STCU
SCIENCE & TECHNOLOGY CENTER IN UKRAINE

20 ANNUAL REPORT

20

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

TABLE OF CONTENTS

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

2020 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 25 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 three branch offices in 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 25 years of experience funding and managing multi-national 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 $330 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	Amount 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	$100.82
Non-Government Partners	$61.00
Total	$333.54

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 1995-2020

$334M USD total funding

2,100+ projects

21,000+ scientists and researchers

336 International Partners

2020 EXECUTIVE DIRECTOR STATEMENT

Curtis "B.J." Bjelajac
Executive Director

It has been an exciting 25 years here at the STCU, and 2020 was no different. Along with Ukraine and the rest of the world, the STCU quickly learned how to remain productive during a worldwide pandemic. The start of the COVID-19 pandemic in the early months of 2020 forced the closure of the STCU's offices (except for essential tasks and personnel) for the remainder of 2020. Furthermore, the pandemic had a negative impact on not only the STCU's ability to generate new business, but also the Center's ability to conduct in-person workshops and conferences. As was the case with the rest of the world, the STCU team quickly got up to speed on the use of remote technologies (i.e. Zoom, WebEx, etc.) to perform everyday tasks, as well as to successfully transition a number of events from in-person events to virtual events. The STCU did have many successes in 2020, which you will find outlined in this annual report, however, the year was dominated by the global pandemic and its ramifications.

Although I would like this annual report to focus on the positive accomplishments of the Center during 2020, I would be remiss if I did not dive into more detail about the impact of the pandemic on the Center's operations and funding during the year. As mentioned above, the STCU closed all its offices in March 2020, and the STCU Secretariat quickly transitioned to remote work, a tribute to the dedication and professionalism of the STCU staff. I am proud to say that there was little to no interruption of STCU activities despite the shift to working from home. Some conferences have been delayed until a time that they can be conducted in person; however, most events were successfully transitioned to remote only via the use of modern technology. I would like to express my utmost gratitude to the staff of the STCU for their professionalism and commitment during the transition from office to remote work. Daily life was a quite unpredictable during the final three quarters of 2020, but the staff never waivered in their commitment to the success of the organization.

In addition to impacting the Center's operations, it appears that the pandemic impacted funding in 2020 as well, as new project funding decreased drastically over the previous year. At $4.82M, 2020 funding was approximately 60% lower than 2019 funding levels. This is a significant drop-off and remains a concern for the STCU heading into 2021. Some of the drop-off can be directly attributed to the pandemic, as the EU informed the STCU that a significant amount of its funding was redirected towards public health and the fight against COVID-19. As a direct result of this redirection, 2020 was the first year that the STCU did not receive any funding from its traditional funding parties (EU and US). Nonetheless, 2021 is a reminder that funding for the STCU continues to be volatile, especially given the traditional swings in partner project funding.

Partner project funding for the past few years was the largest source of funding at the STCU. However, as mentioned earlier, funding from partners is extremely volatile, ranging anywhere from $4M to $9M per year. Unfortunately, 2020 was one of the leaner years in partner project funding, as the STCU experienced a decline in the number and funding

amounts of new partner projects to a level not seen since the highly volatile year of 2015 ($4.28M of partner project funding was received in that year). As many remember, 2015 was the year after the Maidan revolution and start of the Donbas war. As was the case in 2015, uncertainty (this time involving the pandemic) more than likely played a significant role in the funding decisions of STCU's partners. Total partner project funding in 2020 was $4.82M compared with $9.0M in 2019, representing a 47% decline year over year. It appears that we are still not out of the woods yet, and that the ongoing uncertainties brought about by the COVID-19 pandemic will continue to weigh on the Partner Program in 2021, especially in the case of Non-Government Partners.

Despite the year's many challenges, the STCU accomplished quite a lot in 2020.

The STCU continues its work on the project to implement New Emergency Measures for Pridniprovskiy Chemical Plant (PCHP) at Kamianske (formerly Dniprodzerzhynsk). The EU provided €3.5M of funding to implement several emergency measures that will immediately improve the safety and security of the PCHP site. Barring any unforeseen issues, this 2nd stage of the project will finish in the latter part of 2021, with the EU considering funding a 3rd stage of the project in the amount of €5.7M. The scope of works for the 3rd stage of the project is expected to include completion of the emergency measures not covered in the 2nd stage, and to implement additional activities identified during the 1st stage (risk assessment) of the project.

Furthermore, work continued apace on the EU initiative CBRN Export Control on Dual-Use Materials and Intangible Technologies in the GUAM (Georgia, Ukraine, Azerbaijan, and Moldova) countries, as well as the Targeted Initiative on Nuclear Forensics funded jointly by the European Union and the U.S. Department of Energy/National Nuclear Security Administration. Both initiatives are multi-year programs involving several workshops and seminars conducted both virtually and in person throughout this past year, which build upon those conducted in prior years.

I would like to take this opportunity to recognize a couple of long-time colleagues who will no longer be with us going forward because of staffing reductions at the STCU. First, I would like to thank Ms. Natalia Dudko for all her efforts over the past two decades to move the Center from its humble beginnings to the successful international organization that it is now. Natalia was one of the first hires at the STCU and began her career as a Senior Specialist working on the technical side of projects, but was also flexible enough to pivot to the procurement department these past few years when it became clear that she could help with that important function. I would also like to thank Ms. Vlada Pashynska, the STCU's representative in Kharkiv, who also spearheaded most of the STCU's biosafety and biosecurity initiatives during her nearly two-decade tenure at the Center. On behalf of the entire STCU Secretariat I would like to wish our colleagues all the best in their future challenges. 2020 will be that much more difficult without them by our side.

The STCU Secretariat looks forward to a healthier 2021, built on the scientific accomplishments (i.e. vaccines) of 2020. I wish to thank the Governing Board and Party Representatives for their longstanding support and guidance, and the entire STCU staff for their continued hard work and dedication over the last 25 years. We look forward to the next 25 years as we continue to transform and expand.

HIGHLIGHTS and ACCOMPLISHMENTS

STCU PROVIDES THE GEORGIAN RADIATION REGULATORY AUTHORITY (LEPL AGENCY OF NUCLEAR AND RADIATION SAFETY) WITH EUROPEAN UNION-FUNDED MOBILE LABORATORY

December 2020

Within the framework of the EU-funded project "Strengthening the Preparedness for Nuclear Emergencies of the Agency of Nuclear and Radiation Safety of Georgia (ANRS): Delivery of the Mobile Laboratory -G 4.01/19B", the STCU procured and supplied a mobile laboratory (~€900K) that can be used to determine the propagation and impact of radioactive plumes caused by nuclear or radiation events.

The mobile laboratory is based on the Mercedes-Benz high-capacity off-road minibus and is designed to accommodate three experts. It is equipped with a positive pressure ventilation system, ensuring safe operation for specialists in a polluted environment. In addition to the mobile lab, a trailer was provided to transport required cargo, equipment, and containers.

The mobile laboratory was equipped with all necessary equipment for on-site radiological measurements and assessment. With the equipment installed in the mobile laboratory, it is possible to take samples of water, soil, and air, and study and analyze alpha, beta, gamma, and neutron radiation (including gamma and alpha spectrometry) in the field, whilst still achieving high, laboratory-grade precision readings. The laboratory operates with software used to estimate the spread of radiation-contaminated clouds or air masses whilst taking into consideration the surrounding terrain.

