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The NEO problem: activities in Russia

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NEO: The Asteroid/Comet Impact Hazard (ACH) Problem

Being for many decades a very specific matter of fundamental research the ACH Problem is recognized as a global issue.

In number of countries the systemic approach to this problem is being developed.

- A good example of successfully completed program is the “Space Guard Survey” that was funded and controlled by NASA.
- The recently announced “Space Situational Awareness (SSA)” Program directly serves the strategic aims of the European Space Policy.

In Russia the problem is studied in research centers of the Russian Academy of Sciences (RAS), universities, industry, etc. as well as broadly discussed in Russian community. A number of all-national and international meetings on the issue were devoted to the ACH problem in 2009.

The state authorities seem to consider a need of nationally and internationally coordinated approach to ACH.

"Near Earth Astronomy – 2009"
Kazan, August 2009

"ACH – 2009"
St.Petersburg, September 2009

"Malta Symposium on Hazardous Near Earth Asteroids"
October 12-16, 2009

"Space & Global Security of Humanity" International symposium
Cyprus, November 2-4, 2009

from media

msnbc.com staff and news service reports
updated 9:34 p.m. ET Dec. 30, 2009

MOSCOW - Russia's space chief said Wednesday that a spacecraft may be dispatched to shift an asteroid's course and reduce the chances of Earth impact…….

Anatoly Perminov, the head of Russia's Federal Space Agency, told Golos Rossii (Voice of Russia) radio that officials would hold a meeting soon to assess a mission to the asteroid Apophis. He said his agency might eventually invite NASA, the European Space Agency, the Chinese space agency and others to join the project.

In Russia the implementation of a comprehensive work program on ACH can only be funded and coordinated at the federal level.

Reasons:

- The ACH is a multi-problem. Various organizations are to be involved (coordinated).
- The capabilities of research centers are not sufficient for implementation and support of modern service of detection and monitoring of NEO, in particular those with the space-born facilities. The expensive technologies of preventing collisions and mitigation can be proposed but not be realized under the responsibility of research institutions.
- The ACH is a global (international) problem. International cooperation on ACH means cooperation of countries. This implies the involvement of Russia Government.

The necessity of coordination at national scale was broadly recognized. The Expert Working Group (EWG) on the ACH Problem was established by the Space Council of the RAS in February 2007 .

The EWG includes representatives from the Russian Academy of Sciences, universities, industry, Roscosmos, EMERCOM, Rosatom as well as from other organizations interested in the problem. The information on the activity of the group is presented at the web site http://www.inasan.ru/eng/asteroid_hazard/.

