STCU

SCIENCE & TECHNOLOGY
CENTER IN UKRAINE

2016 ANNUAL REPORT

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 threads and advance non-proliferation

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STATEMENT OF THE STCU GOVERNING BOARD CHAIRMAN

Eddie Maier

Chairman of the STCU Governing Board

As you all know, on April 6, 2016 the STCU celebrated its 20th Anniversary. A true milestone for the Center! On behalf of the Governing Board, let me take this opportunity to once again thank Ukraine for hosting and providing its steady support to the Center; the Secretariat for its commitment and dedicated work over the last 20 years; and the several Executive Directors for the leadership provided. But now the party is over, so back to work!

The 2015 Annual Report recalled the accomplishments of the Center in these 20 years, highlighting STCU's shift to larger scale projects and enhanced partnerships with ISTC, MESIS and EU CBRN CoE. The Center reinforced its influence in the security domain, and proved its capacity to adapt rapidly to the evolving regional and global challenges, thanks to its multidisciplinary approach and multilateral dimension.

The 2016 Annual Report includes success stories, activities and events that, I am glad to say, are fully consistent with these cooperative features, which ensured STCU's success through the years.

With regard to projects, the swift procurement and delivery of fire extinguishing foam to Iraq demonstrated STCU's efficiency, flexibility and ability to cooperate with vendors from all over the world as well as partners outside its classical working region such as Iraq. It was crucial to

manage this crisis situation originated by ISIL's attacks and wanton destruction. It ultimately promotes STCU's CBRN security objectives worldwide. As for other projects, sound coordination with the European Union is a consolidated reality: in 2016, through STCU, the EU purchased equipment to enhance first-responder's capabilities to detect and identify chemical, radiological and nuclear materials (CBRN CoE Project 52) and to support CBRN Forensics (CBRN CoE Project 58) in the South East and Eastern Europe region (SEEE).

STCU meetings and activities in the region also further strengthened the visibility of the Center. For example, in November 2016, an ISTC-STCU delegation participated in the International Scientific Conference, "Public Health and Global Health Security: Vision for Tomorrow" held in Tbilisi, conducted in honor of the 20th Anniversary of the National Center for Disease Control and Public Health (NCDC) of Georgia, with which STCU successfully implemented more than 10 projects over the years. Moreover, the 43rd Meeting of the STCU Governing Board took place on December 7, 2016 in Tbilisi, and new projects of approximately $7.2M were approved. The ISTC Governing Board also met in Tbilisi (on December 6th), marking the first time the two Centers held back-to-back Governing Board meetings in the same city. These coordinated meetings provided the opportunity to organize a visit by a joint ISTC-STCU delegation, which I had the pleasure to lead, to the Secretariat of the CBRN CoE SEEE region. As you see, synergies in this region are as strong as ever.

In light of these achievements let me once again congratulate the Center for the results achieved in these, now, 21 years. Larger projects, strong efficiency, a demonstrated CBRN security focus and the proven ability to cooperate effectively with partner countries and organizations allow me to state with confidence that the 2013 change to the vision and mission statements are being pursued and implemented properly.

Thanks to these efforts, STCU has established itself as a key, reliable player in the field of CBRN security in the region and on the global stage.

After all this good news, let me finally address a "sad" special thanks to some of our friends who, after having contributed for a long time to STCU's success, recently departed their positions. I am referring to Mr. Adriaan Van der Meer, Ms Anne Harrington and Mr. Simon Limage. Thank you, and thank you all.

STATEMENT OF THE STCU EXECUTIVE DIRECTOR

Curtis "BJ" Bjelajac

STCU Executive Director

In 2016, the STCU celebrated 20 years of operations, serving the program needs of the STCU Parties in pursuit of their WMD nonproliferation and CBRN security policy objectives. The STCU held its 20th Anniversary event in Kyiv on April 6, 2016, in conjunction with its 42nd Governing Board meeting, and is grateful for the hospitality of the Government of Ukraine (especially the Ministry of Education and Science) in making both events a resounding success.

Furthermore, for the first time ever, the STCU and ISTC held back-to-back Governing Board meetings (43rd and 63rd respectively) in December 2016 in Tbilisi, Georgia, allowing both Boards the chance to work together, as well as to sample for themselves the legendary Georgian hospitality. Special thanks go to Marine Chitashvili, Director General, and her team at the Shota Rostaveli National Science Foundation in hosting both Centers' Board meetings. These back-to-back meetings are a good example of the ever increasing cooperation between the STCU and ISTC, which allows both Centers to leverage each other's strengths and assets in these times of declining resources.

The highly successful program of STCU co-funding projects with the national S&T authorities of Azerbaijan, Georgia, Moldova, and Ukraine (formerly known as the Targeted R&D Initiatives Program) continued through its eleventh year of project solicitations, approvals, and co-funding cycles. Since the program's inception in 2005, the Parties approved over $23M of projects, with 50% of that total funding provided by Azerbaijan, Georgia, Moldova, and Ukraine, and the remainder financed by Canada, the European Union, and the United States of America. Unfortunately, due to fiscal constraints on the part of the EU and US, expansion of the program beyond its current ceiling of annual pledged funding amounts is not possible (a combined total of approximately $1.25M from the EU and US).

The STCU Partner Program continued to struggle in 2016, with the approximately $5.5M of new funding only slightly higher than the $4.3M registered in 2015. However, both amounts for 2015 and 2016 are down significantly from recent years (2009 – 2013) when new funding from Partners averaged just over $10M per year. The ongoing war in Donbas and uncertainties in the Ukrainian economy are continuing to weigh on the Partner Program, especially in the case of Non-Government Partners.

Despite the disappointing amount of funding, 2016 did however bring some very good news in relation to the future of the STCU Partner Program. On July 14, 2016 the STCU signed a basic ordering agreement (BOA) with the US DoD-DTRA which has an

ordering period of five years and a maximum ceiling of $10M. The ISTC signed a similar BOA with the US DoD-DTRA as well in July. The agreement allows DTRA to possibly use the Centers to manage its Cooperative Threat Reduction (CTR) program in the countries that the two Centers operate. Next steps are for both the ISTC and STCU to investigate suitable projects for DTRA to put through the Centers utilizing the BOA mechanism.

In 2016, the United States requested the STCU's assistance in a project very much in line with the new STCU vision and mission statements which focus on CBRN risk mitigation at both the regional and international level. In late October 2016, the Islamic State in Iraq and the Levant (ISIL) ignited stockpiles of sulfur to hinder Iraqi and coalition advances near Mosul. According to press and diplomatic reporting at the time, the fires and associated smoke killed at least two and hospitalized eighty. The US Department of State's Global Threat Reduction program partnered with the STCU to rapidly procure and freight 374,000 liters of foam capable of extinguishing the fires. By the end of November 2016, the STCU procured and freighted approximately $2.6M worth of foam to Baghdad, for further delivery to Mosul. This project is a concrete example of where the STCU can assist in resolving urgent, international CBRN threats.

The excitement of the success of the Iraqi foam project in 2016 unfortunately did not go without a matching disappointment in the failure to extend the EU funded Odessa Ukrainian Anti-Plague Research Institute (UAPRI) Bio-Security Improvement project. Due to a cabinet reshuffling in April 2016, the Minister of Health of Ukraine (Minister Kvitashvili) and most of his team departed their posts by the end of May 2016. Given the approaching deadline for the project (scheduled to finish in late August 2016), and the significant change in Ministry of Health personnel, the EU advised the STCU in mid-June that the project would not be extended, and asked the STCU to initiate all steps to close the project. In early July 2016, a letter was sent by the European Commission to the Acting Minister of Health informing him that the project would not be extended. The STCU returned all funds on hand to the EU in December 2016. The STCU Secretariat sincerely regrets the closure of this project short of its intended goals.

