The New Manhattan Project
Science for peace the World Over

Citadel: a Concept for a credible Planetary Defence System

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NPP «Planetary Defence Centre», 2016
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Asteroid 2015 TB145 (Halloween)

10 Okt. 2015

20 days

31 Okt. 2015

Halloween Asteroid

D = 600 m
V = 35 km/s

L = 486 000 km

Moon

Photo: NAIC-Arecibo/NSF

A. V. Zaitsev
Consequences of possible impact of an asteroid of type Halloween

Impact's Energy $\approx 50,000$ Megatons TNT
(This exceeds thrice all nuclear potential of humanity in 20-th century)
Magnitude of Earthquake $> 8$ (the Richter scale)

Crater

10 km

3 km
The size of a primary zone of destructions

Diameter of the destructions zone $\approx 800$ km
The area $\approx 500 \, 000 \, \text{km}^2$

Moscow region

Europe

- no damage
- weak damage
- moderate damage
- severe damage
- destruction
- collapse
Quantity of evacuated people

- 10,000,000 - 100,000,000
- 50,000,000 - 400,000,000
- 5,000,000 - 50,000,000
- 50,000,000 - 200,000,000

Estimated 2015 Population Density
persons per km²
- 0 - 5
- 5 - 25
- 25 - 200
- 200 - 500
- 500 - 1,000
- 1,000 - 1,500
- > 1,500
Secondary consequences of the asteroid’s impact

Emissions from a crater, fires, a dust and gases, a tsunami, industrial disasters …
The threat from space can appear at any moment
## Comparison of the Planetary Threats

<table>
<thead>
<tr>
<th>Natural threats</th>
<th>Consequences for mankind</th>
<th>Opportunity of the forecast</th>
<th>Opportunity of defence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Partial destruction</td>
<td>Degradation</td>
<td>Full destruction</td>
</tr>
<tr>
<td><strong>Asteroids and comets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Geological</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Earthquakes, volcanos,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a tsunami …)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Climatic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Warming, cooling, …)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biological</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Epidemics, …)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Technogenic threats</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Militarians</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ecological</strong></td>
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<td></td>
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</tbody>
</table>
Since the threat from space can appear at any moment, it would be a inexcusable carelessness not to make use of its prevention possibilities that we possess.
What Do We Need to Do?

It is necessary to solve a broad range of problems. The simplest of them are scientific, technical and financial problems.

The most difficult – organizational and international legal problems.
RUSSIAN PROTOTYPES OF BASIC MEANS TO CREATE PLANETARY DEFENSE SYSTEM

Detection means

- 6 m telescope (Zelenchuk, Russia)
- 70 m planetary radio-locator
- Spacecraft “Arcon” with a telescope of 1 m in diameter

Interception means

- LV "Proton", "Zenit", "Soyuz-2", "Eriny" and "Max"
- Spacecraft "Vega" prototype of reconnaissance spacecraft
- Spacecraft "Phobos" prototype of interception spacecraft
- Thermonuclear bomb of 50 Mt in power
- Decent vehicle "Venera-9" prototype of emergency capsule

Control systems

- Main hall of the mission control (Korolev, Russia)
- Control room of the Defense Ministry of Russian Federation

This is high time to combine all means available into United Planetary Defense System
The Concept of the International Planetary Defence System
“Citadel”
From Institutes and Organizations

Dmitrij F. Lapishko  Leading scientist of Institute of
Astronautics, Kharkov National
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Professor

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Lomonosov Moscow State University,
Dr.

Konstantin A.
Fedenkowski  Director General of Special Research
Bureau of MEL,
Academy of the RAC

Georgy M. Polibin  Director General and Director
General of Lavochkin Association,
Academy of the RAC, Dr.

Sergey A. Sukhanov  General Designer of “Vimpel”
Research Joint-stock Corporation,
Dr.

Sergei P. Sukhachev  Director of SEC ESR, Bremen
Moscow State Technical University,
Dr.

Acknowledgements

We would like to express gratitude to experts who made the Concept possible
by their studies in various spheres of science and technology. We hope that the
Concept will help to reach understanding between experts and decision makers for
establishing efficient international cooperation in developing means of Earth
protection from asteroid-comet hazard.
<table>
<thead>
<tr>
<th>Development of PDS components</th>
<th>LV Zenith</th>
<th>S/C-Interceptors</th>
<th>$100 M x 2 = $200 M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LV Dnepr</td>
<td>S/C-reconnaissance</td>
<td>$500 x 2 = $1000 M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$30 x 2 = $60 M</td>
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<td></td>
<td></td>
<td></td>
<td>$50 x 2 = $100 M</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$260 M $1100 M</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$1360 M</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Detection and examination service</th>
<th>LV Soyuz</th>
<th>S/C-observers</th>
<th>$50 x 2 = $100 M</th>
</tr>
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<td></td>
<td>LV Dnepr</td>
<td>S/C-reconnaissance</td>
<td>$500 x 2 = $1000 M</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$30 x 4 = $120 M</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$50 x 4 = $200 M</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$220 M $1200 M</td>
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<td></td>
<td>$1420 M</td>
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<table>
<thead>
<tr>
<th>Interception service</th>
<th>LV Proton</th>
<th>S/C-Interceptors</th>
<th>$110 x 3 = $330 M</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$600 x 3 = $1500 M</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$330 M $1500 M</td>
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<tr>
<td></td>
<td></td>
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<td>$1830 M</td>
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<th>Ground-based infrastructure</th>
<th>S/C-Interceptors</th>
<th>$1000 M</th>
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**Total:** $5.6 Bn
Protection from huge comet nuclei will demand much more time, greater expenses and development of new technologies. In particular, it will require means of impact more powerful, than nuclear. Probably, they will include technologies based on the use of the antimatter.
The most difficult – organizational and international legal problems.
About the approach to formation of international-legal bases of ensuring planetary defence

Creation of the International Planetary Defense System (PDS) from asteroid-comet danger will demand progressive development of international legal outer space instruments.

