STCU

Initiatives for Proliferation Prevention
United States Department of Energy

USIC

Expanding Opportunities in Technology Commercialization

Washington, DC March 2009

Developing High-Technology Products in Ukraine

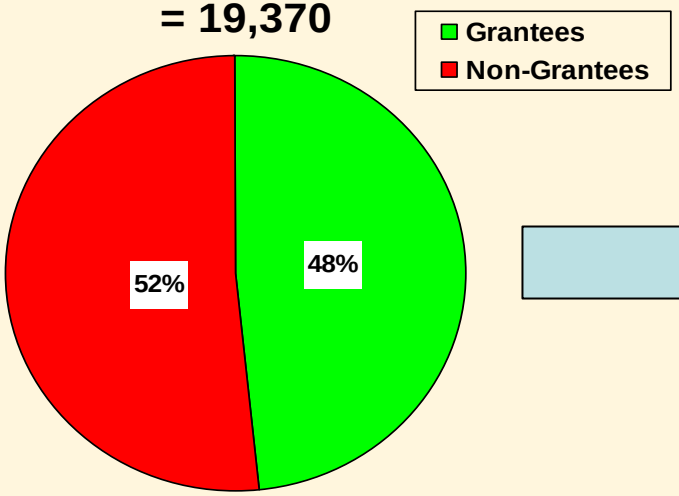
Vic Korsun, US Deputy Executive Director
www.STCU.int *vic.korsun@stcu.int*

STCU -- Making Progress, Seeing Results

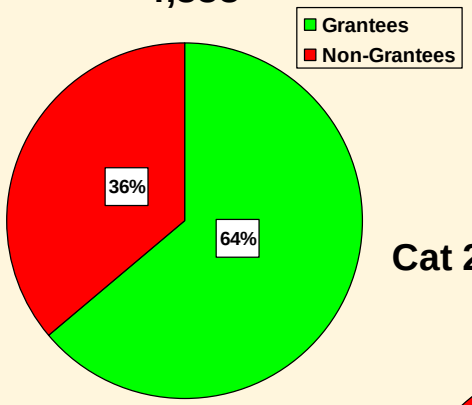
- 1900 Projects since 1995
- 9000 FWS scientists engaged
  - in Ukraine, Georgia, Azerbaijan, Moldova & Uzbekistan
- 190 Partner Organizations – Govt. & Commercial
- 240 Patent Applications – National & International

Total Former Weapon Scientists (FWS) in STCU Project/Proposal Records (July 2008, All Countries)

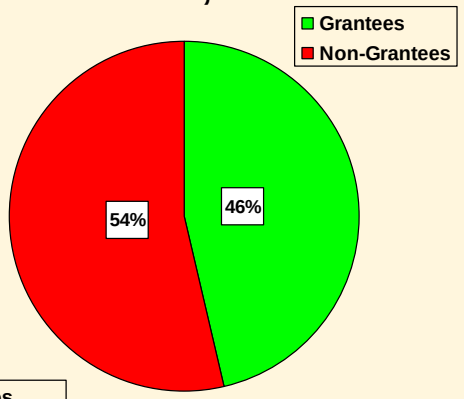
Total FWS Registrants
= 19,370



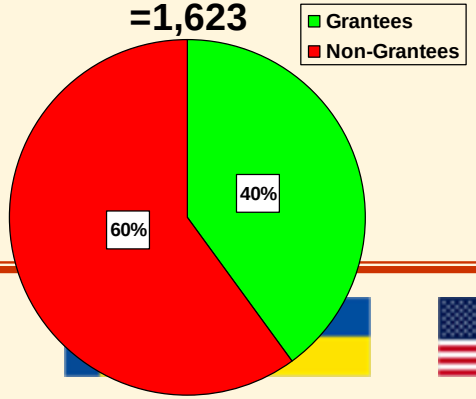
Cat 1: Weapons
=4,838



Cat 2: Delivery Systms.
= 10,021



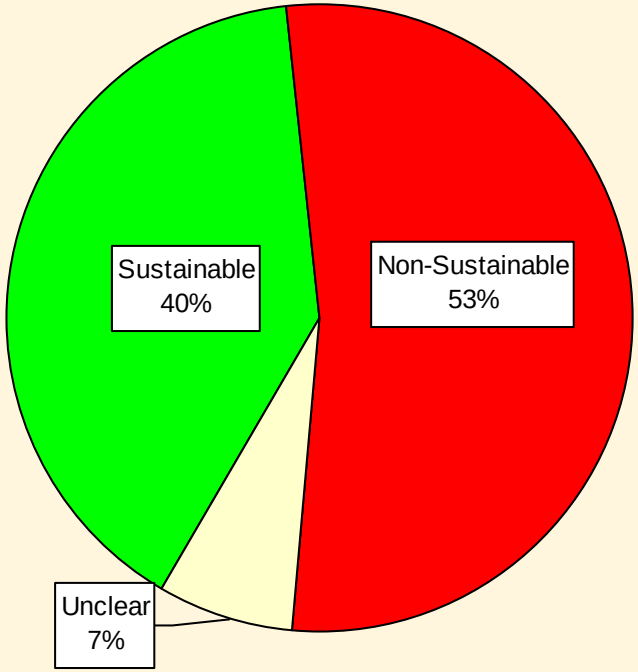
Cat 3: ABM Systms.
=1,623



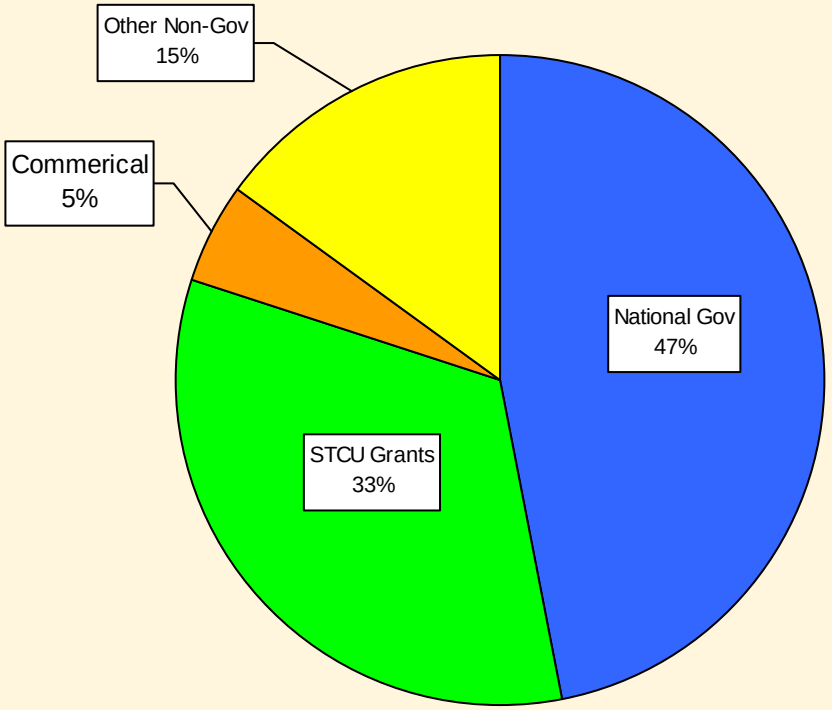
1995 Informal Estimate from Ukrainian GB member = 20,000-30,000 Scientists with military R&D background

Transition To Sustainability Takes Time & Constant Effort…Or Bigger Effort

Institute Sustainability Estimate (2008 Annual Survey)