Training in the effective operation of the mobile laboratory was also contracted along with the equipment supply. The training was conducted upon the equipment delivery and covered the following subjects:

• Safety requirements pertaining to the laboratory operation;

• Technical requirements for the operation of the equipment installed in the laboratory;

• Gamma spectroscopy and spectral analysis pertaining to the equipment installed in the laboratory

STCU HOLDS MEETING WITH NASU PRESIDENT ZAGORODNY

22 December 2020

On December 22, 2020 an STCU delegation led by Executive Director Curtis "B.J." Bjelajac and Senior Deputy Executive Director (Ukraine) Mykola Lyubiv held talks with the newly elected President of the National Academy of Sciences of Ukraine, Academician Anatoly Zagorodny. The sides discussed the mutual cooperation between the STCU and NASU over the years and future cooperation going forward into 2021. The sides agreed that their cooperation over the previous years was highly valuable for the advancement of Ukrainian science and development of contacts between Ukrainian and Western scientific institutions.

SUCCESS STORIES

STCU PROJECT #6412. THE STUDY OF GENE FUND OF AZERBAIJAN POPULATION BASED ON STR-MARKERS OF Y-CHROMOSOME

Funding Parties: *Funding amount: € 48,162*

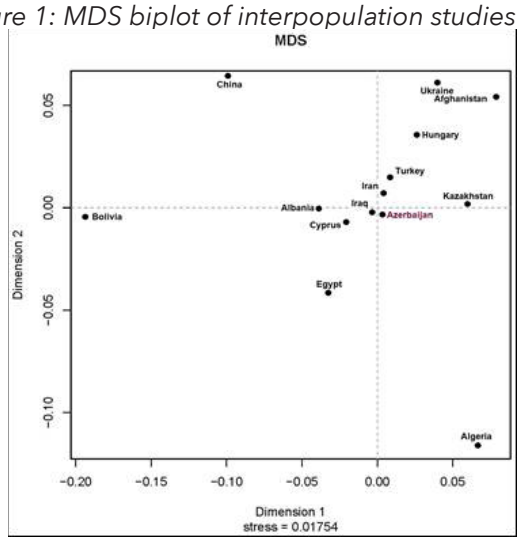
Among genetic markers, localized in autosomal and sexual chromosomes, STR-markers (STR – short tandem repeats) of the Y-chromosome are particularly important and are widely used for solving identification issues in forensic medical examination, genealogical research, as well as for studying the genetic structure of the various human populations localized in different parts of our planet, etc.. Since these markers in Azerbaijan were not systematically studied or studied fragmentarily, the main aim of STCU Project #6412 was to genotype the native Azerbaijan population by studying the gene fund via Y-STR markers and to evaluate the possibility to apply the obtained data in specific areas of identification and genealogical issues.

To achieve these goals, haplotyping (genotyping) of 225 Azerbaijani citizens was carried out using a multiplex AmpFLSTR™ Yfiler™ PCR Amplification kit consisting of 16 Y-STR markers. Allelic frequencies and some forensic and population-genetic parameters of each STR loci were calculated by using PowerStat software. Haplogroups were identified using different haplogroup predictors (NEVGEN as the main predictor and Whit Athey's as the alternative predictor).

Analysis showed that the allele frequencies of Y-STR loci varied over a wide range - 0.004-0.627. During haplogroups identification, different predictors revealed the following haplogroup branches (frequencies in %): E (E1b1b – 9.78), G (G1 – 0.89; G2 – 6.67), J (J1 – 18.22; J2 – 26.67), I (I1 – 1.33; I2 – 1.67), H (1.33), L (2.56), N (1.78), Q (1.78), R (R1a – 7.56; R1b – 10.67; R2 – 0.89) and T (6.22). The possible time of origin of the main branches of Y-DNA tree vary within ~12,000-48,500 years ago. Based on the obtained results, a schematic map of the distribution of Y-DNA haplogroups in the territory of Azerbaijan was compiled.

Interpopulation analysis was performed based on calculated pairwise RST-distances (RST – Stalkin's population differentiation parameter) and p-value between neighboring countries or those countries with historical relations with Azerbaijan (Turkey, Iran, Iraq, Afghanistan, Egypt, Kazakhstan) and countries relatively far away from Azerbaijan (Albania, Cyprus, Algeria, Bolivia, Hungary, Ukraine, China (Han)) with 10,000 permutations. The calculations were performed using the online Y-Chromosome Haplotype Reference Database (YHRD, https://yhrd.org/amova/choose_populations). For clustering analysis, Multi-Dimensional Scaling (MDS) plots of studied populations were performed based on RST values. Both analyses show that the population of Azerbaijan has the smallest genetic distances with the populations of Turkey, Iran, Cyprus and Iraq. Regardless of the nature of the correlation in the biplot, the population of Azerbaijan clusters with the same group of populations (see figure below).

Figure 1: MDS biplot of interpopulation studies



The project team concluded that the Y-DNA (Y-chromosome DNA) gene pool of the population of Azerbaijan is quite rich in its haplogroup composition. Despite this, there are dominant haplogroups (E, G, J, R, T) that play a decisive role in the formation of the local gene pool and they are not invasive (i.e. the carriers of these haplogroups are a native population of the Republic of Azerbaijan). As for minor haplogroups (H, L, N, Q), the population of Azerbaijan is multi-national and their presence in the gene pool is quite natural.

To facilitate future research in this area, the haplotypes (n=225) obtained during this project were placed in local (http://imbb.az/uploads/AZE_Y_STR_Profiles_for_YHRD.pdf) and international databases (https://yhrd.org/YA004693) under accession number YA004693.

SUCCES STORIES

STCU PROJECT #P635. R&D OF MICROSTRIP DETECTOR MODULES AT PRE-PRODUCTION STAGE FOR THE CBM EXPERIMENT AT FAIR

Funding Parties: *Funding amount: €292,718*

Currently, the international accelerator facility FAIR (the Facility for Antiproton and Ion Research), one of the largest research projects worldwide, is being built in Darmstadt, Germany. At FAIR, matter that usually only exists in the depth of space will be produced in a lab for research. Scientists from all over the world will be able to gain new insights into the structure of matter and the evolution of the universe from the Big Bang to the present. FAIR is under construction at GSI Helmholtzzentrum für Schwerionenforschung (GSI). Its existing accelerator facilities will become part of FAIR and will serve as the first acceleration stage.

For the realization of FAIR, accelerator experts, scientists and engineers of FAIR and GSI are working closely together in teams all over the world. One such team includes the scientists and engineers from LLC RPE "LTU" (Kharkiv, Ukraine). As participants in STCU Partner Project P635, funded by GSI, the Kharkiv team contributes to this global effort by designing and providing technological solutions for detector modules and their components, including high-density multi-layer microcables for the Silicon Tracking System (STS) of the Compressed Baryonic Matter (CBM) experiment.

The central detector of the CBM experiment at FAIR will be the large area STS. The most sensitive part of the STS are the strip detector modules in which low-mass multi-layered microcables made of foiled dielectrics with aluminium conductive layers are used to transfer signals from silicon strip sensors to the front-end electronics. The total amount of detector modules required for the CBM STS is approximately 1,000 pieces, each of which provides data flow from more than 2,000 sensitive strips to readout electronics.

With funding provided by GSI in the framework of this project, the efficiency of the production line in Kharkiv was significantly increased. Furthermore, the project team also developed design solutions for full-scale detector modules, as well as mock-ups and prototypes of the detector modules and test microcables. Finally, technological processes for creating ultra-light, adhesiveless aluminium-polyimide materials were also developed within the scope of the project.

