

**Critical Issues Forum 2006-2007**

**Space: Forum for Cooperation or Next Frontier for WMD Proliferation?**

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**Benchmark III**

**Objective 1 - Building on the Ideas of Previous Imagination**

**Starship Troopers**

“Starship Troopers” is a 1997 movie directed by Paul Verhoeven, written by Edward Neumeier, and starring Casper Van Dien, Dina Meyer and Denise Richards. The movie is very loosely based on the 1959 novel “Starship Troopers” by Robert A. Heinlein.

**The plot**

The movie’s action occurs in the 23rd century. The movie follows a period of approximately two years after the graduation from a Buenos Aires high school of a young man named Juan Johnnie Rico. After disagreements with his parents about their wish for him to attend Harvard University and also on the issue, Rico follows his girlfriend Carmen into the military service in the hopes of becoming a citizen, a privilege afforded only to those who serve the military government - "The Federation".

Rico is assigned to Mobile Infantry, while Carmen is assigned to the Fleet Academy (to become a starship pilot) and Rico's best friend Carl to military intelligence. A girl from Rico's high school, Dizzy Flores (who has had a crush on Johnny since school), also ends up in the Mobile Infantry and is assigned to Rico's training platoon. At boot camp Rico makes a pal of Ace Levy. He soon finds the grueling boot camp training program more difficult than anticipated, with terrible injuries being inflicted by the officers and non-commissioned officers, particularly his drill sergeant, Zim. But Rico excels at the training and eventually is promoted to squad leader; in the meantime, Carmen, his present girlfriend, breaks up with him in favor of her classmate Zander.



After a trooper is killed in training accident and Rico found culpable (and subsequently punished), he decides to quit the program. However, just before he leaves the camp, an asteroid destroys Buenos Aires, and kills his parents. Horrified, Rico chooses to stay on and fight to destroy the insect threat. He joins the war against the insect species - Arachnids, called "Bugs" by soldiers - hailing from a distant planet called Klendathu.

The Mobile Infantry travels to the planet Klendathu to battle the warrior bugs, a ruthless enemy with only one goal - survival of their species no matter what. In the initial encounter, some 100,000 lives are lost, over 80% of the soldiers being wounded (including Rico) or killed, among them some of Rico's fellow boot-mates. The Federation military commander, Sky Marshal Dienes resigns and is replaced by Sky Marshal Tehat Meru. She says that they must understand the bug in order to

fight it. Rico's unit was rescued by his former high school history teacher, Rasczak, and his "Roughnecks", a unit which Rico, Dizzy, and Ace Levy, are reassigned to. After one engagement, Rico is field-promoted to corporal and assigns Dizzy to his squad leader position. Their next mission plunges them into a trap as they are assigned to investigate the silence of an outpost on one of the Bug's worlds, Planet P. They discover, from the only survivor, General Owen, that the bugs possess high intelligence and are "sucking" the brains out of humans to learn more about them. As the troopers realize their situation, a huge force of bugs attacks them. Rasczak and Dizzy both die in the ensuing battle and the Roughnecks barely evacuate alive. However, Rico's request to bombard the planet from orbit is denied.



After a funeral service for Dizzy, Rico's old friend Carl, now a Colonel in intelligence, gives Rico his reason for the deaths of many of Rico's squad mates - military intelligence had already ascertained that there might be a "brain" bug on Planet P, and the Roughnecks had been used as bait in an attempt to verify the information. He tells Rico that the Mobile Infantry will return to Planet P and capture the brain bug for research. Rico accepts the mission and Carl gives him a

battlefield promotion to Lieutenant and command of the Roughnecks. Rico is also reunited with Carmen, as she has been promoted to be a pilot of the ship from which the Roughnecks operate, the TFCT Rodger Young.



In the ensuing offensive against Planet P, the Rodger Young is destroyed, and Carmen barely evacuates with Zander. However, their escape pod lands deep underground in Bugs' territory. They are subsequently captured by the Bugs, and Zander's brain is eaten by the brain bug. Rico organizes a rescue attempt and manages to save Carmen in the nick of time, and they escape to the surface safely. Upon reaching the surface, they find the brain bug

has been captured by Rico's former training sergeant Zim (now demoted to buck private). Rico and Carmen renew their relationship, and the brain bug is sent to Earth to be studied in an attempt to find a way to defeat the Bug menace.

