Warhead for the first multiple reentry vehicle of a sea-launched ballistic missile. As part of the product, a small-sized thermonuclear charge and devices of the automation system, which have minimal dimensions, are used. Among the developers, the project was called "One Hundred per Hundred" (to accommodate 100 kilotones of power in 100 kg of charge). The dense layout of the components of the warhead made it possible to create a light and small-sized product that meets the requirements for placing three warheads on one launch vehicle. The mass of the warhead is 170 kg; the 1 kt/kg objective suggests it has a yield of 170 kt if design yield was achieved. The product was put into service in 1974.

The first warhead of a multiple reentry vehicle with individual aiming at aiming points, weight 210 kg. The product was put into service in 1978. Again, the 1 kt/kg objective suggests 210 kt.


These examples suggest that dual linear imploded primary devices gave 1 kt/kg; dual spherical primaries gave 1.5 kt/kg.
**VNIITF Russian Nuclear Weapons Summary Film**

(Russian: Рабочая группа 80)

(English: Working group 80)

**Lauréats**

- Ленинской Премии - 4
- Государственной Премии СССР - 53
- Государственной Премии РФ - 6
- Государственной Премии им. Г.К.Жукова - 1
- Премии Правительства РФ - 7
- Почетные звания РФ - 1
- Заслуженный деятель науки РФ - 1
- Заслуженный конструктор РФ - 4

**Awards**

- Ордена и медали СССР и РФ - около 1400

**Nuclear Weapons Development**

- KB-2 VNIITF DEVELOPED 90 NUCLEAR WEAPONS FOR ALL PURPOSES
- 100% OF ALL STRATEGIC BOMBS, 100% OF ALL TACTICAL BOMBS, 100% SHELLS
- ВМФ: ядерные боеприпасы 100%
- BBC: авиабомбы стратегические 100%
- СВ: ядерные артиллерийские снаряды 100%
- РВСН: ядерные боеприпасы 20%

(English: This film is dedicated to)

50-ти летию РФ ЯП ВНИИТФ

60-ти летию ПОБЕДЫ

(... To the 60th Anniversary of Victory)
Ядерные боеприпасы сухопутных войск
(NUCLEAR AMMUNITION OVERLAND TROOPS)

(152.4 mm diameter nuclear artillery shell)

изделие 152
(PRODUCT 152)

(PRODUCT 6: NUCLEAR WARHEAD FOR SURFACE-TO-AIR DEFENCE MISSILES)

изделие 6
(PRODUCT 245: LARGE, HIGH YIELD THERMONUCLEAR FREEFALL BOMB)

изделие 245

(PRODUCT 30: HIGH YIELD NUCLEAR WARHEAD FOR ARMY TACTICAL MISSILES)

изделие 30

(STRATEGIC NUCLEAR MISSILES OF THE NAVY)

Ядерное боевое оружие ракетных комплексов стратегического назначения ВМФ

изделие 255A13
(3rd GENERATION: MIRV THERMONUCLEAR WARHEADS)

PRODUCT 82
SINGLE WARHEAD

(USE OF PRODUCT 82)

3 MIRVs FROM SINGLE MISSILE

DESIGNERS OF PRODUCT 95


Научный руководитель и главный конструктор института
К.И. Щелкин

Заместитель научного руководителя и главного конструктора института
В.Ф. Гречишников

Трехракетный залп комплекса Д-6У

Старт ракеты

Прицельное разделение БФ

Ввод БФ в атмосферу
ГРАЖДАНСКАЯ ОБОРОНА

Учебник
2014 г.

Защитными свойствами от действия ударной волны обладают также танки, БТР и BMP.

При невозможности использовать защитные свойства различных сооружений следует применять элементарные меры защиты. Так как для незащищенного человека наиболее опасность представляет скоростной напор, то целесообразно до подхода ударной волны лечь на землю лицом вниз, головой или ногами в сторону взрыва. При этом площадь поперечного сечения уменьшается примерно в 10 раз, а воздействие скоростного напора будет минимальным.

Воздействие скоростного напора снижает различного угла бегущей волны (скалы, амь, порох, др.) или низкого прочных стенок, пан и другие предметы, за которыми можно укрыться.