The newly developed materials were successfully used for creating ultra-light microcables for the CBM experiment. A number of different options (64 and 128 channels) for providing read outs were considered and investigated. Finally, in close cooperation with GSI, the project team began to use high-precision photomasks during the process of microcable manufacture which yielded a significant increase to both the quality and yield of the microcables produced.

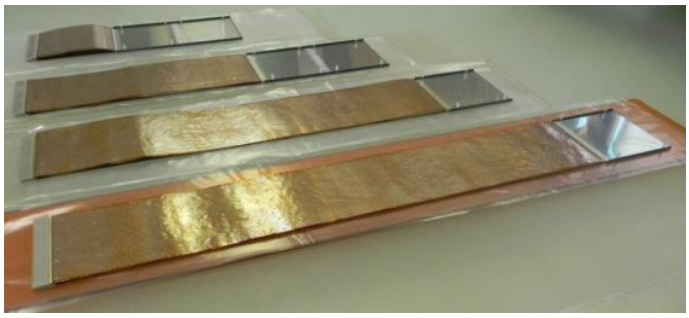


Figure 1: STS-module mock-ups

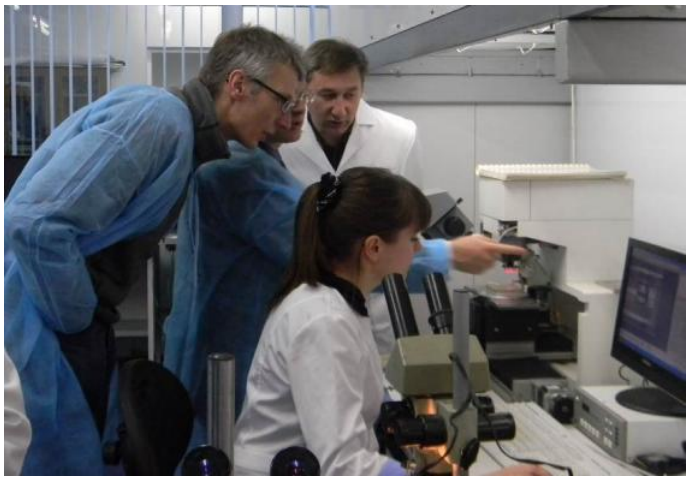


Figure 2: Visit of GSI representatives to the assembly site of RPE "LTU"

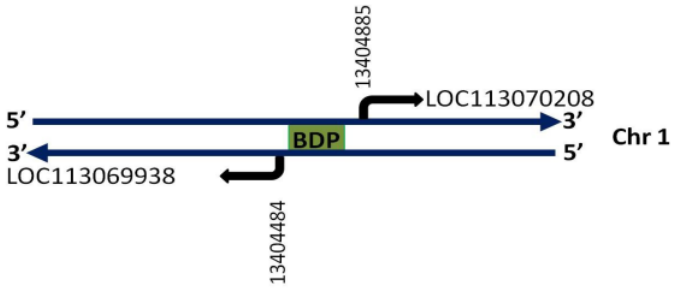
STCU PROJECT #6417. MOLECULAR-GENETIC STUDIES OF THE CONTAMINATION EFFECTS ON SOME ANIMAL SPECIES IN THE CASPIAN SEA

Funding Parties: *Funding amount: € 48,780*

The Caspian Sea, surrounded by Azerbaijan, Iran, Kazakhstan, Russia, and Turkmenistan, has seen a long history of oil and gas exploration and production, resulting in acute soil degradation and contamination problems which adversely impact the marine habitat. Unfortunately, some of these effects are felt most strongly in the Republic of Azerbaijan. Polluted water in the Caspian Sea causes significant changes in marine organisms and their biodiversity. The Caspian Sea, being a closed basin, creates restricted conditions for the exchange and flow of genes.

STCU Project #6417 analyzed the morphological characteristics (body length and mass) of the fish and crustaceans of thirty (30) species from four (4) taxonomic groups (Amphipoda, Cumacea, Decapoda and Mysidacea), collected from six (6) different areas in the Caspian sea with different levels of water contamination, ranging from clean (Lankaran, Novhani and Pirshagi), moderately contaminated (Pirallahi and Shikhovo) and heavily contaminated (Hovsan). The results of the analysis did not reveal statistically significant differences between the samples, even though there are striking differences in the population composition. More specifically, Caspian shrimp and goby fish have gone through an evolutionary path that distinguishes them from other basin inhabitants.

The inter-species comparison of all annotated proteins from four (4) crustacean and five (5) fish species (crustaceans Armadillidium vulgare, Eurytemora affinis, Hyalella azteca and Daphnia pulex; fishes Carassius auratus, Neolamprologus brichardi, Oryzias latipes, Salmo salar and Cyprinus carpio) revealed that although thousands of proteins from the five (5) fish species show the full-length high (≥80%) level evolutionary conservation, the inter-species protein diversity of the four (4) crustaceans species seems to be higher. Moreover, in some cases, when compared with the crustaceans-crustaceans homology, the crustaceans-fish protein conservation was found to be higher.



The figure above is a schematic presentation of a putative CpG-island BDP promoter located between the LOC113069938 and LOC113070208 H2H genes at distance of 401 bp (inter-TSSs distance: 196 bp) on the chromosome 1 of C. auratus. These genes encode the alpha subunit of the succinate-CoA ligase and CDGSH iron-sulfur domain-containing protein 2-like, respectively.

The genome-wide studies of eight (8) crustacean and fish species indicate that the mutual genome location (Tail-to-Head or Tail-to-Tail or Head-to-Head) of the pattern of adjacent nuclear gene pairs seems to be species specific. These findings indicate that the significant genome rearrangement occurred after these species were separated from a common ancestor.

Exploring the promoter architecture of eight (8) crustacean and fish nuclear genes revealed that (i) most of the protein genes have, at least, one putative bidirectional promoter (BDP); (ii) hundreds of Head-to-Head genes in these genomes have a potential BDP between them. These results suggest that BDPs may play a key role in the coordinated transcription of the crustacean and fish genes involved in the same cellular processes.

A search for possible traces of the mtDNA in the nuclear genome of eight (8) crustacean and fish species discovered that only one crustacean (A. vulgare) and one fish (C. auratus) species have long (≥500 bp) insertions of mtDNA in the nuclear genome. In particular, for the first time, almost complete insertion of the mtDNA was found in the fish nuclear genome. These findings suggest that the Mitochondrion-to-Nucleus transfer in crustacean and fish species occurred after these species separated from a common ancestor.

The results of this project are extremely important for the understanding of (1) evolutionary history and (2) the genome promoter architecture of fish crustacean genomes.

SUCCES STORIES

STCU PROJECT #9700. CREATION OF LEGAL AND REGULATORY FRAMEWORK FOR ENSURING PROTECTION AND SAFETY IN RELATION TO EXISTING EXPOSURE AT AND AROUND URANIUM LEGACY SITES IN UKRAINE

Participating Parties:  

Funding amount: €327,256

An alarming legacy of the Soviet Union, the now-defunct Pridniprovskiy Chemical Plant (PChP), is a threat which lies on the edge of the city of Kamyanske, home to approximately 240,000 people. Located on the Dnipro river banks, 450 km south-east of Kyiv, the PChP was one of the largest Soviet uranium processing facilities covering an area of around 2.6 million square meters. Poorly constructed and operated at a time when safety principles were given little consideration, the PChP processed uranium ore for use in the Soviet Union's military industrial complex for more than 40 years. With the collapse of the Soviet Union, the plant ceased operations and, since that time, has remained idle with no attempts to clean-up or decommission the site. This legacy site includes highly contaminated areas and buildings and about 36 million tonnes of residual radioactive material.

