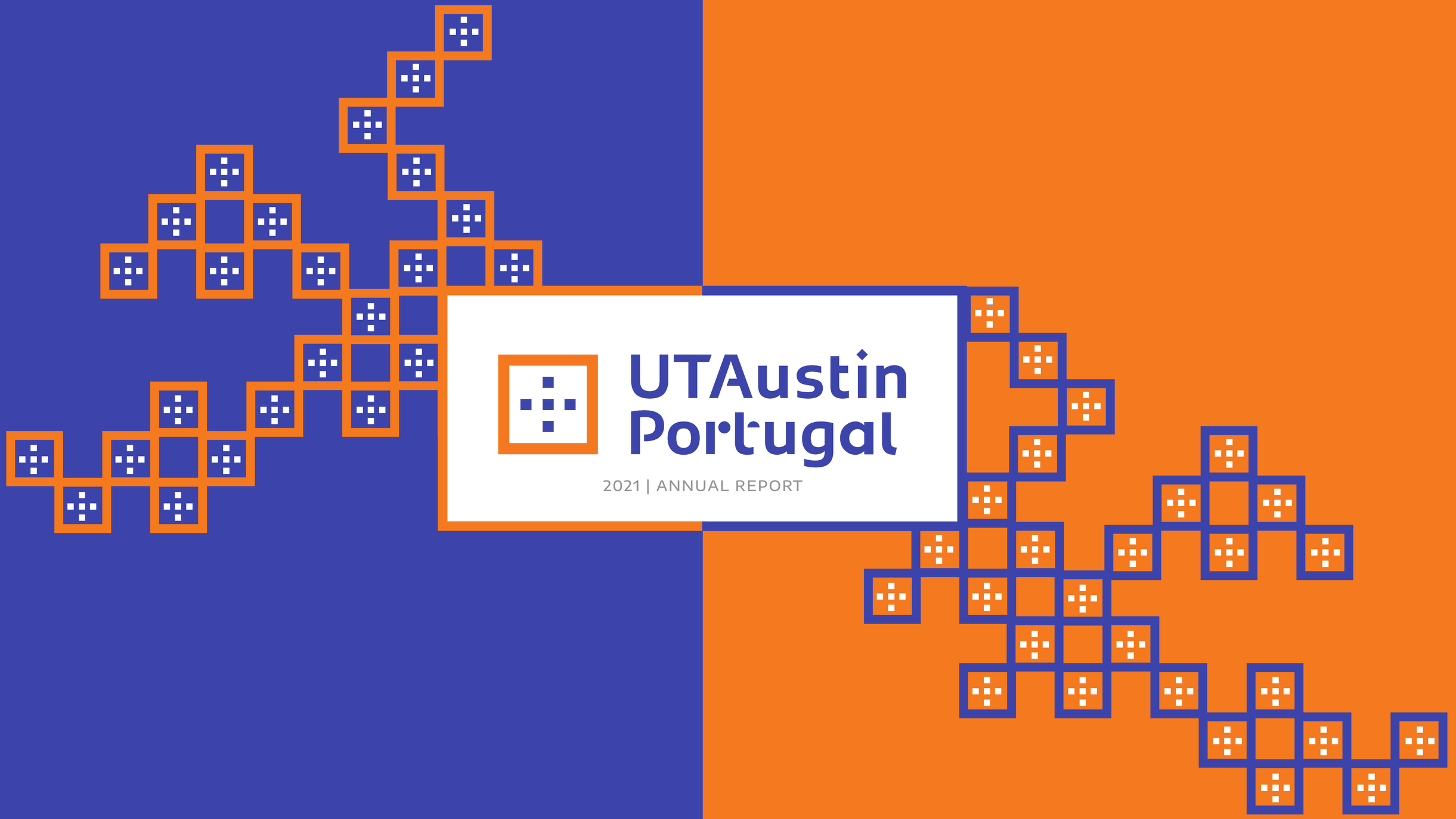
UTAustin
Portugal
2021 | ANNUAL REPORT

UTAustin Portugal

FCT Fundação para a Ciência e a Tecnologia

TEXAS The University of Texas at Austin

By alphabetical order

2021 ANNUAL REPORT

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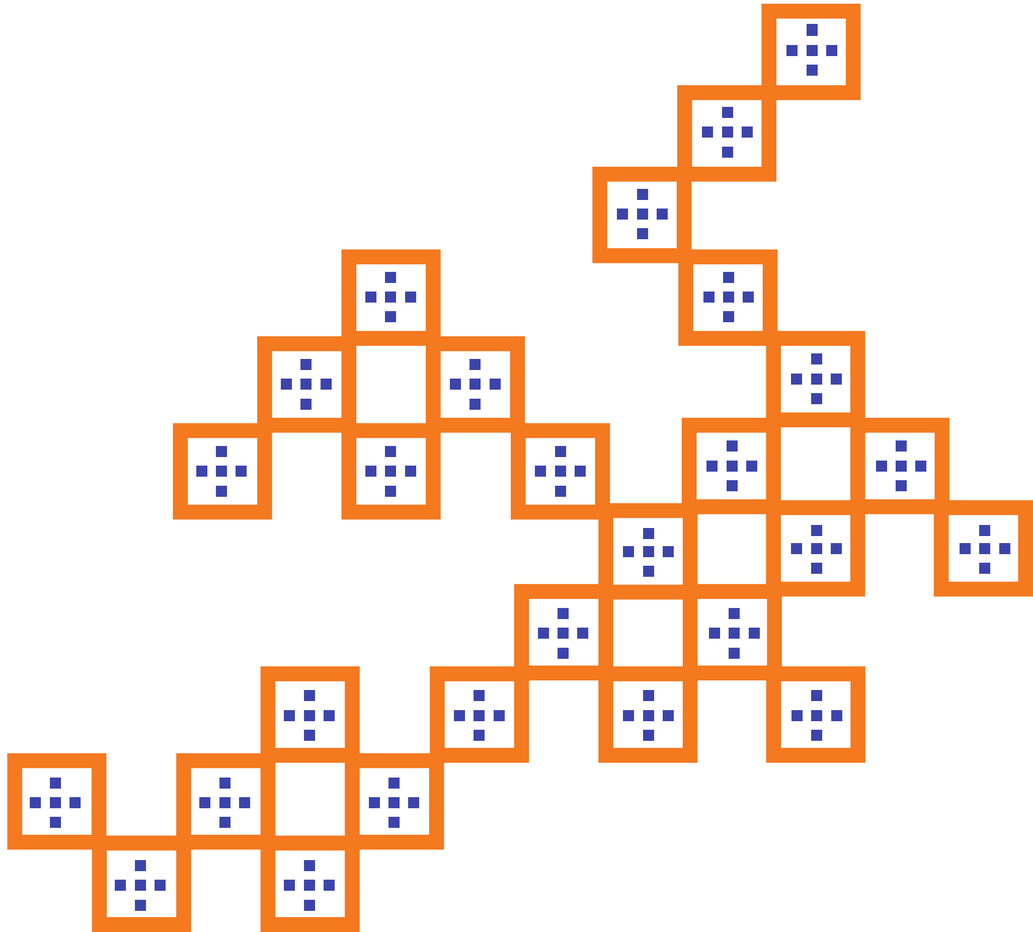
A word of appreciation goes out to all our Exploratory and Strategic Research Projects for their inputs to the sections in this report devoted to the Program's R&D Portfolio as well as to everyone we relied on to coordinate and implement in 2021 the training events.

Observation: The photographs in this report were either collected from free-to-use image databases (Pexels and Unsplash) or requested to members of the Program.

Published in March 2022



01 **Steaming Ahead:** Statement from the Leadership P.04

02 **About Us** P.06

03 **Because Impactful Change** does not Happen Overnight P.09

04 **2021 in Figures** P.13

05 **Main Achievements** of the Year P.16

06 **Conclusions & Recommendations from our** ERC Meeting P.22

07 **Our Research: Creating Science-Based** Knowledge for a Thriving Future

- 7.1 Overview P.26
- 7.2 2019 Strategic Research Projects (2021 Performance Overview) P.31
- 7.3 2019 Exploratory Research Projects (2021 Performance Overview) P.32
- 7.4 2021 Publications P.34
- 7.5 2021 Call for Exploratory Research Projects P.36

08 **Redesigning Training Activities** in Pandemic Times

- 8.1 Full List of Training Activities Organized by the Program P.45
- 8.2 Our Wall of High-Caliber Training Experts P.47
- 8.3 Our 2021 Training Portfolio in Detail P.49

09 **The UT Austin Portugal Annual Conference** Connecting the Dots: Interdisciplinarity as a Way to Build Up Resilience P.59

10 **Moving from Fact Reporting** to Science Storytelling

- 10.1 Communication in figures P.77
- 10.2 Main Communication Outputs P.79

11 **Key People & Partners** Backing Up the Program Everyday P.82

12 **Challenges & Opportunities** in 2022 P.86

UTAustin Portugal

01

Steaming Ahead: Statement from the Leadership

José Manuel Mendonça
National Director of the Program in Portugal

We are going through odd times. The last two years seemed to compact a whole century: our society faced a pandemic - that might not be over yet - and very recently, we all woke up to a tragic war conflict unfolding in the centre of Europe with the potential to transform the world's geopolitical order.

I've always believed - and still believe - in the power of science to bring peoples and nations together, to create knowledge for the common good. This role of science becomes even more important when crises, whatever their nature, strike. Although I may sound a little biased, I regard the UT Austin Portugal joint venture as a successful example that draws on Science and Technology cooperation to build strong, long-lasting partnerships mobilizing actors from different countries towards common challenges.

As we turn the page and move into another year of joint action, I cannot afford to miss the opportunity provided by our Annual Report to express my gratitude to our transatlantic community and sponsor and our counterparts at UT Austin for their unabated trust and engagement with the Program. When I look back at 2021, I realise how much we did and accomplished amid a sea of uncertainty.

Leading an International Partnership in times of unpredictability becomes less of a problem when people around you turn challenges into opportunities for growth and improvement. We've seen this outstanding capability across our exploratory and strategic research teams, who found ways to work together at a distance. As our ERC Chair, Peter Arzberger, noted on the occasion of the ERC Annual Meeting, the Program was able to make substantial progress despite another year of lockdowns, travel restrictions and social distancing rules.

I've been serving on the Program practically since its beginning, although in different capacities. Therefore, I think no one will get me wrong for saying that this ability to succeed in daunting and complex times reflects a maturity level that cannot be reached overnight nor without a long-term vision or a critical judgment of our failures and accomplishments. I am confident that you'll sense this maturity when you read the 2021 Annual Report. A maturity that allows us to say: full steam ahead whatever challenges come our way.

John Ekerdt
Principal Investigator of the Program at UT Austin

Annual reports are a time for reflection on the totality of the effort and we ask ourselves if the continuum of programs in education, research and education enable us to meet our mission to promote and enable the engagement of Portuguese scientists and companies with the University of Texas at Austin, and the University of Texas System at large, in multidisciplinary research, technology transfer and commercialization activities, and to realize our vision to contribute to a knowledge-based society and foster science and innovation-based companies, enabling Portugal to better face the challenges of the future. The leadership and staff in Portugal and Austin may be biased. I trust as you read this report that the answer to both meeting the mission and realizing the vision is yes.

Multidisciplinary, collaborative research that impacts society and engages with translation partners is at the core of the program. Eleven three-year strategic projects were in their second year and these projects are educating and training over 40 students. Travel restrictions prevented in-person exchanges of students and researchers; however, the collaborations were robust and the progress made is truly impressive. We started eight exploratory, goal-oriented, collaborative scientific projects on emerging and transformative research and development to build the pipeline for future programs and train additional students. I encourage you to read the titles and short summaries of these various projects to get a sense of how they can and are enabling Portugal to better face the challenges of the future. As the year ended, we concluded a second round of proposal reviews leading to eight new exploratory projects that started in 2022.

Training continued in a hybrid mode last year and the number of opportunities span the research themes of advanced computing, medical physics, nanotechnologies, and space-earth interactions. The number of participants in organized training activities is truly impressive, with about 47% of the participants from Portugal. We all missed out on in-person exchanges and in-person meetings and training. We were hopeful these would have occurred last year and are currently planning a robust exchange of researchers in 2022 that we can report next year.

UTAustin Portugal

02

About Us

About Us

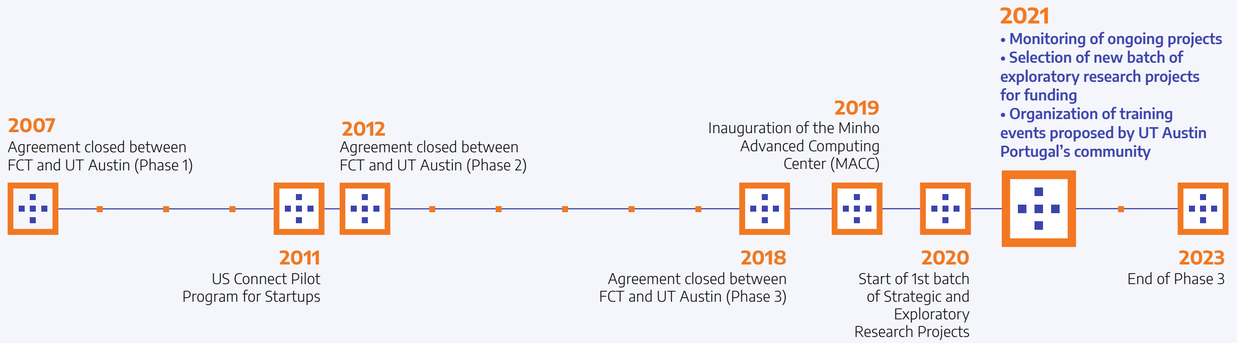
This year, the UT Austin Portugal Program is turning 15 years old. A milestone worthy of celebration that the Program Leadership will evoke as an opportunity to reflect on the Partnership's achievements, recap relevant lessons and look to what the future holds and where we can go on delivering impactful change.

This long-standing partnership between the Portuguese Science and Technology Foundation (FCT) and The University of Texas at Austin (UT Austin) was launched in 2007 as part of a strategy to promote Portuguese scientific institutions at the international level.

Since then, it has played a pivotal role in supporting Portugal build a world-class research and innovation ecosystem, able to participate actively in the international setting in scientific areas deemed critical to address some of the most pressing local, national and global challenges faced by societies and businesses. The Program has evolved throughout the years, adapting to the needs of Portugal's economic and social fabric, building internal capabilities for increasing exposure to international competition in the research arena and making use of Portugal's geo-spatial position and unique resources to give the country a more prominent role in the shaping of major R&D agendas.

Although to some extent the Program's 3rd phase veered from Phases 1 and 2, with new knowledge areas replacing former ones and new stakeholders and beneficiaries being brought on board, many collaborative individual relationships and networks have outlived this evolution and are still active, using the Program's instruments or other schemes to deepen gained expertise and take previous R&D results further ahead.

The Program's journey



Additionally, the Program's footprint over the years is becoming more tangible than ever. A good example comes from the entrepreneurial talent who participated in the past Program's entrepreneurial initiatives and benefited from an immersive experience in Austin's vibrant business community and UT Austin's mentorship. Such an experience has certainly had an impact on the successful journey they have been making.

Something that remained unchanged over the years was the intention to build a continuum between education, research and innovation activities. This approach has proven successful in helping outcomes move along the value chain, also thanks to the Leadership's commitment to lead and engage the Program's community in cross-disciplinary collaboration.

Encouraged by our past achievements, with our minds set on the major challenges our society faces today and will face tomorrow, we take every annual reporting exercise as a self-improvement opportunity and a statement of the values we uphold: **transparency, trust and shared credit.**

This annual report showcases our shared achievements over 2021. We thank every one of you who helped us along this year.

About Us

VISION

To contribute to a **knowledge-based society** & **foster science** & **innovation-based companies**, enabling Portugal to better face the challenges of the future.

MISSION

To promote and enable the engagement of Portuguese scientists and companies with the University of Texas at Austin, and the University of Texas System at large, in **multidisciplinary research**, **technology transfer** and **commercialization activities**.

FIVE KNOWLEDGE AREAS

- **Advanced Computing**
- **Space-Earth Interactions**
- **Medical Physics**
- **Technology Innovation & Entrepreneurship**
- **Nanotechnologies**

THREE STRANDS

Education
Advanced Training Programs
Workshops
Research Exchanges

Research
Exploratory Research Projects
Strategic Research Projects

Innovation
Coaching & Mentoring
Residency in Austin
Industry Affiliates

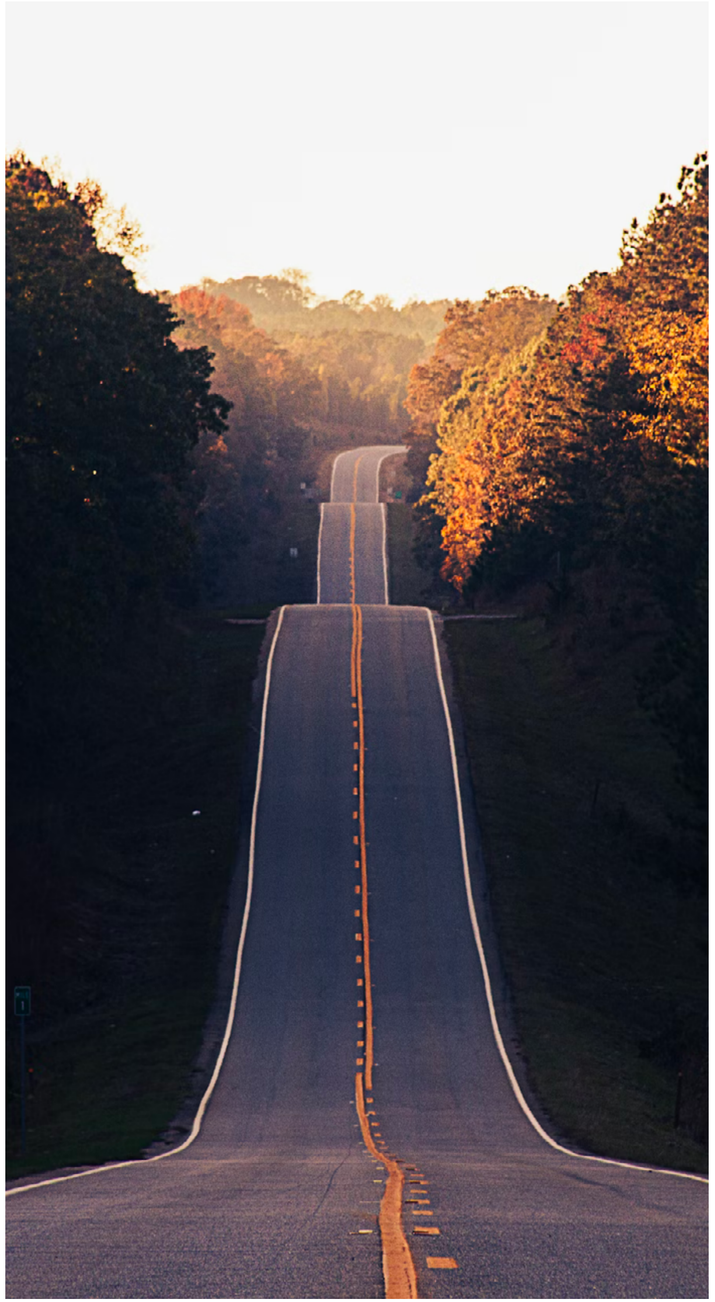
UTAustin Portugal

03

Because Impactful Change does not Happen Overnight

Because impactful change does not happen overnight

The examples here provided are not meant to be exhaustive but to shed light on the time frame Science and Technology (S&T) Partnerships need for their impact to be grasped. Therefore, at the Program, we work to improve our understanding of the impact of our choices and investments over time, while recognizing that impact on research and innovation often involves time lags and results from multiple inputs.



Science Advances, Volume 7 | Issue 45, published in 2021, features a 29-page critical review on the latest innovations in Molecular Imprinting (MI), as well as different applications where MI Polymers (MIPs) have been used to target biomolecules of interest. The article[1] was written by Nicholas Peppas (UT Austin) and Simão P. B. Teixeira, Rui L. Reis, and. Manuela E. Gomes, Rui M. A. Domingues - all affiliated with Portuguese research institutions at that time - and funded through different EU, Portugal and US sources. The collaboration between most of the authors on this research topic can be traced back as far as 2014 to the project RECOGNIZE – Intelligent Scaffolds by Molecular Recognition for Advanced Applications in Regenerative Medicine, (UTAP-ICDT/CTM-BIO/0023/2014), which received funding from FCT under Phase 2 of the UT Austin Portugal Program.

In 2016, UTEN, UT Austin Portugal's former instrument to support technology transfer and innovation, launched a new edition of the Global Startup Program (GSP), which had started three years before. This scheme helped Portuguese entrepreneurial endeavours in different phases of their development, from early-stage commercialization projects to early-stage startups and mature technology ventures. By 2016, more than 200 companies had participated in UTEN-related activities and the impact of such intake speaks for itself: altogether, during 2012-2017, these companies closed deals worth 130 million dollars and hired 67 highly skilled Portuguese workers during and sometime after their participation in the Program.

[1] S. P. B. Teixeira, R. L. Reis, N. A. Peppas, M. E. Gomes, R. M. A. Domingues, Epitope-imprinted polymers: Design principles of synthetic binding partners for natural biomacromolecules. Sci. Adv. 7, eabi9884 (2021).

GSP's distinguished alumni include **Portugal's latest new unicorns, Feedzai and SWORD Health** and also the fast-growing company **doDoc**, acquired by the British Envision Pharma Group in 2021. These alumni have been echoing through newspaper headlines as a result of their skyrocketing success.

Feedzai, a startup founded in 2011 that fights financial crime with Artificial Intelligence, secured 200 million dollars in 2021, entering the exclusive group of unicorns. The UT Austin Portugal Program intersects with the company's success story. Right in its beginning, Feedzai entered the UTEN Global Startup Program to bring its big data analytics platform into the US energy sector. While working with UTEN in 2011 and 2012, the company applied its real-time high-volume data analytics to market applications, including monitoring bank transactions and smart grid energy monitoring. However, the market analysis conducted during UTEN's mentorship revealed that the most appropriate and fastest growing market for Feedzai's technology was credit fraud prevention. And thus, founders took the learned lessons, applied them and here they are, ever-growing.

SWORD Health, a digital musculoskeletal care provider, reached an outstanding milestone in their growth in 2021: *"a Series D funding round of $163M and $26M secondary, bringing the investment in SWORD Health to more than $320M and valuing the company at $2B"*. SWORD Health's founder proudly says they're on a mission to free two billion people from pain, and this mission started back in 2015. By then, SWORD Health had been accepted by UTEN for acceleration, coaching and mentoring. There was a particular aspect founders were looking for: meeting an FDA requirement to commercialize a rehabilitation system in the US. UTEN experts introduced the startup to local health regulators in the US and enabled founders to plan a swift entry into the North American market.

doDoc is a document collaborative review, editing and authoring firm with headquarters in Boston but with its roots in the city of Coimbra – they are the spillover of a PhD research program in scientific document search and publishing. doDoc was part of UTEN's 2015-2016 cohort. According to the founders, the Program was determinant in refining and speeding up doDoc's go-to-market and operations strategies. **In 2021, the company was acquired by the Envision Pharma Group**, a global provider of evidence-based communication services and industry-leading technology solutions serving pharmaceutical, biotechnology, and medical device companies.

Other entrepreneurs went on collaborating with the Program, taking advantage of the networks built with UT Austin in the past to develop industry-driven research projects funded through competitive research instruments. **SME Sphere Ultrafast Photonics is a former GSP's beneficiary who is now at the helm of the ongoing Strategic Research Project ExtreMed**, awarded over 2 million euros in 2020 to develop a stand-alone SyncRGB-FLIM system that reduces sample exposure to interferences and improves photoprotective conditions. By enabling deep tissue penetration with relatively minor phototoxicity, multiphoton microscopy is regarded as an effective tool for long-term observations of live tissue and extraction of large amounts of data.

Verónica Orvalho, leader of the Portuguese startup Didimo and a former UT Austin Portugal's PI in Phase 1, made the headlines for being on race for the EU Prize for Women Innovators 2021. She featured in the 21 candidates shortlist among a total of 260 applications received. Back in 2011, Orvalho led the project LifeisGame along with UT Austin's researchers **Yang Zhang (School of Information)** and **J.K. Aggarwal (Cockrell School of Engineering)**. LifeisGame's goal was to develop an interactive online game to help children with autism spectrum disorders (ASDs) communicate their emotions through avatars. Today, Verónica's company, Didimo, one of the top 50 scale-up companies in the European Innovation Council, is revolutionizing virtual interactions by making them more human-like.

Leonardo Azevedo an Assistant Professor at the Department of Civil Engineering, Architecture and Georesources of of Instituto Superior Técnico da Universidade de Lisboa was one of the 8 researchers moving to Austin in 2019 under UT Austin Portugal's Advanced Computing Training Program Program (ACTP). Leonardo's internship was at the Department of Aerospace Engineering and Engineering Mechanics of the Oden Institute for Computational Engineering and Sciences, where he worked under the supervision of Professor Tan Bui-Thanh on high-dimension inverse problems such as seismic inversion.

