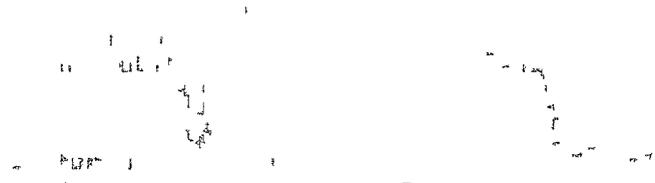


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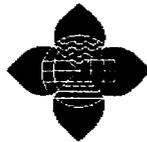


R99-27



ULRMC
Annual Report
The State Of Remote Sensing
In Ukraine

Ukrainian Land and Resource
Management Center



Український Центр М. управління
Землі та Ресурсами

15 June 1999

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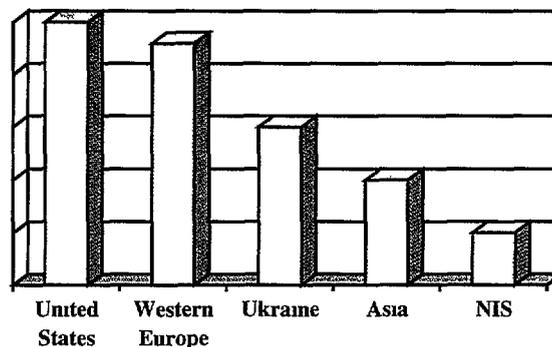
Discussion of Commercial Remote Sensing Activity

I. INTRODUCTION

The Ukrainian Land and Resource Management Center (ULRMC) is a not for profit Remote Sensing Center of Excellence. It was formed through the efforts of the Ukrainian Institute of Environmental Studies (UIES) and the Environmental Research Institute of Michigan (ERIM). Initial start up funding was provided through the United States Agency for International Development (USAID). One of the conditions of the USAID grant was that the ULRMC periodically report on the state of commercial remote sensing in Ukraine. This is the first in a series of annual reports that will address all of the sectors associated with remote sensing. This report will include information primarily on spaceborne and airborne data collection within Ukraine, data exploitation, civil data applications and information products that are available commercially in Ukraine. This information was developed through the use of questionnaires that were distributed throughout the Ukrainian Government and private sector. Center staff then followed up with telephone and personal interviews. This report will not address Treaty Verification Issues, or Ukrainian national reconnaissance programs, it will, however, cover the issues of data availability within the country and the role of Ukrainian national security regulations that either foster or hinder commercial activity in this area. Additionally, information will be provided about the current activities of the ULRMC as the first not for profit private sector remote sensing organization in Ukraine.

Ukraine achieved independence in 1991 with the dissolution of the Soviet Union. Most of the scientific and civil oriented institutions that had used remote sensing data or that had provided data to the scientific community remained intact. It should be noted that under Soviet rule Ukraine produced not only the rocket boosters for the Soviet space reconnaissance program but also the ocean surveillance radar imaging systems as well as some infrared scanners and lowlight video systems. With the removal of a restrictive regime, the public awareness of remote sensing issues increased. Ukraine is an extremely literate country and the average citizen has knowledge of space related and science issues. The Chernobyl disaster has heightened public awareness on all environmental and science issues.

Public Awareness of Remote Sensing

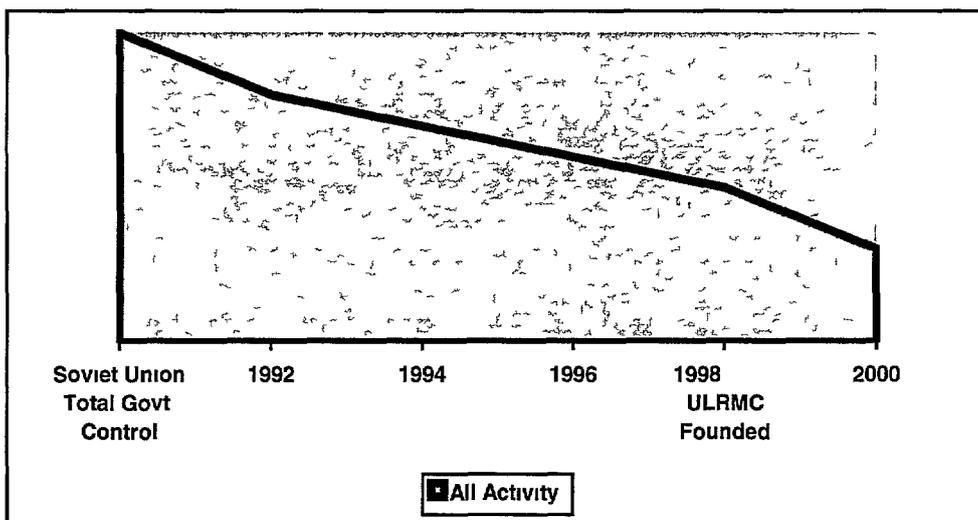


Even though most of the Ukrainian remote sensing institutions remained intact, activity levels were curtailed due to an extreme lack of funding. Since independence a continuing consolidation has occurred, with most organizations becoming consumers of remote sensing data. This has caused additional problems in this sector as there is very little funding available to purchase commercial data, such as LandSat, Spot, or ERS 1/2.

The production of remote sensing data is now concentrated in the Ukrainian National Space Agency and its related remote sensing institutes. These institutes are primarily government organizations that exist through a minimum of government funding and project funding from western governmental programs and organizations such as the World Bank. To date, these types of organizations (Institutes) have participated in a variety of environmental programs funded by the United Nations and the international aid community and act as quasi commercial organizations. These Institutes are the embryonic forms of a Ukrainian private sector remote sensing industry. Remote Sensing Data (Imagery) used in these efforts has been primarily data which is commercially available or collected data that was furnished as part of a project. Little use has been made of data obtained by Ukrainian systems in western funded projects.

Commercialization of imagery collection was attempted with the SICH radar imaging system, but without continued funding and western marketing this program never progressed as envisioned. Additionally, there has been some movement to commercialize the national imagery archives but this remains an open issue to be decided through a national declassification process. Key members of the National Academy of Science of Ukraine as well as individuals within the Ministry of Defense, and the National Space Agency of Ukraine realize that the restrictive security regulations that cover not only remote sensing but also mapping must be modified to bring Ukraine in line with western European nations. It is hoped that Ukraine will follow the precedent of the United States in declassifying all space reconnaissance imagery collected prior to 1976.

**Ukraine
Government Control of Remote Sensing**



II. REMOTE SENSING ORGANIZATIONS

The following are a text and tabular listing of organizations within Ukraine that collect, use or disseminate remote sensing data. It should be noted that the majority of these organizations are affiliated in some fashion with the Ukrainian government. It is also noteworthy that most of these organizations are consumers of geospatial information. Commercial organizations and multi national joint venture efforts have not been listed since this part of the remote sensing market is still in the earliest stages of development and accurate information could not be obtained. Currently, the only private sector organization and the only not for profit organization is the Ukrainian Land and Resource Management Center (ULRMC).

The Ukrainian Land and Resource Management Center (ULRMC)

The ULRMC is a not for profit remote sensing center that was initially funded by a Grant from the U.S. Agency for International Development. The ULRMC brings together elements of remote sensing expertise from both Ukrainian sources and the United States. Currently the ULRMC is conducting demonstration projects throughout Ukraine. These projects provide much needed information and support to the various agencies involved, but more importantly they establish the Center as the major remote sensing organization in the private sector of the Ukrainian economy.

While organized to provide remote sensing data and geospatial products to the Ukrainian government, NGO's, and the commercial sector, the ULRMC has found that it is increasingly active in the policy sector as well. This has been brought about through necessity as the Center must operate as a commercial institution and to do so it will require the modernization of the mapping and spatial data security laws within Ukraine.

The following ULRMC projects are underway in order to demonstrate ULRMC capabilities.

Chornobyl GIS Data Layers

The objective of this project, mandated in the initial grant, is to produce fine resolution data layers for a GIS of the Chornobyl exclusion zone to support modeling and remediation efforts, understanding of public health effects, studies of environmental impact and ecological succession, and land use planning. These activities complement the Chornobyl Center's focus on the use of technologies and land use in the exclusion zone. Specific emphasis will be placed on development of high resolution image maps and digital elevation data. Such data, integrated with other spatial environmental data acquired from maps and ground surveys, will dramatically improve capabilities for mapping land characteristics, monitoring change, and modeling surface processes. This project will support the efforts of the Canadian International Development Agency.

(CIDA) to develop a GIS for the Chernobyl restricted zone. The newly developed data products will be made available to other parties through the ULRMC.

