point of its applicability, assuming a tremendous impact in areas such as the environment, health, energy, transport, information technology. Following the development of new products, biomimetic materials are designed to replicate one or more attributes of a material produced by a living organism.
Throughout the millennia, nature has evolved to adapt and develop highly sophisticated methods to solve problems. There are numerous examples of functional surfaces, fibrous structures, structural colours, and highly catalytic, self-cleaning, self-healing and thermal insulation materials, among others, which offer important lessons for the materials of the future. Some of these solutions may have inspired humans to achieve outstanding outcomes. For example, the strength and stiffness of the hexagonal honeycomb may have led to its adoption for use in lightweight structures in airplane and many other applications.
Biomimetic research is a rapidly growing field having a huge potential for the development of new and sustainable materials that can only be realized through interdisciplinary research rooted in a holistic understanding of nature.

Target Audience

Researchers from academia and industry dealing with the development of new products or applications and wishing to develop a deeper understanding of biomimetic and biomaterials.

Scientific Coordination

Brian Korgel, University of Texas at Austin, USA
Carla Silva, CITEVE, Portugal
Paulo Ferreira, IST and INL, Portugal

Participants

39 registered participants in total:

- 21 male and 18 female participants;
- 20 from Universities (51%);
- 14 from R&D Institutions (33%);
- 4 from other affiliations (13%);
- 1 from Industry (3%).

Speakers

Keith Keitz
University of Texas at Austin, USA

Adrianne Rosales
University of Texas at Austin, USA

Martin Lopez-Garcia
INL , Portugal

João Mano
University of Aveiro, Portugal

MODERATION

Brian Korgel
University of Texas at Austin, USA

Masterclass II: Platforms for global monitoring – Emerging capabilities and challenges

SPACE-EARTH INTERACTIONS

Summary

Space and Earth studies acquire a particularly relevant role today, given the constant challenges created by the new technological inventions that make their observation viable. As we enter the third decade of the 21st century, the prospect of miniaturized space platforms and high-precision Earth remote sensing are beginning to unleash their full potential for global Earth-observing. Emerging technologies create new opportunities, but also pose new challenges.
In this masterclass, world-renowned experts illuminated the underlying Space-Earth interactions from three different vantage points: 1) the emerging capabilities of miniature satellites and their roles in sustained Earth observations; 2) the complementary Earth-observing capabilities, through unanticipated uses of the Global Positioning Systems as a remote sensing technique to monitor the Earth's surface; 3) transdisciplinary solutions tying academia and industry together to address this challenge and to develop the Earth's orbit sustainably.

Target Audience

Academia and Industry interested in Space and Earth Observation studies.

Scientific Coordination

Luísa Bastos, University of Porto, Portugal
Patrick Heimbach, University of Texas at Austin, USA
Pedro Camanho, University of Porto, LAETA, INEGI, Portugal

Participants

49 registered participants in total:

- 28 male and 21 female participants;
- 19 from Universities (39%);
- 17 from R&D Institutions (35%);
- 7 from Industry (14%);
- 6 from other affiliations (12%).

Speakers

Moriba Jah
University of Texas at Austin, USA

Byron Tapley
University of Texas at Austin, USA

Kristine Larson
University of Colorado Boulder, USA

MODERATION

Luísa Bastos
University of Porto, Portugal

Patrick Heimbach
University of Texas at Austin, USA

Masterclass III: Emerging HPC Technologies

ADVANCED COMPUTING

Summary

As pointed out by the European Union, “High-Performance Computing (HPC) is a critical factor for the digitization of industry, its innovation and competitiveness”. By enabling sophisticated modelling and simulation, HPC is a must-have asset that allows modern societies to understand the complexity of massive amounts of data generated by multiple sources, thereby creating valuable knowledge. The application potential of HPC is huge for a wide range of fields from cybersecurity, to climate change and weather prediction, to personalized medicine, space exploration, energy efficiency or even to ICT research itself. This increase in demand for HPC technologies calls for an ever-increasing capacity and efficiency with strong implications on the many emerging and thriving technologies being made available nowadays.
Organised by the Area of Advanced Computing, and counting on world-class experts from ARM and TACC, this Masterclass addressed the HPC capabilities and related opportunities in two ways: 1) by exploring the topic of high-performance large-scale processors and systems in general, and specific on Arm in HPC, supported by examples of relevant academia-industry partnerships and EU-funded projects; 2) by focusing on the next generation of HPC technologies, applications and systems towards exascale architectures and how they are redesigning scientific research.

Target Audience

HPC users/enthusiasts and potentially interested people in the next generational advanced computing technologies.

Participants

35 registered participants in total:

- 30 male and 5 female participants;
- 16 from Universities (46%);
- 9 from R&D Institutions (26%);
- 6 from other affiliations (17%);
- 4 from Industry (11%).

Scientific Coordination

Dan Stanzione, TACC, USA
Rui Oliveira, University of Minho, INESC TEC, and MACC, Portugal

Speakers

Alejandro Rico
ARM, USA

Dan Stanzione
Texas Advanced Computing Center (TACC), USA

MODERATION

Pedro Alberto
University of Coimbra, Portugal

Masterclass IV: The Challenges of Proton Therapy in Cancer Treatment – Research and Clinical Perspectives

MEDICAL PHYSICS

Summary

The area of medical physics permanently seeks to effectively respond to all the challenges that healthcare faces nowadays and cancer is inevitably one of its priorities. Proton therapy is the most advanced form of radiation treatment that uses protons instead of X-rays, allowing a more tailored, patient-centered approach to cancer treatment. This innovative form of treatment calls for leading experts across all disciplines, from upstream to downstream sectors, working in close collaboration. Bridging the research with the clinical setting is fundamental to translate important research discovery into advanced science-based treatments and clinical care, and to feed the clinical outcomes of proton therapy into further research. However, this translation entails important challenges to be addressed by both sides in order to fully exploit the benefits of this therapy. The Masterclass brought together a panel of notable speakers from the research and clinical fields in Portugal, Texas and also Germany for a comprehensive analysis of the challenges of proton therapy in the era of precision medicine.

Target Audience

Medical professionals, radiotherapy technologists, biomedical engineers, physicists, researchers and students from all involved disciplines, interested in taking part in a wider discussion about the scientific and clinical directions of proton therapy.

Participants

53 registered participants in total:

- 35 female and 18 male participants;
- 28 from Universities (53%);
- 15 from other affiliations (28%);
- 6 from Industry (11%);
- 4 from R&D Institutions (8%).

Scientific Coordination

João Oliveira, IPO Lisboa, Portugal
José Marques, IST, Portugal

Speakers

João Seco
DKFZ, Germany

Radhe Mohan
MD Anderson Cancer Center, USA

Tiago Madaleno
IPO Lisboa, Portugal

Cátia Pedro
IPO Lisboa, Portugal

MODERATION

José Marques
IST, Portugal

4.3.2

The ACTP initiative – its impact through the voice of participants

The Advanced Computing Training Program (ACTP) was a one-of-a-kind pilot training scheme that highly benefitted from FCT's mobility fellowship instrument to take researchers in Portugal to Austin between 2018 and 2019. It offered them a unique opportunity to gain access to a research centre at UT Austin that designs and operates some of the world's most powerful computing resources – The Texas Advanced Computing Center (TACC). Additionally, through TACC, participants could also extend their learning experience to other departments, centres or schools of UT Austin.

Admitted candidates benefitted from tailored work plans at TACC, aligned with their research goals and interests. They were actively involved in a myriad of activities, with some getting to help in constructing TACC's new nerve center, the Frontera supercomputer. ACTP participants were also entitled to pick courses from TACC's training portfolio in advanced computation and related resources.

• All ACTP participants said they would recommend the Program;

• Six out of nine participants submitted proposals to the 2019 Exploratory Research Call along with UT Austin / TACC PIs; 1 organized a week's training in Portugal in 2019 with TACC experts; and another had a paper co-authored by TACC and UT Austin researchers accepted at the 30th MIE 2020: Geneva, Switzerland;

• One was hired in 2020 to work at the Minho Advanced Computing Center (MACC), being his previous experience with TACC a plus.

Photo credits: Ana Pádua

Where are they now?

Two Portuguese researchers talk about how UT Austin Portugal influenced the course of their careers.

João Dias and Leonardo Azevedo enrolled in the Advanced Computing Training Program in 2019. One year later, we can learn about the impact of partaking in this initiative.

Photo credits: TACC

Two years ago, the UT Austin Portugal Program launched the initiative Advanced Computing Training Program (ACTP), which allowed nine scientists from Portugal to fully exploit high-performance computing technologies, up to a period of four months, benefiting from one of the world's most powerful computing facilities for the digital modeling and simulation, data management, processing and visualization - the Texas Advanced Computing Center (TACC) at The University of Texas at Austin.