The maximal goal of the EWG

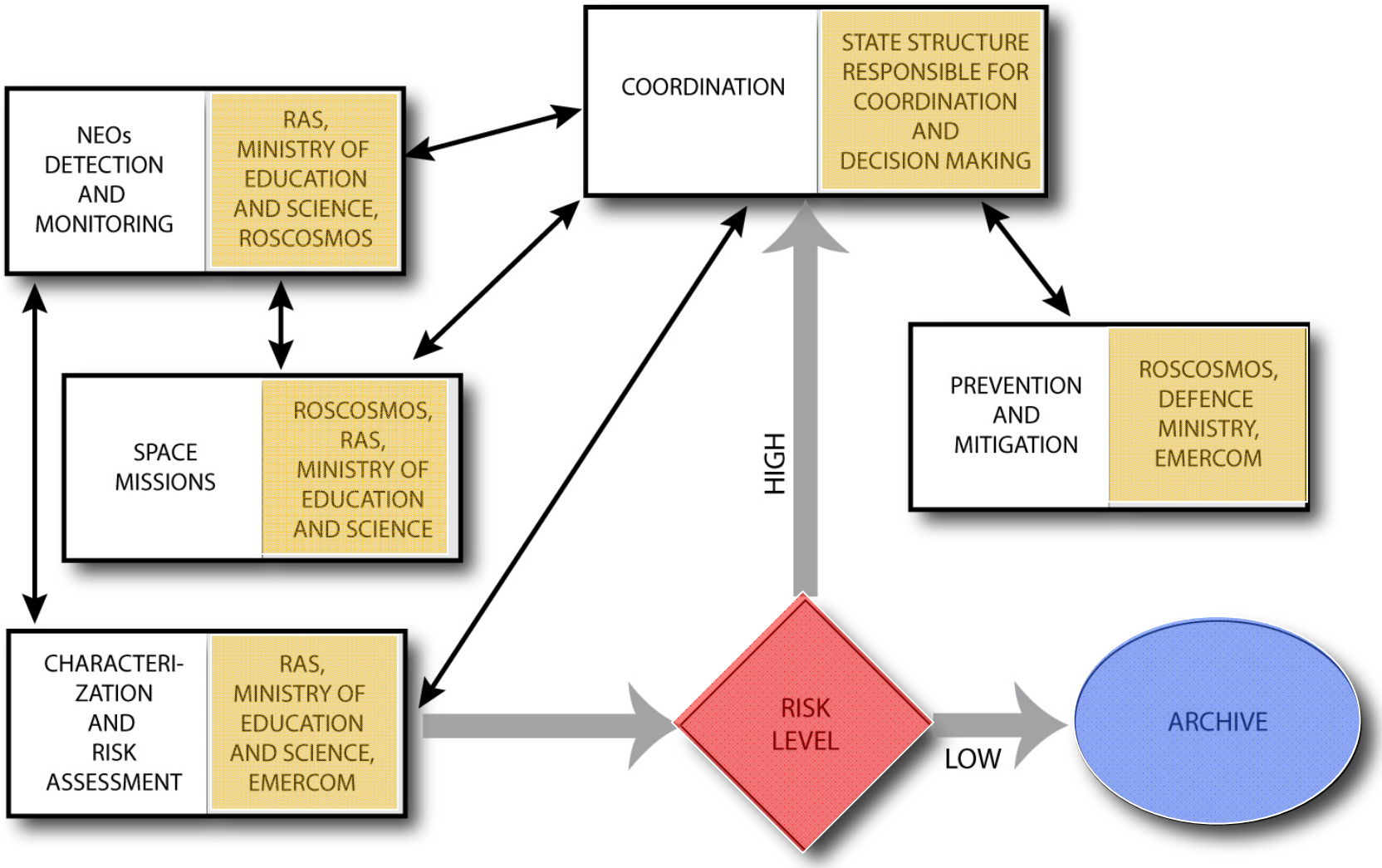
is to work out a draft concept of the long-term Federal Science and Technology Program (FSTP).

Five projects are prepared to be proposed for the FSTP

- **Detection and Monitoring;**
- **Characterization of Potentially Hazardous Bodies** and **Risk Assessment;**
- **Space Missions;**
- **Preventing and Mitigation;**
- **Coordination and cooperation.**

FEDERAL SCI-TECH PROGRAM (FSTP)

„NATIONAL SYSTEM OF SAFEGUARD AGAINST THE ASTEROID AND COMET HAZARD"



Detection and monitoring

Goals of the project:

Organization of coordinated system for detection and monitoring NEOs at national level and it's integration into world system.

Some ideas proposed for the concept of the FSTP:

Detection:

The construction of 1.6 m aperture wide field telescope for at ISZF RAS.

Monitoring:

