STCU
SCIENCE & TECHNOLOGY CENTER IN UKRAINE

ANNUAL REPORT

2019

To advance global peace and prosperity through cooperative CBRN (Chemical, Biological, Radiological, and Nuclear) risk mitigation by supporting civilian science and technology partnerships and collaboration that address global security threats and advance non-proliferation

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This document was produced with the financial assistance of the European Union, and the governments of the United States of America and Ukraine as Parties to the Agreement Establishing the Science and Technology Center in Ukraine (STCU).

ABOUT US

2019 STCU ANNUAL REPORT

HISTORY

- The Science and Technology Center in Ukraine (STCU) is an intergovernmental organization with diplomatic status whose Parties use science and technology engagement and cooperation to promote international security and well-being. The STCU was established by international agreement in October 1993. The current Parties to the STCU are Azerbaijan, the European Union, Georgia, Moldova, Ukraine, the United States, and Uzbekistan.
- STCU activities fall in two broad categories: Research Projects, which employ scientists in the development of new science and technology (S&T) and Supplemental Programs, which include workshops, training, and other events to integrate scientists into the global S&T and industrial community. Over the past 24 years, the STCU has been active with over 21,000 scientists in more than 1,000 research institutes and universities engaged in STCU projects and activities, primarily across the GUAM countries (Georgia, Ukraine, Azerbaijan, and Moldova).
- The STCU is headquartered in Kyiv, Ukraine and currently has four branch offices in Kharkiv, Tbilisi, Chisinau, and Baku.

FUTURE

- The Center is developing new targeted programs and activities in response to member countries' needs and priorities.
- The Center continues to investigate and engage new sources of funding for R&D projects and programs.
- The STCU is expanding synergistic cooperation with the EU's CBRN Centres of Excellence (COEs) and other governmental initiatives to support regional and local priorities.

STRENGTHS

- More than 24 years of experience funding and managing multinational R&D projects and activities.
- A network of hundreds of institutes/universities and thousands of scientists with expertise in many fields, including biotechnology, material science, physics, and nuclear safety.
- Transparency in operations, as well as best practices in procedures to allow the Center to effectively manage more than $300 million dollars of funded projects and activities.
- Full-service project planning and execution with on-site monitoring and audits.
- STCU's International agreement allows cost-effective operations within STCU partner countries as the Center is not required to pay any local duties and taxes.

Party	Total in Millions of USD
United States of America	$81.67
European Union	$77.17
Canada	$10.17
Japan	$1.04
Sweden	$1.67
Government Partners	$97.61
Non-Government Partners	$59.39
Total	$328.72

VISION

To advance global peace and prosperity through cooperative Chemical, Biological, Radiological, and Nuclear (CBRN) risk mitigation by supporting civilian science and technology partnerships and collaboration that address global security threats and advance non-proliferation.

MISSION

- To address the global security threat of the proliferation of WMD-applicable chemical, biological, radiological, and nuclear knowledge and materials;
- To support the integration of scientists with WMD applicable knowledge into global scientific and economic communities through national, regional, and international research collaboration;
- To develop and sustain a culture of nonproliferation and CBRN security awareness and responsibility through education, mentorship, and training;
- To promote international best practices and security culture to mitigate CBRN security threats.

STCU 1995-2019

$329M USD total funding

2,000+ projects

21,000+ scientists and researchers

329 International Partners

WELCOME

FROM THE STCU GOVERNING BOARD CHAIRPERSON

Eddie Maier,
Chairman of the STCU Governing Board

Thanks to the efforts of the Secretariat, and all the Parties, the year 2019 has been another successful year for the STCU. The Center attracted $12.2M in terms of new funding; proving once more that it remains a safe and attractive funding mechanism in the region.

STCU is a multilateral institution that fits the priorities of its parties and is capable of implementing regional co-funded activities, such as the EU and U.S. funded Nuclear Forensics Initiative in the GUAM Region.

The STCU is also an important partner for the implementation of the EU's Export Control programme, and organized a number of successful seminars and workshops in Kyiv in May 2019 and Ypre, Belgium in August 2019, as well as the selection and start of the second PhD grant for the GUAM Region.

The EU's €2.5M Pridniprovskiy Chemical Plant (PChP) project continued at sustained pace. In 2019 it also completed the $2.1M DTRA project to plan, develop, and implement a sustainable mentorship program in Azerbaijan in support of the Threat Agent Detection Response (TADR) system, comprised of a Central Reference Laboratory (CRL), Zonal Veterinary Laboratories (ZVL), and Anti-Plague Division (APD) Laboratories. Together with its sister organization the ISTC, STCU has contributed to the Seismic Initiative funded by the U.S. Department of Energy/ National Nuclear Security Administration (DOE/NNSA) in the Caucasus and Central Asia

All these projects demonstrate the capacity of STCU to manage for its members very diverse types of projects and adapt to the new security challenges.

The STCU also continues to receive new partnership funding from private industries and universities.

No doubt that STCU, as well as the ISTC, will continue to implement in the future critical activities such as support for the COVID-19 outbreak, field exercises (i.e. LIONSHIELD), trainings and webinars, etc. The STCU proved again and again that it has the capacity to respond fast in the face of these new challenges.

After several years of as Chairman of the board, I will retire from the service to the European Commission. Nevertheless, I will continue to keep an eye and hands on STCU activities. Despite the difficult times we face with the worldwide outbreak of the SARS-CoV-2virus, I trust that the parties will demonstrate their willingness to support the STCU in the future, scientifically and financially.

I wish all board members, staff of the secretariat, partners, a full success in their task.

Keep safe,

Eddie Maier

EXECUTIVE DIRECTOR STATEMENT

Curtis "B.J." Bjelajac
Executive Director

During the course of 2019, several existing and new projects were the focus of the Center's activities. The EU Export Control Targeted Initiative to contribute to the creation, consolidation and/or updating of effective export control systems for dual use items, both tangible and intangible in the GUAM countries, continued into its second year, with a number of seminars/meetings in Kyiv and Ypres, Belgium. The EU Export Control program contributes to CBRN risk mitigation and more specifically to the fight against the proliferation of WMD by focusing in particular on dual-use materials, equipment, and technology. The overall aim of the program, going into its 3rd year in 2020, is to transfer EU best practices regarding dual-use export controls in order for third countries to meet the export control related requirements of United Nations Security Council Regulation 1540 (2004) and other relevant international instruments.

The STCU continued to work closely with it sister Center, the International Science and Technology Center, in order to implement important interregional projects. In September 2019, the STCU signed a $2.2M project, funded by the U.S. Department of Energy/National Nuclear Security Administration, to implement a project to strengthen regional seismic monitoring and earthquake response by investing in national seismic networks. The project will deploy high-quality digital broadband weak/strong motion seismic stations while supporting efficient, real-time data exchange across individual country borders in Central Asia and the Caucuses. The STCU project will cover Azerbaijan and Georgia, whilst the ISTC project (also funded by the U.S. Department of Energy/National Nuclear Security Administration) in the amount of $3.0M will cover Armenia, Kazakhstan, Kyrgyzstan, and Tajikistan.

STCU held its 49th Governing Board Meeting in Yerevan,

Armenia, and is grateful for the hospitality of the Armenian government and the assistance of the ISTC, who conducted its 69th Governing Board back-to-back with the STCU for the fourth year in a row.

December 2019 saw the STCU bring to a close the $2.1M project with the U.S. Defense Threat Reduction Agency (DTRA) to provide a continuation of DTRA's mentorship program in Azerbaijan. With the successful completion of the mentorship program implementation, responsibility for diagnostic and laboratory maintenance sustainment was transitioned to the Government of Azerbaijan.

STCU experienced a slight decline in overall approved project funding in 2019, compared to 2018. This decline was due to a slight decline in funding from the traditional STCU Funding Parties (the EU and the United States), as well as from the Partners Program. However, 2019 is the fourth year in a row that the STCU received funding in excess of $10M, and continues the bounce back from the low water mark in funding received ($4.72M) back in 2015.

The STCU Partner Program continued to achieve above-average project funding levels in 2019, and it was the dominant category of new STCU project funding in the year. In fact, the approximately $9.0M in new Partner Project funding in 2019 was amongst the highest annual total during the decade of the 2010s. The amount of 2019 new Partner Project funding was almost double the combined 2019 amount of new funding from the traditional STCU Funding Parties. However, within this Partner Program success is a trend worth noting. When the Partner Project funding is broken into its constituent parts, one can see that the vast majority of the 2019 Partner Project activity was funded by Governmental Partners ($6.32M versus $2.7M by Non-Governmental Partners). Thus, international donors still play a vital role in the financing of STCU projects.

In 2019, the Ukrainian government reaffirmed its long-term commitment to STCU by issuing Cabinet of Ministers Resolution No. 609 dated July 10, 2019, to allow the STCU, at Ukrainian government expense, to stay at our current premises on Metalistiv Street until December 31, 2030. For its positive statements, and for this high-level and long-term commitment of support to the STCU, the STCU Secretariat is grateful to the Ukrainian Party.