Leonardo Azevedo and João Dias spent their time at Austin at different moments. The first, back in the spring of 2019, and the latter, in the fall of 2019. During his two-month stay, Leonardo, an Assistant Professor at the Department of Civil Engineering, Architecture and Georesources of Instituto Superior Técnico, worked with Professor Tan Bui-Thanh and his team, from the Department of Aerospace Engineering and Engineering Mechanics at the Oden Institute for Computational Engineering and Sciences. During this period, they explored and implemented prototypes of efficient methods to tackle a high-dimension inverse problem such as seismic inversion. Confident about what he learned by participating in ACTP, when asked, Leonardo does not hesitate to recommend such experience.

"I certainly acquired new skills on computer sciences, which allowed me to broaden my network of contacts and participate in projects on topics that are not my 'natural' domain."

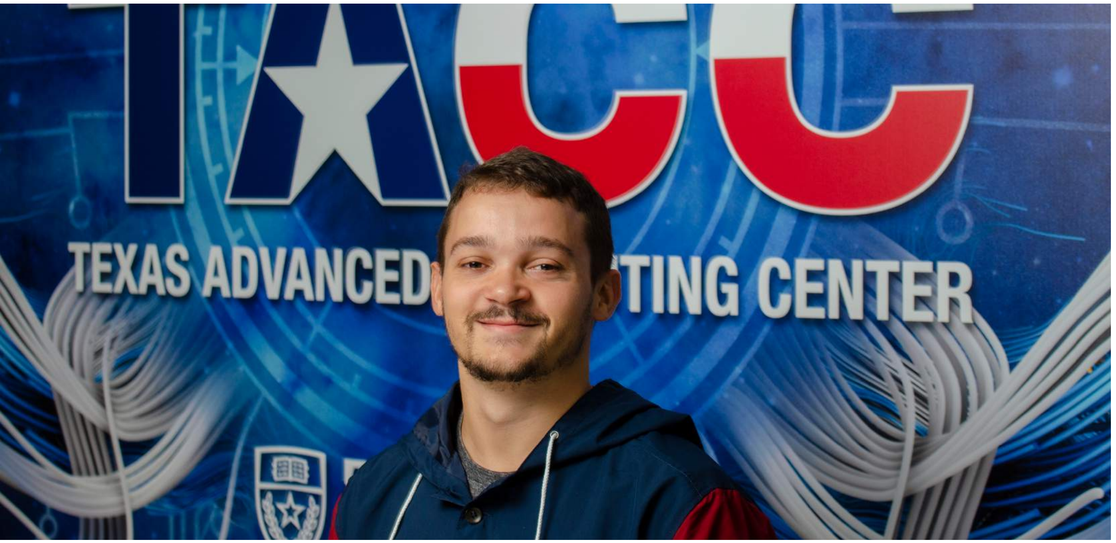
Leonardo Azevedo

Having had an amazing opportunity to work up close with the expert staff and computing systems of TACC, while contributing to the institution's mission of "enabling discoveries that advance science and society through the application of advanced computing technologies", Leonardo praises the benefits the Program has brought him. "I certainly acquired new skills on computer sciences, which allowed me to broaden my network of contacts and participate in projects on topics that are not my 'natural' domain'", he explains. "As a direct result of my stay, I also improved my knowledge of inverse problems and mathematical methods for uncertainty quantification in this type of challenges". Stating he also gained insights about HPC and data visualization, Leonardo also credits the Program for a new work methodology: "I now approach problems with a different perspective and I've included what I've learned during the training program in research project proposals submitted to different national and international calls."

João Dias, a recently graduated student in Computer Science, with a specialization in High Performance Computing from the University of Minho back in 2019, is not shy about what this opportunity meant to him, calling it "a life-changing one". Since he had heard about the Program before, João's expectations were very high – "I could definitely say that they were not defrauded", he adds. At TACC, he was assigned to a project that focused on the gathering and analysis of data dumps from the GRACE satellites, working with Dr. Paul Navrátil, Director of Visualization at TACC. Appreciating this exclusive opportunity,

Photo credits: Ana Pádua

Photo credits: TACC



João acknowledges what it means to work at a facility that has a supercomputer in the top 10 of the Top500. "The quality of the facility, resources, and work produced in that computing center is something remarkable, and an opportunity to participate in a project there is very attractive."

Being the last participant of this call, the UT Austin Portugal Program proposed a challenge at the end of last year, which João took as his own from the very beginning – filming his daily activities, showing what the day-to-day of a researcher at TACC looks like. "Despite being a bit biased, the vlog is a trustworthy example of what a researcher does at TACC", João claims. The video remains the Program's most clicked one, with 1.4k views and counting. "It is understandable. The opportunity that the Program provides to its participants is pretty unique, so it is normal to generate some curiosity and interest", he mentions.

"The knowledge and the outlook that I acquired in the usage of the supercomputers at TACC have a daily impact on my current work. The fact that I was a user previously helps me understand the issues other users may have when working with supercomputers."
João Dias

Although their experiences were very different, namely when it comes to scientific applications, both participants agree that this experience was a key opportunity that better prepared them for future challenges. And how are things now, after the Program? Some of the work developed by Leonardo Azevedo has remained somehow associated with the UT Austin Portugal Program. Leonardo received his UT Austin mentor in Lisbon to prepare a project proposal submitted to the UT Austin Portugal Program 2019 Call for Exploratory Research Projects. The proposal "reached a high evaluation and ranked immediately below the threshold. We will use this as a base for future submissions", he explains. As for João, he now works at the Minho Advanced Computing Center (MACC), as a System Administrator. "The knowledge and the outlook that I acquired in the usage of the supercomputers at TACC have a daily impact on my current work. The fact that I was a user previously helps me understand the issues other users may have when working with supercomputers." João believes the challenges of the future relate mainly to the potential for the development of MACC itself. "This project, in my opinion, addresses a long-standing gap in the Portuguese scientific community, by providing resources to help in research and innovation problems with great prospects of growth", he concludes.

Together with Research and Innovation, Education is one of the core instruments of the UT Austin Portugal Program. Through educational activities like the Advanced Computing Training Program, the Program is contributing both to talent building and the forming of sustained transatlantic partnerships.

4.4 Stakeholder's Engagement Activities

In times when people are asked to keep social distancing, it is fundamental to find alternative ways to stay connected and maintain high levels of engagement for the benefit of communities. UT Austin Portugal Program regards the relationship with its stakeholders critical to succeed. In 2020 the Program was able to organize most of its planned stakeholders' engagement activities, with digital technology proving crucial to alleviate the disruption the pandemic brought to the way we networked, socialized, travelled, communicated and collaborated.

Photo credits: FCT

Annual Meeting with the Program's Governing Board | FCT, Lisbon, January 10 2020

Some stakeholders' engagement activities help the Program converge towards its mission. The Annual Governing Board Meeting is one of them. Before COVID-19 hit Europe and the United States, the Program's Board of Directors met for the first time since the onset of Phase 3 with its International Partnership's sponsor, FCT, and the Governing Board in the city of Lisbon. This governance body is chaired by José Paulo Esperança, Vice-President of FCT, assisted by the Program's former Principal Investigator at UT Austin, Robert A. Peterson, representing the American Partner; José Manuel Mendonça, on behalf of Portuguese Universities and two CEOs who bring the industry vision and mindset to the Science and Technology Partnership: Célia Reis (Altran Portugal) and António Vidigal (EDP Inovação). The meeting offered the Governing Board the opportunity to review the progress made by the joint-venture in 2019 against the goals set forth; get to know the key lessons retained by the Leadership and the Executive Team; make recommendations and approve the 2020 Work Program and its corresponding budget.

Annual Meeting with the Portuguese Area Directors | INESC TEC, Porto, February 21 2020

Further to the meeting with the Program's Governing Board, the Board of Directors invited Area Directors in Portugal to present them the final version of the 2019 Annual Report and get their support in the implementation of the approved 2020 Work Program. This one had been conceived to take the best possible advantage of the momentum gained over the previous 12-month period to further encourage effective partnerships through collaborative R&D projects, high-level education and training opportunities between Portugal and Austin. The importance of Area Directors' role in the Program's pursuit of scientific excellence and alignment with national and international research innovation agendas was particularly emphasized on several occasions throughout the meeting. They are regarded as first-line Ambassadors of the Program, contributing to growing the brand and the International Partnership's scientific prestige in and outside of Portugal.

ERC members

Peter Arzberger
Chair of the Committee
Area of Advanced Computing

Oliver Jäkel
Area of Medical Physics

Edwin L. Thomas
Area of Nanotechnologies

Alison Campbell
Area of Technology Innovation and Entrepreneurship

Alfred Ng
Area of Space-Earth Interactions

Meetings with Project Coordinators | June and November 2020

For the first time ever, the International Partnership is a hub of industry-led transatlantic research projects with high innovation potential. These projects correspond to a collaborative arrangement that is new to the Program, contingent on a creative mix of public and private funds and subject to a well-established body of rules due to the nature of the financial incentive projects are granted with. Overseeing the execution of such projects is a collective and complex endeavour involving the consortia themselves, the Program, FCT, ANI, Managing Authorities of the European Regional Development Fund (ERDF) in Portugal and the Ministry of Science, Technology and Higher Education through the Go Portugal initiative. In 2020, the Program's main priority was to connect with all strategic research consortia and earn their trust by expressing its full support throughout project implementation in different ways: acting as a fast-tracking partner to FCT and ANI for queries, doubts and concerns brought up by consortia; passing on information from the sponsors; offering tailored advice on communication matters to raise project profile; spotting synergetic opportunities with other projects and high-level initiatives, either championed or not by the Program; developing monitoring tools to see how the transatlantic collaboration for each project is working (including project management; sharing and commercialization of IP) and progressing to help the Program achieve its long-term goals. In June and later on in October 2020, the Program's Leadership in Portugal held individual meetings with grantees specifically aimed at identifying potential constraints projects could or would be facing, technically and financially, due to the pandemic. Conversations revealed that flexibility with funding and management rules was extremely important for consortia to weather the storm the prompted COVID-19 crisis.