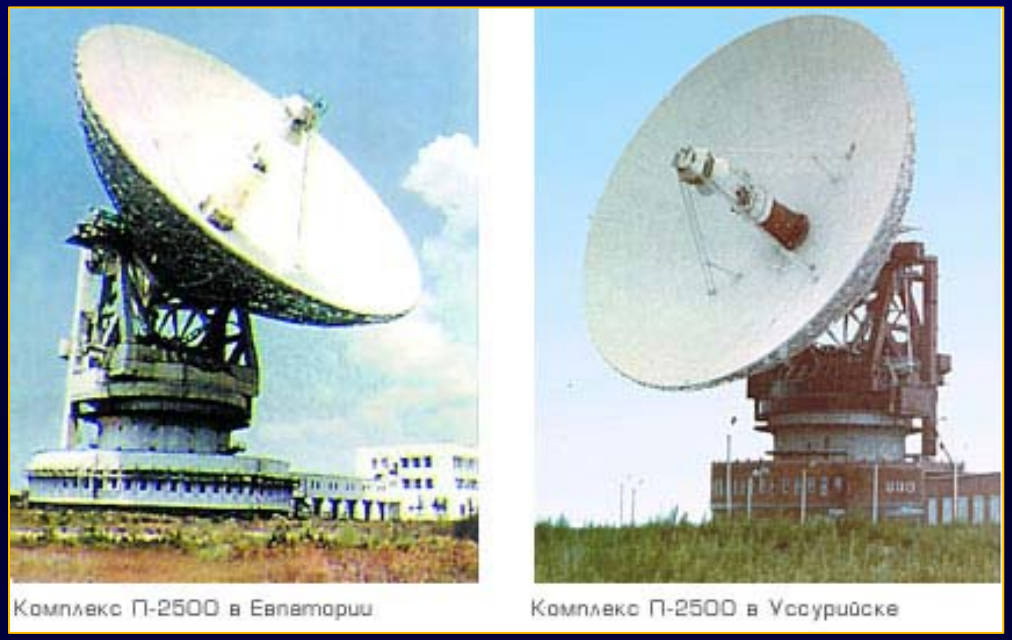
Organization of a coordinated network of existing astronomical instruments and/or construction of uniform set of (cheap) instruments specially designed for monitoring
Elaboration a reciprocally acceptable procedure of usage of the relevant data from military observational centers.

Wide-angle telescope AZT-33VM

Spectral range	visual	400-1100 nm
	IR	1500-2500 nm
F	visual	5600 mm
	IR	16000 mm
focal ratio	visual	1:3,5
	IR	1:10,2
2ω	visual	$2,8^0$
	IR	20’
2y’	visual	277 mm
	IR	95 mm

Institute of Solar-Terrestrial Physics ,Siberian Branch RAS (ISZF RAS)

Radar technology for NEOs in Russia



Evpatoria, Ukraine

Ussuriisk, Russia

P2500 ground station was used for “Vega”, “Astron“, “Phobos”, “Granat“.

At 3.5 cm it was used for “Voyager”.

In Doppler experiments the accuracy of velocity measurements was 0,15-0,3 mm/s.

As raadiotelescope it can work at 3,5 cm, 5 cm, 18 cm, 32 cm and 92 cm.

In 1991-1996 гг. It was used for VLBI experiments (e.g. "Crustal Dynamics").

The high level discussion on the use of 70-m radar in Ussuriisk for the study of PHO is going on.

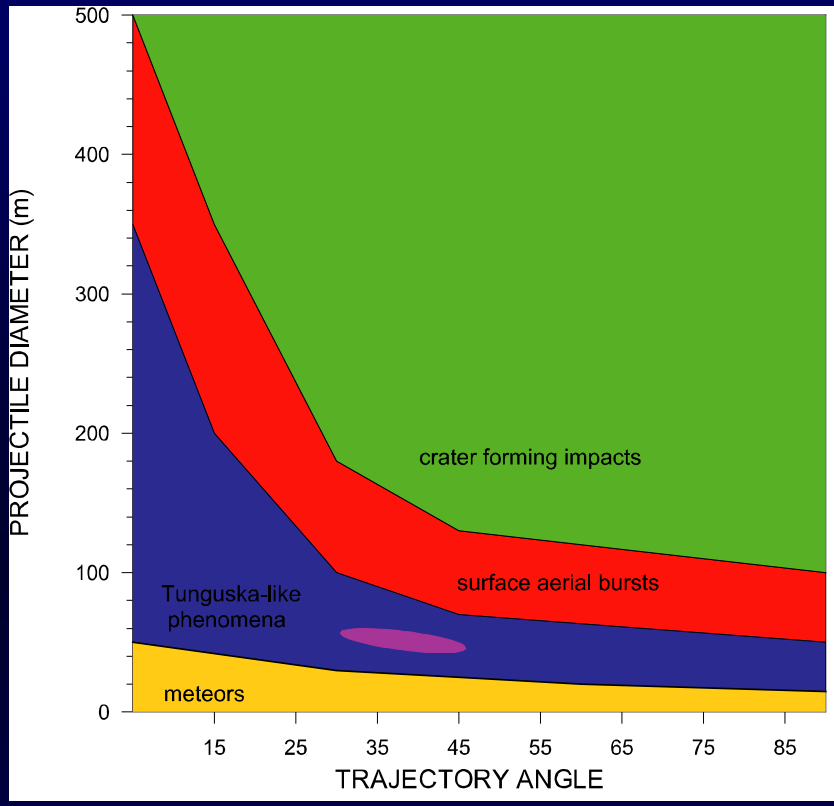
Characterization of Potentially Hazardous Bodies and Risk Assessment