I would like to take this opportunity to recognize a long-time STCU friend who is leaving his position because of retirement. I would like to thank Mr. Eddie Maier, Chairman of the Governing Board of the STCU, and most recently the Deputy Head of Unit of Security and Nuclear Safety at the European Commission's DG DEVCO for all his efforts to help both Centers, especially the STCU. On behalf of the entire STCU Secretariat I would like to wish Eddie all the best in his future endeavors. 2020 will be that much more difficult without Eddie by our side.

Over the past twenty-four years, the STCU has proven to be an efficient tool in promoting international scientific and technological cooperation with a nonproliferation component, as well as cooperative CBRN risk mitigation. The year 2020 marks the 25th Anniversary of STCU operations, and the STCU Secretariat looks forward to celebrating this milestone by continuing its professional service to its stakeholders, and aligning itself to better serve their needs in the future.

HIGHLIGHTS and ACCOMPLISHMENTS

STCU ATTENDS THE EU CBRN CENTERS OF EXCELLENCE & BIOSAFETY ASSOCIATION OF CENTRAL ASIA AND THE CAUCASUS 6TH ANNUAL CONFERENCE "BACAC: BRIDGING THE GAPS"

11-15 March 2019

March 11-15, 2019 the EU CBRN Centers of Excellence & Biosafety Association of Central Asia and the Caucasus (BACAC) held the 6th Annual Conference "BACAC: Bridging the Gaps" in Tashkent, the Republic of Uzbekistan. The meeting was organized by BACAC in cooperation with the European Union CBRN Centers of Excellence Initiative (EU CBRN CoE). The event brought together more than one hundred seventy (170) specialists in the field of human and animal health from different countries of Central Asia and the Caucasus, as well as from the European Union, Moldova, Ukraine, the USA, and other countries.

The event consisted of pre-conference workshops (11–12 March), a conference programme (13–14 March), and a BACAC membership meeting (15 March). The pre-conference training workshops were devoted to "Laboratory Quality Management Implementation", "Laboratory Risk Assessment", "Opportunities to Enhance the Implementation of the BWC", and other important topics of interest in the Biosafety & Biosecurity (BS&S) area. The scientific programme of the conference "BACAC: Bridging the Gaps" covered the most urgent problems of BS&S in the BACAC region, as well as worldwide, including:

- Regulatory frameworks;
- Harmonization of national frameworks according to international agreements (BWC, IHR, Codex Alimentarius, etc.);
- Emergency Response Cooperation (Regional and International);
- International Standards;
- Introduction of the new WHO Laboratory Biosafety Manual (4th edition);
- Dual-use, bio-ethics and expert control issues;
- Cooperation in biosafety/biosecurity training;
- Disease Surveillance (Silk Road Program, EU BIOLAB, etc.).

The STCU delegation for the events was comprised of twenty (20) experts from the BS&S field representing the Ministries of Health, Veterinary Services, and advanced scientific Bio-Institutions from all four (4) STCU Recipient countries (5 experts from each STCU country: Georgia, Ukraine, Azerbaijan, and Moldova). Dr. Vlada Pashynska, STCU's Senior Specialist in BS&S, presented a report entitled "Recent Biosafety and Biosecurity Activities of the STCU", which detailed the STCU's many years of experience in the implementation of BS&S related projects. The conference provided an excellent opportunity for the STCU and its member BS&S experts to update their knowledge of current international BS&S developments, as well as to foster regional and international networking and partnerships.

STCU CONDUCTS TRAINING ON "IDENTIFYING DUAL-USE GOODS AND TECHNOLOGIES IN UKRAINE: GENERAL FRAMEWORK, KEY POINTS ON MISSILE AND NUCLEAR TECHNOLOGIES, AND TEST CASES"

20-24 May 2019

STCU and the Ukrainian Chamber of Commerce and Industry (UCCI) conducted a training course on "Identifying Dual-Use Goods and Technologies in Ukraine: General Framework, Key Points on Missile and Nuclear Technologies, and Test Cases" May 20th-24th in Kyiv, Ukraine. The training was held under the STCU's Export Control Targeted Initiative funded by the European Union, which aims to raise awareness in STCU member countries, as well as to enhance the effectiveness of export control systems for dual-use items and related materials, equipment, and technologies through the provision of necessary training and educational programs. The training course included lectures, practical exercises, and group test cases which were focused on the following:

- To analyze the legal and technical aspects of Dual-Use Regulations (when and why they were born, how they are structured, etc.)
- To understand what are the key concepts and the main points of the regulations;
- To learn how to carry out a technical compliance analysis in order to understand whether a license is mandatory or not;
- To learn what are the most sensitive goods in the aerospace and nuclear industries;
- To understand how to identify sensitive End-User countries;
- To increase the level of awareness on the practical aspects of commodity classification and licensing;
- To define the initial steps required to set up an internal compliance analysis procedure.

Over 50 participants attended the training from such organizations as: Scientific and Technical Center for Defense Research Ltd., Yuzhnoye State Design Office, Taras Shevchenko National University, Kyiv Institute for Nuclear Research of NASU, State Fiscal Service of Ukraine, State Service of Export Control of Ukraine, and representatives from UCCI's many regional offices.

STCU CONDUCTS 1ST SPRING UNIVERSITY ON EXPORT CONTROL FOR GUAM COUNTRIES

20-24 May 2019

The STCU hosted the 1st Spring University on Export Control for GUAM Countries May 20th-24th in Kyiv. The objective of the event was to provide participants with a comprehensive understanding of various interrelated issues concerning the CBRN Export Control of Dual-Use Materials and Intangible Technologies. The STCU Spring University was funded by the European Union in the framework of the STCU's Export Control Targeted Initiative (TI).

The Export Control TI has a sub-program that is dedicated to the engagement of the academic community in the GUAM region, with a particular focus on the impacts of export control in intangible technology transfer, as well as the education of professionals so that they are aware of the many different export control systems. The Spring University encouraged the academic community to commit to building relevant legal frameworks, policy provisions, and administrative capacity so that their home country can live up its international obligations under various export control regimes.

Attendees included forty (40) participants from GUAM countries' governments, scientific institutions, universities, and industry, as well as experts from the EU's Joint Research Centers.

The Spring University provided a unique opportunity for the participants to discuss and gain valuable insight into current dual-use materials and intangible technologies, export control issues, and emerging challenges from a regional perspective. The Spring University offered participants the possibility to obtain an EU-STCU Certificate on CBRN Export Control of Dual-Use Materials and Intangible Technologies, which was awarded to each participant who passed a final evaluation conducted at the end of the course.

Results of the Spring University include:

- An upgrade of the professional skills of the participants who have a direct link to the development and implementation of strategic trade control policies in the GUAM countries;
- The course provided future trainers with the knowledge required to train younger generations;
- The development of a regional network of experts from the GUAM countries.

STCU CONDUCTS 1ST CONFERENCE ON NON-PROLIFERATION AND DUAL-USE AWARENESS (CONDENSE)

28-30 August 2019

On 28-30th August, STCU and ISTC, in partnership with the In Flanders Field Museum, hosted a conference in Ypres, Belgium, which brought together young scientists and participants from seventeen (17) countries. Ypres was selected as the location of this important conference because it was the site of the first large scale use of chemical weapons during World War I. With this history as a backdrop, the participants mulled over questions of responsibility, innovation, technological trajectories, and the potential for misuse of scientific and technological developments. The CONDENSE conference was funded by the European Union in the framework of the STCU's Export Control Targeted Initiative.

The event kicked off on the eve of the conference when the entire group attended the Last Post ceremony at Menin Gate, held every night since 1928. On the first day of the conference, each participant gave a six minute lightning presentation on their research and its societal implications which served to prime the participants and get to know each other.

In the afternoon of the first day, the group visited DOVO-Poelkapelle, an explosive ordnance disposal facility which destroys the explosive legacy leftover from World War I in the fields and towns of the Ypres region. The site processes over 200 metric tonnes of explosive ordnance annually (including chemical munitions). The site visit concluded with a "walk shop", a brain storming exercise whilst walking, which discussed the role of scientists in non-proliferation and raising dual-use awareness.

In the evening of the first day, the group attended a public lecture by Dr Jean Pascal Zanders (a specialist in questions of CBRN armament and disarmament). In the grand surroundings of the In Flanders Fields Museum, Dr Zanders laid out the historical trends that led to, and enabled, the militarization of chemistry in World War I.

On the second (final) day, the attendees held discussions on the themes that emerged the previous day and were encouraged to delve deeper into the issues of communication during a presentation by Ana Izar of the United Nations Office of Disarmament Affairs, and challenged to formulate new approaches by Dr Brett Edwards, Senior Lecturer at Bath University, in an invigorating set of group exercises.

The conference concluded on the second day with a good number of participants eager to use the opportunity to formalize networks and elaborate proposals for further work.