In 2021, the former ACTP beneficiary coupled with his former mentor at UT Austin to submit an Exploratory Research Project application to the Program's 2021 Call. Their project MMO -*Multi-source modelling of the ocean: coupling Earth observations with acoustic waves* came to be awarded almost € 100.000 for a 12-month period.

UTAustin Portugal

04

2021 In Figures

2021 IN FIGURES

20

Active projects, either upstream or downstream the knowledge-to-value chain, convening 40 entities in Portugal and 28 PIs at UT.

11

Industry-driven projects led by Portuguese SMEs

9

Exploratory, high-risk/ high-potential projects conducted by academic or research partners.

We launched a new Call for Exploratory Research Projects

Committing a public budget of approximately

€ 800.000 to fund 8 new transatlantic consortia

And attracting
44 PT-UT teams
25 Institutions in Portugal
28 PIs at UT Austin

Our Projects

Created

36

New scientific jobs.

Supported

84

Research works by students

50% being Doctoral Works

58% being funded through the Program

Map 1 - Institutions in Portugal with applications submitted to the 2021 ERP Call

Outcomes of Projects

30 Papers accepted for publication/published in international peer-review journals

22 featuring in 1st quartile journals*

*As per the criteria used by the Authenticus platform

21 Prototypes

13 Training Activities Organised

↳ **5** Masterclasses

Over 1200 registrants from **40** countries

88 experts from **8** countries mobilized

1 Algeria | 1 Angola | 4 Belgium | 20 Brazil |6 Canada | 5 Colombia | 1 Czech Republic | 1 Denmark | 2 Deutschland | 1 Ecuador | 1 Europe | 1 Finland | 1 France | 14 Germany | 35 Greece | 47 India | 2 Iran | 1 Iraq | 6 Italy | 2 Japan | 1 Malta | 1 México | 3 Mozambique | 1 Nepal |3 Nigeria | 2 Philippines | 821 Portugal | 1 Romania | 2 Saudi Arabia | 6 Singapore | 2 Slovenia | 2 South Korea | 78 Spain | 3 Sweden | 4 Switzerland | 1 Taiwan | 1 Tanzania | 5 The Netherlands | 2 United Arab Emirates | 122 USA | 3 United Kingdom

Map 2 - Countries of registrants in our 2021 training events

UTAustin Portugal

05

Main Achievements of the Year

Main Achievements of the Year

What we set out to achieve and how well did we stick to the plan

As we prepare ourselves to review the Program's performance in 2021, we should go back to the closing chapter of our 2020 Annual Report where we outlined our main ambitions for the following year. Back then, with careful optimism, we set out the commitments we would work to deliver throughout the year:

- **Resume research exchanges between Portugal and UT Austin**, once travel restrictions had been eased and FCT's regulation for international research mobility approved. We planned to open a Call for Expressions of Interest to identify potential beneficiaries in advance, thereby expediting the implementation of such exchanges as soon as the main obstacles had been removed.
- **Promote a combination of hybrid with full on-site and online training activities**, with the support of our Area Directors and through the launch of a pilot call for workshop proposals, open to our transatlantic community and tapping into topics center stage to our research lines and projects;
- **Commit close to € 800.000 to support another batch of transatlantic exploratory research projects** across the four areas of the Program;
- **Keep track of our ongoing Flagship Strategic and Exploratory Research Projects' progress**;
- **Improve communication and monitoring and reporting activities** to make the Program's footprint in the research and innovation landscape more visible and understood and support a culture of excellence, trust and self-improvement.

Figure 1 (page 18) gives an overview of the Activity Plan approved in early February 2021 by UT Austin Portugal's Governing Board and how we delivered against planned actions. The three columns represent the three broad types of activities the Program is structured around.

The first column on the left includes the main management and coordination activities, i.e., activities deemed critical to take stock of the Program's progress and settle on further improvements based on lessons learnt, available funding, external drivers and recommendations from its main governing bodies.

In the second column, the activities that help the Program make its core message across and build up its community's engagement and loyalty. As a publicly-funded partnership, there is an ethical obligation to communicate consistently, regularly, and transparently what we are doing and achieving to our internal and external stakeholders.

The third column encompasses the activities at the heart of the Program, i.e, those that fall under the three main strands - **Education > Research > Innovation** - and make it unique and distinctive.

When 2021 started, there was some optimism about the regression of the pandemic as the first vaccines against Covid-19 rolled out. Nevertheless, the emergence of new variants, either more aggressive or fast-spreading and with different evolution paces across the globe, meant another year of uncertainty and the continuation of several restrictions upon society and the economy. To some extent, this context affected the Program's activity plan as we had envisioned it and explains why we only executed half of the budget for which funding had been requested. For instance, we could not organise research exchanges as we did in previous years; we could not take any delegation to UT Austin, and most of our training was forced into an online setting.

Management & Coordination Activities

- ✓ Submission of the 2020 Annual Report
- ✓ Annual Meeting with the GB (approval of the 2021 Activity Plan)
- ✓ Publication of the 2020 Annual Report
- ✓ 2019 Exploratory Research Projects Mid-Term Assessment
- — 2021 Individual Meetings with Lead Beneficiaries of 2019 Strategic Research Projects (1st year review)
- ✓ ERC Annual Meeting
- ✓ Submission of 2022 Activity Plan and Budget Proposal

Stakeholders' Engagement & Communication Activities

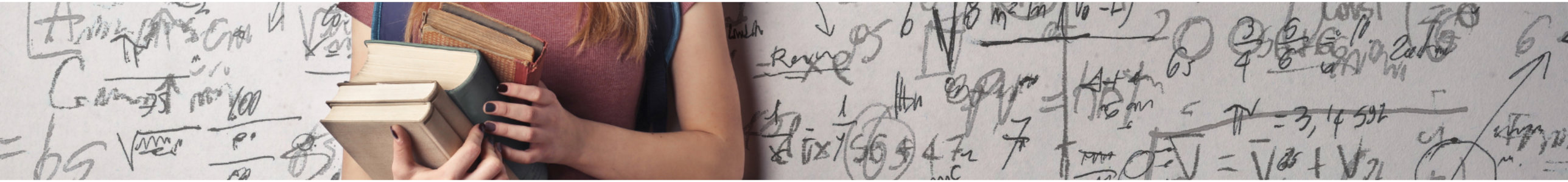
- ✓ Presentation of the 2021 Activity Plan to Area Directors
- ✓ Publication and dissemination of the 2020 Annual Report
- ✓ Participation in the National Science Summit
- ✓ Organization of the Program's Annual Conference
- ⊘ Annual Visit to UT Austin: Program Leadership and PT Delegation

Activities under the Program's Main Strands

- ✓ 2021 Exploratory Research Projects Call
- ✓ Organization of Thematic Workshops and Other Training Activities/Area
- ⊘ Research Exchanges Scheme

✓ Done — Readjusted ⊘ Cancelled

Figure 1: Implementation of Planned Activities in 2021

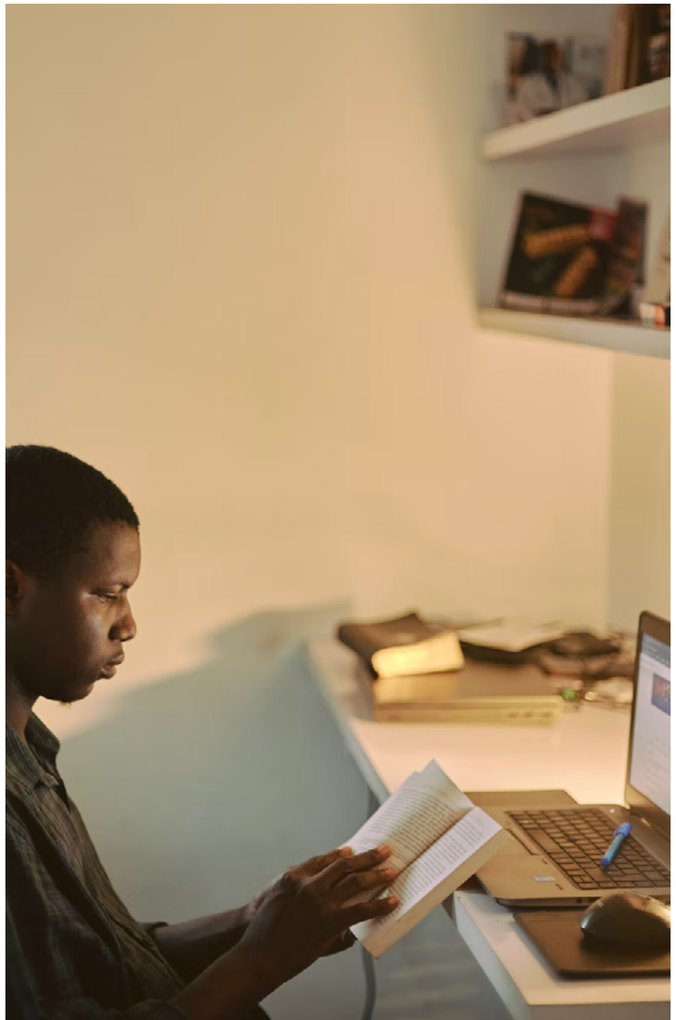


Education

In 2021, we launched a pilot action. Through a competitive call, we invited our transatlantic community to come together and submit proposals for short-term advanced training covering topics aligned with the Program's Areas.

Accepted proposals addressed themes as relevant as *responsible innovation; principles, applications, and nanotechnology innovation in pharmaceutical sciences; biological engineering and medicine; the challenges and the opportunities of proton therapy; the potential of 2D Materials in biomedical applications* and *the role of nanotechnologies in advanced energy generation, conversion, and storage towards net-zero climate emissions.* Additionally, we worked with one of our Strategic Research Projects to launch a webinar series on High-Performance Computing.

Through these courses, we succeeded in mobilizing registrants and world-class speakers across academia and industry from the Partnership's geographical scope and beyond, with the Program's brand reaching countries in Europe, Asia, and America. In the frame of the Program's largest knowledge-sharing and networking event - the Annual Conference - we hosted five Masterclasses with leading minds from organizations in Portugal, the USA, Germany, New Zealand and Spain.



The main problem we faced while implementing the training plan - which was entirely composed of online or hybrid activities in 2021 - was ensuring that registered participants were actually in attendance, but the high number of registrants made up for the absenteeism levels.. The number of "no show ups" recorded at the first session of a course was usually high. Generating commitment from registrants seems to be more challenging with online events and its aggravated by the fact that registrations for the Program's training activities are free of charge. At a certain point, we decided to include in some of our communication materials messages to make registrants aware of the costs and people involved in the planning and implementation of our courses and call on their full attendance.

Even when Covid-19 restrictive measures were eased, and the Program returned to organizing hybrid events, with physical sessions being broadcast live on YouTube, a large majority of registrants still opted for the online participation mode.

As for the research exchanges scheme, we had to put it again on hold as a result of ongoing travel restrictions and limited access to UT Austin campus and facilities for most of the year.

Research

We secured another round of approximately € 800.000 to support a new set of exploratory research projects through a competitive solicitation that attracted over 40 PT-UT consortia.

We also kept close to our ongoing Strategic and Exploratory Research Projects to understand how they were getting on with their research activities. This was possible through regular reporting, science storytelling and networking activities, such as the National Science Summit or the Thematic Roundtables at our Annual Conference, even if the in-person component of these events ended up falling short of expectations.

As the Program moves towards the end of the current funding cycle, its project portfolio shows evidence of:

- science-based knowledge clusters feeding into specific application markets/domains and initiatives of national strategic interest;
- the Program's ongoing contribution to human capital development through advanced hands-on training of students and researchers both in Portugal and at UT Austin;
- the formation and strengthening of individual networks between Portugal and UT Austin-based researchers, linked to efforts to leverage previous results and pursue collaborations using the Program's instruments and others;
- the consolidation of Nanotechnology as a cross-cutting area, where the Program has been most contributing with projects; and the
- growing internationalisation of Portuguese application-driven science and exposure of Portuguese companies to US partners.

The Program's success in the 2019 Strategic Research Projects competition came at the expense of readjusting the Partnership's budget to accommodate the support to more projects than it had been anticipated, especially at UT Austin.

Innovation

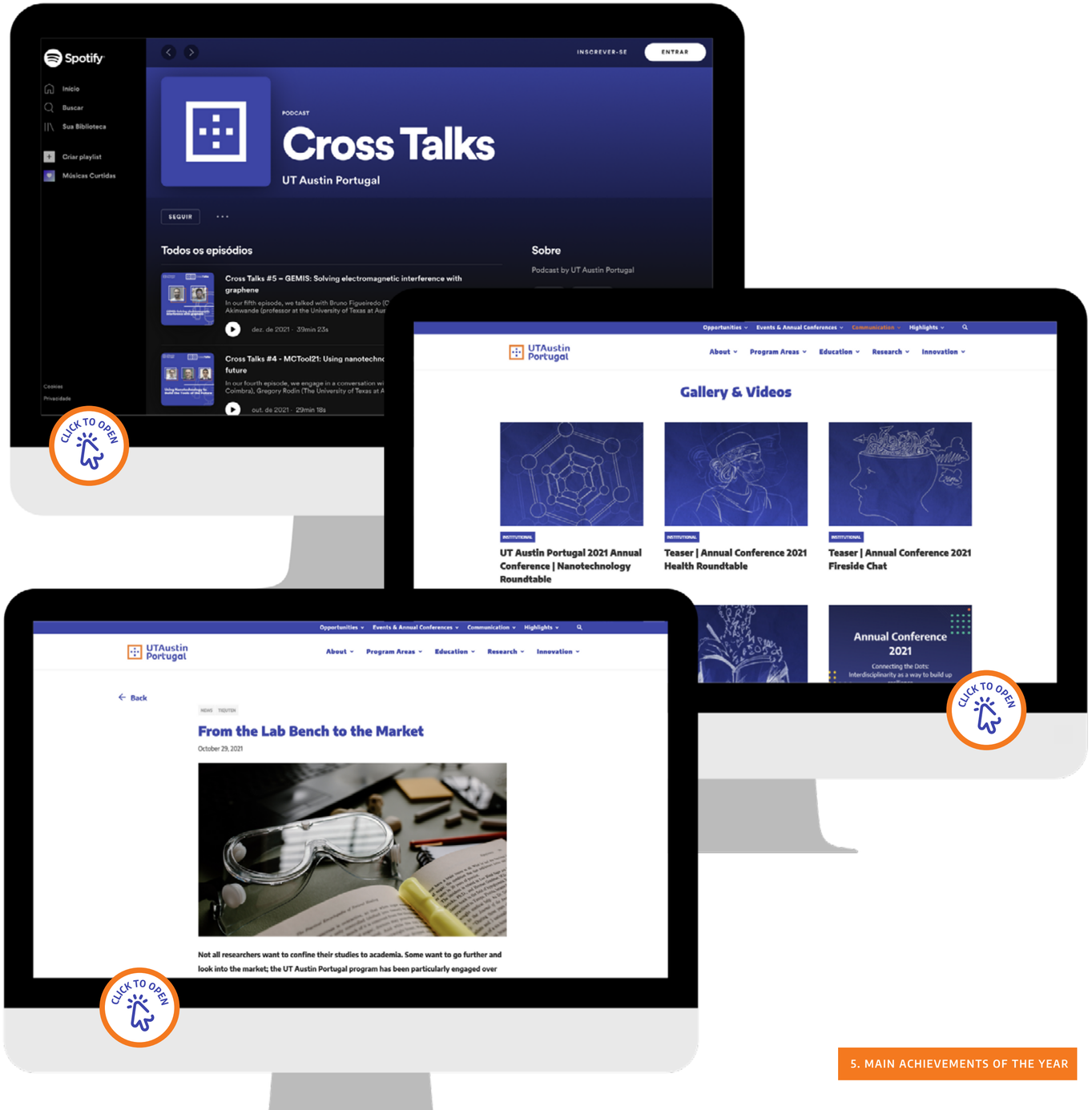
This reallocation tipped the Program's investment balance to research and away from the Program's Technology Innovation and Entrepreneurship (TIE) activities, most notably the PT Corps pilot. Nevertheless, in 2021, three training activities with TIE's seal were organised: the *Responsible Innovation workshop, the From Innovations to Operations – the Management of New Technology Implementations* Masterclass and the *Commercializing University Research Innovations* Warm-up Session.

Communication and Monitoring

We were highly committed to diversifying how we communicated with our community and stakeholders by embracing science storytelling, moving beyond simply reporting facts to writing stories people could relate to and feel empathy for.

We adventured ourselves for the first time in new narrative formats, most notably podcasts to cover our strategic research projects. We went on producing animated videos to promote our thematic sessions at the Annual Conference; and we devoted time to browse through the Program's archives initiatives whose impact can be measured only now and is worthy of visibility.

Lastly, we used our meetings with the Governing Board and the External Review Committee as an opportunity to reflect on how well we've been delivering on our mission and how we can improve ourselves to stay up to our community and sponsor's best expectations.



UTAustin Portugal

06

Conclusions & Recommendations from our ERC Meeting

Conclusions & Recommendations from our ERC Meeting

In October 22 and 25, our External Review Committee met again with the Program's Leadership and members of our community. The ERC meeting was structured to provide both an overview of progress and a vision for the Program's future, including future research directions and opportunities; strategies to sustain the Program intellectually and fiscally; and the Program's summary assessment of barriers that inhibit the its path forward.

The ERC believes the Program is reaching a stage of maturity, in the level of expertise of its senior researchers, who are now leading projects and expanding the scope of the partnerships. Therefore, it applauds the Program for looking to 2023 and beyond and recommends that partners identify areas of mutual research interest, with a dialogue between Portugal and UT Austin to designate at least one area of great interest to UT Austin.

As highlighted by Minister Manuel Heitor, who closed the meeting, times ahead call for major contributions from Science and Technology. The Minister raised several areas which the ERC felt the Program was well positioned to address. Using the UT Austin–Portugal platform and its network of researchers is an opportunity for Portugal to reap the benefits of its long-term investments in new, emerging, or expanded areas, such as forest fire monitoring and response; advanced batteries for reduced energy consumption; new satellites for earth and ocean observations; and cancer research via new methodologies.

At the end of the year, the ERC was reinforced with the appointment of Professor Marie-Paule Pileni, Emeritus Distinguished Professor at Sorbonne University, to serve on the committee as the reviewer for the area of Nanotechnologies. Professor Pileni replaces Professor Edwin L. Thomas, who resigned in the beginning of 2021.

ERC Members

Alfred Ng
Area of Space-Earth Interactions

Alison Campbell
Area of Technology Innovation and Entrepreneurship

Oliver Jäkel
Area of Medical Physics

Peter Arzberger
Chair of the Committee
Area of Advanced Computing

Edwin L.Thomas
Former ERC Member for the Area of Nanotechnologies (resigned in 2021).

Marie-Paule Pileni
Area of Nanotechnologies (joined in December 2021).

Marie-Paule Pileni graduated and did her scientific carrier at Sorbonne University, Paris, (ex Université P&M Curie). She has conducted outstanding and highly interdisciplinary research over her scientific career. Her combined expertise in colloid science and in nanoscience has paved the way for several breakthroughs. Her most important discovery is the self-assembly of inorganic nanocrystals into 3D crystalline structures called colloidal crystals or supracrystals for which there are potential application ranging from nanoengineering to cancer therapy. Her research has been at the frontier of physics, chemistry, biophysics and more recently of biomedicine. She is a member of several Academies. She received a large number of awards from United States of America, Japan and Europe. She is Commander of the “Ordre National de la Légion d'Honneur ”. She has published more 450 articles with H index of 79.

UTAustin Portugal

07

Our Research: Creating Science-Based Knowledge for a Thriving Future

Our Research: Creating Science-Based Knowledge for a Thriving Future

A framework to ensure a timely and seamless pathway for market uptake of science.

7.1 Overview

The Program's research strand relies on two types of project: **Exploratory** and **Strategic Research Projects**. This allows the Program to tap into both breakthrough and market-driven research and to enable projects to move along the value chain and from lower to higher Technology Readiness Levels with an eye to commercialisation. At least this was the intention behind the creation of these two project arrangements.

However, the success in the funding round of the first batch of Strategic Research Projects in 2020 has exhausted the funds to support the opening of further similar calls until 2023. Therefore, the Program has not been able to open but calls for Exploratory Research Projects with funding remaining at the same levels in 2019 and 2021.

In the absence of a funding scheme to support industry-driven R&D activities, exploratory research projects are faced with the need to source outside of the Program for awards or grants to increase their Technology Readiness Levels (TRLs). Otherwise, there is a risk of their potential being underexploited.

> The projects the Program has been stamping its seal on since 2018 are clearly contributing to forming clusters of knowledge around application areas or societal challenges addressed by international agendas and where Portugal either may have a competitive edge over or needs to create critical mass in.

Research for Health Challenges

Healthcare Technologies

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

Health is one of the fields for which the Program has been funding cutting-edge R&D through both academic and business-led projects. Two scientific areas have been at the forefront of this investment: Nanotechnologies and Medical Physics. Selected projects are responding to global health priorities from personalised medicine to advanced cancer diagnosis, treatment and remote patient monitoring solutions, ageing-related disabilities or improved vaccine efficacy to mitigate new risks and threats for public health and healthcare systems worldwide.

1. TOF-PET for Proton Therapy (2019 SRP - Medical Physics)
2. ExtreMed (2019 SRP - Nanotechnologies)
3. NanoStim (2019 SRP - Nanotechnologies)
4. SENTINEL (2019 SRP - Nanotechnologies)
5. ImmuneNanoVac (2019 ERP - Nanotechnologies)
6. AT&PT (2019 ERP - Medical Physics)
7. Target (2019 ERP - Nanotechnologies)
8. Piezoflex (2019 ERP - Nanotechnologies)
9. MagTubeCancer (2021 ERP - Nanotechnologies)
10. THER-PBCT (2021 ERP - Medical Physics)
11. NxGNanoTher (2021 ERP - Nanotechnologies)
12. 2D Therapy (2021 ERP - Nanotechnologies)

Research for More Competitive and Cleaner Industries

Industrial Applications

Automotive, Aerospace, Electronics, Manufacturing and Telecommunications

Enhancing industrial competitiveness is another goal of some of the projects supported by the Program in Phase 3. This competitiveness can be achieved through different ways: from combining nanomaterials with digital solutions to develop high-performance cutting tools aimed at increasing the lifecycle of hard-to-machine components, to addressing the issue of electromagnetic interference through a graphene-based solution that makes EMI (Electromagnetic Interference) shielding more flexible, affordable and lighter and therefore more adequate for vehicles industries where weight reduction is imperative, to increase autonomy and reduce carbon footprint.

Indeed, because industrial competitiveness cannot be reached at the expense of undermining climate and natural ecosystems, there is an urgent need to roll out advanced technology solutions reconciling environmental concerns and resource-use efficiency with upgraded industries. Therefore, the Program is also playing its part supporting research for clean tech.

1. MCTool21 (2019 SRP - Nanotechnologies)
2. Soft4Sense (2019 SRP - Nanotechnologies)
3. TARGET (2019 ERP - Nanotechnologies)
4. GEMIS (2019 SRP - Nanotechnologies)
5. COFforH2 (2019 ERP - Nanotechnologies)
6. Piezoflex (2019 ERP - Nanotechnologies)
7 . NanoCatRed (2019 SRP - Nanotechnologies)
8. LubEnergy (2021 ERP - Nanotechnologies)

Research to Turn the Tide on Climate Change and Fuel Energy Transition

Space-Earth-Ocean Energy

The impact of human activity on climate has never been so perceptible: in 2021, we saw fast-burning wildfires ravaging California, Greece and Turkey, while torrential rainfalls were sweeping away villages in Germany in high Summer; ice caps melting in the Poles at a fast pace and carrying water into the ocean put coastal towns and villages on alert for potentially devastating floods.

The last decade was the warmest ever recorded, with temperatures reaching extreme levels worldwide, triggering unprecedented natural hazards. The alarms went off, and there is a fierce urgency to make the transition to a net-zero economy. It's now or never, some experts warn.

With scientific knowledge we hold the power to understand how our actions affect climate and what actions must be taken to turn the tide on climatic changes. In particular, the study of Space-Ocean-Earth interactions has provided us with valuable information and tools to help us monitor the health of our planet and support better evidence-based decision-making to ultimately bring the most benefit to humankind and protect the Earth. The Program's R&D portfolio includes projects shaping a future ocean and climate change monitoring satellite constellation in the Atlantic as well as activities with an eye to energy transition through the study and assessment of decommissioned oil platforms as potential sites for offshore wind energy generation.

1. MAGAL Constellation (2019 SRP - Space-Earth Interactions)
2. uPGRADE (2019 SRP - Space-Earth Interactions)
3. SOS Wind Energy (2019 ERP - Space-Earth Interactions)
4. TARGET (2019 ERP - Nanotechnologies)
5. MMO (2021 ERP - Space-Earth Interactions)
6. ML@GridEdge (2021 ERP - Advanced Computing)

Research Towards the Digital Society

Computation for Research and Innovation Communities

In 2021, the European Union launched its proposal for the Path to the Digital Decade, an initiative to support the digital transformation of Europe by 2030, stepping up EU's commitment to benefitting citizens and businesses and improving our understanding of the Earth, Oceans and Space. Europe's digital Leadership calls, among other things, for a sustainable and resilient digital infrastructure allowing improved connectivity, fast communication, secure data transfers, and storage and processing of large amounts of data generated by multiple sources.