New project funding in 2016 more than doubled over the previous year (from $4.7M to $11.1M), due in large part to the aforementioned $2.6M project to assist with the extinguishment of the Mosul fires in Iraq. Furthermore, with the approval of the 2015 co-funding of projects cycle with the national S&T authorities of Azerbaijan, Georgia, Moldova, and Ukraine pushed into early 2016, $1.5M of project funding shifted out of 2015 and into 2016. However, the amplitude of change in funding levels from 2015 to 2016 is an example of what STCU management believes will be the only constant in funding in the near future - volatility.

In closing, I would like to take this opportunity to recognize a number of long-time STCU friends who departed their positions because of retirement or due to the change in the US Presidential Administration. First, I would like to thank Mr. Adriaan van der Meer, former Executive Director of the ISTC, and most recently the Head of Unit of the Instrument contributing to Stability and Peace (IcSP) at the European Commission's DG DEVCO for all his efforts to help both Centers, especially the ISTC during its difficult transition from Moscow to Astana. Second, I would like to also thank US Deputy Assistant Secretary of State Mr. Simon Limage, the STCU and ISTC Board Member from the United States, who as one of the longest serving Board members helped both Centers to increase their cooperation, especially in areas facilitating leaner, more efficient operations. Finally, I would like to thank Ms. Anne Harrington, Deputy Administrator for Defense Nuclear Nonproliferation for the National Nuclear Security Administration of the US Department of Energy, who was a pioneer (often taking a lot of arrows, as most pioneers do) in the establishment of both Centers from her days working at the US Embassy in Moscow, as well as during her tenure at the US Department of State (where I had the pleasure of first meeting her), until most recently looking for ways the Centers can help her numerous programs at the US Department of Energy. On behalf of the entire STCU Secretariat I would like to wish our friends all the best in their future challenges. 2017 will be that much more difficult without them by our side.

HIGHLIGHTS AND ACCOMPLISHMENTS

TRILATERAL MEETING WITH UKRAINE, POLAND, AND THE UNITED STATES REGIONAL COLLABORATION ON BIOLOGICAL SECURITY, SAFETY, AND SURVEILLANCE

On October 3-4, 2016 in Lviv, Ukraine, a tri-lateral meeting with representatives of Ukraine, Poland, and the United States of America convened to discuss regional collaboration on biological security, safety, and surveillance. Attendees included government and scientific experts, who discussed regional (Ukraine and Poland) cooperation in surveillance and prevention of especially dangerous infectious diseases, including zoonotic diseases in Ukraine and neighboring countries.

Ukraine's delegation included representatives of the Ministry of Foreign Affairs (O. Kapustin), Ministry of Health (Dr. N. Vydaiko), Ministry of Defense (M. Usatyi) and State Service of Ukraine on Food Safety and Consumer Protection (M. Bilous). Scientific experts from the Institute of Laboratory Diagnostics and Veterinary-Sanitary Expertise in Kyiv and Lviv's Institute of Epidemiology and Hygiene also took an active part in the discussions.

The Chief Veterinary Officer of the National Veterinary Research Institute in Pulawy, Mr. W. Skorupski, led the Polish delegation which included subject matter experts from the same organization.

The United States delegation included representatives of the US Department of Defense DTRA (K. Garrett, G. Braunstein, W. Sosnowski, and J. Wintrol), as well as representatives of the Black & Veatch and Metabiota corporations (D. Mustra, Dr. M. Guttieri, S. Anderson, T. Borth and others). Curtis "BJ" Bjelajac, Executive Director, and Vlada Pashynska, Senior Specialist represented the STCU.

The meeting focused on existing frameworks, regulatory coordination, and ongoing cooperative projects in research, surveillance and diagnostics of a number of dangerous zoonotic diseases, such as avian influenza, leptospirosis, Crimea Congo hemorrhagic fever, and brucellosis. A special session was devoted to the current increase in cases of African Swine Fever (ASF) in both Ukraine and Poland. Delegates discussed countermeasures and possible cooperation between the Ukrainian and Polish veterinary services and their specialists, to develop more effective approaches to eradicate and control the spread of ASF in Ukraine, Poland, and other European countries.

THE 42ND MEETING OF THE STCU GOVERNING BOARD APRIL 5-6, 2016; KYIV, UKRAINE

The Forty-Second Meeting of the Governing Board of the STCU convened on April 5-6, 2016 in Kyiv, Ukraine, in the Ministry of Education and Science. Officials from the STCU Governing Parties of the European Union, Ukraine, and the United States of America participated in this meeting. Also present were government officials and other representatives from the Delegation of the European Commission, the Embassy of the United States of America, the Shota Rustaveli National Science Foundation, and the Academies of Science of Azerbaijan and Moldova.

This 42nd Governing Board Meeting took place on the occasion of celebrating 20 years of STCU operations. The very first meeting of the STCU Governing Board took place on December 14-15, 1995 in Kyiv, Ukraine. At that first Governing Board meeting, representatives from Canada, Sweden, Ukraine, and the United States of America approved the STCU operating procedures, statutory documents, and approximately $1.7M in cooperative research projects involving former weapon scientists in Ukraine. The Governing Board also participated in the 20th Anniversary festivities at the Great Hall of the Academy of Sciences of Ukraine, where senior officials from all the STCU Parties, as well as institute directors, leading scientists, and former members of the STCU Secretariat gathered to celebrate the achievements of STCU over its 20 years of operations.

At the 42nd meeting, the Governing Board approved one new government funded scientific project for a total of €1,697,563. The Governing Board also confirmed three new Partner Projects valued at $120,014, and confirmed nine Partner Project contract extensions valued at $550,227 and €132,226.

The Governing Board also approved five STCU-Azeri co-funding projects, totaling $199,997 and €43,569, with $249,334 in matching funds from the Azeri National Academy of Sciences, six STCU-Moldovan co-funding projects, totaling $124,615 and €22,078, with $149,615 in matching funds from the Moldovan Academy of Sciences, nine STCU-Ukrainian co-funding projects, totaling $199,909 and €220,758, with $449,896 in matching funds from the Ukrainian Academy of Sciences, and eleven STCU-Georgian co-funding projects, totaling €339,756, with $384,739 in matching funds from the Shota Rostaveli National Science Foundation.

The Governing Board confirmed its support for the launch of new Targeted Initiatives Programs (thematic funding) which will involve cooperation with the ISTC and focus on the following areas: Radiological Source Risk Mitigation in Well Logging Applications, Seismic Monitoring and Hazard Mitigation, Clean/Renewable Energy & Energy Efficiency Development, and Export Control.

HIGHLIGHTS AND ACCOMPLISHMENTS

STCU EXECUTIVE DIRECTOR ATTENDS 2016 SCIENCE DAY IN UKRAINE EVENT

STCU Executive Director, Curtis “BJ” Bjelajac, participated in the Day of Science in Ukraine organized by the Ministry of Education and Science on May 20, 2016.

During the event, Mr. Bjelajac delivered short remarks congratulating Ukrainian scientists and educators on this important day. High-level Ukrainian government officials also attended the event including: the Vice Prime Minister Mr. Vyacheslav Kyrylenko, the Minister of Education and Science Mrs. Lilia Hrynevych, and the Deputy Minister of Education and Science Mr. Maksym Strikha, who also represents Ukraine on the STCU Governing Board.

