White Paper on Offshore Software Development in Ukraine

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www.amcham.kiev.ua

Preface

Dear Reader,

Thank you for taking an interest in the capabilities of Ukrainian software developers.

Countless personal experiences have reinforced in our minds the expertise, resourcefulness, efficiency and, above all, talent, of programmers born and educated in the –Former Soviet Union, specifically, Ukraine.

The objective of this white paper is to describe Ukraine's current place in the Offshore IT market and to assess its potential for the future. For purposes of this paper, software development, or custom development, will be the focus, as opposed to IT enabled services (call centers, support services, data entry, transcriptions, etc.). Ukraine will be shown in relation to more established offshore software development locations such as Ireland and India and in relation to up and comers such as China and the Philippines.

The American Chamber of Commerce in Ukraine (AmCham) is devoted to the development of bilateral commercial ties between Ukraine and the U.S. Advocating Ukraine's outstanding software development capability to American companies is an excellent example of how the AmCham serves both Ukrainian and American industries.

We have made our best efforts to include the most current and realistic data in this document. However, this industry is moving quickly in Ukraine, and there are new developments each day. If you feel that parts of this white paper are not accurate or are out of date, please contact me directly with your comments. We intend this white paper to be a living document, representing the dynamic nature of the country it promotes. An updated version is already forthcoming, and will feature several case studies and more analytical data.

Our sincerest thanks go to the members of the AmCham IT Committee in Ukraine mentioned herein, who donated their valuable time and expertise to the preparation of this document.

Sincerely Yours,

David S. Diamonon
Chair, AmCham IT Committee

Michael A. Dolzhenko
Co-Chair, AmCham Offshore Software Division, AmCham IT Committee

Alex Garmash
Co-Chair, AmCham Offshore Software Division, AmCham IT Committee

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Executive Summary

In the era of globalization and specialization outsourcing non-core activities to third parties became a universal tool, helping companies to concentrate on their basic, profit-generating activities, while letting professionals take care of secondary business processes.

There are several strong characteristics of Ukraine that provide positive benefits for international organizations considering working with software development resources from Ukraine:

- Availability of resources;
- Availability of programming specialists;
- Labor Costs;
- Technical excellence;
- R & D focus;
- Strong fundamental education;
- Experience with complicated projects;
- European culture;
- Great potential;
- Location;
- Business travel;
- Availability of local professional organizations.

Like any developing and young industry, the Ukrainian offshore software development industry has a number of drawbacks. People involved in the industry clearly recognize them and try to combat them. These disadvantages may be real or merely perceived, but they prevent Ukraine from becoming an outsourcing superpower:

- Business and Management skills;
- Bandwidth costs;
- Industry association development;
- Language barrier;
- Lack of certification organizations;
- Brain Drain;
- Legal and regulatory issues.

Although leading Ukrainian providers have existed for 10 years, the industry is still young, which leads to both disadvantages and advantages. Because the outsourcing sector is small but very competitive with the rest of the Ukrainian IT –industry, not to mention industry outside of IT, in terms of payment, career opportunities, job challenges and social protection, it attracts the best of the best. This situation will last so long as free resources are available. Indian companies, by contrast, have started to meet problems attracting new high quality personnel. Another positive impact is that Ukrainian companies are much more flexible when seeking to attract clients. They strive to overtake the leader and to prove themselves.

On the other hand, there is a lack of industry associations and powerful lobby and certification authorities, all of which make industry's positions harder. Although the total number of companies involved in offshore development is about one hundred, if speaking of

reputed companies only, the situation is that commonly none come to mind if you ask a well-educated person to name one offshore programming company.

This industry is sure to continue growing quickly. Ukrainian companies and project managers are quickly gaining experience and many are currently preparing to attain world recognized quality and business process certifications. The window of opportunity to discover and enjoy the work of the best talent in Ukraine is still open but disappearing quickly.

Twenty years ago India had no India with which to compete, as Ukraine does today. But the Ukrainians are coming and striving to attain their rightful place in the IT world.

Offshore Software Development: What is it and why do it?

Offshore development in the IT world is the term most often used to describe the business of outsourcing software programming and engineering services beyond national boundaries. The three most common justifications for offshore development are cost reduction, internationalization and inadequate supplies of domestic resources.

Cost reduction is the traditional reason for offshore development. Low-level tasks such as coding and software testing can be performed in less-developed countries at costs as low as ten percent of domestic ones. India has built revenues for this type of outsourcing from $110 million in 1990[1] to an expected $6.3 billion in 2000-2001.[2] Attracted by such huge success, other less-developed countries are attempting to become serious contenders for India's near monopoly.

Software manufacturers seeking international markets and needing to localize their products to specific platforms, languages and cultural requirements often find it most efficient to use offshore development resources in or near their target markets. Ireland, Australia and Finland are in the most demand for this type of outsourcing today. Cost savings from these more-developed countries remain available, but are less dramatic.

The growing shortage of IT professionals, especially in the most developed industrial countries, is rapidly becoming the most important reason for offshore development. For instance, the U.S. Department of Commerce reports that by 2003 there will be a shortfall of some 1.4 million computer programmers in the United States alone.[3]

In the case of software development, making outsourcing "offshore" often brings the best results by providing high quality software solutions at an inexpensive price.

The following reasons influence companies, including some in the Fortune 500, to engage in offshore development:

- Constant shortage of world-class software professionals;
- Pressure to cut costs to secure competitive edge during the ongoing recession;
- Need to update IT skills and tools constantly.

Benefits of offshore software outsourcing:

- Substantial reduction in total project costs;
- Flexibility resulting from the ability to attract resources for large projects quickly;
- Compression of project development and implementation time;
- Access to a resource pool of highly skilled and experienced IT professionals;
- World-class quality of developments.

Project management is always a challenge, but it may involve even much more effort and risk for a company if the project is carried out by another company in a different country. Although almost everyone clearly understands benefits of offshore software outsourcing,

[1] http://members.tripod.com/~iimc/spm/report.html
[2] http://www.nasscom.org/template/itinindia.htm
[3] http://www.empowermentzone.com/itworker.txt

many companies hesitate to go offshore for the first time because they have the following substantial and often well-grounded fears:

- Language problems and miscommunication because of lack of common language between the offshore team and the customer;
- Opacity of the developments at the offshore site because of lack of formal and regular communication;
- Insufficient level of control over offshore development team;
- Poor or lack of local acceptance tests that results in supplying deliverables in which the customer finds many defects;
- Poor IT management and environment at the offshore site.

Existing Delivery Models

Several different delivery models exist for software development. These can be categorized as variations of outsourcing or 3rd party models, wholly owned subsidiary models and body shopping. Further categories are defined within this section.

Onsite Team

Onsite needs only project coordination
Well-suited for cases where

- There is reduced customer interaction
- There is reduced knowledge transfer from customer
- The scope is well defined
- The processes and policies are well defined

Offshore team

- Detailed design, Code and Unit Test
- Integration Test

Well-suited for cases where

- There is ongoing interaction with customer
- A changing business environment is prevalent
- A new technology is used

Onsite and Offshore with lead team onsite

- Lead Team at Onsite
- Project Management Lead
- Knowledge Transfer Lead
- Quality Assurance Lead

Onsite and Offshore with lead team offshore
Lead Team at Offshore

- Project Management Lead
- Knowledge Transfer Lead
- Quality Assurance Lead

Onsite and then Offshore

Lead Team arrives from offshore

- Knowledge transfer
- Procedure setup

Lead Team returns offshore

- Setup environment
- Performs knowledge transfer

- Functions as knowledge expert

Well-suited where

- The initial learning curve is high
- The nature of work is repetitive

Onsite, Offshore and then Onsite

- Lead Team arrives from offshore
- Lead Team returns offshore
- Lead Team arrives onsite again
- Implementation
- Knowledge Transfer

Well-suited where

- Knowledge transfer is needed from offshore
- The customer needs support for implementation

Fully Offshore - Full team is at offshore

Well-suited for:

- Customers with very well-defined work units procedures and policies that are well-defined
- Communication-intensive cases

Full team is offshore under customer management

Well-suited for:

- Creating virtual organizations
- Delivery, that depends on multiple customer points of contact
- Cases where work forecast horizons are limited

Fully Onsite - Full team is onsite

Well-suited for:

- Staff augmentation at customer locations
- Consulting
- Onsite studies
- Offshore engagement planning projects
- Short term engagements

Ireland fits these criteria very well. Demographically, 40% of its population is estimated to be less than 25 years of age. Its twenty universities produce an adequate number of IT professionals to allow Irish offshore development business to grow. Close links between the universities and hardware/software platform manufacturers ensure that graduates are well prepared to begin working when they complete their studies. As a result there are some 550 Irish offshore development companies, 80% of which are Irish owned. Irish Government policies strongly support these developments. Offsetting these advantages are relatively high wage rates. These capabilities translate into 2000 offshore development revenues of over $6 billion. [4] Of all packaged software sold in Europe, 40% is produced in Ireland.[5]

India shares most of the same advantages, but with significantly lower wage rates. The Indian government is aggressively helping to develop the offshore development sector, which now accounts for more than 10% of the value of all Indian exports. The Indian

[4] http://members.tripod.com/~iimc/spm/report.html
[5] http://members.tripod.com/~iimc/spm/report.html

National Association of Software and Service Companies (NASSCOM) is one of the strongest industry groups in the World. India has an excellent university support system that works closely with leading hardware and software manufactures. During the year, the number of quality certified software companies from India increased to over 170; Fifteen Indian companies now have the unique distinction of a SEI-CMM Level 5 certification. (Only 23 companies worldwide have achieved level 5 Certification).[6]

Several areas are customers for offshore services namely the US, Western Europe and Japan, with the US being the largest market. With regard to the US market, India enjoys first-to-market advantage and owns anywhere from 80 percent to 95 percent of the U.S. offshore market. It also has the advantage of possessing a large, English-speaking population and government very interested in developing and maintaining their status as an IT powerhouse.

Within the last few years other countries have emerged as locations for software development. The countries of the former Soviet Union and Eastern Europe fall in to this category, as well as China and the Philippines. Current wage rates in these countries put them at similar levels to India and they have the advantage of an in-depth educational system put in place by the Soviet Union. The former Soviet Union, Ukraine included, should be posed to make the most of these advantages and takes its place in the worldwide custom software industry.

Almost every country in the region has a large network of colleges that produce far more IT graduates than are needed locally. That's why the Czech Republic, Hungary, Lithuania, Poland, Romania, and Ukraine, are starting to show up more on the offshore IT radar screen.

India has put special emphasis on quality of services, which has resulted in having 32 companies at SEI CMM Level 5 assessment, as of October 2001. It is understood that only 58 organizations across the world have acquired such assessment. The motivation for Indian IT software and services companies to attain SEI CMM Level 5 assessment dates as far back as 1995, when Motorola's unit in India acquired this certification. Ukraine is just at the beginning of its certification process.

For smaller companies looking to begin working with offshore resources, they will have an excellent chance to work with very skilled people and develop a long-term relationship, whereas such a company may not be recognized by any Indian firms due to the small team size and small potential. For Fortune 1000 companies it is an opportunity to mitigate their risk from having all their offshore risk in one country.