STCU ATTENDS THE BIOSURVEILLANCE NETWORK OF THE SILK ROAD ANNUAL MEETING

25-27 September 2019

The Biosurveillance Network of the Silk Road (BNSR) held its 6th Annual Plenary Meeting in Nur-Sultan, Kazakhstan, on 25-27 September 2019. The BNSR is a non-governmental organization that is dedicated to support the creation of a well-functioning disease surveillance network in Eastern Europe, the South Caucasus, and Central Asia. In so doing, the BNSR contributes to strengthening human and animal health security not only nationally, but also within the region, as well as globally. The BNSR is comprised of biosafety and biosecurity experts from Executive Committee Member countries: Azerbaijan, Georgia, Kazakhstan, and Ukraine, as well as from Observer countries such as: Armenia, Albania, Belarus, Bulgaria, Moldova, Romania, and Uzbekistan.

As the chair of the BNSR for 2019-2020, Kazakhstan hosted the 2019 BNSR Annual Meeting with a focus on strengthening approaches to effective preparedness to prevent, respond, and recover from communicable disease threats.

The purpose of the BNSR Annual Meeting is to provide a sustainable forum for participants to share information regarding national and regional biosurveillance activities, which includes: disease detection, laboratory diagnosis, epidemiological analysis, disease reporting, and intersectoral communication & collaboration. The primary focus of the 2019 meeting was the One Health approach, BNSR sustainment, and the expansion of multi-disciplinary collaboration within the network.

At the 2019 BNSR meeting, delegations from Azerbaijan, Georgia, Kazakhstan, Ukraine, Moldova, Uzbekistan, Turkey, Belarus, Bulgaria, Romania and the USA worked side by side with experts from the World Organization for Animal Health, British Medical Journal, Science and Technology Center in Ukraine, Defense Threat Reduction Agency, INTERPOL, University of Zurich, PubMed, The World Health Organization, Southeast European Center for Surveillance and Control of Infectious Diseases, Centers for Disease Control and Prevention, and the United States European Command.

Dr. Vlada Pashynska, STCU Senior Specialist in BS&S, participated in the event by sharing STCU's extensive experience in the implementation of related projects over the past two decades

STCU ATTENDS FIRST DONORS' BIOSAFETY AND BIOSECURITY CONFERENCE IN UKRAINE

14-15 November 2019

The First Donors' Biosafety and Biosecurity Conference in Ukraine was held in Kyiv, Ukraine, on 14-15 of November 2019. The Meeting was organized by the Ministry of Heath of Ukraine, Public Health Center, and the Ministry of Foreign Affairs of Ukraine, in cooperation with the Defense Threat Reduction Agency of the United State of America.

The conference's aim was to review Ukraine's international cooperation in the area of BS&S. Delegations and representatives of Ukraine's key BS&S partners and donor countries took part in the event, in particular delegations from DTRA & CDC of the USA, delegations from the EC and Germany, experts from the WHO, OSCE, FAO, STCU, CRDF, as well as other international organizations.

The Minister of Health of Ukraine, Dr. Zoryana Skaletska, opened the conference by underlining the importance of BS&S to Ukraine, especially given the current epidemiological situation in Ukraine, as well as rising risks presented by the ongoing military conflict in the East of Ukraine. Experts and specialists from agencies such as the Ministry of Health of Ukraine, Ministry of Foreign Affairs, Commission on BS&S of the National Security and Defense of Ukraine, State Service of Ukraine on Food Safety and Consumer Protection, Ministry of Defense of Ukraine, State Border Guard Service, and the National Academy of Sciences of Ukraine all reported about their ongoing activities, achievements, and problems in the area of BS&S in Ukraine, and pointed to possible opportunities for cooperation with the international community to not only improve the BS&S system in Ukraine, but also facilitate the integration of Ukraine into the global health system.

The STCU was invited to the First Donors' Biosafety and Biosecurity Conference to present the organization and its efforts and experience in implementation of BS&S related projects in Ukraine as well as in other STCU Recipient countries. The STCU Executive Director Mr. Curtis Bjelajac delivered remarks on behalf of the United Kingdom Department of Defense (an STCU partner that was unable to attend) about the UK's view of BS&S activities in Ukraine, and in particular the achievements of the UK MoD funded project via the STCU entitled, "Education and awareness-raising in Ukraine", which was devoted to the introduction of modern BS&S and Bioethics training courses in the University education system in Ukraine. Dr. Vlada Pashynska, STCU Senior Specialist in BS&S, also presented at the conference a report entitled, "The STCU: Working for Two Decades to Mitigate Biosafety & Biosecurity Threats".

SUCCESS STORIES

STCU PROJECT #9906. BUILDING THE NEXT GENERATION OF NUCLEAR FORENSIC SCIENTISTS: THE GUAM NUCLEAR FORENSICS SUMMER SCHOOL

Funding Parties:

In the framework of STCU Project #9906 entitled, "Next Generation of Nuclear Scientists", a staged approach was taken to attract young researchers to the area of nuclear forensics and thus enable a smooth transition of knowledge to the next generation. The project comprises Georgia, Ukraine, Azerbaijan and Moldova (a.k.a GUAM countries), and includes grants for internships at the graduate level (three months), fellowships for post-doctoral students (two years), and a summer school (one week) for undergraduate students.

In the framework of the project, STCU jointly hosted a seminar with the Kyiv Institute for Nuclear Research (KINR) entitled "Summer School on Nuclear Forensics Science for GUAM Countries" on September 9th-13th, 2019 at the George Kuzmycz Training Center in Kyiv, Ukraine. The seminar was held under the umbrella of an STCU Targeted Initiative on Nuclear Forensics funded jointly by the European Union and the United States Department of Energy/National Nuclear Security Administration (U.S. DOE/NNSA). The summer school was a regional event, attended by twenty-one students selected from Georgia, Ukraine, Azerbaijan and Moldova. The objectives of the summer school included:

- •Raising awareness of the field of nuclear forensics among students of physics, chemistry, and other scientific disciplines;
- •Communicating the principles of conducting a nuclear forensic investigation;
- •Teaching scientific fundamentals (including elements of radiochemistry, nuclear physics, and instrumental analysis); and
- •Providing examples of actual seizures of material out of regulatory control and their examination

The agenda was jointly developed under the leadership of KINR by experts from the GUAM countries together with international experts from the European Commission Joint Research Centre-Karlsruhe and from the U.S. DOE/NNSA Office of Nuclear Smuggling Detection and Deterrence. Instructors used a variety of didactical approaches to deliver scientific contents. A combination of lectures, table-top exercises, interactive elements, technical visits, demonstrations, and hands-on exercises resulted in a comprehensive learning programme delivered over the course of a week. The summer school benefitted from the training facilities, as well as from the equipment (hand-held devices for detection, localization, and initial identification of material, laboratory instruments for characterization of seized samples, and the infrastructure for handling nuclear and other radioactive materials) available at KINR.

The course successfully demonstrated the viability of regional approaches to building nuclear forensics capacity. Students made substantive contacts with nuclear forensics subject matter experts from their own country, as well as experts from the international nuclear forensics community. Finally, students used the opportunity to form a regional network of young researchers with an awakening interest in nuclear forensics. These contacts will serve as an invaluable support network for the next generation of nuclear forensics in the GUAM region.

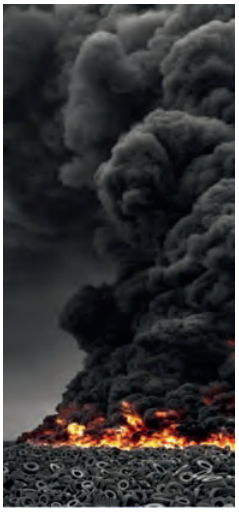
STCU PROJECT #P744. CONVERSION OF CARBON-CONTAINING WASTE TO CARBON BLACK, ITS PURIFICATION AND USE IN VARIOUS INDUSTRIAL APPLICATIONS

Funding Parties:   *Funding amount: $ 163,626*

Carbon containing waste, such as scrap tires and plastic bottles, is currently one of the biggest environmental concerns facing society today. The toxic pollutants contained in this waste, damage the environment as they can take hundreds of years to naturally decompose, causing long-lasting land, water, and air pollution.

Scrap tires on their own contribute a large portion of the carbon containing pollution mentioned above. In 2019, the global tire market reached 3.2 billion units, with a rate of growth of around 4% during the last five year period of 2014-2019. Most forecasts show the market reaching 4.0 billion tire units by 2025. To give you an idea of the scope of the problem, in developed countries, each person generates approximately one scrap tire per annum.

Tires are typically manufactured using various materials, including natural and synthetic rubber, carbon black, steel, silica, natural fibers, polyester, and sulfur. The complex composition of tire rubber causes huge problems for the development of sustainable environment-friendly methods for its utilization. The current scrap tire management in the United States, which is representative of most developed countries, is far from environmentally sustainable. For example, 55% of scrap tires in the U.S. are incinerated, emitting hazardous exhausts into the atmosphere. Compare that with only approximately 30% of scrap tires reused in certain applications such as playgrounds, rubber-modified asphalt, road and landfill construction, and other applications and you get an appreciation for the size of the problem. Unfortunately, as bad as the situation is in the developed world, the scrap tire management situation in the developing world is much worse. In short, our world is facing a scrap tire disposal crisis that is in urgent need of a solution.