The Program is helping Portugal make the path towards digitalisation through its exploratory and industry-driven research, mainly in the area of Advanced Computing but also Nanotechnologies.

Supported projects range from a novel framework to simplify the management of High-Performance Computing infrastructures supporting Big Data and parallel computing applications to a distributed machine learning model for predicting the temporal energy needs of future connected communities or new quantum metamaterials in the form of metasurfaces, expected to enable promising applications in photonic quantum communications and quantum information.

The Program's ongoing collaboration with UT Austin's Texas Advanced Computing Center (TACC) has been crucial to place Portugal be at the forefront of research and innovation in the European HPC landscape.

1. ACT-PM (2019 ERP - Advanced Computing)
2. BigHPC (2019 SRP - Advanced Computing)
3. PAStor (2019 ERP - Advanced Computing)
4. ML@GridEdge (2021 ERP - Advanced Computing)
5. QMETA (2021 ERP - Nanotechnologies)

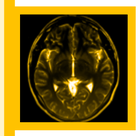
Highlights of UT Austin Portugal's Phase 3 Projects

- Clusters of science-based knowledge emerging around application market and intersecting initiatives of strategic interest, at the national and international levels.
- Talent Development: Advanced hands-on training of students and researchers both in Portugal and at UT Austin.
- Strengthening of individual networks between Portugal and UT Austin-based researchers linked to efforts to leverage previous results and pursue collaborations using the Program's instruments and others.
- Consolidation of Nanotechnology as a cross-cutting area and where the Program has been most contributing with projects.
- Internationalisation of Portuguese application-driven science and exposure of Portuguese companies and research institutions to US partners.

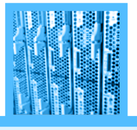
A Glimpse of our Research Portfolio in 2021

Portugal's geostrategic position in the Atlantic gives the country an edge over the creation and development of advanced space and earth observation infrastructures for multiple and integrated services aimed at space and non-space sectors. The set-up of an Atlantic constellation, being a Portugal's ambition, cannot be detached from a large collaborative international framework involving several countries, companies and research organisations. **MAGAL Constellation**, a UT Austin Portugal's Strategic Research Project, is among the initiatives the Portuguese Space Agency regards as most contributing towards this constellation of micro and nano satellites monitoring the Atlantic Ocean. MAGAL Constellation aims to define a new concept for ocean local and regional monitoring in association with its data modelling, analysis and forecast.

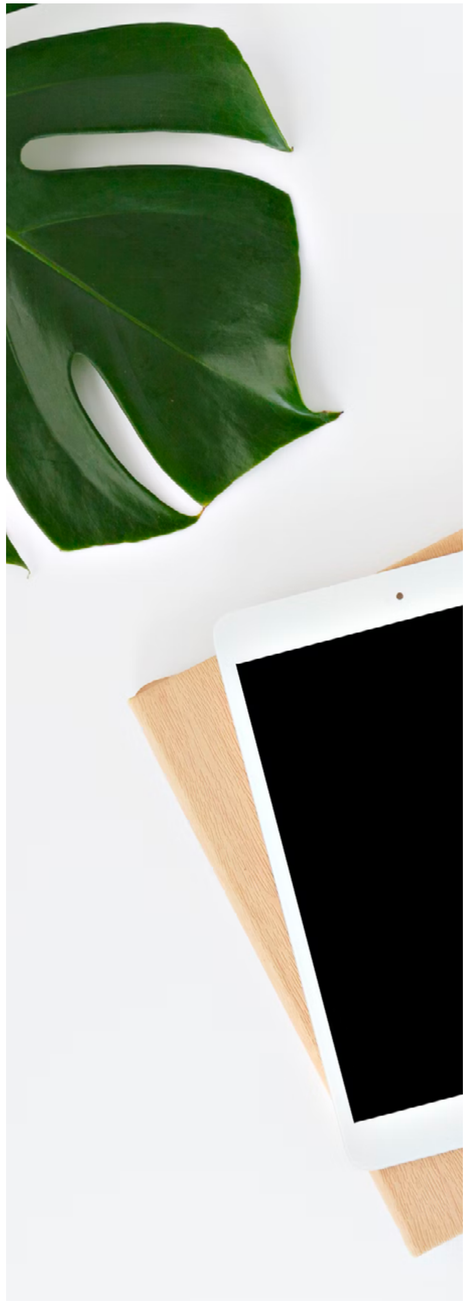
Proton Therapy is the most advanced type of radiation treatment for prostate, lung, head, and neck, liver, esophagus and brain cancers. The reason is simple: unlike in common gamma radiotherapy, the proton energy destroying the tumor can be delivered with much better accuracy, thus minimizing the damage to the surrounding healthy tissue. However, the uncertainty of the proton range seriously limits the precision of the radiation therapy. Positron emission tomography (PET) is increasingly considered a reliable imaging method to support treatment plan correctness. The **TOF-PET for Proton Therapy** project is building a new type of PET scanner, showing how tissues and organs are functioning to understand what the prescribed dose of protons should be and whether they are traveling to the right spots to fight off cancer tumours. The value of this approach is soon to be experimentally validated at the proton beam facility of the MD Anderson Cancer Centre in Texas.



Although vaccines are among therapies with the greatest impact in health, improved vaccines are needed for vulnerable groups with decaying immune function, such as the elderly. In this age group, protection afforded by vaccination (namely against influenza) is important but still sub-optimal. 2019 Exploratory Research Project **ImmuneNanoVac**'s results have showed promise of increasing vaccine efficacy among individuals who are more susceptible to severe consequences of infection (such as influenza or COVID-19). By advancing the knowledge on reprogramming host immune responses by nanoparticulate systems the project has successfully identified optimal nanomaterials to improve vaccine efficacy in vulnerable groups.



High-Performance Computing refers to the processing of extremely complex problems using the aggregated computational power of several computing systems running in parallel. Identified by the EU as a strategic resource for accelerating the industry, its innovation and competitiveness, HPC has great application potential in a wide range of fields. Addressing the challenges of managing the available computational and storage resources is crucial for taking full advantage of the next generation of HPC supercomputers. The **BigHPC** project is addressing these challenges with a novel management framework, for Big Data and parallel computing workloads, that can be seamlessly integrated with existing HPC infrastructures and software stacks. The team in Portugal and at UT Austin's Texas Advanced Computing Center is developing and integrating new monitoring, virtualization, and software-defined storage management components to cope with the infrastructural scale and heterogeneity, as well as the different workload requirements, while ensuring the holistic performance and resource usage for both Big Data applications and HPC infrastructures.



Active Projects in 2021

Click on the acronym to access the project web page.

#	Acronym	Title	Main Area	Status (31-12-2021)	Type of Project
1	STORM	Atmosphere – Ocean – Solid Earth Coupling: Seismic Tools to Explore and Monitor the Oceans	SPACE-EARTH INTERACTIONS	Concluded	2017 ERP
2	GEMIS	Graphene-enhanced Electro-Magnetic interference Shielding	NANOTECHNOLOGIES	Ongoing	2019 SRP
3	EXTREMED	Extreme Ultrashort Pulses for Advanced Medical Applications and Diagnostics	NANOTECHNOLOGIES	Ongoing	2019 SRP
4	UPGRADE	Miniaturized Prototype for GRavity field Assessment using Distributed Earth-orbiting assets	SPACE-EARTH INTERACTIONS	Ongoing	2019 SRP
5	BIGHPC	A Management Framework for Consolidated Big Data and HPC	ADVANCED COMPUTING	Ongoing	2019 SRP
6	SOFT4SENSE	Smart Surfaces for Reliable Tooling Integration	NANOTECHNOLOGIES	Ongoing	2019 SRP
7	SENTINEL	Novel injectable biosensor for continuous remote monitoring of cancer patients at high-risk of relapse	NANOTECHNOLOGIES	Ongoing	2019 SRP
8	TOF-PET FOR PROTON THERAPY (TPPT)	In-beam Time-of-Flight (TOF) Positron Emission Tomography (PET) for proton radiation therapy	MEDICAL PHYSICS	Ongoing	2019 SRP
9	MCTOOL21	Manufacturing of cutting tools for the 21st century: from nano-scale material design to numerical process simulation	NANOTECHNOLOGIES	Ongoing	2019 SRP
10	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	Ongoing	2019 SRP
11	NANOSTIM	Nanomaterials for wearable-based integrated biostimulation	NANOTECHNOLOGIES	Ongoing	2019 SRP
12	NANOCATRED	Novel metallic NANOparticles on NANOstructured supports for oxyanion CATalytic REDuction in water	NANOTECHNOLOGIES	Ongoing	2019 SRP
13	PIEZOFLEX	High-performance piezoelectric flexible materials enabled by hierarchically porous graphite for application as mechanical energy harvesters and sensors	NANOTECHNOLOGIES	Ongoing	2019 ERP
14	TARGET	TeraHertz Sources using Graphene Field-effect transistor	NANOTECHNOLOGIES	Concluded	2019 ERP
15	COFFORH2	Covalent organic frameworks as artificial metalloenzymes for hydrogen activation	NANOTECHNOLOGIES	Concluded	2019 ERP
16	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	Ongoing	2019 ERP
17	PASTOR	Programmable and Adaptable Storage for AI-oriented HPC Ecosystems	ADVANCED COMPUTING	Concluded	2019 ERP
18	ACT-PM	Automating Crash-Consistency Testing for Persistent Memory	ADVANCED COMPUTING	Concluded	2019 ERP
19	IMMUNENANOVAC	Nanomaterials to design new vaccine adjuvants	NANOTECHNOLOGIES	Concluded	2019 ERP
20	SOS-WINDENERGY	Sustainable Reuse of Decommissioned Offshore Jacket Platforms for Offshore Wind Energy	SPACE-EARTH INTERACTIONS	Concluded	2019 ERP

Figure 2: ERP – Exploratory Research Project SRP – Strategic Research Project

7.2 Strategic Research Projects: 2021 Performance Overview

SRPs are three-year long research projects promoting industry engagement and leadership.

The elite of industry-led projects bearing the Program's seals in 2021 amounted to 11 US-PT consortia, most of them already in their second year of execution.

Since these projects are partly funded through EU funds, they are subject to specific monitoring and evaluation procedures, which are not extendable to the US partners, though. Therefore, we only get to see a partial view of their progress through current reporting forms.

With this is mind, the Program adopted a holistic approach to the performance review, i.e., it took the transatlantic consortium – not each individual team - as the unit of analysis, and focused on the scientific and innovation component of the projects and their collaborative nature. Between August and October 2021, the Program conducted its first project progress assessment through an online survey. The report structure accommodated suggestions and recommendations made by the External Review Committee in their 2020 Annual Meeting. The time frame for data reporting varied from project for project, i.e., some consortia reported 6-month progress, other 12.

Project Progress Report Highlights[3]

36 new scientific jobs (3-year goal: 36)

27 in Portugal

9 at UT Austin

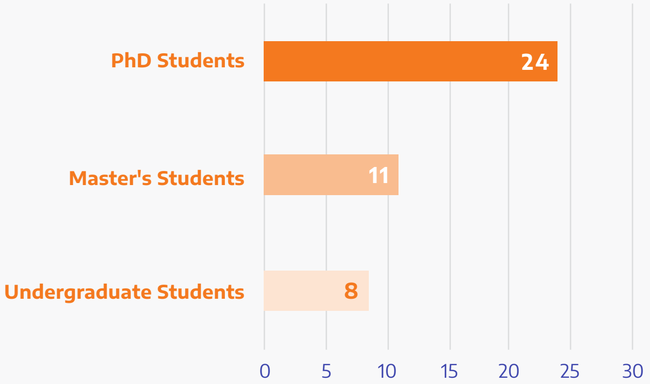
28 research fellowships granted

10 prototypes

43 research works supported

12 papers accepted or published in peer-reviewed international journals

- Amid the disruptions brought about by the pandemic, all consortia pointed out relevant achievements during their projects' reporting periods;
- At the root of most of the implementation challenges identified by the teams was the Covid-19 pandemic, which forced consortia to readjust their project management practices and, in some cases, draw on existing human resources to overcome difficulties recruiting skilled staff.
- IP protection, exploitation and dissemination activities have been reported across supported consortia, evidencing efforts of partners to increase research impact and market uptake (assessment of potential IP strategies for R&D results; planning of commercialization pathways; organization of outreach activities; submission of further funding application requests).
- Collaborations extended to partners outside of the consortia and included companies, end-users, intergovernmental organisations with a scientific mission, research centers and universities not necessarily located within the Program's geographic boundaries.



Graph 1: Research works supported in the reporting period (students' profiles)

[3] Some of the data collected refers to 2020 but has not been considered in the 2020 Activity Report.

7.3 **Exploratory Research Projects: 2021 Performance Overview**

ERPs are up to one year, goal-oriented scientific projects on emerging and transformative R&D topics, which hold the promise of moving into higher Technology Readiness Levels. This type of project is part of the Program's *Research* instrument.

In 2021, eight exploratory research projects from the 2019 Call were underway towards its completion, plus one from the 2017 edition. Throughout the year, 7 out of the 8 projects selected for funding in 2020 came to request the Program and FCT, the sponsor, a no-cost extension. The main reason behind such requests resided in the pandemic context, which caused intermittent access to laboratories and research equipment during the lockdown and made travels between Portugal and the U.S.A. impossible for a long time. Despite a turbulent outset for most of these teams due to the pandemic, they should all be acknowledged for their relentless efforts to avoid significant time derailments with project execution. The average length of a project stood at 14,5 months.

Although FCT demands that PIs in Portugal submit one project report at every 12 months, the Program asked the transatlantic teams to complete a progress report halfway through their one-year time frame. The report form was broken down into the following sections:

- General Project Information;
- Project Summary (Background; Approach/Methodology; Expected Outcomes; Expected Impact; Main Implementation Challenges; Main Findings; Main Achievements);
- Key Performance Indicators (Publications; Students Involvement; Mobility and Exchanges; Innovation and Technology Transfer, Honors and Awards; Other Dissemination and Outreach Activities in Portugal and abroad);
- Project Origin (Previous Projects; Further Funding Applications).

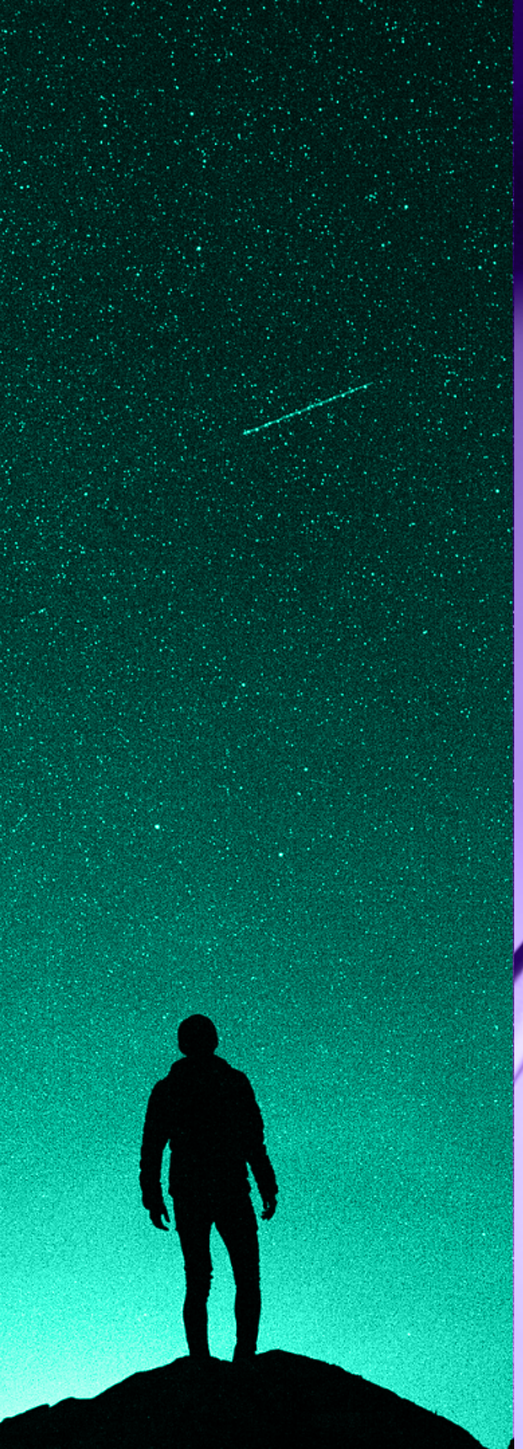
This was an improved version of the report model used for the first time in 2020 to inform the Program's External Review Committee (ERC) about the 2017 Exploratory Research Projects' performance ahead of this governing body's Annual Meeting.

The form covered a number of indicators converging towards indicators that FCT recommended. However, the Program went further beyond FCT's technical report - which focuses solely on Portuguese teams - since questions were built to capture information about the project holistically, i.e., as an international joint-venture.

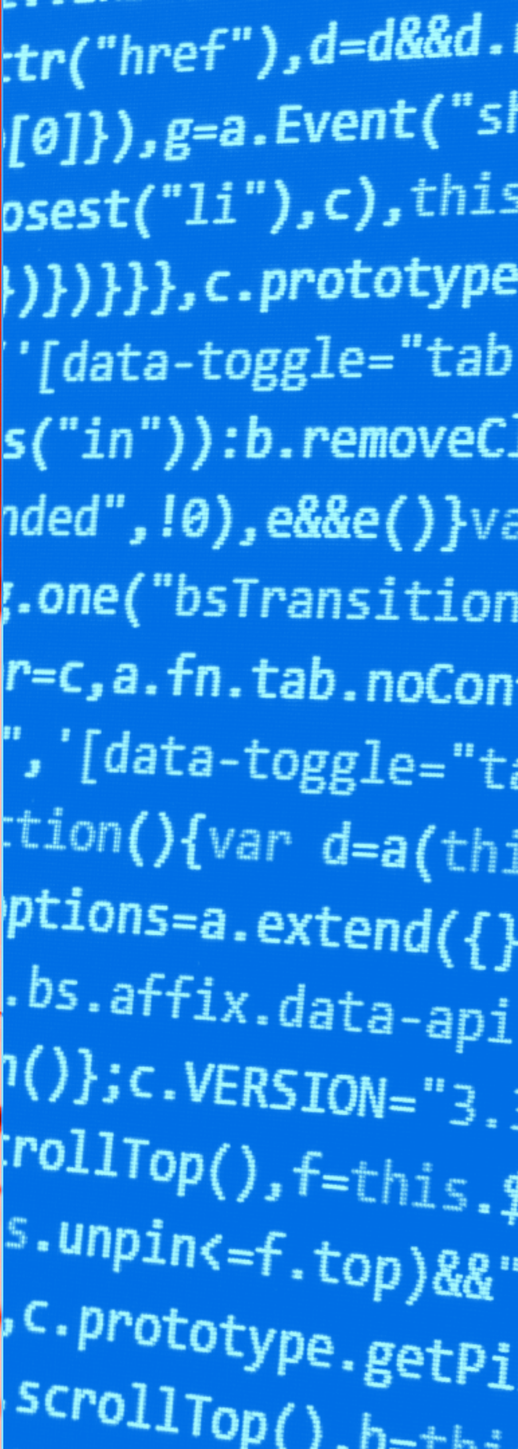
All consortia were surveyed once more after project closure. The final report form was very much similar to the interim one, but new questions were added to better understand whether the PIs were considering any follow-up to their projects to maximise the impacts from their research and public contribution.

At the time of writing of this report:

- 18 scientific papers accepted/published in peer-reviewed international indexed journal, of of which 17 feature on 1st quartile journals (according to the criteria used by the Authenticus platform), attesting to the high quality of the projects' scientific production. Due to the ERPs' standard time frame, it is expected that scientific production becomes more tangible in the months after project closure.
- 1 invention disclosure, 2 patent fileds, and 11 prototypes developed.
- Work plans engaged up to 40 students in research activities, most of them pursuing Doctoral studies (42,50% PhDs).
- Collaborative networks in the frame of these projects stretched beyond UT Austin – Portugal boundaries, with some papers being co-authored with researchers affiliated with institutions from Brazil, Norway, China, The Netherlands, Italy, Japan, Germany and Republic of Korea.




Use In Ventilated Area • Recap When Not In Use
Euler Diagram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7.4 2021 Publications[4]

Our projects are producing scientific outputs to the best standards

[COFFORH2] Salonen, L. M., Petrovykh, D. Y., & Kolen'ko, Yu. V. (2021). Sustainable catalysts for water electrolysis: Selected strategies for reduction and replacement of platinum-group metals. Materials Today Sustainability, 11–12, 100060.

[COFFORH2] Boucher, D. G., Kearney, K., Ertekin, E., & Rose, M. J. (2021). Tuning p-Si(111) Photovoltage via Molecule|Semiconductor Electronic Coupling. Journal of the American Chemical Society, 143(6), 2567–2580.

[COFFORH2] Joseph, C., Shupp, J. P., Cobb, C. R., & Rose, M. J. (2020). Construction of Synthetic Models for Nitrogenase-Relevant NifB Biogenesis Intermediates and Iron-Carbide-Sulfide Clusters. Catalysts, 10(11), 1317.

[COFFORH2] Frey, L., Jarju, J. J., Salonen, L. M., & Medina, D. D. (2021). Boronic-acid-derived covalent organic frameworks: from synthesis to applications. In New Journal of Chemistry (Vol. 45, Issue 33, pp. 14879–14907). Royal Society of Chemistry (RSC).

[COFFORH2] Goralski, S. T., & Rose, M. J. (2022). Emerging artificial metalloenzymes for asymmetric hydrogenation reactions. In Current Opinion in Chemical Biology (Vol. 66, p. 102096). Elsevier BV.

[COFFORH2] Kerns, S. A., Seo, J., Lynch, V. M., Shearer, J., Goralski, S. T., Sullivan, E. R., & Rose, M. J. (2021). Scaffold-based [Fe]-hydrogenase model: H2 activation initiates Fe(0)-hydride extrusion and non-biomimetic hydride transfer. In Chemical Science (Vol. 12, Issue 38, pp. 12838–12846). Royal Society of Chemistry (RSC).

[4] Only international peer-reviewed Journals

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[GEMIS] Silva, B., Rodrigues, J., Sompalle, B., Liao, C.-D., Nicoara, N., Borme, J., Cerqueira, F., Claro, M., Sadewasser, S., Alpuim, P., & Capasso, A. (2021). Efficient ReSe2 Photodetectors with CVD Single-Crystal Graphene Contacts. In Nanomaterials (Vol. 11, Issue 7, p. 1650). MDPI AG.

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[ImmuneNanoVac] Teixeira, S. P. B., Domingues, R. M. A., Babo, P. S., Berdecka, D., Miranda, M. S., Gomes, M. E., Peppas, N. A., & Reis, R. L. (2020). Epitope-Imprinted Nanoparticles as Transforming Growth Factor-β3 Sequestering Ligands to Modulate Stem Cell Fate. Advanced Functional Materials, 31(4), 2003934.

[ImmuneNanoVac] Ward, D. M., Shodeinde, A. B., & Peppas, N. A. (2021). Innovations in Biomaterial Design toward Successful RNA Interference Therapy for Cancer Treatment. Advanced Healthcare Materials, 2100350.

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[NanoCatRed] Restivo, J., Gonçalves Pinto Soares, O. S., & Ribeiro Pereira, M. F. (2020). Processing Methods Used in the Fabrication of Macrostructures Containing 1D Carbon Nanomaterials for Catalysis. In Processes (Vol. 8, Issue 11, p. 1329). MDPI AG.

[NanoCatRed] Santos, A. S. G. G., Restivo, J., Orge, C. A., Pereira, M. F. R., & Soares, O. S. G. P. (2021). Influence of organic matter formed during oxidative processes in the catalytic reduction of nitrate. In Journal of Environmental Chemical Engineering (Vol. 9, Issue 4, p. 105545). Elsevier BV.

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[SOS-WindEnergy] Mendes, P., Correia, J. A. F. O., De Jesus, A. M. P., Ávila, B., Carvalho, H., & Berto, F. (2020). A brief review of fatigue design criteria on offshore wind turbine support structures [JD]. Frattura Ed Integrità Strutturale, 15(55), 302–315.

[SOS-WindEnergy] Xin, H., Correia, J. A. F. O., Veljkovic, M., Berto, F., & Manuel, L. (2021). Residual stress effects on fatigue life prediction using hardness measurements for butt-welded joints made of high strength steels. International Journal of Fatigue, 147, 106175.

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7.5 2021 Call for Exploratory Research Projects

For the second time since the start of Phase 3, the Program managed to secure funds both in Portugal and UT Austin to launch a new Exploratory Research Projects Call in 2021.