At the conclusion of the event, Ukrainian scientists and educators received awards and diplomas for their design and implementation of innovative technologies.

STCU HANDS OVER EQUIPMENT TO UKRAINIAN BORDER GUARDS

On April 7, 2016, the STCU Chairman and Executive Director attended a ceremony at which the STCU formally handed over equipment and materials worth € 3.7M to the Ukrainian State Border Guards. The items provided will be used to enhance Ukrainian capabilities to detect and identify chemical, radiological and nuclear materials both at the border crossing checkpoints and inside their territory. The equipment includes: mobile detection laboratories; gamma and neutron detectors; personal dosimeters; chemical detectors; and isolating protective wear.

The equipment handed over to the Ukrainian State Border Guards is part of a larger STCU project with the European Commission which included assistance to the Ministry of Interior of Moldova as well. In total, the project financed equipment and material purchases worth € 4.1M.

All across the region, intermediate-level and low-level radioactive sources connected with former military activities, sites, and enterprises, which used radioactive materials and which were liquidated in the 90-ies, still remain a problematic issue even today. During the last four years alone, the Ukrainian Authorities detected approximately 100 cases of illicit trafficking of RN materials. Thus, it was clear that the control of the borders in the region for illicit trafficking of CBRN materials needed to be reinforced, and was the raison d'être for the initiation of this project by the European Commission.

THE 43RD MEETING OF THE STCU GOVERNING BOARD DECEMBER 7, 2016; TBILISI, GEORGIA

The Forty-Third Meeting of the Governing Board of the STCU convened on December 7, 2016 at the Shota Rostaveli National Science Foundation in Tbilisi, Georgia.

At this 43rd meeting, the Governing Board approved one new government funded scientific project for a total of $2,558,688. The Governing Board also confirmed thirteen new Partner Projects valued at $365,377 and €1,335,887, and confirmed twenty-one Partner Project contract extensions valued at $2,335,767 and €451,077.

The Governing Board also approved the 2017 Administrative Operating Budget and Supplement Budget requests from the STCU Secretariat.

The Governing Board confirmed the one-year extensions of both the Executive Director, Mr. Curtis “BJ” Bjelajac, and the Senior Deputy Executive Director, Mr. Ihor Lytvynov.

The 43rd STCU Governing Board meeting is the third time that the STCU Governing Board met in Georgia. The Board also met in Georgia on June 16, 2005 for its Twentieth Meeting, and on May 27, 2010 for its Thirtieth Meeting.

On April 6, 2016, the STCU held its 20th Anniversary celebration in the Great Hall of the National Academy of Sciences of Ukraine in Kyiv, Ukraine. More than 150 people joined in the celebration, including ambassadors of all STCU Parties (Azerbaijan, the EU Delegation, Georgia, Moldova, and the United States of America); as well as senior Ukrainian government officials, including the Minister of Health of Ukraine. Attendees also included senior government officials from the United States of America and the European Commission. Many leading S&T institute directors, scientists, and current and former STCU Secretariat staff joined in the festivities as well.


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ng regional CBRN detection capacity
order Guards in Ukraine and Moldova
for Ukraine: € 3,650,000 and for Moldova: € 450,000
ANNIVERSARY

STCU 20th ANNIVERSARY

The STCU was the first intergovernmental organization in Ukraine, established by an agreement signed on October 25, 1993 by the four founding Parties: Canada, Sweden, Ukraine, and the United States of America. The agreement came into force on May 4, 1994, when Ukrainian President Leonid Kravchuk issued a decree accepting the STCU Agreement. The STCU became fully operational when it established its technical Secretariat and held its first Governing Board meeting on December 14-15, 1995. It's the occassion of this first Governing Board meeting that STCU celebrated two decades of work towards creating a better, safer world.

Subsequently, the European Union acceded to the STCU Agreement in November 1998, replacing Sweden as a Party. Over the years, Azerbaijan, Georgia, Moldova, and Uzbekistan also joined the STCU. Finally, Japan has also participated as a special sponsor of STCU projects. Today, the STCU, headquartered in Kyiv, has offices in Baku, Chisinau, Tbilisi, and Kharkiv.

From the first STCU Governing Board meeting in 1995 through the April 6th, event, STCU sponsored more than 1,700 cooperative science research projects amounting to over $274M in research grants to Ukrainian, Azerbaijani, Georgian, Moldovan, and Uzbek scientists. Furthermore, STCU engaged nearly 21,000 scientists, of which approximately 12,000 were former weapons scientists during the Soviet era.

From 1995 until the April 6th, event, STCU awarded $274M in project funding to scientists and technicians in the STCU Parties as follows:

- Azerbaijan $7.0M
- Georgia $16.6M
- Moldova $3.2M
- Ukraine $230.7M
- Uzbekistan $16.5M

The STCU also connected these scientists to a variety of governmental and non-governmental partners. From 1995 through April 2016, STCU managed over $124M in R&D projects sponsored by these external partners, including governmental programs and American, Canadian, and European businesses. Since 1995, project funding contributions from STCU Parties and other donors breaks down as follows:

- Canadian Government $10.0M
- European Commission $62.0M
- Other European Government $7.8M
- Japanese Government $1.0M
- Swedish Government $1.7M
- US Government $144.5M
- All Non-Government $47.0M

STCU is proud to act as a catalyst for the "evolution to partnership" among former Funding and Recipient Parties. From the start of STCU's co-funding with the national S&T authorities of the

GUAM countries program in 2005 until the April 2016 event, STCU GUAM Parties have contributed generously to project funding (with every dollar matched with CA, EU, and US funds) as follows:

- Moldova $0.9M
- Azerbaijan $2.4M
- Georgia $2.1M
- Ukraine $5.2M
- Total $10.6M

PROJECT ACTIVITIES

STCU FACILITATES US EFFORT TO THWART ISIL CHEMICAL ATTACKS

In late October, the Islamic State in Iraq and the Levant (ISIL) ignited stockpiles of sulfur to hinder Iraqi and coalition advances near Mosul. According to press and diplomatic reporting, the fires and associated smoke killed at least two, hospitalized 80, and negatively affected coalition forces. The US Department of State's Global Threat Reduction program partnered with the STCU to rapidly procure and freight 374,000 liters of foam capable of extinguishing the fires.

From first contact by the US Department of State on October 24th, the STCU procured and arranged the first delivery of 52,000 liters to Baghdad on October 31st. Subsequent deliveries of the bulk of the remainder of the foam arrived in Baghdad by November 5th. The STCU's speed and flexibility in working with vendors in diverse places such as Sæbøvågen, Norway and Green Bay, Wisconsin, US as well as coordinating with colleagues in Washington, DC and Baghdad to respond to this timely and international crisis, demonstrated the continued value of the STCU to its Parties and its ability to advance it's CBRN security objectives worldwide.