External Review Committee Annual Meeting | Virtual Session, October 8-9 2020

On October 8 and 9, the UT Austin Portugal Program's newly constituted ERC convened to assess the Program and its components for the first time since the start of Phase 3.
Reporting to FCT and UT Austin Portugal's Governing Board, the ERC is an independent panel composed of high-profile academics, researchers and a knowledge transfer expert, who act as advisors for the Program, evaluating its scientific progress annually to make informed recommendations and challenge the International Partnership to stretch collaborations and look for new opportunities. The two-half day meeting took place in a digital setting and attempted to cover the full spectrum of activities and instruments the Program relies on to realize its mission, by bringing in beneficiaries and external stakeholders to give testament to its importance. It proved challenging to provide other than an overview of the Partnership in this first meeting, which also involved FCT, the Program's US and PT Leaderships, the Executive Team in Portugal and the Ministry of Science, Technology and Higher Education on the very last day to close the session. Given the complexity and extent of the Program, the ERC made the conscious decision to embark on a "learning approach" in 2020. Tangibly this had a few implications: between May and August, the Chair met several times with the Board of Directors to gain a broader understanding of the joint-venture before summoning the other members of the panel for a preparatory meeting in September; the panel committed to reviewing other aspects of the Program at shorter, additional focused meetings before the next.
Ultimately, the new stage of maturity that UT Austin Portugal is in represents an increased capability to implement new collaborative arrangements and to support the transfer of solutions from the lab to the market, looking to solve global problems through continuous cooperation.
The ERC presented to FCT and the Program's Governing Board a report on the progress made by the International Partnership, which should be used to help us build upon our work to date, learn from our lessons and maximize the impact of our activities.

Annual Conference, October 7-8 2020

Under the theme “Innovation at the Intersection of Academia and Industry”, the UT Austin Portugal Program’s 2020 Annual Conference took place in a hybrid format, with over 100 participants watching the event online, between October 7 and 8. Combining a live program at CEiiA, the Centre of Engineering and Product Development in Portugal, and an online schedule of four masterclasses, the 2020 edition featured 15 distinguished speakers to discuss science-based innovation in the frame of academia-industry collaborations.

Keynote Sessions (October 7)

On October 7, all eyes were on the two distinguished Keynote Speakers, Maria Helena Braga (Faculty of Engineering of the University of Porto) and Luis Sentis (Department of Aerospace Engineering at The University of Texas at Austin). They were invited to share their thoughts on how bold science in their areas of expertise is shaping disruptive solutions for some of our societies’ most pressing challenges, in a session that sought to promote a broader discussion with invited experts joining in as discussants to comment on Braga and Sentis’s ideas: Paulo Ferreira, Head of the Department of Advanced Electron Microscopy, Imaging and Spectroscopy at the International Iberian Nanotechnology Laboratory (INL) and Director for the Program’s Area of Nanotechnologies; Pedro Camanho, Professor at the Department of Mechanical Engineering of the Faculty of Engineering of University of Porto (FEUP), Vice-President of the Institute of Mechanical Engineering and Industrial Management (INEGI), President of the Associated Laboratory in Energy, Transportation and Aeronautics (LAETA) and Director for the Program’s Area of Space-Earth Interactions; and Ricardo Conde, Portugal Space’s Interim President.

Braga’s keynote “The future of batteries as we know them today: possible entanglements leading to a transformation” was a thought-provoking reflection on the future of sustainable energy storage. The Portuguese researcher, who worked alongside the 2019 Chemistry Nobel John Goodenough, has made an outstanding contribution towards a new generation of solid batteries. Braga’s ferroelectric glass-electrolyte comes as a safer, eco-friendlier and less expensive that should help secure the future of electric vehicle batteries.

“In a hypothetical future, robots could be strong participants in our economy”. This was one of the statements made by Luis Sentis on his presentation, titled “Invention and commercialization of human-centered robots through academic-industry collaborations with NASA”. The UT Austin’s Professor and successful entrepreneur claimed that robots could be used across multiple areas and for many purposes, but reminded that the human capital remained the number one priority”. Luis Sentis used some of his projects to show his full support to any work surrounding sustainable and human interactive machines and robotics systems that increases productivity, security and health.
Minister of Science, Technology and Higher Education, Manuel Heitor, closed the first day of the Conference stating that UT Austin Portugal was a “key initiative in Portugal, engaged in making it happen, in doing more, feeding new ideas, and new researchers and, in particular, trying to foster new frontiers of knowledge, always through an open and collaborative platform”.

159 Registered participants — 92 — 67

68 from Universities (43%)

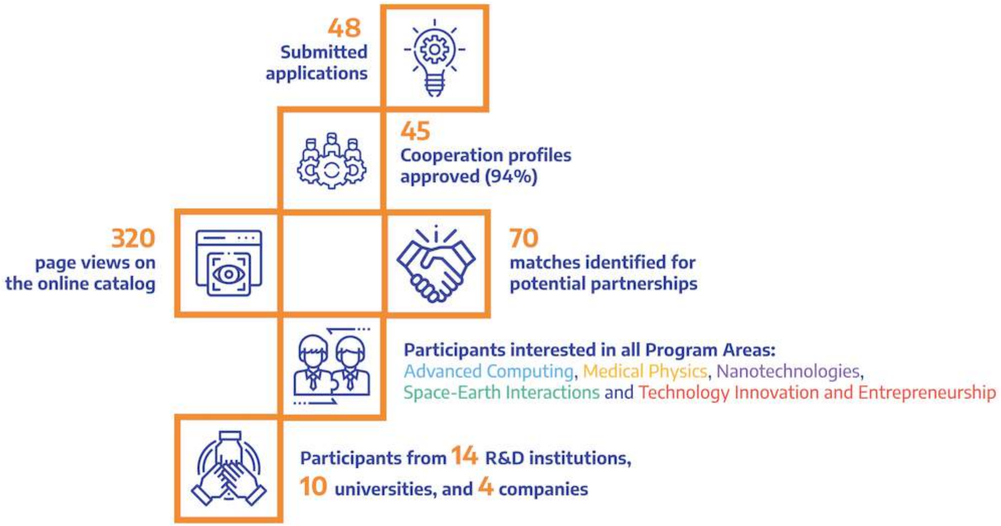
49 from R&D Institutions (30%)

17 from Industry (11%)

25 Other Affiliations (16%)

28 E-posters uploaded in total

- **11** from 2019 Strategic Research Projects (39%)
- **9** from 2017 Exploratory Research Projects (32%)
- **8** from the 2020 Call for Poster Proposals (29%)
- **15** related to Nanotechnologies (57%)
- **9** related to Space-Earth Interactions (32%)
- **2** related to Advanced Computing (7%)
- **2** related to Medical Physics (7%)



E-Poster Gallery (October 7 and 8)

A digital portfolio exhibited a collection of posters selected under the Conference's 2020 Call for Posters, and also posters featuring projects supported by the Program, such as the 2019 Strategic Research Projects and the 2017 Exploratory Research Projects.

The E-Poster Gallery covered the areas of Advanced Computing, Medical Physics, Nanotechnologies, and Space-Earth Interactions and was online for the entire duration of the Conference, opening on October 7 at 2 p.m. (Lisbon time) / 8 a.m. (Austin time) and closing on October 8 at 6 p.m. (Lisbon time) / 12 p.m. (Austin time).

Conference attendees were able to click on titles of their interest and see the full posters in detail. The majority of Posters included an audio presentation by the respective authors, providing not only a more in-depth description of the work conducted but also a less impersonal digital experience for participants browsing through the Gallery. Additionally, participants were given the opportunity to provide feedback and discuss the featured R&D projects through a dedicated virtual chat room.

Cooperation Profiles / E-Networking Corner (October 7 and 8)

Although the 2020 edition of the Annual Conference was held online, the Program still wanted the Conference to serve as an opportunity to strengthen networking and cooperation opportunities among participants. An online catalogue with cooperation profiles submitted by registered attendees wishing to find potential partners among the audience was made available on the Program's website. Close to 50 profiles were published and 70 potential matches identified prior to the Conference. Participants could use the Conference's chat rooms to meet with their matches and find out whether there was room for cooperation in the future.