## The analysis of film

In the "Starship troopers" one of the probable scenarios of the development of human society is shown. We see that all countries united and formed single state - the Federation. However, this is a weapon society – everything is under the military's control, marches are everywhere, militarist slogans are everywhere too. It is necessary to serve in the army no less than 2 years to become a citizen of the Federation, who has the right to vote and social privileges ("Service Guarantees Citizenship! Join Up Now!".)

Much of the non-combat military dress seen in the film appears to be adapted from the designs of World War II German Army uniforms, most prominently amongst the fleet personnel and the intelligence officers (like the Carl). The use of the same grey color scheme, seen in almost all the uniforms, is also prominent.

Space is also militarized. Moreover, there is a weapon in space and wars are waged there. We also see how natural space objects (asteroids) are used as a weapon. But for all that troopers wore an unpowered ensemble which seemed to differ only slightly from modern-day army gear. Their weaponry was not far advanced considering that humans were depicted as having fleets of starships, but the Military Infantry fought as unsupported light infantry for most of the movie being unable to call on armor, artillery, air, or space support, all while moving mainly under their own motive power. In his commentary on the DVD edition of the film, director Paul Verhoeven

states unambiguously that the movie's message is "War makes fascists of us all", and that he sees the movie as a satire of American militarism. [1]

## The sequel

"Starship troopers" was obviously made with a sequel in mind. The movie ends with a clearly stated victory in the battle but not the war and a promise of further adventures for the characters. Scientists investigate captured "brain bug" in a secret laboratory on Earth. However, events are developed very rapidly and insects plot mischievous plans. Devastating asteroid flow falls unexpectedly to earth, destroying entire cities. The Earth is burned, roads and communication facilities are destroyed, and military authorities are in panic and lose control over the society. Scientists continue searching for the insects' weakness. However, the most terrible thing is still ahead.

Spacecrafts land on the earth. There are the soldiers of the Federation in those spacecrafts, who went missing once in the battles with the insects. There are our old friends among them. But now they are our enemies - their mind is under insects' control.

Scientists are already close to the solution, and enemy soldiers unload capsules with eggs, from which thousands of insects are hatched. Insects grow and crawl along the Earth, destroying every living thing on its way; however, scientists managed to create a virus that is fatal for the insects. Rico and his soldiers pulverize the virus in the Earth's atmosphere and the insects die. Normal life is restored on Earth, civil government is selected. Now the task of the military is protection of the Earth under new government's control.

## Objective 2 - Scenarios for the Future

Let's consider the situation: a nation that up to now has not been known to be pursuing a space program has suddenly announced that it has successfully orbited a "military vehicle." What reactions might be given by other nations or non-governmental organizations?

At first it is necessary to note that this event can hardly occur unexpectedly as it was shown earlier in Benchmarks I and II.

It is necessary to set up the appropriate base - carry out research in different fields of science, develop advanced technology. It is necessary to develop rocket engines, launchers and carrier rockets for orbital injection of any space object. Preliminarily it will be required to carry out the tests of rockets. As a rule, all such launches are recorded with different observation systems, which we already wrote about earlier. Thus, the society will be potentially prepared to a similar event and it will not be unexpected.

Let us assume however that some state managed to keep a secret about its space developments, it created and launched into space some "military vehicle". It is obvious that the reaction will depend on what functions this object performs.

If the object does not pose a threat (for example, spy satellite) and does not violate the existing treaties, governments and United Nations will not react to this event. Certainly, the object will be registered in the existing lists of the space objects (see Benchmark II).

If the space object poses a real threat, violates international treaties or causes losses to other countries is a different matter.

The reaction can be different.

### ***Diplomatic sanctions:***

- the break or the suspension of diplomatic relations, recall of diplomats;
- the announcement of the colleagues of the diplomatic mission as a persona non grata;
- the cancellation of the scheduled visits of leaders;
- the implementation of limitations to the entry into the country;
- the suspension of rights and privileges, resulting from membership in the international organization (deprivation of the right to vote, deprivation of the right of representation, deprivation of the right for assistance), expulsion of law-breaker from intercourse

between states; the temporary suspension of membership in the international organization; expulsion from the international organization.