[6] http://www.nasscom.org/template/itinindia.htm. For alternate statistics, please see footnote #12.

Offshore Software Development in Ukraine

Status

General

Ukraine is located in Eastern Europe, bordering the Black Sea, between Poland and Russia. As of 2000, the population is 49 million living in an area slightly smaller than the size of Texas. With the dissolution of the Soviet Union at the end of 1991, Ukraine achieved independence. Since becoming independent, Ukraine has avoided the internal ethnic conflicts that have plagued it's neighbor to the east, Russia. Ukraine boasts a 98% literacy rate with 87% of high school graduates going on to higher education. Of those, 35% choose information technology related disciplines. Kyiv is the capital of Ukraine with a population of approximately 3 million persons.

Similar to other countries in Central and Eastern Europe, Ukraine has not experienced a high demand for the use of their software engineers, as countries like India and China have. This results in higher availability of technical resources in close proximity to major European capitals. The majority of software development firms today are located in the capital city of Kyiv. Kyiv is approximately 2 to 2.5 hours from the major Western European capitals with flights arriving almost daily. To the US, Ukraine is a 7-10 hour time difference.

According to experts and to the data of the Ministry of statistics the total of computers in Ukraine in 1999 has made about 1 million. In this case about 270,000 computers either are in failure condition or obsolete. Annually in Ukraine are for sale 180 - 200 thousand computers, 30 % from that are intended for substitution faulty and obsolete. Thus, in 2000 the park of computer equipment will increase up to 1.130 million computers. India has more than 3 million computers. Thus, it is possible to consider a degree of computerisation of Ukraine as sufficient for success of branch of software development.

At this time there are few large software development shops in Ukraine. The majority of companies have between 20 and 50 persons, with only a few firms having 250+ persons and several others that are five persons or less. Given the depth of IT resources available in the market, smaller firms can ramp up quickly by tapping the available pool of talent.

Education

Ukraine inherited its educational system from the Former Soviet Union, which consistently graduated highly qualified students in applied sciences such as mathematics and physics. A large component of their training today includes software development and many of them take their logical thinking skills and use them in a career as a software engineer. Ukraine boasts a 98% literacy rate with 87% of high school graduates going on to higher education. Of those, 35% choose information technology related disciplines. Presently, there are more than 39 educational institutions that maintain more than 15 IT related programs. The estimated number of students that are graduating each year with certificates in IT disciplines is more than 3,000 and is growing year-by-year. According to Kyiv Polytechnical

Institute, enrollment in IT related departments is increasing at a rate of 10-15 percent per year.[7] Certification in specific technologies is also taking place. For example, several local firms are qualified to administer testing for Microsoft Certified Engineers (MCE). According to Microsoft statistics more than 1000 have passed the MCE exams thus far in Ukraine.

Because of low demand in the domestic market for research and development in mathematics or physics, former researchers are also looking to commercialize their talent and technology they have been developing over the years. This provides a wealth of undiscovered talent and technology in Ukraine, which can be applied to the systems and applications being developed by U.S. companies. For years in the Soviet Union and then Ukraine, technical documentation was available only in English; this has resulted in technologists having a high level of English comprehension skills. There is a certain level of high-end project managers who do have good speaking skills; however, an emphasis still does need to be placed on training in this area.

Industries and intellectual capital

Ukraine possesses considerable intellectual potential with its Ukrainian National Academy of Sciences, numerous scientific and technological Institutes, universities and R&D companies. Ukrainian scientists have achieved world-class results in such fields as mathematics, physics, computer sciences, biology, electric welding, new materials and space sciences.

The basis of the country's scientific and technological development is in the following branches of Ukrainian economy: aircraft industry, ship-building, missile and tank engineering (Ukraine is among the five countries in the world with a closed cycle of tank manufacturing), bio-technologies, radio-electronics, low temperatures physics, nuclear physics, communication and telecommunication. The Ukrainian aerospace and defense industry, which includes more than 500 military enterprises and research institutes, is known for its state-of-the-art technology and production of reliable equipment.

The traditions of mathematical schools are also very strong in Ukraine. Kyiv had always been the leading center of computing technologies in the former USSR: the second computer in the world was created in Kyiv as well as on of the largest schools of cybernetics – the Glushkov Research Institute.

Among other economic priorities are the development of processing and food industries, heavy machinery and industrial equipment production, machine tools, large electrical transformers, ships, locomotives, rail cars, passenger (ANTONOV-140) and cargo aircraft (ANTONOV-70, ANTONOV-225), agricultural machinery as well as textiles.

Market:

Worldwide, as the demand for programmers has continued to grow faster than the available supply of qualified specialists, companies have been looking for new sources of labor to fill the gap. As the problem has become even more acute in the past few years, Ukraine has stepped onto the world stage as a source of highly skilled, low cost programmers. Until the last few years, the trend was to hire these programmers away from Ukraine, a trend known

[7] Emmy B. Gengler – Softjourn, Inc. interview with Vadim Aleksandrovich Tikhonov – Business Automation Department – Kyiv Polytechnical Institute. December 2001.

as “brain drain.” While this still occurs, increasingly, companies are more interested in harnessing the available labor in Ukraine without having to relocate staff outside of Ukraine.

According to the Ukrainian Association of Software Developers (UASWD), 90% of the offshore software development in Ukraine is done on the "black market", and to their estimations 32 million USD in software development work was done in Ukraine in 2000; however, the Ukrainian government only officially registered 3.1 million USD.[8] Given the small size of the software exports market, it is not currently being tracked by any major industry analysts. However several estimates do exist which vary widely depending on how the numbers are calculated. According to Emmy Gengler, the CEO of Softjourn, Inc., the offshore software development market in Ukraine was worth between 18 million and 45 million USD in 2000.[9]

There are more than 200[10] offshore software development services companies in Ukraine, most of which fall into two categories:

- Those with 50 to 300 programmers partly or fully foreign owned or 100% Ukrainian owned, but which do most of their work for foreign clients as contractors. These organizations often have well-developed management structures and (in the case of contractors) sales and marketing organizations worldwide.
- Those with 10 to 20 programmers doing smaller jobs and getting their contracts through friends and acquaintances abroad within the Ukrainian Diaspora. Most of these organizations keep much lower profiles and many are not even registered as official companies (those present on the “black market”).

According to the employment agency ANCOR, the biggest demand for IT professionals in Ukraine is for experienced programmers in C/C++, Web-developers, Database specialists and Unix-administrators. Specific experience is being requested in: WebLogic, WebSphere, Tuxedo, SilverStream, ATG/Dynamo, NSMQ, EJB, CORBA, OAS, Jserv, JRUN, and ColdFusion.

[8] Viktor Spiridonov, Executive Director of the Ukrainian Association of Software Developers. October 2001.

[9] Market estimate was first calculated for an interview with the Eastern Economist in March 2001. Assumes between 2,000 and 3,000 professional programmers working in the software exports market (custom development) in Ukraine in both foreign and domestic companies at the end of 2000. [For comparison, it is estimated that between 5,000 and 8,000 programmers work in this market in Russia.]. In order to size the market we would have to take in to account those working at an operations development center (ODC) for a foreign company and therefore functioning as a cost center, and those that are selling their services at an offshore market rate to third parties. This would result in a range of monthly revenue between 600 USD and 2,000 USD (2,000 USD is a low-end figure. More realistically revenues generated can range from 2,000 USD– 6,000 USD. For purposes of this calculation, the low-end figure will be used). Utilization rates: 100% utilization rate for ODCs and 75% per programmer per year for those selling to third parties. Results in an annual revenue generation: 7,200 USD - 18,000 USD per capita. Estimate an average of 2,500 programmers in the offshore market which results in an annual revenue of 18 million to 45 million USD. [As compared to India's share of the offshore market at 6.3 billion USD. In Russia their offshore market is estimated between 60 and 100 million USD.].

[10] Kyiv Post, September 19,2001

As of November 2001: (Salaries for IT specialists are growing at approximately 10% annually).

Table 1: Salaries for Ukrainian IT Professionals

Position	Monthly Salary in USD (after Taxes)		
	Min	Average	Max
Systems/Information Manager	290	819	1,894
Systems Analyst	320	929	1,272
Network Administrator	150	490	1,110
Software Development Manager	545	743	917
Software Administrator	300	466	773
Customer Support Engineer	200	621	1,000
Service Engineer	481	481	481
Software Engineer	100	414	569
Programmer Analyst	800	978	1,156

Source: ANCOR.

Ukraine has not received the attention of its neighbor to the east from the Fortune 1000 companies, however, precedence has been set and can apply in the Ukraine market. There is also the opportunity for Ukraine and Indian firms to work together, or from other countries, as Irish firms have come in to Ukraine and set up shop as they experience short falls of trained developers.

Strengths

There are several strong characteristics of Ukraine that provide positive benefits for international organizations that consider working with software development resources from Ukraine.

- **Availability of resources.** Ukraine has a substantial reserve of software development resources waiting to be tapped. Its institutes of higher learning and universities continue to turn out thousands of graduates in IT, IT-related or engineering fields. Notwithstanding a continuous brain drain, these specialists are still growing in number, especially in regions far removed from the capital of Kyiv. In addition, the study of programming languages has made it down to the approximately 10 to 15 thousand high school graduates, who are studying various aspects of computer science as part of their education. Both international and local

recruiting agencies operate on the domestic HR-market, so that the hiring process is rather efficient for companies wishing to avail themselves of IT-resources throughout Ukraine.

- **Availability of programming specialists.** The Ukrainian Association of Software Developers (UASWD) estimates that there were 40,000 – 60,000 people in 2000, which were potentially capable (under condition of short period restoring of skills, re-qualification and improvement of professional skill) to be engaged in programming. A study involving the heads of software development companies in Ukraine, estimated that there are currently between 5,000 – 6,000 persons who are engaged in programming as a primary activity, for both the local Ukraine market and the export market.

- **Labor Costs.** Although we recommend looking beyond the low cost of Ukrainian IT resources to the additional arguments in their favor, cost factors are undeniably a key consideration in any company's decisions around outsourcing. Costs for software development depend on a set of factors: needed skills, project size, commercial renown of the provider, the geographical location and experience of a provider, the provider's pipeline, fixed overhead costs whether included in the base price or not, the specific type of contract under negotiation (development or maintenance), ratio of onsite to offsite work, guaranteed workload and other factors. Accordingly hourly rates may vary from as low as $10 (in rare cases) to $40 and even $50. Testers and quality assurance personnel typically cost 20-30% less, and project managers 50-100% and even 150% more. Key personnel, if the client insists on a certain candidate, can cost up to 2 times more. Table 1. gives an idea of the prevailing wages for certain categories of IT professionals.

- **Technical excellence.** Ukrainian programmers possess all the needed up-to-date technical skills, as well as those needed for legacy migration. Within Ukraine all the latest worldwide technical literature is available, both in English and in localized versions. Over recent years Ukrainian student and school programming teams have consistently beaten their competitors from all over the world in closely watched international competitions. Local providers understand the meaning of keeping abreast of all developments in the field and take the requisite preparatory steps: they organize specialized technical libraries and invite leading specialist to give special lectures on the latest trends and technologies. In addition, there are a number of certification centers from Sun, Microsoft, Novell as a well as independent authorities.