Masterclasses (October 8)

Building on the success of last year's Annual Conference Masterclasses, the Program held not two, but four Masterclasses. These thematic sessions took place in a digital setting during the second day of the conference and were put together by the Program's Area Directors in close collaboration with a panel of world-class speakers from Portugal, UT Austin and beyond (See Education, page 77).

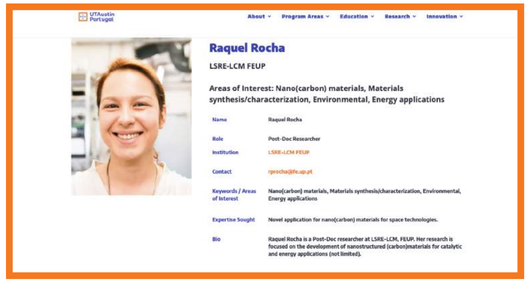


Photo credits: Raquel Rocha

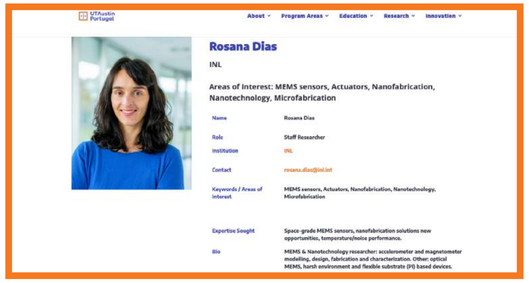


Photo credits: Rosana Dias

National Science Summit, Lisbon Congress Center, November 3 2020

Bringing together beneficiaries and ambassadors of its Research and Education initiatives, the Program organized a session on November 3 at Ciência 2020, the National Science Summit that happens every year in Lisbon to celebrate the main accomplishments of the Portuguese scientific community.
The Summit's 2020 edition looked to promote discussion beyond the main topics and challenges of the national S&T agenda. The impact of the COVID-19 pandemic, and how science and innovation could help the country in its recovery efforts were center stage for obvious reasons. A repeated idea throughout the event, which took on a hybrid format, was that international cooperation proves critical to overcoming crises like the one the world was facing in 2020.
Drawing on this perception, the "UT Austin Portugal: A meeting of minds an ocean apart" session, which attracted over 180 online viewers, served as an opportunity to reflect on the international joint venture between Portugal and UT Austin. In attendance at the Lisbon Congress Center's main auditorium were the Minister of Science, Technology and Higher Education and the President and Vice-President of FCT (see the full agenda on the next page).

Photo credits: Ciência Viva

encontro CIÊNCIA '20

UT Austin Portugal: A meeting of minds an ocean apart

November 3, 2020
2.00 p.m. | 3.30 p.m. (Lisbon time)

Ever since the Age of Discovery, the Portuguese have been known to be fearless people to whom no insurmountable obstacle could hold them back from dreaming and going further.

More than six centuries have passed since the onset of this world-changing age, but the drive for breaking barriers remains a foundational trait of the Portuguese people. In today's world, Portugal is making its way in new territories – those of knowledge, forging relations with strong overseas partners and emerging as a key science and innovation world player.

The successful joint venture with UT Austin, which started more than a decade ago, is part of the country's long-term strategy to navigate and master STEM-based research to deliver impactful, transformative innovation on a global scale.

In this 90-minute session, you will get the chance to learn how the international partnership is delivering on its mission through first-person accounts of its beneficiaries and ambassadors.

Agenda

2.00 p.m. **How far have we come?**
Overview of the Program's achievements since the start of Phase 3

Rui Oliveira, UT Austin Portugal **(Institutional)**

2.05 p.m. **A breakthrough transatlantic project in the area of cancer treatment**
(2017 Exploratory Research Project DREAM – Drug delivery nanosysteM for HPV infection therapy)

Carla Cruz, UBI **(Nanotechnologies)**

2.25 p.m. **The Advanced Computing Training Program at the Texas Advanced Computing Center**

Dan Stanzione, TAAC, UT Austin
João Barbosa, formely TACC **(Advanced Computing)**

2.45 p.m. **Shaping the future of Proton Therapy: technological breakthroughs in cancer treatment equipments**
(2019 Strategic Research Project TOF-PET for Proton Therapy (TPPT): In-beam Time-of-Flight (TOF) Positron Emission Tomography (PET) for proton radiation therapy)

Stefaan Tavernier, Petsys Electronics **(Medical Physics)**

3.05 p.m. **Navigating the Space: a new Age of Discovery for the world**
(2019 Strategic Research Project uPGRADE- Miniaturized Prototype for GRavity) field Assessment using Distributed Earth-orbiting assets

Tiago Hormigo, Spin.Works **(Space-Earth Interactions)**

3.25 p.m. **UT Austin Portugal's elite of industry-driven research projects (video)**

3.30 p.m. **Final remarks**

José Manuel Mendonça, UT Austin Portugal **(Institutional)**

Carla Cruz is an Assistant Researcher in the Health Sciences Research Centre at the University of Beira Interior (CICS-UBI) and Invited Assistant Professor at the Faculty of Health Sciences- UBI. Currently, she is Vice-Coordinator of the Biopharmaceuticals and Biomaterials group at CICS-UBI and member of the Executive Board of CICS-UBI. With two patents granted and one pending, she is the Principal Investigator of 10 research projects, including the UT Austin Portugal Program, collaborating with several international institutions. She has participated in more than 60 conferences, presenting her work in many international conferences.

Dan Stanzione is the Executive Director of the Texas Advanced Computing Center (TACC) and Associate Vice President for Research at The University of Texas at Austin (UT Austin). He is the Principal Investigator for a National Science Foundation (NSF) grant to deploy and support Stampede2, a large scale supercomputer, which has over twice the system performance of TACC's original Stampede system. Stanzione is also the PI of TACC's Wrangler system, a supercomputer for data-focused applications. For six years he was Co-Director of CyVerse, a large-scale NSF life sciences cyberinfrastructure. Stanzione was also a Co-Principal Investigator for TACC's Ranger and Lonestar supercomputers, large-scale NSF systems previously deployed at UT Austin. In the UT Austin Portugal Program, he serves as the Area Director of Advanced Computing at Austin.

João Barbosa joined TACC's Scalable Visualization team in 2011 as a Graduate Research Assistant in High-Performance Graphics and Scientific Visualization. As a full-time Research Associate at TACC, João has worked in several SciVis projects that range from high-level applications such as Gas and Oil to low-level high-performance software packages such as GraviT and pvOSPRay in partnership with leading hardware and software companies. His current research focus lays in high-performance real-time in-situ photo-realistic ray tracing for SciVis. During his time at TACC, João also served as a mentor of the participants under the Advanced Computing Training Program. Now he will be joining the Minho Advanced Computing Center (MACC) as a full-time researcher in Scientific Visualization.

Stefaan Tavernier, Professor, has spent most of his scientific career developing detectors, mainly for particle physics. He has been the Principal Investigator of the CERN NA25 experiment and the spokesperson of the CERN RD-18 Project (Crystal Clear collaboration) for 15 years. Since 1990, he gradually became interested in applications of particle physics in the field of Medicine. In 2010, he retired as a Full Professor at the University of Brussels, and founded the company PETsys Electronics, together with Professor João Varela, from IST Lisbon. PETsys Electronics is providing electronics to many of the major research institutes in the world such as Lawrence Berkeley Lab, NASA, Sandia Labs, CERN, ETH Zurich, KEDA and other top universities.

Tiago Hormigo is co-founder of Spin.Works, an aerospace company dedicated to the development and manufacturing of aerostructures and unmanned systems for the Aeronautics, Space and Defence markets, as well as Head of Space Business Development and Project Manager. Tiago Hormigo previously worked as a Project Engineer of EADS Astrium and Senior Engineer with the Advanced Projects Team at Deimos. In 2002, he was part of the European Space Agency Center's Mars Express Mission, as Mission Analyst. Tiago Hormigo has a Master's degree from Delft University of Technology in Aerospace Engineering.

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia | TEXAS The University of Texas at Austin

4.5
Communication and Outreach: Highlights

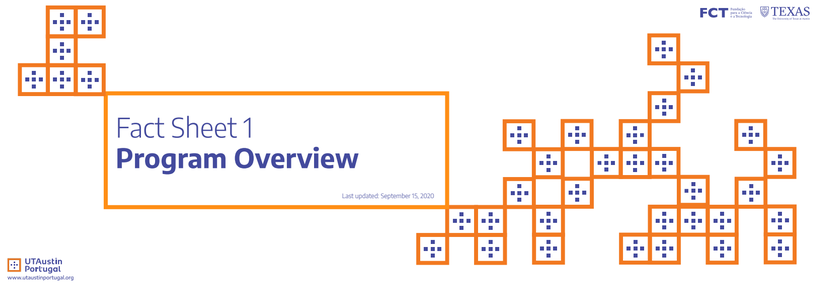
This area is accountable for developing and implementing a communication and branding strategy, aiming to help convey the UT Austin Portugal Program's mission, vision and initiatives to its internal and external stakeholders and generate commitment and awareness of the Program. This area works closely with the other areas of the Program to make sure that it captures the dynamics of the Program and the information it needs to promote and communicate it.