No significant changes were made to the Terms of Reference and Call Announcement of the previous edition, which opened in 2019. Only the application period was shortened to one month and a half upon the sponsor's request[5] , which might explain the slight decrease in the total number of proposals received compared to the same indicator in 2019.

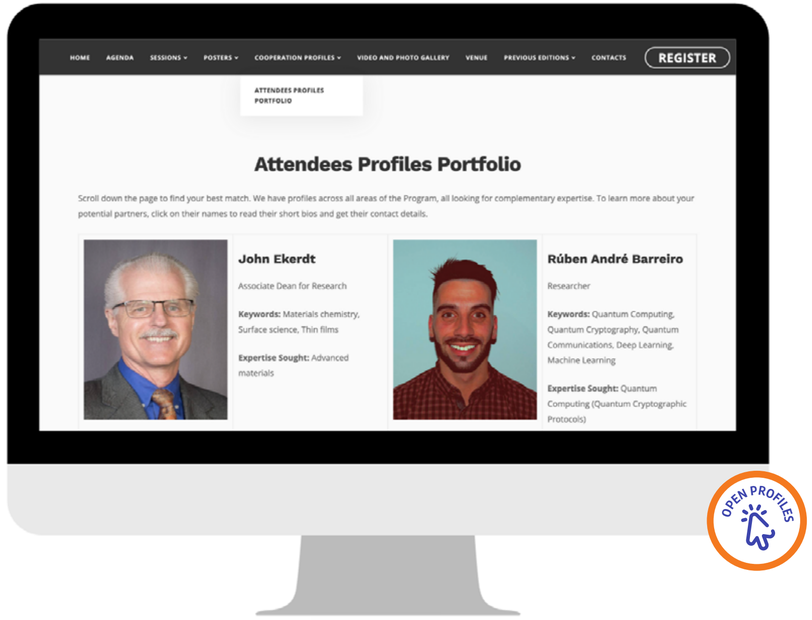


Figure 3: Snapshot of Online Cooperation Profiles

[5] The sponsor recommended a shorter time frame for proposal submission in order to ensure that the call's evaluation calendar did not extend beyond 2021.

Our small but diligent executive team stepped in to bring people from both sides together by publishing and disseminating cooperation profiles and meeting arrangements to expedite partnership formation.

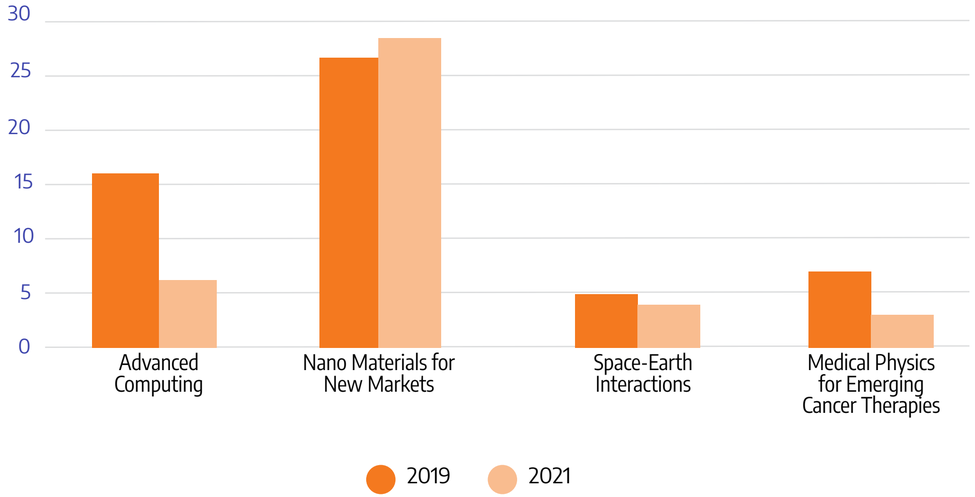
40 out of 44 applications were deemed eligible to proceed to the evaluation stage by an independent high-caliber panel of international experts across all areas of the Program, most of which had evaluated and scored the former batch of ERPs.

UT Austin Portugal 2021 ERP Call - Evaluation Panel

João Seco - German Cancer Research Center, Germany | Medical Physics
Chris Bowen - University of Bath, UK | Nanotechnologies
Su Metcalfe - Cambridge University, UK | Nanotechnologies
Maria del Fuente Freire - Oncomet, Spain | Nanotechnologies
Kevin Ryan - University of Limerick, Republic of Ireland | Nanotechnologies
Marie-Paule Pileni - Université Pierre et Marie Curie, France | Nanotechnologies
Patrizio Candeloro - Università Magna Graecia di Catanzaro, Italy | Advanced Computing
Andrea Bondavalli - University of Firenze, Italy | Advanced Computing
Simon McIntosh-Smith - Microelectronics Group and Bristol University, UK | Advanced Computing
George Xian - U.S. Geological Survey, Earth Resources Observation and Science Center, USA | Space-Earth Observations
John Hines - formerly at NASA, USA | Space-Earth Observations
Yolanda Prezado - Institute Curie, France | Medical Physics

2021 ERP Call Highlights

- Amount of available funding on both sides at the same levels of 2019:
  - € 400.000 in Portugal
  - US$ 400.000 in UT Austin
- 44 Proposals (against 58 in 2019), representing € 2,6 million of requested funding (PT side)
  - 21 Portuguese institutions mobilized
- Participation of PIs from 2017 and 2019 Calls (Exploratory and Strategic Research Projects) evidences intention to build on results of previous collaborations
- Submitted applications indicate increasing focus on R&D for health- and energy-related projects, with Nanotechnology consolidating its status as a cross-cutting area.



Graph 2: Eligible Proposals per Area (2019 and 2021 Calls)

8 Projects recommended for funding

With a public contribution of € 398 779,54 for Portuguese teams and matched funding for UT Austin's.

- **5** Projects in Nanotechnologies
- **1** Project in Advanced Computing
- **1** Project in Medical Physics
- **1** Project in Space-Earth Interactions

2021 Exploratory Research Projects

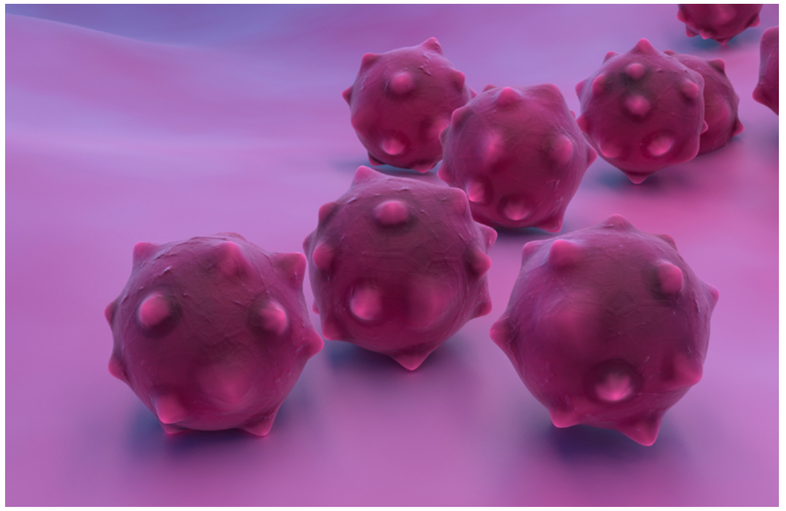
Click on Acronym and Title to visit the projects' web pages

Main Area	Acronym & Title	PI in Portugal and Main Contracting Institution	PI at UT & Affiliation	Start Date
SPACE-EARTH INTERACTIONS	MMO - Multi-source modelling of the ocean: coupling Earth observations with acoustic waves	Leonardo Azevedo, Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)	Tan Bui-Thanh, Department of Aerospace Engineering and Engineering Mechanics, Cockrell School of Engineering The Oden Institute for Computational Engineering and Sciences	March 1, 2022
MEDICAL PHYSICS	THER-PBCT - Theranostic Strategy for Proton Boron Capture Therapy of Pancreatic Cancer	António Paulo, Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)	Chun Li, Department of Cancer Systems Imaging, MD Anderson Cancer Center	April 1, 2022
ADVANCED COMPUTING	QMETA - Realising Quantum METAmaterials with Quantum Dot Arrays	Paloma Huidobro, Instituto de Telecomunicações (IT)	Yuebing Zheng, Walker Department of Mechanical Engineering, Cockrell School of Engineering	March 1, 2022
NANOTECHNOLOGIES	NxGNanoTher - Next-generation nanomaterials to sensitize breast cancer to immunotherapy	Helena Florindo, FARM-ID, Associação da Faculdade de Farmácia para a Investigação e Desenvolvimento (FARM-ID)	Nicholas A. Peppas, Department of Biomedical Engineering, Cockrell School of Engineering	February 15, 2022
NANOTECHNOLOGIES	2D-Therapy - New 2D nanomaterials for cancer phototherapy and immunotherapy	Artur Pinto, Faculdade de Engenharia da Universidade do Porto (FE/UP)	Jean Anne Incorvia, Department of Electrical and Computer Engineering, Cockrell School of Engineering	January 1, 2022
NANOTECHNOLOGIES	LubEnergy - Engineering Lubricious Interfaces for Enhancing Energy Efficiency	Fábio Ferreira, Instituto Pedro Nunes (IPN)	Filippo Mangolini, Walker Department of Mechanical Engineering, Cockrell School of Engineering	January 1, 2022
NANOTECHNOLOGIES	MagTubeCancer - Magnetic Nanoparticles For Cancer Therapy: Collection And Elimination of Circulating Tumor Cells	Marta Laranjeira, Instituto de Investigação e Inovação em Saúde da Universidade do Porto - Associação (i3S)	James W. Tunnell, Department of Biomedical Engineering, Cockrell School of Engineering Department of Oncology, Dell Medical School Department of Diagnostic Medicine, Dell Medical School	January 15, 2022
ADVANCED COMPUTING	ML@GridEdge - Distributed Machine Learning Solutions for Coordinating Distributed Energy Resources at the Edge of the Power Grid	Pedro Moura, Instituto de Sistemas e Robótica	Javad Mohammadi, Civil, Architectural, and Environmental Engineering, Cockrell School of Engineering	March 1, 2022

MMO - Multi-source modelling of the ocean: coupling Earth observations with acoustic waves

Ocean currents are not all the same and some impact how nutrients are transferred around and how carbon mixes up in the deep ocean. Understanding these flows improves scientists' knowledge of climate change and the sea as a whole.

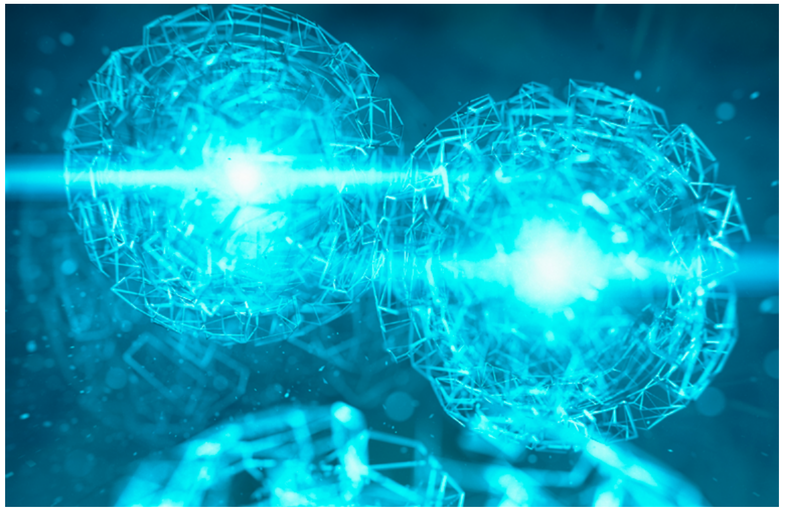
In this project, researchers will study the complex oceanic dynamics of the Gulf of Cádiz in the Atlantic Ocean. They will use spatial data science methods, geophysics, scientific machine learning and computational mathematics to develop new modelling and observation tools in a project aligned with AIR CENTRE, a UT Austin Portugal's partner.



THER-PBCT - Theranostic strategy for proton boron capture therapy of pancreatic cancer

Proton therapy is emerging as one of the most attractive radiotherapeutic strategies to treat different types of cancers. However, this type of therapy may be less effective with radioresistant tumors, such as the pancreatic ductal adenocarcinoma, one of the deadliest types of cancer. Radioresistance happens when tumor cells or tissues adapt to the radiotherapy-induced changes and develop resistance. A new approach, Proton Boron Capture Therapy, can pave the way for new radiotherapeutic strategies to treat such tumors by enhancing proton therapy's relative biological effectiveness. In this type of therapy, doctors inject a standard borated solution into the human body to tackle deep-seated tumors in cancer patients, which triggers nuclear fusion reactions in cancer cells without harming healthy ones.

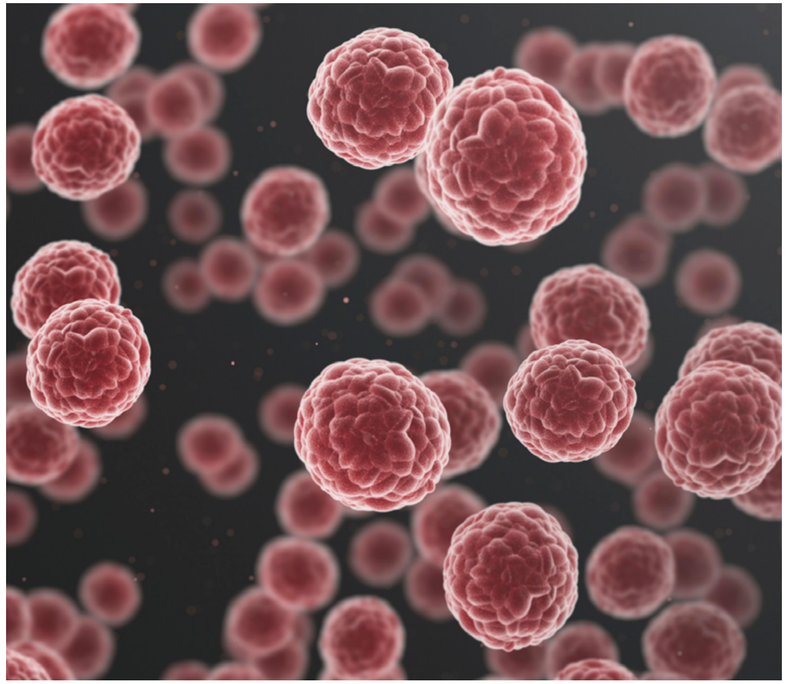
The PT-UT team will study new ways to deliver boron into pancreatic ductal adenocarcinoma cells, thus opening up opportunities for a more personalized radiotherapy of pancreatic cancer along with a better ability to predict the therapeutic outcome.



QMETA - Realizing quantum METAmaterials with quantum dot arrays

Ever heard of metamaterials? It's a class of artificially structured materials that exhibit extraordinary electromagnetic properties. Metamaterials made big advances in light control possible, leading to new applications in efficient and compact nanophotonic devices. This has improved modern communications to a significant extent.

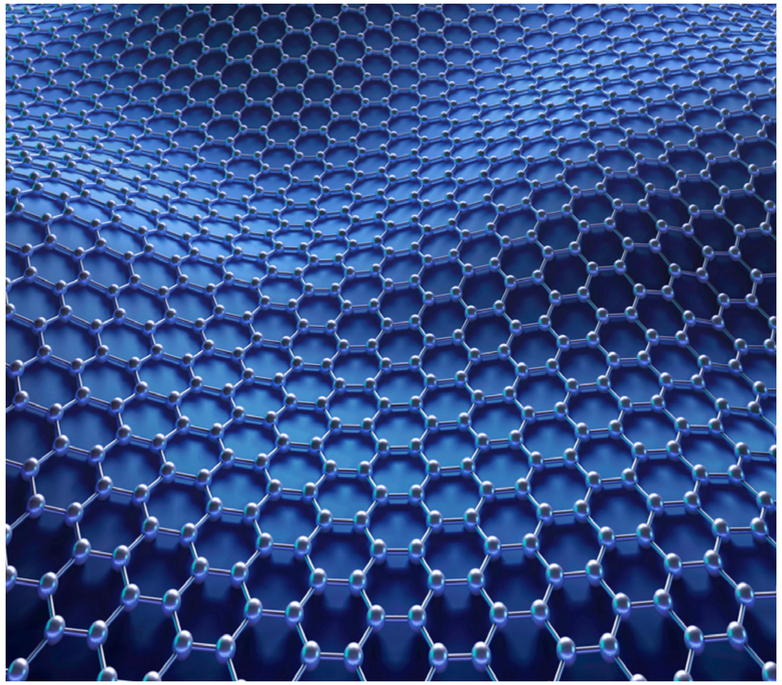
Now, researchers want to make a new category: quantum metasurfaces. They will merge the concept of metamaterials and metasurfaces with the use of quantum emitters, in particular quantum dots. With these new materials, they foresee future applications in new markets of photonic quantum communications and quantum information.



NxGNanoTher - Next-generation nanomaterials to sensitize breast cancer to immunotherapy

In 2021, breast cancer will become the most common form of cancer worldwide. Beyond this, breast cancer brain metastases are the second most common cause of brain metastases — when the tumour spreads throughout the body and reaches the brain.

In this exploratory joint venture, Portuguese and UT Austin researchers want to make a novel nanomaterial-based immunotherapy to re-educate host immunity against breast cancer brain metastases, fighting this deadly form of cancer. Their focus is on gathering crucial data on optimal nanomaterials to sensitize this type of metastases to immunotherapy.



2D-Therapy - New 2D nanomaterials for cancer phototherapy and immunotherapy

Two-dimensional materials are crystalline materials consisting of single- or few-layer atoms.

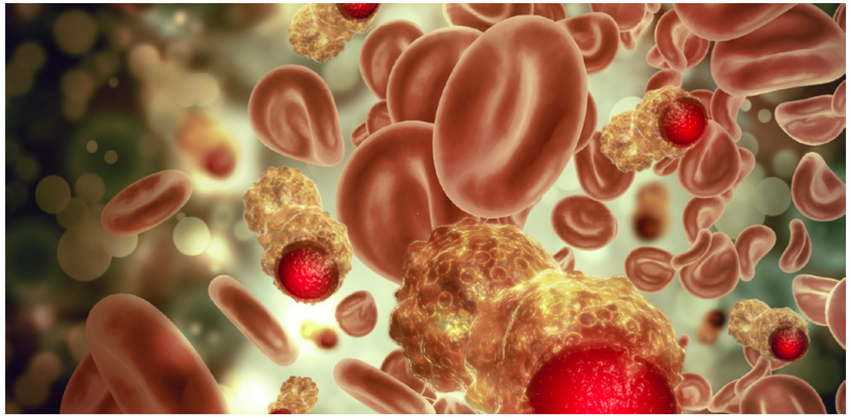
At the nanoscale, these materials can be combined with photothermal therapy, photodynamic therapy or even chemotherapy. This is because 2D materials have a large surface area and great radiation absorbance properties. Still, making these nanomaterials is a complex and laborious process.

Researchers want to change this. In this project, the PT-UT Austin team will work with these materials to see if they can be tuned for phototherapy uses. They will further their research into applying their ideas to lung cancer.

LubEnergy - Engineering lubricious interfaces for enhancing energy efficiency

Did you know that in the transportation industry, around 30% of fuel used in vehicles is used to overcome friction in the engine? This has in impact on how much energy we're spending with little productivity. Improved approaches for friction and wear management could result in enormous energy savings and benefits for industrial productivity and lead to drastic reductions in greenhouse gas emissions.

Researchers in Portugal and UT Austin will look into new materials and evaluate the friction and wear response of a class of advanced coatings and improve lubricating performance.



MagTubeCancer - Magnetic Nanoparticles For Cancer Therapy: Collection And Elimination of Circulating Tumor Cells

More than 90% of cancer deaths are due to metastases. One of the biggest causes of metastases are circulating tumour cells. Techniques that remove circulating tumour cells from the blood in vivo could reduce metastatic events and the tumour's aggressiveness. Based on this knowledge some methodologies to kill and retain a larger number of circulating tumour cells have been proposed such as microtubes functionalized with antibodies.

Researchers will now develop a device to improve circulating tumour cells capturing efficiency. The device would have a simple design, be inexpensive and able to handle large blood volumes without blood separation techniques.

ML@GridEdge - Distributed machine learning solutions for coordinating distributed energy resources at the edge of the power grid

Smart buildings and connected communities are the cornerstones of future sustainable power grids and tomorrow's energy communities. Resilient operation of a city's energy infrastructure hinges on accurately predicting buildings' temporal energy presumption (production and consumption).
Traditional prediction models mostly leverage historical information (such as energy demand) of individual buildings in isolation. This is mainly due to data sharing hesitance which originates from building managers and occupants' privacy concerns.

Researchers in this project intend to develop a novel federated machine learning model for predicting the temporal energy needs of future connected communities. The results of the developed models will be crucial for optimizing energy resources in smart cities towards a more decarbonized society.

UTAustin Portugal

08

Redesigning Training Activities in Pandemic Times

Redesigning Training Activities in Pandemic Times

Most of the training activities carried out in 2021 took a digital format, with only a few being organized in a hybrid or full-onsite mode. Digital was actually a path we had beaten before: back in 2020, when the pandemic shut us off from the physical world and we had to resort to digital settings to go on interacting, socializing and networking, the Program was pushed to quickly learn to navigate videoconferencing platforms to deliver training or organizing stakeholders' engagement activities.

In 2021, we took the decision to give our transatlantic community a greater sense of agency about Program's training portfolio. To this end, we called on experts, faculty and researchers from both sides to put forward proposals for short-term advanced training programs. Some of the selected proposals actually originated from research work pursued in the frame of supported ongoing projects (e.g.: Proton Therapy: The Opportunities and The Challenges).

Additionally, the Program partnered with the BigHPC consortium and put on a webinar series on High-Performance Computing which ran along the second half of the year and brought together luminaries from academia and industry.

Although our training portfolio aimed primarily at our PT-UT Austin community (including The University of Texas MD Anderson Cancer Center), we extended the participation in our online courses to people from other locations, thereby raising the international profile of the Program beyond its traditional boundaries.

Lastly, we organized another round of thematic Masterclasses at our Annual Conference covering several key topics across the Program's knowledge areas and mobilizing leading minds from prestigious organisations. All training activities have been recorded for later viewing and archiving purposes.

4 short-term advanced training programs

67 hours of training

5 thematic premium masterclass

88 high-profile experts from **8** countries — 47% from Portugal, 37% from USA

1 webinar series

2 Warm-up Sessions

over **1200** registrants from **40** countries — **81%** affiliated to Academia & Research Performing Organizations

ONLINE TRAINING – PROS

- Opened up opportunities to take the UT Austin Portugal brand beyond its geographical scope;
- Allowed the Program to deliver advanced training when travel bans were in place;
- Suitable for short-term training, allowed to explore sub-topics of broader themes;
- Accommodates a higher number of registrations.

ONLINE TRAINING – CONS

- Less room for interaction and networking between speakers and attendees;
- Does not allow in-depth coverage of topics nor variety of learning methods;
- Additionally, the effects of short-term training in capacity building may be far less significant than those of long-term and intensive training.
- “No show-ups” can be even higher than for in-person events.