Sources of 2008 Financing For All Responding TUs



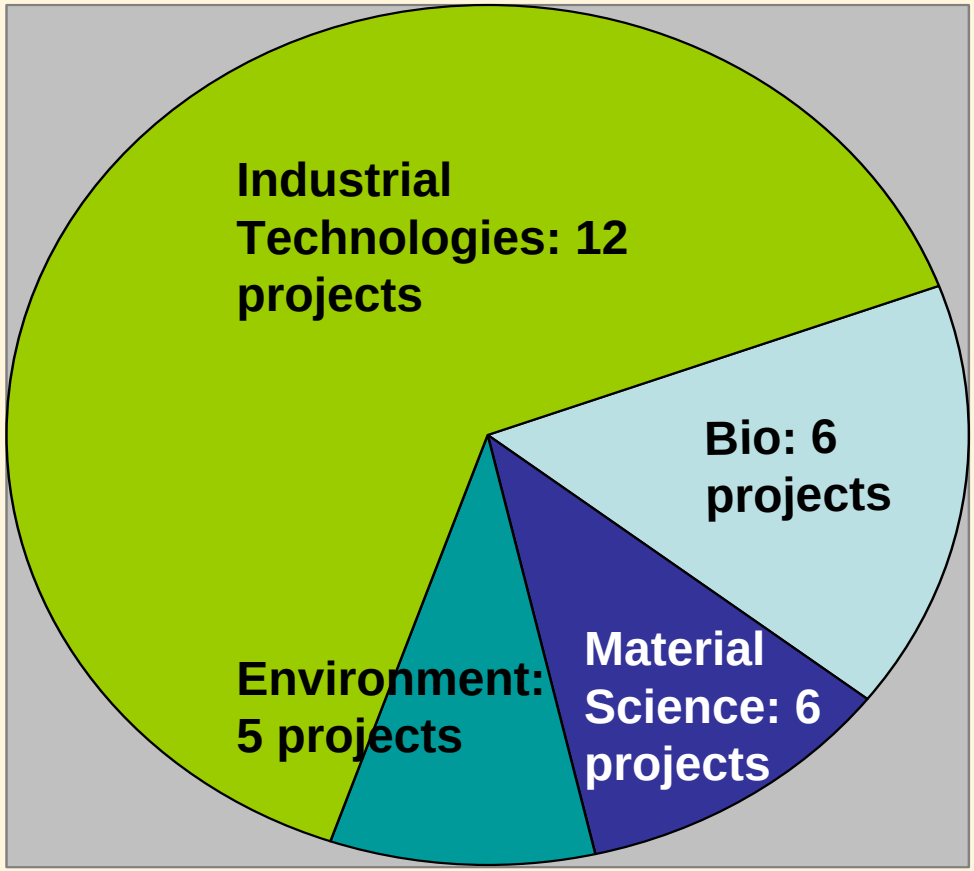
Obstacles/Barriers to Institute Self-Sustainability as Expressed by ISP Institutes

– Legal, Infrastructure, Marketing

- Inadequate international IP rights protection.
- Institutes have no legal right for commercial activity.
- Laws related to IPR protection of is uncertain and contains significant gaps.
- Regulation of venture commercial activity at institutes penalizes everyone – scientists, institutes and investors.
- Laws related to foreign companies (taxation, banking and finance restrictions, currency control issues, etc.) are onerous and difficult to deal with.
- Laws related to IP transfer and licensing are unclear and confusing.

- Investors are fearful because the legal climate in Ukraine is so uncertain and treacherous.
- Inadequate modern equipment at institutes.
- Lack of scientific standardization, certification and international regulations observance (ISO, GMP, GLP).
- Not enough trained personnel connected with commercialization activity.
- Need for marketing and promotion of institute services and intellectual property products.
- Limited ability to attract investors and partners to visit institutes, meet scientists..

29 IPP-STCU Projects by Primary Technical Area



(USD, Millions)

Industrial Technologies: **8.8**

Material Science: **2.8**

Biotechnologies, Agricultural Sciences & Medicine: **1.4**

Environmental & Non-Nuclear Energy Research: **1.2**

Total: 14.2

Active GIPP-USIC-STCU Projects

STCU Project	FSU Institute, country	IPP Project	US Industrial Partner
P143b	Institute of Metal Physiscs, Ukraine	PNNL-T2-241 UA	ADMA Products Inc
P154	Donetsk Institute of Physical-Organic and Coal Chemistry, Ukraine	ANL-T2-229 UA	Superior Graphite Inc.
P199b	Institute of Bioorganic Chemistry and Petrochemistry, Ukraine	DOEH-T2-0002 UA	HQ project
P200c	Institute of Organic Chemistry, Ukraine	DOEH-T2-0002 UA	HQ project
P208	Institute of Nuclear Physics, Uzbekistan	LANL-T2-200 UZ	Isonics
P215	Donetsk Institute of Physics and Engineering, Ukraine	ANL-T2-232 UA	Ceramatec
P228	Kharkov Institute of Physics&Technology, Ukraine	ANL-T2-224 UA	AlphaMed Inc.
P238	Research Center “Pratt & Whitney – Paton", Ukraine	ORNL-T2 211 UA	Pratt & Whitney
P287	Kharkov Institute of Physics&Technology, Ukraine	PNNL-T2-265 UA	Campbell Applied Physics
P291	International Center for Electron Beam Technology, Ukraine	PNNL-T2-275 UA	Fuel Cell Energy
P316	Institute of Microbiology and Virology, Ukraine	PNNL-T2-280 UA	Northwest Agricultural Products
P326	Mykolaiv Institute of Pulse Processes and Technologies, Ukraine	PNNL-T2-277 UA	Ford Research & Advanced Engineering
P344	Institute of Physics, Ukraine	LLNL-T2-250 UA	Rhyolite Technology Group

Ukraine: Its Strengths

- Agriculture & Food
- Metallurgy & Ore Mining
- Machine Building
- Transportation & Communication
- Rockets & Aircraft

Advanced Scientific Innovations – An Untapped Ukrainian Goldmine

Untapped Ukrainian R&D

Work with top scientists and engineers in Ukraine and CIS doing product development.

GIPP & USIC, through STCU, are uniquely positioned to help US businesses tap into the unexploited technologies residing in these countries.

Unlike some other CIS countries, Ukraine and STCU's member countries are eager to work with the US!









Benefits for STCU R&D-Partners

- Project planning and oversight
- Financial oversight of project
- On-site monitoring and auditing of projects
- Moderate R&D costs
- Salaries paid directly to researchers doing work – tax free (approx. 30% savings)
- Duty-free customs for equipment and materials
  - Customs clearance assistance
- Host Government Concurrence
- Multi-lingual STCU staff (English, Ukrainian or local native, and Russian)?

STCU reduces your business risk in Ukraine and other CIS countries!







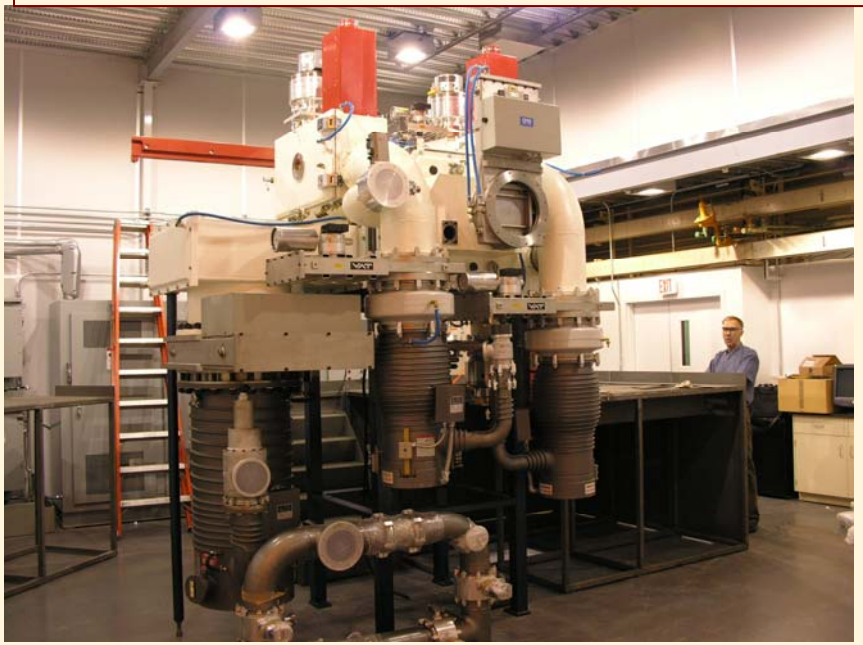


Selected Projects & Example Opportunities for Partnering at STCU

Next Generation EB-PVD Apparatus

- ***GE Global Research Center***
- ***Brookhaven National Laboratory***
- ***International Center for Electron Beam Technologies of Paton Welding Institute (Kyiv)***