Рис. 1.8. Защитные свойства полевых фортификационных сооружений от воздушной ударной волны ядерного взрыва

---

**TRANSLATION FROM PUTIN'S 2014 CD BOOK**

**Difference in basic design of UK/USA versus Russian MIRV's Anisotropic (unequal from all directions) x-rays on 2nd stage:**

**UK USA**

- Komodo 2-point primary, Type 126 pit
- Beryllium
- Very dirty, expensive.
- US35 loaded secondary

**Russia**

- Faster compression allows cleaner secondary
- Channel foam is not needed
Ю. Н. Бабаев был крупнейшим специалистом в области создания атомных и термоядерных зарядов. В 1955 г. совместно с Ю. А. Трутеневым он сформировал новое направление в создании термоядерных зарядов с кардиально улучшенными характеристиками. В 1958 г. была успешно завершена экспериментальная отработка первого заряда нового типа. 

Это работе предшествовали большие теоретические исследования и экспериментальное исследование ускоренных термоядерных процессов, которые были в многом еще непонятны. Были сформулированы задачи на разработку новых программ для расчета.

23 Feb 1958: first test of double-primary design. Babaev, Russian book Heroes of the atomic project

IN 2005, RUSSIA DECLASSIFIED DOUBLE-PRIMARIES TECHNOLOGY FIRST TESTED 23 FEBRUARY 1958 AND STILL IN USE TODAY:

At the initiative of Yu. N. Babayev and Yu. A. Trutennev and under their leadership, thermonuclear charges for national economic chains were developed at VNIIEM. Charges with minimal scoping radioactivity. Some of them were used to create reservoirs, extinguish gas fires, intensify gas and oil fields, etc.

A lot of theoretical work was carried out by him on the use of nuclear explosions for the development of ferrous materials.

The further direction of Yu. N. Babayevo’s work was the radical improvement of nuclear charges, a dual approach. The theory was developed, calculation methods were improved, etc. Some thermonuclear charges were designed in dangerous manufacturing technology. They were tested, but they did not always work stably and required fine-tuning, but Yuri Nikolaevich did not have time to do this.

Yu. N. Babayev made a colossal contribution to the development of theoretical deuterium projects, which contributed to the creation of a mathematical apparatus. His activity was a powerful incentive for the development of calculations of the most complex mathematical problems and physical processes. He worked a lot in related fields. He was engaged in nuclear subjects: pumping laser from a nuclear explosion. He was also interested in studying the effect of radiation on humans and the environment. He also had proposals for launching military vehicles into space.

Yu. N. Babayev has raised a large galaxy of young scientists, candidates and doctors of sciences, who today successfully continue his work. In 2000, upon completion of one of the developments in which Yuri Nikolaevich took a direct part, he was awarded the State Prize of the Russian Federation (posthumously). He was awarded two Orders of Lenin, the Order of the Red Banner of Labor, and the medal "For Labor Valor".

After double primaries detonation

Using 2 primaries allows a 2.5 fold increase in efficiency

How elongated fusion stages are compressed into spheres for maximum fusion efficiency by anisotropic vep delivery
1st ever Russian MIRV warhead, 210 kg each; first put into service in 1978.


Monoblock warhead of the first megaton range missile for submarines, 650 kg, year 1974.

Monoblock warhead for use against ships and shore bases, 690 kg, 1975.

650 kg 1968 SLBM warhead

1st Russian MIRV for SLBM submarine missiles, put into service in 1974: mass is 170 kg, a small-sized thermonuclear charge allows placing three warheads on one launch vehicle.

RIGHT: 1961 Russian megaton ICBM warhead
Length 189.3 cm, midsection diameter 130 cm, mass 736 kg.

200 kt thermonuclear warhead deployed from 1981 to 1991 for a 450 km range operational-tactical missile which was withdrawn from service under the INF Treaty, in exchange for the American Pershing INF disarmament.

40 kt tactical nuclear warhead, 1960: length 287 cm, midsection diameter 88 cm, mass 950 kg. (Much heavier than American designs for such a low yield!)

1962: first mass-produced Russian aircraft dropped megaton yield strategic thermonuclear weapon.

1963 deployed Russian megaton SLBM warhead, length 230 cm, diameter 130.4 cm. Mass 1144 kg.

Russian 50 megaton bomb, 30 tons, 2x8m size, tested at half power on December 24, 1962, Novaya Zemlya.

First ever Russian 40 kt nuclear warhead for an intermediate-range ballistic missile, 1200 km range, withdrawn from service 1960.

2 megaton warhead for ICBMs, range 12,000 km, 1970 to 1979.

First ever Russian thermonuclear warhead for an intercontinental ballistic missile, 3 megatons yield, 8500 km range, in operation 1960 to 1966.
ABOVE:
RDS1 tested 29 August 1949. Lower right shows designer Khariton at the museum with this copy.