8.1 Full List of Training Activities Organized by the Program

Title	Scientific Coordination	Area	Training Hours and Modules	Start and End Date (2021)
New methods in Radiotherapy Seminar (under the University of Coimbra's 2021 Biomedical Engineering Advanced Course coordinated by Professor Maria Filomena Botelho, FMUC)	Emil Schueler, Department of Radiation Physics, Division of Radiation Oncology of The University of Texas MD Anderson Cancer Center (MDACC)	MEDICAL PHYSICS	**1 ½ hour long**	May 13
BigHPC Webinar Series On the Road to HPC: Major Challenges and New Opportunities	João Paulo Rodrigues, INESC TEC (BigHPC Consortium)	ADVANCED COMPUTING	**3 hours long** • **Webinar #1:** Containerized Application Performance at Petascale. • **Webinar #2:** Is HPC ready for "Big" Data Storage? • **Webinar #3:** Monitoring in the BigData Era	July 22 – November 18
Responsible Innovation	Fernando Almeida, INESC TEC & ISPGAYA	TECHNOLOGY INNOVATION AND ENTREPRENEURSHIP	**12 hours long** • The Profit-Impact-Innovation paradox • Innovation for sustainable development • The Agile innovation model • The ISO 56000:2020 (innovation management) • Strategic combination of Agile with other productivity frameworks • Measuring the impact of responsible innovation Workshop • Aligning management 3.0 with responsible innovation • Tools and techniques used in Agile innovation • Towards a business case for responsible innovation	September 27 – October 1
Interdisciplinary Training on Principles, Applications and Nanotechnology Innovation in Pharmaceutical Sciences, Biological Engineering and Medicine	Nicholas A. Peppas, UT Austin Helena Florindo, University of Lisbon	NANOTECHNOLOGIES	**14 hours long** • Biomedical Micro- and Nanotechnology: Overview • Micro-/Nanofabrication – IC and non-IC Origins • Some Fundamentals of Biochemistry & Molecular Cell Biology and Physiology as Used in Nanotechnology • Principles of Biomaterials in Nanotechnology • Principles of Biomaterials, Bionetworks and Biohydrogels in Nanotechnology | Micro- and Nanofluidics • Principles of Diagnostic Devices & Sensors • Advances in Diagnostic Devices • Nanotechnology for Immune Modulation • Nanomaterials, Quantum Dots | Therapeutic Devices | Combination immunotherapy treatments | Nanoparticulate mediated cancer therapies • Drug Delivery Devices – Part I • Drug Delivery Devices – Part II | siRNA Nanotechnology • The Future of Innovation in Nanotechnology	October 4 – December 13

8.1 Full List of Training Activities Organized by the Program

Title	Scientific Coordination	Area	Training Hours and Modules	Start and End Date (2021)
Commercializing University Research Innovations	Van Truskett, UT Austin	TECHNOLOGY INNOVATION AND ENTREPRENEURSHIP	**1 hour long**	October 18
Science Communication and Publics	Júlio Borlido, i3S		**2 hours long**	October 19
Defining an HPC Open Ecosystem, Where We Are and How Do We Get There Masterclass	Rui Oliveira, INESC TEC, University of Minho, UT Austin Portugal John Davis, BSC-CNS	ADVANCED COMPUTING	**2,5 hours long**	October 21
The Challenges of Proton Therapy in Cancer Treatment Research and Clinical Perspectives (2nd edition) Masterclass	José Marques, IST João Oliveira, IPO Lisboa	MEDICAL PHYSICS	**3 hours long**	October 21
Next-Generation Batteries Masterclass	Brian Korgel, UT Austin Carla Silva, CITEVE Paulo Ferreira, INL and IST	NANOTECHNOLOGIES	**2,5 hours long**	October 21
The Azores Region – a unique gateway to deep sea research in support of the UN Decade of Ocean Science for Sustainable Development Masterclass	Luísa Bastos, Astronomy Observatory of Professor Manuel de Barros Patrick Heimbach, UT Austin Pedro Camanho, INEGI, University of Porto	SPACE-EARTH INTERACTIONS	**2,5 hours long**	October 21
From Innovations to Operations: the Management of New Technology Implementations Masterclass	João Claro, INESC TEC, University of Porto	TECHNOLOGY INNOVATION AND ENTREPRENEURSHIP	**2 hours long**	October 21
Proton Therapy: The Challenges and the Opportunities	Joana Dias, INESC Coimbra Wenhua Cao, MDACC Humberto Rocha, University of Coimbra Brígida Ferreira, University of Lisbon Gino Lim, University of Houston	MEDICAL PHYSICS	**9 hours long** • An overview of Proton Therapy • MD Anderson Proton Center experience: past, present and future • Proton Therapy treatment planning in practice • Quality Assurance in Proton Therapy • Proton Therapy research: what are the main future challenges? • MatRad: the open-source system for radiation treatment planning • Optimization of Intensity Modulated Proton Therapy • The role of Artificial Intelligence in Proton therapy	December 3 – December 15
Net-Zero Climate Emissions: The role of nanotechnologies for advanced energy generation, conversion and storage	Killian Lobato, University of Lisbon Brian Korgel, UT Austin Carla Silva, CITEVE Guilherme Gaspar, University of Lisbon Paulo Ferreira , INL and IST	NANOTECHNOLOGIES	**12 hours long** • The European Green Deal – The technological requirements for Net-Zero climate emissions by 2050 • Photovoltaics, current market and industry, and a technological outlook • Energy storage (electrochemical batteries and supercapacitors, other potential technologies) • Green fuel generation using renewable energy (H2 generation, synthetics fuels)	December 13- December 16
The on-site workshop 2D Materials for Biomedical Applications, proposed by Jean Anne Incorvia (Cockrell School of Engineering, UT Austin) and Artur Pinto (Faculty of Engineering, University of Porto), was due to happen in December 2021 in Porto. However, with the pandemic getting worse in Portugal at the end of the year, the workshop was postponed to January 2022 and redesigned for an online setting.		NANOTECHNOLOGIES	Disseminated in 2021 but postponed to 2022 due to the pandemic	

8.2 Our Wall of High-Caliber Training Experts

Amit Ruhela
TACC, UT Austin, USA

Ana Colaço
University of Azores, Portugal

André Augusto
Arizona State University, USA

Andrew Thurber
Oregon State University, USA

António Vallêra
University of Lisbon, Portugal

Artur Pinto
University of Porto, Portugal

Arumugam Manthiram
UT Austin, USA

Brandon Gunn
MDACC, University of Texas, USA

Brian Korgel
UT Austin, USA

Brígida Ferreira
University of Lisbon, Portugal

Bruce Howe
University of Hawaii at Mānoa, USA

Bruno Antunes
Wavecom, Portugal

Carla Silva
TACC, UT Austin, USA

Catarina Carvalho
INESC TEC, Portugal

Cátia Pedro
IPO Lisboa, Portugal

Christine Chung
MDACC, University of Texas, USA

Claudio Pistidda
Helmholtz Zentrum Hereon, Germany

David Mitlin
UT Austin, USA

Deidra Ward
UT Austin, USA

Dennis A. Huang
UT Austin, USA

Eduardo Espinheira
Porto Business School, Portugal

Emil Schueler
MDACC, University of Texas, USA

Fátima Montemor
University of Lisbon, Portugal

Felix Janssen
HGF-MPG. Alfred Wagner Institute, Germany

Fernando Almeida
INESC TEC & ISPGAYA, Portugal

Froy Aparicio
Nächstes Level, Germany

Ghufran Hashmi
University of Oulu, Finland

Gino Lim
University of Houston, USA

Guihua Yu
UT Austin, USA

Guilherme Gaspar
University of Lisbon, Portugal

Gurleen Kaur
IPVF, France

Hans-Peter Wieser
University of Munich, Germany

Helena Florindo
University of Lisbon, Portugal

Humberto Rocha
University of Coimbra, Portugal

Jean Anne Incorvia
UT Austin, USA

Joana Dias
INESC Coimbra & University of Coimbra, Portugal

Joana Baptista
University of Lisbon, Portugal

João Claro
INESC TEC, University of Porto, Portugal

João Dias
MACC, Portugal

João Monteiro
ISPGAYA, Portugal

João Oliveira
IPO, Portugal

João Paulo
INESC TEC, Portugal

João Ribau
Agência Nacional de Inovação, Portugal

João Seco
DKFZ, Germany

8.2 Our Wall of High-Caliber Training Experts

John D. Davis
BSC-CNS, Spain

Mateo Valero
BSC-CNS, Spain

Jorge Correia
University of Lisbon, Portugal

José Coelho Rodrigues
INESC TEC, University of Porto, Portugal

José Santos
ISPGAYA, Portugal

José Marques
IST, Portugal

José Morais
University of Porto, Portugal

JR Deshazo
UT Austin, USA

Júlio Borlido
I3S, Portugal

Júlio Costa
Wavecom, Portugal

Killian Lobato
University of Lisbon, Portugal

Laura Wallace
UT Austin & GNS Science, USA

Lei Dong
University of Pennsylvania, USA

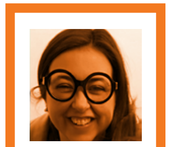
Lifeng Liu
INL, Portugal

Luís Graça
iMM, Portugal

Luísa Bastos
Astronomy Observatory of Professor Manuel de Barros, Portugal

Marco Bravo
UT Austin, USA

Maria Filomena Botelho
University of Coimbra, Portugal



Maria Helena Braga
University of Porto, Portugal

Narayan Sahoo
MDACC, University of Texas, USA

Nicholas Peppas
UT Austin, USA

Niklas Wahl
DKFZ, Germany

Patrick Heimbach
UT Austin, USA

Paulo Ferreira
INL & IST, Portugal

Pedro Camanho
University of Porto, Portugal

Pedro Carneiro
University of Porto, Portugal

Pedro Salomé
INL, Portugal

Peter Lund
Aalto University, Finland

Radhe Mohan
MDACC, University of Texas, USA

Ricardo Macedo
INESC TEC, Portugal

Richard Todd Evans
TACC, UT Austin, USA

Rick Fernandez
20-20 Innovation, Inc., USA

Robert Hebner
UT Austin, USA

Rui Oliveira
UT Austin Portugal, Portugal

Senentxu Lanceros-Mendez
University of Minho, Portugal

Stephan DeLuca
Energy Materials Corporation, USA

Stephen Lien Harrell
TACC, UT Austin, USA

Upul Wijayantha
Loughborough University, United Kingdom

Uwe Seidel
IPCEI, Germany

Van Truskett
UT Austin, USA

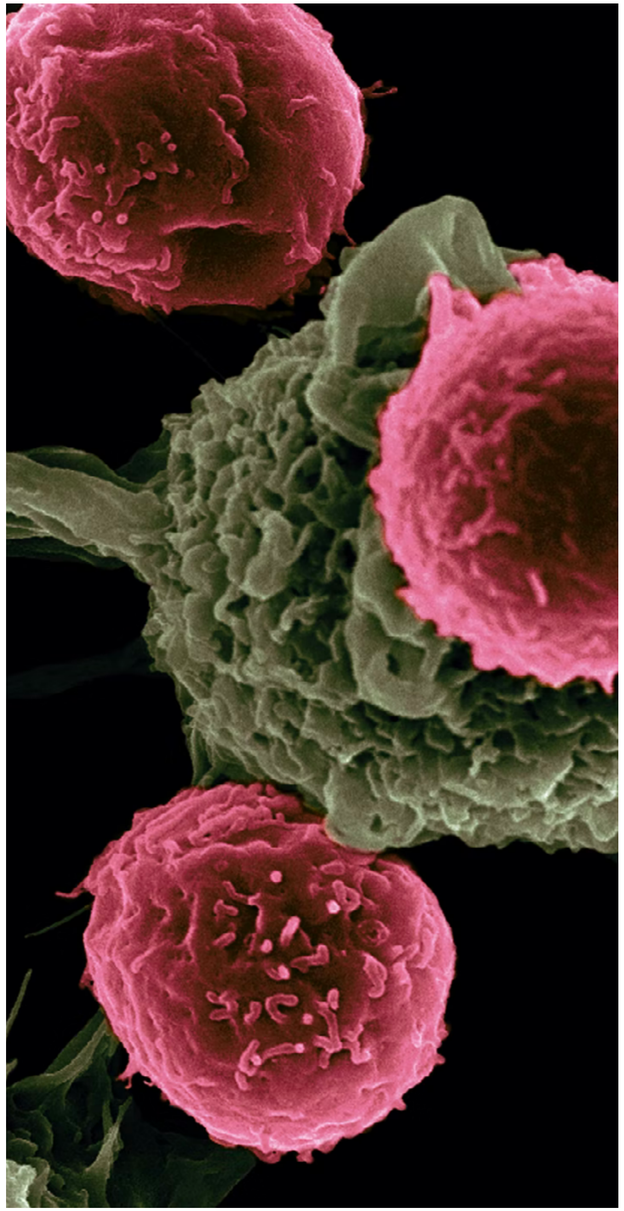
Vanesa Gil
ARAID Aragon Hydrogen Foundation and Fha, Spain

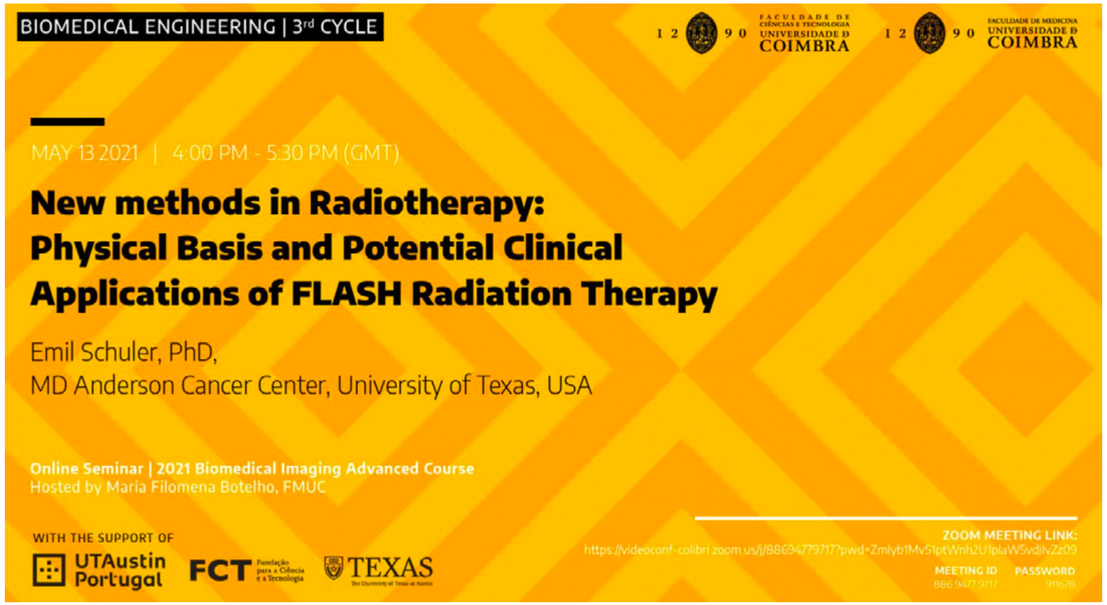
Wehnua Cao
MDACC, University of Texas, USA

Wenbo Gu
University of Pennsylvania, USA

Yong-Hang Zhanga
Arizona State University, USA

8.3 Our 2021 Training Portfolio in Detail





New methods in Radiotherapy: Physical Basis and Potential Clinical Applications of FLASH Radiation Therapy Seminar

ONLINE

Emil Schueler, Assistant Professor at the Department of Radiation Physics, Division of Radiation Oncology of The University of Texas MD Anderson Cancer Center (MDACC), at the invitation of the UT Austin Portugal Program, delivered the online seminar on “New methods in Radiotherapy” within the scope of the University of Coimbra’s 2021 Biomedical Engineering Advanced Course, coordinated by Professor Maria Filomena Botelho, Director of the Biophysics Institute of the Faculty of Medicine.

In the fight against cancer, many new therapies are emerging. FLASH radiotherapy is one of the most promising. Professor Schuler explained that FLASH radiotherapy is the ultra-fast delivery of radiotherapy at dose rates generally several thousand times higher than the ones currently used in routine clinical practice. He went on adding that such a definition is based on the dose rate needed to induce what experts call the FLASH effect, which demonstrated sparing healthy tissue around the tumour. Although these developments are only at their beginning and field experts are still learning more about what is needed to achieve the FLASH effect in different tissues and organs, Professor Schueler reaffirmed his belief that the data researchers have been gathering through several preclinical studies will be ultimately translated to the clinical setting.

On the Road to HPC: Major Challenges and New Opportunities

ONLINE

This webinar series was a joint initiative of the Program and the 2019 Strategic Research Project BigHPC. It attests to the consortium's commitment to knowledge sharing and dissemination beyond its partners and direct stakeholders to convey how collaboration between academia and industry play an important role in advancing High Performance Computing for the benefit of science, societies, and the economy at large.

Sessions intended to provide rather practical insights into HPC-related topics ranging from containerization technologies to scientific visualization, to HPC monitoring and data storage and involved academic and business experts from the BigHPC consortium.

Full series can be watched here

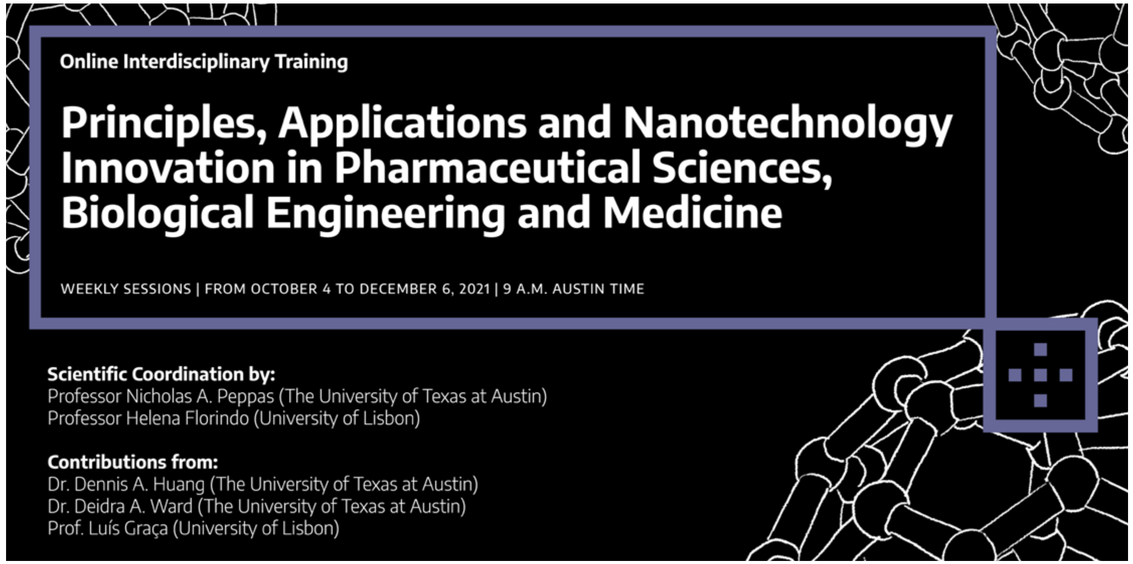
Responsible Innovation (Call for Short-Term Advanced Training Programs)

ONLINE

This training activity focused on an integrated approach to help for-profit organizations, a start-up or a mature company, face the challenges associated to innovation, a risky and sometimes costly bet and yet a key lever for achieving long-term success.

The responsible innovation approach is based on the strategic combination of three core disciplines: innovation management, circular economy, and sustainable development, through the application of agile methodologies and international standards.

The recorded version of the course is available here



Principles, Applications and Nanotechnology Innovation in Pharmaceutical Sciences, Biological Engineering and Medicine (Call for Short-Term Advanced Training Programs)

ONLINE

This online training program was designed for young graduate and senior students, as well as for faculty and technical staff wishing to gain in-depth knowledge of nanotechnology to develop new biomedical and pharmaceutical systems or found technology-based startup companies. The aims of this advanced training program were:

- To provide the chemical and physical background of nanoscale systems with an emphasis on chemistry, preparation and physical properties;
- To design new nanotechnology-based systems for pharmaceutical and medical applications; and
- To demonstrate how innovations using nanoscale technology will provide new medical, biological and related products.

The research team behind the 2019 ImmuneNanoVac Exploratory Research Project took charge of the design of this course, which attracted the highest number of registrations from all courses organised in 2021 by the Program.

Proton Therapy: The Challenges and the Opportunities (Call for Short-Term Advanced Training Programs)

ONLINE

Intensity-Modulated Proton Therapy (IMPT) treatment planning was the underlying topic of this online training. Invited luminaries from leading institutions in cancer research in the US and Europe brought state-of-the-art information to clinical professionals and researchers. The goal was to shed light on the results of ongoing research and development which are expected to have significant impact on clinical practice, contributing to improving the qualitity of delivered treatments.

The training program was thought for professionals involved in clinical practice (medical oncologists, medical physicists, planners) as well as for researchers in medical physics, medicine, computer science, operations research and professionals from the healthcare industry.

The recorded version of the course is available here

Net-zero climate emissions: the role of nanotechnologies for advanced energy generation, conversion, and storage (Call for Short-Term Advanced Training Programs)

ONLINE

The purpose of this advanced training program was to present to industry and academia the technological and scientific pathways required for deployment of sustainable cost-effective large scale energy storage and conversion powered by renewable energies.

The training program was open to both people in academia and in industry. Attendees from academia (undergraduate and graduate students, as well as postdocs and researchers) were expected to be already working in the area covered by this advanced training, or at least be interested in pivoting their activities into such an area. On the other hand, industry professionals were also welcome to participate, regardless of whether they were already conducting businesses intersecting with the topics in the spotligth or wished to understand how they could bring their expertise into nanotechnology-based energy applications.

Watch the recorded video of this course here

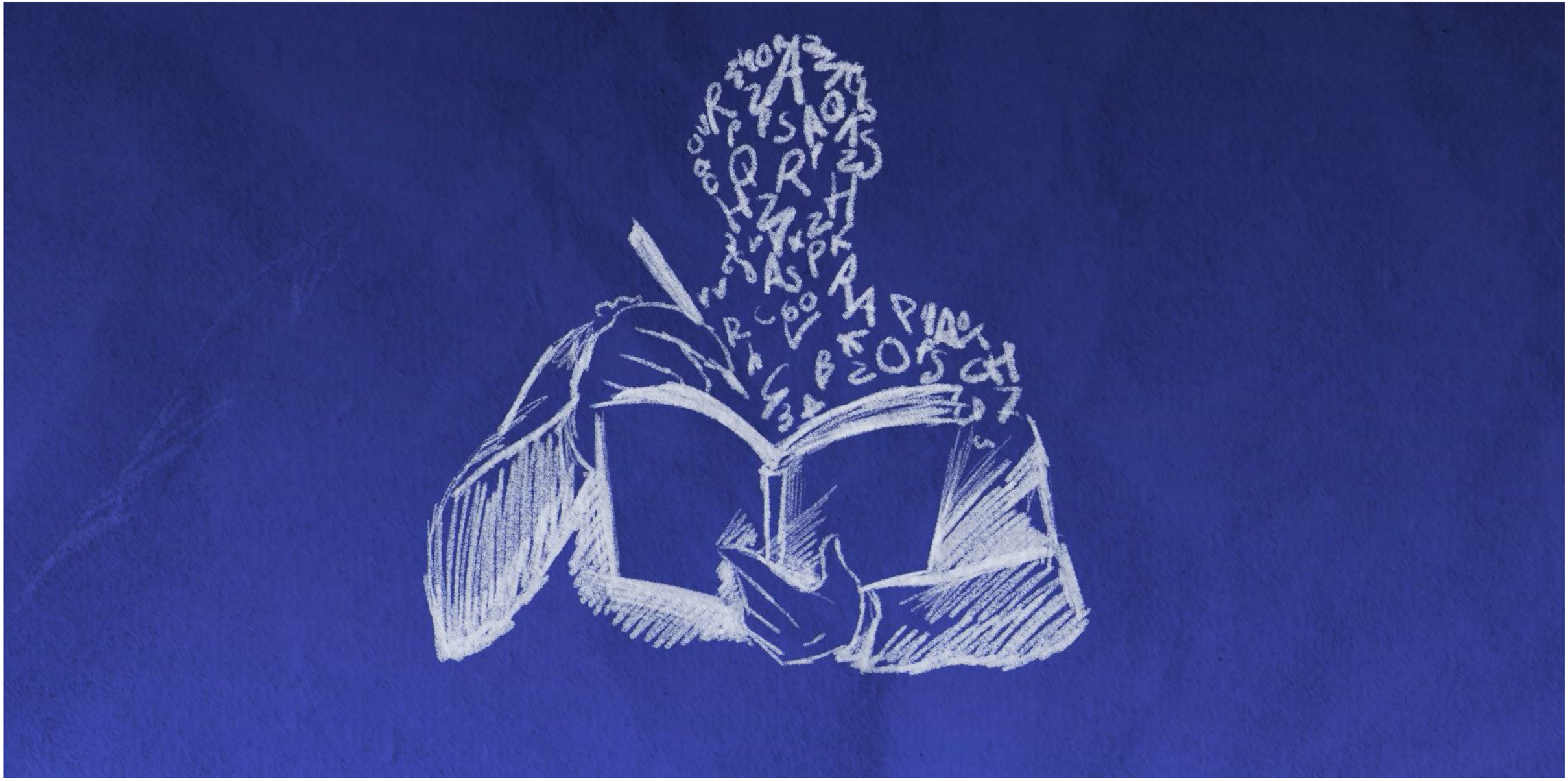
2D Materials for Biomedical Applications (Call for Short-Term Advanced Training Programs)

ONSITE POSTPONED

This one-day workshop was designed to take place in a 100% on-site format at the Faculty Engineering of the University of Porto at a time when most of the measures to combat the pandemic in Portugal had been eased. Some days before the workshop's start date, the scientific coordinators and the Program made the decision to postpone the event to January and held it virtual-only as there was a surge of Covid-19 cases and a new variant on the horizon, and many countries, including Portugal and the USA, were giving a step a back in the reopening of society.

The training, which bridged disciplines across Nanotechnologies and Biomedicine to delve into the large library of 2D materials available today as well as its potential applications in health and medicine areas, was scheduled for January 2022. Coordinating this workshop were the PIs of one of the Exploratory Research Projects awarded funding by FCT, through the Program, in 2021: Professors Artur Pinto (FEUP, Portugal) and Jean Anne Incorvia (UT Austin) would be researching together new 2D nanomaterials for cancer phototherapy and immunotherapy.