Protective coatings; high-temperature components for engines, fuel cells; micro-porous, micro-laminated, graded structures



Prototype

Manufactured at Paton W I, Ukraine

Installed at GE, NY, Sept 2005

PLANT GROWTH REGULATORS

FOR WIDE SPECTRUM OF USE ON 25 AGRICULTURAL CROPS

Based on Biotechnology of micromycetes cultivation from root system of herbs

Agrostimulin Biosil	for cereals, leguminous and perennial herbs
Biomax Betastimulin	for sugar beet
Zeastimulin	for corn
Radostim	for seed treatment
Treptolem	for sunflower, ripe
Charcor	for root system development

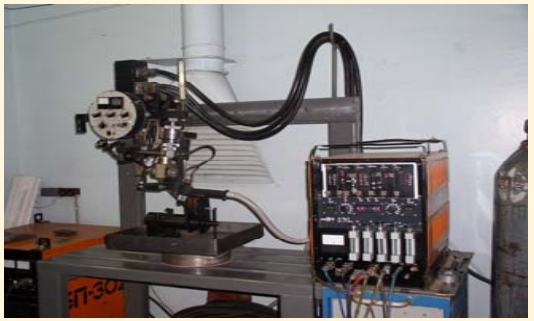
Welding & Brazing Technologies for Repair of Turbine Engine Airfoils

- ***United Technologies Corporation***
- ***Oak Ridge National Laboratory***
- ***E.O. Paton Electric Welding Institute, Kyiv***
- ***Joint Venture Pratt-Whitney-Paton, Kyiv***

20% of new blade cost

80% of new blade lifetime

A specialized workshop for repair components with more than 20 working places at Scientific and Technical Center “Advanced Technologies” of Paton Welding Institute



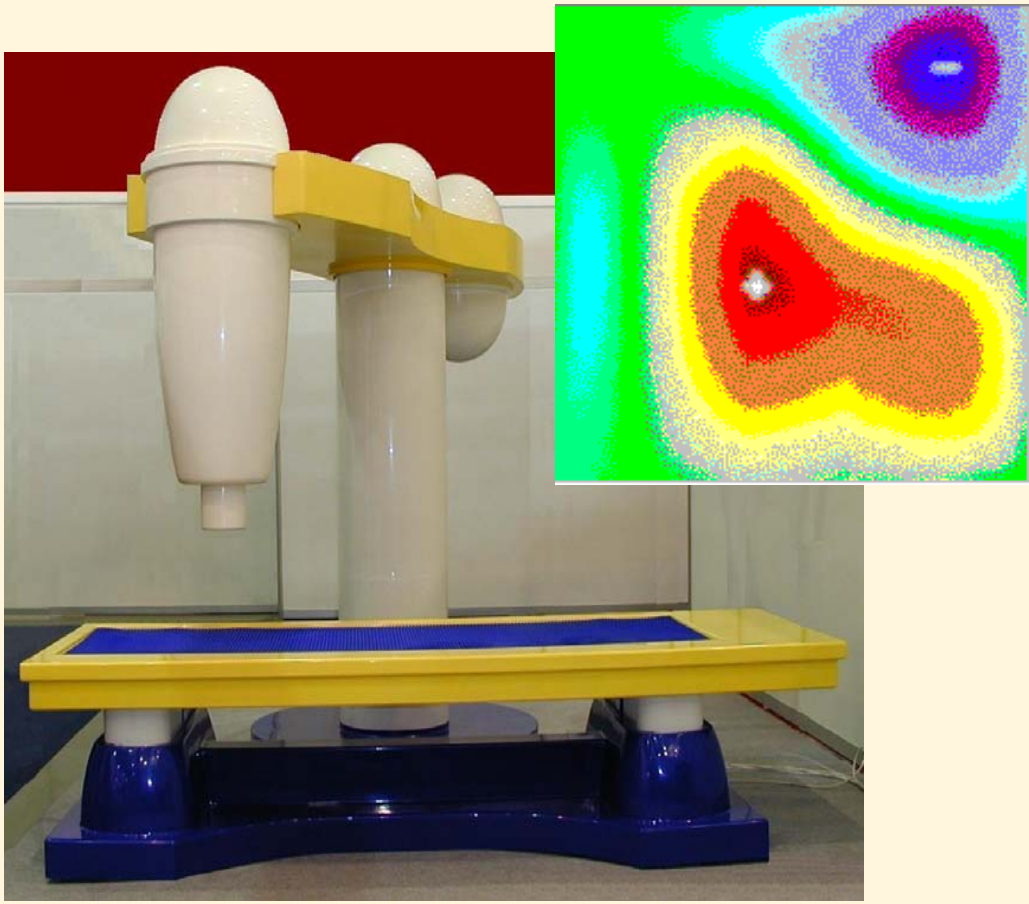
Ukrainian Robotic Micro-manipulators take the smallest step in the world!