In any organization, communication staff play an important role in helping management connect and engage with internal and external stakeholders to build up loyalty and create a sense of belonging and identity. At UT Austin Portugal, the Communications area works to ensure that the Program's mission and accomplishments become visible through communication activities. Continuous alignment between the area's activity plan and the Program's annual plan ensures that target audiences are reached in due time, through the right channels, and the value and impact the Partnership are generating come across effectively.

The Communications area embraced 2020 with confidence and determination, drawing on the results of the previous year. The following goals were set:
- Increase **visibility in the media**;
- Release **five thematic videos** about the **areas of the Program**;
- Launch **updated communication materials and merchandise**;
- Conduct several **written interviews with research teams supported by the Program**;
- Release a **bi-monthly newsletter**;
- Continue to grow the Program's **social media community**;
- Promote internal stakeholders' and direct beneficiaries' active **involvement and participation** in the dissemination of the initiatives of the Program.

However, as the COVID-19 situation unfolded the communication plan and goals had to be readjusted. It is undeniably true that social distancing and remote work disrupted the way we communicated. Most of our interactions shifted into digital; people were flooded with information coming from all sources and directions, even corridor conversations and networking were happening online. The Program's Communications area faced unique challenges but also exceptional opportunities to keep the community aware, interested and connected.

As the overall activity slowed down, particularly in the first months after the pandemic started, the team invested time in actions to not only strengthen the Program's presence on the web and social media channels but also earn the trust and confidence of its direct beneficiaries through communication advisory, tailored support and development of templates or ready-to-use communications materials with the Program's branding. Upon request of sponsor FCT, the Program put forward a short guide for the Strategic Research Project consortia to acknowledge FCT and the International Partnerships in all their outputs and dissemination and communication materials. The guide was extended to the two other International Partnerships. Additionally, the team worked to shape messages capable of instilling hope and authenticity during a time of crisis and ventured into a whole new way of communicating the first-ever hybrid Annual Conference of the Program.



So, what did this mean in practice?

• Dedicated webpages on the Program's website were developed for every single project awarded funding in 2020. This was possible thanks to the use of a project description form specifically designed to collect information that could feed into different communication materials over time (e.g., E-Posters, Project Factsheets; Promotional Videos). The webpages are intended to be regularly updated as projects move forward, and results can be showcased;

• Production of content for social media channels showing how the Program was performing;

• Use of social media channels to share and post news and information sent by our key stakeholders, thus ensuring that they recognized the Program's ability to reach the people and organizations that matter;

• Two editions of a webinar on science communication were organized between July and September to help research teams design and implement a communication plan to maximize the outreach of their R&D projects. The training was complemented with the release of a practical guide offering several tips, recommendations and valuable sources on research communication strategy;

• New digital communication materials were developed, including:

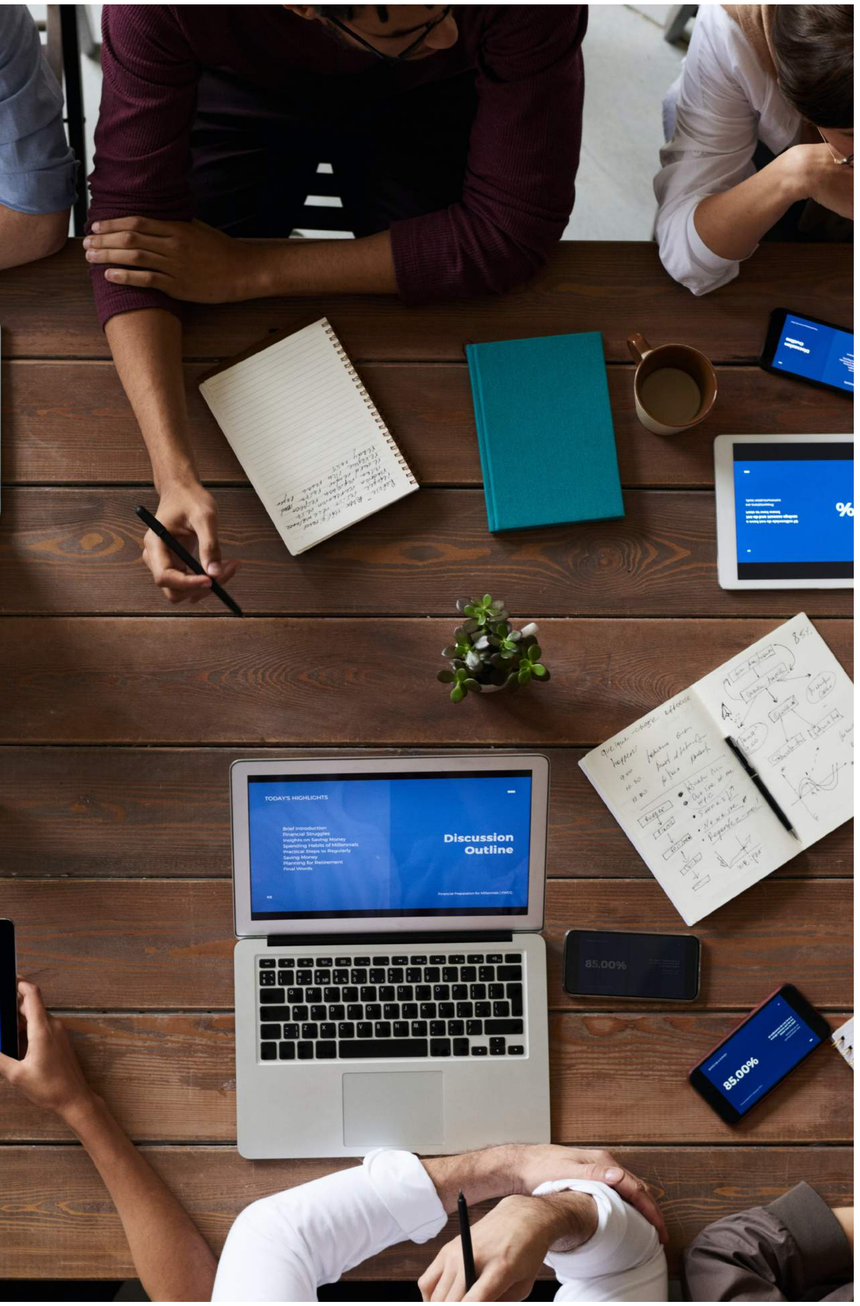
  • Three factsheets with infographics to make the value and impact of the Program more visual, thus tangible to its stakeholders and society at large. The factsheets, whose content had been put together by the Program's Area of Evaluation and Impact Assessment, were included in the supporting material for the ERC Annual Meeting.

  • A PowerPoint presentation that could be used by the Program's staff and ambassadors to demonstrate how and where the International Partnership was making a difference in the S&T international setting;

• Creative teasers and promotional videos were produced, being the most important the video showcasing the 11 Strategic Research Projects. This full in-house production, which received very positive feedback from the Minister of Science, Technology and Higher Education and FCT itself, was premiered at the Program's 2020 Annual Conference and played later on at the 2020 National Science Summit. In approximately five minutes, the video gives a glimpse of how the Program is tackling global challenges through research-based innovation spearheaded by transatlantic company-driven consortia;

• Continuous assessment of communication endeavors and key indicators, which was regarded as critical to 1) work around disruption caused by the COVID-19 crisis and 2) go on meeting the expectations of the Program's community.

There is still much room for improvement and the team is well aware of that. The biggest challenges for 2021 are to use more storytelling to convey the value the Program is creating as ongoing projects advance and the impact of past activities is assessed; and be consistent, yet adaptable, across all social media where the Program is present.



Communication Strategic Objectives

- **Disseminate the Program's initiatives**
- **Increase the Program's visibility**
- **Raise community awareness**
- **Build up the Program's identity and brand**
- **Promote community engagement**
- **Communicate impact**

Communication Tools

- **Website**
- **Social Media**
- **Newsletter & Emailing**
- **Knowledge-sharing and Networking events (e.g.: Annual Conference)**
- **Merchandise**
- **Factsheets and Infographics**
- **Press Releases**
- **Stakeholders' Meetings**

Communication in Figures | 2020 Highlights

Our Website: enhancing our community's digital experience

- Visitors from 130 different countries;
- Visited by 11118 users;
- 37056 page views (101 page views per day);
- 49% of the users visited the website through organic search;
- Besides the Homepage, the 2020 Annual Conference webpage was the most visited, with 1715 page views.

Our Newsletter: Keeping our audience informed and engaged

- 3 Newsletter issues released;
- 8 Mailchimp campaigns;
- Average number of people reached per campaign: 1649 (10% more than in 2019);
- Subscription rate grew almost 10%.

Social Media: a tool for visibility and engagement

- Followers: Twitter – 1758 (+ 9 than in 2019); Linkedin – 899 (+617 than in 2019); Facebook – 415 (+58 than in 2019); Youtube – 42 subscribers (+24 than in 2019);
- Youtube: 16 videos uploaded, 331.8 hours of watch time and 8982 views.