It can be presented in the format of the International Treaty “About measures of ensuring the defence of the Earth from asteroid-comet danger”, which will serve as a foundation for creating of the PDS, and financial coverage of the activities.

It is necessary to introduce amendments or reservation into a number of provisions of the existing international outer space law.

We may outline general principles that we would need to proceed from when preparing the draft Treaty.
General principles of preparing the draft of the Treaty

Stage of Concept

1. The formation of the Treaty should be based on a concept of the PDS preliminary agreement by the international community. The PDS “Citadel” Conception can be used as an option.

2. The legal basis must have binding juridical character for states taking part in the PDS creation.

3. The Treaty should include main principles for establishing and using of an international fund - Mankind Insurance Fund - for financing, developing, maintaining, and modernizing of the PDS.

4. The Treaty should include regulations for operation of Planetary Defence Centres.

5. The legal basis can be structured with reference to areas of tasks (scientific, technological, organisational, financial etc.) or stages of the PDS formation.

6........
Principles of preparing a draft of the International Treaty
"About measures of ensuring the defence of the Earth from asteroid-comet danger"

Introduction

Identifying the existence of asteroid and comet threats, impact hazards, near-Earth objects, and minor satellites, has become an urgent challenge for the international community. The International Treaty on the Prevention of Threats, Activities, and Events in Outer Space by Avoiding Their Development and Dealing with their Consequences (ITPEADEC) is essential to address these issues. The treaty aims to establish international legal framework and mechanisms to deal with potential threats from space objects, including asteroids and comets.

The next steps are as follows:

1. A definition of legal and technical aspects of asteroid and comet danger, impact hazards, near-Earth objects, and minor satellites, etc., under the jurisdiction of national authorities and international organizations, and the legal basis for comprehensive outer space legal framework should be established.

2. An international forum should be established to promote international cooperation in the prevention, detection, and tracking of asteroids and comets.

3. A protocol should be developed to address the legal and technical aspects of asteroid and comet danger, impact hazards, and near-Earth objects.

4. An international agreement should be drafted to address the legal and technical aspects of asteroid and comet danger, impact hazards, and near-Earth objects.

5. A legal and technical framework should be established to address the legal and technical aspects of asteroid and comet danger, impact hazards, and near-Earth objects.

6. An international agreement should be drafted to address the legal and technical aspects of asteroid and comet danger, impact hazards, and near-Earth objects.

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Stages of Formation of the International Treaty "About measures of ensuring the defence of the Earth from asteroid-comet danger"

1. Principles of preparing the draft of the Treaty
2. The draft of the Treaty
3. The Treaty
4. The International Conference
5. International Treaty "About measures of ensuring the defence of the Earth from asteroid-comet danger"

The States
- China
- India
- The European Union
- The Russian Federation
- The USA
- Japan
- etc.
Stages of Creation of the International Planetary Defence System

Financial Base
Legislative base

International Planetary Defence Centre

Regional Centre “East”
Regional Centre “West”

Level for short-term reaction “East”
Level for short-term reaction “West”

Level for long-term reaction (virtual)

Developers
The solution to the problem lies neither in the scientific or technical fields, nor in the financial or political sphere. It belongs to moral and ethical issues. The problem will not be solved until leaders of the countries come to understanding of their responsibility for the future of the Earth and its inhabitants.
Decrees and Resolutions

- United Nations
- Organization for Economic Co-operation and Development
- Parliamentary Assembly of the Council of Europe
- House of Lords in Great Britain
- United States Congress
- The World Federation of Scientists (Erice Statement-2)
- Working Group "Risk and Safety" under the President of the RAS
- Federation Council of the Federal Assembly of Russia
- and other organizations
Erice Statement-2
To the G20 Leaders

Dear G20 Leaders,

We, the World Federation of Scientists, are writing to you today to express our concern regarding the current global economic situation and the urgent need for collaborative action to address the challenges we face.

The ongoing financial crisis has had a profound impact on the global economy, with many countries experiencing a slowdown in growth and increased unemployment. This crisis has been exacerbated by the ongoing crisis in the Middle East, which has led to a significant increase in oil prices and volatility in financial markets.

We call on you, the leaders of the G20, to work together to address these challenges and to promote a more stable and prosperous future for all. This will require bold and innovative solutions, as well as a commitment to open and transparent dialogue.

We believe that a collaborative approach is essential to addressing the global challenges we face. We urge you to consider the following recommendations:

1. Strengthen international cooperation in addressing the global financial crisis
2. Promote a fair and equitable system for allocating resources
3. Enhance global governance and oversight

We look forward to your consideration of these recommendations and we stand ready to work with you to implement them.

Sincerely,

[Your Name]
[Your Organization]
Proposals

In order to implement the Project of the International Planetary Defense System, we suggest the following:

1. To create an international working group for elaboration of the International Treaty “About Measures of Ensuring the Defence of the Earth from Asteroid-Comet Danger”.

2. To forward the «Erice Statement-2» to leaders of the states and special a Statement to religious and spiritual leaders of the planet asking them to convince leaders of the states to make a decision on creation of the International Planetary Defense System.

3. To organize the international Conference for acceptance of the Treaty.

4. To start creation of the International Planetary Defense System.
Thank you for attention