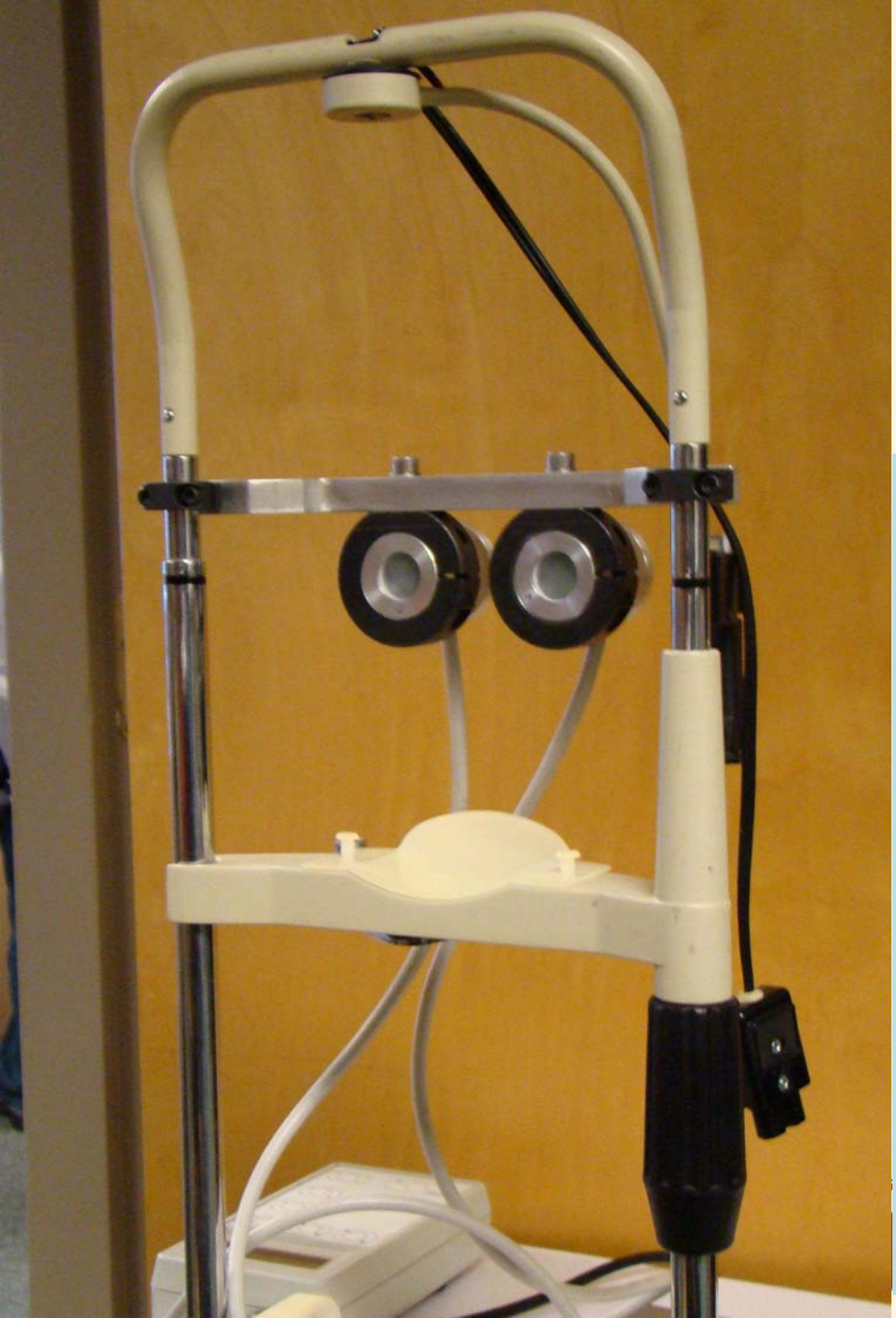
- **Accurate & reproducible half-nano-meter steps (world-record!)**
- **Used for demanding bio-tech applications such as:**
  - *Patch Clamp (holding & positioning cells),*
  - *IVF (in-vitro fertilization), and*
  - *Cell cloning,*
- As well as in semiconductor integrated circuits industry – all growing markets.

Partnering Opportunities for US Companies with USIC and STCU

Non-Invasive, Risk-Free Magneto-Cardio System for Early-Diagnosis of Heart Diseases

- Measures the tiny magnetic fields emitted by the human heart
- Risk-free diagnosis of ischemia, ventricular arrhythmias, & other heart ailments through imaging & quantitative analysis
- Non-invasive clinical evaluation of new drugs & therapies.





Unique Treatment for AMD -- Age-Related Macular Degeneration

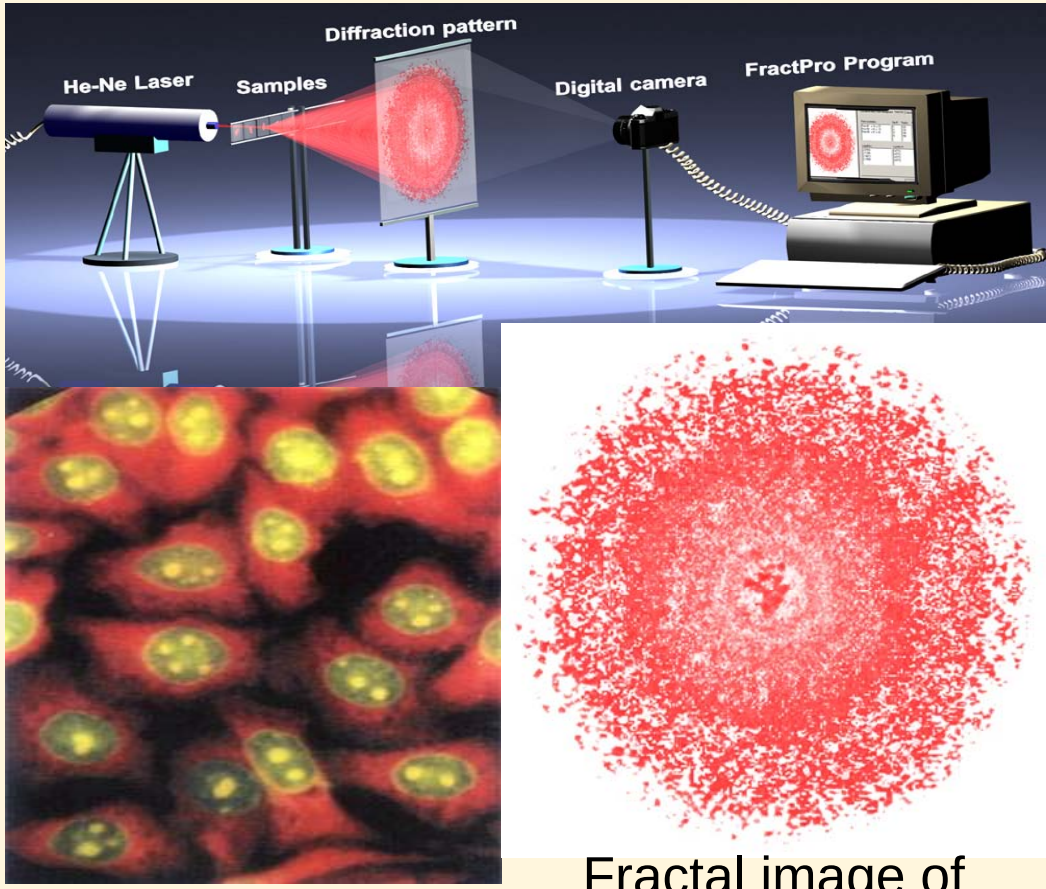
- Dry Form AMD represents 90% of the total cases of AMD
- Currently no Dry Form AMD treatments, only medications to slow the disease.
- Sharp decrease of object distortion
- After 1st procedure 88 % of patients have vision acuity improvement up to 26%.
- After 2nd procedure another 22%.
- Normalizes retina reflexes.
- Raises cone color sensitivity to 33%

DYNAMIC CELL MONITORING USING A NEW FRACTAL MICROSCOPE SYSTEM (FMS)

FMS provides a quantitative view of virus-cell interactions in a time-series of frames at any stage of cell