Enter a team of scientists from the Ferdinand Tavadze Institute of Metallurgy & Material Sciences (Tbilisi, Georgia) sponsored by G3C Technologies Corporation (New Jersey, U.S.A.) which in the framework of STCU Project #P744 have accomplished the following milestones:

- Enhanced G3C's Conversion Technology by refining and automating the pilot reactor developed within a previous project (STCU Project #P716, also sponsored by G3CT);
- Developed recovered carbon black (rCB) products with properties suitable for various industrial applications, with an emphasis on rCB use as filler for rubber and plastic products.

- The refined G3C Technology mentioned above allowed the scaling up of G3C's rCB Enrichment Technology, which in turn allowed for the use of rCB in advanced applications such as in the semi-conductor industry, as well as in the fabrication of novel TiC-SiC ceramic and steel alloy materials.

As of today, the project has developed initial specifications and is working towards full specifications for a commercial size G3C Conversion System.

STCU FACILITATES THE LAUNCH OF A MASTERS COURSE ON CBRN DUAL-USE TECHNOLOGY TRANSFER CONTROLS AT TARAS SCHEVCHENKO NATIONAL UNIVERSITY

Chemical, biological, radiological and nuclear weapons belong to the category of non-conventional arms. The characterisation as 'non-conventional' refers to the fact that in all countries, irrespective of their political system, the highest political authorities must authorise the release of these weapons for use in armed conflict. 'Conventional' equally means that the use of such weapons has been pre-delegated to lower levels of command.

In contrast to conventional weaponry, there exists no arms trade in non-conventional arms. The preferred term used with reference to non-conventional weapons is 'proliferation'. Its original meaning is derived from cell biology: a rapid and repeated, sometimes uncontrolled growth of cells like, for example, in cancer. The connotation is negative; it suggests a threat.

In view of the absence of trade in ready-to-use CBRN weapons, the uncontrolled transfer of underlying technologies is the primary cause of concern. The concern applies to state and non-state actors (terrorists, criminals) alike. The transfers patterns may be domestic or trans-national. Most technologies have legitimate purposes, often unrelated to weapon acquisition processes, but many can easily be adapted to serve the pursuit of CBRN capacities. Furthermore, proliferation may involve the transfer of certain technology types that are way down the weapon acquisition process, meaning that without broader knowledge of the dynamic, a supplier would never suspect that a particular sale has malicious finality.

After a year and a half of preparations, teaching of the master's course on CBRN dual-use technology transfer controls began last autumn at the Taras Schevchenko National University (TSNU) in Kyiv, Ukraine. Its development was financed by the European Commission as part of a Targeted Initiative on 'Export Controls of Dual-Use Materials and Technologies'.

Teaching of the first module took place from 21–25 October 2019 and students will have completed the sixth and final module before the end of March 2020. The TSNU Faculty of Economics selected six out of nine proposed teaching modules and integrated them in the new two-year master's course entitled 'Economic Security of Entrepreneurship: Export Control Rules of Dual-Use Goods and Technologies'.

The overall project also envisages capacity-building not only at TSNU, but also at other academic and scientific institutes in Ukraine and in the other three so-called GUAM countries. As an information and outreach centre, the Faculty of Economics at TSNU will continue to promote the course contents both inside Ukraine and among its neighbours.

STCU PROJECT #6224. PHYSICAL AND PHOTOELECTROCATALYTIC PROPERTIES OF $(AG,CU)_2ZNSN(S,SE)_4$ FOR ENVIRONMENTALLY FRIENDLY PHOTOVOLTAIC AND PHOTOELECTROCATALYTIC DEVICES

Funding Parties:  

Funding amount: $ 50,000

Within the Renewable Energy Road Map, an integral part of the Strategic European Energy Review of the European Union (EU), you will find the following statements, "The European Union faces serious energy challenges concerning sustainability and greenhouse gas emissions." To help tackle this problem, the EU sets for itself the target of "producing 20% of total EU energy consumption from renewable energy sources by 2020". With these goals in mind, the project team from STCU Project #6224 went to work with solar cells, as they have shown themselves to be an environmentally friendly source of energy, potentially going a long way to helping the EU to meet their aforementioned commitments.

The main purpose of the project was the fabrication and investigation of $(Ag,Cu)_2ZnSn(S,Se)_4$ (ACZTSSe) films, prepared by post-selenization of sprayed Cu_2ZnSnS_4 (CZTS) films and the establishment of the relationship between the composition and homogeneity of the thin films, crystals and their preparation conditions in regard to the fabrication methods of ACZTSSe based solar cell devices.

The quaternary compound of CZTS is a promising candidate for a low cost absorber layer, as is the equivalent of $CuInS_2$ when replacing indium (In) with Sn and Zn in a 50/50 ratio. CZTS thin films have the suitable optical band-gap energy of 1.4 –1.5 eV and a large optical absorption coefficient of 10^4 cm^{-1}, with the added benefit that all constituents of CZTS films are non-toxic. The need to replace indium stems from the fact that indium is twice as expensive than Sn, Zn, and Cu. Furthermore, In can be found as easily in the environment as Cd and Se; however, it is much more difficult (one or more orders of magnitude) to find than Zn, Cu, Sn, and S. The latter would, from the viewpoint of availability, be better suited for large-scale production. However, while CZTSSe devices fabricated have achieved peak efficiency of 12.6%, further improvements have been stymied by an inability to increase the open circuit voltage, V_{OC}. Experimental and theoretical studies identify band tailing and bulk defects as the key culprits that limit V_{OC}. The project team put forth the hypothesis that the V_{OC} limit can be overcome by alloying CZTSSe with $Ag_2ZnSn(S,Se)_4$. Thus, the degree of cation order/disorder was shown to play a crucial role and therefore became a major focus of the project.

The project team developed the optimal process for AZTSSe solar cells fabrication yielding the first efficient SLG/Mo/AZTSSe/CdS/In devices to ever be produced. The newly developed device efficiency was measured to be up to 2.6%, which left room for improvement, but the main goal of the project was achieved with the development of a cheaper, more environmentally friendly SLG/Mo/ACZTSSe/CdS/In device which was also shown to have a reasonably easy method of spray pyrolysis.

The knowledge obtained during the project will help to better understand the physics of these materials and pave the way to engineering technologies for growing structurally perfect crystals and films. Finally, a number of recommendations for device fabrication using this technology were also developed.

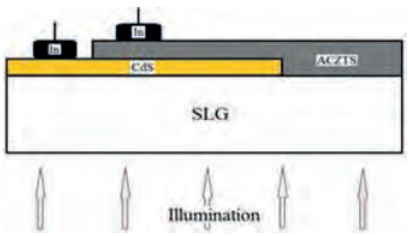


Figure 1: Schematic representation of the SLG/CdS/ACZTS structure (N 150319_b Sample).

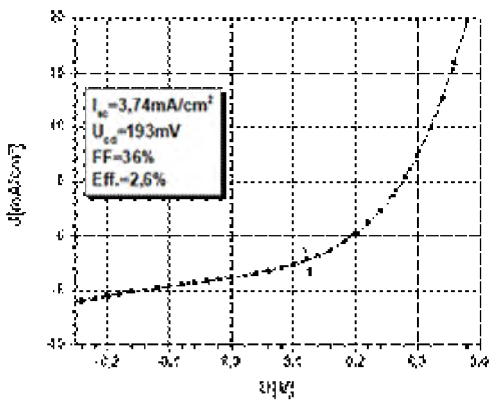


Figure 2: Current versus voltage in the obtained ACZTSSe based heterostructures.

STCU PROJECT #6250. HYBRID JOSEPHSON JUNCTIONS FOR NOVEL COMPONENTS OF SUPERCONDUCTING SUPERCOMPUTERS FOR TELECOMMUNICATIONS AND ENVIRONMENTAL MONITORING

Funding Parties: 

Funding amount: $100,000

Superconducting quantum interference devices (SQUIDs) are very sensitive magnetometers that operate via the "Josephson effect". The "Josephson effect" is the phenomenon of supercurrent, a current that flows indefinitely long without any voltage applied, across a device known as a Josephson junction, which consists of two or more superconductors coupled by a weak link.

Most of the low-Tc SQUIDs that operate today as ultrasensitive magnetic flux detectors are based on planar Nb-Al/Al_2O_3-Nb tunnel junctions. To allow faster operation, the use of an external resistor is required; however, the inclusion of this item significantly complicates the system. Alternatively, the use of self-shunted junctions is a promising way forward for large-scale integrated Josephson devices.

Within STCU Project #6250, the project team analyzed the crystal structure of MoRe and Si(W) model layers, a part of the MoRe-Si(W)-MoRe heterostructures, by scanning and transmission electron microscopy. The project team found that a hybrid Si(W) layer with nanometer tungsten inclusions is formed during magnetron deposition of silicon targets with tungsten wires.

The unique feature of this discovery is the extremely low capacitance of the barrier that appears to be the best solution to increase the transfer coefficient of the dc SQUIDs, to reduce significantly the flux noise, and to decrease the response time of the rf SQUIDs.

Furthermore, the project team discovered that the MoRe alloy is much better for superconducting electrodes than Nb since the MoRe films are mechanically resistant and much more stable against oxidation.

