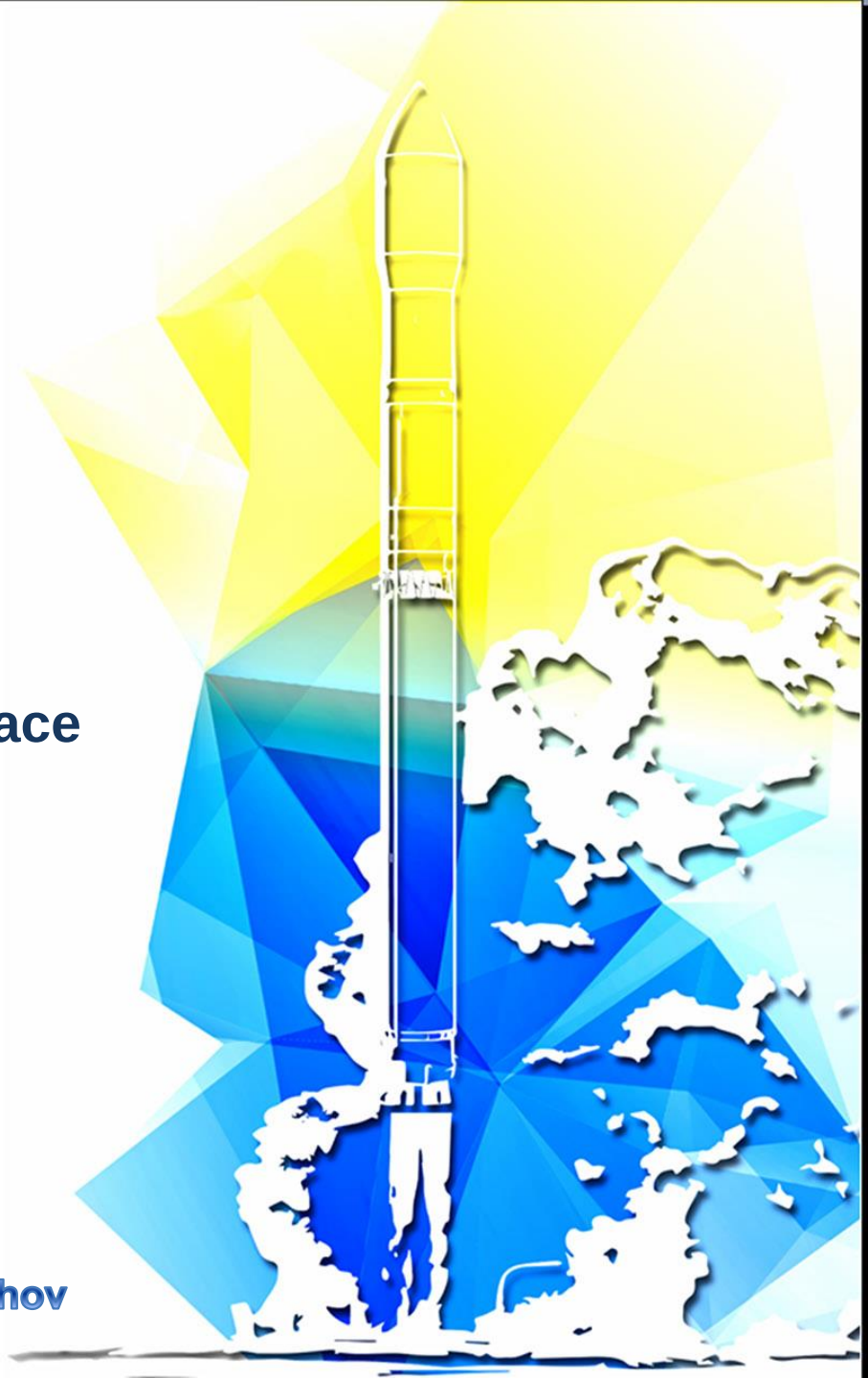
National Space Facilities
Control and Test Center