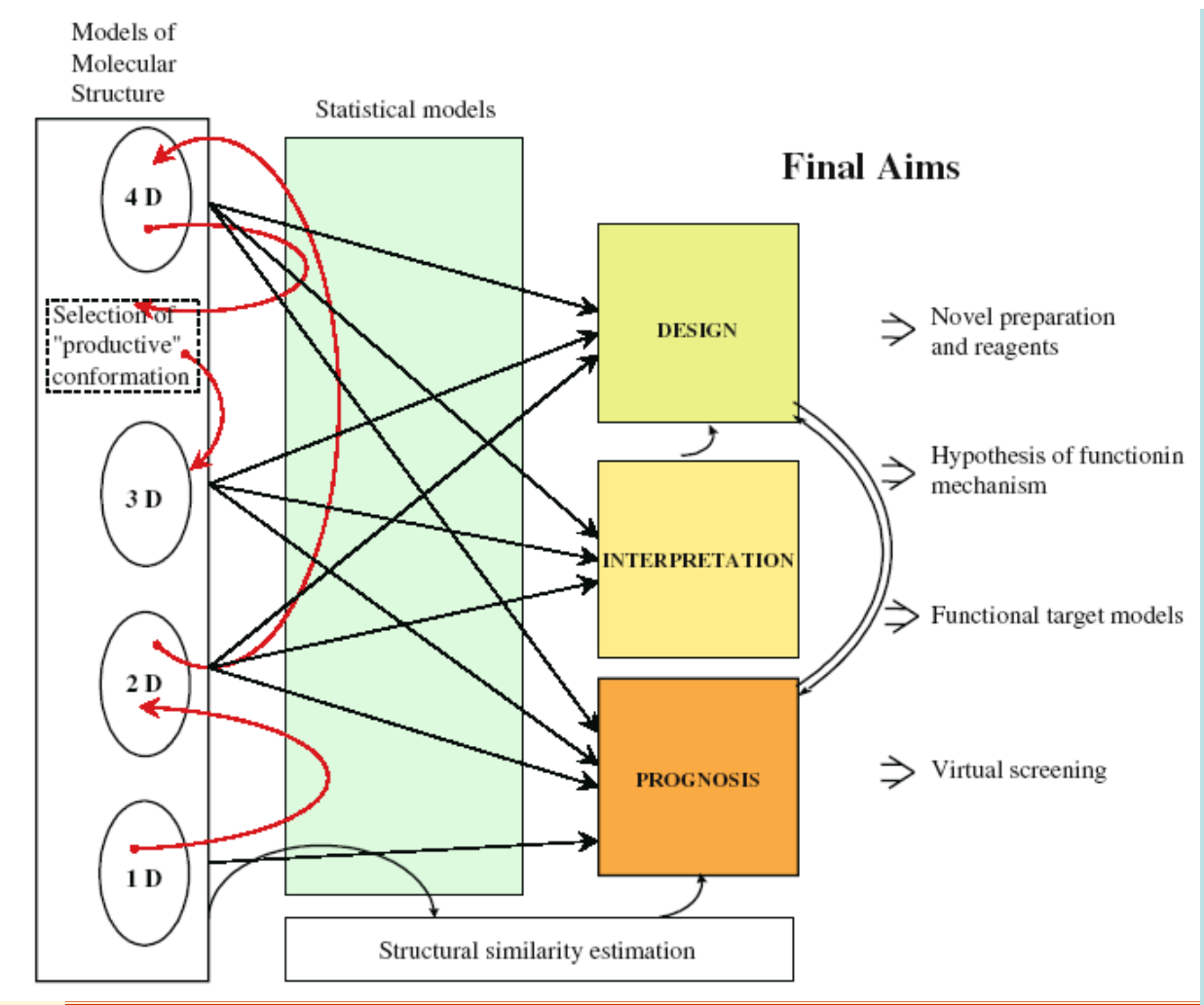
Interaction – useful in:

- life sciences and drug design,
- in agriculture and veterinary sciences,
- in physics of liquid crystals and surface phenomena,
- in polymer and colloid chemistry.



Fractal image of herpes infected cell.

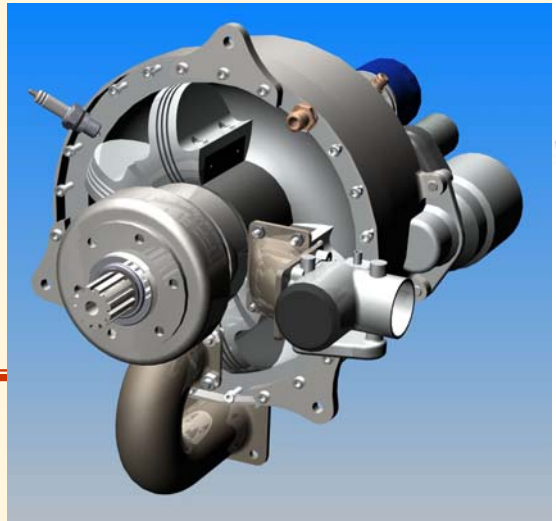
Anti-Viral Drug-Design Using Hierarchical System of Solving

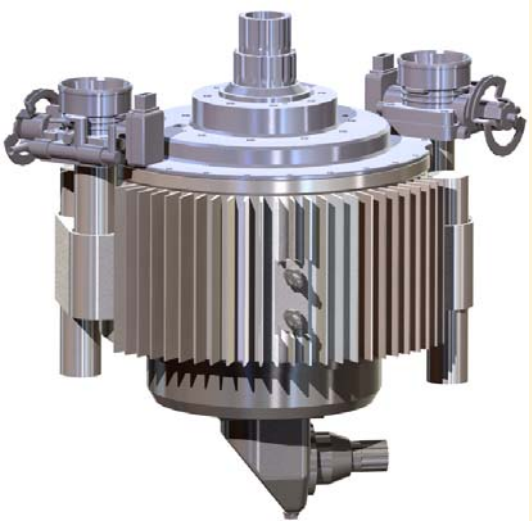


- Developed QSAR computer-based techniques to evaluate antiviral compounds for herpes virus
- Understood the chemical–biological interactions governing their activities,
- Designed new compounds with strong antiviral

NEW Engines for Transportation

- Advanced **TurboMotor** combines the best of Internal Combustion Engine and Rotary Engine at a price 2 times less.
- Simple, robust kinematics.
- Able to transmit great torque.





Small Hybrid Wind-Solar Energy for Residential & Rural Use

- Wind-Solar Hybrids for power generation for small systems anywhere.
- Aero-mechanical pitch regulation.
- Low-speed synchronous generators with permanent magnets.
- Lowers household bill 50% to 90%.
- Adds energy to existing grid.

AT LOW COST !

Hydrocarbon Waste Processing and Electricity Generation

Prorotype developed and tested. Gasification developed for generating electricity.

Fig.1 Separated tires

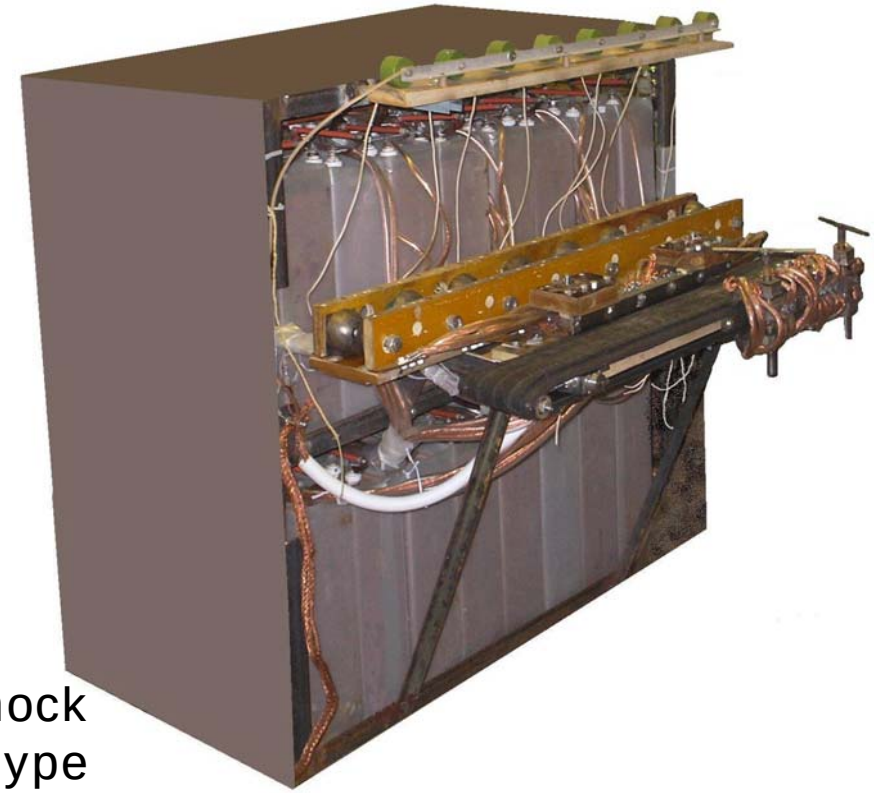


Fig.2 Magnetic shock equipment prototype

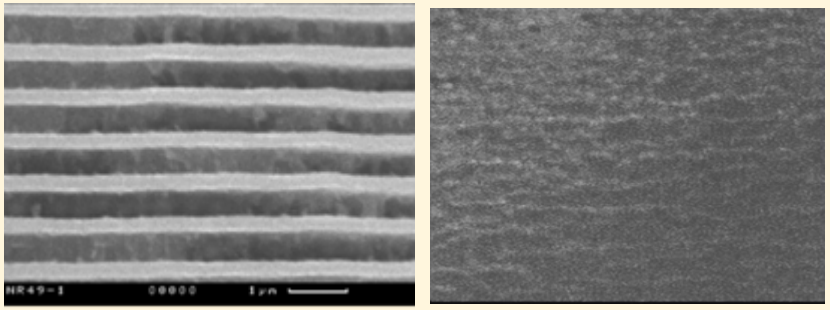
THERMAL BOILER WITH UNDERFEED RETORT
USES WA

- Uses wood chips, saw dust, chaffed straw and peat as a fuel.
- Allows combustion of fuel with moisture content up to 50%.
- Scalable to 1 MW.
- Efficiency 83%,
- Emission of CO and NOX is 250-300 ppm.