Using media outlets to reach the general public

- 71 news mentioning the UT Austin Portugal Program;
- 2 press releases.

2021 Outlook

05

As we leave 2020 behind and move into a new year, we carry forward the lessons learnt along with increased tenacity, flexibility and ability to adapt – competencies that we developed further as we made it through the pandemic.

The vaccines announced to fight off COVID-19 brought hope, but uncertainty will not subside overnight. Therefore, the 2021 Activity Plan has been designed out of careful optimism, ambition and confidence, keeping in mind the External Review Committee's recommendations and overarching comments in their latest report to the Program's Governing Board and Board of Directors.

We might well have to wait until the end of the first semester of 2021 to support research exchanges again at UT Austin or organise large on-site networking and training events for international travel, and social gathering restrictions are likely to continue for some time.

However, taking advantage of the digital transformation that revamped organizations and people's lives in 2020, and our own experience with virtual events last year, we expect to embark on a combination of hybrid events with full on-site or on-line training and networking activities. To this end, we will carry on working closely with our Area Directors and pool of experts in Portugal, UT Austin and other locations where we have set up links with to put on educational programs catering to our main direct beneficiaries and strategic stakeholders. Additionally, we are also planning on opening a Call for Workshop Proposals to receive applications from our transatlantic community and across the Program's scientific domains and topics that are center stage to our projects.

As for the mobility arrangements that ensured in the past hands-on training and immersive learning experiences at UT Austin and TACC, we intend to launch a call for Expressions of Interest to ascertain the interest of researchers and students in Portugal to spend some time abroad. The implementation of research exchanges will depend on travel restrictions being lifted and the sponsor's approval of regulation deeming mobility-related costs eligible.

As for the Research Line of Action, a new Call for Exploratory Research Projects is anticipated to be announced in the course of the year. However, it is very unlikely that the Program launches a new edition of Strategic Research Projects, at least, in a format similar to the previous edition. The Program's success in the 2019 competition came at the expense of readjusting the budgets to accommodate the support to more projects than it had been anticipated, especially at UT Austin. This reallocation tipped the Program's investment balance to research, and away from the program's Education and the Technology Innovation and Entrepreneurship (TIE) activities.

The Program is aware that a reduced breadth of activities may lead to a loss of influence and attractiveness and negatively affect the ability to effectively deliver long-term strategy.

To mitigate these risks, the Program will continue to oversee the projects selected under the 2019 Calls, relying on an integrated and holistic approach. This means looking to them as a portfolio of synergistic projects, rather than just 19 separate projects, to spot cross-cutting learning opportunities and cross-fertilization potential even beyond the Program's community. In this mission, the Program is committed to helping consortia identify best practices and collaborative opportunities with strategic stakeholders and high-level initiatives and address weaknesses through support and advice. We are aware that such commitment requires a great deal of effort, but by doing it, the Program is increasing its chances to achieve demonstrable, large-scale impact.

This will not be done without a sound communication strategy designed to earn and build our most direct beneficiaries and partners' trust along with a reliable reporting and monitoring system - with room for improvement, though. Both communication and reporting/ monitoring activities play a pivotal role in making the Program's outputs, outcomes and impact visible and understood.

In 2021 we count on all of you to carry on fostering impactful change with a science-to-innovation approach. Thank you for being part of our community!

Annex

06

Training and Large Networking Events (Agendas)

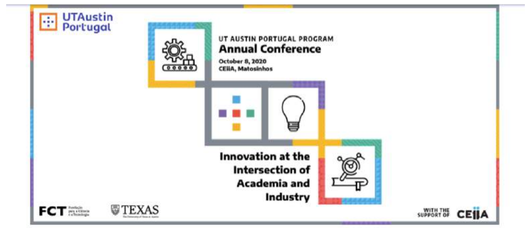
- 2020 Annual Conference, October 7 2020
- Masterclass in Nanotechnologies, October 8 2020
- Masterclass in Space-Earth Interactions, October 8 2020
- Masterclass in Advanced Computing, October 8 2020
- Masterclass in Medical Physics, October 8 2020
- Ciência 2020, November 3 2020

Communicaton Guide

- Quick Guide on Communication of R&D Projects (produced for the Communication of R&D Projects Webinars)

Mailchimp Campaigns

- Save the Date | UT Austin Portugal 2020 Annual Conference
- UT Austin Portugal achieved €21.9M to support 11 high-quality R&DI projects
- UT Austin Portugal 2020 Annual Conference - Meet our Keynote Speakers and Register Now!
- UT Austin Portugal 2020 Annual Conference - MASTERCLASSES UPDATE
- UT Austin Portugal | Call For Poster Proposals - Deadline Extension
- UT Austin Portugal 2020 Annual Conference Goes Digital!
- UT Austin Portugal 2020 Annual Conference | Updated Agenda And Open Registration!
- UT Austin Portugal 2020 Annual Conference | Going Online - Register Until October 2!

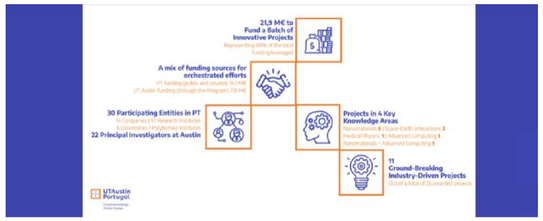


SAVE THE DATE!
October 8, 2020, Matosinhos

UT AUSTIN PORTUGAL'S 2020 ANNUAL CONFERENCE
Innovation at the Intersection of Academia and Industry

Another edition of the UT Austin Portugal's Annual Conference is coming!

This year's Conference focuses on *innovation at the Intersection of Academia and Industry*. After all, the Program is supporting for the first time ever a batch of highly innovative industry-driven projects led by Portuguese companies in conjunction with non-



Did you hear the big news?
€21.9M to support 11 disruptive industry-driven research projects with UT Austin Portugal's seal

We are proud to share with our community that UT Austin Portugal was the best performer in the *2019 Call for R&TD Co-Promotion Projects - International Partnerships*! Not only had the Program the highest number of projects approved, but it also pulled in the largest amount of funding.

The International Partnership's 11 market-driven research projects, selected under this pioneering and competitive funding solicitation, represent a financial commitment of 21,9 million euros - 40% of the total eligible investment (public and private) allocated to a total of 25 awarded PT-US consortia.

UT AUSTIN PORTUGAL 2020 ANNUAL CONFERENCE
Open Call for Poster Proposals
EXTENSION OF DEADLINE: July 27, 2020

The UT Austin Portugal Program is inviting researchers / practitioners to submit proposals for posters to be displayed at this year's Annual Conference, under the topic of Innovation at the Intersection of Academia and Industry, on October 8, 2020.

Scope of this call:

Proposed posters shall address research results or work in progress, particularly highlighting collaborations between academia and industry aiming at solving critical problems of a given industry, covering, at least, one of the five scientific areas of the Program.

UT AUSTIN PORTUGAL'S 2020 ANNUAL CONFERENCE
UPDATE: WE ARE GOING DIGITAL!
October 7-8, 2020 | Start time: 2 p.m. (Lisbon time) | 8 a.m. (Austin time)

The UT Austin Portugal Program has always looked at challenges as learning opportunities and goods arguments for putting itself to the test. When we started planning the Annual Conference last year, we were far from imagining that the 2020 edition of the Program's largest networking event could be at risk of not taking place for safety reasons and international travel restrictions.

So how could we still reunite to celebrate our community's achievements, welcome new members and discuss the state-of-the-art of highly relevant scientific themes with societal impact?

Newsletters

- UT Austin Portugal Program | Gathering pace for ambitious new challenges
- UT Austin Portugal Program | A lesson we take with us
- UT Austin Portugal Program | We are all in this together

UTAustin Portugal

Create knowledge.
Foster change.

Newsletter #72 | February 2020

Gathering pace for ambitious new challenges.

To say we are excited for 2020 is an understatement. We started this year with a retrospective look at 2019 – a year in which the UT Austin Portugal Program was able to operationalize the instruments set for Phase 3 and deliver on its mission and strategic

UTAustin Portugal

Create knowledge.
Foster change.

Newsletter #74 | December 2020

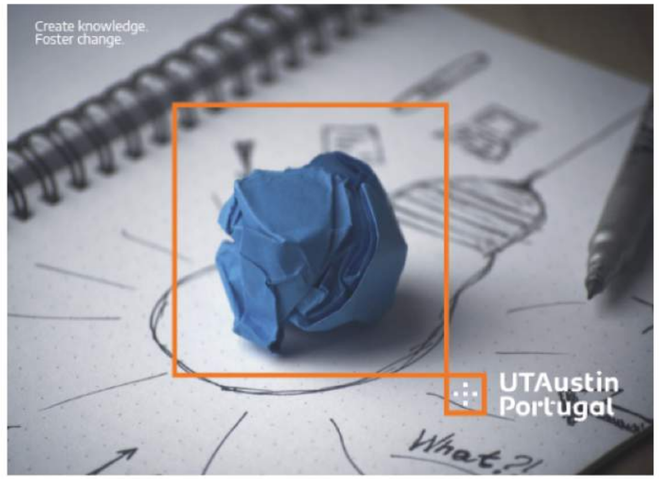
A lesson we take with us.