At the request of the Ukrainian Government, the European Commission funded STCU Project #9700, a €3,5M project with the overall goal to implement emergency measures at the PChP, including this sub-project for the creation of the required legal and regulatory framework for ensuring protection and safety in and around existing legacy nuclear sites in Ukraine, including PChP. In order to develop these frameworks, the STCU worked closely with the Ukrainian Radiation Protection Institute to develop a new law entitled, "Law of Ukraine on the Management of Nuclear Legacy Sites". The law was drafted in close cooperation with the Ministry of Energy and Coal Industry of Ukraine (MECI), as well as with the Ministry of Health of Ukraine and the State Nuclear and Regulatory Inspectorate of Ukraine.

Upon acceptance by the MECI, the draft law was formally introduced to the Verhovna Rada (Parliament) of Ukraine for approval. The law defines in much more depth terms such as "legacy nuclear site", "residual radioactive material", "remediation" and "institutional control" of a nuclear legacy site. The law also outlines protection and safety principles for the management and remediation of these legacy nuclear sites. The overarching goal of these principles is the "protection of present and future generations and the environment, justified protective actions, and optimised protection and safety in existing exposure situations". The key entities of a legacy nuclear site, such as a "designated

Figure 1: Map showing radioactive contamination of the PCHP site

agency", "operator" and "user" are defined in more detail, with each entity's roles and responsibilities clearly delineated. Furthermore, the legislation defines a strategy for management and remediation of legacy nuclear sites, as well as how to assess existing exposure situations, in order to adequately plan, finance, and implement any future remediation actions at legacy nuclear sites. Finally, the law harmonizes Ukrainian legislation with international (IAEA, Euratom) regulations in regard to the management of legacy nuclear sites.

The next step for the project is to develop new Basic Safety Standards on Radiation Protection in Existing Exposure Situations, which will establish radiation protection standards at the technical level. The document will define the regulatory requirements for protection and safety in existing exposure situations, specifically those that are caused by the residual radioactive material at legacy nuclear sites. The document will spell out the requirements for remediation, safe management, and disposal of residual radioactive material, as well as the criteria for the classification of residual radioactive material, including its conditional and unconditional use.

Figure 2: Samples of "free-standing" radiological hazards

Figure 3: Deteriorated PChP buildings and facilities where uranium ore was processed. Residual radioactive material to this day can still be found inside these buildings.

SUCCES STORIES

STCU PROJECT #9811. SUPPORT OF ESTABLISHMENT OF EFFECTIVE AND EFFICIENT NUCLEAR MATERIALS SAFEGUARDS IN SERBIA

Participating Parties:  

Funding amount: €927,000

The Vinča Institute (Vinča, Belgrade, the Republic of Serbia) was founded in 1948 as a nuclear and material science research center in the former Yugoslavia. Ten years later, in 1958, a heavy water-moderated, zero-power critical assembly 'RB reactor' was constructed at the institute. One year later, a 6.5-megawatt heavy water-moderated 'RA research reactor' capable of using uranium fuel enriched to 80% U235 was commissioned and started as well. Just over forty years later, in 2002, the Government of Serbia decided to decommission the RA research reactor and all its ancillary facilities.

In July 2009, the Government of Serbia established the Public Company Nuclear Facilities of Serbia (PC NFS) under a law entitled, "The Law on Ionizing Radiation", which established PC NFS as the only nuclear operator in Serbia responsible for the management and maintenance of all nuclear facilities within the country, including the Vinča Institute. PC NFS' responsibilities delineated in the law include overseeing all legal requirements for the entire lifecycle of nuclear facilities such as design, construction, testing, commissioning, utilization, extended shutdowns, and decommissioning of nuclear facilities. Furthermore, PC NFS is also responsible for the management of radioactive waste generated by nuclear facilities.

Despite having highly qualified personnel, PC NFS reached out to the European Union in order to improve their on-site measurement capabilities, as well as to improve the inventory and control of movements of nuclear materials at the Vinča site in line with EU and international best practices. It was clear that the request of PC NFS was in line with the EU's contributions to international efforts to prevent the proliferation of weapons of mass destruction,

Figure 1: A training session for PC NFS personnel was conducted In Kyiv at the Institute for Nuclear Research

Figure 2: New storage containers provided for the PC NFS site

Figure 3: New equipment provided for the PC NFS laboratories

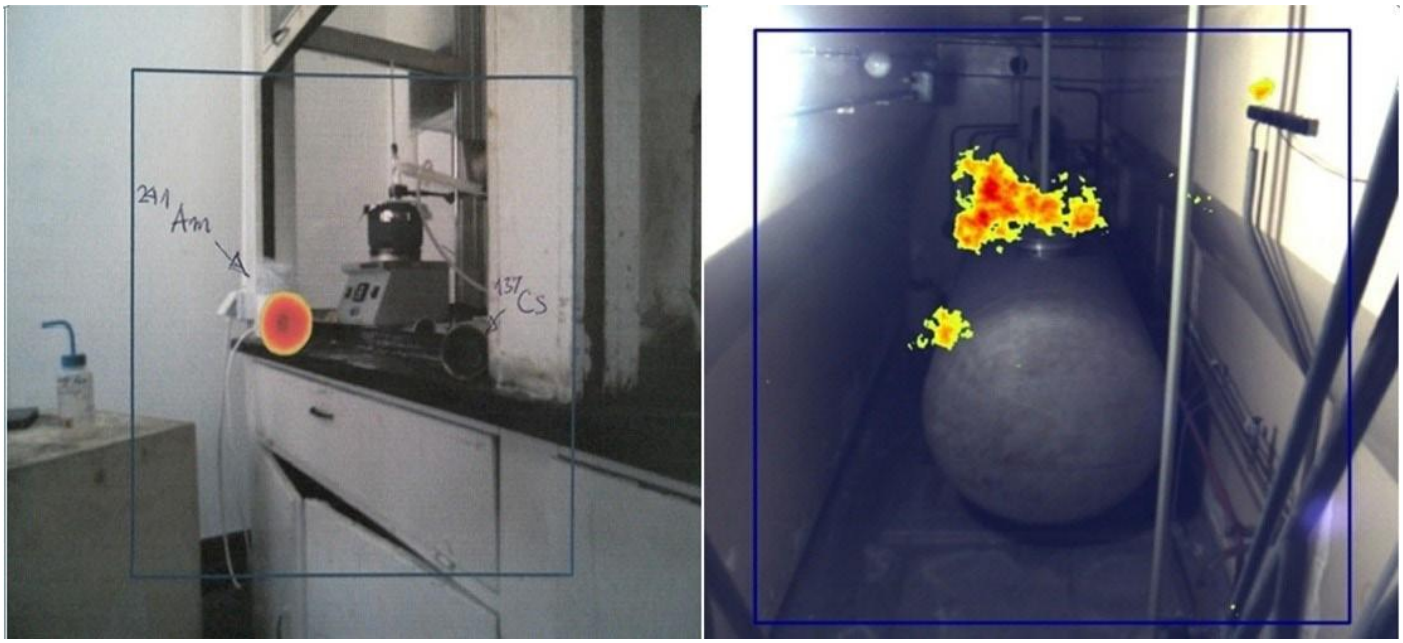


Figure 4: Real-time gamma-ray imaging of radioactive contaminations

so in early 2018 the EU turned to the STCU to implement STCU Project #9811 to assist PC NFS to achieve their stated goals.