The project team is now working to find promising new applications for such advanced Josephson junctions in areas such as superconducting electronics.For example, the project team is convinced that such rf SQUIDs could improve the measurement of magnetic flux variations from a single microwave photon counter in the ultra-high frequency regime.

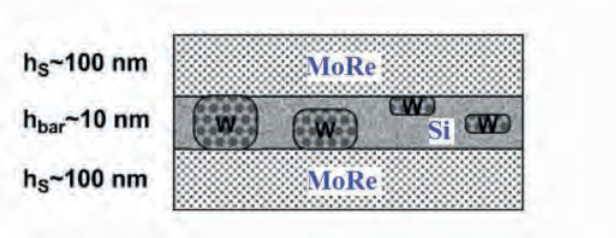


Figure 1: Sketch of a MoRe-Si(W)-MoRe junction with silicon (Si) barrier layer doped with tungsten (W) nanoclusters

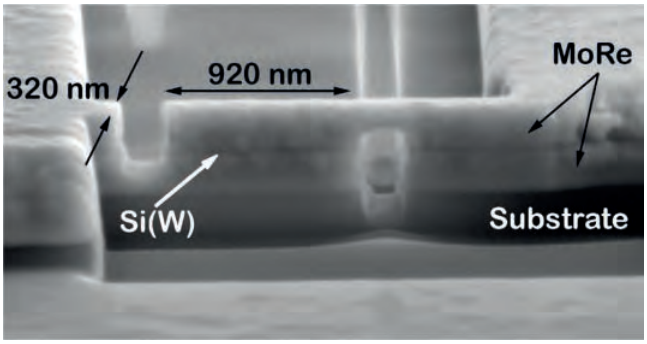


Figure 2: SEM micrograph of the heterostructure formed by a combination of optical lithography, metal deposition and FIB milling steps

STCU PROJECT #6247. OBJECT-ORIENTED COMPUTATIONAL MODELS-SOFTWARE FOR PREDICTION OF ELASTIC AND PHONONIC PROPERTIES OF THREE-DIMENSIONAL NANOCOMPOSITES AND METAMATERIALS

Funding Parties: *Funding amount: $100,000*

Elastic nanocomposites and metamaterials through their unique mechanical and wave behaviors belong to a family of technologically innovative materials that are widely used in practice as the primary elements of many engineering systems. These materials are both strong and lightweight, and in the case of wave propagation can serve a role as not only wave barriers, but also act as filters and lenses.

The use of computational nanotechnologies for the study of nanocomposites and metamaterials is an extremely promising field because of its ability to ensure the unified parameterization of elastic and phononic phenomena in a wide spectrum of characteristic features of those materials. Numerical simulation on the basis of guideline data can also optimize experiments because the numerical analysis reduces the scope, cost, and time required for the experiment.

As a result of STCU Project #6247, a modern methodology-software tool was created that allows for the efficient evaluation of local and overall elastic and phononic properties of particulate nanocomposites and periodically structured composite metamaterials of 3-D configuration using both the numerical multipole expansions method, as well as the boundary and finite element methods. Furthrmore, the software also includes the following functionality:

- Nanoscale modification of micromechanics models for the adequate description of involved objects, adapted to these models numerical algorithms;
- A software supplement of corresponding 3-D static and frequency-domain problems, including the demonstration of software capacities and established regularities on input data with the specification of material and spatial peculiarities of actual nanocomposites and acoustic metamaterials.

Finally, the project team also created models and software forms for computational nanotechnology for application in the synthesis of nanocomposites with improved deformation and stiffness characteristics, distinct anisotropy in the elastic properties, as well as acoustic metamaterials and phononic crystals with a high resolution of elastic wave filtering, locking, and localization.

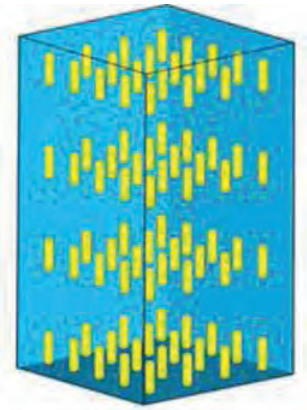


Figure 1: 3-D short fiber nano-composite

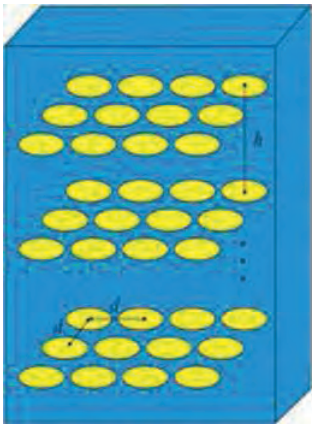


Figure 2: 3-D acoustic metamate-rial with disc-shaped inclusions

STCU PROJECT #6362. PROMISING FUNCTIONAL NANOMATERIALS ON THE BASE OF SILICON AND CARBON FOR MODERN SENSORS AND OPTOELECTRONICS

Funding Parties: *Funding amount: €48,770*

Novel nanomaterials are a part the family of carbon nanoparticles (NP) which were discovered more than 10 years ago and show a promising combination of excellent biocompatibility, easy functionalization, and tunability of emission spectrum. Nowadays, carbon-based NPs are considered a promising material for use in such diverse applications as catalysts, nanofiltration, sensors, cancer treatment, and bio-imaging applications.

Looking to capitalize on this trend in material science, the project team from STCU Project #6362 developed protocols for the creation of free standing porous SiC layers and synthesis of carbon NPs powder by electrochemical etching of polycrystalline SiC substrates. As a result of the aforementioned selected modes of electrochemical etching, two types of NPs of complex composition were created - large porous SiC particles and small NPs of complex composition named CFO (carbon fluorooxide).

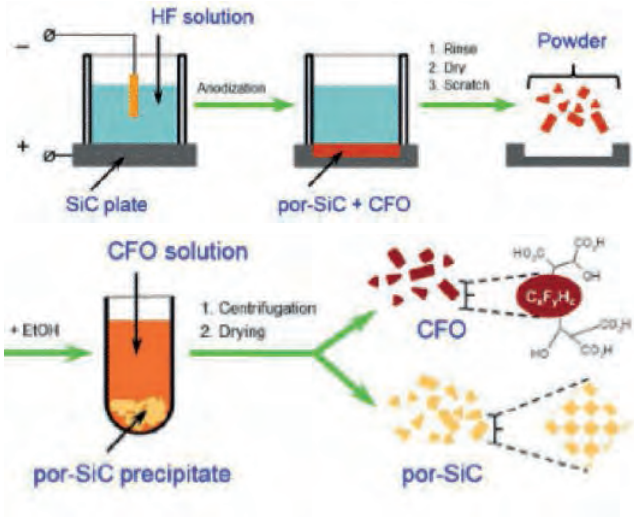


Figure 1: Porous SiC preparation by electrochemical etching

Furthermore, the project team developed and studied methods of synthesis of luminescent carbon nanodots dispersed in nanostructured silica matrixes. Silicon oxide nanopowders and nanoporous silicon oxide were used by the project team as morphological templates. SiO_2:C nanocomposites were then synthesized by pyrolitic decomposition of organosilicon compounds dispersed in nanostructured silica matrixes. The extremely broad emission spectrum of such SiO_2:C nanocomposites in the visible region allows it to be used as a phosphor for artificial white light sources. The absence of expansive and toxic materials (i.e. Cd- and Pb-containing compounds, in particular CdSe, CdTe, PbS and PbSe) make these developed materials very attractive for different optoelectronic applications.

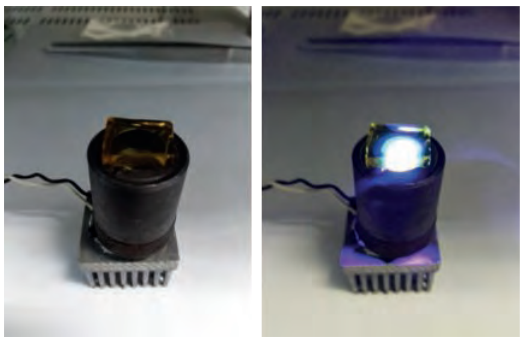


Figure 2: Layout of white light source based on 408 nm LED (violet emission) with nanoporous SiO_2:C phosphor

STCU PROJECT #6301. FLUORINE CONTAINING SOLID POLYMER ELECTROLYTE MEMBRANES FOR ENERGY STORAGE DEVICES

Funding Parties:

Funding amount: $70,000

The scientific community is currently paying a lot of attention to the development of new and more efficient methods of energy storage and conversion. Firmly within this direction, the goal of STCU Project #6301 was to develop new approaches to the synthesis of comb polymers containing metal ion host fluorine donor groups in the side chain, so as to develop solid polymer electrolyte (PE) based lithium, containing "salt-in-polymer" systems with good room temperature ion conductivity.

What made the project team's approach novel was the hypothesis that often during the synthesis of polymers, the cross-linking processes and formation of various linking systems are not observed. In addition, the project team postulated that fluorine containing, organic polymers are characterized by increased ion hosting properties.

With this in mind, the project team synthesized organocyclosiloxanes with various surrounding groups, studied their polymerization and copolymerization reactions in the hope of obtaining new siliconorganic polymer electrolytes for electro storage devices in lithium batteries.