***Economic sanctions:***

- limitation on goods import;
- the rise of customs duties on goods;
- the implementation of quotas and licenses into the trade;
- making of high demands to goods and companies;
- the suspension or the cancellation of joint projects, commercial agreements and technical assistance;
- the increase of the tax payments;
- the freezing of the contributions of the country-disturber in its banks; the withdrawal of its contributions from the banks of the disturber;
- the embargo (the prohibition to sell property and technologies to the country-disturber).

***Transport sanctions:***

- the cancellation of regular flights;
- the suspension of transport communication.

***Military sanctions:***

- the use of the armed measures.

## Objective 3 – Incidents

### The attack from space



*Asteroid 951 Gaspra*

Asteroids, also called minor planets or planetoids, are a class of astronomical objects. The term asteroid is generally used to indicate a diverse group of small celestial bodies that drift in the solar system in orbit around the Sun. Hundreds of thousands of asteroids have been discovered within the solar system. As of March 3, 2007, from a total of 368,650 registered minor planets, 152,554 have orbits known well enough to be given permanent official numbers. Current estimates put the total number of asteroids above 1 km in diameter in the solar system to be

between 1.1 and 1.9 million.

Asteroids enter the Earth's atmosphere from outer space every day, usually traveling at a speed of more than 10 kilometers per second. Most are small but occasionally a larger one enters from space. The heat generated by compression of air in front of the body as it travels through the atmosphere is immense and most asteroids burn up or explode before they reach the ground. Starting from the second half of the 20th century, close monitoring of the Earth's atmosphere has led to the discovery that such airbursts occur rather frequently. A stony meteoroid of about 10 meters in diameter can produce an explosion of around 20 kilotons, similar to that of the Little Boy bomb dropped on Hiroshima, and data released by the U.S. Air Force's Defense Support Program indicate that such explosions occur high in the upper atmosphere more than once a year.



The Earth, and all the other planets in the solar system, has been continuously pelted by asteroids and comets ever since their formation. Just look at the moon through a small telescope or a good pair of binoculars. The surface is covered by craters that were created by impacting asteroids and comets. Similar craters have been observed on the surface of the Earth. Because the Earth is so active geologically, most traces of impact craters have been erased by erosion and tectonic

activity. Nevertheless, over one hundred seventy impact craters have been identified on the Earth.



*Left. Barringer Meteor Crater. Arizona, USA (photo by D. Roddy).*

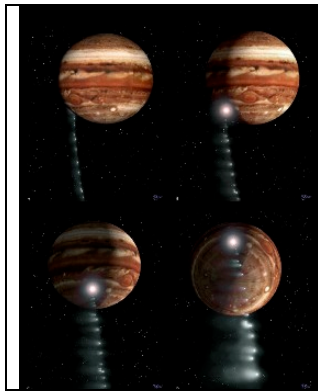
This crater is about 1,200 meters in diameter and 170 meters deep. It was created approximately 50,000 years ago. The meteorite which made it was composed almost entirely of nickel-iron. It was 45 meters across, weighed roughly 300,000 tons, and was traveling at a speed of 12 km/s. The explosion created by its impact was equal to 2.5 megatons of TNT, or about 150 times the force of the atomic bomb that destroyed Hiroshima [2].

The Tunguska event is the largest impact event in recent history. It was a massive explosion that occurred near the Podkamennaya Tunguska River in what is now Krasnoyarsk Krai of Russia, on June 30, 1908. The explosion was most likely caused by the airburst of an ~20 m asteroid or piece of a comet 5 to 10 kilometers above the Earth's surface. The energy of the blast was later estimated to be between 10 and 20 megatons of TNT, which would be equivalent to Castle Bravo, the most powerful nuclear bomb ever detonated by the US. It felled an estimated 80 million trees over 2,150 square kilometers.

An incident like Tunguska occurs approximately once per every hundred years. Smaller ones, but easily big enough to take out a large city, occur at least 3 times per century. While most of the recent recorded impacts have happened in places that were barely inhabited, we won't always be that lucky. If the Tunguska event had happened over the city of New York it would have been nearly leveled.