Western Ukraine Flood Assessment

In November 1998, a disaster situation occurred in the Zakarpattia Region of the Carpathian Mountains in extreme western Ukraine adjacent to Slovakia, Hungary, and Romania. Days of abnormal rain caused increased runoff from the mountains, flooding major towns and villages at lower elevations and displacing thousands of people. Mudslides were a particularly serious problem, causing extensive loss of property and lives.

The flooding that occurred in the Zakarpattia Region in November has provided an opportunity for the Center to respond with maps and GIS analysis to assist in assessment and mitigation of future events such as this. The GIS was used to conduct integrated spatial mapping and analysis of land cover, elevation, hydrology, populated areas, and human infrastructure. Satellite image data from SPOT was used to provide an image base map immediately following the flood. Landsat TM was used to derive land cover information. Maps of the region will be used to capture human infrastructure (roads, populated places, etc.) and river structures (dams, bridges). Locations of known events affecting populated areas, infrastructure, and river structures will be entered into the database. Elevation data will be incorporated to evaluate landform and slopes contributing to mudslides. The GIS will be used to demonstrate development of information products that can assist mapping areas susceptible to flooding, mapping potential slide areas, and predicting areas most susceptible to loss of property and lives.

Agricultural Monitoring and Assessment

This project will assist the development of GIS capabilities for integrating remote sensing data resources, other spatial environmental data, and ground data to enable the determination of agricultural status and distribution over extensive countrywide geographic regions. Procedures will be implemented for integrating satellite image data, land and climate parameters, and demographic data to stratify agricultural regions and measure cropland area. Methods will be demonstrated for integrating field measurements and farm survey data with satellite image data to estimate crop yield and agricultural production. To assist understanding the contributory role of satellite image derived information, initial efforts will review the current methods of agricultural production estimation for their adequacy and timeliness. The results of the project will contribute to improved capabilities for monitoring agricultural regions and estimating production, thereby assisting the needs of agricultural reform in Ukraine. Issues relating to water resource requirements and harvest distribution will also potentially be addressed under this activity.

Ukraine National Scale GIS

This project will further develop a national-scale database of spatial environmental data developed by the U S Geological Survey. In its current state, the database includes coverages of several land parameters at 1:1M scale. These coverages include GTOPO30 global elevation data, Digital Chart of the World (DCW) layers of hydrology, boundaries, populated places, and human infrastructure, AVHRR land greenness, and several classifications of land cover. The USGS proposes to work closely with Center personnel to add additional information into the database to further enhance the information content of attributes associated with locations (such as populated places). The additional information could include population size, per capita income, industries, landmarks, names of local government officials, etc., for demographic units ranging from oblasts (regions) to cities and towns. The effort will require Ukrainian support for provision of attribute information. The enhanced GIS will provide a country-wide view of Ukraine at relatively low data volume that, when put on CD-ROM with map viewing software, could be disseminated to governmental units, schools, and commercial groups such as travel agencies as evidence of the capabilities of the ULRMC.

World Bank Black Sea Biodiversity Conservation

The World Bank Environmental Section is assisting Ukraine in the establishment of Bio Reserves along the Black Sea Coast. This area is a major stop-over point for many migratory Bird Species. It is also home to many species listed in the Ukrainian Red Book (Endangered Species). With the demonstrated capabilities of the Center this project would establish a GIS as a management and monitoring tool for data collected in the field by Botanists, Biologists and Ecological Specialists. The GIS would also assist in the management of these areas. Adequate data currently exists over the area in question, SICH, ERS -1, LandSat, SeaWiFS, AVHRR, and Corona imagery is commercially available. Data from the Russian imaging program is also available commercially. Date ranges for imagery coverage range from the 1960s through current coverage. Additional imagery from the mid 1940's may be available in the photo archives of the US. This project is currently scheduled to be funded by the World Bank.

Real-Time NOAA/SeaWiFS Satellite Data Reception and Processing Station

This project will provide ULRMC with a High Resolution Picture Transmission (HRPT) station satellite receiving station capable of capturing data from the Sea Wide Field-of-view Sensor (Sea WiFS) and the NOAA Advanced Very High Resolution Radiometer (AVHRR) sensors as well as data from many other satellites. ULRMC staff will receive training in all aspects of station operations, data processing, and applications. SeaWiFS provides daily multi-spectral images optimized for the assessment of agricultural and forestry vegetation and production, oil spills, coastal water quality problems, and regional atmospheric pollution. Several specific demonstrations will be

developed with ULRMC staff. The project will include all of the required hardware and software to collect, process, and analyze data from these satellites in support of ULRMC applications. The hardware and software will also be capable of integrating and analyzing commercially available data from Landsat, SPOT, ESA, and other sources. Orbital Sciences Corporation, which manages the SeaStar spacecraft, has a strong interest in supporting a ULRMC HRPT station for collecting and archiving the SeaWiFS data. Such activities would provide a source of revenue for the ULRMC and the receiving station operations. SeaWiFS is scheduled for a 15 September 1999 IOC, with FOC no later than 15 October 1999. Having an operational SeaWiFS terminal in Ukraine will greatly improve the utility of this regional resource. SeaWiFS data is available through the Orbital Science Corporation.

The following projects are currently under consideration and, if approved, should bring other sources of funding, private and governmental.

Hazardous Emergency Response Tool

Urban-based nuclear power plants pose unique safety planning requirements in Ukraine as far as evacuation routing, prioritization of the transportation infrastructure, and location and capacity of area hospitals. This project utilizes GIS and remote sensing technologies to assist emergency managers in planning for and responding to disasters. This enables the Center to develop and maintain spatial databases that support capabilities to model hazardous event development, determine population at risk, identify evacuation routes and times, locate emergency care facilities, and plan measures for mitigating the impacts of hazardous events.

Black Sea Oil Spills and Bilge Dumping Monitoring System

The objective of this project is to provide Ukraine with a remote sensing and GIS based environmental monitoring system to detect, identify, and assist remediation of oil spills and bilge dumping in the Black Sea. A GIS of marine and coastal land environmental data will be configured to ingest daily SAR and optical satellite image data that have been acquired by Ukrainian reception stations and internet access. Image processing tools will be implemented within the GIS to geo-register the satellite images and exploit the data for evidence of surface slicks that may be indicative of oil spills or bilge dumping. Once detected, slick information will be compared to a database of historical accidents and other events affecting ocean surface characteristics to assist evaluation of the detected phenomenon. The system will generate map and information products showing location, size, and timing of the detected incident. Such products will be electronically disseminated to enforcement and remediation organizations for response. The results of this project will contribute to Ukraine's efforts to reduce petrochemical pollution of the Black Sea. An important aspect of this project will be to work with Ukrainian government officials to put an infrastructure into place to penalize violations and remediate damage.

Environmental Monitoring and Management of Water Resources

This project will demonstrate development of a GIS that includes remote sensing data resources, other spatial environmental data, and models to provide a Ukrainian Regional Environmental Management Information System (REMIS) for river watersheds. The system will be used to monitor river basins for events such as snowmelt and floods, assess the influence of point and distributed sources of pollution, and predict floods. Satellite image data will provide periodic snow cover and moisture content, land albedo, and vegetation presence and status. Other spatial environmental data will include infrastructure and *in situ* water quality monitoring data. Elevation data are a specific need for modeling land runoff.

GIS-Based Petroleum/Gas Pipeline Decision Support

The objective of this project is to integrate remote sensing data resources, other spatial environmental information, and ground survey information into a GIS decision support system for pipeline industry use. This enables the Center to support the Ukrainian government and petroleum industry efforts to plan pipeline routing, risk assessment, and disaster response. Imagery collected using the Interferometric Synthetic Aperture Radar (IFSAR) system provides elevation data necessary for developing customized algorithms to meet clients' needs. Using remote sensing expertise and change detection algorithms, the effects of pipeline and tank construction on water quality can be monitored.

Remote Sensing Data Availability and Distribution System

This project will develop an information system to enable search and access to remote sensing data resources in Ukraine as well as international data archive and distribution centers. An internet accessible system will be developed to conduct searches in interactive mode. Access to the system will be provided at all Ukrainian government organizations requiring spatial data. This project will contribute to ULRMC program requirements for establishment of an information archive that identifies locations of data and develops metadata standards for use in Ukraine.

Agricultural Privatization Assistance

The objective of this project is to implement GIS and remote sensing approaches for developing databases to assist local agricultural area assessments and farm management. Large-scale image base maps will be integrated with spatial environmental information and ownership boundaries to demonstrate uses of information products by land-owners for economic planning of farm-level activities. The spatial context of infrastructure such as road networks will be added to demonstrate uses of information products for planning crop harvest activities and scheduling the transportation of farm products to commodity processing facilities and markets. Information products will be produced to demonstrate local government use for tax assessments relative to farm size,

farmstead developments, and potential productivity. The project will support the privatization efforts of the Ukrainian government and USAID by demonstrating the use of land survey information for assisting local farm management and economic assessments.

Landsat Base Map

The purpose of this project is to develop a national image base map for Ukraine. A total of 81 TM (Thematic Mapper) scenes will be required to achieve coverage of the country and include cross-border coverage of adjacent countries along the international boundary. The Landsat archive contains complete coverage for the summer season of the late 1980s, with almost all scenes (74 out of 81) occurring in the single year of 1988.

This project will orthorectify and mosaic Landsat TM scenes to create a seamless geo-referenced digital image map of moderate resolution (30-m). The resultant digital map will provide a near-temporally consistent, multispectral image base of summer land cover conditions for the entire country. The image base will enable baseline documentation of the extent of active agriculture and forest cover, the conditions of coastlines, and other land cover conditions just prior to Ukraine independence. The image base will be useful as a source of information for land feature context when assessing national programs such as land privatization and agricultural reform, and when monitoring regional change associated with land development or disaster impacts. The digital map will be useful as an image base for cartographic maps ranging from 1:50,000 to 1:250,000. The digital map could be marketed as a product to be sold to commercial and educational interests requiring land cover information.

NATIONAL SPACE AGENCY of UKRAINE (NSAU)

The National Space Agency of Ukraine is responsible for all space activity of the nation. This includes not only the well-publicized cooperative space flights with the United States and Russia but also work on the International Space Station. Less publicized, but also of extreme value to the nation, are the remote sensing projects undertaken and supported through allocations of the national budget. The SICH series of remote sensing satellites were planned to be unique earth observation systems. The only complete image of all Ukrainian territory, using SICH data, was completed by the Kalmykov Center for the Radiophysical Sensing of the Earth (CRSE).

SICH is an integrated observation system designed for observation of sea surface, sea and ocean ice cover as well as land cover. The SICH satellite contains Side Looking Radar (SLR), a microwave scanning radiometer, a multizone low-resolution scanner and a multizone medium resolution scanner. The SLR has a resolution cell of 2.5 X 1.3 km, with a swath width of 460 km. Perhaps the most heavily exploited sensor on SICH is the SLR. The SICH SLR has been used in the timely detection and monitoring of cyclones, tropical hurricanes and typhoons. It has also been used to monitor surface pollutants on the sea surface, monitor ice formation and the ice processes as well as the Melt State of

ice fields SICH data has also been used to explore the geologic structure of Ukraine to determine the economic viability of mineral mining

The SICH 1 system was totally funded, launched as well as operated by the NSAU with support of various affiliated institutions There was an effort by the NSAU to commercialize the SICH system, but without aggressive marketing and additional support this effort fell short of expectations However, an impressive archive exists of SICH data (1996) that covers all of Ukraine and wide areas of the earth that may be still used for commercial purposes

It is the intent of the ULRMC to offer SICH data as part of the standard imagery types available for customer applications and requirements In this case SICH data can be paired with other commercial remote sensing systems to provide coverage of any given area across the spectrum

In addition to SICH data the NSAU also maintains an archive of space reconnaissance imagery that is comparable to the recently declassified KH-4 imagery in the United States NSAU also has access to all of the current commercial imaging systems as well as the current commercialized Russian imaging satellites

The National Space Agency of Ukraine may be contacted at
zubko@rsd nsau kiev ua

Kalmykov Center for the Radiophysical Sensing of the Earth (CRSE)

CRSE is closely partnered with the Ukrainian Land and Resource Management Center The CSRE Director, Dr Valery Tsymbal, advises ULRMC on all applications of radar imaging as used in environmental and pollution detection programs CRSE was instrumental in the design and also in the interpretation of data collected by the Ukrainian SICH 1 system The staff at CRSE are expert in the application of radar imaging technology to a variety of environmental and agricultural problems SICH imagery was used by CRSE to locate and monitor oil spills in the Black Sea and have continued to monitor oil pollution problems in the Caspian region Dr Tsymbal and the staff in Kharkiv are envisioned as playing a key role in a Oil Spill detection program in the Black Sea as an all weather day/night sensor is required for tip-off to any problems The Kharkiv Center also operates an AN -12 airborne data collection system that includes an infrared scanner, FLIR and a SLAR system CRSE has been funded primarily on a project basis but is now closely affiliated with ULRMC and will be involved in all future remote operations that require radar imagery expertise

The Center for the Radiophysical Sensing of the Earth may be reached at
kalmykov@crse kharkov ua

The Center for Aerospace Research of the Earth (CASRE)

CASRE is a component of the Institute of Geological Sciences within the National Academy of Science structure of Ukraine. CASRE specializes in remote sensing data collection and interpretation, image processing, development of specialized sensors and preparation of geographic – referenced products. It carries out integrated fundamental and applied research into mass energy transfer in geo systems. Its influence on physical, chemical and biological mechanisms, that are sensitive to natural and anthropogenic factors, form natural object spectral response. The data used in this research may be obtained through the airborne collection system owned and operated by CASRE. This aircraft operates sensors in the visible, infrared and microwave bands.

Currently CASRE is active in research programs that cover the ecological monitoring of the environment and the agricultural applications of remote sensing data. CASRE is a member of the European Association of Remote Sensing Laboratories and has an established relationship with the European Space Agency as well as scientific organizations in France and Germany. CASRE is primarily funded through project work for International Scientific and Environmental organizations, with some base line support provided from the Ukrainian government through the Academy of Science.

CASRE may be contacted at casre@casre.kiev.ua

SCIENTIFIC RESEARCH CENTER of AEROSPACE INFORMATION and ECOLOGICAL MONITORING

This research Center is located within the V. M. Glushkov Institute of Cybernetics and is an affiliate of the National Academy of Science of Ukraine. The Scientific Research Center of Aerospace Information aims its research efforts at developing systems and methods of routine ecological monitoring and software for thematic processing and interpretation of earth remote sensing data. This Center also develops systems for the automation of remote sensing processes as well as introducing aerospace remote technologies to various sectors of the national economy. Of primary interest are the application of these technologies to the Western regions of Ukraine and the training of local specialists in their use. The research Center offers commercial use or cooperative production programs with its video collection of environmental data, remote-sensing data in agriculture and forestry as well as geology. The Scientific Research Center of Aerospace Information is primarily funded through project work obtained from International Scientific and Environmental organizations, with some basic level of funding obtained through the Ukrainian National Academy of Science.

The Research Center may be contacted through the National Academy's web address root@nas.gov.ua

NOTE The tabular Data also lists the organizations mentioned above

Ukrainian Organizations with Remote Sensing/GIS Capability

	Committee on National Safety, Commission on Nuclear Policy and Ecological Safety (affiliated with the Office of the President of Ukraine)
Mailing Address	11, Bankivska St , Kyiv, 252220, Ukraine
Leader	Prof Valery P Kuhar, Head of Commission
Telephone, fax, e-mail	Tel (380 44) 558 5388
Kind of cooperation	Possible state level support of activity

	Continual Committee of Supreme Rada on Ecological Policy Questions
Mailing Address	6-8, Bankivska St , Kyiv, 252009, Ukraine
Leader	Yuri I Samoilenko, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 291 7701, fax 293 5381
Other contact	Anatoliy A Pysarenko, tel 291 7708
Kind of cooperation	Possible state level support of activity

	National Security and Defence Council of Ukraine (NSDCU)
Mailing Address	Bankivska St , Kyiv, 252009, Ukraine
Leader	Prof Volodymyr P Horbulin, Secretary of Council
Telephone, fax, e-mail	Tel (380 44) 291 6027, fax 226 2936
Other contact	Yuri A Petrychenko, tel 291 5604
Kind of cooperation	Possible state level support of activity through work with The Environmental and Resource Research Institute of Ukraine

	Ukrainian Environmental and Resource Research Institute of Ukraine (UERRI), NSDCU
Mailing Address	13, Chokolivsky Blvd , Kyiv, 252180, Ukraine
Leader	Dr Kostyantyn K Yartsev, Director
Telephone, fax, e-mail	Tel (380 44) 243 8346, fax 243 8350
Kind of cooperation	Support of activity as a founder of ULRMC

	Ukrainian Land and Resource Management Center (ULRMC), UERRI, ERIM (USA)
Mailing Address	13, Chokolivsky Blvd , Kyiv, 252180, Ukraine
Leader	Albert Fuerst, President, Dr Kostyantyn K Yartsev, Vice-President Dr Oleksandr A Kolodyazhnyi, General Director
Telephone, fax, e-mail	Tel (380 44) 243 8346, fax 243 8350

	Cabinet of Ministers of Ukraine, Department on Technogenic and Ecological Safety, Civil Protection of Population
Mailing Address	12/2, M Hrushevskoho St , Kyiv, 252008, Ukraine
Leader	Vasyl S Lutsko, Head of Department
Telephone, fax, e-mail	Tel (380 44) 226 3303, fax 228 3620
Kind of cooperation	Possible state level support of activity Interaction with Ukrainian information and analytic system on emergency situations

	Ministry of Environmental Protection and Nuclear Safety (MEPNS)
Mailing Address	5, Khreshchatyk St , Kyiv, 252601, Ukraine
Leader	Vasyl Y Shevchuk, Minister
Telephone, fax, e-mail	Tel (380 44) 226 2428, fax 229 8383
Other contact	Oleksandr O Mazurkevich, Head of Department, tel 228 4520 Semen H Kublanov, Head of Department
Advantages	Main Ministry on complex management of environment in Ukraine
Kind of cooperation	Support of project on Environmental management information system, other environmental projects

	Main State Inspection for Supervision on Nuclear Safety, MEPNS
Mailing Address	3, Verhovna Rada Blvd , Kyiv, 252300, Ukraine
Leader	Anatolij I Demianenko, Head of Inspection
Telephone, fax, e-mail	Tel (380 44) 559 6962, fax 559 5344
Other contact	
Kind of cooperation	Support of possible project on Emergency Evacuation of Nuclear stations

	Main Administration of National Natural Parks and Reserves, MEPNS
Mailing Address	1, Tymiryazivska St , Kyiv, 252014, Ukraine
Leader	Mykola P Stetsenko, Deputy Minister, Head of Department
Telephone, fax, e-mail	Tel /fax (380 44) 294 9556
Other contact	Igor B Ivanenko, Anatolij O Tkachov, tel 295 2647
Kind of cooperation	Support of possible project on Biodiversity (Azov – Black Sea Corridor) Use of RS and GIS for nature reserve protection

	State Inspection on Azov Sea Protection, MEPNS
Mailing Address	49, Artema St , Mariupol, 341015, Ukraine
Leader	Mykola A Afanasev, Head of Inspection
Telephone, fax, e-mail	Tel (380 629) 331 435, fax 335 041
Other contact	Valentin D Sudnik
Kind of cooperation	Support of possible project on Biodiversity (Azov – Black Sea Corridor) Use of RS and GIS for Azov sea problems

	State Inspection on Black Sea Protection, MEPNS
Mailing Address	3, R Luxemburg St , Odessa, 270001, Ukraine
Leader	Slava K Dolinskiy, Head of Inspection
Telephone, fax, e-mail	Tel (380 482) 251 447, fax 251 446
Other contact	Lidia S Barabash (Sevastopol), tel (380 652) 592 693
Kind of cooperation	Support of possible project on Biodiversity (Azov – Black Sea Corridor) Use of RS and GIS for Black sea problems

	Ukrainian Scientific and Research Institute of Ecological Problems, MEPNS
Mailing Address	6, Bakulina St , Kharkiv, 310866, Ukraine
Leader	Prof Anatoliy V Grytsenko, Director
Telephone, fax, e-mail	Tel (380 572) 453 188, fax 455 047, e-mail mnts@uscpcw.kharkov.ua
Other contact	Prof Oleksandr K Kuzin, Deputy Director, tel /fax 409 125
Current activities	Environment, water quality, water activity management
Advantages over local competitors	Main institution on water quality in Ukraine Extensive archive on water quality and hydrological data Some experience in GIS and RS
Kind of cooperation	Joint work on environmental projects
Participation in projects with ULRMC	Participation in environmental management information system project as well as some other projects
Proposed role for the future common project	Data and experience resource

	Ukrainian Scientific Center of Sea Ecology, MEPNS
Mailing Address	89, Frantsuzkiy Blvd , Odessa, 270009, Ukraine
Leader	Prof Valeriy I Myhaylov, Director
Telephone, fax, e-mail	Tel (380 482) 636 622, fax 637 200
Other contact	Yuriy M Denga
Current activities	Environment, sea water quality, sea coast management
Advantages over local competitors	Main institution in Ukraine on Black and Azov sea problems Extensive archive on water quality and water activity data
Kind of cooperation	Joint work on projects
Participation in projects with ULRMC	Participation in Black-Azov sea projects
Proposed role for the future common project	Use of experience and data

	Committee on Hydrometeorology (CHM), MEPNS
Mailing Address	6, Zolotovoritska St , Kyiv-34, 252601, Ukraine
Leader	Vyacheslav M Lipinskiy, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 226 3366, fax 229 4907, e-mail ntu@meteo freenet kiev ua
Other contact	Deputy Head of Committee Victor O Trofimenko, Deputy Head of Department, tel 228 7461
Advantages	Main state body on realization of environmental monitoring, observation (including aircrafts and experimental fields) and prediction of agriculture production
Kind of cooperation	Support of possible project on environmental management information system, other environmental and agricultural projects

	Republican Center on Environment Observation, CHM
Mailing Address	39, Nauki pr , Kyiv, 252028, Ukraine
Leader	Oleksandr O Kosovets, Director
Telephone, fax, e-mail	Tel (380 44) 265 9458, fax 265 1346
Other contact	Volodymyr L Onufrienko, Deputy Director
Advantages	Main archive of CHM
Kind of cooperation	Data for environmental and agricultural projects

	Ukrainian Hydrometeocenter, CHM
Mailing Address	6, Zolotovoritska St , Kyiv-34, 252601, Ukraine
Leader	Mykola I Kulbida, Head of Center
Telephone, fax, e-mail	Tel (380 44) 221 9387, fax 229 1080
Other contact	
Advantages	Main state body on meteorological prediction, works on prediction of agriculture production, including RS
Kind of cooperation	Cooperation on meteorological questions, environmental and agricultural projects

	Ukrainian Scientific and Research Hydrometeorological Institute, CHM
Mailing Address	37, Nauki pr , Kyiv, 252028, Ukraine
Leader	Volodymyr M Voloshchuk, Director
Telephone, fax, e-mail	Tel (380 44) 265 1250, fax 265 5363
Other contact	Oleksiy A Krivobok, Head of RS Department, tel /fax 265 8664, e-mail bel@ozsol kiev ua
Advantages	Main scientific and research institute on hydrometeorology, works on prediction of agriculture production, including RS
Kind of cooperation	Cooperation on environmental and agricultural projects, RS data processing, Zakarpattia and Snowmelt projects, etc

	Committee on Water Activity, MEPNS
Mailing Address	8, Chervonoarmijska St , Kyiv-4, MSP, 252601, Ukraine
Leader	Victor M Horev, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 226 2607, fax 226 2607
Other contact	Anatolij I Tsibulskiy
Advantages	Main state body on water resources management Extensive archive on water activity
Kind of cooperation	Use of water resources and water activity data

	Committee on Geology and Depths Use (CGDU), MEPNS
Mailing Address	34, Volodymyrska St , Kyiv-34, 252003, Ukraine
Leader	Sergiy V Goshovskiy, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 226 2007, fax 228 6221
Other contact	Evgen O Yakovlev, Head of Main Department on hydrogeology and ecogeology
Advantages	Main state body on geology and use of depths Extensive archive
Kind of cooperation	Use of geological and depths data

	State Geological Enterprise "Geoprognoz", CGDU
Mailing Address	8, Pylypa Orlyka St , Kyiv, 252000, Ukraine
Leader	Leonid S Halytskiy, Director
Telephone, fax, e-mail	Tel (380 44) 293 0315
Advantages	Extensive archive on geological and hydrogeological data Some experience in use of GIS, ArcInfo
Kind of cooperation	Use of geological and hydrogeological data

	Committee on Oil, Gas and Oil Treating Industry, CGDU
Mailing Address	60, Artema St , Kyiv, 252050, Ukraine
Leader	Head of Committee
Telephone, fax, e-mail	Tel (380 44) 226 3241, fax 211 3010
Advantages	Main state body on geology and use of depths Extensive archive
Kind of cooperation	Use of data on oil and gas industry

	The Ministry of Ukraine of Emergencies and Affairs of Population Protection from the Consequences of Chornobyl Catastrophe
Mailing Address	55, O Honchara St , Kyiv, 252030, Ukraine
Leader	Vasyl V Durdinets, Minister
Telephone, fax, e-mail	Tel /fax (380 44) 226 3437
Other contact	Sergiy Kumchenko
Advantages	Main state body on emergencies and Chornobyl questions
Kind of cooperation	Projects 1 Zakarpattia, 2 Evacuation, 3 Chornobyl

	State Committee on Forest Economy of Ukraine (SCFEU)
Mailing Address	5, Khreshchatyk St , Kyiv, 252601, Ukraine
Leader	Valery I Samoplavskiy, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 226 3253, fax 228 7794
Advantages	Main state body on forestry
Kind of cooperation	Exchange of data

	Ukrainian Scientific and Research Institute of Forest Economy and Agromelioration, SCFEU
Mailing Address	86, Pushkinska St , Kharkiv, 310024, Ukraine
Leader	Igor M Patlay, Director
Telephone, fax, e-mail	Tel (380 572) 431 549, fax 432 520, e-mail root@u-fr1 kharkov ua
Other contact	Igor F Buksha, tel 431 549
Advantages	Forestry monitoring, data archive, international programs
Kind of cooperation	Joint projects with use of RS data and GIS

	State Committee on Fish Economy (SCFE)
Mailing Address	45a, Artema St , Kyiv, 252053, Ukraine
Leader	Mykola M Shvedenko, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 216 6243, fax 212 2032
Advantages	Main state body on fishery
Kind of cooperation	Exchange of data

	South Scientific and Research Institute of Sea Fishery and Oceanography , SCFE
Mailing Address	2, Sverdlova St , Kerch, Crimea, 334500, Ukraine
Leader	Director
Telephone, fax, e-mail	Tel (380 6561) 21 065, fax 21 572, e-mail bnp@ugniro crimea ua
Other contact	Borys M Panov
Advantages	Fishery observations, data archive
Kind of cooperation	Joint projects with use of RS data

	State Committee on Land Resources
Mailing Address	10, M Hrushevskoho St , Kyiv, 252601, Ukraine
Leader	Leonid Y Novakivskiy, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 226 2170, fax 226 2154
Other contact	Leonid D Grekov
Advantages	Main state body on land resources, cadastre, inventory and privatization
Kind of cooperation	Joint project on privatization and agriculture with use of RS

	State Committee of Statistics (SCS)
Mailing Address	3, Sh Rustaveli St , Kyiv-23, 252601, Ukraine
Leader	Oleksandr G Osaulenko, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 226 2421, fax 227 2433
Advantages	Main state body on statistics, agriculture production prediction Extensive data archive
Kind of cooperation	Support activity on privatization and agriculture, including production prediction

	Scientific and Research Institute of Statistics, SCS
Mailing Address	3, Sh Rustaveli St , Kyiv-23, 252601, Ukraine
Leader	Volodymyr I Karpov, Director
Telephone, fax, e-mail	Tel (380 44) 225 3086, fax 225 6043
Other contact	Volodymyr F Kirichenko, tel 213 1039
Advantages	Main institute on statistics, agriculture production prediction Some experience in RS use
Kind of cooperation	Project on agriculture production prediction with use of RS

	Ministry of Agriculture and Industry Complex (MAIC)
Mailing Address	24, Khreshchatik St , Kyiv, 252001, Ukraine
Leader	Yury M Karasyk, Minister
Telephone, fax, e-mail	Tel (380 44) 226 3466
Advantages	Main state body on agriculture
Kind of cooperation	Possible state level support of activity

	Ukrainian Scientific and Research Institute of Agricultural Radiology, MAIC
Mailing Address	Chabany vil , Kyiv-Svyatoshin distr , Ukraine
Leader	Boris S Prister, Director
Telephone, fax, e-mail	Tel (380 44) 266 4502, fax 266 7175
Advantages	Research of radioactive pollution of lands and agriculture production, data archive
Kind of cooperation	Chornobyl project

	Committee on Science and Technology (CST)
Mailing Address	16, Shevchenko Blvd , Kyiv-30, 252601, Ukraine
Leader	Prof Stanislav O Dovgyi, Head of Committee
Telephone, fax, e-mail	Tel (380 44) 225 4279, fax 221 6788
Advantages	State policy in science
Kind of cooperation	Possible support of activity

	Ukrainian Antarctic Center (UAAS)
Mailing Address	55b, O Honchara str , Kyiv-54, 252650, Ukraine
Leader	Prof Gozhik, Director
Telephone, fax, e-mail	Tel (380 44) 216 9446, fax 216 9334
Advantages	Main institution on Antarctic questions Experience in RS data use
Kind of cooperation	Possible joint project

	Ukrainian Academy of Agriculture Sciences (UAAS)
Mailing Address	9, Suvorova St , Kyiv, 252010, Ukraine
Leader	Prof Myhaiylo V Zubets, President
Telephone, fax, e-mail	Tel (380 44) 290 1085, fax 226 3284
Advantages	Main institution on scientific and organizational questions in agriculture
Kind of cooperation	Support of activity in agriculture

	Institute of Agroecology and Biotechnology, UAAS
Mailing Address	12, Metrolohichna St , Kyiv, 252143, Ukraine
Leader	Oleksiy O Sozinov, Director
Telephone, fax, e-mail	Tel (380 44) 266 2338
Advantages	Agriculture monitoring
Kind of cooperation	Projects on agriculture

	Institute of Hydrotechnics and Melioration, UAAS
Mailing Address	37, Vasylykivska St , Kyiv, 252022, Ukraine
Leader	Petro I Kovalenko, Director
Telephone, fax, e-mail	Tel (380 44) 263 4001
Other contact	Vyachyslav M Tymohin (Crimea), tel (380 652) 225 308
Advantages	Agriculture production Experience of RS use
Kind of cooperation	Projects on agriculture Assessments of influenced factors on production volumes

	Institute of Soils and Agrochemistry, UAAS
Mailing Address	4, Chaykovskoho St , Kharkiv, 310024, Ukraine
Leader	Vitaliy V Medvedev, Director
Telephone, fax, e-mail	Tel (380 572) 470 531, fax 433 390, e-mail mbox@issar kharkov ua
Other contact	Anatoliy V Shatohin
Advantages	Scientific and methodics center on soils and agrochemistry Some experience in RS and GIS Data on soils
Kind of cooperation	Projects on agriculture with RS data and GIS use

	Institute on Land Organization, UAAS
Mailing Address	3, Narodnoho Opolchennya St , Kyiv, 252151, Ukraine
Leader	Dmytro S Dobryak, Director
Telephone, fax, e-mail	Tel (380 44) 277 7344, fax 277 7333
Advantages	Rational land use Data and maps
Kind of cooperation	Projects on agriculture and agriculture statistics

	National Academy of Sciences of Ukraine (NASU)
Mailing Address	54, Volodymyrska St , Kyiv-30, 252601, Ukraine
Leader	Prof Borys E Paton, President
Telephone, fax, e-mail	Tel (380 44) 225 6344, fax 224 3243
Other contact	Prof Victor G Baryakhtar, tel 226 2167
Advantages	Main scientific organ of Ukraine
Kind of cooperation	Support of activity

	Glushkov Institute of Cybernetics (GIC), NASU
Mailing Address	40, Acad Glushkova pr , Kyiv, 252207, Ukraine
Leader	Prof Ivan V Sergienko, Director
Telephone, fax, e-mail	Tel (380 44) 266 2008, fax 266 7418
Other contact	Prof Yuri G Kryvonos, tel 266 7418
Advantages	Main institution on cybernetics and informatics Experience in RS and GIS
Kind of cooperation	Projects on information system creation

	Scientific and Research Center of Aerospace Information and Ecological Monitoring (ASIEM), GIC, NSAU
Mailing Address	19, Horbachevskoho St , Lviv, 290044, Ukraine
Leader	Director Dr Anatoly A Komissarchuk
Telephone, fax, e-mail	Tel (380 322) 744 004, 741 115, fax 340 366, e-mail chief@space lviv ua
Other contact	Volodymyr E Goncharuk
Advantages	Problem-solving on regional level Extensive RS data archive Basing of RS use in Western region of Ukraine (1994) Elaboration and creation of Western regional Center for receiving, processing and transferring of RS data
Kind of cooperation	Participation in joint projects on emergency situations, environment, agriculture, forestry, coal industry

	Institute of Geography, NASU
Mailing Address	44, Volodymyrska St , Kyiv, 252003, Ukraine
Leader	Prof Leonid G Rudenko, Director
Telephone, fax, e-mail	Tel (380 44) 224 6193, fax 224 3285
Advantages	Main scientific institution on geography and mapping Some experience in GIS
Kind of cooperation	Projects on mapping and GIS creation

	Institute of Geological Science (IGS), NASU
Mailing Address	55b, O Honchara St , Kyiv-54, 252650, Ukraine
Leader	Prof Ivan V Gozhyk, Director
Telephone, fax, e-mail	Tel (380 44) 216 9446, fax 216 9334
Advantages	Main institution on geology Some experience in GIS Extensive data archive
Kind of cooperation	Environmental projects

	Center of Aerospace Research of Earth (CASRE), IGS
Mailing Address	55B, O Honchar St , Kyiv, MSP, 254601, Ukraine
Leader	Prof Vadim I Lyalko, Director
Telephone, fax, e-mail	Tel /fax (380 44) 216 9405, e-mail casre@casre kiev ua
Other contact	Mykola I Kobets, tel (380 44) 243 8348
Advantages	NASU's main scientific institution on RS Member of the European Association of Remote Sensing Laboratories (EARSeL) Extensive RS data archive Programs of NSAU, joint grants with Space Agencies of Germany, France Highly skilled specialists in RS and GIS Software (ERDAS, EASI/PACE and self-made) Airborne equipment
Kind of cooperation	Participation in joint projects

	Kalmykov Center for the Radiophysical Sensing of the Earth (CRSE), NASU and NSAU
Mailing Address	12, Academician Proskury St , Kharkiv, 310085, Ukraine
Leader	Director Dr Valery M Tsymbal
Telephone, fax, e-mail	Tel (380 572) 448 397, fax (380 572) 441 012, e-mail vnt@crse kharkov ua, kalmykov@ire kharkov ua
Advantages	Extensive experience in creation and use of cheap, but effective radars Large RS data archive Airborne equipment Currently working in CRSE created space radars for satellites Cosmos-1500, Cosmos-1602, multipurpose radar complex MARS, AKDZ-28
Kind of cooperation	Creation and use of different radar systems, radar data processing and interpretation Projects on Air base (NSAU), LightSAR (NASA), Solid Earth and Natural Hazards – Research and Applications Investigations (NASA/Goddard Space Flight Center), INTAS Projects, etc

	Marine Hydrophysical Institute (MHI), NASU
Mailing Address	2, Kapitanska St , Centre, Sevastopol, 335000, Ukraine
Leader	Prof Valery M Eremeev, Director
Telephone, fax, e-mail	Tel (380 690) 520 452, fax 444 253, e-mail odop@alpha mhi uif net
Other contact	Genadiy K Korotaev
Advantages	Main scientific institution on hydrophysical questions of Azov-Black Sea basin and World ocean Extensive RS data archive Programs of NSAU, international grants Experience in RS and GIS
Kind of cooperation	Participation in joint projects

	Main Administration on Geodesy, Cartography and Cadastre affiliated with the Cabinet of Ministers of Ukraine (MAGCC)
Mailing Address	54, Popudrenka St , Kyiv, 252094, Ukraine
Leader	Dr Anatoly L Bondar, Head of Administration
Telephone, fax, e-mail	Tel (380 44) 559 7389, fax 573 4213
Other contact	Myhaylo D Cheremshynskiy, tel 573 2254 Borys D Lepetjuk, tel 552 2375
Advantages	Main organ on mapping Data archive
Kind of cooperation	Joint projects on mapping with RS use

	Scientific, Research and Production Institute “Geodezkartinformatyka”, MAGCC
Mailing Address	69, Chervonoarmijska St , Kyiv, 252005, Ukraine
Leader	Yuri O Karpynskiy, Director
Telephone, fax, e-mail	Tel /fax (380 44) 227 4252, 227 0684
Advantages	Main institution of MAGCC on maps preparation Some experience in GIS
Kind of cooperation	Use of RS for mapping Joint projects

	State Scientific and Production Center “Pryroda”, NSAU and MAGCC
Mailing Address	6, Shkilna St , Vyshhorod, Kyivska obl , 255240, Ukraine
Leader	Dr Vasyl S Gotymyn, Director
Telephone, fax, e-mail	Tel (380 4496) 51 791
Advantages	Main RS data archive of NSAU and MAGCC Some experience in RS data processing and GIS Software (ERDAS, EASI/PACE, ArcInfo and self-made)
Kind of cooperation	Exchange of data

	Institute of Advanced Technologies, MAGCC
Mailing Address	54, Popudrenka St , Kyiv, 252094, Ukraine
Leader	Dr Oleksandr V Barladin, Director
Telephone, fax, e-mail	Tel /fax (380 44) 552 0215, 554 7171
Advantages	Experience in preparation of printed production (maps, atlases, etc) on current, modern level Some experience in GIS
Kind of cooperation	Exchange of products and data Joint projects

	National Space Agency of Ukraine (NSAU)
Mailing Address	11, Bozhenko St , Kyiv, 252022, Ukraine
Leader	Dr Oleksandr O Negoda, General Director
Telephone, fax, e-mail	Tel (380 44) 226 2555, fax 269 5058, e-mail nsau@nsau.kiev.ua
Other contact	Victor P Zubko, tel 261 0827
Advantages	Main organ on space research and use
Kind of cooperation	Support of activity in RS

	State Design Bureau "Pivdenne", NSAU
Mailing Address	3, Kryvorizka St , Dnipropetrovsk, 320008, Ukraine
Leader	Prof Stanyslav M Konuhov, Chief Designer
Telephone, fax, e-mail	Tel (380 562) 925 167, fax 700 430
Other contact	Volodymyr I Sytnykov
Advantages	Main company in Ukraine in design and creation of rockets and satellites
Kind of cooperation	Support of activity Joint projects

	State Scientific and Production Enterprise "Obry", NSAU
Mailing Address	a/c 18, Chernihiv, 250000, Ukraine
Leader	Gurbik, Director
Telephone, fax, e-mail	Tel (380 4622) 36 076, fax 31 778
Advantages	Main RS data receiving station in Ukraine (NOAA, Meteosat, Sich-1) Extensive RS data archive
Kind of cooperation	Data exchange Joint projects

	Space Research Institute, NASU and NSAU
Mailing Address	40, Glushkova St , Kyiv, 252022, Ukraine
Leader	Prof Vsevolod M Kuntsevych, Director
Telephone, fax, e-mail	Tel /fax (380 44) 266 4124
Advantages	Main contractor of NSAU on scientific and methodics support of RS research in Ukraine Experience in RS data processing and GIS
Kind of cooperation	Data and products exchange Joint projects

	Open Stock Company "Scientific and Production Enterprise "Orbita" (OSC SPE "Orbita")
Mailing Address	2, Panikahı St , Dnipropetrovsk, 320700, Ukraine
Leader	Director Volodymyr O Boyko
Telephone, fax, e-mail	Tel (380 562) 656 821, fax 658 981, e-mail kei@orbita dp ua
Contact	Oleksandr O Sadovnikov, tel (380 562) 659 358
Advantages	Extensive experience in design and participation in utilization of information processing Large RS data archive Creation and technical support of land control of satellite "Sich-1" Creation of land receiving, processing and transferring facilities for "Sich-1", NOAA Participation in creation of "Sich-1" borne instruments
Kind of cooperation	Participation in joint projects Creation of satellite system for environmental monitoring in Dnipropetrovsk oblast and Azov sea region Creation of data transferring network

	National Center of Aerospace Education of Youth
Mailing Address	26, Gagarina pr , Dnipropetrovsk, 320005, Ukraine
Leader	Victor V Hutornyiy, General Director
Telephone, fax, e-mail	Tel (380 562) 466 032, fax 466 171
Advantages	Main educational center on space researches and space use including RS Very well equipped
Kind of cooperation	Participation in educational programs

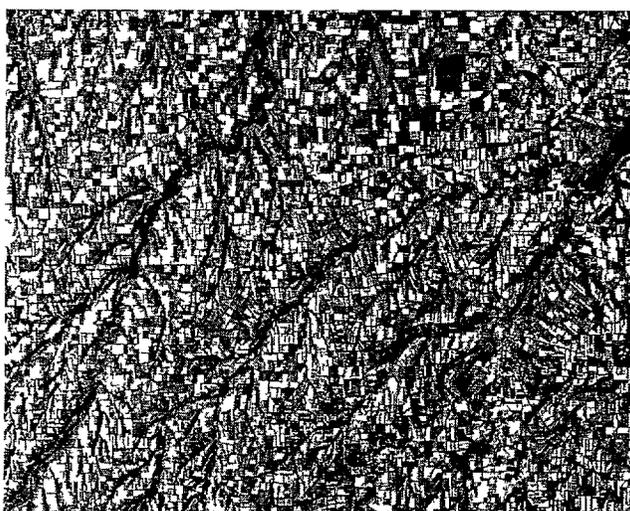
III. COMMERCIALY AVAILABLE REMOTE SENSING DATA COLLECTION SYSTEMS

ERS 1 / 2

The ERS system was launched by the European space agency (ESA) as an earth observation system. Two of the most pertinent sensors for the purposes of this report is the SAR with a nominal resolution cell of 1km x 1km. This sensor has been used in a pilot program along the Atlantic coast of Spain by the European Union to detect oil spills and to monitor bilge dumping in the area. The ATSR (Along track Scanning Radiometer) is also quite useful as it measures both in the visible and infrared bands. It has been used to determine sea surface temperature as well as land cover.