PROJECT ACTIVITIES

PROGRESS ON FIRST RESPONDERS PROJECT

Funding amount: € 1,697,563

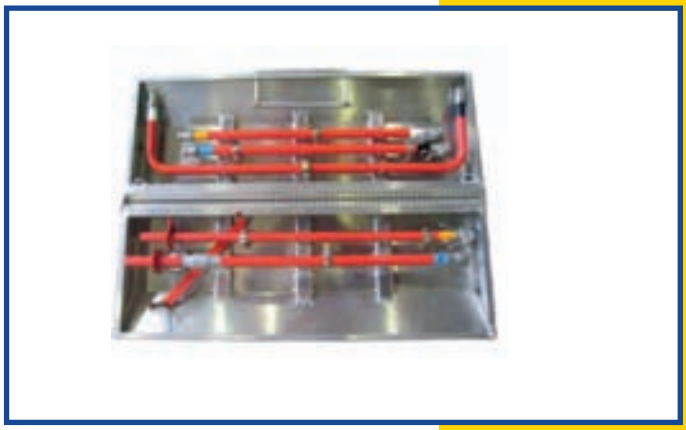
On December 11, 2015 the STCU signed a contribution agreement with the EU which provides €1.7M of funding to buy equipment and materials for first responders in the South East and Eastern Europe (SEEE) Region of the EU's CBRN Risk Mitigation Centers of Excellence (COE) Initiative. This project is unique in that it will test the STCU's ability to purchase equipment and materials for countries outside of STCU's traditional GUAM region. The project foresees purchases for the following countries: Albania, Armenia, Bosnia and Herzegovina, the Former Yugoslav Republic of Macedonia, Georgia, Moldova, Montenegro, Serbia, and Ukraine.

STCU's project is run in coordination with a project (CoE Project 44) implemented by SCK-CEN Belgium to provide training to first responders in the nine countries of the region. It will enable first responder organisations to respond more rapidly and more effectively to CBRN incidents by teaching personnel how to protect themselves, how to measure radiation, and how to quickly determine the most appropriate response to an incident.

Under this project (CoE Project 52) STCU will procure and supply CBRN detection, identification, and protection equipment, and provide basic training on the use of the equipment.

The training carried out by CoE Project 44 determined the required equipment list as follows:

- Chemical Protective Suits
- Full face protective masks
- Personal Dosimeters
- O_2 Detectors
- Colorometric Tubes
- Photo Ionisation Detectors
- Hand-Held Radiation Monitors
- Immunoassay Test Kits
- CWA Test Paper
- Kits for Marking Dangerous Areas
- Skin Decontamination Kits
- Neutralisation Agents
- Portable CBRN Decontamination Units



A large percentage of the equipment is classified as dual-use and requires the provision of export control permissions by the country of manufacture, as well as the provision of end user certificates by the recipient countries.

To date, despite facing significant challenges (i.e. nine different legal jurisdictions, various import and export control issues, etc.), the STCU is on track to deliver the required items to this very important COE region.

SUCCESS STORIES

DEVELOPMENT OF A NEW GENERATION OF MAGNETOCARDIOGRAPH

Participating parties | Funding amount: € 582,973

The Next Generation Magnetocardiography (NG-MCG) - Cardiomox MCG 9.

The Glushkov Institute of Cybernetics (GIC) is the leading informatics organization of the National Academy of Sciences of Ukraine. The Institute's staff successfully completed STCU Partner Project P624, "Development of a Method and Apparatus for 3D Imaging of Electro-physiological Activity of Biological Tissues". Oxford Cardiomox, Ltd., a UK-based high-tech company, financed the project which focused on the development of innovative non-invasive medical diagnostic devices and methods.

The project produced a prototype new-generation magnetocardiograph - the Cardiomox MCG 9 - a non-invasive medical diagnostic device for detecting heart disease. This device is equipped with an extremely sensitive SQUID (Superconducting Quantum Interference Device), which allows the magnetometer to measure the extremely fine magnetic fields produced by the heart. Clinicians can utilize this information to map a patient's biomagnetic signals and detect abnormalities. In addition, the device can be operated in an unshielded hospital environment, enabling the device to be used in any setting. The Cardiomox MCG 9 includes user-friendly software developed using clinical trial data.

Compared with other magnetocardiography equipment, the Cardiomox MCG 9 shows significant improvements in the following areas:

- A more user-friendly display of the quantitative analysis of set parameters; and
- The ability to show real-time 3-D density vector images at different heart tissue depths, as well as the tomography of such images.

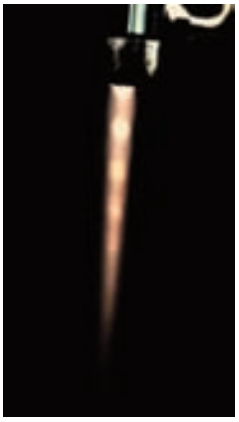
In creating the Cardiomox MCG 9, the project team explored, developed, and implemented innovative physical and mathematical approaches to improve the signal/noise ratio, as well as the spatio-temporal signal resolution of 3-D imaging of heart electrophysiological signals. As a result, the Cardiomox MCG 9 has an effective mapping technique for diagnosis and quantitative assessment of both regional and trans-mural disorders of the myocardium.

Given the successful results of Partner Project P624 (completed in late 2016), Oxford Cardiomox, Ltd. initiated a follow-on project with GIC to implement further improvements to this technology.

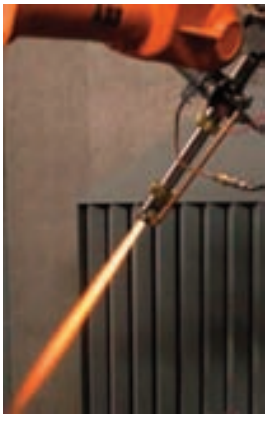
NEW POWER-SAVING TECHNOLOGY FOR THERMAL SPRAYING APPLICATIONS

Participating parties  Funding amount: $ 55,000

STCU Partner Project P642, funded by Canadian partner Sputtek, Inc., enabled a team of scientists from the E.O. Paton Electric Welding Institute of the National Academy of Sciences of Ukraine to develop a design for a versatile new Multi-Chamber Detonation Sprayer (MCDS) that can apply high-quality coatings much more effectively than current technology.



a)



b)

Fig 1 The pulsed flow of combustion products: a) without powder; and b) with powder.

The newly developed MCDS's advantage compared with existing systems is that it harnesses the detonation energies released during the combustion of fuel gas mixtures from specially developed detonation chambers to generate velocities in the laboratory of up to 2,100 m/s, and pressure readings of up to 3.2 MPa. The project team demonstrated that the rate and temperature of the combustion ultimately depends on the parameters of the fuel gas mixture utilized in each chamber.

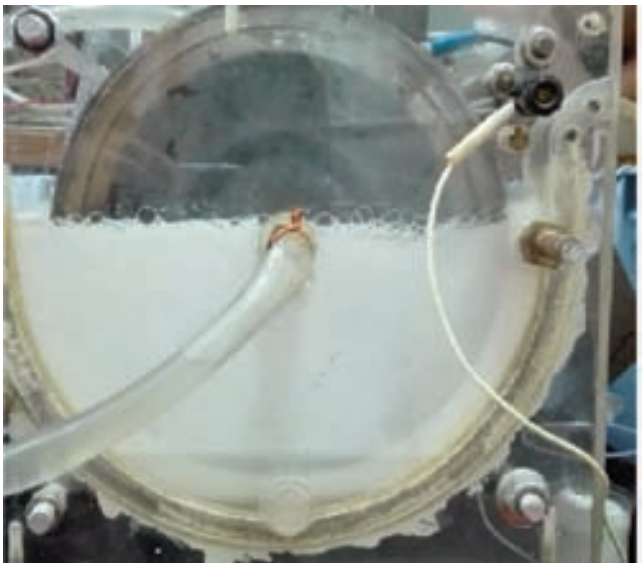
To attain the desired results, the project team accelerated a coating powder using combustion products formed in the MCDS chambers, which concentrates the mixture before sending it to the nozzle, where it interacts with the two-phase gas-powder cloud, achieving velocities of up to 1,000 m/s. The newly developed MCDS device provides extremely high-deposition efficiency for cermets and ceramic powders, 80-90% and 50-70%, respectively. Fig 1(a) shows the pulsed flow seen when a sprayer does not utilize the additive powder, versus Fig 1(b), which shows the pulsed flow exhibited when the powder is utilized.