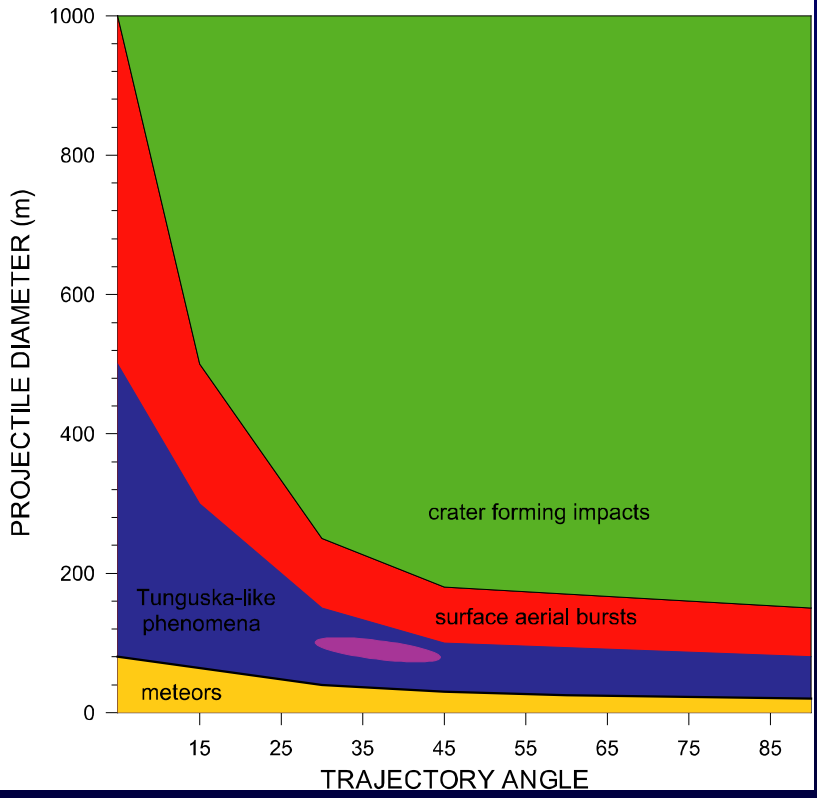
Goals of the project:

- Construction of regularly updated data bases :
  - orbital, physical and chemical properties of PHO,
  - impact structures,
  - comprehensive models of possible consequences;

- Elaboration of criteria for risk assessment;

- Formation of mechanism of the high confidence threat level information to government.





Results of simulation of impacts of asteroids (left) and comets (right) depending on the projectile sizes and trajectory angles.

Space facilities are considered to be powerful instruments for realization of the goals of other projects of the FSTP (detection, characterization, preventing). Nevertheless this project is considered as a separate item because if being approved it will be realized under the Federal Space Program.

Space missions

Goals of the project:

Selection of projects of space missions designed for study hazardous objects in situ and for elaboration of efficient technologies of preventing.

Some ideas proposed for the concept of the FSTP:

The concepts of small-to-moderate size orbital telescope(s) designed for ACH studies are under consideration.

The concept of a mission to a (potentially hazardous) minor body (Apophis as a working variant) is being under feasibility study. Launch is considered at the end of the coming decade. Mission includes orbital (circum-asteroid) transponder. The technical recommendations by Association o Space Explorers and B612 Foundation are being used with thanks!

Mission “Apophis”

A concept view by Lavochkin Industries.