Thematic Masterclasses



Exclusive Thematic Masterclasses • Annual Conference

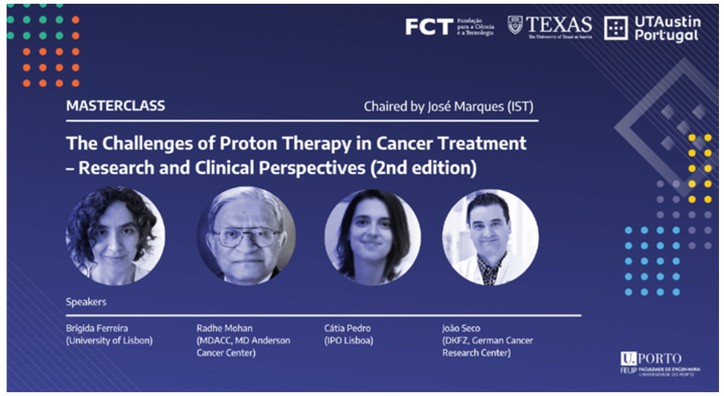
MEDICAL PHYSICS

The Challenges of Proton Therapy in Cancer Treatment Research and Clinical Perspective (2nd edition)

Building on the success of last year's Masterclass, the Scientific Directors for the Program's Area of Medical Physics organized a second edition of "The Challenges of Proton Therapy in Cancer Treatment – Research and Clinical Perspective" in close collaboration with Radhe Mohan from UT MD Anderson Cancer Center (MDACC).

Proton therapy is the **most advanced form of radiation treatment**, which uses protons instead of X-rays to deliver a more **tailored, patient-centered approach to cancer treatment.** Such an innovative form of treatment calls on leading experts across several disciplines, from upstream to downstream sectors, to collaborate. Bridging research with the clinical setting is fundamental not only to translate important research discovery into advanced science-based treatments and clinical care but also to feed the clinical outcomes of **proton therapy** into further research. However, this translation entails important challenges for both sides, which must be necessarily addressed to take full advantage of this therapy in favour of larger cancer patient sets.

In this second edition, distinguished speakers from the research and clinical fields in Portugal, the United States and Germany talked participants through two key topics in the era of precision medicine: **Beam angle and Intensity Modulation Optimization and FLASH Therapy**. Additionally, and in line with this approach, the Masterclass casted light on the dialogue that needs to be crafted between the medical oncologist and the medical physicist towards optimal cancer treatment.



Watch the recorded Masterclass here

SPACE-EARTH INTERACTIONS

The Azores Region - a unique gateaway to deep-sea research in support of the UN Decade of Ocean Science for Sustainable Development

Deep-sea exploration and resource extraction are among today's major scientific challenges and are targets of the recently launched United Nations Decade of Ocean Science for Sustainable Development (2021-2030). The deep-sea hosts sensitive ecosystems with rich biodiversity, as well as important minerals and potential biotechnological resources. In light of increasing industry interest in exploiting deep-sea living and non-living resources, providing a comprehensive baseline inventory, understanding its dynamics, and assessing possible impacts of anthropogenic activities is of paramount interest in order to avoid irreversible environmental disruptions. This Masterclass intended to look into these questions thoroughly.

By its nature, ocean science requires strongly multidisciplinary research and therefore its exploration must summon the efforts from various fields of science towards a holistic approach to the good functioning of deep-sea environments. Novel observing approaches to overcome technological and logistical challenges are needed, along with long-term, sustained monitoring programs to monitor, relate and understand deep-sea dynamics and associated ecosystems. This is a huge task that demands concerted and optimized efforts from various stakeholders. It is therefore important to profit from existing infrastructures (such as smart cables, autonomous underwater vehicles, satellites, among others), simulation capabilities, and data cyberinfrastructures, and to gather efforts and expertise from seafloor and satellite geodesists, oceanographers and ecologists in order to gain further insights into deep-sea functioning. This is essential to draw reliable evolution scenarios and develop decision support capabilities as the basis to guarantee environmental sustainability. A concerted effort will mark a substantive contribution to the UN Decade of Ocean Science for Sustainable Development.

Watch the recorded Masterclass here

Thematic Masterclasses • Annual Conference

ADVANCED COMPUTING

Defining an HPC Open Ecosystem, Where We Are and How Do We Get There

Over the last 3 decades, we have witnessed a transition from closed software ecosystems being the foundation for HPC, enterprises, and businesses to open source software ecosystems based on Linux: from Arduino in the IoT space to Android in the mobile space to Linux in HPC and cloud-based systems with various Open Source Software projects built on top. However, when examining hardware, current commercial off-the-shelf solutions are closed hardware ecosystems that only enable integration at the peripheral (PCIe) level. The combination of current technology trends, the slowing of Moore's Law, and cost-prohibitive silicon manufacturing inhibit significant power-performance gains by relying on traditional closed ecosystems, especially in HPC, technology pushed to the extreme. This new regime forces systems to be much more specialized to achieve the power-performance profiles required for a supercomputer. In the past, HPC has led the way forward, defining the bleeding edge of technology. HPC can do this again with open hardware, as it has done in software with adopting Linux and open source in general. This is not only a technology imperative but one born out of current geopolitics. Given this technology and geopolitical backdrop, we describe how Europe can exploit its resources targeting research and development for technological independence.

In this new technology environment, some of the rules have changed. This has produced a shift from abundant transistors to the efficient use of transistors. Thus, to truly meet the power and performance requirements, we must specialize the hardware. At the same time, the software stack is evolving, becoming more abstract, enabling higher programmer productivity, but sacrificing hardware efficiency. Thus, application owners will need to co-design the full stack, all layers of hardware and software, to meet their performance and power (FLOPs/W) targets. This level of integration is not possible in a closed or even partially open ecosystem. The platform must be open to enable this tight integration. We see this openness today in the Linux OS, toolchain, runtimes, frameworks, and libraries, up to the application layer. This enables rapid development and extension of software systems. However, an open hardware infrastructure is lacking, making specialization impossible.

Openness is required to tailor your hardware platform to the applications, thereby achieving the desired performance in the power-constrained environment. There have been a couple of open-source hardware platforms in the past, but Moore's Law inhibited their adoption for many reasons: general-purpose processor improvements, time to market, cost, software development, etc. Furthermore, unlike Linux, previous open-source hardware was entangled in the companies that created them. Mirroring the same model as Linux, RISC-V has followed a similar development path and has enjoyed significant industrial and academic adoption. Like Linux before it, the RISC-V ecosystem is in the nascent period where it can become the de facto open hardware platform of the future. The RISC-V ecosystem has the same opportunity in hardware that Linux created as a foundation for open-source software. This enables the co-design of the RISC-V hardware and the entire software stack, creating a better overall solution than the closed hardware approach that is done today.
As Europe HPC recognized in the past with Linux, Europe has the opportunity to lead the charge, creating a full-stack solution for everything from supercomputers to IoT devices, all based on an open ISA, providing interoperability and freedom to create, build, and deploy superior technology based on European IP.

In this masterclass, John Davis provided background on HPC and how BSC shaped the current state of the art in HPC. Using RISC-V as an instrument, he provided a vision for the future and a collection of current research and innovation projects, infrastructure, and the community that has been building the foundation for the future.

Watch the recorded Masterclass here

NANOTECHNOLOGIES

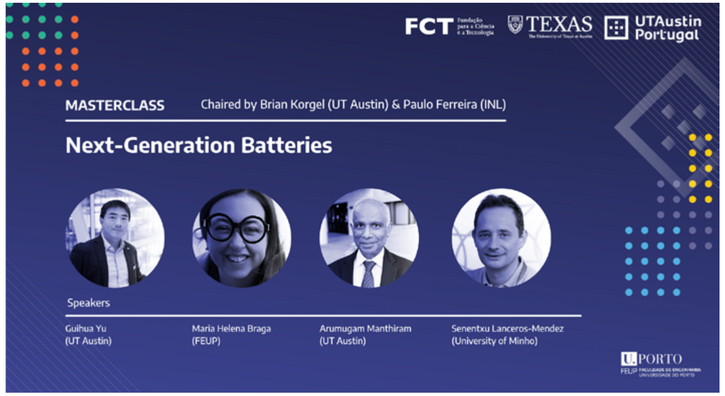
Next-Generation Batteries

The current lifestyle of the world population that tends to concentrate the majority of the people in urban areas and requires massive use of transportation poses important energy challenges for climate change and sustainability of humankind. As a result, there is an immediate need for widely-deployable energy storage, both stationary and mobile, for which the role of batteries is central. In this context, batteries can be considered as a “central element for sustainability”, in an integrated and structured way, to answer the challenges related to decarbonisation and dissemination of sustainable energy communities. To this end, there is a pressing need to develop the batteries of the future and introduce these technological developments in solutions capable of alleviating the challenges of climate change.

This explains the revolution we are observing now in the energy generation and storage field, where batteries lead a central role, after decades of technological stagnation. A recent joint study by the International Energy Agency and European Patent Office underlines the key role that battery innovation is playing in the transition to clean energy technologies. It provides global data and analysis based on the international patent families filed in the field of electricity storage since 2000 (over 65 000 in total). It reveals that between 2005 and 2018, patenting activity in batteries and other electricity storage technologies grew at an average annual rate of 14% worldwide, four times faster than the average of all technology fields.

Batteries of Generation 3a are already close to market, while Generation 3b is predicted to be available in the market by 2025. Generations 4 and 5 have even higher energy densities, but are currently still under research and development to address some key technological challenges. Among the Generations 4 & 5 technologies, polymer-based all-solid-state lithium-ion batteries are expected to be introduced to the market faster, as they rely on the same or similar cathode and anode materials and fabrication processes as Generation 3. This will likely be followed by all-solid-state batteries based on lithium metal.

The goal of this premium Masterclass was to bring together renowned researchers who are at the forefront of research in materials and technologies for batteries and are contributing to the exciting transition to cleaner energy technologies. The class explored several approaches to the development of materials and batteries.



Watch the recorded Masterclass here

TECHNOLOGY INNOVATION AND ENTREPRENEURSHIP

From Innovations to Operations: the Management of New Technology Implementations

Implementations consist of the activities between the decision to adopt a new technology and its incorporation in the routine operations of the adopter, or its abandonment. The full realization of the potential of new technologies thus requires a good understanding of their implementation processes.
In fact, the decision to adopt may be only a first – and often far from sufficient – step in integrating a new technology in the ongoing work of an organisation and benefiting from its routine use. Multiple factors influence the perceptions, decisions, and actions involved in implementations, and these factors, which concern technologies, providers, adopters, users, and external contexts, determine the implementation ecosystem, which strongly conditions the implementation process.

In particular, implementations typically face misalignments between the technology and the adopter, which cause initial losses of productivity and may require multiple alignment efforts. Misalignments result from a lack of compatibility between the technology and the adopter and are a driver of change. One of the main sources of misalignments is the technology's systemic complexity, i.e., the structure of the users that have to coordinate to use the technology. A second important source is the technology's learning complexity, i.e., the degree to which it is perceived as difficult to understand and use.

Alignment efforts may consequently involve adaptations in the structure, technical setting, and capacity of the adopter, or in the structure and functionalities of the technology. A thorough and early understanding of the characteristics of the technology and the adopter allows innovators and implementation managers to better evaluate the need for alignment efforts, and thus facilitate and better plan new technology implementations.

This masterclass provided attendees with a framework to deal with the challenges of addressing misalignments in technology implementations, and work on how to plan implementations, based on real cases.

Watch the recorded Masterclass here

Warm-up sessions • Annual Conference

Watch the recorded Session here

Commercializing University Research Innovations

In the last ten years, 70% of university inventions were licensed to startups and small companies, creating jobs supporting an estimated 4.3 million US workers (per AUTM).

University technology transfer capabilities are critical to moving ideas from the lab to the marketplace and are responsible for evaluating and protecting discoveries available for commercialization through new and existing companies. This effort alone is not enough to ensure a productive result. A nurturing startup approach creates university incentives and organizational structures to support nascent faculty entrepreneurial endeavors. This approach signals that the university is aware of market factors and a desire to partner with the private/public sector to find pathways for commercializing its research technologies.

Van Truskett, Executive Director of UT Austin's Texas Innovation Center, shared, first-hand, her 14-year expertise in enabling the commercialization of university-based knowledge and aiding young startup companies to succeed.

Science Communication and Publics

Science communication has evolved into an inclusive process that requires the participation of society in scientific development to reduce the knowledge gap among citizens and to boost knowledge transfer. Some new trends have been emerging like citizen science, knowledge coproduction, grass-roots activities, community science centers, amongst others.

In this workshop, Júlio Borlido, Science Communication Officer at i3S, talked participants through some of these new approaches and dynamics to explain why some practices may be more effective in closing the gap between science and society than others.

Borlido framed a number of key questions to spark discussion: Do publics actively appropriate the resources provided by science and do this to allow them to build more active citizenship? Does the engagement of scientists and scientific institutions with publics on a collaborative basis help to address Science and Technology-based concerns?

UTAustin Portugal

09

The UT Austin Portugal Annual Conference


LIVE NOW
Opening Remarks
John Dendl (UT Austin Portugal)


UTAustin Portugal
UT AUSTIN PORTUGAL
2021 Annual Conference | October 20-21
Connecting the dots


LIVE NOW
Fireside Chat
Lauren Meyers (UT Austin) and Elisabeth Fernandes (Público)
Connecting the dots | Interdisciplinarity as a way to build up resilience


Opening Remarks
João Falcão e Cunha (FEUP)


NanoStim - Nanomaterials for wearable-based integrated biostimulation
FCT
TEXAS
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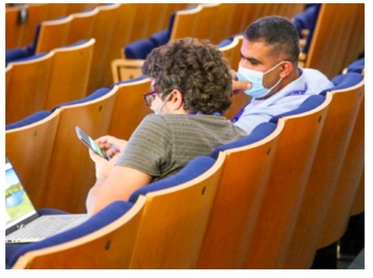
Connecting the dots
Interdisciplinarity as a way to build up resilience

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Connecting the dots
Interdisciplinarity as a way to build up resilience


Defining an HPC Open Ecosystem, Where We Are
John D. Davis (Barcelona Supercomputing Center-CNS)


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2021 Annual Conference | October 20-21
Connecting the dots
Interdisciplinarity as a way to build up resilience

The UT Austin Portugal Annual Conference

Connecting the dots: interdisciplinarity as a way to build up resilience

The Merriam-Webster dictionary defines resilience as the ability to recover from or adjust easily to misfortune or change. In the fight against COVID-19, the word resilience was frequently used in narratives emphasizing the importance of different scientific disciplines converging provide a better understanding of complex problems and empower societies to face disturbances as windows of opportunities.

Although the interplay between different disciplines is not a Tnovelty, it became more acute in the past two centuries. Science has turned into an open space where knowledge communities - sometimes standing on opposite sides or apart from one another - come together to solve multi-layered puzzles. Reality is indeed far too complex to be approached through a single angle or fit in a single knowledge compartment.

Connecting the dots: interdisciplinarity as a way to build up resilience. We picked our largest event - our Annual Conference - to discuss how interdisciplinarity in science had been helping societies become more resilient, i.e., able to cope with adversity and distress and come out stronger.

Watch the full event here

In late October, researchers and experts from different countries and affiliated to different institutions came together to discuss interdisciplinary research and how science has been contributing to combatting worldwide threats by connecting different fields and areas of expertise. Staged at the Faculty of Engineering of the University of Porto (FEUP) and broadcast to a worldwide audience on our YouTube Channel, the Program's 2021 Annual Conference attracted over 210 registrants from 20 countries, mainly from Portugal, then from the USA. Although the Conference was designed to be a hybrid event, allowing in-person attendance, a large majority of registrants and special guests opted for online participation.

The Conference kicked off with two warm-up sessions on the 18th and 19th of October. The first one, dedicated to technology transfer, was hosted by Van Truskett from the Texas Innovation Center at The University of Texas at Austin. Truskett, herself a researcher and entrepreneur, talked about the much-needed bridge between academia and the market and shared tips on how to commercialize university research innovations. The second warm-up session was conducted by Júlio Borlido, a senior science communicator at i3S. Borlido delivered a very interactive session that gave researchers techniques to make science communication to non-scientific audiences more effective.

Connecting the dots: the hurdles and the opportunities

Fireside Chat with Lauren Meyers (UT Austin)

The conference debuted on the 20th with a fireside chat between **Elisabeth Fernandes, Data Strategy Manager at Público and Lauren Meyers, the Founding Director of UT COVID-19 Modeling Consortium.** Their conversation surrounded the COVID-19 pandemic and how one can fight viral threats with data. Over the past year, modeling and data analysis has been in the public eye as never before. The media have brought to our attention mathematical and advanced computational predictive models that would usually be reserved for scientists' fora. Although sometimes wrongly taken for crystal balls, modeling tools have become a prominent part of the Covid-19 outbreak response, providing decision-makers relevant insights on the pandemic dynamics, the shielding effect of vaccination, or individuals' response to social isolation. They have also shown us that the fight against any pandemic calls for a full-comprehensive interdisciplinary approach involving experts from a wide range of fields. Why? Because these models are but a first attempt to better understand and cope with a situation with many layers of complexity and multiple effects, yet requiring integrated action.

Lauren Meyers, a pioneer agent in network epidemiology, used the Texas COVID-19 Modeling Consortium, an interdisciplinary network of researchers and health professionals building models to detect, forecast, and control COVID-19, to talk us through her own experience connecting the dots of different knowledge fields to develop solutions for public health challenges using mathematical concepts. A fascinating journey into how we could make sense out of patchy data and of different angles towards improvements in human welfare.

Academia remains the sector where the majority of our Conference's registrants comes from.

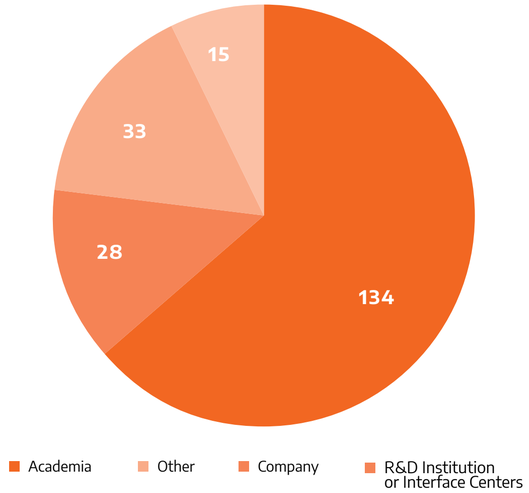


Figure 4: Registrants' Affiliations

The Wonderful World of Nano Roundtable

Nanomaterials abound in living systems and nature, from insects to plants to ocean spray or volcanic ash. At the nanoscale, scientists are creating nanomaterials themselves that mimic some of those natural nanostructures towards disruptive solutions for some of the biggest challenges across a myriad of application areas.

What is so special about working at the nanoscale is to see that matter acquires different and unique properties - such as higher strength, lighter weight, increased conductivity, or chemical reactivity - that are extremely relevant to a wide range of solutions from medical devices to aircraft, food or consumer electronics.

Nanotechnologies allow for disruptive solutions for some of the biggest challenges across a myriad of application areas. The list is extensive, and the impact is unprecedented. This thought-provoking roundtable, conducted by Lars Montelius, Director-General of the International Iberian Nanotechnology Laboratory, gathered researchers and industry professionals of the Program's community to reflect on the grandness behind nanotechnology.

Alfredo Silva, IncreaseTime, presenting the 2019 SRP NanoStim project

Minister Manuel Heitor closing the first day of the Annual Conference

UT Austin Portugal projects highlighted at the Roundtable:

- **ImmuneNanoVac** – Nanomaterials to design new vaccine adjuvants;
- **GEMIS** – Graphene-enhanced Electro-Magnetic interference Shielding;
- **NanoStim** – Nanomaterials for wearable-based integrated biostimulation;
- **MCTool21** – Manufacturing of cutting tools for the 21st century: from nano-scale material design to numerical process simulation.

Manuel Heitor, Portuguese Minister of Science, Technology and Higher Education, closed the first day of the Conference stressing that FCT's International Partnerships have become critical players in the development of Portuguese science, paving the way for new opportunities to access competitive, emerging and more demanding markets.

Health: An Open Space for Scientific Interdisciplinarity Roundtable

The Conference went on the next day to delve into health, an open space for scientific interdisciplinarity. The combat against the pandemic convoked experts from different backgrounds to a battlefield against an invisible enemy.

In this battle, troops have not always converged on the tactics to defeat the virus. Was this a failure of interdisciplinarity? Or a reminder that interdisciplinarity is not a juxtaposition of layers of knowledge but a robust integration of different views anchoring on compromises to overcome tensions and tackle challenges whose solutions lie beyond the scope of a single discipline?

Health has long since been an open space for interdisciplinary research and collaboration, one that is substantially reliant on the intersection of various disciplines and paradigm...because health problems are multidimensional. But what does it take to make the most of different perspectives and angles, however much they diverge, to advance medical science and medical health? Navigating between disciplines to bring them closer together requires constant explanation, negotiation and readjustment from all researchers involved.

Moderated by Miguel Coimbra, coordinator of INESC TEC's TEC4Health, this roundtable provided an opportunity to analyze Health as an open space for interdisciplinary research and collaboration, i.e., one that is substantially reliant on the intersection of various disciplines and paradigms to solve challenges. The discussion was preceded by presentations of health-related projects and initiatives spanning several knowledge fields, from Machine Learning to Nanotechnology, Physics and Earth Observation.

Two projects with the Program's seal were highlighted in this roundtable:

- **TOF-PET for Proton Therapy** – In-beam Time-of-Flight (TOF) Positron Emission Tomography (PET) for proton radiation therapy;
- **SENTINEL** – Novel injectable biosensor for continuous remote monitoring of cancer patients at high risk of relapse.