Synthesis of initial monomer type organo-cyclotetrasiloxanes with the same or different attached groups were performed via the hydrosilylation reactions of 2.4.6.8-tetrahydro-2.4.6.8-tetramethylcyclotetrasiloxane (D_4^H) with trifluoroacetic acid, tetrafluoropropyl acrylate, octafluoropentyl acrylate, tridecafluoroheptyl acrylate and vinyltriethoxysilane in the presence of platinum catalysts (Platinum hydrochloric acid, Karstedt's catalysts, and Pt/C) at various temperatures. As a result, corresponding fully substituted organocyclotetrasiloxanes D_4^R were obtained. Taking it a step further, the hydrosilylation reaction of D_4^H with propyl trifluoroacetate (tetrafluoropropyl propionate, octafluoropentyl propionate, tridecafluoroheptyl propionate) and vinyltriethoxysilane at a ratio of 1:3:1 of initial compounds, in the presence of platinum catalysts at various temperatures, resulted in the development of organocyclo-tetrasiloxanes $D_4^{R,R'}$. Taking it a final step further, via sol gel reaction, the compound $D_4^{R,R'}$ was doped with certain amounts (5, 10, 15, 20 mass%) of salt yielding both Lithium trifluoromethanesulfonate and Lithium bis(trifluormethanesulfonyl)imide solid polymer electrolyte membranes. The Ion conductivity of the developed membranes yielded 25°C changes from $8.1x10^{-4}$ to $2x10^{-6}$ S/cm.

The polymerization and co-polymerization reactions of D_4^R and $D_4^{R,R'}$ was studied in the presence of a terminated (regulated) agent, as well as without such an agent, and the optimal conditions of polymerization reactions was determined and comb type polymers were developed. Furthermore, using polymers doped with Li salts ($LiCF_3SO_3$ and $CF_3SO_2NLiSO_2CF_3$ (5, 10, 15, 20%)) via sol-gel reaction, polymer electrolyte membranes were also obtained. The ion conductivity of PE membranes was determined and it changes in the range $8.2x10^{-5}$ - $1.2x10^{-9}$ S/cm.

Finally, the project team developed membranes containing Al_2O_3 nanoparticles (nanopowder 40 nm). The project team demonstrated that even a small amount of this substance can lead to an increase in membrane conductivity from $8.2x10^{-5}$ up to $3.3x10^{-4}$ S/cm.

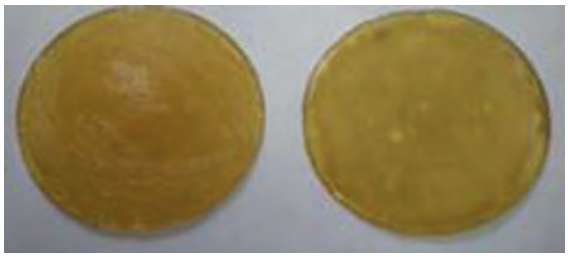


Figure 1: Two newly developed membranes

With an increase of fluorine atoms, the ion conductivity of PE membranes decreases. Some of the newly developed PE membranes will lead to interesting products for further application in Lithium ion elements.

STCU PROJECT #6385. INFORMATION TECHNOLOGY PREDICTION, DESIGN, AND OPTIMIZATION OF NEW EFFECTIVE ANTIVIRAL NANOCOMPOUND DRUGS

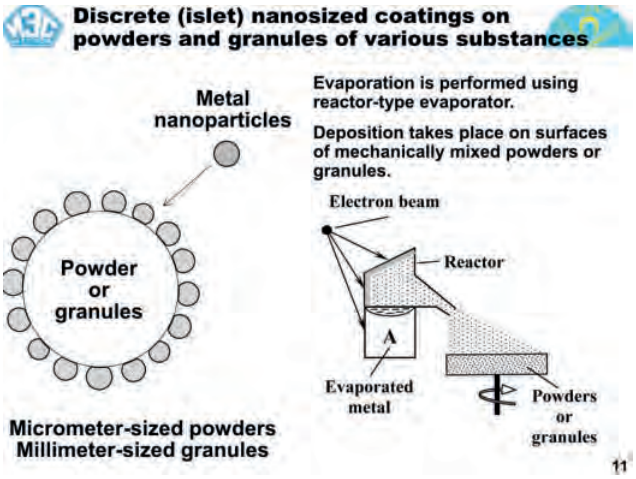
Funding Parties: *Funding amount: €48,776*

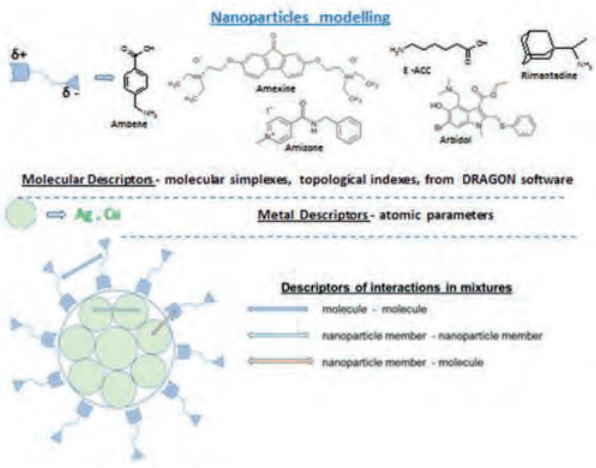
Nanotechnology is a modern combination of scientific knowledge; methods, and tools used to design and control the synthesis of atoms and molecules, the building blocks of all structures, which also happen to have dimensions of less than 100 nanometers. The use of nanotechnology and nanomaterials certainly is one of the most promising areas of science in the XXI century. One such promising area of science is the study of viral infections, which make up 95% of all known infectious human diseases.

The creation of medical drugs with high antiviral activity is an extremely important area of biomedicine. This is where nanotechnology is revolutionizing drug development, as it is facilitating the use of metal nanoparticles which can attack a wide range of targets in specific viruses, and limit the opportunity for the virus to develop resistances to antiviral drugs.

Looking to build upon this technology, the project team from STCU Project #6385 developed a modern approach for producing nanodrugs by depositing metal nanoparticles (Ag, Cu) with an electron beam of molecular flow on the surface of crystals of selected promising organic compounds in a UE-142 vacuum setup. The selection of promising organic antiviral compounds was carried out using modern information technology based on a computer-assisted hierarchical system of Quantitative Structure-Activity Relationship (QSAR) analysis. This methodology was utilized in the most optimal form for nanoparticles in the framework of the hierarchic developed QSAR system.

The combined use of nanotechnology and information technology, two of the world's most modern developments, made it possible to create new effective drug compounds for the prevention and treatment of influenza. For example, the nano preparation of Aminocaproic acid (ACC) with silver nanoparticles on its surface exhibits significantly greater anti-influenza activity than ACC without nanosilver. ACC is a proteolysis inhibitor and antiviral drug. Thus, the project team is looking into the introduction of ACC with silver nanoparticles into respirators and wet wipes, as a more effective means of protection against influenza, and possibly the coronavirus (2019-nCoV SARS-CoV-2) which wreaked havoc on the world starting at the end of 2019.





STCU PROJECT #6222. THREE-DIMENSIONAL HIERARCHICAL HYBRID NANOARCHITECTURES BASED ON GRAPHITIC AEROGELS AND NANOCRYSTALLINE SEMICONDUCTOR COMPOUNDS FOR MULTIFUNCTIONAL APPLICATIONS

Funding Parties: *Funding amount: € 45,952*

The project team of STCU Project #6222 invented "aero-GaN", the first artificial material exhibiting dual hydrophilic/hydrophobic properties (see Nano Energy 2019, 56, 759, Impact Factor 15.548; highlighted by the Physics World, https://physicsworld.com/a/hydrophobic-or-hydrophilic-aero-gallium-nitride-is-both/).

Aero-GaN is promising for a variety of applications such as microfluidics, microrobotics, energy storage and conversion (e.g., supercapacitors and solar cells), environmental protection (e.g., large absorption of crude oil, sensors, etc.), biological applications (e.g., drug delivery, tissue engineering, implantable devices and biosensing, etc.), as well as electromagnetic shielding to replace the heavy metals used for this purpose in many industries, such as automotive and aerospace.

As part of the project, an ultra-lightweight pressure sensor based on aero-GaN was shown to have nondimensional sensitivity from 16.2×10^{-3} at low pressure (5 atm) to 7.4×10^{-3} at high pressure (40 atm). This level of sensitivity, in conjunction with currents as high as tens of milliamperes, makes GaN aeromaterial feasible for exploitation in portable electrical equipment and aerospace applications.

Furthermore, in the framework of the project, pressure sensors were developed based on graphene aerogels (GA) decorated by piezoelectric SnO_2 or GaN nanocrystalline thin films deposited by magnetron sputtering. Both the aforementioned pressure sensors, with a weight around 500 µg, are flexible, ultra-lightweight and exhibit good responsivity. An average sensitivity of 5.6×10^{-4} kPa^{-1} was obtained at 5 V for the GA/SnO_2 nanocomposite with 250 nm SnO_2 film thickness while a value of 6.7×10^{-4} kPa^{-1} was measured for the nanocomposite with 350 nm film thickness.