The ESA believes in open pricing and all prices of data products are posted at their web site. Typical products range in price from a few hundred ECU to over 2000ECU.

ERS 1 / 2 data may be ordered on line by contacting esrin@esa.it



"ERS1"
South Buh River Basin
Ukraine

Commercial Imagery taken from Project Archive ULRMC

RADARSAT

Radarsat is operated by the Canadian Center for Remote Sensing (CCRS) It is a SAR system that operates in the 5.3GHz range with a Horizontal / Horizontal (HH) polarization This system has global coverage and repeats every twenty-three days Radarsat has multiple imaging modes which include Standard, Wide Swath and Fine resolution mode The range resolution in standard mode is 25M with an Azimuth resolution of 28M The fine resolution mode has a Range resolution of approximately 8 – 9 m with an azimuth resolution of 9m

CCRS has used radarsat imagery in extensive studies of the arctic ice pack and the system is also used in Alaska by the USGS for mapping purposes Radarsat is also available to the Alaskan Fire Center and has been used to chart burned areas that require reseeding Radarsat has it's own web page with complete system parameters This imagery may also be ordered over the Internet

Radarsat can be contacted at radarsat@space.gc.ca



"RADARSAT"
Dnepropetrovsk
12 May 1997

Commercial Imagery taken from Project Archive ULRMC

SPOT

The Spot system has lead the way in higher resolution civil imaging systems SPOT (satellite probatoire d' obovration de la terre) is a French government sponsored earth observation system Prior to the new series satellites SPOT data was panchromatic with a nominal 10m resolution SPOT has global coverage and completes an earth cycle every 26 days The new SPOT system will include both a panchromatic sensor as well as multispectral data collector For the new system, the panchromatic sensor will have a nominal 5-m resolution and the multispectral system will have a nominal 10m resolution

Spot imagery products are sold through the SPOT Image Corporation, sensor and all system data are available over the Internet Imagery may also be ordered online, but price information is not posted

SPOT Image may be contacted at www.spot.com



"SPOT"
Mouth of South Buh River
Ukraine

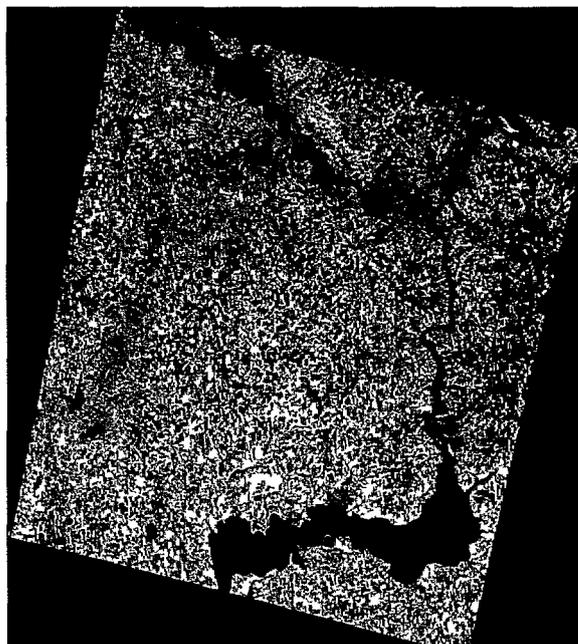
Commercial Imagery taken from Project Archive ULRMC

LANDSAT

Landsat was the first truly civil remote sensing satellite system The system first became operational in 1972 ERIM, one of the ULRMC founders, did much of the original sensor design on the first Landsat system Landsat has a multispectral scanning system (MSS) and also the thematic mapper (TM) Nominal spatial resolution for this system is 30m Landsat has been used throughout the world in applications ranging from climate change, agriculture and land use planning The newest generation of Landsat was successfully launched on 15 April 1999, placed in orbit and is now operating as planned Landsat 7 will provide the spatial resolution of 10m data, along with the multispectral data

needed for detailed studies. The reported cost has also decreased to \$500.00 per image. All of the Landsat data may be ordered either through the EROS Data Center operated by USGS or through space imaging corporation. There is a two-tier pricing program in place for Landsat. The lowest price is available to US government agencies and organizations affiliated with US government programs. More information on the

Landsat system may be obtained through the USGS EDC at www.usgs.edc



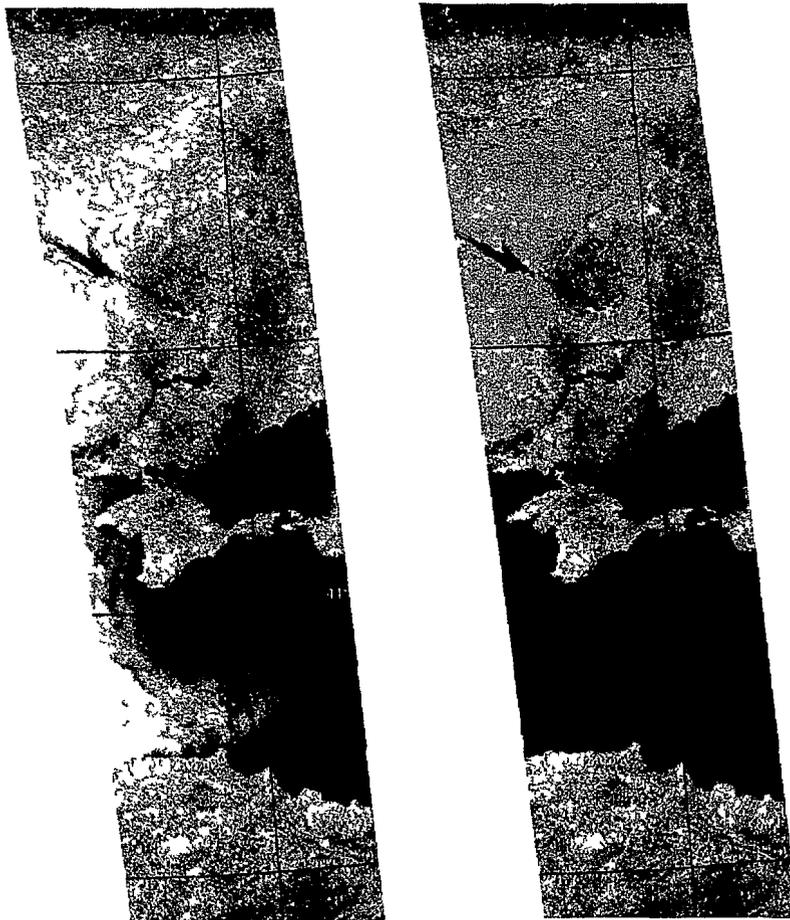
"LANDSAT"
Dnipro River
Ukraine
14 Sept 1994

Commercial Imagery taken from Project Archive ULRMC

SICH

Although not commercialized as the previous systems, SICH data is available through the National Space Agency of Ukraine. SICH has global coverage and also complete coverage of the territory of Ukraine. The principal remote sensing systems on the SICH satellite are as follows, SLR (side looking radar), wavelength 3.1 cm, resolution element 2.5 x 1.3 km, swath width 460 km. RM-08 microwave scanning radiometer, MSU-M multizone low resolution scanner, MSU-S Multizone medium resolution scanner.

SICH data can be obtained by contacting the NSAU at zubko@rsd.nsau.kiev.ua



Radar SICH 1 image
9 Oct 1996

 Zones of rains

Kalmykov Center for Radiophysical Sensing of Earth Kharkiv

KH-4

KH-4 is the declassified space reconnaissance imagery available through the United States Geological Service, EROS data center in Sioux Falls South Dakota KH-4 has complete coverage of Ukraine, with some stereo imagery available KH-4 was a film return system with a nominal resolution of 2 to 5 meters Both negatives and duplicate positives are available Browse images as well as an image locating system is on line at the EROS data center Acquired from 1963 through 1973, KH-4 is an invaluable tool for determining the rate of change in land use and also is being used to support the ULRMC Agricultural Assessment program

KH-4 imagery may be ordered on line through the USGS EDC at www.usgs.edc The cost is \$17.95 per image, shipping and handling not included



Formerly Classified
Corona Imagery (KH-4)
1964



IV. IMAGE PROCESSING SOFTWARE

ESRI - developed software is available commercially in Ukraine through ECOMM Company ERDAS and ARC/INFO licenses as well as training packages are available ESRI has donated some software packages to government ministries as an incubator for western image processing software The table listed below includes contact information

Intelligence Systems GEO is the official distributor of MapInfo software These software packages are quite prolific as most Ukrainian government organizations have started out with this software for their geospatial data processing needs Contact information is listed in the table below

Other image processing software exists in Ukraine but most of this is unique to work on the Soviet era reconnaissance systems that had been developed in Ukraine This software is not easily maintainable and has limited utility with western commercial systems There are current Russian commercial image processing software that has developed from this background such as ORTHOSPACE This software package is optimized to work with the KVR imaging system and will operate in a Windows NT environment Currently there are no commercial representatives of this product in Ukraine, but as the remote sensing sector matures, this package may be required to fully utilize data within Ukrainian archives once this data has been commercialized

Further information on ORTHOSPACE may be obtained from SOVINFORMSPUTNIK at www.sovinformsputnik.com

Name of Company	ECOMM Co
Mailing Address	of 925, 18/7, Kutuzov St , Kyiv, 252133, Ukraine
Leader	Eugene S Seredynin, President
Telephone, fax, e-mail	Tel /fax (380 44) 294 8604, e-mail es@ecomm.kiev.ua
Advantages	Official distributor of ESRI Experience in RS data processing and GIS
Kind of cooperation	Purchase of ERDAS and ArcInfo software Data and products exchange Joint projects

Name of Company	Intelligence Systems GEO
Mailing Address	9a, Saperne Pole St , Kyiv, 252042, Ukraine
Leader	Victor S Chabanyuk, Director
Telephone, fax, e-mail	Tel (380 44) 261 1728, fax 269 2504, e-mail chab@isgeo.kiev.ua
Advantages	Official distributor of MapInfo Some experience in RS data processing and extensive experience in GIS Many years dedicated to work on the Chernobyl project
Kind of cooperation	Purchase of software Data and products exchange Joint projects

V. DATA AVAILABILITY

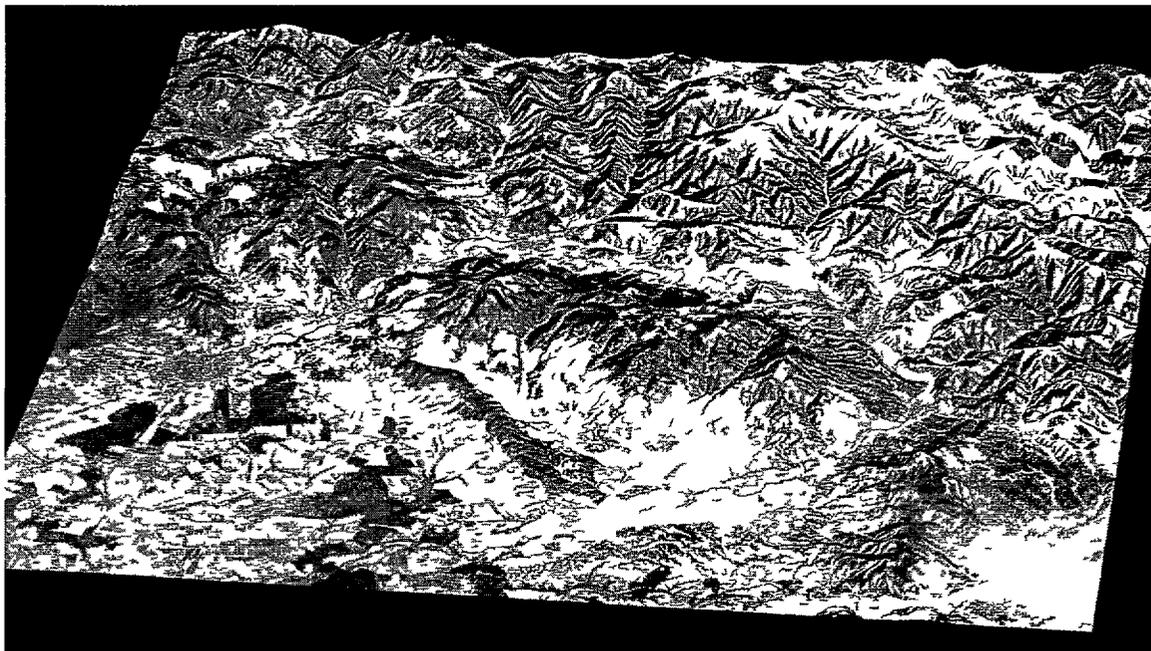
The imaging systems listed are commercially available throughout Ukraine, in as much as data can be ordered through archive and corporate locations. SICH data may be obtained through the NSAU and KH-4 data can be ordered over the Internet. It should be noted that with the exception of KH-4 imagery all of the systems listed cannot supply imagery with a resolution better than 10M. In most cases the geospatial products generated from this data are presented at nominal scales smaller than 1:100,000. This scale is the threshold for the activation of security restrictions within Ukraine.

The application of these security regulations can vary. Recently a water project in Lviv ran afoul of the 1:100,000 barrier as the GIS being created for the city administration depicted utility lines, water and sewer lines at a level of detail that exceeded the legal limit. The problem was solved by bringing a security consultant into the GIS effort and providing physical security for the data created for the GIS. This adds expense and another layer of bureaucracy to any project that requires the use of or generates geospatial data.

These regulations also hamper the delivery of emergency services to the citizens of Ukraine, as the various government ministries do not have map products of sufficient detail to assess critical situations. Imagery products supplied by the ULRMC can

generally exceed the scale restrictions currently in place. In fact, the planned National Data Collection of all Ukrainian territory by the Canadian operated Interferometric SAR sensor will be able to provide Digital elevation models (DEM) at the sub meter level, if required.

It is imperative for Ukraine to modernize their national security regulations as covering geospatial products so as to bring them in line with Western Europe. It is the view of the ULRMC that this would be best accomplished by a National Declassification Commission that could build a consensus among all of the competing parties on this issue. Declassification should not be construed as the negating of all security regulations, in Ukraine. In the United States a comprehensive review of these regulations found areas that required additional protection. The ULRMC stands ready to assist this process in any manner as the current restrictive regulations on geospatial information hamper commercial activity and the growth of the private remote sensing sector.



Sample DEM

VI. Assessment

The Remote Sensing Industry in Ukraine is in a period of flux. There is a continued effort by the Government of Ukraine to privatize components of this industry yet there continue to be restrictive legislation on the scales and types of geospatial products available to the public and commercial organizations. The strictly commercial market for geospatial products is immature, yet the technical capability to produce these products within Ukraine is at least on a level with that of Western Europe.

The ULRMC, as a private not for profit entity, is unique in Ukraine as it has a basis in Ukrainian law to work in this sector and is the first truly private entity in the Ukrainian Remote Sensing Industry that handles data collection, data management, data interpretation and the production of synthesized geospatial products. The ULRMC, together with its Ukrainian and US components, is ideally situated to commercialize the Remote Sensing Industry in Ukraine. The initial process has started through the marketing efforts of the Center. However, the results of this effort will not be available for at least 6 to 8 months. It is hoped that the second annual report on remote sensing in Ukraine will provide a favorable report in this area, but at present the issue is undecided.

The land privatization program as well as agricultural programs in Ukraine could benefit from the types of technologies that can be applied from Remote Sensing. There is a growing public awareness of these technologies and an interest in their application to the Ukrainian economy. The mechanism to do this well is the ULRMC. The funding sources for this work must be developed from NGO's and the international Aid community and the large commercial investors, as there is no ability within the Ukrainian government to fund extensive programs in this area. The ULRMC will be the litmus test of commercialization in the Remote Sensing Industry. A prosperous and active Center indicates that commercialization is succeeding.