In 1980 scientists Walter and Luis Alvarez discovered that a layer of soil containing unusually high concentrations of the noble metal iridium - rare on the Earth, but abundant in meteorites - had been deposited all over the earth about 65 million years ago. That date marks the end of the Cretaceous period, a time when not only the dinosaurs, but thousands of other plant and animal species suddenly became extinct. The Alvarazes theorized that the mass extinctions had been caused by the impact of a giant meteorite, perhaps six miles in diameter. Such an impact would throw up a cloud of dust thick enough to obscure the sun for several years, disrupting the planetary food chain and causing the disappearance of vast numbers of species. This hypothesis has gathered support from many directions. Traces of coesite created by the impact have been found in Cretaceous-Tertiary boundary rocks at sites around the globe. Traces of burned material in the same layer provide evidence for continent-wide firestorms, while tsunami deposits around the Caribbean provide evidence of gigantic tidal waves. The discovery of the giant 65-million-year-old Chicxulub crater, buried a mile beneath the Yucatan peninsula, appears to have provided the final proof.

The increasing acceptance of Walter Alvarez' theory of dinosaur extinction, and the 1994 observation of comet Shoemaker-Levy 9 crashing into Jupiter increased the level of alarm. The US military also declassified the information that its military satellites, built to detect nuclear explosions, had detected hundreds of upper-atmosphere impacts by objects ranging from one to 10 meters across.



*Left. An artist rendering of Shoemaker-Levy 9 breaking up and impacting into Jupiter.*

In 1994 a large comet (Shoemaker-Levy 9) hit Jupiter. The Hubble telescope recorded the impact with tremendous accuracy. As it entered the atmosphere of Jupiter temperatures reached over 20,000 degrees. The impact sent a fireball thousands of miles into space. The scale of the impact may look small in scale, but bear in mind the size differential between Jupiter and Earth.

The educated guesses about the consequences of impacts of various sizes are presented in [3]:

Impactor Diameter (meters)	Yield (megatons)	Interval (years)	Consequences
< 50	< 10	< 1	meteors in upper atmosphere most don't reach surface
75	10 - 100	1000	irons make craters like Meteor Crater; stones produce airbursts like Tunguska; land impacts destroy area size of city
160	100 - 1000	5000	irons, stones hit ground; comets produce airbursts; land impacts destroy area size of large urban area (New York, Tokyo)
350	1000 - 10,000	15,000	land impacts destroy area size of small state; ocean impact produces mild tsunamis
700	10,000 - 100,000	63,000	land impacts destroy area size of moderate state (Virginia); ocean impact makes big tsunamis
1700	100,000 - 1,000,000	250,000	land impact raises dust with global implication; destroys area size of large state (California, France)

What the effects would be from a large-scale impact are very uncertain. Most scientists believe that an object in the 100-m to 500-m range could penetrate the atmosphere and cause local damage if it either exploded in the atmosphere or impacted the land or ocean. If the impact took place near a major city, or if it occurred in the ocean near a major city and caused a tidal wave, it could be very deadly. Fortunately, however, most of the Earth is still unpopulated. The chance of this type of impact is probably lower than once every 1,000 to 10,000 years. The bodies larger than 500 m are of much more concern. A single impact could cause global devastation. Calculations that were used to predict the effect of a global nuclear war have been applied to this problem. Massive earthquakes would jet out around the globe at thousands of miles an hour, destroying all buildings and life in their path. It would also trigger volcanic activity setting off eruptions and explosions all over the world. It is likely that such a large impact would raise enough dust into the atmosphere to change Earth's climate -- in effect, a "nuclear winter". A fireball would be sent into the sky miles tall. Any life that had survived the initial impact would be overcome with a whole new set of problems. Pieces of the earth and dust would block the atmosphere, preventing the earth from getting any sun. Plant life would become extinct, and humans would face the horrifying reality of a nuclear winter.

### ***The accidents with nuclear powered space objects***

For more than four decades, both the US and the Soviet Union/Russia have utilized nuclear power sources (Radioisotopic Thermoelectric Generators - RTGs - as well as space nuclear reactors) to meet some of the energy requirements of their spacecrafts. Although other radioactive fuels have been considered for RTGs, plutonium-238 has been used most widely. Pu-

238 is a radioactive isotope - a form of plutonium that gives off energy as rays and particles. It continues to be the radioactive fuel of choice today and in planned future missions. Because the nuclear fuel in RTGs is radioactive, safety is a critical issue.

During the period of using RTGs, several launch failures, failures to achieve orbit, and accidental re-entries through the Earth's atmosphere have occurred. None of these accidents have caused measurable health effects in the human population, though some environmental contamination has occurred.