The project has stimulated and fortified collaboration with other European research groups which are yielding interesting results. For example, work has resulted in numerous joint publications with a team from Kiel University, Germany, led by Professor Rainer Adelung. Moreover, the scientists from the Moldovan team participated in the advanced course of "Electron Microscopy and FIB" at Kiel University, and participated in the practical training of Transmission Electron Microscope as well as in training of crystallographic data analysis in specialized software.

FINANCIAL ACTIVITY IN 2019

2019 saw a slight decrease in the amount of new STCU project funding compared with 2018. In 2019, the STCU Governing Board approved approximately $12.18M in new projects, a decrease of approximately $1.28M in total new project funding compared with 2018. 2020 new project funding is expected to decrease further to approximately $8-$10M in line with future expected funding levels for the Center. Furthermore, the STCU expects to see continued volatility in funding levels in the near term (~3 years), with average funding settling somewhere in the range of $6-$10M annually.

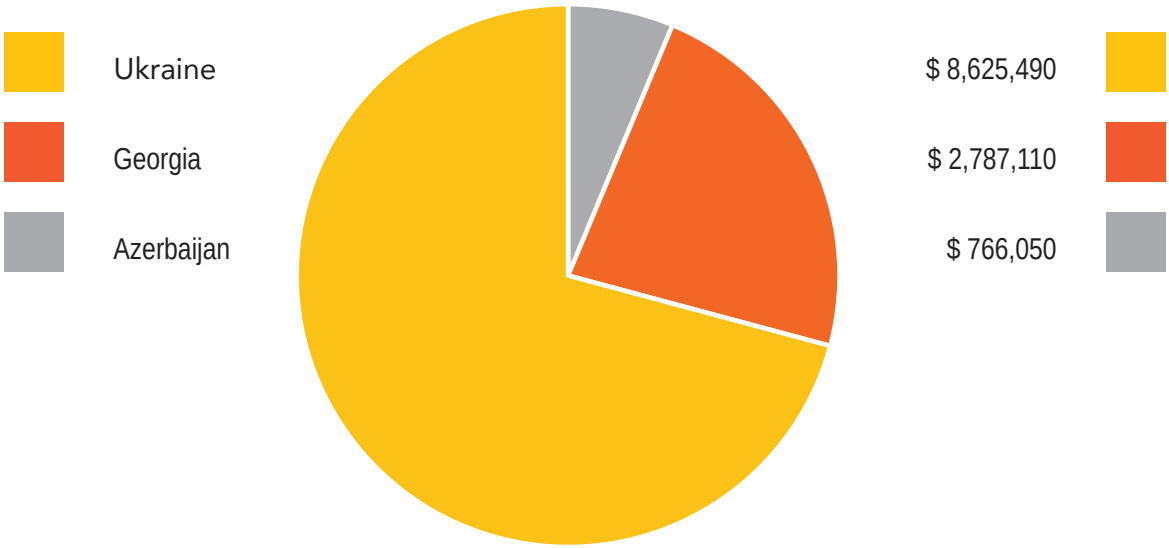
New partner project funding in 2019 was slightly down compared to 2018. The $9.0M of new partner project funding in 2019 was $600K less than that received in 2018. In 2019, new project funding from all partner organizations represented 74.0% of the total amount of new STCU project funding. This percentage is in line with the 80% of total funding the STCU has received historically from partner organizations.

As discussed in previous year's annual reports, the STCU had steadily expanded outside of its historical region of operation (Georgia, Ukraine, Azerbaijan, and Moldova) with projects in places such as the former Yugoslavia and the Middle East. However, 2019 was the first time in a number of years, that the STCU did not have any newly funded projects outside of the GUAM region. The STCU expects 2019 to be a one-off in this matter, with a return expected to the funding of projects outside of the GUAM region in 2020.

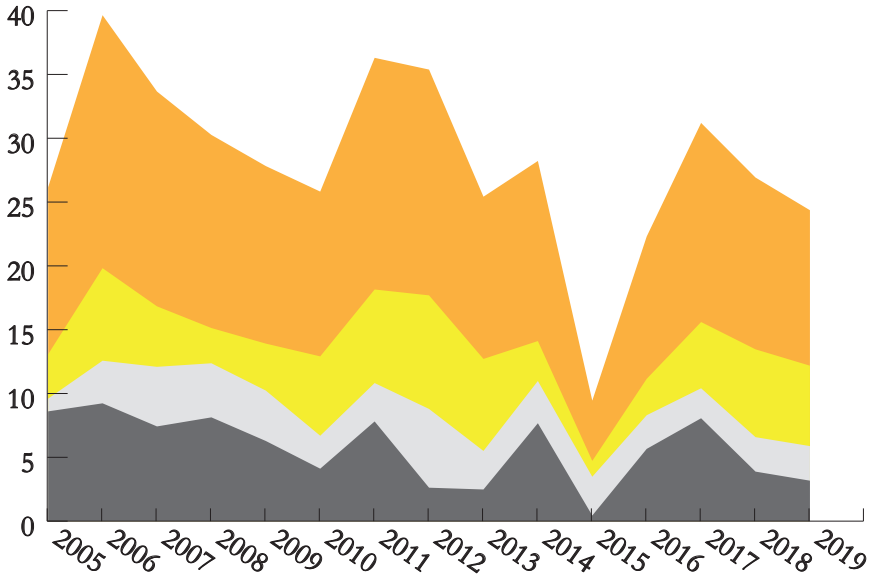
In 2019, the number of participants redirected decreased to 1,784 (801 of those were Former Weapons Scientists) compared with 2018, when the same number was 2,094. This decrease is very much in line with the decreases seen in 2017 and 2016, when the total number of participants redirected had fallen to 1,925 and 1,900 respectively. As mentioned in the 2018 annual report, the increase seen in number of participants in 2018 reflected a short-lived trend, with the number of participants expected to continue its drop to around 1,500 and lower, as the STCU continues its move away from its traditional R&D projects, to the newer CBRN security and security culture projects, which often are completely focused on the purchase of equipment and materials.

For the eighth time, external auditors from KPMG Baltics SIA audited the financial management and accounting systems, as well as the system of internal controls for both the operations of the STCU administration and STCU-funded projects. The results of this audit can be found on the STCU's website at: www.stcu.int/documents/stcu_inf/reports/audit/2019/. Some weaknesses were identified in conjunction with the December 31, 2019 financial statement audit and will be corrected during the course of 2020.

New Project Funding in 2019 by LOCATION OF RECIPIENT ORGANIZATION:

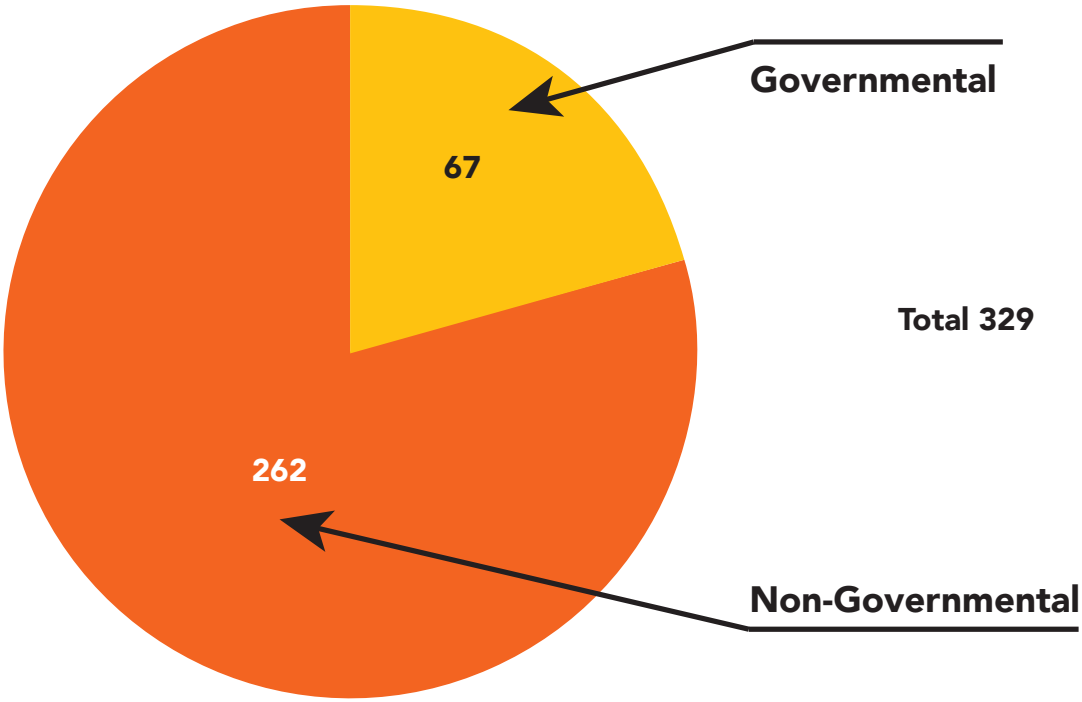


Regular/Partnership Funding, 2005-2019 (funding in millions USD/year):