The MCDS developed by this project (Fig 2) can be used to apply high-quality coatings to materials and components utilized in sectors as diverse as energy and aerospace. To capitalize on the results of the project, the project team filed patents on the new MCDS design (Ukrainian patents №. 103465 and 83831).

Fig 2 Equipment developed for MCDS coating application.

THE ELECTROPHYSICAL PROCESSING OF WHEY TO MORE EFFICIENTLY OBTAIN HEALTHY AND ENVIRONMENTALLY SAFE PRODUCTS

Participating parties   Funding amount: $ 50,000



Membrane electrolyzor EDC-3

Whey, a dairy byproduct, is an excellent source of protein for the human diet. STCU Project 6011 investigated via electrophysical processing, a method for recovery of whey proteins into protein-mineral concentrates (PMCs) without commonly used chemical additives. The project utilized a process called electro-fractionation of PMCs and deproteinized whey (DW), to assure the **simultaneous** processing and isomerization of lactose into lactulose. Depending upon the processing mode utilized, the project team demonstrated the ability to isolate approximately 70% of whey proteins with various levels of mineral content.

During the course of the project, the team developed EDC-3 (see picture above), a prototype membrane electrolyzer to experiment with the geometric-constructive parameters of all six electrolyzers of different conductivity, recovering the different types of whey proteins described below. This unique approach reduces the amount of energy required during the separation process by 50%.

- High Weight Proteins (HWP) are proteins that contain: (a) bovine serum albumine – a protein with a high content of essential amino acids; (b) lacto-peroxidase - a protein with peroxidase enzyme properties that function as a natural antibacterial agent, and (c) lactoferine - a natural antioxidant which also contains antiviral, antibacterial, and antifungal properties which can regulate iron absorption and bioavailability;
- Caseins (CSN) are proteins that are a good source of amino acids and carbohydrates, as well as two inorganic elements - calcium and phosphorus;
- Beta-lactoglobulins (β-Lg) are proteins that are an excellent source of essential and branched-chain amino acids that can bind fat soluble vitamins, as well as increase their bioavailability;
- Alpha-lactalbumins (α-La) are proteins which contain the best profile of essential and branched-chain amino acids (i.e. valine, leucine, and isoleucine), as well as tryptophan, an amino acid which helps regulate sleep, mood, and stress.

The EDC-3's yields are excellent, with the project team obtaining up to 12.5 kg of PMCs and 30 kg of lactulose per ton of whey. Given retail prices of $100-150/kg for whey protein concentrates similar to PMCs and $100/kg for lactulose, as well as very low production costs (whey costs approx. $3/ton, and the energy required to process it costs approx. $2.2/ton), the newly developed approach can generate profits (in a laboratory setting) of approximately $4,000 per ton of whey.

The project team is currently working with dairies, food processors and the pharmaceutical industry to determine interest, as well as to develop new industrial approaches that would allow the project team to capture the same yields in mass production as realized in the laboratory environment, thus unlocking the profit potential of this newly developed technology.

RESEARCH ON AFRICAN SWINE FEVER THREAT REDUCTION THROUGH SURVEILLANCE IN UKRAINE: SURVEILLANCE OF POTENTIAL ARTHROPOD VECTORS

Participating parties   Funding amount: $ 285,458

African Swine Fever (ASF) is a highly contagious hemorrhagic disease carried by pigs. When uncontained, it can quickly threaten the pork industry. The African Swine Fever Virus (ASFV) has spread rapidly to the edges of Europe, with outbreaks reported in Ukraine, Belarus, and the Russian Federation. In these regions, the virus is currently uncontained in both domestic and wild pig populations, putting the very large pig populations and agribusinesses present in those markets at risk.

In Ukraine alone, more than 180 cases were reported between 2012 and 2017, leading to the culling of approximately 80,000 pigs and resulting in estimated losses of approximately $14.0M to the Ukrainian economy. During that period, 20 of Ukraine's 24 oblasts reported cases of ASF. To prevent the spread of the disease in Ukraine, veterinary authorities from Ukraine teamed up with colleagues in Poland and the Baltic States to establish buffer zones on the borders with the Russian Federation and Belarus.

STCU project P609, funded by the US Department of Agriculture, enlisted a research team from the National Scientific Center's Institute of Experimental and Clinical Veterinary Medicine in Kharkiv, Ukraine (NSC IECVM) to implement transmission (also known as a "vector") surveillance in selected regions of Ukraine, with the goal of establishing approaches that may be used at the national level.

ASFV is naturally maintained by a cycle of transmission between wild boars and the soft tick. The virus is then spread to domestic pigs by the bite of an infected soft tick or by ingestion of infected wild pig tissues. Certain soft tick species of the genus Ornithodoros can serve as biological vectors and reservoirs of ASFV as well as over 70 other human and animal viral, bacterial, and parasitic pathogens. Soft ticks of this group were first discovered in Ukraine in the 1950s, despite the belief of many Western European scientists that they are not normally found north of Turkey or the Balkans. The project team from NSC IECVM focused on this soft tick species, conducting surveys to clarify soft tick distribution patterns throughout Ukraine.

Sampling soft ticks in the field.

Field samples were identified morphologically as Ornithodoros verrucosus, and live specimens were used to establish a laboratory colony of this suspected ASFV vector at the NSC IECVM. During the project, scientists from NSC IECVM developed research capabilities in soft tick biology, collection methods, rearing and colonization techniques, and vector-host pathogen interactions.

The project's results were published in two international peer-reviewed journals, as well as presented at five national and international ASF conferences.

ASSESSMENT OF GEOLOGICAL HAZARDS IN THE SOUTH CASPIAN OIL AND GAS BASIN (ABSHERON-PRIBALKHAN)

Participating parties   Funding amount: $ 50,000

Earthquakes in the Caspian Sea cause potential seismic hazards for oil and gas deposits in the Central Caspian (1986-1989, magnitude (M) = 6.1-6.3), Northern Caspian (1963, M=6.3) and Southern Caspian (2000, M=6.2-6.3) seismic zones. The study area is one of the more significant places in the formation of geodynamic processes in the Caspian Sea. Earthquakes occur here and deformation happens under the influence and effect of Central Caspian geodynamic conditions.

STCU Project 6014 used geodynamic and seismic monitoring, and cluster and fractal analysis to reveal the cyclic and representative occurrence of seismic events. The project utilized Alan Factor analysis and the coefficient of variation (CV) to the sequence, as well as the multidimensional alignment method for the earthquakes that occurred between 1842 and 2015 (see Fig 1) in order to learn the dynamics of a series of seismic events occurring in the Absheron-Pribalkhan threshold, to clarify the distribution process of earthquakes, and to reveal the characteristics of the seismic regime of the area.

During the project, the team developed cumulative graphs approximating the consequence of earthquake rates by energy class (K) varying between values 11-14 (roughly for comparison K11~M4; K13~M5). Among them, the most important (see Fig 2) reflects the peculiarities of the seismic regime of the Absheron peninsula.