- **R&D focus.** Unlike India, which is well-known for the ability of its IT-companies to undertake routine coding and do the job with a consistent and predictable level of quality (recently put in doubt by trends noted by NASSCOM), Ukrainian companies have a strong advantage in R&D. By R&D we mean not only scientific research, but also all the software development that requires creativity and strong skills in adjacent domains.

- **Strong fundamental education.** It may seem paradoxical, but the main advantage of Ukrainian programmers is said to come from the fact that they are often not programmers by education! Quite commonly a Ukrainian programmer gets a strong fundamental education in such fields as mathematics, physics and other domains, then switches over to computing when he or she graduates and looks for a job. Ukraine has a well-educated and skilled labor force, with a 98 percent literacy rate,

rate compared to 52% for India.[11] Despite difficult times, Ukrainian educational institutions keep producing well-qualified graduates, especially in the areas of fundamental technology sciences. For many institutes the end of the Soviet Union required them to institute tuition charges. While initially decreasing the number of students entering programs, the availability of jobs in IT means that students still enter these disciplines, often beginning work in the industry during the 3rd year of their studies. For the institutes tuition means that they can now purchase new equipment and licensed software for the students to train on. There are many cases when software development companies work close with Universities to improve and adapt educational process to the demand on the market. Motorola has worked with Kyiv Polytechnical Institute to establish a lab to train specialists in Digital Signal Processing (DSP), microprocessor and micro-controller equipment.[12] Multi-national companies such as Hewlett Packard and Dell are also providing equipment enabling the institutes to establish training labs.

- **Experience with complicated projects.** Despite current problems in Ukraine and the widespread notion in the press that science is dying, Ukraine remains a scientific superpower. Past achievements in space and military production have left solid traditions of working through complicated projects that are IT dependent. Higher education remains strong in the areas of mathematics and theoretical physics, which rely heavily on IT-technologies. Recently the international IT-majors have begun to realize the opportunity posed by opening full affiliates in Ukraine and engaging them in their global and complicated projects.

- **European culture.** Whatever else one may say about Ukraine, geography and centuries long tradition place it firmly in Europe. Today's young and middle age managers and specialists who work in hi-tech companies have the same or higher levels of education, English language skills and motivation as their European colleagues.

- **Great potential.** All the above factors contribute to the great potential of the Ukrainian software outsourcing industry for integration in the worldwide IT industry. Traditionally, Ukrainian companies (with a focus on product development, not outsourcing) have strong positions in very few domains. Today these are; antivirus software, OCR and scientific software. The main reason for lack of success in other fields is the lack of experience in and failure to invest in marketing, which is a legacy of the Soviet Union and its command economy. Recently the situation has begun to right itself. Ukrainian specialists who left Ukraine to work abroad have begun trickling back, bringing with them invaluable experience in marketing and sales as well as business ties needed for the young IT-industry. Also, there has been an influx of Western managers into Ukrainian IT companies, where they usually serve in Marketing, Sales or Business Development. The local IT-industry serving domestic clients has dominant positions in systems integration, accounting software and Web-development, where it overshadows the offices of international companies in Ukraine. These local providers are also beginning to expand into the international market.

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[11] World Fact Book 2001.
http://www.odci.gov/cia/publications/factbook/index.html

[12] (December 2000) Motorola donated $20,000 to Kyiv Polytechnic Institute (KPI) for the continued training of specialists in Digital Signal Processing (DSP), microprocessor and micro-controller equipment. These funds are just a part of Motorola's continued involvement with KPI. In 1995 Motorola established a Laboratory for Digital Signal Processing at KPI.

- **Location**. The majority of software development firms today are located in the capital city of Kyiv. Kyiv is approximately 2 to 2.5 hours from the major Western European capitals with flights arriving almost daily. For Western European companies this means a nearshore relationship with software developers in Ukraine. For the US, Ukraine is 7 – 10 hours ahead of the US, 6:00pm in Kyiv means 8:00am in CA, USA. Staggered work times allow for overlap and communications between the two locations and for the possibility to hand off work at then end of the day. In a bug-fixing mode, this allows for errors fixed during the day in Kyiv and unit tested to be handed off to QA in CA for review during their workday.

- **Business Travel.** This category takes in to account two sides to the travel issue. One is the ability of clients or potential clients to visit Ukraine with ease, for purposes of discussing potential projects and during the project cycle as needed. In this case, three moves have been made since the second quarter of 2000, which have eased this process. Invitation letters to obtain visas have been done away with for most countries. As of the second quarter of 2001, international visitors to Ukraine are no longer required to register when staying in Ukraine for more than three days. Lastly, with particular regard to the U.S., is the ease of obtaining long-term multi-entry visas to Ukraine. As of November 2001, three-year multi-entry visas have become easier to obtain for U.S. citizens based on a reciprocity agreement. The other side of the business travel issue is for Ukrainian citizens to be able to travel easily to the customer location on an as needed basis. With regard to business travel to the US, members of the American Chamber have been assisted considerably. Cooperation between the American Chamber and the U.S. Embassy has enabled the quick and easy processing of business visas for the staff of members of the American Chamber. For more information refer to the American Chamber of Commerce of Ukraine web site: www.amcham.kiev.ua.

- **Availability of Local Professional Organizations.** Ukraine has several professional organizations that support software developers in their daily problems, thus helping the companies to overpass the issues and grow more professionally:
  - Ukrainian Association of Software Developers (UASWD) (http://www.uaswd.org.ua/) - is a collaboration formed to promote sustained and significant growth of the computer software industry and affiliated industries in Ukraine. To accomplish this growth, UASWD will promote policies and conduct programs that enhance technology and market growth for its members, and that contribute to economic growth and job expansion in the region. UASWD has been active in working with the New Society (a group of 19 Verkhovna Rada Deputies which are looking to promote the development of the High Tech industry in Ukraine and prevent the “brain drain”.) in the formulation of new tax laws, which will aid in the growth of the software exports market.
  - IT Committee of American Chamber of Commerce in Ukraine: (http://www.amcham.kiev.ua) The IT Committee in Ukraine was created by those companies - Amcham members - whose main business objectives make them interested in development of the IT market in Ukraine. The IT committee is also dedicated to increasing Amcham membership of IT companies.

Weaknesses

Like any developing and young industry, Ukrainian offshore software development industry has a number of drawbacks. People involved into the industry clearly recognize them and trying to combat them. These disadvantages may be real or just perceived, but they prevent Ukraine from becoming an outsourcing superpower.

- **Business and Management Skills:** As has been mentioned before, Ukraine has an excellent technical education system built over several decades; however, business and management education have only been developing since Independence. Management education refers to the ability to manage large-scale software development projects within a defined budget and timeline. In an industry where still 75% of IT projects fail to complete on-time and to the satisfaction of the client, it is clear everyone still has a long way to go in this regard and Ukraine is just at the beginning. An area that they would like to improve is: make the students more responsible for their own work instead of having to continually follow-up. This change will shift the responsibility back to the students and will have a positive affect on the educational system.[13]

  Although some providers have worked in the market for 10 years or more, the industry has never taken a hand in shaping educational standards. Until recently the industry enjoyed slight recognition on the local market and was unable to attract talented managers from other fields. To date the lack of managers, especially project managers and sales managers remains a great inhibitor to growth. Recently the Ukrainian government has drawn public attention to IT and this provides hope that at least educational standards will be changed to fully meet worldwide industry needs. In addition, the return home of Ukrainian specialists who have gained experience in leading IT companies abroad provides talent to fill middle and top management positions in local firms.

  Business skills can be explained by the level of practical experience available in Ukraine an area that may be lacking is business expertise for a particular industry, especially if that area is not yet been developed in Ukraine. This results initially in a lack of business analysts who can translate user requirements in to design and or work closely with clients to capture business requirements and see them through implementation. This also includes persons who will act as liaison between the business user groups and the technical systems groups. They will also aid in producing test scenarios and test scripts that match the functional specifications developed and analyze test results. This disadvantage can be overcome by working closely with a liaison person from the client company, an independent consultant who will act as a liaison, until Ukrainian outsourcing firms are able to build up the necessary industry expertise.

- **Bandwidth Costs**: Ukraine has comparatively high cost for telecommunication services, but these costs are falling year by year. This will affect companies choosing either the “Ownership” or “Contractor” model. From the major Ukrainian cities, 128K connections can be installed for an investment of between $600-$1,500 in equipment, approximately $350-$1,000 in installation fees and maintained for $70-$400 per month depending on load. A variety of communication mechanisms

[13] Emmy B. Gengler – Softjourn, Inc. interview with Vadim Aleksandrovich Tikhonov – Business Automation Department – Kyiv Polytechnical Institute. December 2001.

can be used between dispersed international offices. As an alternative, Satellite communications can also be implemented. For download only, equipment can be installed for between $300 and $700 with load fees at $0.78 per MB. The download speeds range from between 1.5 to 2 Mb.

- **Industry association Development:** As was mentioned, industry associations are currently forming in Ukraine, but they have not yet had time to make major inroads in the development of the software exports market. It is planned and perhaps desired that there be one association to develop and lead a united effort to promote Ukraine and assist in developing Ukraine's internal infrastructure (hardware, legal and regulatory) to support the development of the software exports market. However, it will take some time before the efforts produce results. Ukraine has the possibility to follow an excellent model. NASSCOM, the Indian association of companies involved in offshore software development, has been instrumental in lobbying the Indian government for favorable tax and regulatory changes. It also undertook campaigns to promote India throughout the world. Most importantly for the clients of these Indian member firms, it organized an industry effort to improve software development quality and business processes in India. As a result, most CMM level 5 certified companies are located in India. NASSCOM also provides reference information and support that helps American and other clients work more easily and effectively with Indian companies.

- **Language barrier.** This issue of knowledge of English is crucial for middle and top management. Generally Ukrainian developers pick up adequate language skills in their courses of higher education. Outsourcing companies give preference to candidates who also speak the language and their ability to offer above market salaries, more stability and more challenging jobs assures access to those programmers with the best language skills. The process of Ukraine's integration into the global economy allows us to hope that there will continue to be an adequate supply of programmers reading and also speaking English with proficiency. As for the other European languages, German and, especially, French can become a barrier for communications, because Ukrainian programmers do not typically study these languages. However, the situation can be remedied and even today there are Ukrainian IT companies, which accept non-English project specifications.

- **Lack of certification authorities.** Ukraine does not have any agencies providing CMM assessment at the moment, though the need is now widely recognized and plans are afoot act on this need. There are also very few providing ISO 9000 assessment. As a result there are almost a few Ukrainian IT companies, which are ISO certified. But all more or less reputed providers have established quality management systems that may correspond to CMM or ISO. In addition, Ukrainian providers are rather flexible and are ready to adjust their procedures to suit your needs.