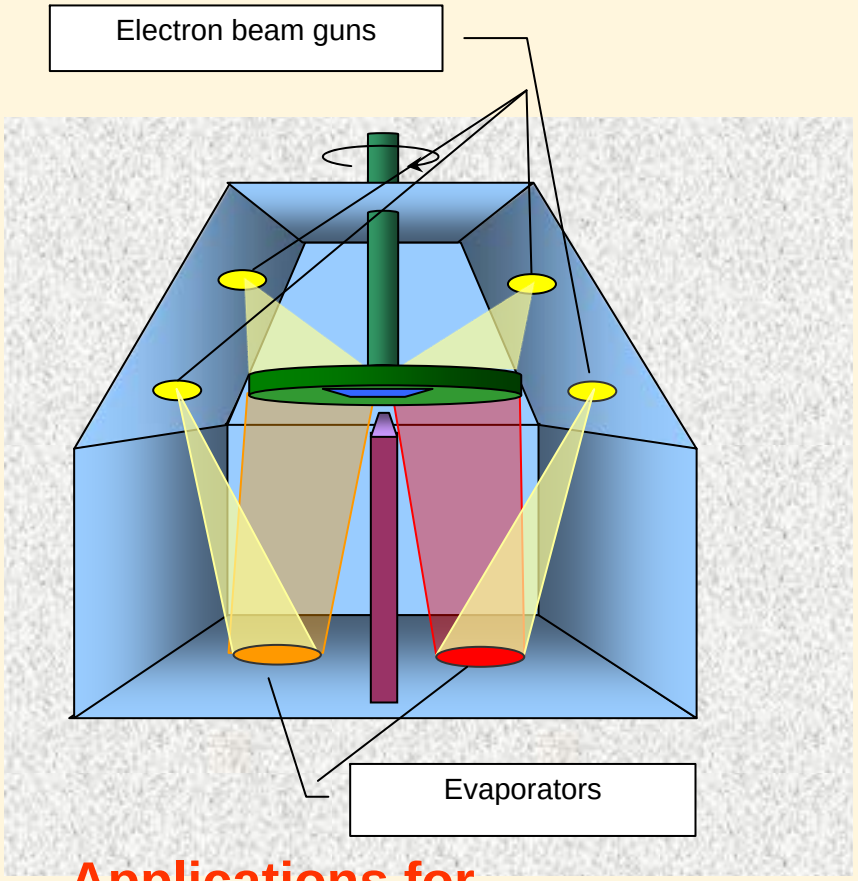
PRESSURE JOINING OF TITANIUM-ALUMINIDES USING THIN INTERLAYERS

Advantages of titanium-aluminides:

- Low self-diffusion and creep resistance;
- High elasticity modulus;
- Low specific weight;
- High strength properties at working temperatures;
- High oxidation resistance.



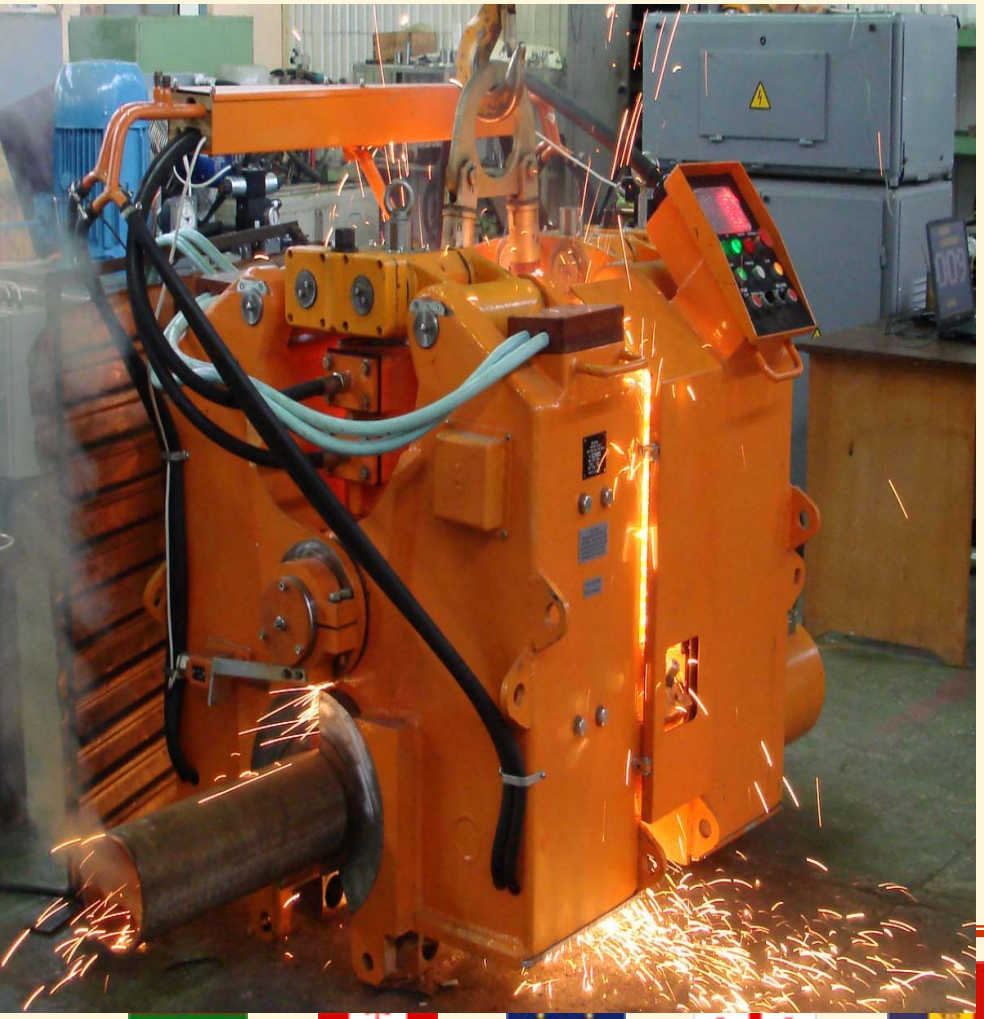
Al + Ti → AlTi



Applications for

Aircraft and car engines welded components

CONSTRUCTION AND REPAIR OF DEEPWATER OFF-SHORE OIL & GAS PIPELINES AND VERTICAL PIPE RISERS OF UNDERWATER PIPELINES BY FLASH BUTT WELDING (FBW)



- For underwater FBW using commercial machine K584M.
- Computerized prototype of the machine for underwater FBW of 114-325 mm pipes.