Clearly observed slopes with the energy class K=13 are inter-related with the “disturbance” of

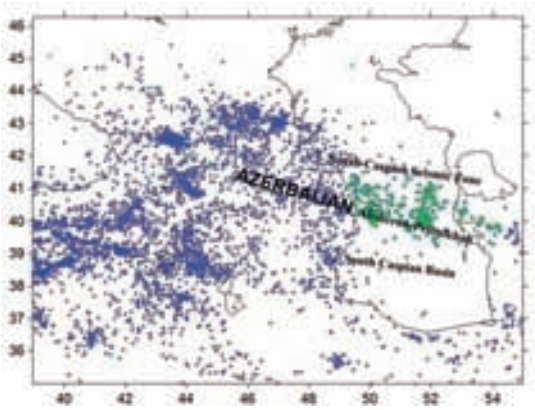


Fig 1 Seismic event distribution for 1842-2015

stationarity of the seismic regime in the periods between 1968 and 1971, as well as 1998 and 2002, pointing to a discrepancy in the earthquake re-occurrence cycle. However, earthquakes with energy classes 11 and 12 are characterized by a smoothly distributed rhythm. Sharp deviations of

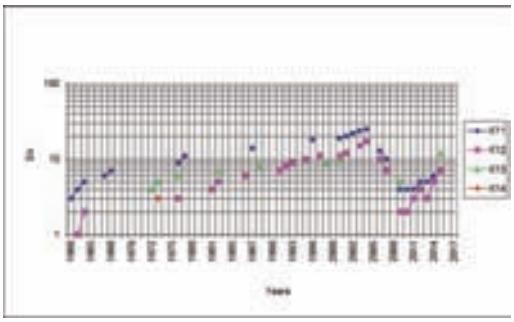


Fig 2 Cumulative graph of Absheron peninsula earthquakes between 1931 and 2016 (Cumulative number of earthquakes; K – energy class of the earthquakes).

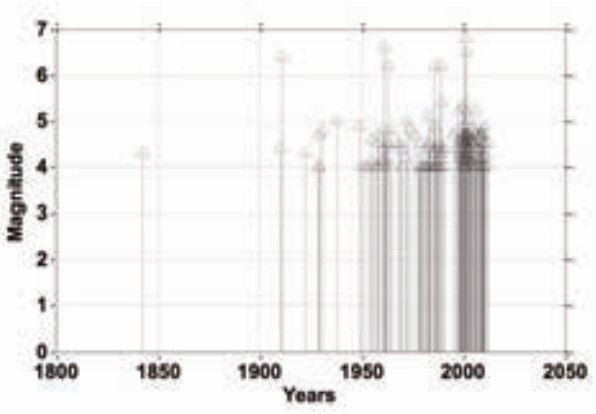


Fig 3 Time-magnitude distribution of events in the investigated area, with magnitude M≥4. Approximately three sub-sequences can be identified: (i) from 1910 to 1938, (ii) from 1949 to 1991 and (iii) from 1995 to 2015. In period (i) only nine events occurred, while in period (ii) 83 events, and in period (iii) 101 events were detected.

slope on the cumulative plots points to the occurrence of strong events in the region in 1935, 1961, 1963, 1986, 1989, 2000, 2004, 2010, and 2014.

The project's analysis revealed the presence of time-clustered structures in the time dynamics of large events in the Absheron-Pribalkhan region. The analysis suggests a non-Poissonian (clusterizing, non-random process, thus implying correlation and dependence among the events) behavior of the seismicity of the area, contributing to a deeper understanding of the time dynamics of the seismicity and a better assessment of the relative seismic hazard.

The results of this project will be used to better understand the seismic risks for the oil and gas deposits of the Caspian Sea and the Absheron peninsula. Analysis of the project data will allow the study and comparison of changes in the seismic activity over time, with an eye to assessing the potential threat of seismic activity in the future. Obviously, the ability to forecast such seismic activity would have commercial benefits for both oil and insurance companies, and the project team is currently working with potential partners to valorize the project results.

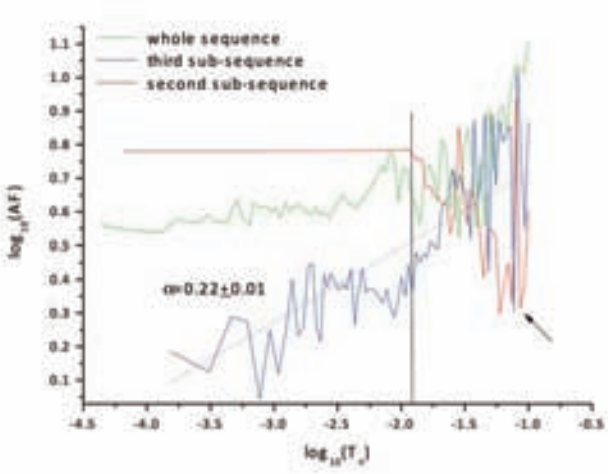


Fig 4 Allan Factor analysis for the three sub-sequences as indicated in Fig 3

FINANCIAL ACTIVITY IN 2016

2016 saw a drastic increase in the amount of new STCU project funding compared with 2015. In 2016, the STCU Governing Board approved just over $11.2M in new projects, an increase of approximately $6.5M in total new project funding compared with 2015. The drastic increase in total new project funding in 2016 was partly due to an administrative delay in 2015 co-funding of projects with the national S&T authorities of Azerbaijan, Georgia, Moldova, and Ukraine (formerly known as the Targeted R&D Initiatives Program), which meant that about $1.5M of funding was pushed into 2016. In addition, the STCU's project to rapidly procure and freight $2.6M worth of foam capable of extinguishing the fires set by ISIL in Mosul, Iraq also added to the year's total. 2017 funding is expected to decrease slightly (barring unexpected projects of the magnitude of the Iraq project) to approximately $10.0 - $11.0M. 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 $6.0 - $10.0M annually.