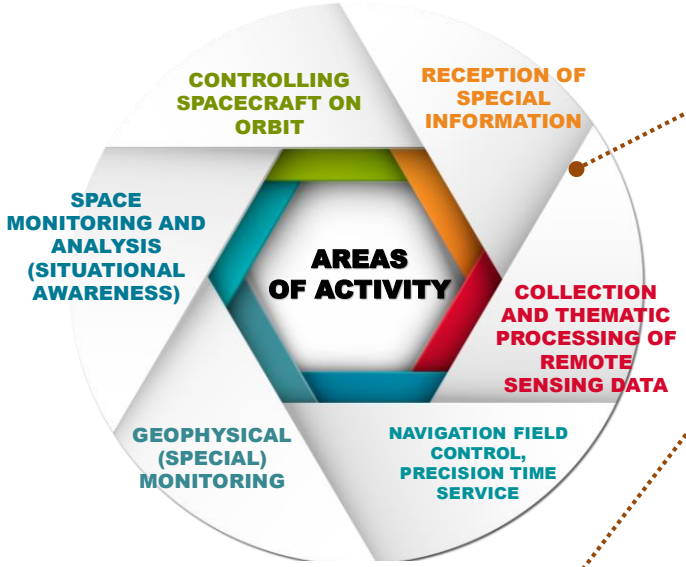
Observation of the near-Earth space in Ukraine



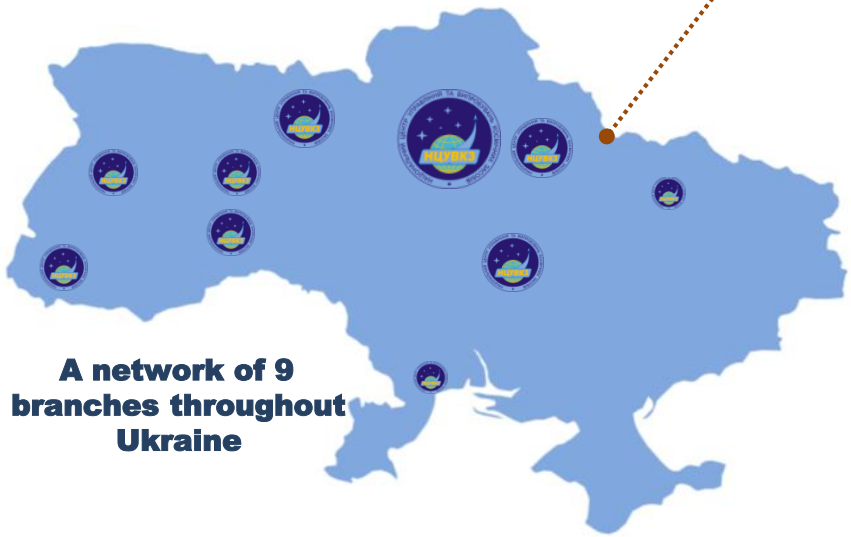
Dr. O.Kozhukhov

National Space Facilities Control and Test Center

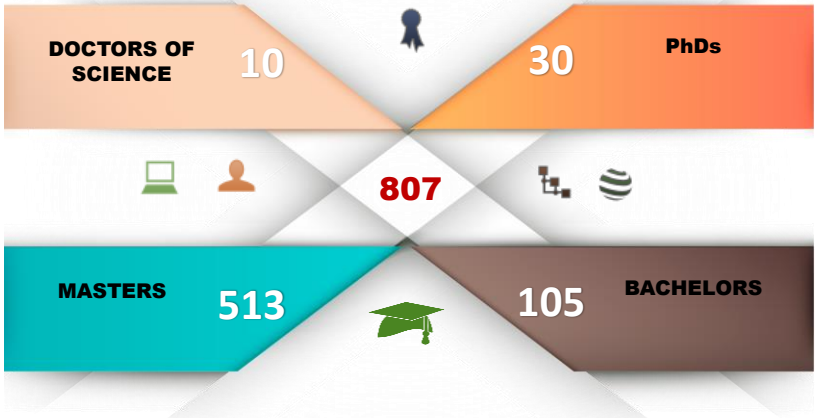
Areas of Activity



NSFCTC – is the only research and testing organization in Ukraine, which ensures the implementation of the entire complex of operations on the operation of space, navigation and seismic systems, as well as remote sensing data processing.



