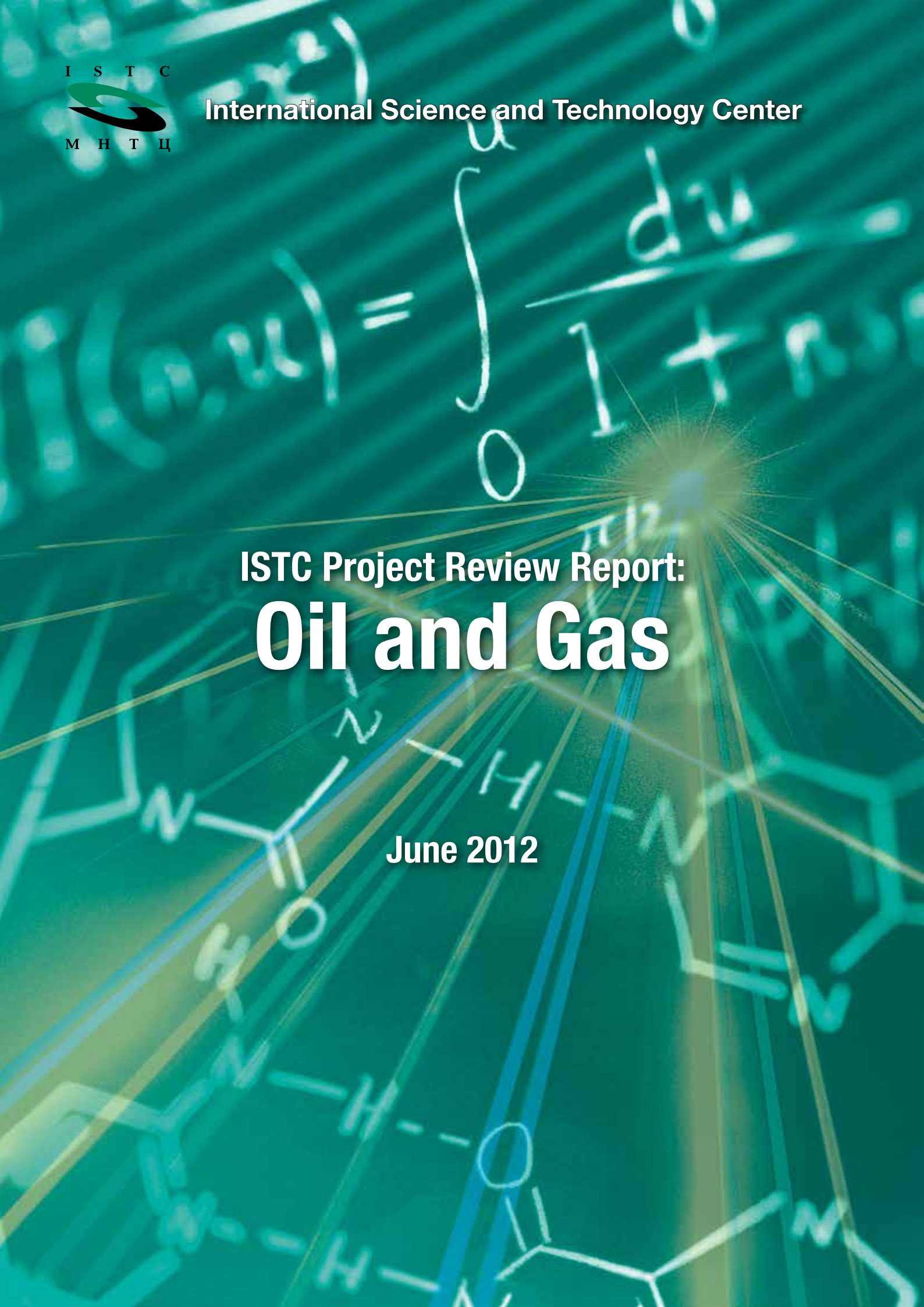

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International Science and Technology Center

ISTC Project Review Report:
Oil and Gas

June 2012

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Contents

Executive Summary

Following the approval by the ISTC Governing Board (GB53) of a program to review the results of completed ISTC projects in identified scientific areas, an international panel reviewed the results of ISTC projects in the sector of oil and gas.

The Results of the evaluation were that 2 projects were rated A (all objectives being met), 11 projects rated A/B (most objectives being met) and 3 projects rated B (all project objectives being partially met). Two projects were considered as one follow-on project.

The report on oil and gas has been published by ISTC. The publication can be downloaded from the ISTC web-site: www.istc.ru or can be ordered via e-mail to Mrs Elena Zaitseva of ISTC: zaitseva@istc.ru

Introduction

The ISTC began work as an International organization in 1994. More than seventeen years after the center opened its doors, the ISTC Governing Board (G53) approved a program to review the results of completed ISTC projects per identified scientific area. This intergovernmental organization involves 39 nations and is in charge of cooperative science with a non-proliferation aspect. Work takes place on the basis of the ISTC Agreement of 1992 and subsequent ISTC Governing Board decisions and implementation guidelines.

During the years of activities, the ISTC has supported more than 2,750 civilian-oriented projects, which have involved more than 90,000 scientists, engineers, and other technical personnel leading to more than 300 patents and numerous publications in prestigious international journals. The funding parties have contributed more than 850 million USD in support of ISTC projects. There was also an additional 170 million USD in supplemental (support) programs. The research institutes and laboratories participating in ISTC projects have provided substantial in-kind resources. Thousands of collaborators from countries around the globe have played a role in ISTC projects and participated in ISTC conferences and workshops.

The topics of the reviews will include, but not be limited to nuclear safeguards, safety, security and related issues; nuclear reactor technology development; technologies to support oil and gas research; and research to support energy requirements (e.g. renewable energy, energy storage, energy transmission) as well as research in the medicinal field.

An Operational guide was made outlining the procedures and approach to be applied to this ISTC review process of the results of the work of ISTC. Annex 1 contains a Project Review Process Flow Chart which provides a summarized overview of the steps taken to review the projects in this sector.

This report describes the results of the review of ISTC projects in the oil and gas sector.

Approach

THE REVIEW PANEL

A review panel was established to review the results of the ISTC projects in the Oil and Gas Sector. The panel and chairperson were selected by the Secretariat in close consultation with the sponsoring parties/partners of each review. This panel was chaired by Dr. Rohatgi Upendra and Dr. Patrick Russo acted for the Secretariat.

The other participants in the panel were:

- Dr. Philip Stauffer, Scientist IV, Los Alamos National Laboratory, USA;
- Dr. Aleksei Shevchenko, Business Development Manager, Schlumberger, Russia;
- Prof. Nikolay Mikhaylov, Gubkin Russian State University of Oil and Gas, Russia.

In addition to reviewing technical reports and other documents from the 17 projects oral presentations were given to the panel by the following project managers:

- Prof. Evgenii Aleksandrov, project 985, Institute of Biochemical Physics, Russian Academy of Sciences, Moscow, Russia;
- Dr. Anatoly Kartelev, project 3525, originally at RFNC-VNIIEF, Sarov, N. Novgorod reg., Russia, now director of company Geokart;
- Prof. Evgeny Novitsky, projects 2904 and 3908, RFNC-VNIIEF, Sarov, N. Novgorod reg., Russia.