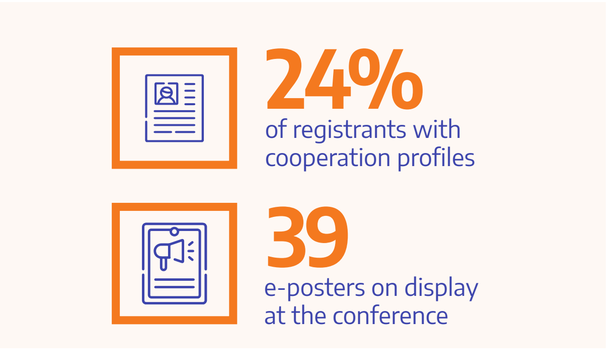


Figure 5: Information from e-posters and cooperation profiles

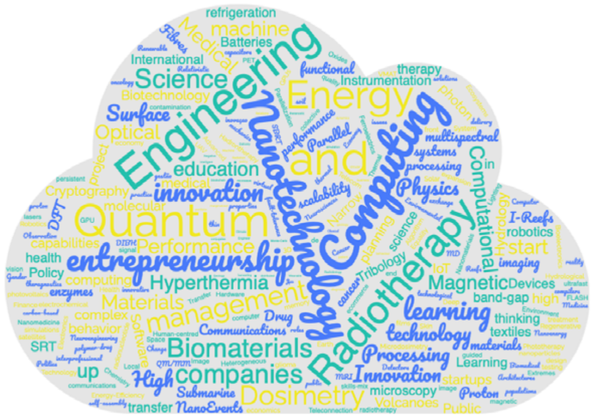


Figure 6: Word Cloud – Keywords used in Cooperation Profiles

Our Guests

Opening and Closing Ceremonies & Roundtables

João Falcão e Cunha
FEUP

José Manuel Mendonça
UT Austin Portugal

John Ekerdt
UT Austin Portugal

Helena Pereira
FCT

OPENING REMARKS

Lauren Meyers
Founding Director of UT
COVID-19 Modeling Consortium

Elizabeth Fernandes
Data Strategy Manager at
Público

FIRESIDE CHAT

Lars Montelius
INL

Luís Graça
iMM,
ImmuneNanoVac project

Bruno Figueiredo
Graphenest,
GEMIS project

Alfredo Silva
Increase Time,
NanoStim project

Filipe Fernandes
University of Coimbra,
MCTool21 project

ROUNDTABLE: THE GREAT WONDERFUL WORLD OF NANO

Manuel Heitor
Minister of Science, Technology
and Higher Education

CLOSING REMARKS

Miguel Coimbra
INESC TEC, FCUP

Karol Lang
UT Austin,
TOF-PET project

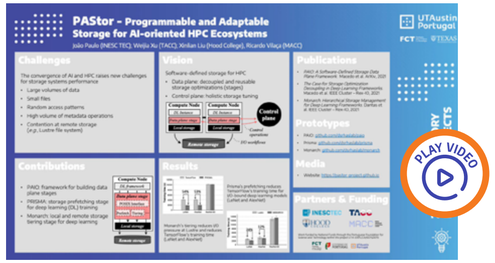
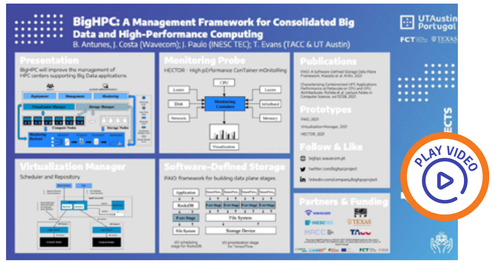
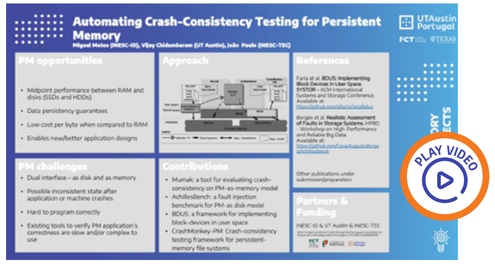
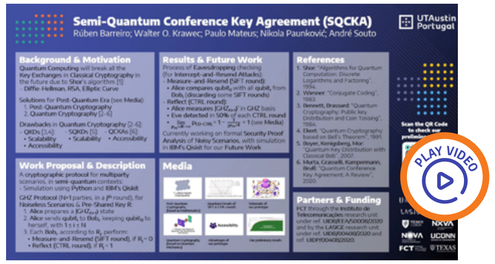
Rui Sousa
Stemmatters,
SENTINEL project

Mireille Paulin
CNES,
Tele-epidemiology

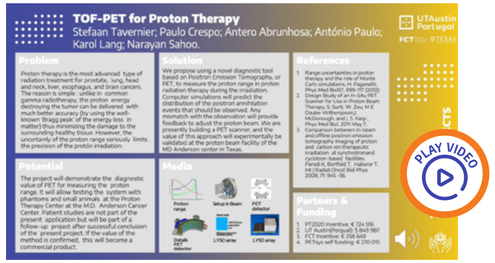
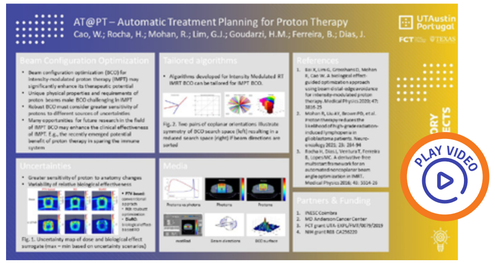
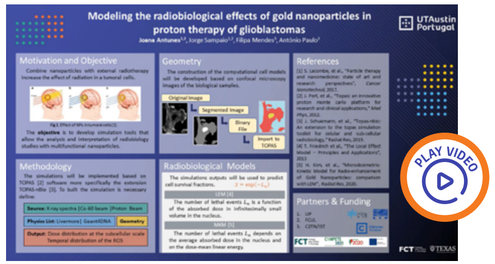
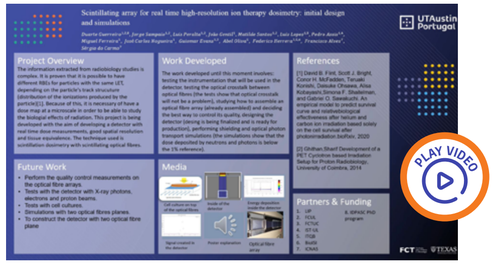
Arlindo Oliveira
IST, Machine learning and
pandemic monitoring

ROUNDTABLE: HEALTH: AN OPEN SPACE FOR SCIENTIFIC INTERDISCIPLINARITY

E-Posters

	Title	Main Author & Affilliation	UT Austin Portugal Project	Area
	PAStor - Programmable and Adaptable Storage for AI-oriented HPC Ecosystems	João Paulo, INESC TEC; University of Minho	PAStor	ADVANCED COMPUTING
	BigHPC: A Management Framework for Consolidated Big Data and High-Performance Computing	Bruno Antunes, Wavecom	BigHPC	ADVANCED COMPUTING
	Automatic Crash-Consistency Testing for Persistent Memory	Miguel Matos, Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento em Lisboa (INESC ID/INESC/ IST/ULisboa)	ACT-PM	ADVANCED COMPUTING
	Semi-Quantum Conference Key Agreement (SQCKA)	Rúben Barreiro, NOVA School of Science and Technology and LASIGE (Laboratório de Sistemas de Grande Escala)	-	ADVANCED COMPUTING

E-Posters

	Title	Main Author & Affilliation	UT Austin Portugal Project	Area
	TOF-PET for Proton Therapy	Stefaan Tavernier, PETsys Electronics, AS	TOF-PET for Proton Therapy (TPPT)	MEDICAL PHYSICS
	AT@PT - Automatic Treatment Planning for Proton Therapy	AT@PT team	AT@PT	MEDICAL PHYSICS
	Modeling the Radiobiological Effects of Gold Nanoparticles in Proton Therapy of Glioblastomas	Joana Antunes, Faculty of Science of University of Lisbon	-	MEDICAL PHYSICS
	Scintillating Array for Real Time High-Resolution Ion Therapy Dosimetry: Initial Design and Simulations	Duarte Guerreiro, Faculty of Sciences of the University of Lisbon (FCUL), Laboratory for Instrumentation and Experimental Particle Physics (LIP)	-	MEDICAL PHYSICS

E-Posters

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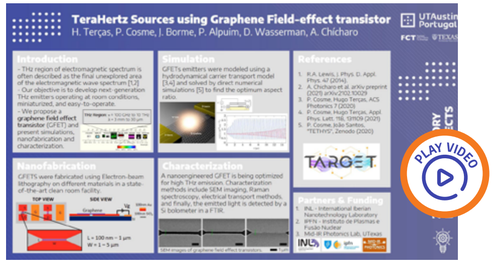
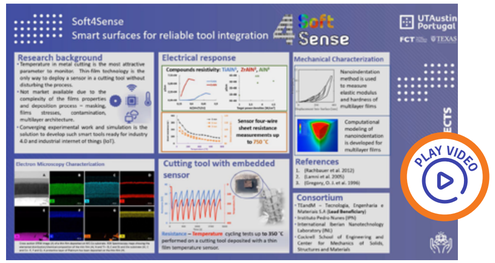
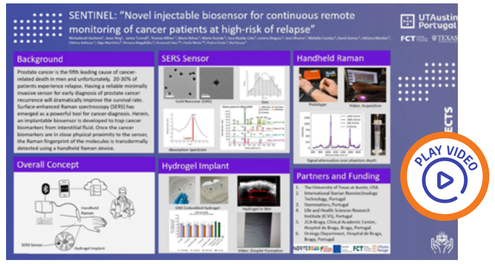
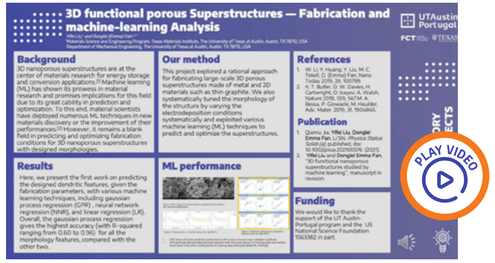
	TeraHertz Sources using Graphene Field-Effect Transistor	Alexandre Chícharo, INL - International Iberian Nanotechnology Laboratory	TARGET	NANOTECHNOLOGIES
	Soft4Sense: Smart Surfaces for Reliable Tool Integration	Soft4Sense team	Soft4Sense	NANOTECHNOLOGIES
	SENTINEL: "Novel injectable biosensor remote monitoring of cancer patients at high-risk of relapse"	Mohadeseh Hashemi, The University of Texas at Austin	SENTINEL	NANOTECHNOLOGIES
	3D Functional Porous Superstructures - Fabrication and Machine-Learning Analysis	Donglei (Emma) Fan, Texas Materials Institute Walker Department of Mechanical Engineering, The University of Texas at Austin	PIEZOFLEX (UT Austin team)	NANOTECHNOLOGIES

E-Posters

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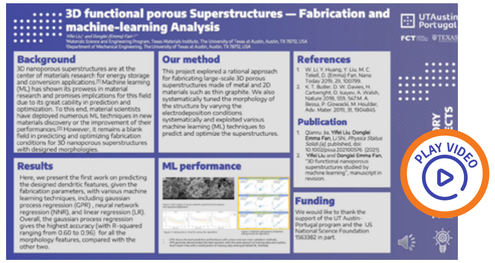
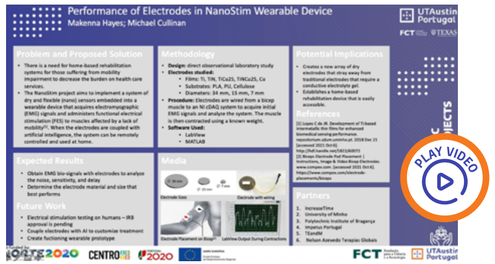
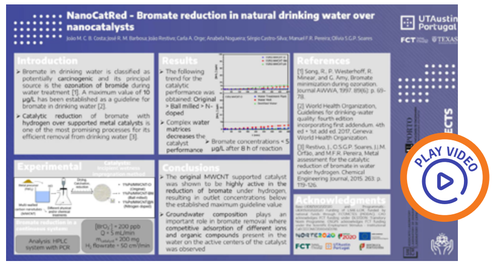
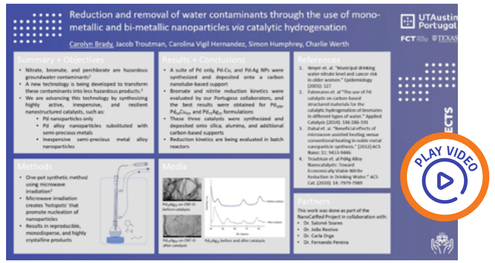
	PIEZOFLEX - Growing Piezoelectric Materials in Hierarchically Porous Graphite	Paula Ferreira, Department of Materials and Ceramic Engineering, CICECO University of Aveiro	PIEZOFLEX (PT team)	NANOTECHNOLOGIES
	Performance of Electrodes in NanoStim Wearable Device	Makenna Hayes, Department of Mechanical Engineering, The University of Texas at Austin	NanoStim	NANOTECHNOLOGIES
	NanoCatRed - Bromate Reduction in Natural Drinking Water over Nanocatalysts	João Costa, Laboratory of Separation and Reaction Engineering – Laboratory of Catalysis and Materials (LSRE-LCM), Faculty of Engineering, University of Porto	NanoCatRed (PT team)	NANOTECHNOLOGIES
	Reduction and Removal of Water Contaminants through the Use of Monometallic and Bi-metallic Nanoparticles via Catalytic Hydrogenation	Carolyn Brady, The University of Texas at Austin	NanoCatRed (UT Austin team)	NANOTECHNOLOGIES

E-Posters

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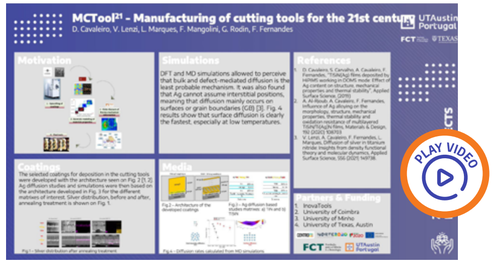
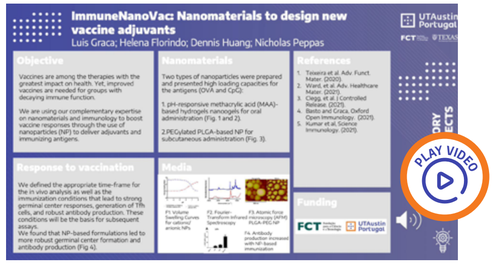
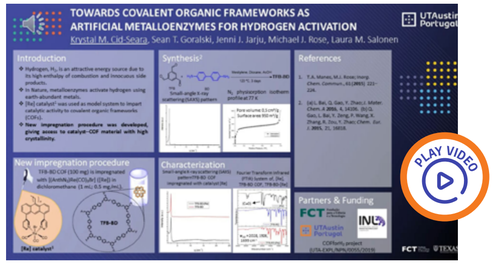
	MCTool21 Manufacturing of Cutting Tools for the 21st Century	Diogo Cavaleiro, SEG-CEMMPRE, Mechanical Engineering Department, University of Coimbra	MCTool21	NANOTECHNOLOGIES
	ImmuneNanoVac: Nanomaterials to design new vaccine adjuvants	Luís Graça, Instituto de Medicina Molecular; University of Lisbon	ImmuneNanoVac	NANOTECHNOLOGIES
	ExtreMed - Extreme Ultrashort Pulses for Advanced Medical Applications and Diagnostics	ExtreMed team, Sphere Ultrafast Photonics	ExtreMed	NANOTECHNOLOGIES
	Towards Covalent Organic Frameworks as Artifical Metalloenzymes for Hydrogen Activation	Krystal Cid-Seara, INL - International Iberian Nanotechnology Laboratory	COFforH2 (PT team)	NANOTECHNOLOGIES

E-Posters

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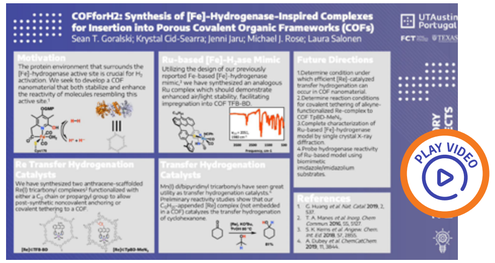
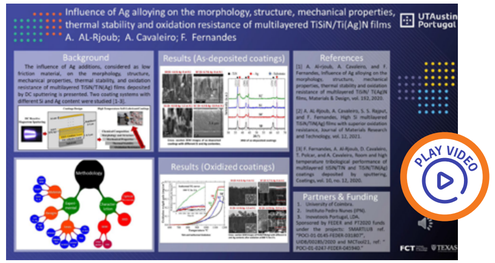
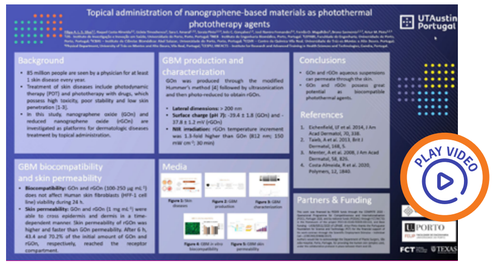
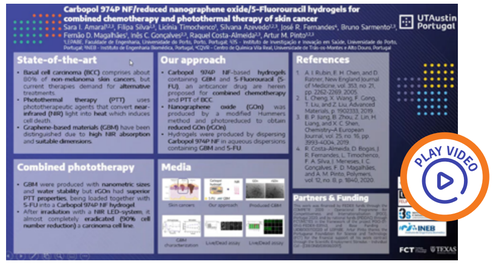
	COFforH2: Synthesis of [Fe]-Hydrogenase-Inspired Complexes for Insertion into Porous COFs	Sean Goralski, of Chemistry, The University of Texas at Austin, Department	COFforH2 (UT Austin team)	NANOTECHNOLOGIES
	Influence of Ag alloying on the morphology, structure, mechanical properties, thermal stability and oxidation resistance of multilayered TiSiN/Ti(Ag)N films	Abbas AL-Rjoub, Portugal, CEMMPRE - Centre for Mechanical Engineering Materials and Processes	-	NANOTECHNOLOGIES
	Topical Administration of Nanographene-based Materials as Photothermal Phototherapy Agents	Filipa A. L. S. Silva, i3S - Instituto de Investigação e Inovação em Saúde, Universidade do Porto; INEB - Instituto de Engenharia Biomédica, Porto, Portugal	-	NANOTECHNOLOGIES
	Carbopol 974 NF/reduced Nanographene Oxide/5-Fluorouracil Hydrogels for Combined Chemotherapy and Photothermal Therapy of Skin Cancer	Sara Amaral, LEPABE, Faculdade de Engenharia, Universidade do Porto; i3S - Instituto de Investigação e Inovação em Saúde, Universidade do Porto; INEB - Instituto de Engenharia Biomédica	-	NANOTECHNOLOGIES

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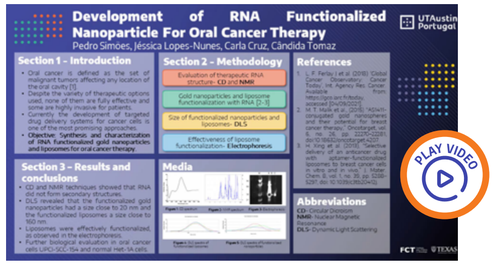
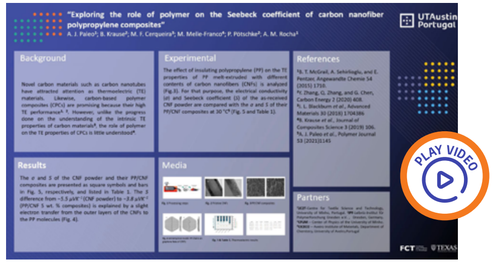
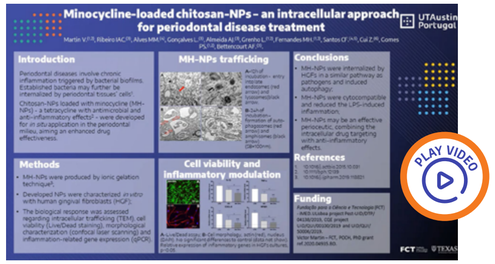
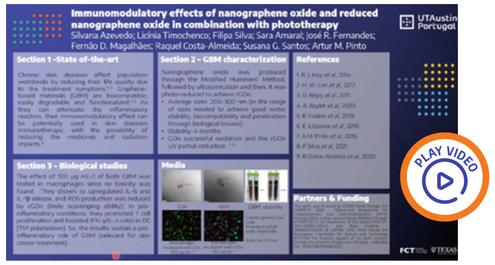
	Development of RNA Functionalized Nanoparticle for Oral Cancer Therapy	Pedro Simões, CICS-UBI Centro de Investigação em Ciências da Saúde, Universidade da Beira Interior	-	NANOTECHNOLOGIES
	Exploring the Role of Polymer on the Seebeck Coefficient of Carbon Nanofiber Polypropylene Composites	Antonio J. Paleo, 2C2T-Centre for Textile Science and Technology; University of Minho	-	NANOTECHNOLOGIES
	Minocycline-loaded Chitosan-NPs - an Intracellular Approach for Periodontal Disease Treatment	Victor Martin, Laboratory for Bone Metabolism and Regeneration – Faculty of Dental Medicine, University of Porto; LAQV/REQUIMTE, University of Porto	-	NANOTECHNOLOGIES
	Immunomodulatory Effects of Nanographene Oxide and Reduced Nanographene Oxide in Combination with Phototherapy	Silvana Azevedo, LEPABE, Faculdade de Engenharia, Universidade do Porto; i3S - Instituto de Investigação e Inovação em Saúde, Universidade do Porto; INEB - Instituto de Engenharia Biomédica	-	NANOTECHNOLOGIES

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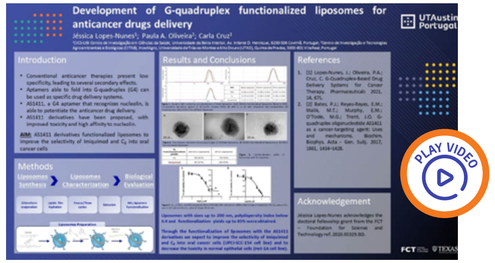
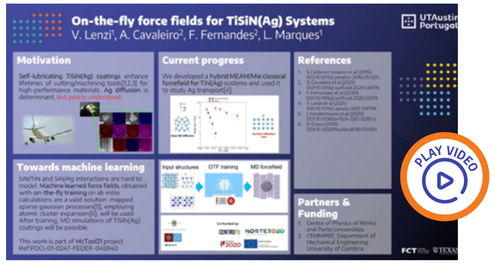
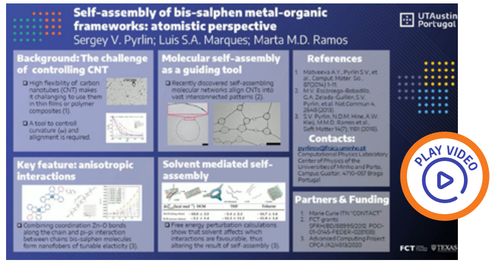
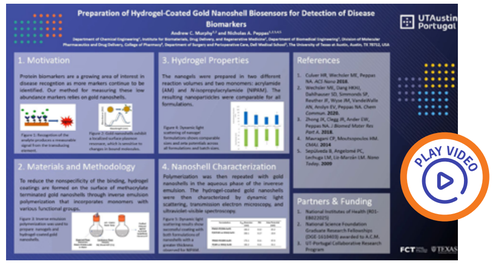
	Development of G-Quadruplex Functionalized Liposomes for Anticancer Drugs Delivery	Jéssica Lopes-Nunes, CICS-UBI Centro de Investigação em Ciências da Saúde, Universidade da Beira Interior	-	NANOTECHNOLOGIES
	On-the-fly Force Fields for TiSiN(Ag) Systems	Veniero Lenzi, Centre of Physics of Universities of Minho and Porto	MCTool21	NANOTECHNOLOGIES
	Self-assembly of Bis-Salphen Metal-Organic Frameworks: Atomistic perspective	Sergey V. Pyrlin, Centre of Physics of Universities of Minho and Porto	-	NANOTECHNOLOGIES
	Preparation of Hydrogel-Coated Gold Nanoshell Biosensors for Detection of Disease Biomarkers	Andrew C. Murphy, Department of Chemical Engineering & Institute for Biomaterials, Drug Delivery, and Regenerative Medicine, The University of Texas at Austin	-	NANOTECHNOLOGIES

E-Posters

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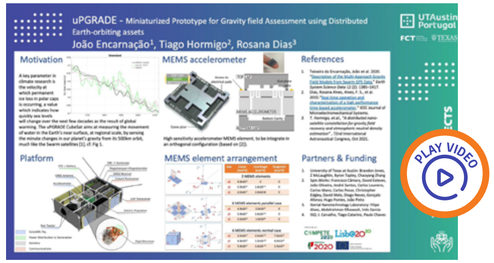
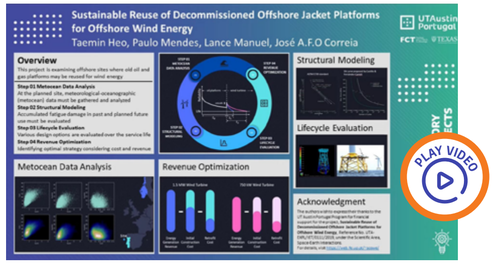
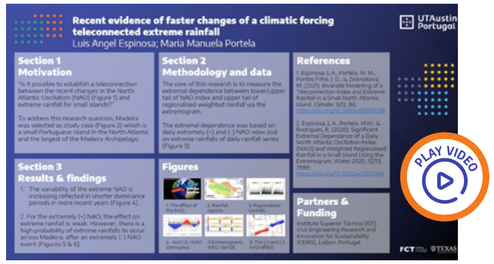
	Miniaturized Prototype for Gravity Field Assessment using Distributed Earth-Orbiting Assets	João Encarnação, The University of Texas at Austin & Delft University of Technology	uPGRADE	SPACE-EARTH INTERACTIONS
	Sustainable Reuse of Decommissioned Offshore Jacket Platforms for Offshore Wind Energy	Taemin Heo, Department of Civil, Architectural and Environmental Engineering, The University of Texas at Austin	SOS-WindEnergy	SPACE-EARTH INTERACTIONS
	MAGAL Constellation	Arlindo Marques, Efacec	MAGAL Constellation	SPACE-EARTH INTERACTIONS
	Recent Evidence of Faster Changes of a Climatic Forcing Teleconnected Extreme Rainfall	Luis Angel Espinosa, Civil Engineering Research and Innovation for Sustainability (CERIS), Instituto Superior Técnico (IST)	-	SPACE-EARTH INTERACTIONS

E-Posters

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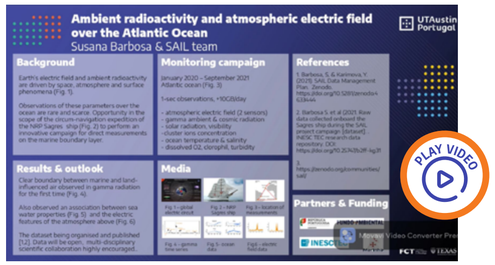
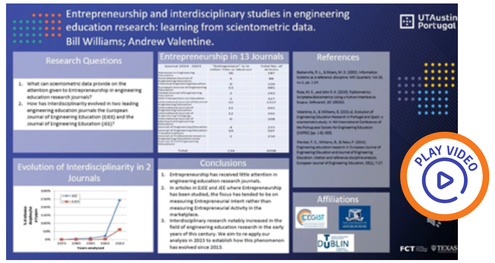
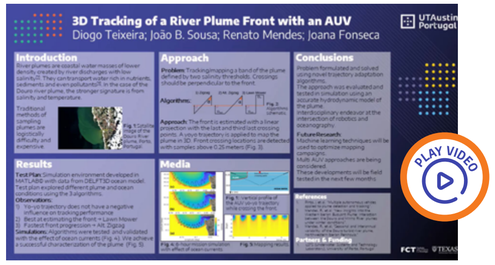
	Ambient Radioactivity and Atmospheric Electric Field over the Atlantic Ocean	Susana Barbosa, INESC TEC	-	SPACE-EARTH INTERACTIONS
	Entrepreneurship and Interdisciplinary Studies in Engineering Education Research: Learning from Scientometric data	Bill Williams, CEG-IST, Centre for Management Studies of Instituto Superior Técnico, Universidade de Lisboa	-	TECHNOLOGY INNOVATION AND ENTREPRENEURSHIP
	3D Tracking of a River Plume Front with an AUV	Diogo Teixeira, Faculty of Engineering of University of Porto	-	TECHNOLOGY INNOVATION AND ENTREPRENEURSHIP

UTAustin Portugal

10

Moving From Fact Reporting to Science Storytelling

Science is not finished until its communicated.