A network of 9 branches throughout Ukraine



Main tasks of Space Monitoring and Analysis System

Administering the main catalog of space objects (SO) and the catalog of tracked spacecraft.

Monitoring of the SO approaches in the outer space, determination of maneuvers of the spacecraft.

Predicting impact areas of the reentering space objects.

Information support of consumers of different levels (notifications).

Identification of space objects and identification of spacecraft designation.

Space Weather activities.

Observation of objects approaching the Earth.

SMAS Facilities

Radar 5N86 "Dnepr", Mukachevo

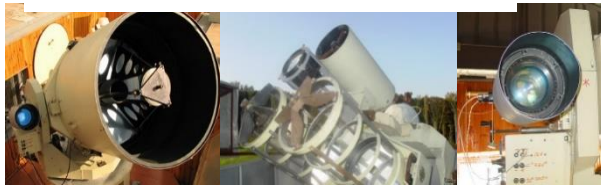
Perspective L-band Radar

Perspective cm-band radar

QOS "Sazhen-S", Dunayivtsi

Outer Space Monitoring Center

Optical sensors of Lviv National University,Lviv



Optical sensors RI"OAO" Odesa

RD SCP, Novosilky, Kyiv region

Optical sensors UzhNU, Uzhhorod

Radar Surveillance Facilities of SMAS

Modernized UHF Radar (5N86)

- Detection of SO in the sector 120 degrees at a distance: from 250 to 5600 km

Radar of the L-bandusing the technology of digital antenna arrays

- Detection of SO in all directions (support and rotary device) at a range: up to 3000 km

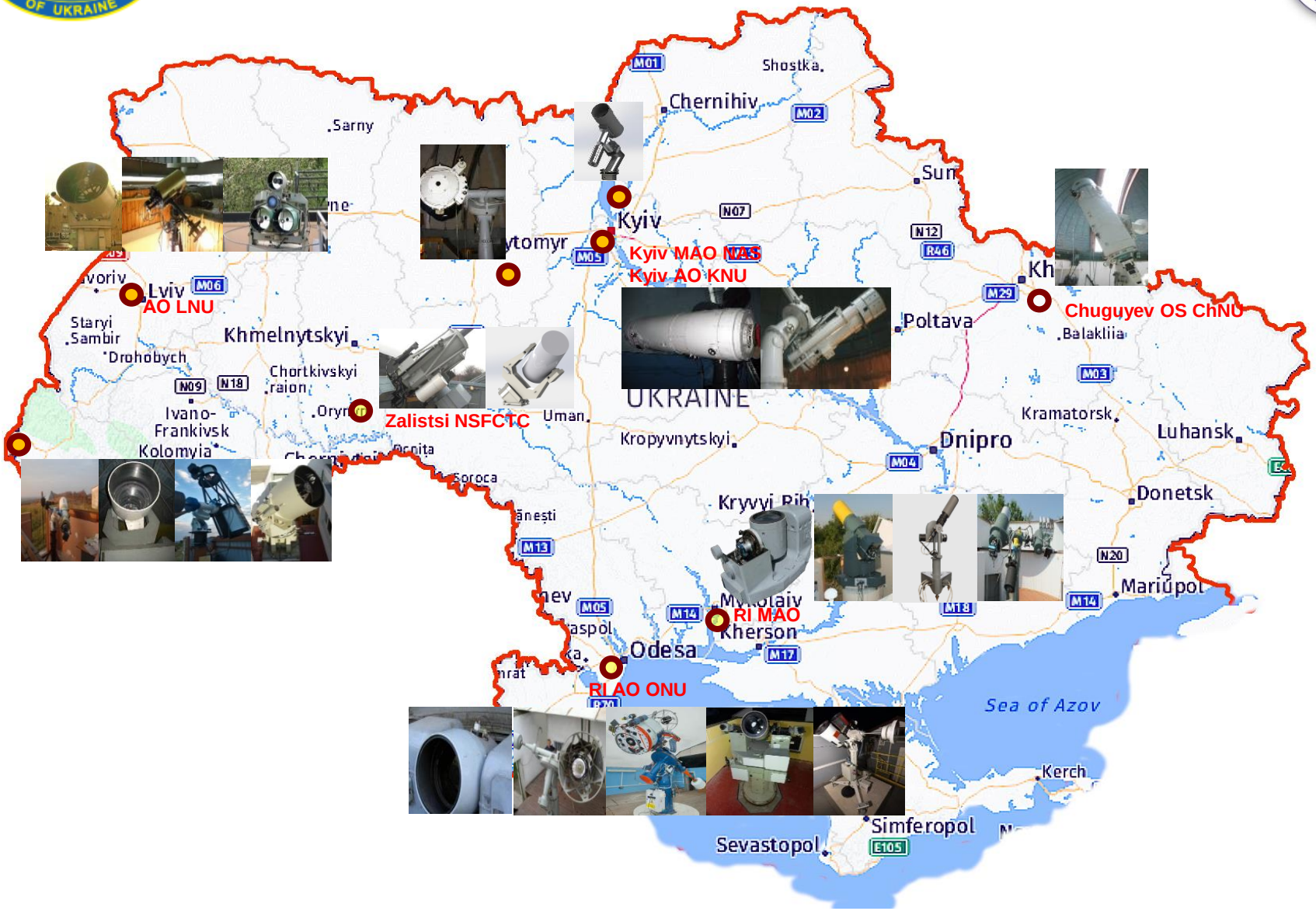
- Modular principle of the construction of receiving and transmitting equipment