As a result, the project provided various required equipment to PC NFS, including gamma detectors, a laboratory HPGe spectrometer, a gamma camera, hand-held HPGe spectrometers, CZT spectrometers, alpha spectroscopes, radioisotope identifiers, multi-purpose digital survey meters, neutron dosimeters, neutron spectrometers, a computer workstation, and storage containers. In addition, training was also provided to PC NFS personnel in the following subjects: Euratom legislation, basic States obligations, Euratom verification strategies and techniques, nuclear forensics, and nuclear material accounting & control.

Upon completion of this project, the European Union agreed to further assist its Serbian partners in their strategic goal of transforming PC NFS into a certified laboratory for complete radiological and nuclear material analysis based on Serbian, Euratom, and IAEA regulations. As a result, a follow-on STCU project (#9812) funded by the EU in the amount of €1.5M was initiated in 2020 to procure additional equipment and training in order to meet this goal.

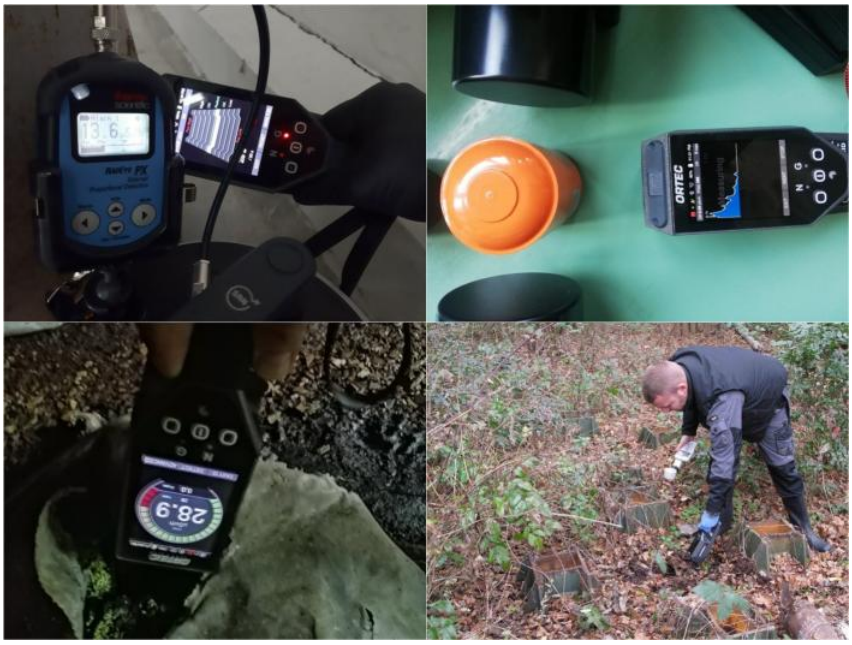


Figure 5: RN monitoring at PC NFS site using provided equipment

SUCCES STORIES

STCU PROJECT #6419. IDENTIFICATION OF VERTICILLIUM WILT RESISTANT GENES OF COTTON AND UTILIZATION OF RESISTANT AND TOLERANT GENOTYPES IN BREEDING PROGRAMS

Funding Parties: *Funding amount:: $48,756*

The most economically impactful disease on the cotton industry is Verticillium wilt, caused by a soil-borne fungus Verticillium dahliae, which can attack about four hundred fifty (450) plant species. The Verticillium pathogen is the primary causal agent of Verticillium wilt which causes billions of dollars in annual agricultural losses worldwide. Verticillium reduces agricultural yields up to 50% or more and affects several high value crops, including cotton. The economic benefits of developing disease resistant genotypes for use in agriculture production, especially cotton, are enormous. For example, it is estimated that Verticillium caused cotton yield losses of 0.5-3.5% in the United States, with yield losses as high as 7.9% in seed-cotton yield in other regions as well. Most commercial cotton varieties are susceptible to Verticillium.

Control of Verticillium wilt is extremely difficult. One method of control, soil fumigation, is both expensive and hazardous, and often does not yield significant results. Another method, fungicides, are generally not economical for control of the Verticillium wilt pathogen because of the pathogen's longevity (approximately ten years or more) and the broad host range of Verticillium dahliae. Today, the only effective measure for the control of the disease is cultivation of disease-resistant varieties of plants.

Soils used for cotton production in Azerbaijan are heavily infested with the Verticillium wilt pathogen. Such widespread infections are especially dangerous because dead plant remains maintain a high level of fungus in the soil, which cannot be eliminated by fungicide treatment. Once established in a field or landscape, the spread of the pathogen occurs primarily by soil cultivation and movement of soil by wind or water. Inoculum densities and disease severity tend to increase from year-to-year when susceptible crops are planted.

The main objective of STCU Project #6419 was the identification of the chromosomal location of Verticillium wilt-resistant genes using Chromosome Substitution Lines of cotton. With this goal in mind, the project team extracted Verticillium wilt pathogens from infested plants and grew the pathogen collections using a special medium.

In order to select disease-resistant cotton genotypes, the project team worked with inoculated plants with conidia suspension of the wilt pathogen (See Figure 1). The project team verified the resistance of the plants by identifying and checking the activity of antioxidant enzymes.

Using this method, the project team was able to rank approximately 1,200 cotton genotypes in artificially inoculated field soil. Resistant and tolerant plants were selected by the project team based on stem ranking results. Twelve resistant and twenty-seven moderately resistant cotton lines with economically important traits were selected and characterized by the project team. Finally, the project team selected two genotypes, Agdash-3 Select and Kharabakh-11, to plant and test in the fields of a farm in the Zardab region of Azerbaijan.

The project successfully identified a number of different cotton genotypes. Using MAS (Marker Assisted Selection) in an artificially infested field, the project team identified six (6) Verticillium wilt-resistant and three tolerant cotton genotypes. The Agdash-3 Select genotype was created by selecting disease resistant forms of the Agdash genotype.

The project team demonstrated the economic benefit of their research by cultivating plants of the Agdash 3 Select – Verticillium wilt-resistant variety, which eliminate the need for fumigator use, saving cotton farmers approximately $12 per hectare.

The project's work also successfully minimized soil infestation, ensuring that soil microorganisms such as bacteria, actinomycetes, fungi, algae, and protozoa were not affected. Finally, the project furthered the creation and planting of disease-resistant cotton cultivars in order to prevent the infestation of soil with the Verticillium wilt pathogen resulting in more healthy soil and ecology.

Figure 1: Inoculation of plant with wilt conidia suspension of wilt pathogen

TABLETOP EXERCISE ON COMBATING ILLICIT TRAFFICKING OF NUCLEAR MATERIALS IN MOLDOVA

Funding Parties:

The STCU, jointly with the National Agency for Regulation of Nuclear and Radiological Activity (NARNRA), hosted a scenario-based tabletop exercise (TTX) on combating illicit trafficking of nuclear materials in Moldova on October 12-13, 2020. The TTX was held under the umbrella of an STCU Targeted Initiative on Nuclear Forensics funded jointly by the European Union and the U.S. Department of Energy/ National Nuclear Security Administration. The training was attended by representatives of the following Moldovan organizations: Customs Service, Border Police, NARNRA, Civil Protection and Emergency Situations Service, and Innovative Technology (the Technical Support Organization for NARNRA). Nuclear forensics experts from the EU, USA, Georgia, Ukraine, and Azerbaijan participated in the event as observers. The purpose of the TTX was as follows:

- To assess and verify the preparedness of the national authorities of the Republic of Moldova to respond to attempts of illicit trafficking of radioactive materials at the border crossing points or inside the country;
- To verify and improve the system for the exchange of information and existing mechanisms for cooperation among various state authorities;
- To evaluate national capabilities in nuclear forensics;
- To identify gaps and technical issues impeding adequate response measures in reaction to such cases, so as to further improve existing capacities, plans, and procedures.