- **Brain Drain:** Since gaining Independence, many of the most talented of Ukraine have left for other locations; Western Europe, the US. However, there is another group that is dedicated to developing the Ukraine market and developing the country as an IT powerhouse. Using its excellent education base, Ukraine has a great chance of making this happen. It is estimated that 2500 IT specialists leave Ukraine each year.[14] They are leaving not just for the US and Western Europe, but Russia also has a strong pull with the growth in its internal IT market. To combat this issue, many

[14] Viktor Spiridonov – Executive Director. Ukrainian Association of Software Developers. November 2001.

companies such as: Tessart and Softjourn have established relationships with educational institutes for funneling of students in to their organizations. This may be in the form of internships or jobs after graduation or assistance with education development. One IT Company in Kharkiv has gone a step further; Telesens KSCL Ukraine has established an IT training center. The center, which began in January of 2001, has graduated 60 students as of November 2001. The development of its own institutes follows the Indian model, for example, Infosys very recently bankrolled the development of a new leadership institute in Mysore, a city south of Bangalore.

- **Legal and regulatory issues**: There are many legal issues in the areas of intellectual property, export and import, taxation, labor laws, company registration and reporting, and currency control. Some of these issues are applicable to only the Ownership or contracting models, others are applicable to both. Customs issues the import of products for temporary import and for permanent use in the software exports business. Other areas are taxes including profit taxes and employee taxes that remain quite high. Also included in this category is government regulation, for example in the areas of encryption and the use of the Internet. This area needs to be carefully monitored. An explanation of current legal and regulatory status in Ukraine is detailed in a separate section of this paper.

Legal Framework of Offshore Software Development in Ukraine

Legal issues will be an important part of a company's decision on how to work with Ukrainian software developers. The choices available entail

(i) Establishing business presence in Ukraine (the 'legal presence' model); and
(ii) Contracting an existing Ukrainian software development firm (the 'contracting' model).

The legal consequences of using each of these models will be considerably different. While the following information should not replace legal advice specific to each company's individual situation, it will help you to understand the issues.

Overview
The choice between the 'contractual' and the 'legal presence' models, as well as the choice of a certain model of legal presence in Ukraine, are both highly dependent on two reasons: (i) the foreign company's policy as regards the local market and (ii) the practical targets and strategy of penetration. If one is interested in exercising 100% control over the local personnel and management, their skills and trustworthiness, and in ensuring a certain quality of production – the 100% foreigner-owned LLC is the best thing. Those who are merely interested in sale-purchase may feel comfortable with having a commercial representative office controlled by a foreign manager who is employed by the main company. As the tax burden is the same for both the local entities and the rep. offices, the real choice depends on the urgency of the matter and the company's readiness to pay the registration fee to the Ministry of Economy (the registration of an LLC is both less expensive and takes less time).

The disadvantage of the 'legal presence' model, however, resides in taxation and accounting burden, labor laws limitations and certain difficulties related to income repatriation, i.e. maintaining legal presence in Ukraine is much more costly than just signing contracts with locally-based developers, and evokes more difficulties (during the initial stage). But it also gives a foreign software developer the possibility to develop the most convenient operational and business control schemes in much less time than under the 'contracting' model, as he's armed with the knowledge of the local personnel and various legal and taxation peculiarities.

Under the 'contracting' model the contracting party (a foreign one) is less exposed to local laws (except for income repatriation, copyright issues and some export regulations to be considered herein below), so the expenses to maintain this model would be much lower, but that would also mean less control over the local partners and certain dependence on in terms of both 'clarity of title' to software and certain contracting terms (due to various customs and taxes' regulations).

Certain legal issues pertaining to the transfer of valid property rights in software apply to both models. Since under either model there could be a need to officially move the software and also some auxiliary hardware across the border, the applicable hardware and software export and import restrictions are to be looked at carefully.

Accordingly, the most important legal issues will be:

- Establishing legal presence in Ukraine.
- Taxation.
- Labor law issues.
- Property rights in software.
- Software exportation and importation in Ukraine.

Although these are the primary issues that should be taken into account when considering offshore software development operations, this is not an exhaustive list and additional issues may depend on particular circumstances. The following brief discussions of these topics are provided for background purposes only; specific legal advice should be sought for particular projects.

Establishing Legal Presence in Ukraine
Types of Legal Presence

When thinking over the idea of a Ukraine-based software development company the foreigner is free to use any of the three main legal frameworks to legalize his business. Particular accounting and taxation issues differ within those legal schemes, while the general copyright and export/import framework stays intact.

(i) Representative offices (commercial and non-commercial)

The effective Ukrainian legal framework differs between the commercial and non-commercial rep. offices, i.e. those allowed to conduct commercial activities in Ukraine and those intended for only market survey and the representation of the foreigner's interests in Ukraine, though the Foreign Economic Activities Act does not provide directly for this classification (under it, a rep. office is either an entity or a natural person representing the interests of the foreign commercial entity in Ukraine who possesses the duly executed official powers to represent its interests (normally it's a legalized Power of Attorney (POA) or an extract from the relevant company's minutes re. the appointment of the company's officials)). Still, with respect to actual interpretation of the term "commercial activities" (any activities, including any business activities, involving the exchange of both material and immaterial goods,) according to the Ukrainian tax officials almost any of the rep. offices is able to conduct commercial activities and is therefore subject to relevant taxation.

(ii) Subsidiaries (with 100% or less foreign participation)

Ukrainian law authorizes the following types of business organizations, any of which can be used by foreign companies:

- Joint Stock Company ("JSC");
- Limited Liability Company ("LLC");
- Full, Limited or Mixed Partnerships.

Up to 100% foreign participation is allowed (except for certain fields, e.g. TV and telecom activities, insurance, etc.). The JSCs may be either closed (with the shareholders' right of first purchase) or open (when the subscription is open to public and no right of first purchase is available). The minimum effective charter capital for a JSC is 147,500 UAH (roughly $27,900) and 50% are to be contributed before the state registration; that for an

LLC is 11,800 (around $2,230) with 30% to be contributed before the state registration. Corporate governance in an LLC is simpler than that of a JSC, especially in terms if calling for the shareholders' meeting and changes to statutory fund. The taxation regime is 100% equal, and the general practice shows the joint venture LLCs to be the most popular form of a foreigners' legal presence in Ukraine.

(iii) Joint activity agreements with Ukrainian entities.

The Civil Code provides also for a so called 'joint activity agreement' (a structure close to a limited partnership though without any separate legal entity) as another form of legal presence in Ukraine, but the general legal framework (joint property, prohibition to independently dispose of the property and the right of first purchase) as well as a set of accounting (like no inclusion to general expenses and separate VAT-payer registration) and tax disadvantages make it the lease desirable (and the most rare) form of foreigners' legal presence in Ukraine.

Incorporation and registration procedures

With regard to the state registration of rep. Offices, there is currently discord between various executive authorities, for the legal framework is not certain on the issue – the Corporate Profit Tax Act provides for the commercial rep. offices' registration as the tax payer (with no other registration needed), while the Ministry of Economy requires separate official registration (the analog of the new companies' registration) with no regard to taxable income in Ukraine. This current discord is being partially inspired by the amount of the registration fee (USD 2,500). The general official registration (that of the Ministry of Economy) is described in more detail in the Regulation regarding the official registration of the rep. offices of foreign companies in Ukraine (No. 30 dated January 18th, 1996), while the registration for tax purposes is covered in a special resolution of the Tax Department 'Official procedure of the rep. offices registration as the corporate profit tax payers (No. 23 dated January 16th, 1998), and the second type of registration is anyway a must. There are two types of rep. offices' bank accounts in UAH (dependent on their commercial or non-commercial activities) and the easy regime for hard currency bank accounts. Various auxiliary registrations at the other state and local authorities (e.g. the Statistics Committee, the Pension Fund, the Social Security Fund, Tax Inspection and Tax Police, etc.) is also needed to make either the rep. office or the local company duly and legally operative.

Incorporation of a Ukrainian legal entity with foreign investments requires its registration at the relevant department of local governmental authorities, and the process normally takes around 3 weeks for an LLC or a Closed JSC and not less than 50 days and not more than 6 months for an Open JSC. All the stated terms are calculated with regard to the mentioned auxiliary registrations. To enjoy the right of VAT-free repatriation of investment in case of liquidation of the entity the foreign investment itself also requires special registration at the local governmental authorities, and should any export/import activities be held, the customs accreditation should also apply.

Choosing a Pre. Office or a Subsidiary for Software Development

The real choice is highly dependent on various approaches (see above in the *Overview*). In addition one could only say that with regard to developing the software intended to use outside the Ukraine the 'contractual' model seems to be preferable, while the copyright issue tends to favor the local LLC or a rep. office models (the software developer shall enjoy

the full-scope national protection *per se* within Ukraine and abroad). Still, should a Ukrainian developer be the owner of the copyright, the foreign company purchasing the copyright could face certain tax and legal complications (due to a wrong 'royalty' definition within the Corporate Profit Tax Act). Finally, in terms of owning and disposing of the hard currency accounts the rep. office model seems to be the most appropriate (no obligatory sell of hard currency received under the foreign trade contracts).

Taxation

As Ukraine does not have the Tax Code yet (though it is expected to take effect since the year 2002), the further survey is based on the effective tax legislation. Still, due to the forthcoming Tax Code, the real 2002 tax regime may differ to certain extent.

(i) Corporate Profits Tax and Repatriation Tax

The corporate profit tax issue is quite simple for local companies – the total income is taxable (the company's gross revenue, there including the royalties, deducted its total costs), and the software developers pay the ordinary 30% rate. Commercial rep. offices also pay the corporate profit tax with regard to their activities in Ukraine and the rate is also 30%.

In addition to the general corporate profit tax the local company shall withhold the 15% income repatriation tax (tax imposed on the amount of the 'foreigners' income of Ukrainian origin') when transferring the dividends to the mother foreign company, or sharing income under the joint activities agreement, or just sending the income money abroad. These 15% are imposed on the net profit (i.e. gross profit minus 30% profit tax). The real rate of the repatriation tax may vary though; as the effective Avoidance of Double Taxation Treaties concluded by Ukraine establish various rates of repatriation tax (from 0%with Cyprus of Great Britain to full 15% with Russia). The term 'Ukrainian origin' of the foreigners' income means under the effective tax law any type of income obtained as the result of the foreigners' activities at the territory of Ukraine, including but not limited to any type of interest, dividends, royalties, rentals, other passive income, nay types of real-estate-related income, etc.

Another trouble the mother company can get into under the 'legal presence' concept is so called 'transactions between the related entities' and 'normal pricing'. 'Related entities' are normally construed as (i) both legal and natural entities exercising control or being controlled by the entity in question either in whole or in part, (ii) the officials of the said entity, and (iii) the relatives of any natural person that suits any of the two previous criteria. Under the effective Ukrainian tax law the prices under the deals entered into by the related entities must not deviate too much from 'normal prices' ('normal or common prices' being the prices available within the ordinary course of business under the deal that entails no related entities). There is no special under-law regulation regarding the calculation of the normal prices, so the application of the afore said concept sounds to be a rather tough story, moreover that the real market value of any software is difficult to determine as it is highly dependent on both its purpose and the input data.