Perspective radar of centimeter band based on the 25-m Kasegren antenna

- Ultraprecise measurement of orbit parameters of SO

- Identification of the spacecraft designation

Optical Sensors of SMAS

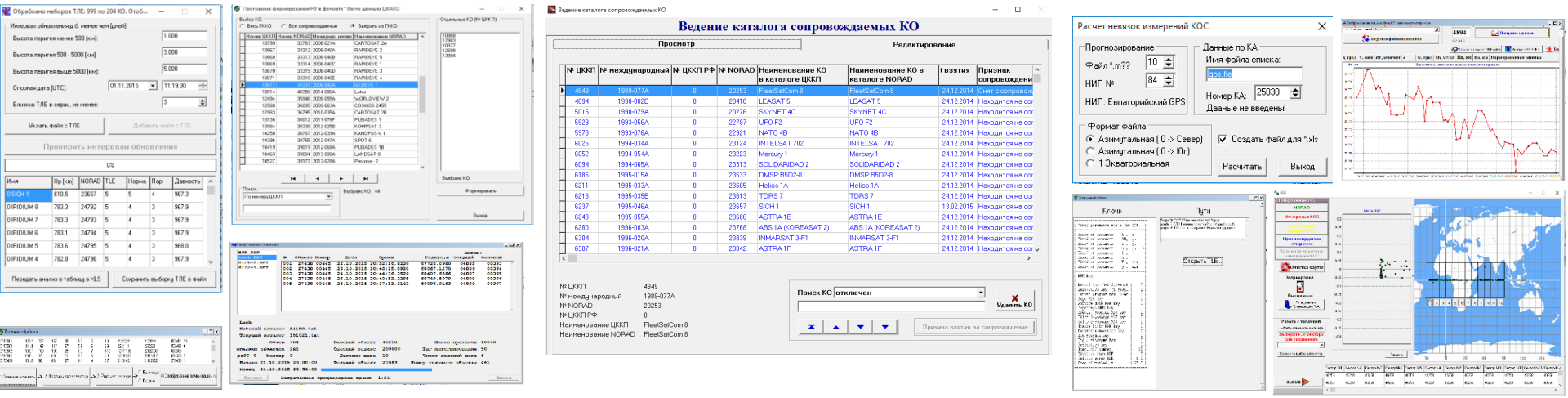


Outer Space Monitoring Center

Main analytical unit of SMAS is the **Outer Space Monitoring Center (OSMC)**, located in the NSFCTC Branch of the Western Center of Radiotechnical Surveillance.

Main tasks of the OSMC

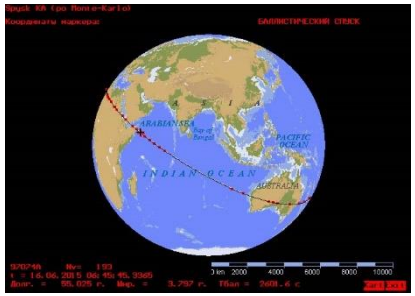
- Collecting and storing information about the space situation from all possible sources (means of observation, Internet, etc.), data processing.
- Analysis of space situation data.
- Formation of tasks for monitoring facilities.
- Providing information to SMAS users.