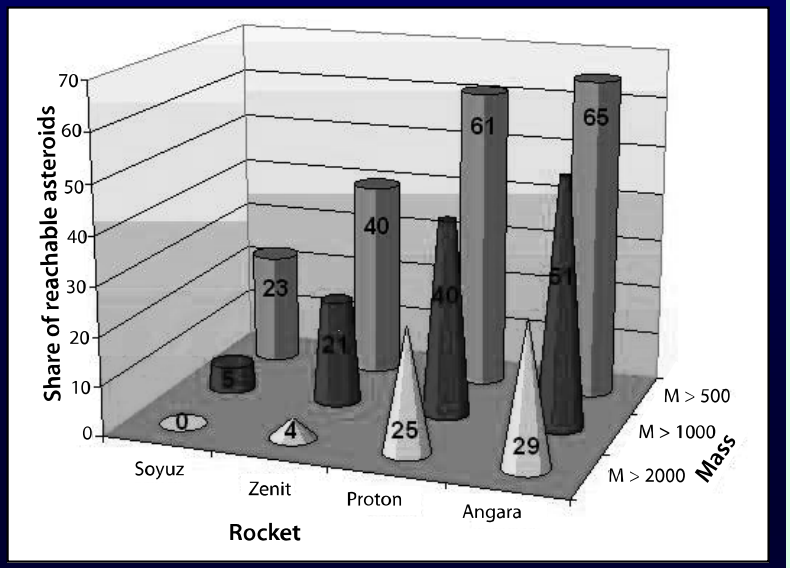
Heritage o the Phobos-Grunt Project will be used.

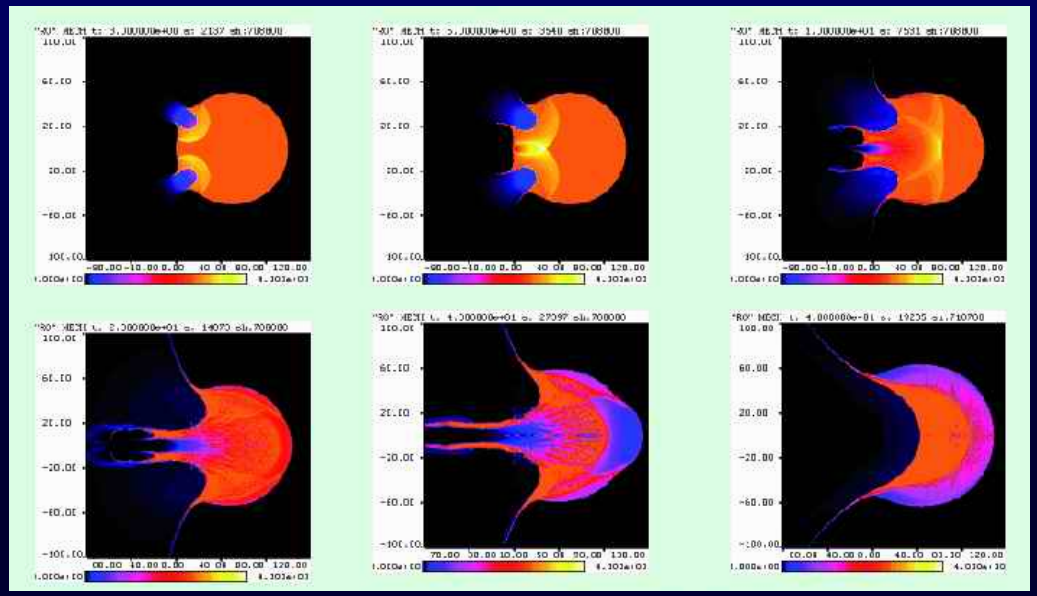
Preventing and mitigation

Goals of the project: development of coordinated system of R&D activity in Russia on the systems of preventing impact and mitigation.

Some ideas proposed for the concept of the FSTP:
To continue studies and to develop approaches to efficient preventing. The studies should be officially included in the working plans of industry and military research centers.

To reconsider existent technologies of mitigation to adjust them for the ACH. There is a keen demand on the definite and reliable criterion of the risk.





Some results of the analysis of various possibilities to deliver payload to the hazardous bodies (left).
Model of desintegration of the 100m asteroid (right).

Cooperation and coordination

National level: The EWG is a first step in the direction. Coordination of the FSTP (if accepted) will be a major goal.

Important coming event

Consideration of the draft FSTP at the Science and Technology Council of Roscosmos.

International level:

There are evidences of real interest of political structures in Russia to participation in the developing process of international cooperation at the UN level.

Thank you for your attention!