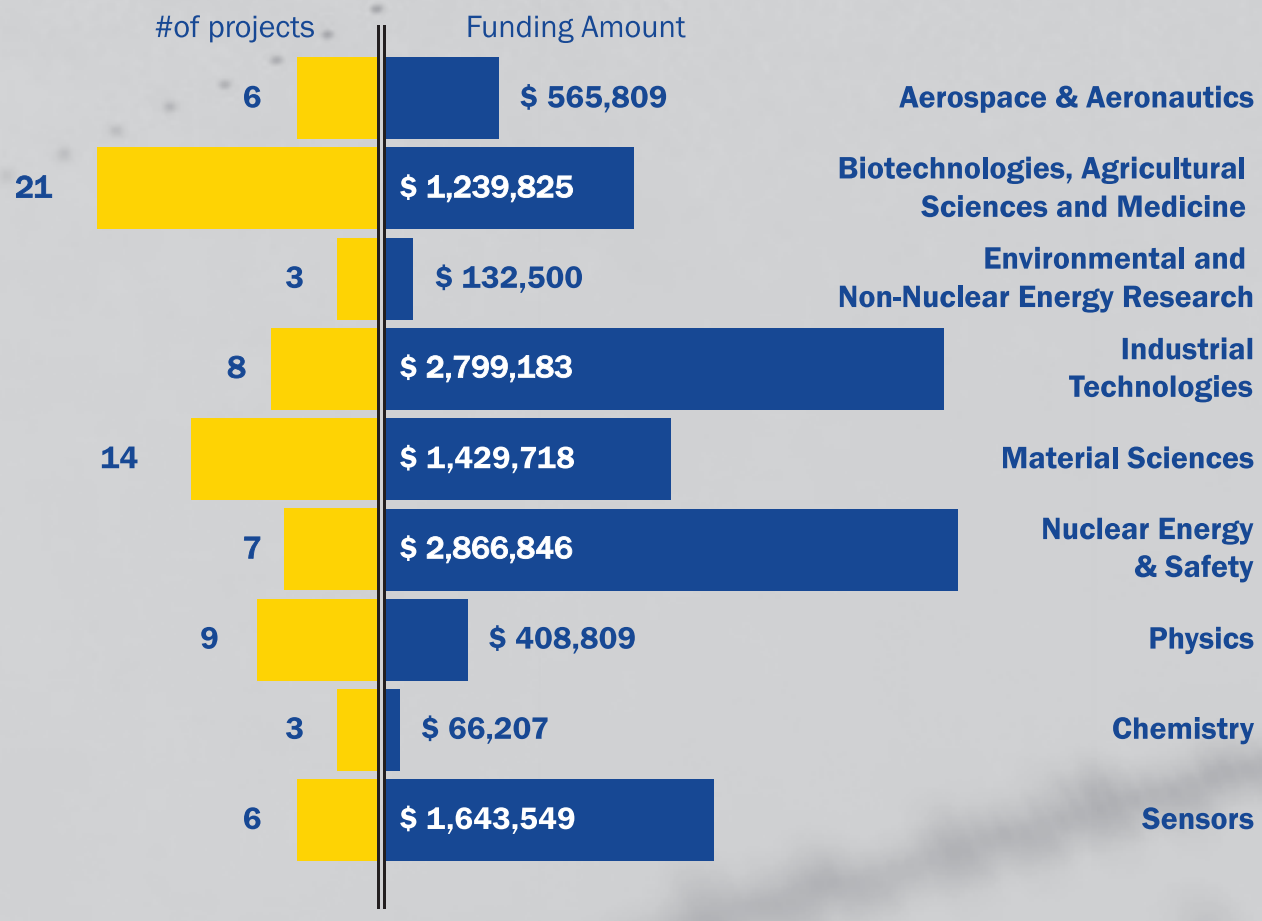
New partner project funding in 2016 increased compared to 2015, but this was not surprising, as 2015 was one of the lowest in recent memory. The $5.5M of new partner project funding in 2016 was $1.2 M more than that received in 2015, and was on par with 2004 and 2005, when the amount of funding was $5.8M and $4.5M, respectively. In 2016, new project funding from all partner organizations represented 49.1% of the total amount of new STCU project funding. This percentage is much lower than the 80% of total funding the STCU has received from partner organizations in recent years, and reflects the pivot to much bigger regional/international projects (i.e. Iraqi foam, UA & MO Border Guards) initiated by the US and EU recently.

For the fifth 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.intMdocumentsMstcu□infMreportsMauditM2016M*** Some weaknesses were identified in conjunction with the December 31, 2016 financial statement audit and will be corrected during the course of 2017.

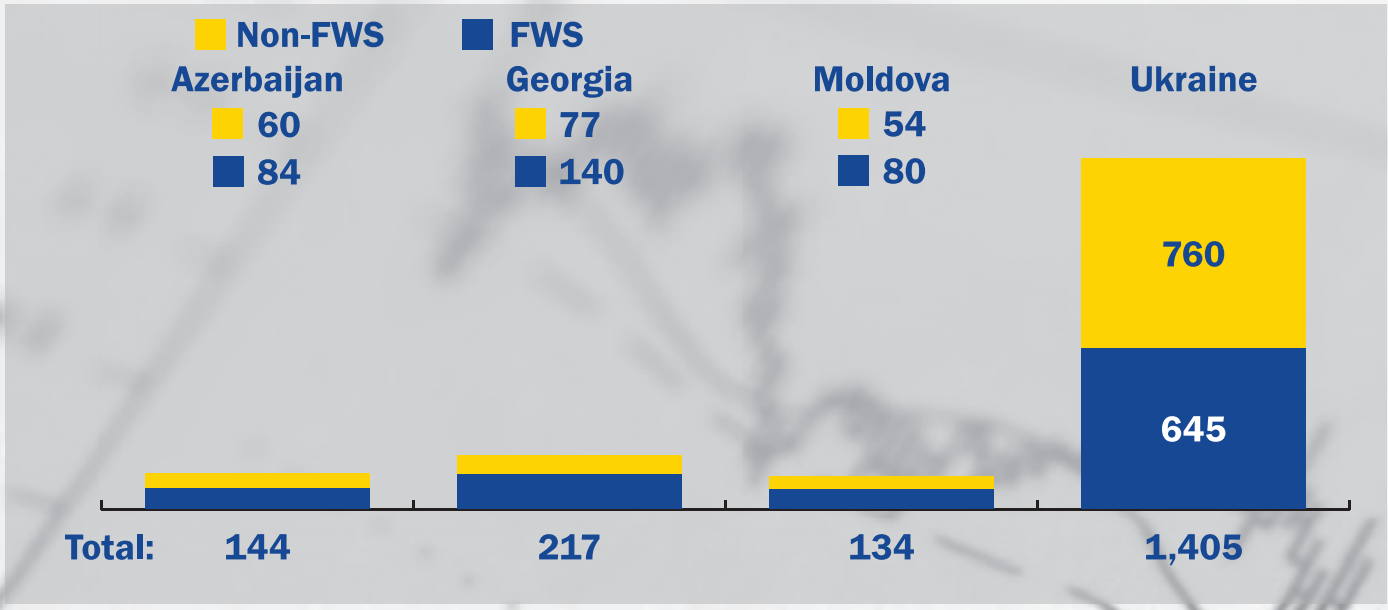
New Project Funding in 2016 by SOURCE:

US: United States
$ 3,033,209
EU: European Union
$ 2,630,148 (€ 2,369,503)
GP: Governmental Partners
$ 2,845,266
NGP: Non-Governmental Partners
$ 2,643,823
Total: $ 11,152,446