The TTX covered the entire process from detection to response, and finally to nuclear forensic investigation. Through the use of a number of different scenarios (i.e. green border, border crossing, and within-country), the TTX managed to bring together a wide spectrum of agencies and authorities involved in the various steps related to a nuclear security event.

Each agency reported on their operational/technical activities performed in the framework of the exercise. Related operational/ technical activities appear to function well within each agency, and the individual agency Standard Operating Procedures appear to be complete. A Concept of Operations served as the basis for cooperation between the Customs Service, Border Police, NARNRA, and Civil Protection & Emergency Situations Service. However, all agreed that an overarching document, such as an approved national response plan, would provide a more substantial legal basis for operations.

STCU continue to work further with the Ukrainian, Azerbaijani, Georgian, and Moldovan participants of the Nuclear Forensics Targeted Initiative to continue developing training programs to meet the expectations and recommendations of the nuclear forensics program experts.

Figure 1: Classroom portion of TTX

Figure 2: Field work portion of TTX

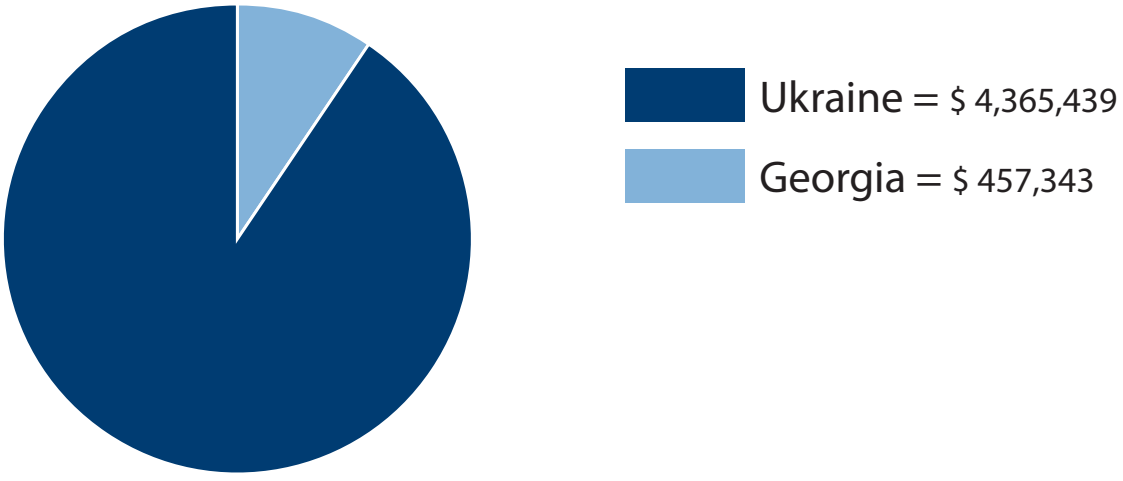
FINANCIAL ACTIVITY IN 2020

2020 saw a drastic decrease in the amount of new STCU project funding compared with recent years. In 2020, the STCU Governing Board approved just over $4.8M in new projects, a decrease of approximately $7.4M in total new project funding compared with 2019. The drastic decline in total new project funding in 2020 was due in large part to the fact that for the first time in the STCU's history, no funding was received from the STCU's traditional funding parties (EU and US), meaning STCU's Partners provided the entirety of funding in 2020. In the case of the EU, a material amount of funding was shifted from its standard CBRN programming to its efforts to fight the COVID-19 pandemic worldwide, resulting in the lack of project funding for the STCU in 2020. Overall funding in 2021 is expected to rebound to approximately $10-12M; however, with the pandemic still raging in many parts of the world, it is difficult to have a clear picture of expected funding going into the new year.

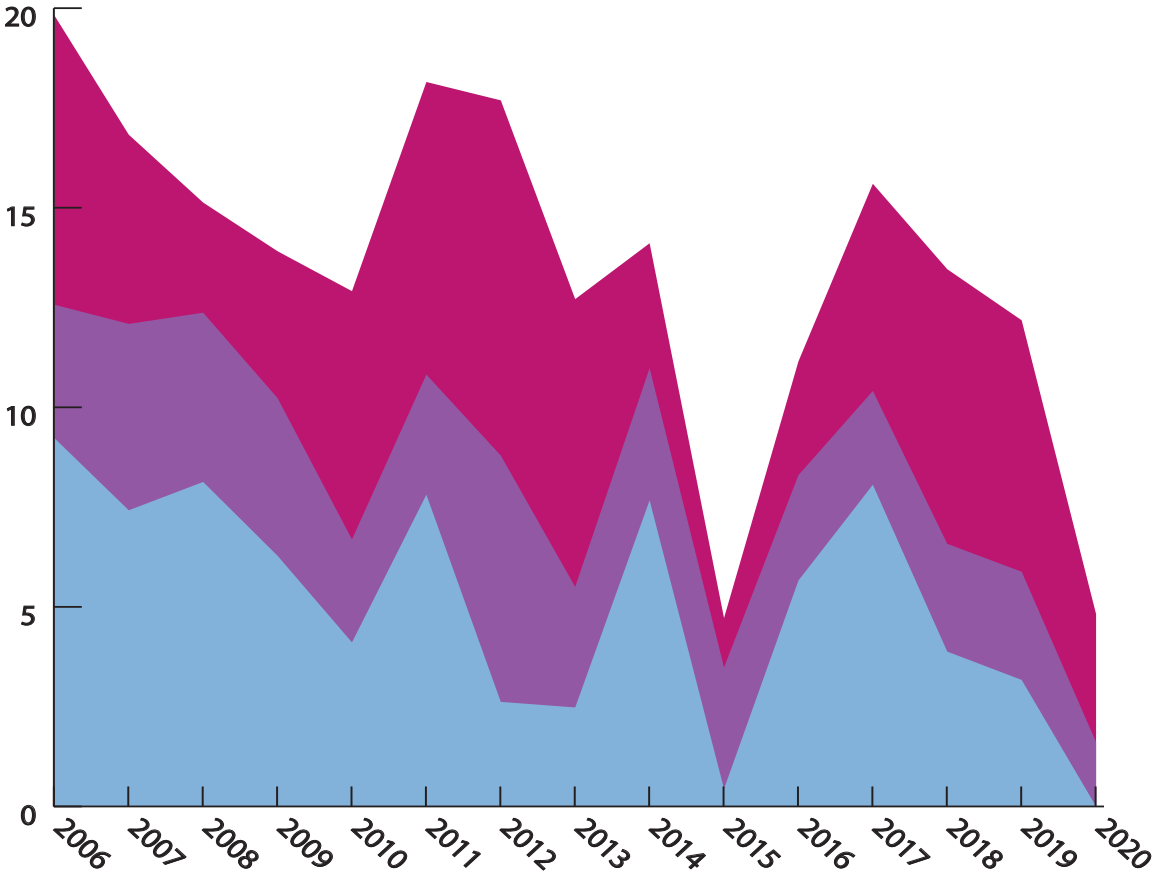
As mentioned above, new partner project funding was the sole source of new projects in 2020, with even that amount slumping compared to 2019. Given the massive disruptions caused by the pandemic in 2020, this downturn in partner funding is also not surprising. The $4.8M of new partner project funding in 2020 was $4.2M less than that received in 2019, and was on par with 2015, when the amount of funding was $4.3M. The downturn in partner project funding in 2015 was also associated with significant disruptions in Ukraine at the time – the Maidan Revolution, the illegal annexation of the Autonomous Republic of Crimea, and the start of the war in Donbas. As with the rest of the world, the STCU is hoping for a calmer, healthier 2021, in the hopes that partner project funding will return to the level of recent years ($7-9M/year)

For the ninth 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/2020/. Some weaknesses were identified in conjunction with the December 31, 2020 financial statement audit and will be corrected during the course of 2021.