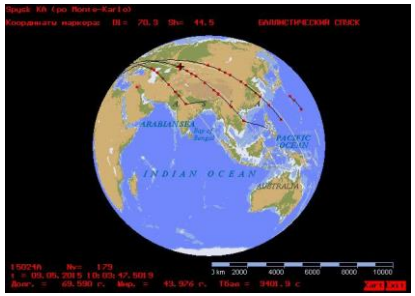


CAPABILITIES OF OSMC

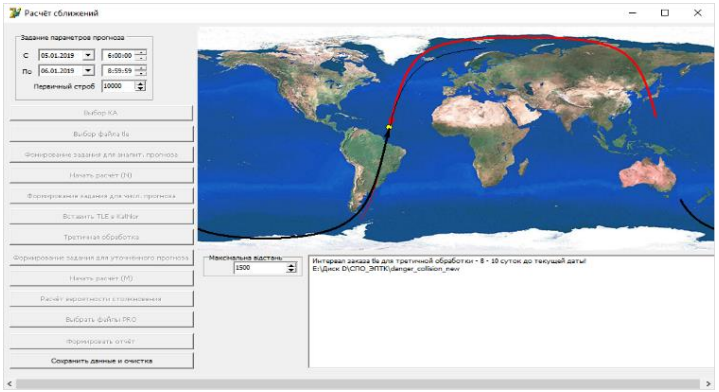
Prediction of the existence time of SO and their possible impact areas

№ по кат. ЦККП	Международ. №	Наимен-ние по кат. ЦККП	Тип	Страна/Владелец	Дата запуска	Дата НУ	Дата прекр. сущ.	Прогноз. инт-л прекр. сущ.	Комментарий
15432	2015-024A	Прогресс М-27М	Не определён	Россия	28.04.2015	06.05.2015	08.05.2015	07.05.2015 - 09.05.2015	





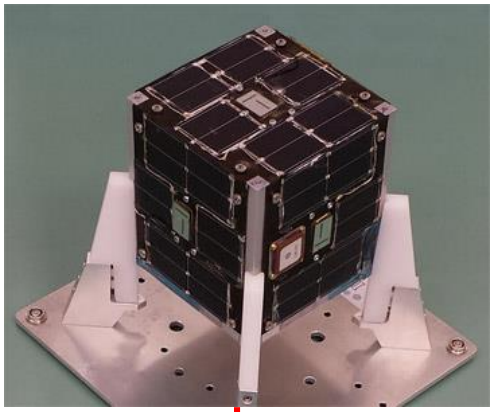
Prediction of possible approaches of selected spacecraft with other SO available in the catalog

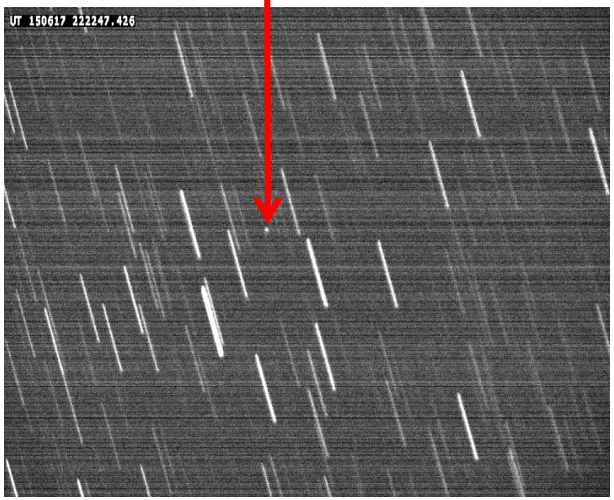


Forecast of dangerous approaches of Space objects for the period **04.01.2019 - 05.01.2019**