THE REVIEW PROCESS

The review process of the results of the work of ISTC includes the following steps:

- Identification of the scientific areas to be revie-wed;
- Procedures for selection of relevant projects per selected scientific area and selection criteria;
- Preparation of a draft review report per selected scientific area;
- Discussion and adoption of the report by the Review Panel and ISTC Governing Board;
- Publication and Dissemination of the report.

The following approach was applied to the projects selected and reviewed for this scientific sector:

- Funded projects that started after 1 January 2001 and are now technically completed and also are ongoing were included in the review process, though exceptions to this time limit maybe allowed for projects of special interest;
- Only projects with financial support of more than $150,000 USD were included in the review process.

Annex 2 provides a list of projects reviewed for this sector. It has a list of projects with relevant project information (i.e. title, institute, foreign collaborator, finances, project duration etc). There were 17 project reviewed.

THE SCORING SYSTEM

An evaluation scoring system was used by the panel to provide an independent review of the selected sector projects. This scoring system is based on a developed evaluation system by the Scientific Advisory Committee (SAC) of ISTC. The final technical report, the project assessment sheet, and the foreign collaborators approvals/assessments were the main sources of information for the completion of the evaluation sheets (see below and in table 7). Oral presentations provided additional information which was considered quite useful but the Panel members, in the final discussion on the outcome of their review, agreed that they did not introduce a negative bias for those projects which had only written information available.

All selected projects for written and oral review were evaluated on the basis of the following criteria:

1) Accomplishment of major tasks of the project, to include, degree of fulfillment of project work, achievement of final objectives and cost efficiency of the project;
2) Contributions to the scientific field in question;
3) Impact of the results of the project, i.e., did it lead to further applied research, commercialization of new technologies, innovation in existing technologies or patents;
4) Dissemination of project results, to include number of publications in internationally recognized journals number of publications in national journals and presentations at international conferences;
5) Collaboration network between CIS institutes;
6) Partnership and collaboration with foreign institutes.

Results of Reviewed Projects

The information included in this section will include a synopsis of the overall evaluation of the projects as defined in Section 1 of the Evaluation Form. The information will be gathered from the written and oral reports to the panel and will cover the entire sector. The areas evaluated will be further detailed in the following sections of this report.

The oil/gas industry consists of five main stages: exploration, extraction, production, transport, and refining. In total, 17 ISTC projects related to at least one of these stages were selected for review. They included one in exploration, five in extraction, ten in transport and one in refining. All the projects were from Russia which is one of the largest producers of oil and gas.

DISSEMINATION OF PROJECT RESULTS

Publication of results in conferences and journals is usually a good measure of the quality of research, especially publications in peer reviewed journals. In addition, dissemination of the results brings international recognition of the work and may help in attracting additional funds or opportunity to commercialize project results.

In general, all of the reviewed projects had performed relatively good research and had the potential for multiple publications. The panel found wide variation in the dissemination of results from the 17 projects reviewed. And although most projects had presentations in international conferences, few published their results in journals. For example, seven projects out of seventeen had no journal publications, six had no conference papers while four had no publications at all. Though it should be noted that five projects each having patents issued as a result of them were specifically meant for technology development, which can limit the potential for publishing in the public domain so that IP can be protected.

Results of each project's publication and patent numbers can be found in Table 1, which also shows estimations for

the success of each project's information desemination according to the following protocol:

The success of dissemination of information is measured by summing a weighted combination of patents, international conference attendance, books, and publications.

Patents and books are given a straight 1:1 weight, while international conferences are given a weight of 1/10 per presentation as presentations are not peer reviewed, and often generate very limited exposure for projects. Finally, publication impact (PI) is calculated by multiplying each publication by its impact factor and summing over the total number of publications:
Publication Impact (PI) = SUM (publication * impact factor)Eq. 1

Thus, if a team had one publication with an impact factor of 4.0, their PI would be 4.0, while a team with 10 publications each having an impact factor of 0.1 would have a PI of 1.0. Impact factor of a journal is a commonly used international metric to describe the likelihood of a publication being cited. Journals with low impact factors are generally not widely read or cited. There was some subjectivity in this process, because some publications merited 'international recognition' status. Some of the more well known Russian journals were in this category.

The final equation used for the weighted score is:

#Patents + #Books + 1/10(International Conference Presentations) + PI Eq. 2

Using this method, several projects rise clearly to the top (Table 1). Projects marked with an asterisk were presented to the review panel. In the case of project 3525, the presentation added significantly to our understanding of the progress that has been made since the project ended.

Half of the projects are in the range of 0-2, showing that (given the available data) many of the ISTC oil/gas projects did not lead to significant impact on the broader scientific or business community. However, as shown by the presentation of Project 985, impacts may be undervalued due to lack of recent information on where the projects have headed since completion.

Table 1

Project	Papers	Impact factor	Publication Impact	Books	Patents	Int Conf	Total Weighted
3525*	1	assume 0.5 ipf	0.5	0	28	0	28.5
2245	4	4.3 0.7	5.7	1	0	16	8.3
2759	5	0.32 1.64 0.7 etc	4.233	0	0	8	5.033
2364	12	1.68 0.29 0.357	4.127	0	0	9	5.027
2937	1	3.3	4.233	0	0	1	4.333
374	3	0.65	1.95	0	0	16	3.55
142	2	0.78	1.56	0	1	3	2.86
2045	1	1.749	1.749	0	0	3	2.049
3439	0	0	0	0	2	0	2
1344	0	1	0	0	1	8	1.8
1482	0	1	0	1	0	8	1.8
3321	0	0	0	0	1	0	1
3362	0	0	0	0	1	0	1
2755	0	0	0	0	0	7	0.7
985*	1	0.357	0.357	0	0	0	0.357
3908-2904*	0	0	0	0	0	0	0

COLLABORATION NETWORK WITH CIS AND FOREIGN INSTITUTES

ISTC supports collaborations between CIS institutes through the inclusion of secondary institutes along with lead institutes on projects. Table 2 shows the lead institute and secondary institutes which collaborated in each oil and gas project reviewed. Though collaboration between institutes is encouraged not all projects included secondary institutes. For example, seven projects that had VNIIEF in Sarov as the lead institute had no other CIS institutes involved. In contrast, project 374, Pulsed High-Power Systems for Geology and Geophysics, had 7 Russian institutes collaboratoring on the project.