Over the last several months, we have been faced with many constraints that have made us rethink the way we live, work and stay connected, be it in a professional or social context. If, at first, it seemed too difficult to maintain any sense of normality, the Covid-19

UTAustin Portugal

Create knowledge.
Foster change.

Newsletter #73 | July 2020



We are all in this together.

For many of us, 2020 is likely to become one of, if not the most, challenging and toughest years of our lives. We have had to learn to live and adapt to a reality that is closer to a sci-fi movie plot. But human nature is not used to lower its guard in the face of adversity and tends to come out stronger and better equipped to tackle new challenges.

News pieces related to the UT Austin Portugal Program

06/01/2020	• UT Austin Portugal participates in pioneer event for joint work on technical developments on satellite constellations
10/01/2020	• UT Austin Portugal highlighted in Texas Engineer Magazine
20/01/2020	• UT Austin Portugal organizes its annual Governing Board meeting
22/01/2020	• The Advanced Computing Training Program “was one of the best experiences I could ever had” – An interview with João Dias
27/02/2020	• UT Austin Portugal’s Leadership and Area Directors gather for annual meeting
28/04/2020	• € 21.9M to support 11 high-quality R&DI projects under the UT Austin Portugal Program
06/05/2020	• Area Director of Space-Earth Interactions elected Fellow of the Royal Aeronautical Society
19/06/2020	• FCT and DGES launch scholarship program “Verão com Ciência”
02/09/2020	• 8 Exploratory Research Projects approved under the UT Austin Portugal Program
17/09/2020	• The UT Austin Portugal Program shows why science communication matters
19/10/2020	• Impactful academia-industry collaborations bring together transatlantic community in UT Austin Portugal’s Annual Conference
20/10/2020	• First ERC Meeting since the beginning of Phase 3 of UT Austin Portugal reinforces commitment to scientific excellence
11/11/2020	• UT Austin Portugal hosts session at National Science Summit 2020 to discuss Science and Innovation
02/12/2020	• Where are they now? Two Portuguese researchers talk about how UT Austin Portugal influenced the course of their careers

News published in the website

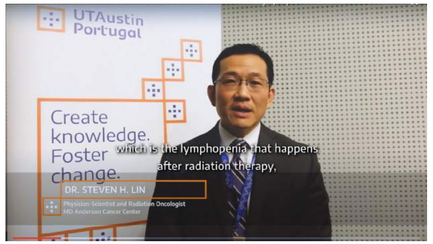
C2TN	27/03/2020	C2TN is a partner in a new UT Austin-Portugal project in the emerging area of proton therapy
ECO	22/04/2020	Mais de 55 milhões de euros para 25 projetos de investigação que envolvem empresas
Governo de Portugal	22/04/2020	Go Portugal com 25 novos projetos de I&D em copromoção com empresas para ativar o posicionamento internacional de Portugal
RTP	22/04/2020	Mais de 55 milhões de euros para 25 projetos de investigação que envolvem empresas
SAPO	23/04/2020	25 projetos de investigação Go Portugal vão receber financiamento de 55 milhões de euros
TV Europa	23/04/2020	Novos projetos de I&D entre Portugal e Universidades dos EUA
E-Global	28/05/2020	11 projetos portugueses recebem 21,9 milhões de euros através de parceria internacional
Cockrell School of Engineering	08/06/2020	New Projects in UT Austin Portugal Program Aim to Address a Range of High-Impact Research Challenges
Texas Advanced Computing Center	22/06/2020	BigHPC Texas/Portugal partnership forged to transform data science
EurekAlert!	24/06/2020	BigHPC Texas/Portugal partnership forged to transform data science
UT Austin College of Natural Sciences	24/06/2020	BigHPC Texas/Portugal Partnership Forged to Transform Data Science
HASLab	01/07/2020	HASLAB participates in project to improve the performance of supercomputers
Expresso	01/07/2020	Empresa portuguesa desenvolve o primeiro nano-satélite para estudos gravimétricos
BIP INESC TEC Magazine	01/07/2020	INESC TEC participates in project to improve the performance of supercomputers
SAPO	01/07/2020	Supercomputador português vai receber quase dois milhões de euros para ajudar a acelerar descobertas
Público	01/07/2020	Equipa luso-americana desenvolve satélite para vigiar a gravidade da Terra
Notícias ao Minuto	01/07/2020	Portugueses desenvolvem primeiro nano-satélite para estudos gravimétricos
Rádio Regional	01/07/2020	Empresa portuguesa desenvolve o primeiro nano-satélite para fins científicos
PC Guia	01/07/2020	Supercomputador português MACC vai ter investimento de quase dois milhões de euros
Jornal Económico	01/07/2020	Empresa portuguesa integra consórcio internacional para desenvolver primeiro nano-satélite para estudos ambientais
Observador	01/07/2020	Empresa portuguesa desenvolve o primeiro nano-satélite para estudos gravimétricos

INESC TEC	01/07/2020	INESC TEC participates in project to improve the performance of supercomputers
INL	02/07/2020	LIP is a partner in BigHPC
DN Insider	02/07/2020	Empresa portuguesa desenvolve primeiro nano-satélite para estudos gravimétricos
ISQ	02/07/2020	ISQ vai testar o primeiro nano-satélite do mundo para estudos gravimétricos
O Instalador	02/07/2020	Primeiro nano-satélite do Mundo pode ajudar a perceber mudanças climáticas
SAPO	02/07/2020	Portugal lidera criação do primeiro nano-satélite do mundo para estudos gravimétricos
Dinheiro Vivo	02/07/2020	Tecnologia portuguesa no primeiro nano-satélite para estudar degelo e companhia
LIP	02/07/2020	LIP is a partner in BigHPC
Exame Informática	03/07/2020	Investigação portuguesa vai melhorar desempenho de supercomputadores
Empreendedor	03/07/2020	ISQ testa primeiro nano-satélite do mundo
Jornal Económico	03/07/2020	Supercomputador português vai ter investimento de quase 2 milhões de euros
Líder Magazine	03/07/2020	Esta empresa portuguesa está a testar o primeiro nano-satélite do Mundo para estudos gravimétricos
Jornal Económico	05/07/2020	Primeiro nano-satélite do mundo será criado por consórcio onde Portugal está em maioria
TechBit	05/07/2020	Investimento de mais de 1.9 milhões de euros para melhorar supercomputadores nacionais
Exame Informática	06/07/2020	Empresa portuguesa lidera construção de primeiro nano-satélite de estudo da gravidade terrestre
INL	08/07/2020	First nano-satellite to study terrestrial gravity will count on INL contribution
Portugal Têxtil	13/07/2020	NanoStim integra estimulação muscular em vestuário
Compete 2020	15/07/2020	MCTool21: Manufacturing of cutting tools for the 21st century
COMPETE 2020 Newsletter	15/07/2020	BigHPC: A Management Framework for Consolidated Big Data and HPC
LSRE-LCM	06/08/2020	Funding secured for research project on the application of nanotechnology to water treatment in partnership with The University of Texas in Austin
Oeiras Digital	07/08/2020	O primeiro nano-satélite do mundo vai ser testado pelo ISQ
Exame Informática	14/08/2020	BOB, Navigator e Oblivion: vem aí uma vaga de projetos para os supercomputadores portugueses
Notícias ao Minuto	25/08/2020	Investigadores desenvolvem tecnologias para transformar águas poluídas
SAPO	25/08/2020	Investigadores do Porto vão desenvolver tecnologias para transformar águas poluídas
Rádio Nova	25/08/2020	Investigadores do Porto vão desenvolver tecnologias para transformar águas poluídas