(ii) Value Added Tax (VAT)

The first thing to say is that VAT is considered to be an internal tax not subject to Avoidance of Double Taxation treaties concluded by Ukraine. There are generally two types of VAT in Ukraine – the one added to the initial price under the local deals ('the internal VAT') and the one added to the invoice price of the imported items ('the import VAT'), but the rate makes always 20% (the export rate is currently 0%). Both types of VAT are refundable (the

internal VAT paid to supplier is set off against the amount of the company's VAT obligations to state budget for the same month, while the import VAT is set off against the same obligations within the next month). Normally the payments under the foreign trade agreements (i.e. remuneration for goods/works/services delivered/accomplished) are not subject to VAT unless the results of the said agreement are used within the Ukrainian territory (e.g. the software exported by a Ukrainian entity is being used inside Ukraine).

(iii) Royalty (main aspects)

With regards to royalties (payment for the use of copyrights), the Ukrainian law provides for both systematic payments (within the license agreement period) and the one-time payment 'for the alienation of copyright'. The normal royalty payments are more preferable then payment for alienation of copyright due to the fact they're non-VAT able under the effective VAT Act. Although such an advantage exists, the revised Law on Copyright and Neighboring Rights has created some troubles regarding the interpretation of this clause. Under this law the author may be compensated not only with royalties but also via a one-off payment and combined payment, while Ukrainian tax legislation doesn't differ between the two things.

(iv) Avoidance of Double Taxation Treaties

With regard to royalties and corporate profit taxes paid to or received by foreign companies Ukraine's treaties on the avoidance of double taxation must not be discarded. Ukraine signed the main part of such treaties as an independent state already, but there are several treaties inherited from the USSR times, which have remained in Ukraine under the Ukrainian Act on Legal Succession to USSR Treaties (e.g. those with the UK and Cyprus). They apply to only the 'contractual' and the 'rep. office' models. The general concept is that (a) foreigners' income is taxable in the country of its' nationality, unless a commercial rep. office is permanently set within the other country (then it is taxable in the rep. office country). The royalties' regime is a bit different – they're taxable in the country of nationality under the ex-USSR treaties and could also be Ukraine-taxable under the treaties signed by the independent Ukraine (in which case, however, the rate can not surpass that of the foreigner's native country). This provision shall not apply if beneficial owner of the royalties, being a resident of a Contracting State, carries on business in the other Contracting State in which the royalties arise, through a permanent establishment situated therein (i.e. the rep. office), and the right or property in respect of which the royalties are paid is effectively connected with such permanent establishment or fixed base.

Labor Law Issues

A foreigner who formed a Ukraine-based company normally faces three main 'ugly ducklings' of the Ukrainian labor law, those being (i) enormous protection for employees and almost no rights for employers (that structure is a Soviet heritage and is not likely to change at least within the next 5 years), (ii) huge taxation to wages (Social security duty and Pension Fund duty when put together are approximately 35% of the employee's wage, and those duties are due and payable by the employer (the company) simultaneously with the wage payment) and (iii) special employment permit for foreigners (e.g. to be employed in your own Ukrainian company you need a special permit from the Labor Ministry, and the procedure could take up to 2 months). Whatever be the foreigner's legal presence in Ukraine, the labor laws are a must for him, and the breach thereof evokes both civil and administrative liability. Even the foreigners employed within the head office of a main company (in case of a rep. office) are subject to local labor laws.

Proper formalization of the labor relations with employees is also important to ensure that (i) the labor contract itself is a fixed-date contract and (ii) a valid title to developed software will belong to the developing company.
Property Rights in Software

Legislative framework

All over the world the peculiarities of software give rise to the discussion of what kind of protection is applicable to this kind of intellectual property. Ukraine is not an exception. At the moment Ukrainian legislation in relation to software protection is not deliberated. From two possible methods of software protection such as copyright and patent regime, Ukraine has chosen the first one. Copyright regime of protection for software has positive and negative aspects. To enjoy copyright, authors of software are not obliged to undertake any registration. They may spare time but deprive themselves of evident data for effective protection.

Unfortunately Ukrainian legislation with regard to software is based on the analogy of law rather than on direct legal regulation. The main legal act concerning software protection is the Law on Copyright and Neighboring rights. The Law was essentially revised on July 11 2001 but that fact didn't touch the software rights regulation. Just a few times the word 'computer program' is mentioned. Article 18 of the Law provides for the following: "Computer programs shall be protected as literary works. Computer programs are subject to protection without any relation to method or form of their fixation". Nevertheless the Law stipulates also some specific rights of software copy possessors, namely rights for free copying, modification and decompiling.

Some other laws are also useful to glance over despite the fact that they do not concern copyrights directly. They are: Law of Ukraine on Information, Law of Ukraine on the Protection of Information in Automated Systems and Law of Ukraine on Protection against Unfair Competition.

When speaking about copyright it's a must to underline that Ukraine follows the continental approach to intellectual property regime. The Ukrainian legal system concerning copyrights distinguishes between moral and economic rights. Moral rights include the right of author to be recognized as such, his right to remain anonymous, right to use pseudonym, right for integrity of work. Economic rights contrary to moral rights are strongly connected with commercial intercourse. They include rights to use and to dispose the objects of copyright. The differentiation mentioned above should be taken into account because moral rights are inalienable. Any author enjoys moral rights even after alienation of economic rights. The Law on Copyright and Neighboring Rights provides for just one reservation to this rule "if it is practically possible". It is not clear if this reservation is applicable to software.

Scope of copyright

Despite the Law on Copyright and Neighboring Rights considers software as a literary work, it is not redundant to enumerate what main rights are granted to the author in this connection:

- Reproduction of works;
- Public performance and public transmission;
- Public demonstration;

- Any repeated publication of works;
- Translation of works;
- Alterations, adaptations;
- Distribution through the first publication;
- Importation

The list is not exhaustive.

As for specific rights of the possessor of a software copy, the Law on Copyright and Neighboring Rights stipulates that such an owner is entitled without any permission of author or another proprietor of copyright to:

- Modify software with a purpose to maintain its compatibility with hardware of a user if otherwise not provided for by a license agreement with an author or proprietor of copyright;
- Produce one software copy under the condition that this copy is earmarked for archiving or substitution of legally acquired specimen in the case the software is lost;
- Recompile software if:
  (a) The person did not have prior knowledge of the information needed to achieve compatibility;
  (b) Decompiling is limited to those elements of software which are necessary to achieve compatibility;
  (c) The information received as the result of Decompiling can be used only for achievement of compatibility;
- Observe, master and investigate functioning of software.

Under revised Law on Copyright and Neighboring Rights 2001 the duration of copyright protection has been extended from 50 to 70 years following the author's death – that is copyright now lasts throughout the author's lifetime and for additional 70 years following his death.

One also should note that the copyright of an employee (as an author) for his/her work is limited under Ukrainian legislation. Employee enjoys only moral rights unless otherwise provided for by his/her contract with employer.

Copyright protection

Intellectual property is much more vulnerable than any other kind of property. And it is natural, because the intellectual property institution is, to a certain extent artificial.

To extend the copyright protection regime to any prospective object of copyright itself Ukrainian legislation demands them to be fixed in a particular material form. Materializing the objects of copyright helps to strengthen the legal proof of copyright existence. Software must have been one of the objects of copyright, which are the most difficult to protect. Therefore it is preferable for a software owner to register his/her title in compliance with Ukrainian legal procedure.

Before examining remedies let's get acquainted with main points of the Law on Protection of Information in Automated Systems. The Law defines some terms that may turn out to be significant. First of all it concerns the definition of 'automated system' and definition of ' information in automated system'. ('Automated system' – is the hardware together with software, 'information in automated system' – is the software together with all data contained therein without any relation to method of their presentation).

The Law covers certain aspects of legal relationship between owners of information, owners of automated systems, users of information and users of automated systems. In particular, ownership to information, produced while using the initial software, is established under an agreement between the owner of the original information in the software and the user of automated system. If such an agreement hasn't been concluded the information is deemed to be the property of the user.

The Law also stipulates guaranties for legal protection. But to have a more comprehensive view on the matter it's better to examine the main remedies peculiar to Ukrainian legal system regarding copyright as a whole. Any of the remedies set forth below is entirely applicable for software protection.

Under the Law of Ukraine on Copyright and Neighboring Rights, the owner of a copyright may claim from the breaching party, including claiming through court procedure, the following remedies:

- Recognition of title and restoration of status that existed prior to copyright breach;
- Cessation of actions violating or threatening to violate the copyright;
- Compensation for moral damage;
- Compensation for damages, the amount of which includes the sum of the profit received by violating party and lost of profit to the party whose rights were violated;
- Other protection measures.

The compensation sum is fixed by the court. The sum of compensation may be set within the bounds established by law (from 10 to 50000 minimum monthly wages, i.e. approximately from 300 US$ till 1 500 000 US$). The court is also entitled to impose a fine on the violating party. The fine shall amount to 10 % of the sum awarded by the court for the benefit of the claimant.

Ukraine is also Party to two main conventions of copyright protection: Berne Convention for the Protection of Literary and Artistic Works and Universal Copyright Convention. This fact can assist foreign contractors gain proper status in Ukraine. For instance, Berne Convention, a much more deliberated then Universal Convention provides, that:

- Its protection shall apply to:
  (a) Authors who are nationals of one of the countries of the Union (Parties to the treaty), for their works published or not;
  (b) Authors who are not nationals of one of the countries of the Union, for their works first published in one of those countries, or simultaneously in a country outside the Union and in country inside the Union.
- Authors who are not nationals of one of the countries of the Union but who have their habitual residence in one of them shall, for the purposes of Bern Convention, be assimilated to nationals of that country.

- The expression 'published works' means works published with the consent of their authors, whatever may be the means of manufacture of the copies, provided that the availability of such copies, has been such as to satisfy the reasonable requirements of the public, having regard to the nature of the work.

  The term of protection granted by Berne Convention shall be the life of the author and fifty years after his death. In any case, the term shall be governed by the legislation of the country where protection is claimed; however, unless the legislation of that country otherwise provides, the term shall not exceed the term fixed in the country of origin of the work.

Copyright transfer

Keeping in mind that only economic rights are transferable, one can undertake one of two methods of software transfer. If copyright holder doesn't intent to use its software at any time in future he may conclude a copyright assignment agreement, that means complete alienation of copyright. The other variant is not to deprive oneself of all economic rights forever and to conclude license agreement. It may be either exclusive license agreement (nobody except license-holder is entitled to use and dispose of the software) or a non-exclusive license agreement (licensor reserve for himself the right to grand licenses to other persons) , in any case the term of transmission and territory covered should be definitely set out.

Making business associated with software in Ukraine foreign legal entities may bump into software-transfer problem. How can this problem be settled? There is no too much choice for foreign contractors. They have several options: to buy software from software reseller, who has no relation to software development; to buy software via concluding an agreement with Ukrainian software developing company; and to establish a daughter company (company with an essential rate of foreign investment, which will be in any case Ukrainian body corporate under the effective Ukrainian legislation). Two main criteria should be taken into account to solve that problem: financial resources of non-Ukrainian legal entity and title reliability in software. If the first criterion is not juridical and depends on opportunity of legal entity, the second one is subject to legal analysis. Ukrainian legal practice proves that it is too difficult to control validity of previous agreements regarding software transfer. To avoid risk of title validity it is recommended for non-Ukrainian companies not to conclude agreements with Ukrainian software resellers.