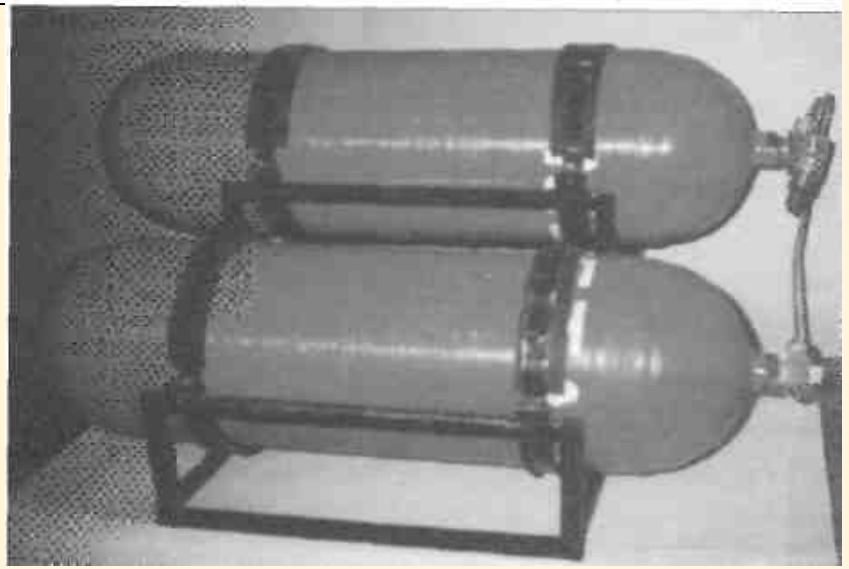
For construction and repair of deepwater off-shore oil/gas pipelines

Energy Conservation Technology for Automotive Fuels

- Producing OXYGEN–CONTAINING ADDITIVE as an ecologically beneficial component for bio-diesel fuels.
- Consumption of diesel fuel with additive was decreased by 21% (of the total volume) depending on working load of the tractor;
- Exhaust smoke disappeared and carcinogenic diesel smut in combustion chamber is not generated;
- Cost of diesel fuel with oxygen-containing additive is 3-5% lower than cost of pure fuel.

LIGHT-WEIGHT WELDED GAS CYLINDERS FOR AUTOS & TRUCKS

- Gas Cylinders with a capacity of 20, 30 and 60 liters
  - hydraulic tests withstood internal pressures of more than 52 Mpa
  - 2.6 times higher than the working pressure.
- Cylinders can be made with a diameter ranging from 200 to 400 mm.
- Cylinders can withstand from 15,000 to 24,000 cycles of internal pressure loading.
- Produced in multiple quantities.



- Design of the cylinders and technology for their manufacture are covered with:
- Ukraine Patents 61162& 55385 and
- DSTU and M/ECER 110-00:2002

100's of Technology & Product Opportunities in Ukraine for Partners:

- Bio-soluble in-vivo Stents Made of Ultra-fine-grained Magnesium Alloys
- Catalytic Converter that Uses 30% Less Platinum
- Super Small Oxide Nano-powders (up to 5nm) for Medicine and Fuel Cells
- Thin, Vacuum-tight, Extra-pure Beryllium Foils and Windows for Output X-rays
- Powder Metallurgy Titanium Components for Automotive and Aircraft Applications

More Technology Profiles available from STCU…

More than 300 TPF's at STCU

Aerospace & Aeronautics	Industrial Technologies	Environmental and Non-Nuclear Energy Research
Biotechnologies, Agricultural Sciences and Medicine	Chemistry	Sensors
Nuclear Energy & Safety	Physics	Material Sciences

www.stcu.int/offer/techmatching/index.php

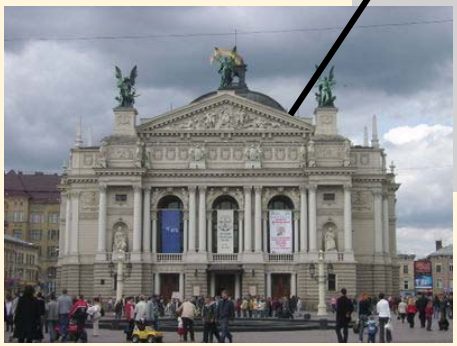
Ukraine's Largest Technological Cities – Centers for Innovation

Kyiv

Kharkiv

Dnipropetrovsk

Lviv



Odessa

Donetsk

Transition to Self-Sustainability Through:

- US DOE GIPP USIC Partner Program

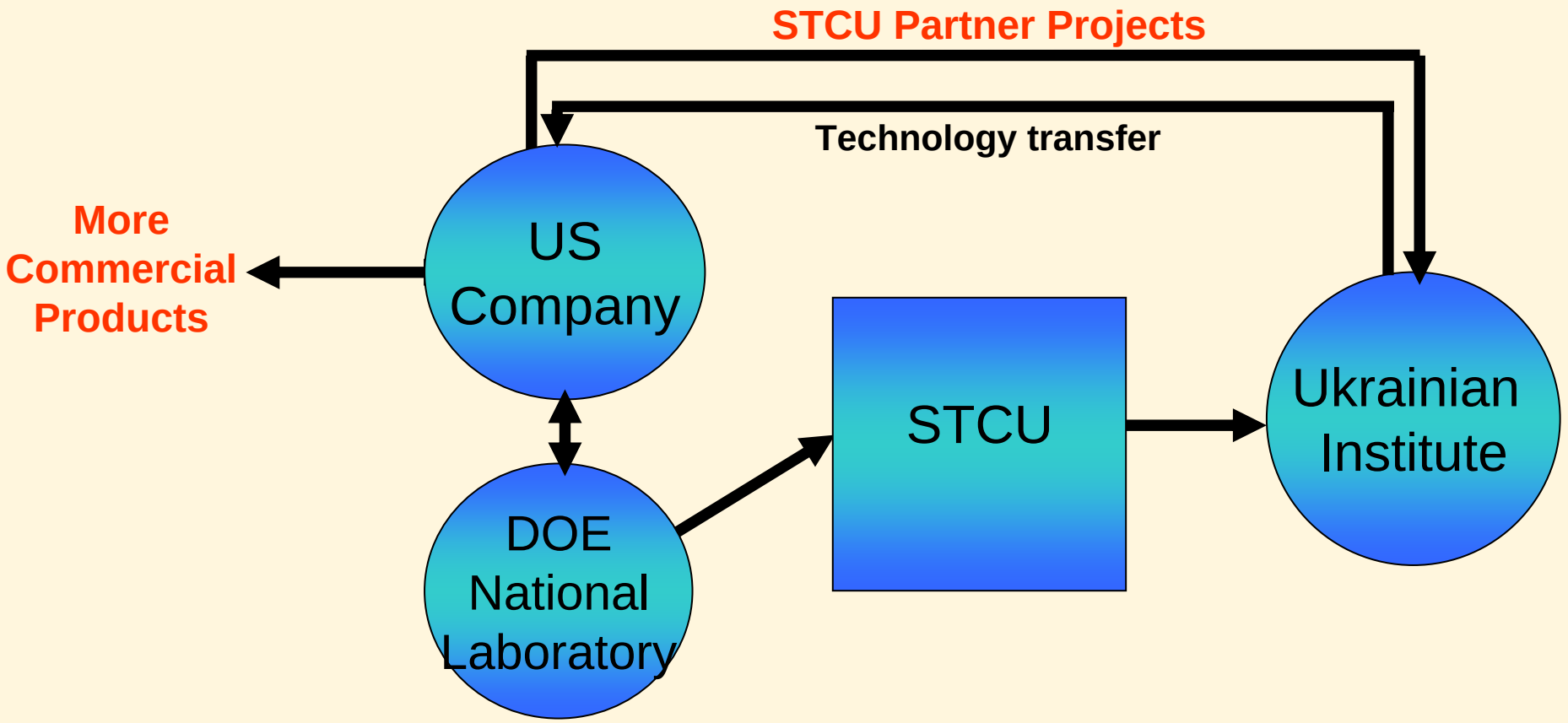
STCU Programs:

- ISP - Institute Sustainability Program
- CTCO - Chief Technology Commercialization Officers Initiative
- IPR management: patent fund, training
- Technology promotion: road shows, matchmaking.