Table 2. List of Collaborators-CIS and Foreign

Project #	Russian/CIS Institutes	Foreign Collaborators
142	VNIIEF, Sarov, N. Novgorod reg., Russia	National Physical Laboratory, Teddington, UK
374	High Energy Density Research Center-Inst.for High Temperature Trotsky Institute for Innovation and Thermonuclear Research Moscow Aviation Institute Nizhegorodskii Mashinostroitelnii Zavod Federal Center of Dual Technologies-SOJUZ Central Research & Design Bureau Central Interbranch R&D Lab for Energetic Condensed Systems	Power Propulsion Program, Textron Defense Systems-USA Institute of Engineering Mechanics and Systems, Tskuba, Japan Shizuoka Institute of Science and Technology, Japan
985	Institute of Biochemical Physics Central Scientific Research Institute of Chemistry and Mechanics	Caveny Production Company, USA Advanced Power Technologies, USA
1344	State Research Center for Applied Microbiology and Biotechnology, Obolensk, Moscow reg., Russia	Argonne National Laboratory (ANL), Argonne, IL, USA Myongji University / Research Institute for Clean Technology, Yongin City, Korea
1482	VNIIEF, Sarov, N. Novgorod reg., Russia	Sandia National Laboratories, Albuquerque, NM, USA
2045	VNIIEF, Sarov, N. Novgorod reg., Russia	Dynamit Nobel, Troisdorf, Germany (Veehmayer M) Lawrence Livermore National Laboratory, Livermore, CA, USA (Baum D W)
2245p	State Research Center for Applied Microbiology and Biotechnology, Obolensk, Moscow reg., Russia Arbuzov Institute of Organic and Physical Chemistry, Kazan, Tatarstan, Russia Moscow State University / Department of Chemistry, Moscow, Russia	US Department of Energy / Initiatives for Proliferation Prevention Program, Washington, DC, USA
2364	VNIIEF, Sarov, N. Novgorod reg., Russia Kazan State University / Scientific Research Institute of Mathematics and Mechanics, Kazan, Tatarstan, Russia	TU Delft, Delft, The Netherlands Universitat Leipzig / Fakultat fuer Physik und Geowissenschaften, Leipzig, Germany
2755	VNIIEF, Sarov, N. Novgorod reg., Russia	Dynamic Materials Corporation, Boulder, CO, USA Lawrence Livermore National Laboratory / Energetic Materials Center, Livermore, CA, USA
2759	VNIIEF, Sarov, N. Novgorod reg., Russia	Los-Alamos National Laboratory, Los-Alamos, NM, USA
2937	VNIIEF, Sarov, N. Novgorod reg., Russia Moscow State University / Department of Chemistry, Moscow, Russia	Laurentian University, Sudbury, ON, Canada (Appanna V)
3221	State Research Institute of Organic Chemistry and Technology, Moscow, Russia	University of Ottawa, Ottawa, ON, Canada
3362p	VNIIEF, Sarov, N. Novgorod reg., Russia	Lawrence Livermore National Laboratory, Livermore, CA, USA US Department of Energy / Initiatives for Proliferation Prevention Program, Washington, DC, USA
3439p	VNIIEF, Sarov, N. Novgorod reg., Russia	US Department of Energy / Nuclear Cities Initiative, Washington, DC, USA
3525p	VNIIEF, Sarov, N. Novgorod reg., Russia Close Corporation «Binar Association», Sarov, N. Novgorod reg., Russia	Los-Alamos National Laboratory, Los-Alamos, NM, USA, US Department of Energy / Nuclear Cities Initiative, Washington, DC, USA
2904/3908	VNIIEF, Sarov, N. Novgorod reg., Russia Boreskov Institute of Catalysis, Akademgorodok, Novosibirsk reg., Russia	

PARTNERSHIP AND COLLABORATION WITH FOREIGN INSTITUTES

Funded projects almost invariably have foreign collaborators preferably from the funding party country or one or more of the ISTC Member-States. The foreign collaborators for each of the oil and gas projects are listed in Table 2. The role of foreign collaborators is to approve the work plan, provide technical guidance, write joint papers, share results, and other activities that will facilitate project progress and international collaboration. However, the review of final reports indicated large variations in the level of involvement and contribution by foreign collaborators.

For example, partner projects appeared to have very close collaborations between the Russian research teams and their foreign collaborators. Specifically, projects 2245 and 3362 were funded under the DOE Initiative for Proliferation

Prevention, and projects 3349 and 3525 were funded under the DOE Nuclear Closed Cities initiative. And it was observed by the reviewers that these four projects showed active involvement by their collaborators from US DOE's national laboratories.

In contrast, the final reports from projects 985, 2755, 2937, and 3525 did not document any significant interactions with their foreign collaborators, though other information sources suggested there was active foreign collaboration during the execution of project 3525.

In the case of projects, 2904 and 3908, which were reviewed and reported here as one project because they were performed as one targeted research initiative, active collaboration appears to have occurred throughout the projects with experts from the Russia company GAZPROM, which was planned to be the end-user of the technology developed from 2904/3908.

Although variations in foreign collaborator involvement maybe expected between projects it is advisable that in the future ISTC should take a more active role in encouraging foreign collaborators and project research teams to interact on a quarterly basis. Also, there should be a formal entry section on each final project report that more clearly documents contributions by the collaborators; as foreign collaboration is an important step torwards providing international exposure and review of project results.

ACCOMPLISHMENTS OF MAJOR TASKS OF THE PROJECTS

The evaluation scoring system outlined above in section 2.2 was independently used by each panel member to assess the accomplishment scores of each project, results of which are shown in Table 3. In general, the reviewers gave a majority of projects accomplishment ratings of A or B, i.e., all objectives were met or all objectives partially met, respectively. However, from one panelist there were three projects, 2245, 3525 and 3908 that received scores of B/C, i.e., most project objectives partially met.

Table 3. Summary of Accomplishments

(Abbreviations: A = all project objectives met; A/B = most project objectives met; B = all project objectives partially met; B/C = most project objectives partially met and C = project objectives not met.)

Project #	Individual Panelist's Grades	Additional Comments from Panelists
142	A/B, B,A,A	This project developed equipment for measuring hydrocarbons in atmosphere near pipes based on differential laser absorption methodology. The technology is not unique but is applied for hydrocarbons which is potentially innovative. The project developed a prototype, and proved the concept, but not a functioning commercial system. The project was highly cost effective. It did meet nonproliferation objectives.
374	A/B,A/B,A,A	It is a very comprehensive study of pulse MHD generator and EM wave diagnostics for ground rock structures. The main objectives were well done in collaboration with different organizations. This was a multi-task project with a lot of objectives well coupled to the major solution. The amount of research and development performed for the level of funding was excellent. Project satisfies nonproliferation objectives.
985	A/B, A,B,B	This was a 2 year project with very clear objectives, which were all addressed during the excecution of the project. But, the main technical results were not well presented in the final report. Many indirect objectives are not clearly displayed in the final report. In fact after comparison of agreement and report the initial staff list was overestimated by two times. Cost efficiency is excellent with setting up of the experimental design and studying combustion, ignition and impact on borehole material. This project met non-proliferation goals.
1344	A,A/B,B,A/B	This is a multiple objective project that studied the role of microbiological and physicochemical effects on the corrosion of pipelines. Results from the project provided guidelines for predicting oil and gas pipelines from such corrosion.
1482	B,A,B,A/B	The project placed a great emphasis on numerical simulation of loads on underwater pipelines, and stress/strain analyses of pipe walls. However, the acoustic measurement system that was the important part of the project's objectives was not developed to the point of being a useful monitoring device. There wasn't clear demonstration of the practical use of the project's results. Nonproliferation efforts were met by the redirection of former missile scientists to the oil/gas sector.
2045	A/B,A,A,A/B	This is a relatively small project (2 years $198K total budget) but the amount of work done is large. There are guidance for liner and jet formation and impact on target. Report was not clear on what happens to the liner and what type of high explosive were used, and size of metal particles in the jet. The final report on this project was quite well done. The authors used their weapons knowledge to benefit the field of oil/gas. Main scientific objectives were satisfied, but it seems that the technical level of all solutions weren't developed enough, e.g., 2D solution instead of 3D. There were no tests on real rocks conditions and measuring tools are very simple. The claimed scientific results were largely met: e.g., experimental and theoretical studies of cumulative penetration of jets into the barriers with different physical and mechanical properties.
2245	A/B,A,B/C,A	The project developed rapid methods for the determination of biogenic sulfate reduction in the areas of water and soil. Project results make it possible to detect corrosion-hazardous microorganisms for regulation of bio-corrosion processes. A similar project was 1344.2 which had a budget of only 300K compared to ›$1M for 2245, and the same research team was involved in both projects.
2364	A/B,A,A/B,B	The project performed fundamental work towards its stated objectives, but not a lot of concrete examples were applied to oil/gas production. The problem discussed in the report is very complicated. It seems that not all of the tasks have been solved precisely. It needs more tests and comparison with the similar software and more core laboratory experiments for proofing the project concepts. There appears to be no clear statement about conclusions of proposed solutions to problems.
2755	A/B,A/B,A,A	Project has performed both numerical analyses and tests for different ideas for explosive welding and also thermo mechanical (Thermit) methods. The report describes tests but was very sketchy about modeling, and scientific tasks could be better clarified in technical or experimental sense. The project developed new types of welding to allow for quality welding of bulky objects and to maintain the required parameters of welds apparently regardless of the qualifications of welders.