For example, in 1964, a US Navy Transit 5-BN-2 navigation satellite failed to reach orbit and disintegrated in the atmosphere, scattering plutonium particles in the atmosphere [6]. The satellite received its electrical power from a 4.5 pound, grapefruit-sized radiothermal generator SNAP-9A. NASA describes the results of this accident: "Since 1964, essentially all of the SNAP-9A release has been deposited on the Earth's surface. About 25 percent ... of that release was deposited in the northern latitudes, with the remaining 75 percent settling in the southern hemisphere..." [7] Release of that plutonium caused an increase in global lung cancer rates, says Dr. John Gofman, professor emeritus of medical physics at the University of California at Berkeley. [10]

The following table [7] lists the effect of this burn-up on the worldwide plutonium-238 distribution:

Sources	Amount (Curies)
Atmospheric Testing 1945-74. Deposited near testing sites and worldwide	9,000
Space Nuclear - SNAP-9A, 1964	17,000
Overseas Nuclear Reprocessing Plants, 1967-1987	3,000 (estimated)
Chernobyl Nuclear Power Station, 1986	810
<i>Total</i>	<i>29,810</i>

The re-entry of Soviet Kosmos 954 in 1978 is one of the best covered and most serious accidents of a nuclear powered space mission. Tens of millions of pepper-flake sized radioactive particles, comprising a fifth to a quarter of the nuclear core, remained scattered over a 124,000 square kilometer 'footprint', stretching southward from Great Slave Lake into northern Saskatchewan and Alberta. The clean-up of these populated and frequented areas and the recovery of a number of large satellite fragments from the more remote bush cost Canada nearly \$14,000,000, of which only \$3,000,000 was later recovered from the USSR. [9]



Cassini on the launch pad.  
15 Oct. 1997 [8]

Cassini is a joint mission by NASA and the European Space Agency. Cassini carries three RTGs with a total of 72 pounds of plutonium-238 (about 400,000 curies), making it the largest space mission ever undertaken involving RTGs. Originally, NASA calculates in its Final Environmental Impact Statement (FEIS) that up to 2,300 people might come down with fatal cancer over a 50 year period from the dispersal of plutonium-238 over a populated area. At a later date, it has lowered this figure to 120. Doctor Michio Kaku (professor of theoretical physics at the Graduate Center of the City University of New York) thinks "that the FEIS has consistently underestimated the possible risks of an accident" [5]. The FEIS admits that plutonium in the RTGs will be subject to three extreme conditions during a launch phase accident: high temperatures, shrapnel, and explosive over-pressure. NASA has conducted some partial tests, which already reveal the vulnerability of the RTGs to such extreme environments. And the FEIS in fact concedes that plutonium will escape the RTGs during a launch phase explosion. Michio Kaku argues that the combination of temperature, shrapnel, and

over-pressure may be sufficient to burst most of the containers wide open: "Given the fact that the simultaneous effect of high temperature, shrapnel, and over-pressure has never been fully tested, and given the fact that in combination they will probably cause a large failure of the iridium casing, a figure of 30% to 40% release is probably more realistic."

If that quantity of plutonium is somehow dispersed into a populated environment, there is no question that such an accident could cause significant health effects resulting in thousands of casualties. An accident at launch phase would release plutonium in an area populated by 100,000 people. But if the winds blow, then the area affected within 5 counties of the launch site could total over a million people.

In fact, experiments conducted on metal oxides have shown that a significant percent of the inventory can be pulverized into a fine dust of micron-sized particles, which can then be blown miles from the original site by the winds. These micron-sized particles are especially dangerous because they stay lodged deeply in the lungs for decades, where ciliary action is useless in expelling these particulates. Thus, these particles can emit radiation at close range to nearby lung tissue for decades to come, causing cancer.

Even if no significant amounts of radiation are released in a plutonium accident, property values are expected to plummet. The NASA's FEIS for the New Horizons Mission acknowledges that in the event of plutonium release "costs may include: temporary or longer term relocation of residents; temporary or longer term loss of employment; destruction or quarantine of agricultural products...land use restrictions which could affect real estate values, tourism and recreational activities; restrictions or bans on commercial fishing; and public health effects and medical care." [11] The FEIS says the cost to decontaminate land on which the plutonium falls would range from "about \$241 million to \$1.3 billion per square mile." [11]

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