Movement of Software and Hardware To and From Ukraine

The import/export system is generally similar to Ukrainian, though not so complicated. The combination of difficulties you could meet depends on (i) whether you're an exporter or an importer and (ii) what is the type of hardware/software under consideration. Under the contracting model, though not being directly exposed to Ukrainian export-import regulations, the foreign importer would still have to issue a series of documents (e.g. due use certificate, obligation not to resell the imported goods to certain countries, etc.) absolutely necessary for a local exporter to be able to receive the export license. Import certification issue sounds less painful in Ukraine due to certain privileges making the one-time importation partially exempt from certification or subject to a shortened certification procedure (though also rather costly).

With regard to so-called 'dual purpose goods, materials and technologies' (i.e. those goods, materials, hardware, software, technologies, works and services related thereto that could be used for both civil purposes and for the elaboration and/or production and/or use of military items, weapons, military or other special techniques and are subject to export regulation by the state), there are several lists thereof, and the relevant software is generally being described there as that 'specially purposed or modified to design and/or produce and/or use and/or control' certain types of hardware and technological processes, so more than half of the software under export might be subject to export control on this ground. Import and export of dual-purpose items is subject to special regulation by the Ukrainian government and requires local exporters' and importers' registration at the State Export Control Office (further – the "SECO").

Import of Software and Hardware to Ukraine

Certification and Licensing Authorities

Currently, there are two organizations in Ukraine affecting the software and hardware import and export – the State Customs Service (the SCS) dealing with the customs clearance of the items imported and/or exported and/or passing Ukraine in transit, and the State Certification Committee (SCC) of Ukraine dealing with the certification of the products manufactured in Ukraine and those imported to Ukraine.

The SCS's functions are common to those of any similar office in any country – general control over the import and export of the items, the legality of the documentary grounds for such activities (this meaning in reality that the customs officers are free to ask ANY possible questions and to demand any documents proving the legality of the operation), due payment of VAT and customs duties, etc. All and any export/import operations require a company to get officially accredited at the relevant regional office of the Ukrainian customs and to comply with the strict requirements of the established tax procedures (including the sets and forms of contracts and other documents to be presented to the customs officials within the course of customs procedures). There are several customs regimes for the goods imported to Ukraine (ordinary deliveries, temporary importation (with the obligation to remove the goods from Ukraine after 1 year expires), consignment deliveries, contributions to statutory capital, etc.), all of them being subject to VAT except for the in-kind contributions to the statutory capital of a local company (which is one of the reasons for LLC's high popularity). One of the interesting issues here is that under the effective Ukrainian laws the software (when pre-installed to hardware) can be regarded not a s a separate exported/imported item but as a part of hardware and fall outside the scope of customs control (unless separately declared in the customs declaration). So there is a room for fraudulent export/import.

It's interesting to admit that under the effective Ukrainian law the software is not within the official list of items subject to compulsory certification. But, as the certification of the majority of the imported goods is obligatory in Ukraine and as the foreign importers normally require certificates from local developers, the SCC cannot be missed under any model. The only exception to that are the in-kind contributions to statutory capitals of the local companies (when the hardware is a unique piece intended for the use only by the consignee). Normally the certification process embraces certification (i) of the unique items, (ii) of the lots of goods and (iii) of the production process (which provides for the control and certification of the goods/works/services production process by the employees of the SCC) and is performed by the SCC's personnel under a special certification agreement, and the amount due and payable for such certification depends on (i) the type of certification procedure and (ii) the type of goods under certification. The pricing model is adopted by the SCC and published since 1999.

To finalize the issue it is necessary to point out that both the software and the hardware (if intended to use inside Ukraine) can be subject to additional of control by various local authorities dependent on the type of activities where the hardware/software is used, especially those activities are inside the licensed activities' list (e.g. the hardware (and the software as the part of the hardware) shall be subject to extra control by the State Telecommunications Committee in case it is intended to be used in the national telephone network). The hardware/software related to the protection of information contained in automatic systems is subject to compulsory certification by the State Security Office. Computer aids and systems are also subject to compulsory certification by a body to be appointed by the SCC.

Export and Import of Dual Purpose Items in Ukraine

First thing to say on the issue is that all and any export and import contracts dealing with dual purpose technologies, software and hardware are to be coordinated with the SECO, and the permit to enter the agreement is to be received from SECO before the contract is signed (under the effective procedure SECO is entitled to ask for any kind of information regarding the deal and the exhaustive list of refusals to deal is not available, i.e. the positive decision is at SECO's sole discretion). Next thing to face is a series of tough requirements to the content of export/import contracts to be concluded (e.g. name of end user (not only the importer), assumed further use, importer's guarantees that the use shall only be that defined in the export/import agreement, the SECO's and exporter's right to control the end use of the exported items any time upon delivery, etc.; special requirements are provided to deal with the producer's intellectual property rights related to the items exported). There are also some additional general requirements to foreign trade contracts as established by the Ministry of Economy and the Foreign Economic Activities' Act.

Besides, under the effective regulations the dual purposes-related contract normally takes effect only upon the receipt of the export license by the local exporter (this being a pretty unclear issue at least with regard to the effective hard currency regulations). Finally, after the contract is duly concluded, a set of documents is to be submitted to the SECO before the export permit is issued (the term could take up to 45 days, dependent on the type of operation for which the permit is sought).

State Export Control Office

The Ukrainian State Export Control Office ("SECO") is the governmental agency that supervises export and import of dual-purpose items (its main powers include supervising the negotiations related to export and import of dual-purpose items, issuing end-use guarantee certificates (so called 'import certificates') and the export/import permits and licenses, establishing the export and import terms and conditions for dual-purpose items, etc.). SECO issues two types of licenses (general licenses are issued in case the export/import of dual-purpose items is continuous for an applicant, while one-time licenses are granted for the applicants acting on time-to time basis). The license looses effect in case the terms and conditions of the contract or of the deliveries plan under which the license is sought, gets changed. The positive resolution on the import/export license under each separate application is left to SECO's sole discretion.

Bounds for foreign importers

Those are (a) obligation to provide the end-use guarantee certificate (so called 'importer's guarantee certificate') stating the items exported from Ukraine shall not be used otherwise than for the purpose declared under the export agreement; (b) obligation to assure the possibility for both the exporter and SECO to control from time to time the end use of the items imported; (c) assure the items imported would stay at the destination point declared under the contract, etc.

Ukrainian exporters/importers – rights and obligations

The Ukraine-based exporter/importer of dual-purpose items has to inform SECO of the negotiations held by it with any party regarding the export/import of the dual-purpose items and of the results and arrangements within the course of such negotiations. The authorization for the negotiations does not discharge the exporter/importer of coordinating

the final agreement with the SECO, and only after that the enforcement of the agreement is started. The export/import license/permit is received for each delivery (unless the local company is a holder of a general license) and his main obligation is to guarantee the compliance of all the terms of the contract and effective laws (esp. with regard to the end use and its control) by the foreign importer. There is also a set of hard currency regulations to be complied with by the local exporter/importer (e.g. prohibition to make a 100% down payment abroad, special license if the delivery term makes more than 90 days, etc.).

A Ukrainian entity may temporarily export dual-purpose items under a provisional export permit for the purposes of demonstration (e.g., exhibitions). The exporter, however, must ensure that the items (i) are not transferred to any foreign entity, (ii) always remain in physical possession of the exporter, and (iii) are returned to Ukraine within a specified term.

Dual and Non-Dual Purpose Items – No Delimitation

Similar to Ukrainian rules, Ukrainian exporters/importers may be required by SECO to apply for an export license even in respect of those items that are not in the official dual-purpose items list, but there is a good cause to suspect they could be used for military purposes (according to the relevant governmental regulations, in this case the main guideline for that is the objective capability to use the essence of the technology or item for military purposes). This provision tends to be a rather loose one and causing half of the known hi-tech technologies be covered to export/import control regime, while the used is not always technically literal enough to evaluate the real opportunities for such military use.

Liability for Breach of Export Rules

Should the export/import rules be violated by a Ukraine-based exporter/importer, the sanctions applicable would be merely administrative (e.g. temporary or permanent cancellation of export license, fines imposed on the directors of Ukraine-based companies, cancellation of import certificate, prohibition to export/import the dual-purpose items and/or to conduct other kinds of foreign economic activities or imposing the individual licensing regime, etc.). No criminal liability is provided directly, but certain types of breaches could be considered as smuggling, or breach of copyright, or breaches of legal procedure for certain business activities, and all of those breaches provide for criminal punishment (imprisonment and fine of up to 7,000 UAH, i.e. approximately $1,300). The confiscation of income received within the course of said activities shall also apply.

Issues to Consider for a Contracting Model

The alternative ‘contractual’ model is nice to use at the start – to see how the business would go, moreover that the influence of the local laws to a foreign client is minimum and the risks of governmental intrusion is also low. Choosing a contractor (developer) is a business target to be solved by the managers. Still, to avoid mistakes, the following preliminary check on each company could be recommended:

(i) Check of due state registration (incorporation certificate and tax payer registration);
(ii) Check of due export/import permits and registrations (copies of the relevant certificates and permits to be presented to client);
(iii) Check of copyright (documentary proofs of a copyright to be presented to the client);
(iv) Check of good financial standing (bank references and proofs of no pledges or other third persons’ rights to main assets and/or copyrights).

(v) Check of licenses (applies to certain types of business activities, e.g. trading of encryption hardware, etc.; needs to be checked each time, since the list of licensed activities is being permanently amended).

When drafting the relevant agreement a series of local peculiarities is to be taken into consideration (a local lawyer just commenting on the ready draft would be of good service here, for Ukrainian legislation is not as stable as that in the US and the EU). Among them the following major points can be stressed on: (i) prohibition to contractual limitation of liability, (ii) non-enforceability of loose warranties and indemnification provisions and non-competition covenants, (iv) unauthorized transfer of copyright (it is necessary therefore to take care of the local contractor's copyright to the software developed by its employees), (v) taxation and pricing peculiarities, (vi) impossibility to apply the 'reasonable person' concept and the 'material breach' concept (under the Ukrainian law material terms are defined either by law or are to be expressly enumerated in the contract), etc. The enforceability of the foreign laws' provisions under the effective Ukrainian legislation must also be closely regarded.

An arbitration tribunal rather than a state court should be chosen as a dispute resolution body. Still, the local International Commercial Arbitration Court (ICAC) of the Commerce and Industry Chamber of Ukraine is probably more advisable than a Western arbitration. – The enforcement of a foreign arbitration award in Ukraine is theoretically possible under the New York Convention on Enforcement of Foreign Arbitration Awards of 1958. The realities are rather sad though – the enforcement procedure takes too long (around 1 year) and is rather costly (legal fees, enforcement payments, etc.) and is almost never successful. At the same time, the ICAC awards are much more familiar to Ukrainian courts and less difficult to enforce. There are also certain 100% unenforceable cases due to lack of a bilateral treaties on mutual assistance in legal matters (e.g., the UK, the US, the EU).

Studies

The studies included in this section were written with the objective to highlight Ukraine's uniqueness and abilities.

To obtain this objective the following guidelines were used during the interviewing process:

1. International individuals were interviewed if they had previous experience in a different offshore market, but have now chosen to work in Ukraine because of its uniqueness. This can include multi-national organizations with experience in multiple locations as well as private companies.
2. Research and Development: Key persons will be interviewed who conduct R&D activities in Ukraine, as part of R&D institutes and in conjunction with universities. A look will be taken to determine if there was R&D undertaken in Ukraine, which was not pursued in other parts of the Soviet Union.
3. Education: Multi-nationals entities, which have reviewed multiple locations in Eastern Europe and other parts of the Soviet Union for investment in education, will be interviewed for their perspective on why they have chosen to fund education in Ukraine. Leadership of various departments will also be interviewed to obtain facts of the structure of education within the technical universities.

The Prize of World-class Mathematical Skills

World famous institutes and a land privatization project led Peter Rabley, partner at International Land Systems (ILS), to Kyiv in 1994. Peter may have found himself in Kyiv, but he was already very aware of the capabilities of the country. Previously Peter's experience had taken him to Russia to work with a Russian mapping company, which was looking for a US partner. Together with another American – Brennan Klose, Peter set up a joint venture, Kiberso, with the objective of commercializing an archive of aerial photographs, specifically digital ortho photo[15] production.

Using his prior experience in Russia and a USAID sponsored land privatization project, Peter found himself as the systems analyst for a project to set up a registration system for land as it was privatized. Given Peter's background in mapping and his experiences in Russia, he knew the possibility to source the application development locally. From Peter's prior work he was aware of the world-renowned Ukraine institutes such as: The Glushkov Institute which is famous for its highly skilled cybernetics and the Paton Institute whose top mathematicians were doing research on welding and metals. Particularly in Kyiv, the institute was responsible for a variety of different systems development including the design of the Soviet version of the cruise missile, specifically in the last mile. This requires a very detailed preprogrammed model of the earth's surface.

Deciding that this is exactly the type of work USAID should be supporting in Ukraine, Peter was able to get agreement to source locally. Peter's company, PADCO, held a tender and received 10 responses. One of those responses led him to a group working with the Main Administration of Geography, Cartography & Cadastre[16] (The civilian mapping agency of Ukraine). It was a young, talented group led by Igor Popiv. The application that was to be developed consisted of two parts; first the tabular side, which defines and tracks who owns the property and the rights contained to the property by that person or entity, and second the spatial side which defines where the property is located in space. The spatial side is defined using a variety of inputs such as topographic maps, satellite imagery, surveying and aerial photography and provides the ability to zoom in on the property. An important part of processing these spatial image data sets is the ability to intelligently extract information from the imagery. An image taken from space is translated in to pixels, which are squares of red/green/blue. Each pixel means something. When a human looks at the image he/she is able to determine what the objects represent. The key is to get a computer to recognize a cluster of pixels, in other words to do a feature extraction. Igor's group demonstrated its ability to perform this task from their previous work with the mapping agency of Ukraine. For the tabular side of the application, Peter was prepared for dealing with inconsistencies in database skills in Ukraine. Since at the time high-volume transaction systems were not yet being developed on the internal Ukraine market. In 1996 the project was completed and successfully rolled out to eight locations around Ukraine.

The successful completion of the land privatization project, the skills available in Ukraine and the successful adaptation of special image and spatial data processing has led to a long term collaboration between Peter and Igor's group. So much so that they have formed a new company, International Land Systems (ILS) with offices in Maryland, United States and in Kyiv, Ukraine. The high level of image handling skills have been adapted for use in

[15] A digital ortho is an image data set with horizontal displacements caused by the sensor/sensor platform combination, the terrain, sensor orientation and position and scaling modeled out. The result of this mathematical modeling is a digital rectified image map with a horizontal accuracy that is predictable for a given scale.

[16] An official register of the quantity, value, and ownership of real estate used in apportioning taxes.

document imagery management, which is the ability to create databases of images and allowing for the ease of searching the content of the images. For example, ILS recently installed their Virginia Land Records™ software in 19 county court houses in Virginia. Soon it will be possible to look up land records from these counties online. Further adaptation has occurred in products such as; **MrSID™ Geo Viewer-** Built for LizardTech by ILS, ILS has developed a fast and easy to use spatial data viewer that allows users to view huge data sets (gigabytes) in seconds in a standard Windows PC environment.

Interviewed for this study[17]:

Peter Rabley
peter@landsystems.com

President
International Land Systems, Inc.
9525 Georgia Ave. Suite 205
Silver Spring, MD 20910-1439 USA
www.landsystems.com

[17] Interviewed February 8, 2002 by Emmy B. Gengler, Softjourn, Inc.

Motorola and Ukraine

In 1994, Motorola entered Ukraine after already having entered the Russian market. Since the beginning, Motorola activities have ranged from the sales support of their products within Ukraine, to the support and development of the embedded systems solutions and software industry. Assistance has taken the form of working with local universities on course development, the creation of laboratories for the study of technologies, and the establishment of a local partner company for the purpose of software development.

What began with a visit to the Kyiv Polytechnic Institute[18] (KPI), in 1994, has grown to include involvement in course development and donations for the creation of laboratories. Since the first visit, Motorola was excited about the University, its classes, the atmosphere and the potential that they saw for growth. In 1995, the Ukrainian representative office of Motorola, provided resources to KPI to enable it to open 3 labs (12 seats each) dedicated to training in Digital Signal Processing (DSP), microprocessor and micro-controller equipment. To date a total of four labs have been opened at KPI with assistance and financing from Motorola businesses and the Motorola Foundation: Three of them target micro controllers, microprocessors and DSP; and one lab concentrates on DSP only. It is estimated that the DSP market will be more than $18 billion by the year 2004. The establishment of these labs will provide a good training ground for students who will be developing for this growing market.

At KPI, Motorola has also helped to create new courses of study in embedded software development. Motorola believes, that KPI has great potential for embedded systems development. According to Ms. Elena Leschuk, an External Technology Planning Consultant with Motorola, “Unlike students in other parts of the world, the students at KPI, as well as students in other CIS technical universities, study hardware and software together, which provides them with the opportunity to really learn embedded software development”. The department of Measuring Systems, at KPI, backs up this statement with the experience of their students studying abroad. As an example, they see a difference in the education of their colleagues in Germany, German computer science students begin to specialize much earlier within their programs and they understand their area of specialization very well. The German students specialize in either hardware or in software, so when a problem appears, it is sometimes difficult for them to troubleshoot where the problem actually lies; is it in the hardware or software? The educational process, within the department of Measuring Systems at KPI, was referred to as a “T” type structure of education, by the department head. The “T” type educational structure means that they first receive an overall base of education in both hardware and software aspects (this is the top of the T), and then they receive a deeper education in their area of specialization.

In Europe, Motorola has four Software Development Centers: Saint Petersburg (Russia), Krakow (Poland), Glasgow (Scotland) and Turin (Italy). Two of them are CMM level 5 certified - St. Petersburg and Krakow. In 2001, Motorola assisted in the creation of a new commercial entity called Information Software Systems (ISS). ISS currently develops applications for various business departments of Motorola. The development is done via Motorola’s virtual management process.

Motorola views Ukraine as being unique in the skill set that is available in fundamental studies. Also, when comparing the programmers of Russia and Ukraine, Motorola sees in its

[18] Also known today as the National Technical University of Ukraine “KPI” (NTUU “KPI”)

own experience, a general trend of more programmers wishing to develop the local market and to develop their talent within Ukraine.

The decision to operate within Ukraine depends not just on resource availability, but also other concerns such as the local laws, a company's strategy and many others. Having been able to sing the praises of the potential for Ukraine is one thing; however, Motorola also offers the following suggestions for improvement in Ukraine.

- Introduction of a Capability Maturity Model (CMM) certification process for Ukrainian companies.
- Improvements in the legal and regulatory environment.
  - For example customs procedures need to be clear for the temporary import of technical items. Motorola has in the past, brought in equipment for testing the software developed in country and then takes the equipment back out. According to Mr. Jeff Bukhman, Director-Technology Planning Europe, Middle East and Africa, "We had a lot of problems importing equipment for testing, unexpected issues arose and it was deemed not worth doing in the future. The process for temporary import needs to be structured so that we know for sure what may we do and what can we expect. "[19]
  - VAT payment required to be paid on equipment for temporary import. Today 20% VAT still needs to be paid when bringing in equipment, even for temporary use in Ukraine (for testing purposes, for example). After the equipment is taken back out, the government is supposed to return the VAT paid. To date there have been some issues with obtaining these refunds.

Overall Motorola is very positive about their involvement in Ukraine and sees it continuing. Mr. Bukhman states that Motorola sees the potential of Ukraine, "We plan to stay in Ukraine and continue our work here with software developers; introducing new technologies, quality control and technical procedures." "Motorola in Ukraine is growing", according to Ms. Leschuk, "We like the climate here, the intellectual atmosphere, and the smart people presence."

Interviewed for this study[20]:

Mr. Jeff Bukhman
Jeff.Bukhman@motorola.com

Motorola
Director -Technology Planning Europe, Middle East and Africa
Global Software Group
8220 East Roosevelt Street, Scottsdale, Arizona 85257 USA
Location Code: AZ49 MD R3108
Phone: (480) 441 0528
Fax: (480) 441-3520

[19] Per the current customs law, code 98 addition #10, equipment not for resale can be brought in without paying VAT. The interpretation of the use of this addition to the customs code, however, is up to the individual customs officials. Article 254 of the proposed new Customs Code also refers to the waiving of VAT for equipment brought temporarily in to Ukraine.
[20] Interviewed by Michael Dolzhenko, Softjourn, Inc., February and March 2002.

Ms. Elena Leschuk
Elena.Leschuk@motorola.com

Motorola
Consultant -External Technology Planning
Room 613, PWI, Bozhenko St. 15, Kiev, Ukraine 03680
Tel: +380 44 227 3777
Tel/Fax: +380 44 227 2766

Complex Systems Modeling department at Shevchenko University

Within the walls of the National Taras Shevchenko University located in Kyiv, Ukraine, can be found the Cybernetics school. One of the departments, within the school, is the department of Complex Systems Modeling. In existence for thirty years, the department has awarded 100 PhD's[21], and 22 Doctors of Science and currently has 84 students. The main focus of the department is on defining and developing new theories and algorithms for the analytical presentation of dynamic objects. This means defining control points and input signals to manage the behavior of a dynamic object in an optimal manner. Application examples include: acceleration systems, aircraft, satellites, and complex robotics.

In order to develop their department, most of the professors have spent time at Yale University where they gained experience in different educational processes. The National Scientific Foundation, a US organization, supported the exchange project. The initial exchange in 1996 lasted for two months, and involved four professors from the university. Several more short-term exchanges occurred in 1997-98.

Current research in the department:

Currently the research of the Complex Systems Modeling department is focused around creating new algorithms for data compression. Another area of research focus is that of image recognition. For example, when a satellite takes a picture of a dark sea, it is possible, using special instruments, to create a recognition map to find objects on the sea. The same is true of recognition of a person in a picture.

In 2001, as part of its efforts to support Ukrainian software producers, the Ukrainian government put up for bid, a project consisting of several components. The department won the bid. In order to fulfill this project, both professors and students alike are currently developing solutions in the following areas:

- Computer Image Creation, which involves taking a picture of a person and then animating it. Similar software does currently exist, however, the goal here is compression optimization of the sound and images, while still maintaining quality.
- The development of algorithms for storing large, complex, and multiple images economically. This involves creating a special algorithm that compresses the images.
- Video image recognition of people and any other determined objects by classifications. An example is enabling recognition of a person's face after it has been scanned. An application the Ukrainian government may use this in is a videophone. Instead of transferring a video image, the phone will transfer several data packets that will be reproduced on the screen as a speaking face. The videophone will also take advantage of the Computer Image creation software described earlier.
- Synthesizing the Ukrainian Language (Software which enables the voice synthesizing of the Ukrainian language). Currently programs exist to synthesize email written in English or text messages (Short message service – SMS) sent in English, or even Russian, however, no program yet exists to synthesize the Ukrainian language.

According Dr. Mykola Kirichenko, the projects are being completed using new unique math principles developed by the department (other than used worldwide), which utilize a

[21] Officially called a PhD candidate in Ukraine, however, in the US it is equivalent to a full PhD award.

combination of new concepts and fundamental knowledge of previous research. The developments of the department have been published in several scientific magazines and one article was presented together with a Yale professor, Roman Kutz, in 2001.

Laboratory work:

The department has benefited from cooperation with high-tech companies in Ukraine. One company with which the department has engaged in long-term cooperation is: International Land Systems (ILS). With assistance provided by ILS, the department organized a small lab to help students utilize their fundamental knowledge in mathematics in combination with IT. Only the top students are able to work on projects undertaken by the lab. Competition among the students for this opportunity is quite high. The lab utilizes the principles and traditions that were used by many of the professors and instructors, many of whom are formerly from the military. Students may begin working in the lab during their 3rd and 4th year of studies. Approximately 15 students now work in the lab. Instructors assign each student their project and are available to assist in solving issues and to answer any questions that arise. The professors also monitor project status for completion. The idea behind the lab is to give the students a venue, which will enable them to come up with creative solutions to the problems presented.

Currently it is possible for companies to work with the laboratory on commercial projects. The contracting company will own the intellectual property. ILS works with the laboratory on a long-term basis, focused on R&D. According to Igor Popiv, General Manager, ILS – Ukraine, "We (have) found this scheme has certain advantages as it is focused on the long run and rather R&D areas that are not critical for our immediate commercial needs." As another benefit the lab has proven to be a good training ground for new staff that ILS may hire.

Ukraine differentiators:

Given the professors experience within Ukraine and on an international level, they offer the following opinion on the pluses of conducting software development and R&D in Ukraine:

- Well-known Russian scientists have originated from Ukraine, for example: Evgeniy Oskarovich Paton[22].
- Ukraine is creative in science; they explore new ways of doing things, new paradigms.
- The first computer in Europe was invented in Ukraine.
- As an example of military development in Ukraine versus Russia. Many of the technological developments for the Space and Military industry, during the period of the Soviet Union, were done in Ukraine. Russia was considered more of an administration headquarters; all the activities including IT research were outsourced to other areas of the Soviet Union, much of it to Ukraine.

[22] Evgeniy Oskarovich Paton was born in 1870 to a family of diplomats. He was a scholar in the area of welding and bridge construction. In 1929 he organized a welding laboratory and Electric welding committee on the basis of which in 1934 was founded The Paton Institute of Welding.

Interviewed for this study[23]

Dr. Mykola Kirichenko
kir@dept115.icyb.kiev.ua

Dr. Fedir G. Garashchenko
Department Head - Complex Systems Modeling Department
garash@unicyb.kiev.ua

Dr. Yuriy V. Krak
krak@unicyb.kiev.ua

School of Cybernetics - Department of Complex Systems Modeling
National Taras Shevchenko University of Kyiv
www.univ.kiev.ua

Mr. Igor Popiv
popiv@landsystems.com.ua

General Manager
International Land Systems – Ukraine
Prospect Glushkov, #40
Cybernetic Center, Institute of Space Research, Room, 212.
Kiev Ukraine

[23] Interviews conducted by Michael Dolzhenko, Softjourn, Inc. March 2002.

The Experimental Automation Department at Kyiv Polytechnic Institute (KPI)[24]

The aim of the Experimental Automation department at KPI is to prepare specialists in programming, electronic and computer techniques for use in scientific research systems. This includes techniques, which are used in the automation of experiments in such areas as; aerodynamics, durability, and simulation. Students take a wide variety of classes from computer simulation and modeling, computer graphics, and digital signal processing to computer aided design. Competition to study within the department is high. Every year 50 new students are granted entrance to the program, with 3.7 students competing for each open position. According to department head, Mr. Yulian Mikhailovich Tuz, competition has been growing steadily for the last several years.

Cooperation with several multi-national companies has benefited the department by enabling it to establish study labs. Already Motorola has established four labs with other labs being established by Analog Devices. Siemens Nixdorf and Rhodes Schwarz (Germany) have also provided new equipment to supply laboratories for the students. This type of cooperation has aided in not only providing learning environments for the students, but also in providing internships and later on full-time employment.

In order to receive their diploma, students are required to complete two internships during the course of their study. An internship averages six months in duration. Due to established relationships with foreign universities, approximately 20% of the students spend their internships abroad. In the past, students have studied in France and in Germany (Technical University of Munich, Bundeswehr University). Many of these exchange programs are made possible due to an organization called, the National Committee IAESTE-Ukraine[25]. The organization is part of the International Association for the Exchange of Students for Technical Experience (IAESTE). The Association was founded in January of 1948 in London and currently has more than 70 member countries. The aim of IAESTE is to provide students with training relevant to their areas of study, as a supplement to their university or college education. Each member country collects offers from employers willing to receive students from abroad for a temporary training period. The national secretaries within each country, select qualified students to meet the employers' requirements as outlined in the training offer. Details of the selected candidates are sent to companies for their final approval. To date more than 450 students from Ukraine have participated in exchange programs. According to Mr. Tuz, “Our specialists see tasks in their entirety (hardware and software), rather than from one side or the other. Several of our students have gone abroad for work, during their internships, and there they act as coordinators of both hardware specialists and software specialists.”

Another requirement for graduation is the completion of a thesis. Examples of past topics are: multi-channel computer systems for aircraft durability testing, computerized applications for the research of vibration parameters, and magnetic card code analysis for banking systems.

[24] Now known as the National Technical University of Ukraine.

[25] http://iaeste.org and http://iaeste.org.ua

Upon graduation, students from the experimental automation department have taken research positions with the Ukrainian Academy of Science, with a number of Industrial Associations, and Antonov Aviation Scientific Technical Complex. Many of the students also go to work with private entities, both multi-national and Ukrainian, this includes: Motorola, Siemens, IBM, Compaq, Ulys Systems, ProminvestBank, and Kvazar Micro.

The professors themselves in the experimental automation department are continually upgrading themselves and pursuing research. One area where intensive research is done is in the measurement of voltage. Voltage has more than 100 basic standards of measurement and every country has different standards. Currently, the department is working with Ukraine and Germany on developing new standards. In Ukraine, new measuring standards must be certified by DerzhStandardt Ministry; in Germany it is the Felicash BundesStandarts, which certifies standards. The professors also continually pursue publishing papers and obtaining patents. Many of these patents are obtained abroad. For example in Great Britain, a patent has been obtained for a digital voltmeter. Other areas of research undertaken include; aircraft and space techniques, the operation and controlling of technological processes, ecological monitoring, information protection, synthesis and analysis of sounds and picture tests of radio electronic equipment.

Additional real work experience for the students is obtained when the professors team together with the students to develop and implement commercial projects. The Antonov [26]complex has been the sight of several projects completed by the department. Students work in the department under the management of team leaders (fellow students) and professors. Examples of projects developed by the students include:

- Numeric methods of modeling and identification, such as: flight and take-off/landing characteristics;
- Design of tools for maintenance and testing of complex objects, such as: **ПАК – 86/225/124**[27]
- Control systems, which have been implemented at Antonov, Space Shuttle Control Center, and "Energia"[28].

The directors of the experimental automation department are committed to continual improvement. This has been demonstrated by their continuous push to develop relationships with companies for both providing equipment for laboratories and assistance with developing course work. These relationships also provide a good source for internships and full-time employment for the students. The perpetual growth in demand to study within this department says a lot about the future of the department and Ukraine. With its very active leadership, company involvement and internship programs, the experimental automation department can expect to have high demand for its graduates for many years to come.

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[26] In 1991 renamed to the Antonov Aviation Science and Engineering Complex, founded on the bases of the former Kiev Engineering Plant. The complex is oriented in to four main branches: transport (cargo) planes, multipurpose aircraft, passenger airplanes and gliders (including hangliders). The Antonov complex has designed and constructed the largest airplanes in the world. http://www.antonovaircargo.com/eng/index.html. The Antonov An-124 Ruslan is the largest production airplane in the world. The An-225, has a 290 foot wingspan exceeded only by the 320 foot wing of Howard Hughes giant flying boat, popularly known as the Spruce Goose. It is the largest airplane ever flown more than once. It was intended to support the Soviet Buran Space Shuttle program.

[27] **ПАК –86/225/124 -** A device and software application that monitors the voltage consistency in airplane engines.
[28] Manufacturer of equipment for the Soviet Space Shuttle, Buran.

Interviewed for this study[29]:

Mr. Yulian Mikhailovich Tuz
tuz@aer.ntu-kpi.kiev.ua

Director of the Experimental Automation Dept., Professor, Doctor of Technical Science, Ukrainian State Laureate in Science and Engineering, Active Member of New-York Academy of Sciences
National Technical University of Ukraine "Kiev Polytechnical Institute".
Tel: (+38044) 2417620

[29] Interviewed by Michael Dolzhenko, Softjourn, Inc. April 2002.

Contributors

Michael A. Dolzhenko
Michael.Dolzhenko@softjourn.com
Business Development Consultant
Softjourn, Inc.
P.O. Box 747
Kyiv, 01024 Ukraine
(+380 44) 235-2505
www.softjourn.com

Emmy B. Gengler
Emmy.Gengler@softjourn.com
Co-founder & CEO
Softjourn, Inc.
39270 Paseo Padre Pkwy, Suite 251
Fremont, CA 94538, USA
Tel: +1.510.744.1528
Fax: +1.510.217.3870
www.softjourn.com

Alex V. Garmash
Alex.Garmash@softline.kiev.ua
Chief Marketing Officer
Eugene S. Sozanskiy
Eugene@softline.kiev.ua
Business Development Manager

Softline Company
(+380 44)574-0243
(+380 44)574-0290
1 vul. Magnitogorskaya
Kyiv, Ukraine 02094
www.softline-solutions.com

Yelenna Dregulyas, attorney at law
ydregulyas@konnov.com
Sergey Khlyebnikov, attorney at law
skhlyebnikov@konnov.com

Konnov & Sozanovsky
23 Shota Rustaveli Street, Suite 5
Kyiv, 01023, Ukraine
Tel. (+380 44) 490-5400
Fax (+380 44) 490-5490
www.konnov.com