2759	A,A,A,A	This project is about developing a monograph describing the methods of modeling and results for pipeline systems and safety. This project represents very good return on investment, well done. Only one task, book publishing, which was completed. The book compiled, and reviewed versions of scientific and methodological principles for improving the safety, environmental friendliness and efficiency of complex industrial pipeline systems by the method of numerical simulation.
2937	A/B,A,A/B,A/B	The main objective of the project was to study microbial processes that negatively impact oil. Factors influencing these processes were studied to develop and test potential microbial biocides for stored oil. This project appears to be a relatively expensive project for the level of effort, though it does address an important problem. It has come up with some good understanding of the role of biocides for reducing bacterial infection of oil supplies. The main scientific objectives of the project were solved, but it isn't clear what the future of the project results will be.
3221	A,A,A,A	Project led to ideas that could improve processing of crude vegetable oil for bio-fuels. Main scientific objectives have been met, but it was not clear how project results will be further developed. Development of new technology for biodiesel production and production in a pilot plant was achieved.
3362	A/B,A,A/B,A	The project proved a new way for cutting large thick pipes, with an approach that is different from current approaches of using explosives. Objectives were fully achieved with preparation of cutting technology using rarefaction shock waves. Created mock-cutter and documentation developed for its manufacture. Conducted testing the effectiveness of technologies and proven its advantage over existing methods. Main scientific objectives have been met, but after the project ended not clear what the next steps are for commercialization.
3439	A/B,A,A/B,A	This was a practical project and all the objectives were met with successful demonstration of fixing leaks or weak points without stopping pipeline flow/operation. Main scientific objectives have been solved. Possible commercial projects are desired. The stated scientific objectives fully achieved. Developed design and technology of repair sections of the pipeline without stopping flow.
3525	A,A/B,B/C,A/B	This was a technology development project and was successful in producing a device and extensive IP (so far 12 patents) that is now being commercially tested and oil wells. Furthermore a company has been created to commercialize the results from the project.
2904/3908	B,A,B/C,B	This was a technology development project that was of special interest to the Russia energy company Gazprom, which has planned to utilize the technology in their fields. The combined cost of the project was relatively high ~$2M. The main objectives of the project were mainly met.

DEGREE OF FULFILLMENT OF SCIENTIFIC OBJECTIVES

Review of final reports of the 17 projects indicated that most of the projects did meet their scientific objectives and tasks (see Table 4). Two panelists indicated that these objectives were only partially met for two projects, 2245 and 3525, both of which are partner projects. One of the points of criticism of project 2245 was that the final report did not track the tasks at correct places in the report. A similar complaint was made by another panelist about project 3525.

DEGREE OF FULFILLMENT OF OTHER OBJECTIVES

This is a broad category but concentrates on nonproliferation through engagement. All but four projects received A or B indicating that all project objectives were met or partially met (see Table 4). However, four projects 2245, 2364, 3525P and 39098/2904 received at least one unmet rating. Although, by definition of ISTC or DOE funded projects have WMD scientists and they are engaged in the projects. One panelist had difficulty with the documentation of project 2245 project and lack of description of this item. He had the same criticism with the report for project 3525. One comment for project 3525 was that the device electrohydraulic bore device ER-A-5 was not tested in the real situation based on the report. However, a subsequent presentation from the project manager indicated that device is being used. A comment on project 2364 was that it only concentrated on petroleum geology. There was one comment for project 3908 namely that there was no discussion on any other objective.

COST EFFICIENCY OF PROJECTS

In general, panelists found that almost all projects were cost effective as seen in Table 4. In panelists' opinions the amount of work performed in the projects compared to project budgets and the relative cost of doing such work in other countries supported the claim of cost effectiveness.

Table 4. Elements of Accomplishments

Project	Panel Grades SCIENTIFIC OBJECTIVES	Panel Grades OTHER OBJECTIVES	Panel Grades COST EFFICIENCY
142	A,B,A,A/B	A/B,B,B,B	A,A,A,A

374	A,A/B,A,A	A/B,B,A,A/B	A,A,A,A
985	A/B,A,B,B	A,A,B,B	A,A,B,A
1344	A/B,A/B,B,A	A,A,A,B	A,A,B,B
1482	B,A,B,A/B	A/B,A,A,B	A,A,A,A/B
2045	A/B,A,A,B	A/B,A,A,A/B	A/B,A,A,B
2245	A,A,B/C,A	A,A,B/C,A	B,A,B,A
2364	A,A/B,A/B,B	A/B,A,B,C	A/B,A,A,A/B
2755	A/B,A/B,A,A	A/B,A,A,A/B	A,B,A,A
2759	A,A,A,A	A,A,A,A	A,A,A,A
2937	A/B,A,A/B,A	A/B,A,A/B,B	B,A,B,A
3221	A,B,A/B,A	A,A,A/B,A/B	A,A,A,A
3362	A/B,A,A/B,A	A,A,A/B,B	A/B,A,A,A
3439P	A/B,A,A/B,A	A/B,A,A/B,A	A/B,A,B,A
3525P	A/B,A/B,B/C,A	A,A,B/C,C	A/B,A,B,A
3908	B,A/B,A/B,A/B	A,A,B,C	B,A,A,B

Contributions to the scientific field

This section addresses the scientific quality of the projects. All of the panelists rated contributions to science as A or B, which implies that most projects contributed to science. Panelists felt that even technology development projects such as 374, 2755.2, 2904/3908, 3362, 3439, and 3525, that focused on building prototypes for real applications had components of science, though one panelist rated the scientific contribution of project 3439 as less than acceptable. His argument was that there were no publications either in conferences or journals, so there was no measurable contribution to science. Though the other panelists felt that a difficult problem was addressed by project 3439 and patents were obtained from the project's results.

As stated earlier, nonproliferation objectives are met by all the projects as scientists with WMD experience applied their scientific knowledge for solving problems in the oil and gas industry.

Table 5: Contribution to scientific field

Project #	Individual Panelist's Grades	Additional Comments from Panelists
142	A/B, B,A,A	This project developed equipment for measuring hydrocarbon in the atmosphere near pipes based on differential laser absorption methodology. The technology is not unique but is applied for hydrocarbons. The project developed a prototype but not a functioning system. Concept has been proven with accurate solution to the problem of detection. The project was highly cost effective. It did meet non proliferation objectives.
374	A/B,A/B,B,A	1. This project is built by combining 6 different solutions but closely combined with a direction of MHD implementation in oil industry. Some of parts have a clear research results but some other has more technical trend. 2. Non-proliferation objectives are as well different for the different part of this project. In general the objectives are met. 3. It's difficult to say that this report has easily initiated new project and brought the new geophysical method, probably new practice investigation and testing of the existing tools needed.
985	A/B,B,B,B	Scientific results in general point of view are not strong and measurable. The mechanism of increasing proposity has not been explained. This work contributes a lot to nonproliferation objectives.

1344	A,A/B,A,A	The project is a comprehensive study of corrosion of oil/gas pipes due to various microorganisms, methods of determining soil/water conditions conducive of corrosion and methods of protecting the pipe surfaces. Main contribution is diagnostic method of characterizing soil for potential corrosion. The scientific results obtained during the project are an important contribution to the problem of sustainability of the pipeline systems. The results obtained in the project are pioneering nature and open up entirely new possibilities for Microbiology. Estimating of strains resistance spectrum against physical and chemical factors can lead market application in this field.
1482	A/B,A,B,A/B	The analytical model of nonlinear model of elastic-plastic behavior is very good and results could be used to guide pipe line safety. Yes, the work has become part of several books including Il'kaev R.I., Seleznev V.E., Aleshin V.V., Klishin G.S. Numerical Simulation of Gas Pipeline Networks: Theory, Computational Implementation, and Industrial Applications Hardcover. 720 pp. (English). Work is continuing. There is lack of description of the software used. Nonproliferation goals were achieved.
2045	A/B,A/B,A,A/B	This is a combined analytical and experimental project. It will provide good guidance for design of perforator. A description for actual bore hole based perforator would have been useful. Also in field testing, only one paper references their good publication. Seems like the work should be carried forward. Work is still in progress.
2245	A/B,B,B,A/B	This is a successful project in terms of building on previous project 1344. Project has identified inhibitors and biocide for microorganisms. This project could be commercialized but has not been.Final report does not describe full scope of the work. However, work is leading edge research.
2364	A/B,A,A,B	One of main contribution is that reservoir is not a static region and porosity and permeability changes overtime with the injection of water. Team is publishing and results have been applied. The research will have impact on the field. It should team with other experts.
2755	B,B,A/B,A/B	This is applied research. It will lead to recommendation of explosive material and some guidance for thermit. It is a practical project. It will lead new high quality welding techniques. Very limited reporting for this area. There should be some follow up work.
2759	A,A,A,A/B	Although this was really an exercise in translation with no new research performed, the results are quite good. This book can lead to future collaborations.
2937	B,B,A,A	It was a trial and error approach. A better approach would be to study mechanism and look for solutions. It has contributed to research. The project does provide new information for protecting oil from aging. Not many publications, follow-up projects to use results in practical applications.
3221	A/B,B,A/B,A/B	This work has not been published and no plan is presented for collaboration or commercialization. However, research is important in showing cost-effective method of producing biodiesel.
3362	A/B,B,B,A/B	This project indicated that rarefaction shock wave could also cut the pipe in a ecologically safe manner. Not many publications. Technology development project. However, good civilian use of high explosives.
3439	B,B/C,B,A/B	No publications so the work has not yet really contributed to the field. No scientific results. This project has initiated a new area of work for pipe line repair. This project should be followed up three dimensional computer models.
3525	A/B,A,B,A	One publication in a Russian journal. Not cited. But the results are of interest to industry and the project has gained many patents. These researchers should be encouraged to license their inventions and be part of the commercialization. No scientific results. However, design has great potential for treating wells that have lost productivity due to clogging of the screen and formation near the wellbore.
3908	A/B,A,B,A/B	This is a technology demonstration project with Russian Gas Companies as primary customer. There is hope that they will continue the support. Good opportunity for advancing the science if the work is published.

Contributions to innovation and commercialization

This section is very relevant to this set project that were reviewed because they all are in either applied science or technology development. Some of them have even developed working models that have been field tested. As shown in Table 1, six projects have obtained patents. Three presentations by project managers for projects 985, 3535 and 2904/3908 indicated that even though 985 and 2904/3908 had no patents, all three are commercialized and generating revenue or are close to commercialization. The panel unanimously rated that all, except one, projects here had developed innovative technologies and have been commercialized or has potential for some commercialization based on the available final reports as shown in Table 6.

The presentations by the three managers showed the status of the results a few years since completion. All these projects continued development of their technologies including: field testing, more patents, publications, and some commercial success. This section can be better judged if there were oral reports from all project managers of projects under review.

Table 6: Innovation and Commercialization

Project	Panel Grades	Comments
142	B,B,B,A	There are no patents or contact with industry. However, significant contribution to field of laser absorption technology.
374	A/B,B,A,A	There are no patents but is a comprehensive study of MHD based pulse power system. It is an advancement but will need exposure. There is no reference to the work in the literature. There have been innovative development and possible one patent application.
985	A,B, B,B	Technology developed will be useful in improving the production in the oil wells. There are no patents. The development has potential to get patents. The practice impact is big. Especially connecting with the practice experiment which was done in the project.
1344	A/B,A/B,A,A	Patent submitted. The results of this project will lead to advancement of diagnostic methods. The results of the project are making a fundamental contribution to the science of stress corrosion which is of great practical importance for the prediction of stress-corrosion and justifies the methods of protection against stress corrosion. The developed methodology can be replicated and have a commercial value. There is a study for IP (intellectual property) design and for the development of innovative technologies on the basis of the results.
1482	B,A/B,B,A/B	There were no patents. Analyses can lead to contracts with GAZPROM. The advancement in the field will be more accurate prediction of pipe failure and with less conservatism. The algorithms developed by this team are likely still in use and well known in the pipeline community. There is potential for patents and future work. A follow up on this project will provide better picture.
2045	B,B/C,B,B	There was no Technology Implementation Plan (TIP) or any information on patents. No one referred to the papers? cannot find much in the way of further work on this topic, no patents, no industrial collaboration.Not much information for this area. Also, while there technical development, there was no application.
2245	A,A,B,A	It is development of new chemicals both as inhibitor and biocides to prevent corrosion. There are patents. Lots of publications of good impact in literature. Description in the report is not very good. Combination of different chemical agent could improver effectiveness.
2364	A,A/B,A,B	There are no patents. It is a good contribution to technology as it is applied research. Project developed software that could be valuable to commercialize, but this was not done. The publications have been referenced.
2755	A/B,B,A,A/B	There are no patents. However, recommendation of process is an advancement for welding large diameter pipes. It is an innovative research. Very limited reporting. Potential for strong results.
2759	A,A/B,B,A	The work and its derivatives have received many citations. The translation process for the main body of work (700+ pages) spawned many publications in the international literature. Impact will be in form citation of this book.
2937	A/B,B,B,A	It is applied research and recommendation for effective biocide will be very useful. It will protect oil from aging due bacterial activity. No patents, but good exposure through a high impact publication.
3221	B,A/B,A,A	One patent submitted. No publications. Minor discussion of Technology Implementation Plan (TIP), but no TIP provided. However, results are of great commercial importance. It should have follow on support.
3362	A,A,A,A	Developed a special design of cutter based on explosives to be used in ocean, both under water and above water. GIPP partner project so a motivated US industry partner will deploy the technology. Very good attempt to commercialize and work with international collaborators.
3439	A,A,A,A	Business Plan is being developed aiming at the practical implementation of the Project results and their presentation to potential industrial partners and other interested parties, e.g. commercial and governmental organizations and utilities. There is registered patent in Russia, Pipeline Repair Devices.
3525	A,A,B/C,A	9 patents were granted and 4 applications have already got approval for patent issuance. Taking into account the preceding intellectual property on device “ERA-5” about 28 Russian and international patents will be granted. Report did not document any field tests. Although a later presentation did indicate field applications.
2904/3908	A/B,A,B,A/B	There are no patents at this time but are planned for different technology developed related to FC. Main development is Electro Chemical Generator for producing hydrogen from natural gas, and is being developed and integrated with fuel cell stacks. There are other applications of hydrogen. The project is poised to commercialize a working fuel cell reactor for pipe line application.

SPECIFIC COMMENTS FOR FURTHER CONSIDERATION

This section contains additional comments highlighting current status of project results and further considerations for the future.

Project 142: Developed a prototype, but not necessarily a functional system. The work did produce a patent in 2007 – http://www.patentstorm.us/patents/7312452.html, but it is possible that similar work has already been done by several teams around the world.

Project 374: Little seems to have come from this work as there is only one reference in the literature to the 3 publications coming from the project.

Project 985: Definite possibilities for patents and future development.

Project 1344.2: One reference in Industrial ecology could not be found. 5 of the 'papers' are identical to ones found in the ref list for #2245 which was involved in the same R&D team.

Project 1482 : This work has become part of several books including Il'kaev R.I., Seleznev V.E., Aleshin V.V., Klishin G.S. Numerical Simulation of Gas Pipeline Networks: Theory, Computational Implementation, and Industrial Applications Hardcover. 720 pp.(English). The algorithms developed by this team are likely still in use and well known in the pipeline community.

Project 2045: Seems like the work could have been carried forward but was not.

Project 2245: This project could be commercialized but has not been to the panel's knowledge. Related to 1344.2

Project 2364: Fundamental work towards the goals but not a lot of concrete examples applied to oil/gas production. Project developed software that could be valuable to commercialize, but efforts to these ends have not been attempted. Publications from this project have been well cited.

Project 2759: Jim Albright, formerly of LANL, was listed as a foreign collaborator. He did work with this team on previous projects but was not really part of the Monograph. He said oil industry was mainly interested because of the access to experimental data that lies in the translated works. The work and its derivatives have received many citations. The translation process for the main body of work (700+ pages) spawned many publications in the international literature. There was a very good return on investment for this project.

Project 2937: No patents, but good exposure through a high impact publication with 12 citations. This work should be commercialized through collaboration with industry.

Project 3221: This project should be expanded to include a large test of the methods so that commercial potential can be assessed as the current results of the project are too limited to tell if the process will scale-up or be viable in a real world setting.

Project 3362: Very good attempt to commercialize and work with international collaborators.

Project 3439: This project has a Technology Implementation Plan (TIP) that is quite impressive. This should be a requirement on all ISTC projects and should be included in the final project summary. The scientists in this project missed an opportunity to publish quality work and should be encouraged to do so now if possible. There should have been acknowledgement that a US national lab was involved in review of this project (i.e., Dr. Philip Stauffer reviewed many of the project's quarterly reports).

Project 3525: This project has resulted in a system that is currently being tested by British Petroleum at their oil wells in Russia. Pictures of the Electrohydraulic Borehole device being prepared for use in the field are shown in Figure 1. Jim Albright formerly of LANL, suggested Peter Roberts, also of LANL, (proberts@lanl.gov 667-1199) to be contacted for ideas on taking this project further. Peter apparently has a patent for a sonic borehole cleaning tool that may be similar.

Project 3908: The fuel cell prototype that was developed during the projects needs more time for testing before it could be considered a working field device. These further tests and tasks are being undertaken by the projects' development team and Gazprom.

OVERALL RATINGS

Before the panel met in Moscow the panel members reviewed technical reports and other relevant project documents and independently came up with their own ratings for each project. At the meeting in Moscow panelists went over each project and presented their overall rating results which are summarized in Table 7, with final consensus scores for each project also being shown. Of the 17 projects reviewed, 2 were viewed by the panel to have met all project review criteria (A), 11 were viewed to have met most project review criteria (A/B), and 3 were viewed to have had all project review criteria partially met (projects 2904 and 3908 were considered as one follow-on project).

Table 7: Summary of Oil and Gas Project Scores

(Abbreviations: A = all project review criteria met; A/B = most project review criteria met; B = all project review criteria partially met; B/C = most project review criteria partially met and C = project review criteria not met.)

Project #	Project title (Sector)	Panelist W	Panelist X	Panelist Y	Panelist Z	Consensus Score
142	Development of Laser Technology for Environmental Monitoring in Gas and Product Pipeline Areas and Energy Saving of Gas and Oil Products.	A/B	A/B	A/B	A/B	A/B
374	Pulsed High-Power Systems for Geology and Geophysics. (Exploration)	A	A	A/B	A/B	A
985	Method of Raising Productivity of Petroleum and Gas-Condensate Wells with the Help of a Two-Stage Thermal and Gas Treatment of a Productive Layer Accompanied by Thermochemical Destruction of Hydrocarbons. (Extraction)	B	B	B	A/B	B
1344.2	Development of Methods both for Microbiological Detection of Stress Corrosion Cracking of Pipelines and its Prophylaxis. (Transportation)	A/B	A/B	A/B	A/B	A/B
1482	Pipelines' Estimation Technique Development in the Area of Underwater Passages Across Deep Rivers with the Implementation of Acoustic Emission Monitoring Technique. (Transportation)	A/B	B	B	B	B
2045	Study of Peculiarities of Small-Size Industrial Shaped Charges' Jet Formation, Evolution and Penetration into Various Materials. (Extraction)	B/C	B	B	B	B
2245	Studies on the Impact, Detection, and Control of Microbiologically Influenced Corrosion Related to Pitting Failures in the Russian Oil and Gas Industry. (Transportation)	A/B	B	A/B	A/B	A/B
2364	Research into Physical and Mineralogical Mechanism of Oil Recovery Decrease in Clayey Oil Pools. (Extraction)	B	A/B	A/B	A/B	A/B
2755.2	Explosive and Thermochemical Welding of Pipes Having Large Diameters. (Transportation)	A/B	A	B	B/C	Range of opinions
2759	Monograph Numerical Simulation of Pipeline Systems for Enhancing Their Safety and Efficiency. (Transportation)	A/B	A	A	A	A
2937	Development of Oil Bio Destruction Suppression Methods in Industrial and Natural Storages. (Transportation)	A/B	A/B	A/B	A/B	A/B
3221	Development of New Technology and Equipment for Production of BIODIESEL - Vegetable Oil Esters. (Alternative Production Methods)	A/B	A/B	A/B	B	A/B
3362	Rarefaction Shock Wave Cutter for Cutting Offshore Oil- Gas Platforms from Outside. (Extraction)	A/B	A/B	A/B	A/B	A/B
3439	Development of Method and Repair Devices to be Used in Emergency-Dangerous Sections of Active Trunk Pipelines Restoration without their Deactivating. (Transportation)	A/B	A/B	A/B	A/B	A/B
3525	Modernization, Manufacturing and Testing of Electrohydraulic Borehole Device "ERA-5" for Stimulation of Oil and Gas Production and for High-Resolution Seismic Prospecting. (Extraction)	A/B	B	A/B	A/B	A/B
2904-3908	Environmentally Friendly Small Capacity Power Plants Based on Fuel Cells for Stationary Application. (Transportation)	A/B	A/B	A/B	A/B	A/B

Conclusions

The following are the main conclusions from the work of the review panel:

- ISTC funded project managers and their R&D teams were technically and organizationally competent, innovative and dedicated to complete their projects in most part successfully.
- Of the 17 projects reviewed, 2 were viewed by the panel to have met all project review criteria (A), 11 were viewed to have met most project review criteria (A/B), and 3 were viewed to have had all project review criteria partially met (projects 2904 and 3908 were considered as one follow-on project).
- There was overall agreement among the panelists that projects were relatively cost effective and met nonproliferation objectives.
- All three project managers interviewed presented information that documented that after their ISTC projects ended they continued their research and commercialization efforts. In some cases these projects were generating revenues. And, the following additional important developments came to light during their presentations.
- Contracts were in place with British Petroleum to field test the bore hole cleaning technology from project 3525 at 300 wells in Russia. (project ended 7/2010).
- Gazprom supported follow-on development and production of the small capacity fuel cell based power plant produced from projects 2904/3908. (project ended 7/2010).
- Large scale field tests at oil wells in CIS using the bore hole chemical treatment technology developed in project 0985 were underway with further enquiries from companies in the US and the UAE. (Project ended 10/2002).

But, it was also observed that:

- Foreign collaborators on projects should be more involved in the evaluation of projects before, during and after their performance.
- A need to better plan from the onset of projects on how to protect IPR.
- Increased dissemination of non-proprietary project results in international peer reviewed journals and international conferences.

Recommendations

The following are the main recommendations of the review panel:

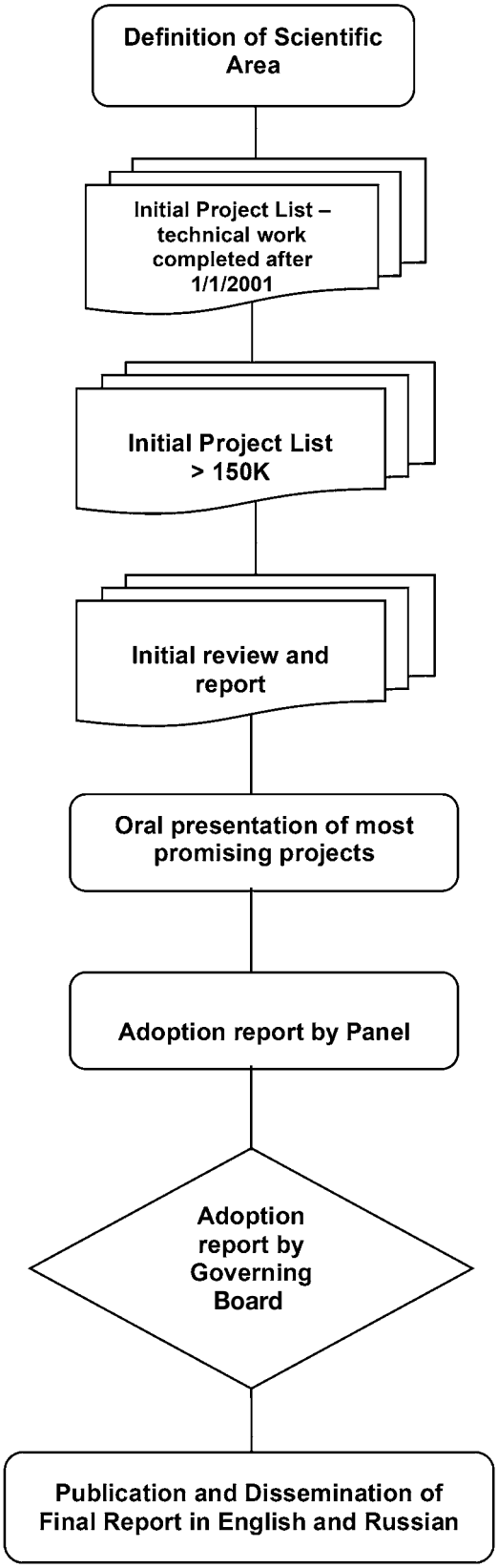
- ISTC should take an active role in stating in the proposal the role of the collaborator and should follow up on it every quarter. The final report should also document the contributions of any collaborator. The project managers at ISTC should actively monitor contributions of the listed foreign collaborators. This is an important aspect of these projects as it provides international exposure to technical work.
- There was a general lack of dissemination of non-proprietary results in the international journals and conferences. This should be encouraged for better visibility in the technical community and possibility of commercialization. ISTC should assist and encourage this.
- There is a need to review completed projects to assess any guidance for commercialization or alternate funding near the time of completion. Usually there is a critical period after the project ends for commercialization efforts to be supported and before the technology becomes “stale” or the development team disbands.
- To better assess the scientific and/or commercial success of ISTC projects there is a need to follow up the projects a few years after their completion as the publications and commercialization success generally occurs 2-4 years later.
- Technology Implementation Plan (TIP) should be required for all the projects and documented in the final report.

The following are suggestions to improve the ISTC project review process:

1) Give more lead time for review of such a large body of data.
2) Refine the grading sheet to focus on metrics that are pertinent to the goals of the review. Namely, look more at total success as perhaps measured in the success statistics methods as presented in Section 3.1 above.
3) Ask for present day updates (written) from all projects before the review to allow recent success to be included in the analysis. Many of the project final reports were written many years before this review took place. For project 985 this could have significantly improved their grading score.
4) Make sure that the project leaders know that the Final Report Summaries are vital to the review process and that they should include all relevant data (patents, international conference attendance, books, and publications, meetings with companies).
5) Have all panelists submit grading scores prior to the panel meeting and then change the order in which each participant defends the grade they assigned.

ANNEXES

ANNEX 1. ISTC PROJECT REVIEW PROCESS FLOW CHART



Annex 2. Projects Reviewed

This annex provides a list of projects reviewed for this sector. It should have a list of projects with relevant project information (i.e. title, institute, foreign collaborator, finances, project duration etc).

Project #	Project title	Lead Institute	Collaborator/Partner	Funding	Project duration	Area
142	Development of Laser Technology for Environmental Monitoring in Gas and Product Pipeline Areas and Energy Saving of Gas and Oil Products.	VNIIEF, Sarov, N. Novgorod reg., Russia	National Physical Laboratory, Teddington, UK (Woods P)	$218,000 (EU: $109,000, US: $109,000)	24 Months (ended Feb. 1998)	Transportation
374	Pulsed High-Power Systems for Geology and Geophysics.	IVTAN (High Temperatures) / High Energy Density Research Center, Moscow, Russia	Lawrence Livermore National Laboratory / University of California, Livermore, CA, USA	$610,000 (JP: $305,000, US: $305,000)	36 Months (ended June 2000)	Exploration
985	Method of Raising Productivity of Petroleum and Gas-Condensate Wells with the Help of a Two-Stage Thermal and Gas Treatment of a Productive Layer Accompanied by Thermochemical Destruction of Hydrocarbons	Institute of Biochemical Physics, Moscow, Russia	Advanced Power Technologies, Inc., Washington, DC, USA (Caveny Leonard)	$275,000 (US)	24 Months (ended Oct. 2002)	Extraction
1344.2	Development of Methods both for Microbiological Detection of Stress Corrosion Cracking of Pipelines and its Prophylaxis	State Research Center for Applied Microbiology and Biotechnology, Obolensk, Moscow reg., Russia	Argonne National Laboratory (ANL), Argonne, IL, USA (Frank James), Myongji University / Research Institute for Clean Technology, Yongin City, Korea (Jeong B C)	$299,977 (US)	39 Months (ended Aug. 2006)	Transportation
1482	Pipelines' Estimation Technique Development in the Area of Underwater Passages Across Deep Rivers with the Implementation of Acoustic Emission Monitoring Technique	VNIIEF, Sarov, N. Novgorod reg., Russia	Sandia National Laboratories, Albuquerque, NM, USA	289, 584 €	33 Months (ended May 2004)	Transportation
2045	Study of Peculiarities of Small-Size Industrial Shaped Charges' Jet Formation, Evolution and Penetration into Various Materials	VNIIEF, Sarov, N. Novgorod reg., Russia	Dynamit Nobel, Troisdorf, Germany (Veehmayer M), Lawrence Livermore National Laboratory, Livermore, CA, USA (Baum D W)	$198,010 (US)	24 Months (ended Oct. 2004)	Extraction
2245	Studies on the Impact, Detection, and Control of Microbiologically Influenced Corrosion Related to Pitting Failures in the Russian Oil and Gas Industry	State Research Center for Applied Microbiology and Biotechnology, Obolensk, Moscow reg., Russia	US Department of Energy / Initiatives for Proliferation Prevention program, Washington, DC, USA	$1,102,500 (DOE)	48 Months (ended Apr. 2007)	Transportation
2364	Research into Physical and Mineralogical Mechanism of Oil Recovery Decrease in Clayey Oil Pools	VNIIEF, Sarov, N. Novgorod reg., Russia	TU Delft, Delft, The Netherlands (Schotting R J), Universitat Leipzig / Fakultat fuer Physik und Geowissenschaften, Leipzig, Germany (Karger J)	$286,000 (EU)	36 Months (ended Aug. 2008)	Extraction
2755.2	Explosive and Thermochemical Welding of Pipes Having Large Diameters	VNIIEF, Sarov, N. Novgorod reg., Russia	Dynamic Materials Corporation, Boulder, CO, USA (Banker J G), Lawrence Livermore National Laboratory / Energetic Materials Center, Livermore, CA, USA (Chandler E A)	$200,000 (US)	24 Months (June 2008)	Transportation
2759	Monograph «Numerical Simulation of Pipeline Systems for Enhancing Their Safety and Efficiency»	VNIIEF, Sarov, N. Novgorod reg., Russia	Los-Alamos National Laboratory, Los-Alamos, NM, USA (Toevs J W, Albright N)	$75,000 (US)	24 Months (ended July 2006)	Transportation
2904	Environmentally Friendly Small Capacity Power Plants Based on Fuel Cells for Stationary Application	VNIIEF, Sarov, N. Novgorod reg., Russia		$1,073,288 + 472,860.37 € (EU: 472,860.37 €, US: $536,644, CA: $536,644)	88 Months (ended Aug. 2011)	Transportation
2937	Development of Oil Bio Destruction Suppression Methods in Industrial and Natural Storages	VNIIEF, Sarov, N. Novgorod reg., Russia	Laurentian University, Sudbury, ON, Canada (Appanna V)	$377,981 (CA)	41 Months (ended Feb. 2009)	Transportation

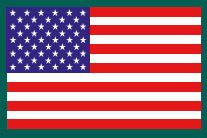
3221	Development of New Technology and Equipment for Production of BIODIESEL (Vegetable Oil Esters)	State Research Institute of Organic Chemistry and Technology, Moscow, Russia	University of Ottawa, Ottawa, ON, Canada (Dube M A, Tremblay A)	$448,743 (CA)	47 Months (on-going)	Aternate Method
3362	Rarefaction Shock Wave Cutter for Cutting Offshore Oil- Gas Platforms from Outside	VNIIEF, Sarov, N. Novgorod reg., Russia	Lawrence Livermore National Laboratory, Livermore, CA, USA (Glenn L A)	$250,000 (DOE)	29 Months (ended Oct. 2009)	Extraction
3439	Development of Method and Repair Devices to be Used in Emergency-Dangerous Sections of Active Trunk Pipelines Restoration without their Deactivating	VNIIEF, Sarov, N. Novgorod reg., Russia	US Department of Energy / Nuclear Cities Initiative, Washington, DC, USA	$165,000 (DOE)	21 Months (ended Mar. 2009)	Transportation
3525	Modernization, Manufacturing and Testing of Electrohydraulic Borehole Device “ERA-5” for Stimulation of Oil and Gas Production and for High-Resolution Seismic Prospecting	VNIIEF, Sarov, N. Novgorod reg., Russia	Los-Alamos National Laboratory, Los-Alamos, NM, USA (Martin O)	$350,000 (DOE)	45 Months (on-going)	Extraction
3908	Environmentally Friendly Small Capacity Power Plants Based on Fuel Cells for Stationary Application	VNIIEF, Sarov, N. Novgorod reg., Russia		$360,000 + 139,535 € (EU: 139,535 €, US: $180,000, CA: $180,000)	24 Months (ended Aug. 2011)	Transportation

Annex 3. Evaluation Form for Technical Review of ISTC Projects

This evaluation form will be completed on the basis of written evaluations: Final Technical Report, Project Assessment Sheet, Foreign collaborators approval/assessment, and the oral presentations to the panel.	
Project Attributes	
Project Number	
Project Title	
Leading Institute	
Project Manager	
Foreign Collaborators	
Duration	
Total Budget	
Funding Parties	
ISTC Project Manager	

Evaluation of Completed Project	
I. Accomplishment of major tasks of the project	
Degree of fulfillment of scientific objectives i.e. were the foreseen research objectives fully met, partially met, or not met at all?	(A, B, C)*
Degree of fulfillment of other objectives i.e. non-proliferation, human engagement, sustainability.	(A, B, C)
Cost efficiency of the project i.e. were the project costs in line with the project activities – was there value for money inside the project?	(A, B, C)
Comments	

Average score of I	(A, B, C)
II. Contributions to the scientific field (A, B, C) Scientific Results Did the scientific results contribute to the scientific field in question? Non-Proliferation Results Did the scientific work contribute to non-proliferation objectives? Other Did the project lead to additional follow-up projects?	
Comments	
III. Impact (A, B, C) i.e. what was the impact of the results of the project? Did it lead to applied research, commercialization of new technologies, innovation in existing technologies or patents?	
Comments	
IV. Dissemination of the results	
Number of publication in internationally recognized journals (weighted with the impact factor of the journal)	(A, B, C)
Number of publication in national journals	(A, B, C)
Presentations at the international conferences (weighted with the “impact factor”: invited, oral, poster)	(A, B, C)
Comments	
Average score of IV	(A, B, C)
V. Collaboration network beween CIS Institutes (A, B, C)	
VI. Partnership and collaboration with Foreign Institutes (A, B, C)	
Final overall evaluation	(A, A/B, B, B/C, C)
Assessment of potential for further development and application	
* A = all project objectives met; A/B = most project objectives met; B = all project objectives partially met; B/C = most project objectives partially met and C = project objectives not met.	



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