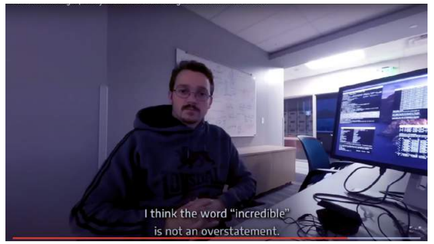
Green Savers	25/08/2020	Investigadores do Porto vão desenvolver tecnologias para transformar águas poluídas
Correio da Manhã	25/08/2020	Investigadores do Porto vão desenvolver tecnologias para transformar águas poluídas
Universidade do Porto	25/08/2020	FEUP garante financiamento para aplicar nanotecnologia ao tratamento da água
Lisboa Green Capital 2020	25/08/2020	Investigadores do Porto vão desenvolver tecnologia que permite transformar águas poluídas
National Geographic	27/08/2020	Primeiro Nano-satélite Para Estudo de Gravimetria Criado por Empresa Nacional
INESC TEC	31/08/2020	Programa UT Austin Portugal apoia oito projetos de investigação exploratória entre instituições portuguesas e a Universidade do Texas, em Austin, num total de cerca de 730 mil €
Ntech.news	31/08/2020	Oito projetos na pole position da inovação exploratória
SAPO	01/09/2020	Programa UT Austin Portugal e FCT com mais de um milhão de euros de apoio a 8 projetos de investigação exploratória
Jornal Incentivo	01/09/2020	Investigadores do Porto vão desenvolver tecnologias para transformar águas poluídas
Ordem dos Economistas	01/09/2020	NanoStim - Nanomaterias para estimulação integrada em vestuário
Compete 2020	01/09/2020	NanoStim - Nanomateriais para estimulação integrada em vestuário
Governo de Portugal	03/09/2020	Ministro da Ciência, Tecnologia e Ensino Superior participa no workshop Space Systems and Innovation: Portugal in Europe 2020-2030
Instituto Superior Técnico	04/09/2020	Conferência Anual UT Austin Portugal 2020: “Innovation at the Intersection of Academia and Industry”
Expresso	04/09/2020	Atlantic Constellation. Portugal vai lançar constelação de microssatélites até 2025
FEUP	25/09/2020	UT Austin Portugal Annual Conference - Innovation At The Intersection Of Academia And Industry
INESC TEC	06/10/2020	Programa UT Austin Portugal reforça laços entre academia e indústria com investigação em tecnologias emergentes
Governo de Portugal	06/10/2020	Ministro da Ciência, Tecnologia e Ensino Superior participa na conferência anual UT Austin Portugal 2020
MSN	07/10/2020	Programa UT Austin Portugal investe 21,9 milhões em 11 projetos de investigação
Expresso	07/10/2020	Programa UT Austin Portugal investe 21,9 milhões em 11 projetos de investigação
The World News	07/10/2020	Programa UT Austin Portugal investe 21,9 milhões em 11 projetos de investigação
Expresso	23/10/2020	Deucalion: novo supercomputador português custa 20 milhões e começa a operar em 2021
BigHPC	27/10/2020	BigHPC participated in UT Austin Portugal 2020 Annual Conference
Há Engenharia	09/11/2020	Engenheiro português é o novo co-editor-in-chief da "Smart Infrastructure and Construction"
BIP INESC TEC Magazine	27/11/2020	Working in Japan... from home!
FEUP	15/12/2020	Investigador da FEUP assume gestão de revista de referência em Engenharia Civil

Video Gallery

[New Challenges in Medical Physics Conference | Importance & Expectations with Maria Filomena Botelho]



[Dr. Steven H. Lin on MD Anderson Cancer Center and radiation-induced lymphopenia]



[UT Austin Portugal | A Day in the Life of a Portuguese Researcher at TACC]

[UT Austin Portugal | Introducing our 2019 Annual Report]

[UT Austin Portugal 2020 Annual Conference | Going online!]

[UT Austin Portugal 2020 Annual Conference | Cooperation Profiles]

[UT Austin Portugal 2020 Annual Conference | Masterclasses]

[UT Austin Portugal | 2019 Strategic Research Projects]

[UT Austin Portugal 2020 Annual Conference | Keynote Speaker Maria Helena Braga (FEUP)]

[UT Austin Portugal 2020 Annual Conference | Keynote Speaker Luis Sentis (UT Austin)]

[UT Austin Portugal 2020 Annual Conference | Masterclass I (Nanotechnologies)]

[UT Austin Portugal 2020 Annual Conference | Masterclass II (Space-Earth Interactions)]

[UT Austin Portugal 2020 Annual Conference | Masterclass III (Advanced Computing)]

[UT Austin Portugal 2020 Annual Conference | Masterclass IV (Medical Physics)]

E-Posters (2020 Annual Conference)

NANOTECHNOLOGIES

ERP 2017	CONTROLLUB
ERP 2017	ELECTROWAVE
ERP 2017	MECHANO
ERP 2017	UT-BORN-PT
ERP 2017	DREAM
Strategic 2019	EXTREMED
Strategic 2019	GEMIS
Strategic 2019	MCTOOL21
Strategic 2019	NANOCATRED
Strategic 2019	NANOSTIM
Strategic 2019	SENTINEL
Strategic 2019	SOFT4SENSE
Call for Poster 2020	Pool boiling of nanofluids on biphilic surfaces for cooling applications in electric vehicles
Call for Poster 2020	Atomistic simulations of silver diffusion within a titanium nitride matrix.
Call for Poster 2020	Tribological and machining performance of TiSiN(Ag) coatings deposited by HiPIMS

SPACE-EARTH INTERACTIONS

ERP 2017	I SEA
ERP 2017	DGCOAST
ERP 2017	STORM
Strategic 2019	MAGAL Constellation
Strategic 2019	UpGRADE
Call for Poster 2020	Next generation gravity field mission design
Call for Poster 2020	Modulation of an argon propellant dual stage cylindrical electrohydrodynamic thruster at low pressure
Call for Poster 2020	Being Framed: Ecotoxicity Prediction, Satellite Data and in silico Methods
Call for Poster 2020	Thermal Data for Surface Characterization and Public Health Application.

MEDICAL PHYSICS

Strategic 2019	TOF-PET
Call for Poster 2020	Simulation of effectiveness of gold nanoparticles radiosensitazion in proton therapy

ADVANCED COMPUTING

ERP 2017	STREACKER
Strategic 2019	BIGHPC

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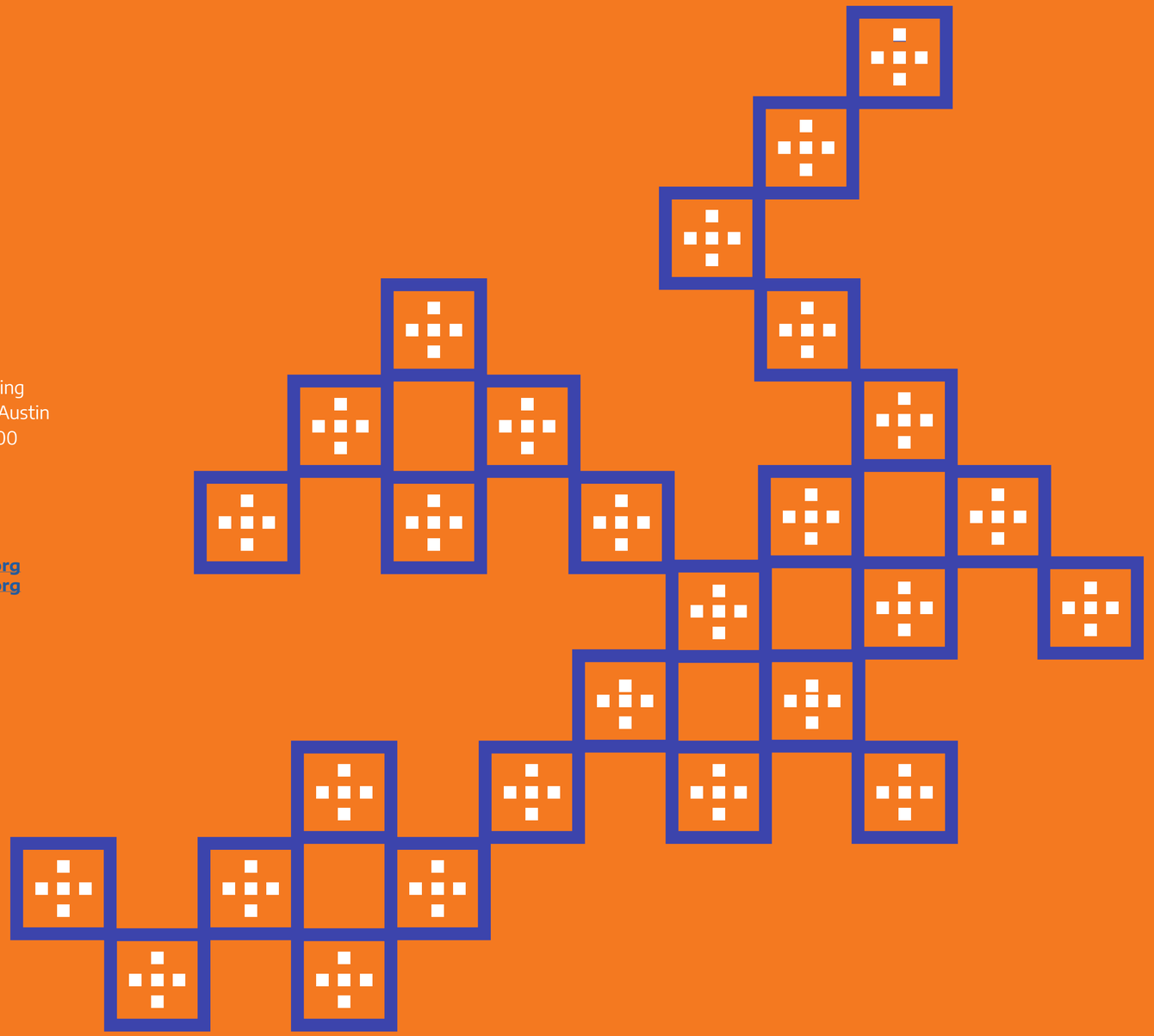

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin