

UNISCAN™ AND ALICE-SC™ GROUND STATIONS AND DEVELOPMENT OF THEIR NETWORKS

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ABSTRACT:

X-band UniScan and L-band Alice-SC ground stations manufactured by R&D Center ScanEx have several important features:

- affordable price;
- based on PC under MS Windows XP;
- complete set of s/w for data reception, storage and processing;
- upgrade for different satellites on s/w level;
- compact design;
- data availability for thematic analysis in 0.5-1.0 hours after reception.

There are networks of UniScan and Alice-SC ground stations in Russia and CIS countries - at present 28 Alice-SC and 36 UniScan ones. Alice-SC ground stations receive data from NOAA, MetOp, Feng-Yun satellites. Now UniScan receives data from IRS-1C/1D, IRS-P5, IRS-P6, Landsat-5, EROS A, EROS B, Terra, Aqua, RADARSAT-1, ENVISAT-1. 10 UniScan ground stations are capable for RADARSAT-1 and 6 of them already were successfully certified by CSA and MDA GSI. There are 8 UniScan ground stations capable for SPOT-2/4. There are networks of UniScan of Ministry of Natural Resources of Russia, Ministry of Disaster management, Roshydromet, Ministry of Higher Education. Also Center ScanEx operates commercial network of UniScan stations in Moscow, Irkutsk and Magadan cities of Russia, allowing to cover all territory of Russia with remotely sensed images. This approach gives a possibility to create geo-portals on the base of RS data: existing Russian geo-portals <http://maps.yandex.ru>, <http://new.kosmosnimki.ru>. Possibility to upgrade layers of such geo-portals with up-to-date information having access to RS data in real-time mode enables to solve different practical tasks: monitoring of floodings, wildfires, control of forestry, agriculture, oil pollutions detection, ice-charting, etc.

Preamble

The main conditions of real-time monitoring of the Earth from space are accessibility of different types of RS Data, their regular reception in real-time mode and technological possibility to process and to make available for analysis for very short time (0.5-1 hour after reception) for the purpose of decision making support. Today in the era of rapid development of computing technologies RS data from space became available for acquisition directly to Microsoft® Windows® based PC and became indispensable tool for increasing reliability of decision making being the source of independent information about objects of nature and infrastructure. Designed and manufactured by R&D Center ScanEx universal ground stations Alice-SC™ (L-band) and UniScan™ (X-band) enable to acquire images from wide range of Earth observing satellites. Networks of these ground stations enable to provide data to users in near real time mode.

UniScan™ and Alice-SC™ ground stations by ScanEx

In present era of rapid development of computing technologies RS data from space became available for acquisition right to Microsoft® Windows® based PC. X-band UniScan and L-band Alice-SC ground stations manufactured by R&D Center ScanEx have several important features:

- affordable price;
- based on PC under MS Windows XP;
- complete set of s/w for data reception, storage and processing;

- upgrade for different satellites on s/w level;
- compact design;
- data availability for thematic analysis in 0.5-1.0 hours after reception.

The **Alice-SC** station provides for the RS data reception and processing from the following satellites:

NOAA (POES)
MetOp
FengYun
NPOESS (to be launched in 2013)

The station consists of:

the antenna system;
the receiving unit with universal demodulator;
the computer interface board;
a set of connecting cables;
the software;
documentation.

Personal computer is not part of the standard Alice-SCTM delivery configuration.

Software

The station is supplied with the software for:
control of acquisition and data recording to a PC hard disc (Alisa Receiver®);
preliminary processing of HRPT data from METOP satellite (METOP Tools)
visualisation and analysis of images (ScanMagic® LL).

More detailed information about Alice-SC ground station can be found at: www.scanex.com/en/stations

station antenna type	axially symmetric solid reflector
Type of positioner	2-axis (X-Y)
Antenna tracking control	step-type
Antenna reflector diameter, m	1.2
Polarisation	right circular
Working frequency band, MHz	1,670 ... 1,710
Digital data rate, Mbps	0.25 ... 2 (BPSK) 0.5 ... 4 (QPSK)
Modulation type	BPSK, QPSK
Noise temperature of the low-noise amplifier-converter, K	65
Rotation range for tilt (Y), deg.	-80...+90
Rotation range for elevation (X), deg.	0 ... 170
Antenna system working temperature range, °C	- 40 ... +50
Wind speed, m/s: working survival	20 30

Main specifications of the Alice-SC



Figure 1 Antenna system of Alice-SC ground station

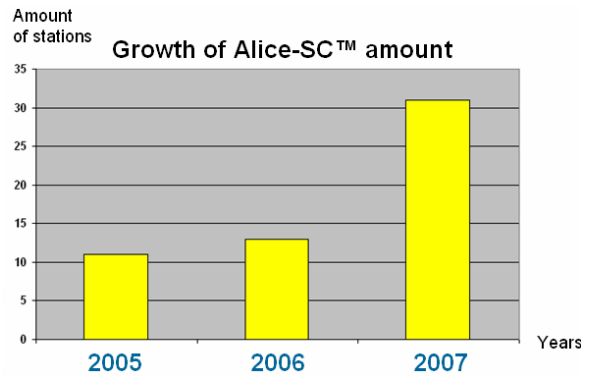


Figure 2 Growth of Alice-SC™ ground stations amount

The UniScan ground station is designed for receiving and processing images transmitted from low-orbiting Earth satellites in X-band with data rates up to 170 Mbps in one channel. Such data rate allows to transmit detailed images with the spatial resolution better than 1 meter. At present the UniScan™ station provides for reception and processing of data from Terra, Aqua, Resurs-DK1, IRS-P5, IRS-P6, SPOT 4, Landsat 5, EROS A, EROS B and RADARSAT-1, ENVISAT-1 satellites.

Main specifications of the UniScan™ station

UniScan™ hardware is universal and programmable. It provides for reception of information in any format, whose parameters are within the following limits:

Parameter	Range
Carrier, MHz	7,750...7,850 8,000...8,500
Rate of information transmission, Mbps	7.5 ... 170 (QPSK) 3.75 ... 85 (BPSK)
Modulation	BPSK, QPSK, SQPSK

The users would not need any hardware modifications to adapt the station for a new satellite and format, only some additional software will be required provided that:
format parameters are within the limits indicated above;
power of the satellite transmission is sufficient to be received by the particular antenna system.

SPOT 5, RADARSAT-2, NPP, NPOESS satellites and many others transmit (or will transmit) information within the UniScan™ range of parameters.

UniScan™ is manufactured in two configurations:
solid-reflector antenna, 3.1 m in diameter with a 3-axis positioner (UniScan™-36);
solid-reflector antenna, 2.4 m in diameter with a 2-axis "X – Y" rotating support (UniScan™-24)

Parameter	UniScan™-36	UniScan™-24
Antenna type	Single reflector axially symmetric, sectional, solid	
Type of antenna positioner	3-axis (X-Y-Z)	2- axis (X-Y)
Antenna reflector diameter, m	3.1	2.4
Antenna gain, dB	45.5	44
Polarisation	Right circular	
Working frequency band, MHz	7,750...7,850 8,000...8,500	
Noise temperature of the low-noise amplifier-converter, K	65	
G/T (at 8.2 GHz frequency, 5 deg. elevation), dB/K	23	22
Rotation range for azimuth direction (Z), deg.	-270 ... 270	----
Rotation range for tilt (Y), deg	-20 ... 20	-90 ... 90
Rotation range for elevation (X), deg.	0 ... 180	0 ... 180
Antenna system weight (not more than), kg	1,000	400
Antenna system working temperature range, °C	-50 ... +50	
Wind speed, m/s: operational survival	20 40	



Figure 3 Antenna system of UniScan™-



Figure 4 Antenna system of UniScan™-24

The UniScan™ consists of:
 the antenna system;
 the control unit;
 universal demodulator;
 computer interface boards;
 an Intel Pentium IV based PC (one or two, see below);
 the software;
 a set of connecting cables;
 documentation.

The UniScan™ is supplied with specialised MS Windows XP software for:
 the control of reception and data recording to a PC hard disc (ScanReceiver®);
 the preliminary processing (data formatting, geolocation and calibration). Definite structure of this software depends on station configuration, i.e. list of data to be acquired;
 the visualisation and analysis of images (ScanMagic®, one license);
 cataloguing images (ScanEx Catalogue Manager®);
 additional thematic image processing (ScanEx Image Processor®, one license).

Data recording and storage is implemented in formats developed by the R&D Center ScanEx. They preserve all of the metadata received from a satellite and the metadata added in the course of reception. These formats are fully supported by the delivered software. It is also possible to obtain low-level products in standard formats.

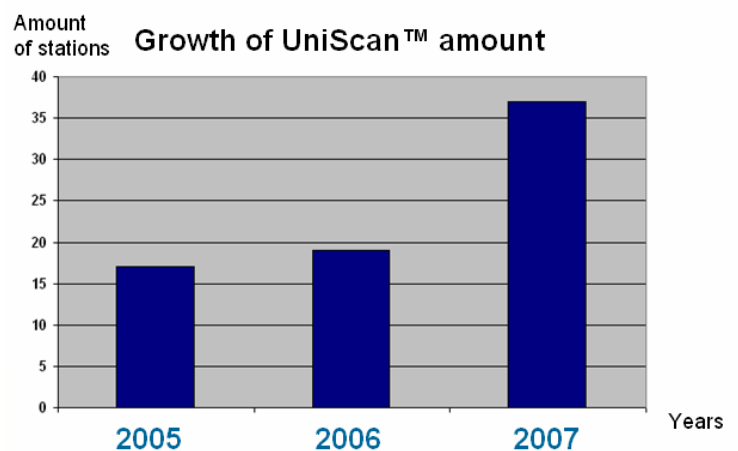


Figure 5 Growth of UniScan ground stations amount

Networks of ground stations and their development

There are networks of UniScan and Alice-SC ground stations in Russia and CIS countries - at present 31 Alice-SC and 37 UniScan ones. Universal Alice-SC ground stations, as mentioned above, receive data from NOAA, MetOp, Feng-Yun satellites. Alice-SC ground stations are mostly operated by hydro meteorological organizations. Thus, 12 such stations were delivered during year 2007 to operative organizations of Roshydromet (www.meteorf.ru) within the World Bank contract.



Figure 6 The network of Alice-SC L-band ground stations

Universal multi-mission UniScan ground stations at present time receive data from wide range satellites Terra, Aqua, IRS-1C/1D, IRS-P5, IRS-P6, Landsat-5, EROS A, EROS B, RADARSAT-1, ENVISAT-1 satellites with spatial resolution from 1,000 m to 0.7 m. 10 UniScan ground stations among total number of 37 ones are capable for RADARSAT-1 and 7 of them already were successfully certified by Canadian Space Agency (www.space.gc.ca) and MDA Geospatial Services (<http://gs.mdacorporation.com>), the worldwide Operator of RADARSAT-1. Besides there are 8 UniScan ground stations in Russia capable for SPOT-2/4.



Figure 7 The network of UniScan X-band ground stations

There are networks of UniScan of Ministry of Natural Resources of Russia, Ministry of Disaster management, Roshydromet, Ministry of Higher Education (Figure 8).



UniScan™ network of RosHydroMet



UniScan™ network of Ministry of Natural Resources of Russia



UniScan™ network of EMERCOM of Russia



Educational UniScan™ network

Figure 8 UniScan network of governmental agencies

Also Center ScanEx operates commercial network of UniScan stations in Moscow, Irkutsk and Magadan cities of Russia, allowing to cover all territory of Russia with remotely sensed images.



Figure 9 Commercial of UniScan stations, operated by ScanEx

Commercial UniScan stations network provides for great RS data archives for all territory of Russia (for example, coverage with SPOT 2/4 data shown on Figure 10).

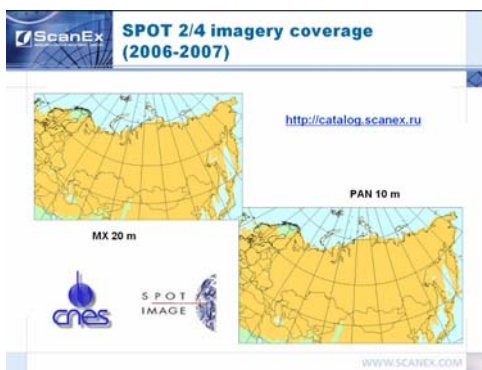


Figure 10 Coverage with SPOT 2/4 images stored in ScanEx's archive

One UniScan ground station enables to observe territory in radius of about 2,500 km from the point of installation that gives a possibility of maximum economically effective regular observation of territory within radius of station visibility, not leaving office and allow to considerably decrease expenses for land studies and survey from aircrafts.

Wide number of satellites and sensors allow to solve maximal spectrum of tasks: detection and monitoring of wildfires, monitoring of oil pollutions on land and sea, creation of up-to-

date thematic maps for objects of nature and infrastructure, monitoring of forests and agricultural fields, control for flooding, maps updating and many other.

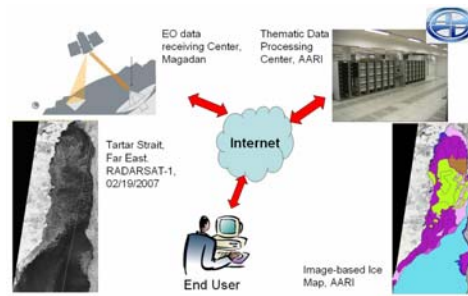


Figure 11 Ice monitoring in Tartar Strait for Exxon-Mobil, provided by AARI (www.aari.ru) and R&D Center ScanEx

Regular and reliable monitoring from space is possible only in case of payment license agreements with operators of Earth observing missions because at present all RS data with spatial resolution better than 250 m are paid and licensed. With our point of view solving task of monitoring in frames of research programs cannot guarantee reliable fulfilment of data acquisition what is impossible for regular observation of territory of interest. R&D Center ScanEx is the Operator of ground stations on the territory of Russia and CIS countries and has signed licensing agreements with worldwide Operators of RS missions (Antrix Corp. Ltd., Spot Image., ImageSat Int. N. V., MDA geospatial Services Inc., Canadian Space Agency; Eurimage). This allows a possibility to apply flexible policy of license payment for users of UniScan™ stations within Russia and CIS that makes RS Data reception on UniScan™ economically affective.

RS data reception directly on UniScan ground stations gives a possibility to create geo-portals on the base of RS data: existing the first Russian geo-portals are <http://maps.yandex.ru>, <http://new.kosmosnimki.ru>. Possibility to upgrade layers of such geo-portals with up-to-date information having access to RS data in real-time mode enables to solve different practical tasks: monitoring of flooding, wildfires, control of forestry, agriculture, oil pollutions detection, ice-charting, etc. With such point of view UniScan ground station is operational component for geo-portals.