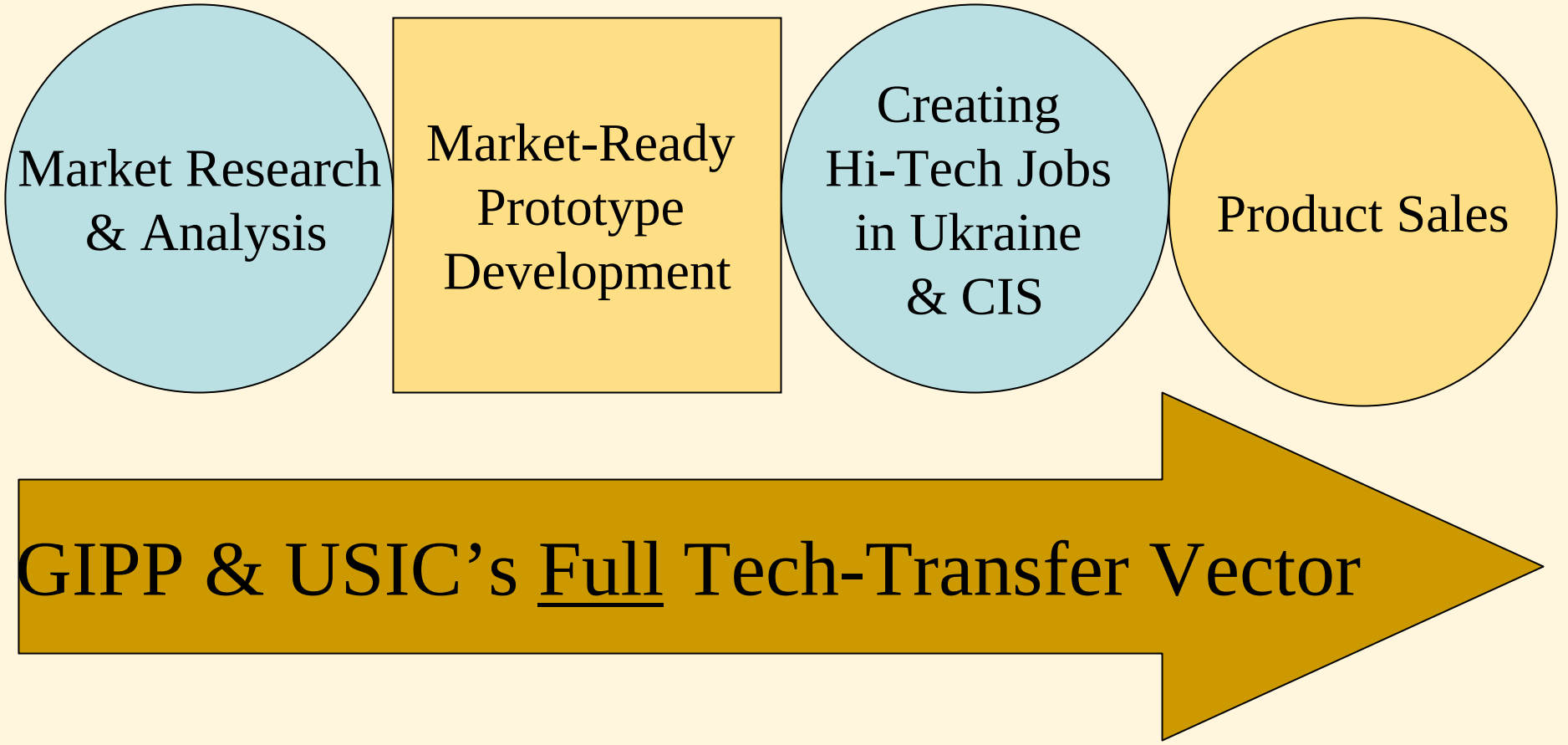
Engagement of FWS Scientists

Self-Sustainability

GIPP-USIC-STCU Partner Process



GIPP & USIC's Full Spectrum Product Development



DOE's GIPP & USIC Help to Change the Landscape for Ukraine and other CIS Countries…

By Creating High-Tech Jobs Based on the IPP-USIC Technologies developed by FWS Scientists at Institutes and Universities!

Creating High-Tech jobs for FWS Scientists and Engineers in Ukraine and the other CIS countries

- High-Tech jobs are the main motivator for scientists to remain in their country.

GIPP & USIC are the right vehicle to accomplish it!

DOE's GIPP & USIC are doing a great job, and you can improve it going forward!

I know that Ukrainian scientists and other CIS countries want you to continue!

Developing the Four Pillars for Ukrainian Science

Science excellence at institutes, universities, and research laboratories	Transfer of scientific results into marketable products	Commercial-ization of scientific innovations	Creation of High Tech jobs for Ukrainian scientists and the Ukrainian people

Let's all work together to increase high tech jobs in Ukraine & CIS, *through DOE's GIPP & USIC*

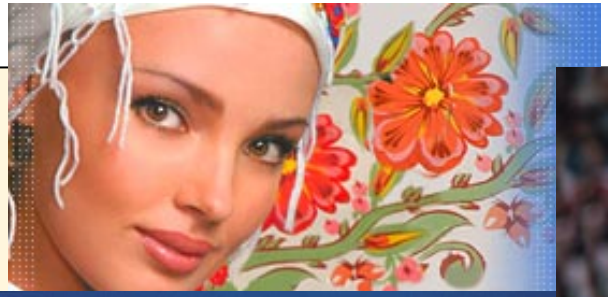


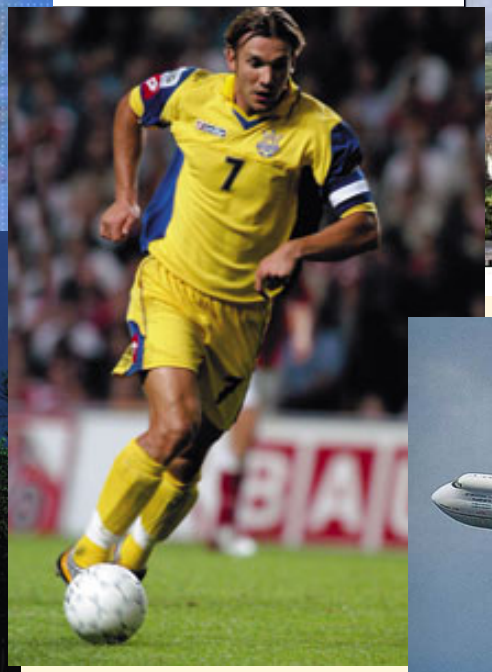


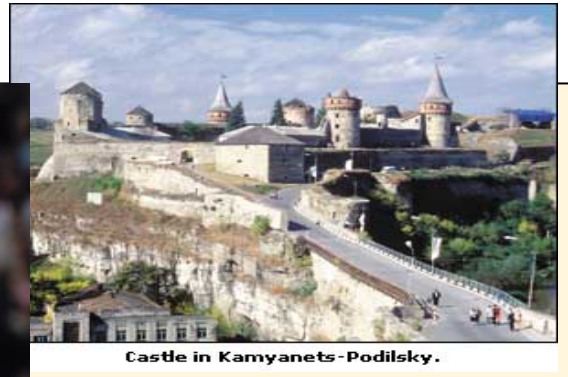




You Can Find It In Ukraine!







Vic Korsun, Science & Technology Center in Ukraine
vic.korsun@stcu.int