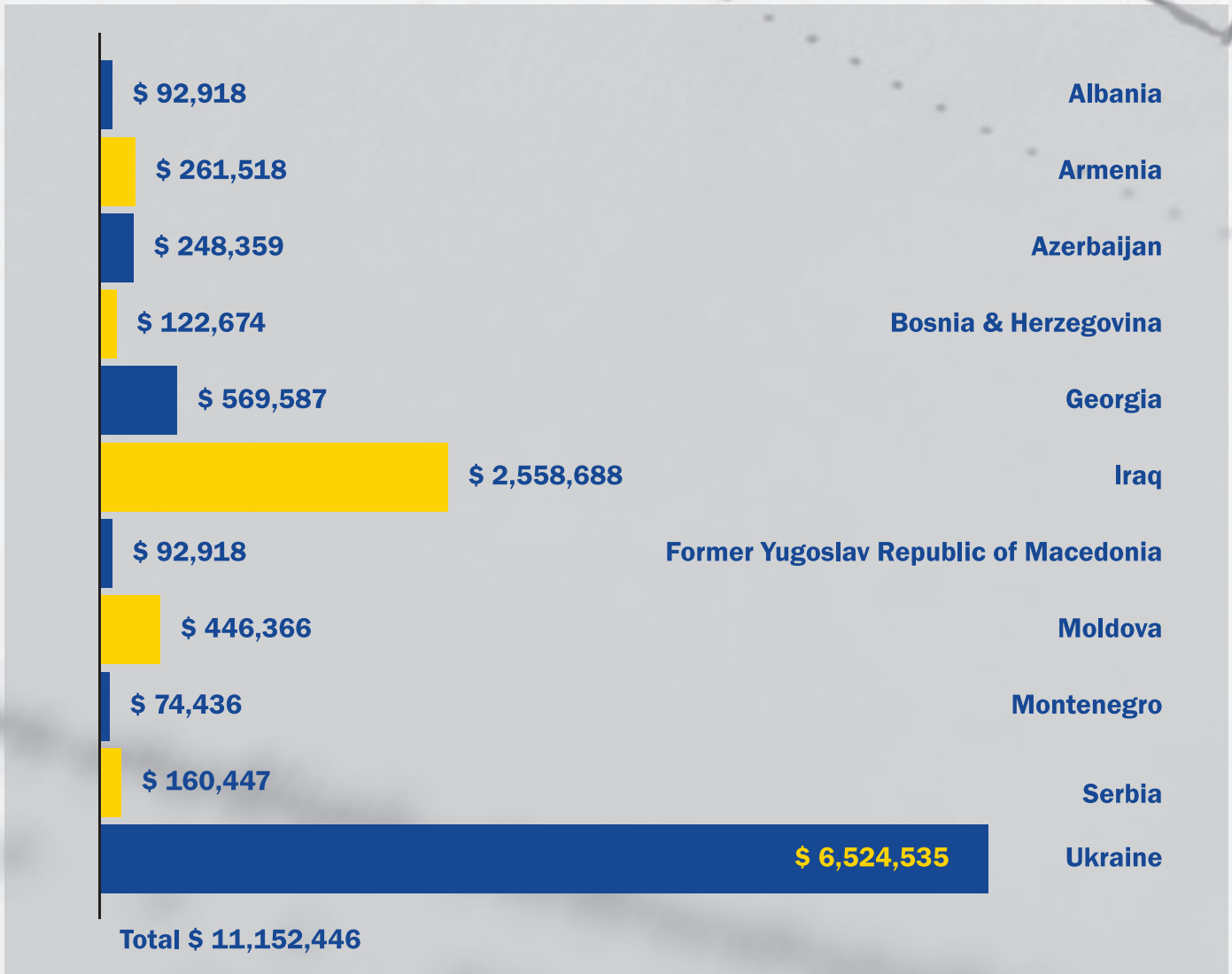
New Project Funding in 2016 by PRIMARY TECHNICAL AREA:



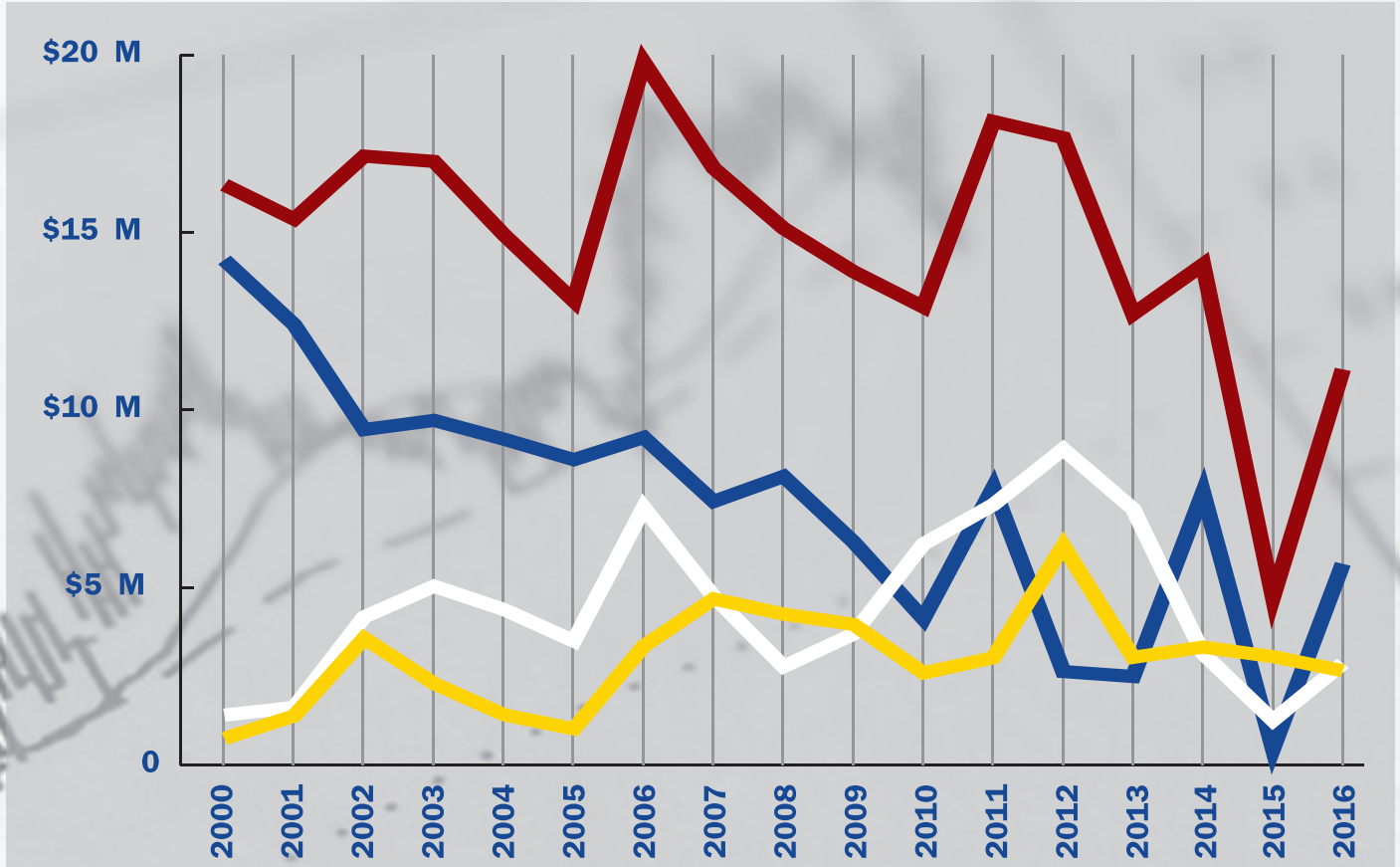
Participants Redirected on STCU Projects During 2016 by LOCATION OF RECIPIENT ORGANIZATION:



New Project Funding in 2016 by LOCATION OF RECIPIENT ORGANIZATION:



Regular/Partnership Funding, 2000-2016 (funding in millions USD/year)



Regular/Co-Funding with S&T Authorities	$14.2 M	$12.4 M	$9.5 M	$9.7 M	$9.2 M	$8.6 M	$9.2 M	$7.4 M	$8.1 M	$6.3 M	$4.1 M	$7.8 M	$2.6 M	$2.5 M	$7.7 M	$0.4 M	$5.7 M
Non-Governmental Partners	$0.7 M	$1.4 M	$3.6 M	$2.3 M	$1.4 M	$1.0 M	$3.3 M	$4.7 M	$4.2 M	$4.0 M	$2.6 M	$3.0 M	$6.2 M	$3.0 M	$3.3 M	$3.0 M	$2.6 M
Governmental Partners	$1.4 M	$1.6 M	$4.2 M	$5.0 M	$4.4 M	$3.5 M	$7.3 M	$4.7 M	$2.8 M	$3.7 M	$6.2 M	$7.3 M	$8.9 M	$7.2 M	$3.1 M	$1.2 M	$2.9 M
Total	$16M	$15M	$17M	$17M	$15M	$13M	$20M	$17M	$15M	$14M	$13M	$18M	$18M	$13M	$14M	$5M	$11M

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