SIR MARK WALPORT

Because we truly believe that communication plays a pivotal role in the Program's brand building process, in enhancing our community engagement and in evidencing the value generated by our initiatives, throughout 2021, we enriched our communication strategy with new narrative formats and by crafting stories in tandem with communicating facts and events.

We see communication as an extension of monitoring and reporting activities. As a publicly-funded Partnership, this could be no different: we are committed to delivering the right message to the right people at the right time with the right tools and channels.

In 2021, we took a refreshed approach and:

Produced podcasts
to help distill the technical jargon that often tears research apart from society and unravel how science is making an impact on business and people's lives. At the same time, we worked to shed light on what it takes to increase proximity and build trust when we have teams from different cultures and knowledge fields working together;

Navigated through science storytelling
to write stories about our projects and people, focusing more on (potential) impact rather than on processes, and scripts for videos premiered at our Conference, with the aim of making science more tangible and relatable to non-scientific audiences;

Developed a website
exclusively dedicated to our Annual Conference, turning it into a point of access to a digital experience of our community's most important event;

Recorded and edited videos of our courses
making them available to a broader audience worldwide. Taking the Program's brand beyond UT-Portugal boundaries helps raise awareness of Portugal's successful experience leading transnational S&T partnerships;

Increased our contact database
through thorough and careful mapping of new potentially relevant recipients of our messages. Invested time in tailored messaging, and well though-out newsletter campaigns and social media posts;

Went on looking out for former beneficiaries & stakeholders
to find out what they are currently doing and how their participation in the Program as impacted their career to produce success stories.

Continued to
produce, update, promote and disseminate online content on our projects, events, people and achievements.

10.1 Communication in Figures | 2021 Highlights

Figure X: UT Austin Portugal 2021 Annual Conference

Our Website: enhancing our community's digital experience

- Visitors from 145 different countries (+15 than in 2020);
- Visited by 17015 users (53.23% increase in visitors) ;
- 50268 page views (138 page views per day. A 36% increase compared to 2020);
- 44.2% of the users visited the website through direct visits and 39.7% through organic search;
- Besides the Homepage, the call for short term advanced training proposals was the most viewed page, with 1942 page views.

Social Media: a tool for visibility and engagement

- Followers on Twitter : 1753 (-5)
- Followers on LinkedIn : 1220 (+ 321)
- Followers on Facebook : 470 (+55)
- Subscribers on Youtube : 86 (+44)
- 75 videos uploaded on Youtube, 248 hours of watch time and 2700 views

Our Newsletter: Keeping our audience informed and engaged

- 13 Mailchimp Campaigns
- Average number of people opening our newsletters: 207

Our podcats: turning science into stories

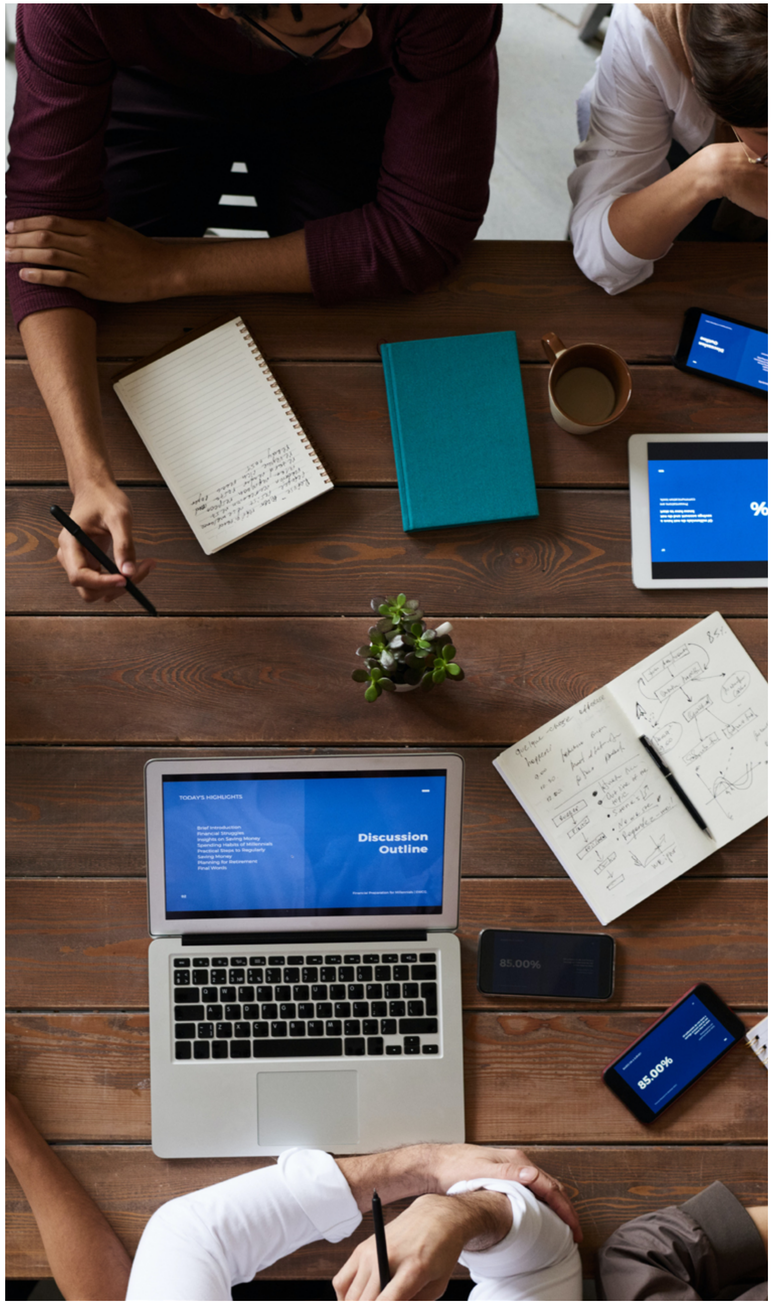
- Launched 5 episodes of CrossTalks
- + 200 plays of our episodes with listeners from all over the world
- 10 speakers invited

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
- Annual Conference and Training Events
- Merchandise
- Podcasts
- Animated Videos
- Meetings with Stakeholders



10.2 Main Communication Outputs

Podcasts

CrossTalks
UT Austin
Portugal Podcast

PLAY EPISODE

Episode #1
BigHPC: Managing and monitoring HPC and Big Data workloads

PLAY EPISODE

Episode #2
TOF-PET: The Challenges of Proton Therapy

PLAY EPISODE

Episode #3
NanoStim: Nanotechnology-enabled wearables for neuromuscular rehabilitation

PLAY EPISODE

Episode #4
MCTool21: Using nanotechnology to build the tools of the future

PLAY EPISODE

Episode #5
GEMIS: Solving electromagnetic interference with graphene

Our Podcast Series highlighted on The Daily Texan

CLICK HERE

UT Austin Portugal launches podcast to bridge gap betweens science, business

Animated Videos in 2021

Click on the images

NANOTECHNOLOGY ROUNDTABLE

ANNUAL CONFERENCE

HEALTH ROUNDTABLE

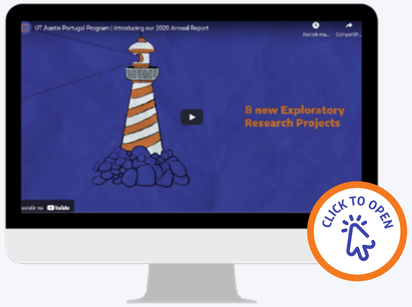
ANNUAL CONFERENCE

FIRESIDE CHAT

ANNUAL CONFERENCE

WARM-UP SESSIONS

ANNUAL CONFERENCE

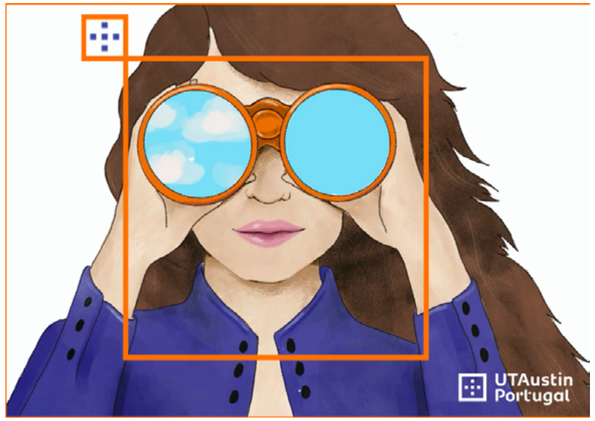


2020 ANNUAL REPORT

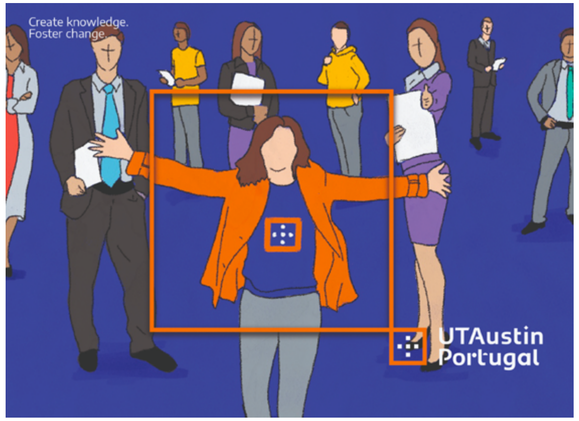
INTRODUCTION

Newsletters

Click on the images



April 2021



July 2021

November 2021

December 2021

Using external events to increase awareness of our footprint

Watch the session here

encontro CIÊNCIA '21

UT AUSTIN PORTUGAL WORKSHOP

June 30, 2021
2.00 p.m. | 3.30 p.m. (Lisbon time)

Better prepared: Strengthening societies through international scientific collaboration

The UT Austin Portugal Program has been a challenge-orientated International Partnership ever since its inception. It has always looked at Science & Technology as a unique platform for strong, enduring international collaboration, a stage for orchestrated efforts to better understand and address phenomena, problems, and challenges that are often borderless and whose magnitude could hardly rely on individual and local-based solutions.

Having evolved throughout more than a decade of existence, embracing new areas of knowledge, redesigning its core instruments and calling on new stakeholders, this FCT's International Partnership draws on its past achievements to project itself stronger into the future.

This year's edition focuses on a few transatlantic research initiatives, either more exploratory or closer to the market, bearing the Program's seal and linking activities across different scientific fields to meet some of today's world's pressing needs and society's long-term aspirations.

All the projects featured in this session are currently underway; they are fully aligned with either national or transnational research and innovation agendas; and should lead to results that attest to the Program's commitment to steer science towards socially and economically relevant and transformative innovation with global resonance.

Ultimately, they give us a clear indication of some of the application areas where the Program has been contributing to creating new advanced capabilities or reinforcing existing ones with an eye on a more sustainable and better future: Digital Infrastructures, Health, Climate and Ocean, and the Environment.

Agenda

2.00 p.m. **Opening Remarks**

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

2.10 p.m. **Programmable and Adaptable Storage for AI-oriented HPC Ecosystems**
(2019 Exploratory Research Project PAStor)

João Tiago Paulo, INESC TEC **(Advanced Computing)**

2.25 p.m. **Automatic Treatment Planning for Proton Therapy**
(2019 Exploratory Research Project AT@PT)

Joana Dias, INESC Coimbra **(Medical Physics)**

2.40 p.m. **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**
(2020 Strategic Research Project MAGAL Constellation)

Vasco Granadeiro, Efacec **(Space-Earth Interactions)**

2.55 p.m. **Novel nanomaterials for treating water pollution**
(2020 Strategic Research Project NanoCatRed)

Sérgio Silva, Adventech **(Nanotechnologies)**

3.10 p.m. **UT Austin Portugal 2021 Annual Conference | Save the Date (video)**

3.15 p.m. **Final remarks**

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

João Paulo is an Invited Assistant Professor and Assistant Researcher at HASLab, one of the research units of INESC TEC and University of Minho. He obtained his Ph.D. degree in 2015 and is currently working on large scale distributed systems with an emphasis on storage and database systems' scalability, performance, security and dependability. Also, he is interested on the applicability of this research work for solving complex data management challenges for Cloud Computing and HPC centres. Currently, he is the coordinator of the PAStor PT-UTAustin exploratory project and the "Efficient and Secure Data Management for HPC and Cloud Computing" CENTRA project, while leading INESC TEC's activities on the Compete2020 BigHPC project and ACTPM PT-UTAustin exploratory project. Also, he has several publications in renowned journals and international conferences (e.g., ACM Computing Surveys, IEEE Transactions on Computers, ACM Transactions on Storage, Eurosys, SRDS, SYSTOR).

Joana Matos Dias has a BSc in Computers Engineering (University of Coimbra, 1996), an MSc in Operations Research (University of Lisbon, 2000), an MSc in Quantitative Finance (University of London, 2011), a Ph.D. and Habilitation in Management Science (University of Coimbra, 2006, 2017). She is an Associate Professor at the Faculty of Economics of the University of Coimbra, where she has been responsible for several curricular units like informatics, logistics, operations research, modeling in management, simulation. She is also a researcher at INESC-Coimbra. Her main research interest is decision making models and algorithms in general, and operations research applied to health problems, combinatorial optimization, multi-objective optimization, in particular. She is the author or co-author of two books and more than 90 papers in refereed international journals, conference proceedings and book chapters.

Vasco Granadeiro graduated in Civil Engineering at IST (University of Lisbon) and started his career as a structural designer. In 2008, he returned to university and completed a Master's and a PhD in Sustainable Energy Systems from the MIT-Portugal Program, meanwhile attending the MIT Media Lab and the Austrian Institute of Technology. After, in 2013, Granadeiro attended a post-doc at INEGI and in 2015 returned to industry by joining Galp, in the Exploration and Production unit, with business development responsibilities. While at Galp, Granadeiro completed the MSc in Petroleum Engineering of the Heriot-Watt University. In 2018, Granadeiro moved to Efacec, to the Automation business unit, as head of marketing and after, in 2019, he accepted a new role as head of the Aerospace business. In the beginning of 2021, Granadeiro was asked to also perform as head of product management of the Automation business unit. Recently, Efacec decided to create a new business division dedicated to scale up selected business segments – Aerospace, Power Electronics and Microgrids – and offered Granadeiro the managing director position. In additon, Granadeiro got elected by his peers in the AED Cluster Portugal for the Board of Directors and for Deputy Coordinator of the Space Commission.

Sérgio Silva is the Founder, Chief Executive Officer and Chief of the R&D Department of ADVENTECH - Advanced Enviromental Technologies, Lda. He is also the Coordinator of the development of new products and projects of WasteWater Treatment Facilities (WWTFs). He is Graduate in Chemical Engineering by the University of Coimbra (1997). Since 1997 he has held different positions as Quality Technician, Quality and Environment Director, Coordinator of Research teams and Chief Project Engineer in several WWTFs. He is also specialized in the treatment of industrial gaseous effluents using Advanced Oxidation Processes. On the Chemical and Environmental Engineering field, he cooperates on the training of young researchers and has participated in several scientific conferences.

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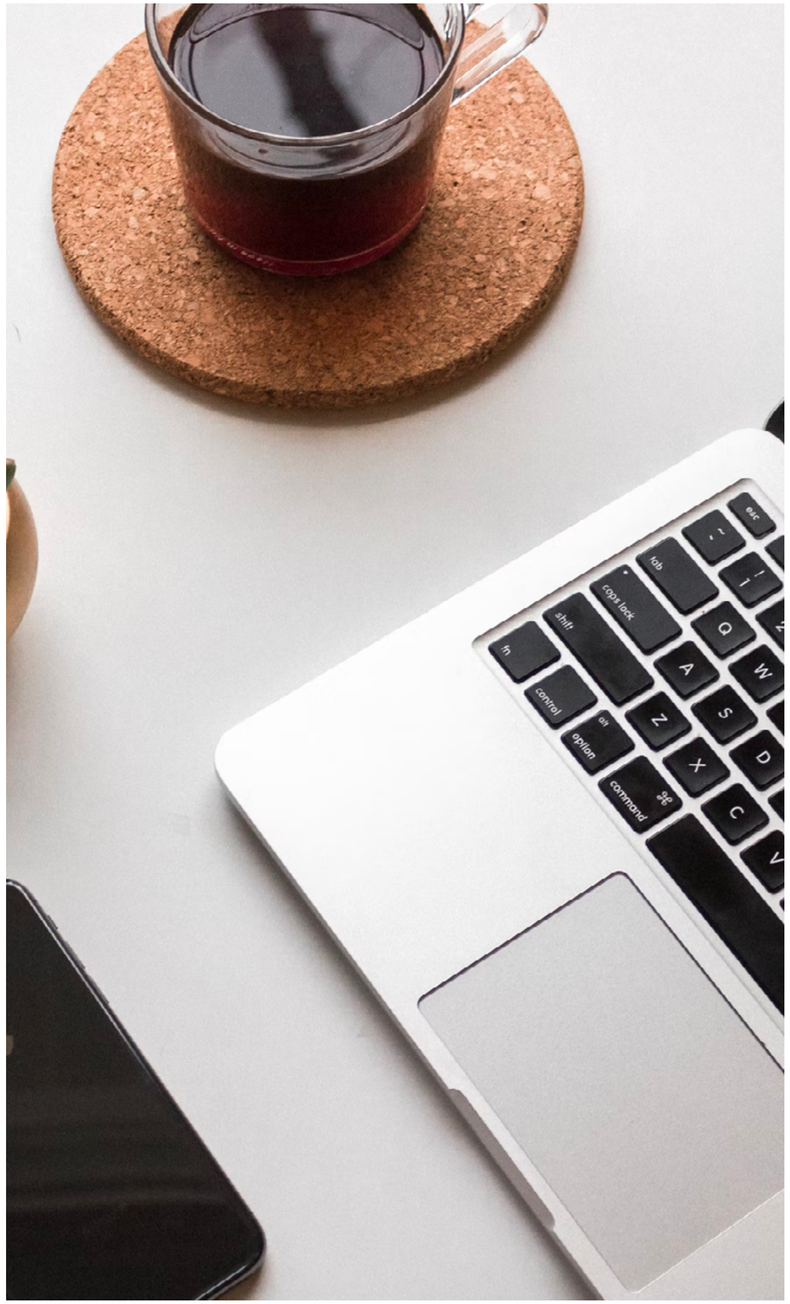
11

Key People & Partners Backing Up the Program Everyday



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Chair of the Board,
FCT Representative

Robert A. Peterson
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José Manuel Mendonça
Portuguese Universities
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António Vidigal
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Chair of the Committee
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Oliver Jäkel
Area of Medical Physics

Alison Campbell
Area of Technology Innovation
and Entrepreneurship

Alfred Ng
Area of Space-Earth
Interactions

Marie-Paule Pileni
Area of Nanotechnologies

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Principal Investigator at
UT Austin

Rui Oliveira
Co-Director in Portugal

Marco Bravo
Co-Principal Investigator and
Executive Director at UT Austin

Andreia Passos
Executive Director
in Portugal

Area Directors

Advanced Computing

Rui Oliveira
Area Director of Advanced Computing in Portugal

Paulo Mateus
Area Director of Advanced Computing in Portugal

Dan Stanzione
Area Director of Advanced Computing at Austin

Medical Physics

João Oliveira
Area Director of Medical Physics in Portugal

José Marques
Area Director of Medical Physics in Portugal

Nanotechnologies

Carla Silva
Area Director of Nanotechnologies in Portugal

Paulo Ferreira
Area Director of Nanotechnologies in Portugal

Brian Korgel
Area Director of Nanotechnologies at Austin

Space-Earth Interactions

Luísa Bastos
Area Director of Space-Earth Interactions in Portugal

Pedro Camanho
Area Director of Space-Earth Interactions in Portugal

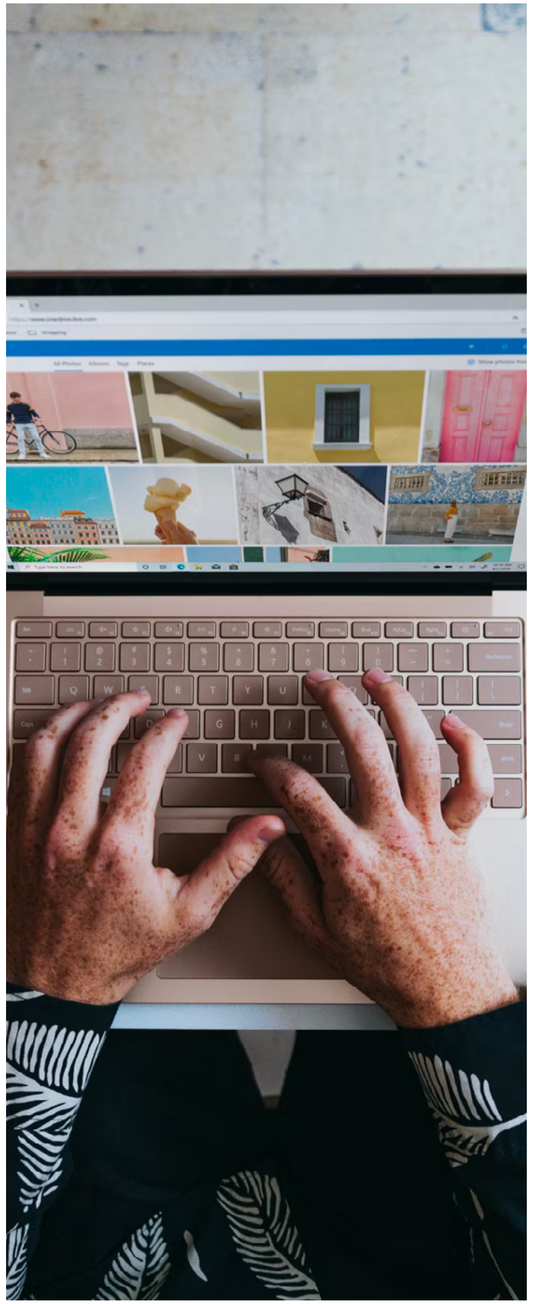
Patrick Heimbach
Area Director of Space-Earth Interactions at Austin

TIE | UTEN

Teresa Mendes
Area Director of Technological Innovation and Entrepreneurship in Portugal

João Claro
Area Director of Technological Innovation and Entrepreneurship in Portugal

Marco Bravo
Area Director of Technological Innovation and Entrepreneurship at Austin



Executive Team

Andreia Passos
Executive Director in Portugal

Marco Bravo
Co-Principal Investigator and Executive Director at UT Austin

Catarina Carvalho
Head of Communications in Portugal

Daniel Dantas
Communications Officer in Portugal (Until July 2021)

Raquel Abreu
INESC TEC, Portugal
(From September 2021)

Rita Costa
Design and Multimedia in Portugal

Sheila Habib
International Relations Officer
(From April 2021)

Vera Pinto
Administrative Support in Portugal

Other Staff at INESC TEC, Host Organization of the Program in Portugal

Bárbara Pinho
INESC TEC
(From September 2021)

Fábio Alves
INESC TEC

Mariana Gomes
INESC TEC

Industrial Affiliates

Abyssal, Edisoft, IBM, Omnidea, Graphenest, Wavecom, Tekever, Frezite HP, Deimos, Petsys Electronics and Omnidea.

The International Partnerships Office at FCT

Ana Reis and Ricardo Araújo.

UTAustin Portugal

12

Challenges & Opportunities in 2022

We completed another year of our journey and we may proudly say significant progress was made even amid a pandemic.

There are still almost two years to go before the current funding phase, initiated in 2018, ends. The Partnership has now reached a new maturity level, looking with increased confidence to the future, even if the challenges ahead remain daunting and uncertainty and instability at many levels go on shaping our world.

As we mentioned at the beginning of this report, in 2022, we commemorate a journey of 15 years, with a foot in the past – so we always remember how we started and how far we've come – and an eye on the next decade.

2022 will be a year of action, with our Transatlantic Leadership and Executive Team working closely together - as usual - to provide our community with research and education opportunities, drawing on lessons learnt and accomplishments to keep surprising our stakeholders in a good way. Increased attention will be given to the Program's project portfolio: convening with our PIs from both Strategic and Exploratory Research Projects throughout project execution and towards their closure has been a practice complemented by the analysis of project progress reports. Discussing the scenarios on the table once their current funding ends is a responsibility we take as ours as well. It could not be any different if we want to maximize the sustainability of our choices and investments.

2022 will also be a year of strategic thinking, with our Leadership being challenged by its governing bodies to reimagine the Program beyond 2023, driven by our long-held commitment to shaping a brighter future through science-based knowledge.

In preparation for a new multi-year funding cycle, where should we be looking at? What areas deemed critical to the country's recovery and competitiveness may the Program bring value to? What results, knowledge, and expertise did the Program generate in the past that should be carried over into a new phase? And in what areas does UT Austin benefit from Portugal's Science & Technology and Innovation communities the most?

These are some of the questions we'll work on over the next months, energized by your trust and loyalty. Enough talk: we're setting sail for another year of our transatlantic collaboration, full steam ahead!

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2021 | ANNUAL REPORT

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