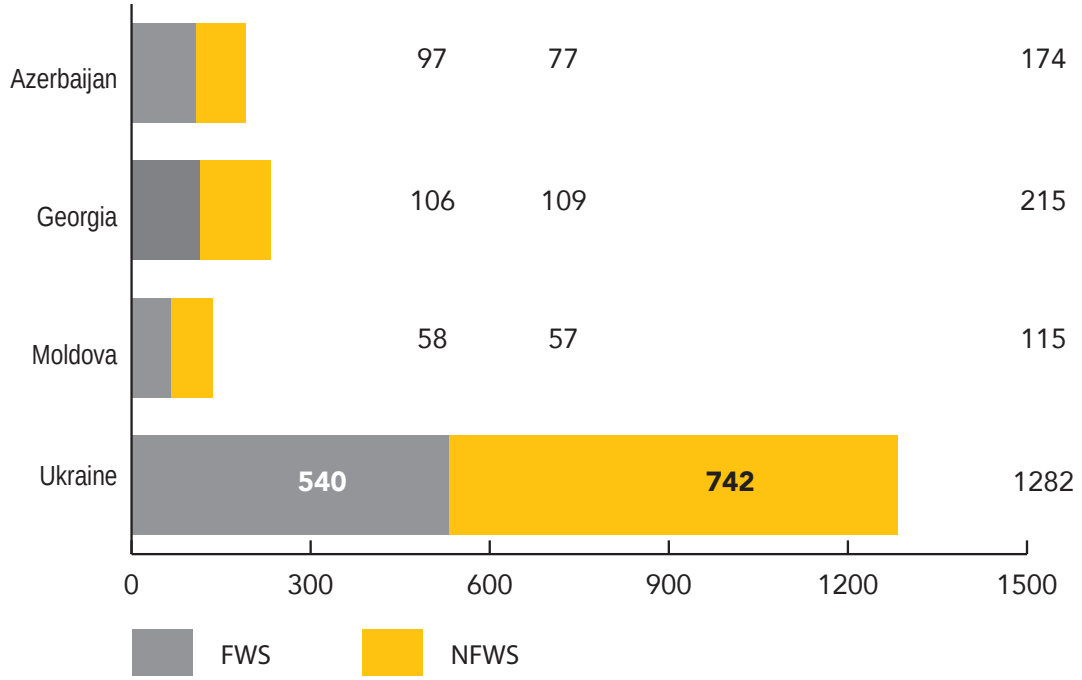


	Regular	NGP	GP	Total
2019	$3,17M	$2,71M	$6,30M	$12M
2018	$3,88M	$2,70M	$6,88M	$13M
2017	$8,06M	$2,35M	$5,19M	$16M
2016	$5,66M	$2,64M	$2,85M	$11M
2015	$0,44M	$3,04M	$1,24M	$5M
2014	$7,67M	$3,31M	$3,13M	$14M
2013	$2,48M	$3,02M	$7,21M	$13M
2012	$2,62M	$6,17M	$8,90M	$18M
2011	$7,81M	$3,01M	$7,33M	$18M
2010	$4,11M	$2,58M	$6,22M	$13M
2009	$6,28M	$3,95M	$3,68M	$14M
2008	$8,13M	$4,24M	$2,76M	$15M
2007	$7,42M	$4,67M	$4,74M	$17M
2006	$9,23M	$3,34M	$7,25M	$20M
2005	$8,60M	$1,00M	$3,48M	$13M

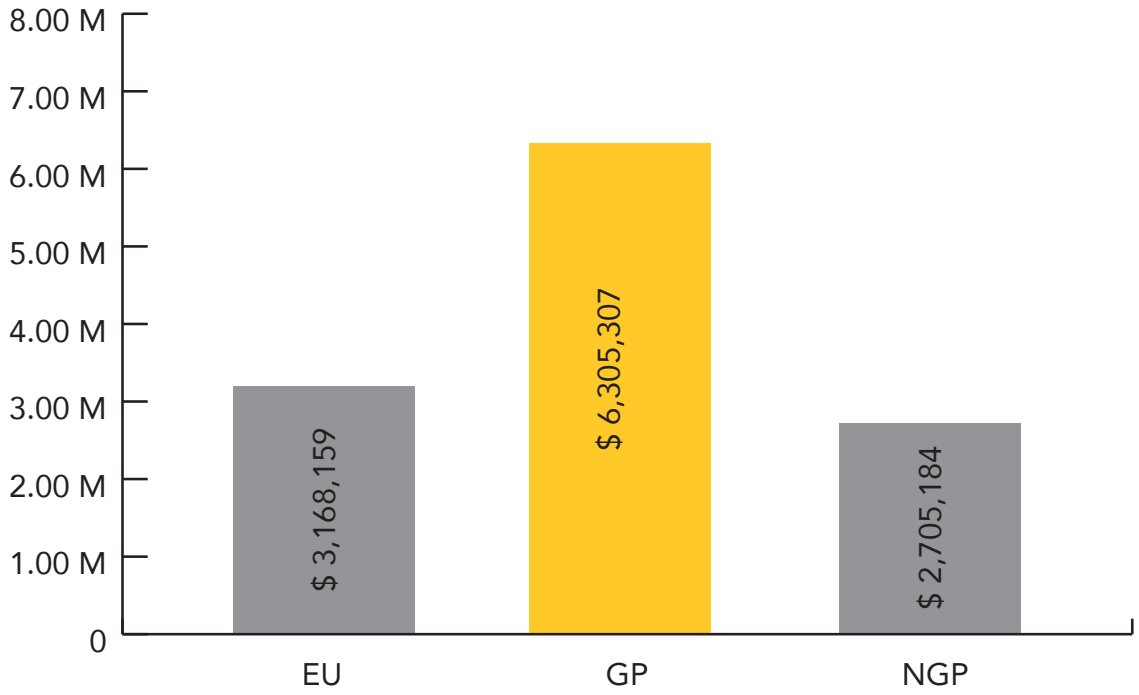
Total STCU Partners, Governmental/Non-Governmental:



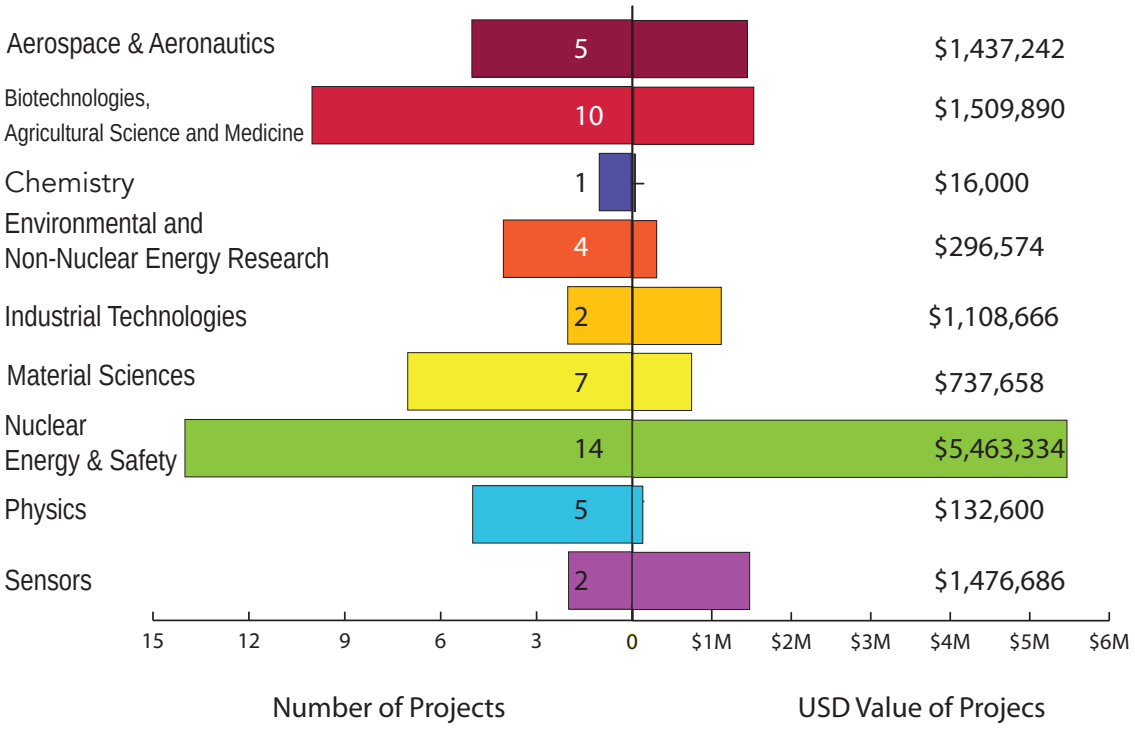
Participants Redirected on STCU Projects During 2019 by LOCATION OF RECIPIENT ORGANIZATION:



New Project Funding in 2019 by SOURCE:



New Project Funding in 2019 by PRIMARY TECHNICAL AREA:



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Science & Technology Center in Ukraine, Annual Report 2018
Printed in Ukraine, 2019