New Project Funding in 2020 by LOCATION OF RECIPIENT ORGANIZATION:

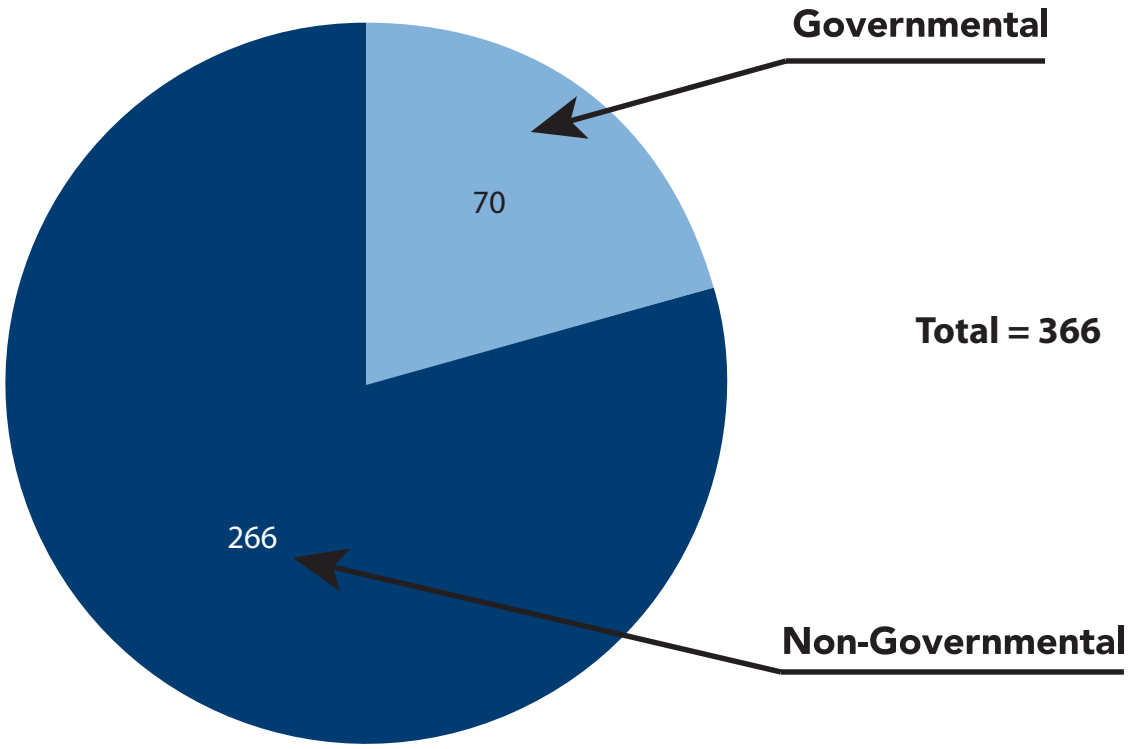


Regular/Partnership Funding, 2006-2020 (funding in millions USD/year):

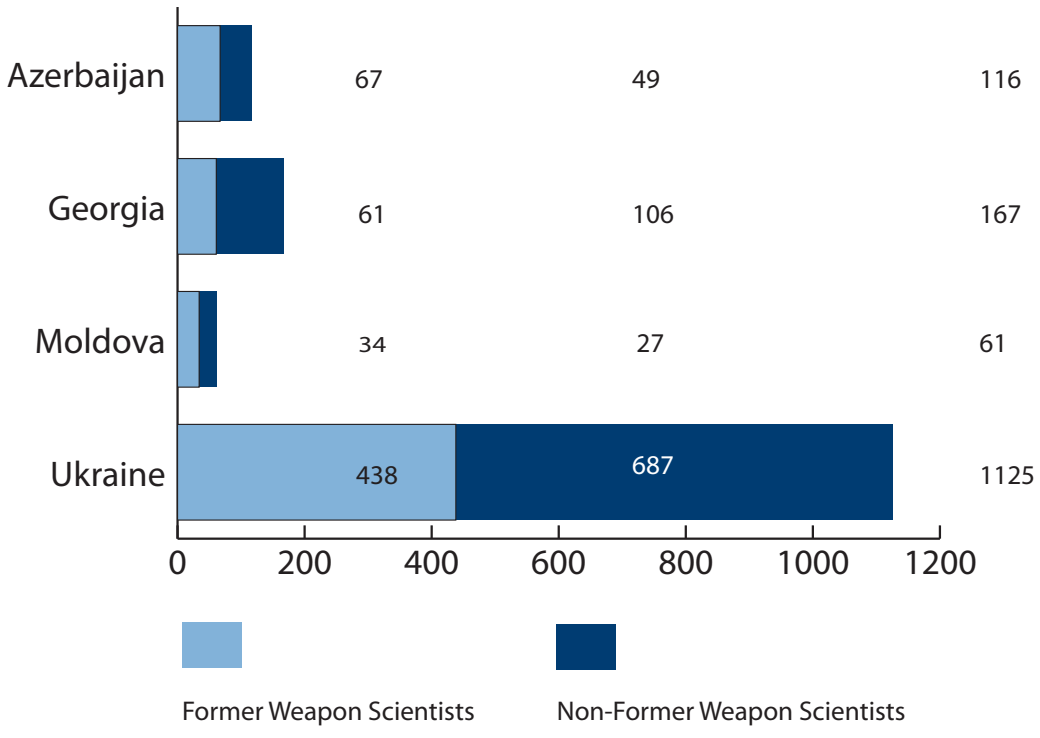


	Regular	Non-Governmental	Governmental	Total
2020	$0M	$1,61M	$3,21M	$5M
2019	$3,17M	$2,71M	$6,30M	$12M
2018	$3,88M	$2,70M	$6,88M	$13M
2017	$8,06M	$2,35M	$5,19M	$16M
2016	$5,66M	$2,64M	$2,85M	$11M
2015	$0,44M	$3,04M	$1,24M	$5M
2014	$7,67M	$3,31M	$3,13M	$14M
2013	$2,48M	$3,02M	$7,21M	$13M
2012	$2,62M	$6,17M	$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