№	Name of base object	International number of base object	Name of approaching object	International number of approaching object	Date of approach	Time of approach (UTC)	Approach distance, (м)
1	COSMOS 367	1970-079A	SL-16 DEB	1992-093DX	04.01.2019	11:08:49.4695	1396.25
2	TRIAD 1	1972-069A	METEOR 2-5 DEB	1979-095AX	04.01.2019	19:09:16.2664	716.28

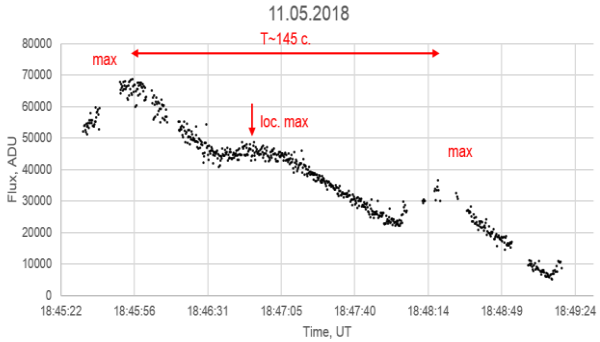
Capabilities of Optical Observation Facilities

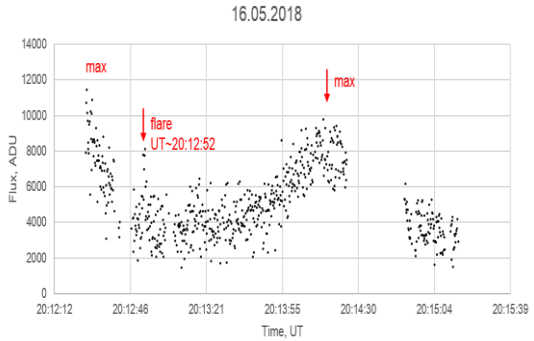


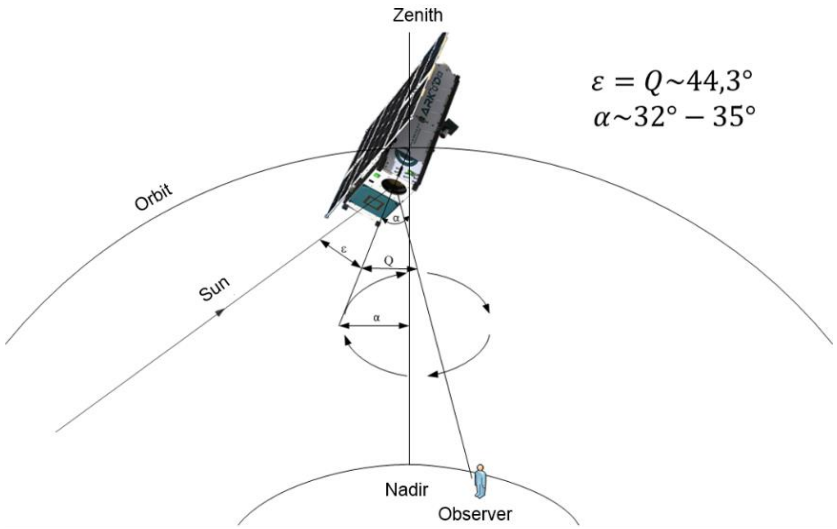


Determination of angular coordinates of SO with sizes from 10 cm at all altitudes (from 400 km to 40000-50000 km) with accuracy up to angular seconds.

Obtaining non-coordinate information for assessing the state of the SO and determining its designation.