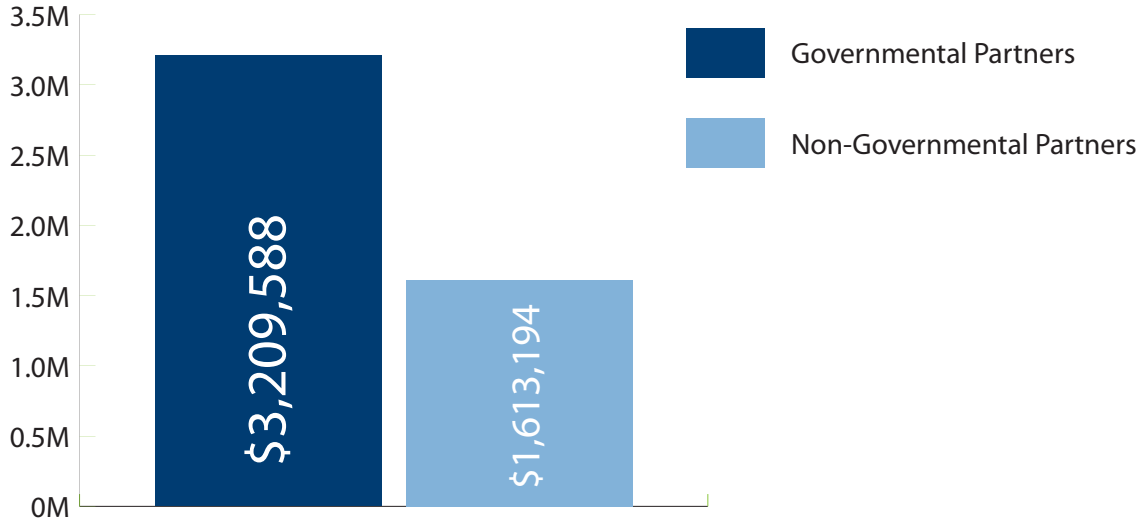
Total STCU Partners, Governmental/Non-Governmental:



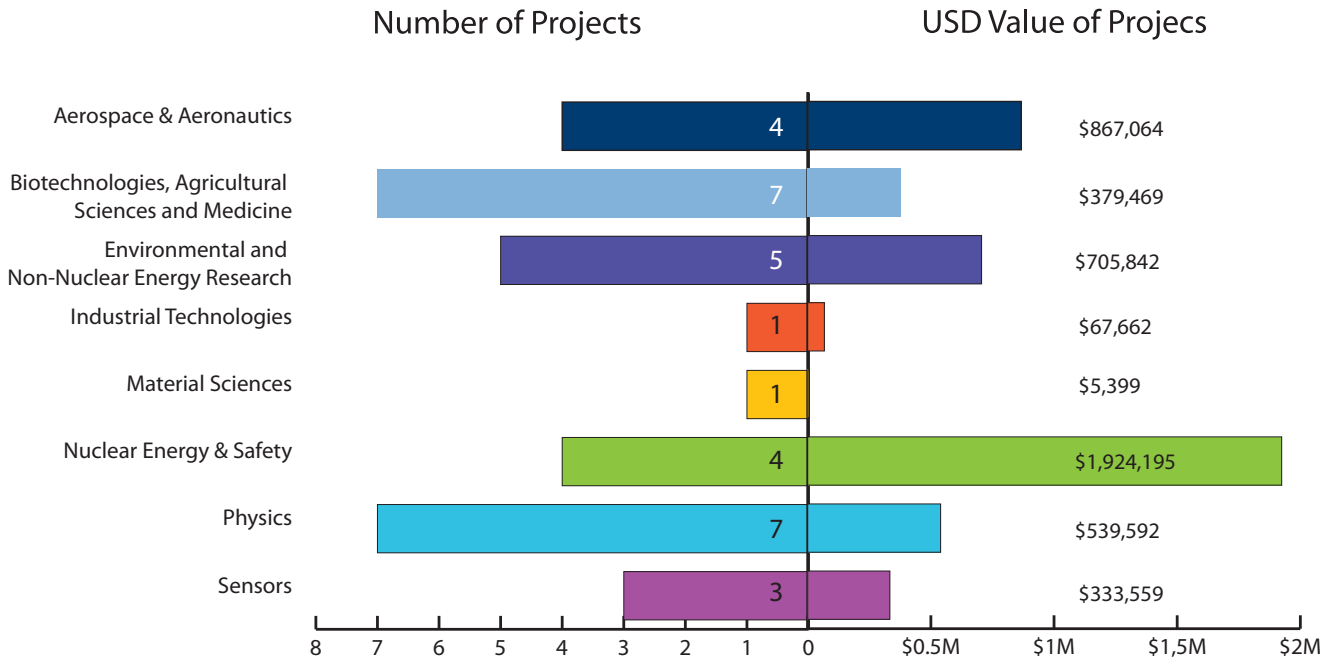
Participants Redirected on STCU Projects During 2020 by LOCATION OF RECIPIENT ORGANIZATION:



New Project Funding in 2020 by SOURCE:



New Project Funding in 2020 by PRIMARY TECHNICAL AREA:



CONTACT POINTS

EUROPEAN UNION

Eddie Maier
Chair

Natalie Pauwels
Board Member
Head of Unit
Stability and Peace - Global and Transregional Threats (FPI.1)
Service for Foreign Policy Instruments
European Commission
Robert Schumanplein 9A
Brussels, Belgium 1046

UKRAINE

Oleksiy Shkuratov
Board Member
Deputy Minister for European Integration
Ministry of Education and Science of Ukraine
16 Taras Shevchenko Blvd.
Kyiv, Ukraine 01601

USA

Phil Dolliff
Board Member
Deputy Assistant Secretary of State for International Security & Nonproliferation Programs
United States Department of State
2201 C Street, N.W.
Washington, DC
20520

Contact person at the European Commission

Sorin Popa
Programme Manager - EU Policies
Stability and Peace - Global and Transregional Threats (FPI.1)
Service for Foreign Policy Instruments
European Commission
Rue de la Loi 41
Brussels, Belgium, 1000
e-mail: Sorin.Popa@ec.europa.eu

Contact person at the Ukrainian Government

Grigoriy Mozolevych
Acting Director General
Directorate on Science and Innovation
Ministry of Education and Science of Ukraine
16 Taras Shevchenko Blvd.
Kyiv, Ukraine 01601

Contact person at the U.S. Government

Barbara Hall
International Relations Officer
ISN/CTR
Office of Cooperative Threat Reduction
Bureau of International Security and Nonproliferation
U.S. Department of State
Tel: (c) +1-202-322-3569
Working from Manila, Philippines
(UTC +8)

STCU SECRETARIAT Headquarters

7a Metalistiv Street
Kyiv, Ukraine 03057
Tel.: +380-44-490-7150
Fax: +380-44-490-7145
e-mail: stcu@stcu.int

Curtis "BJ" Bjelajac
Executive Director (USA)
e-mail: curtis.bjelajac@stcu.int

Mykola Lubiv
Senior Deputy Executive Director (Ukraine)
e-mail: mykola.lubiv@stcu.int

Anthony Nichol
CFO/CAO (EU)
e-mail: anthony.nichol@stcu.int

Information Office in Azerbaijan

Gulam Babayev
119 H. Javid Avenue,
Baku, Azerbaijan 1143
Tel./Fax: +994-12-538-2074
e-mail: gulam.babayev@stcu.int

Information Office in Georgia

Irina Khomeriki
13 Chavchavadze Avenue
Tbilisi, Georgia 0179
Tel.: 995 (32) 22 37 00
Fax: 995 (32) 91 23 86
e-mail: irina.khomeriki@stcu.int

Information Office in Moldova

Alfreda Rosca
1 Stefan cel Mare bd.,Chisinau,
MD-2001, Republic of Moldova
Tel./Fax:+373-69-172-668
e-mail: alfreda.rosca@stcu.int

Science & Technology Center in Ukraine, Annual Report 2020
Printed in Ukraine, 2021