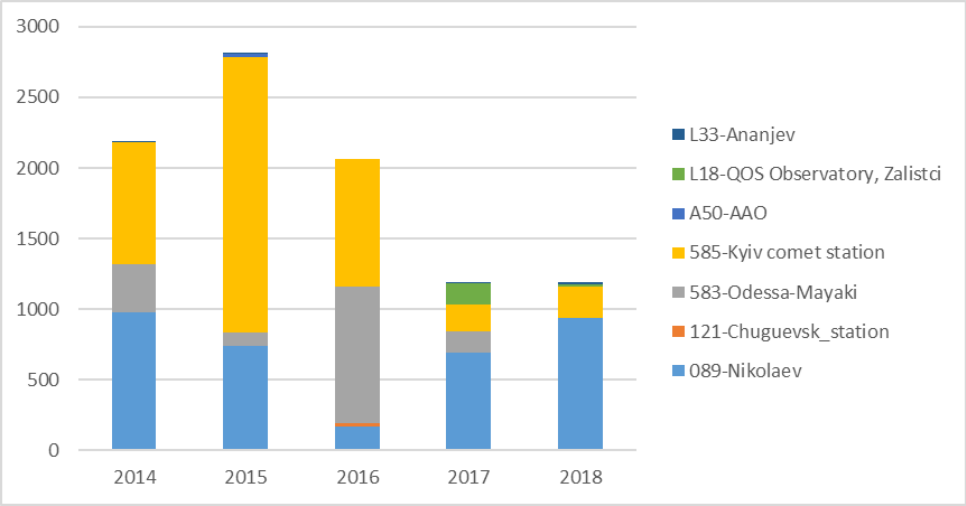




Near Earth Objects

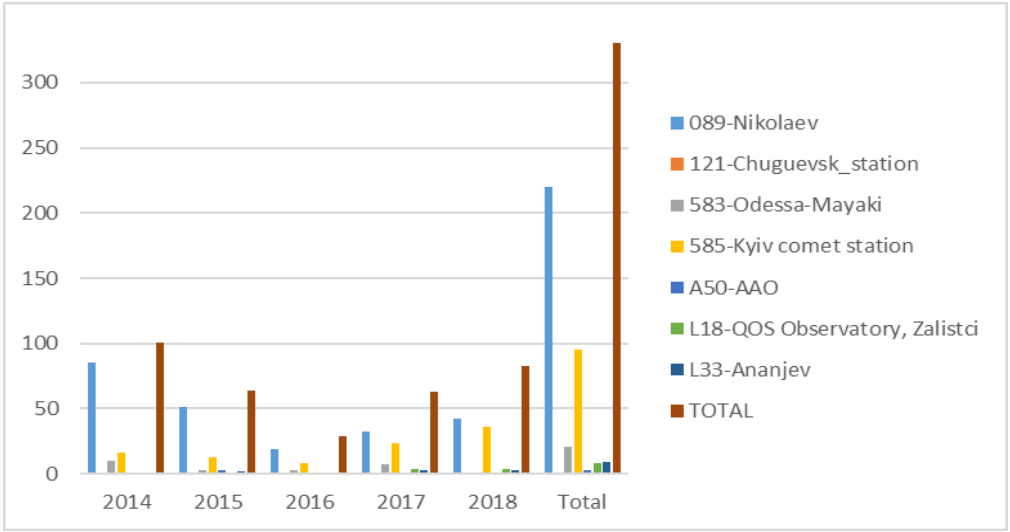
Observation of NEOs by Ukrainian observatories in 2014-2018

Observations



Total: 9450 observations,
330 NEOs
(*https://newton.spacedys.com/neodys/*)

Objects



Ukrainian Software for Surveillance of NEOs - CoLiTec

Main features of CoLiTec

1. Automatic detection of weakly moving objects (WMO>2.5)
2. Work with super-large fields of view (more than 10 sq. degrees)
3. Automatic calibration and image correction
4. Automatic robust algorithm for astroreduction
5. Automatic filtering of poor measurements.
6. Viewer of results (LookSky) with GUI NEOs
7. Multithreading support in multi-core systems and in a local network
8. Processing in a time scale close to real time managed by OLDAS (OnLine Data Analysis System)

Results (2010 – 2018)

Observations: **600 000+**.

Discovered: **1566** asteroids and 4 comets.

Comets

C/2011 X1 (Elenin) – December 10, 2010 (ISON-NM).

The first comet discovered by the Russian astronomer for the last 20 years.

P/2011 NO1 – July 7, 2011 (ISON-NM)

C/2012 S1 – September 21, 2012 (ISON-Kislovodsk)

P/2013 V3 (Nevski) – November 6, 2013 (ISON)

Tropical of Jupiter

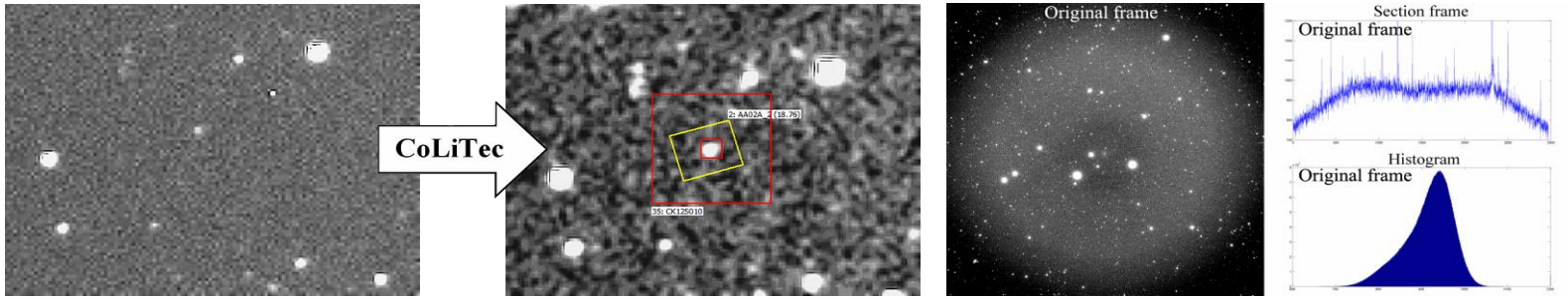
2010 XR32, 2010 XG21, 2010 VO138, 2010 VT36, 2011 QJ9, 2011 QQ47, 2011 QZ75, 2011 YD47, 2011 YA3, 2011 QB76, 2012 SC50, 2012 AF1, 2012 CF52, 2012 BB27, 2012 RZ4, 2012 RM6, 2012 SD3, 2012 SN9, 2013 BP2, 2013 UF9, 2013 VD

NEOs

2011 QY37 **2012 RQ16** **2013 TB80** **2014 KH2**

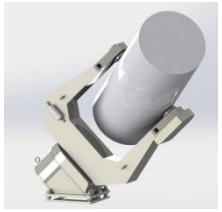
Unusual

2013 UL10, 2018 SQ13 (confirmation only)



Optical facilities

Development of optical observation facilities of NSFCTC in 2019

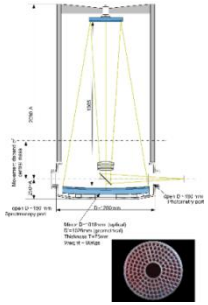


0.5 m f/3.8 telescope with CCD and CMS cameras (CSIRP and NFC)

0.3 m f/1 telescope with CCD or CMS cameras (NSFCTC)

Capabilities of Ukrainian organizations to create new telescopes

Optical systems



Name	D/F	Optical scheme	Focal ratio
WSZ	300/300	Zonnefeld	f/1
WSH	350/700	Gamilton	f/2
WSNP	500/2000	Parabolic Newton with field correction	f/4
WSNH	500/1500	Hyperbolic Newton with field correction	f/3
WSMDC	500/3400	Modified Dall-Kirkham	f/6.8
WSNP	800/3200	Parabolic Newton with field correction	f/4
WSNH	800/2400	Hyperbolic Newton with field correction	f/3
WSNH	1000/3000	Hyperbolic Newton with field correction	f/3
WSMDC	1000/6800	Modified Dall-Kirkham	f/6.8

Mounting

WS- 300 DD	German, with a direct drive. For 0.4 m telescopes
WS-240 WD	German, with a worm drive. For 0.4 m telescopes
WSF-500 WD	Forklift, with a worm drive. For 0.5 - 0.8 m telescopes
WSF-500 DD	Forklift, with a direct drive. For 0.5 - 0.8 m telescopes
WSF-1000 WD	Forklift, with a worm drive. For 0.8 - 1.2 m telescopes
WSF-1000 DD	Forklift, with a direct drive. For 0.8- 1.2 m telescopes

Conclusions

1. Ukraine's software and hardware facilities allow us to carry out a full range of tasks for monitoring near-Earth space throughout the whole range of altitudes, including space debris and NEO.

2. The National Space Facilities Control and Test Center is ready for mutually beneficial cooperation on issues related to the monitoring of near-Earth space.

THANK YOU FOR YOUR ATTENTION!

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