TSAR BOMBA: 100 mt (dirty U238 pusher on central secondary charge) or 50 mt (lead pusher).
ICBM blast silo blast door

Transportation of warhead bus to a Russian ICBM silo

The image contains a page discussing the transportation of a warhead bus to a Russian ICBM silo. It includes diagrams and text in Russian, accompanied by an English translation at the bottom of the page. The translation reads: "Transportation of warhead bus to a Russian ICBM silo."

---

```
<table>
<thead>
<tr>
<th>№ и катализатор</th>
<th>число, годы, год</th>
<th>местонахождение</th>
<th>энерго-</th>
<th>комментарий</th>
</tr>
</thead>
<tbody>
<tr>
<td>245</td>
<td>13.02.1966</td>
<td>СИП шт.Е-1</td>
<td>125</td>
<td>Испытание заряда с термодинамическим блоком, содержащим дейтерий под большим давлением.</td>
</tr>
<tr>
<td>280</td>
<td>07.01.1968</td>
<td>СИП шт.810</td>
<td>7,5</td>
<td>Fизический опыт для определения минимального количества дейтерия, которое может вызывать взрыв.</td>
</tr>
<tr>
<td>333</td>
<td>15.01.1974</td>
<td>СИП шт.5101</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>377</td>
<td>10.12.1974</td>
<td>СИП шт.1204</td>
<td>140</td>
<td>Испытывался особо &quot;чистого&quot; заряда с высоким коэффициентом термодинамики (около 1%)</td>
</tr>
</tbody>
</table>

Испытания зарядов с термодинамическим блоком, содержащим дейтерий под большим давлением.

Ржавая платформа, изготовленная из стали, была установлена для проведения испытаний. Материал платформы был специально разработан для работы в условиях высоких температур и давлений.

---

**Examples of Nuclear Tests for the Development of Low Yield Clean Charge**

**RUSIAN DEVELOPMENT OF CLEANER LOW YIELD TACTICAL NUCLEAR WEAPONS / PNEs**

---

**PURE DEUTERIUM GAS UNDER HIGH PRESSURE**

**Test of Minimum Yield for Pure Deuterium Fusion Charge Burn**

---

**Examples of Nuclear Tests for the Development of Low Yield Clean Charge**

---

**140 Kiloton Total Yield Charge of Only -1% Fission Yield**

---

**Military Effects**

Out of 53 aircraft exposed by 0.52km range, only 2 survived intact. Field artillery and tanks were destroyed at 250-300m and had significant damage out to 500m. Ground-launched missiles were destroyed in 200m, and overhead casualties were destroyed out to 1000m.

---

**Animal Effects**


**The medical/biological studies involved about 8,000 experimental animals (camels, horses, pigs, sheep, dogs, rabbits, guinea pigs, white rats). The basic ways to solve medical/biological problems were by carrying out field experiments that used animals in open areas or test fields and in military and civil protective structures. Animals were placed in more than 500 field and long-term structures, more than 200 war material items (tanks, armored personnel carriers, automobiles, etc.), and residential brick and wooden structures.**

---

**Page 36:** at the 1.6 megaton 1955 test, no thermal burns occurred to animals in houses or structures.
Recently declassified high quality photos of the effects of the 1949 Russian nuclear test RDS-1 on military equipment.
In-flight aircraft flew in circles in the clockwise direction around ground zero at radii (Z) of 2-15 km. For safety, the aircraft at 2km flew at 8km altitude.
Right: 14 different target sectors or lines stretched out to distances of up to 10 km (6 miles) from the 29 August 1949 Russian 22 kt nuclear test tower. This Russian poster uses a non-linear distance scale to show the ranges to which different items were exposed. Tanks were sector 5, out to 2 km in the South-West.
RIGHT: Russian illustration of USA 15 kt Grable nuclear test shell, 1953. Note the oralloy (U235)
Товарищу ХРУЩЕВУ Н.С.
Товарищу БУЛГАНИНУ Н.А.

Докладывая, что 28 декабря 1957 года в 10 часов утра по московскому времени на полигоне № 2 Министерства обороны СССР, в соответствии с утвержденным планом, был произведен взрыв атомного устройства с целью изучения нового способа повышения эффективности использования плутония в атомных зарядах за счет добавления небольшого количества газообразной смеси дейтерия и трития.

Результат опыта положительный.

Прилагаю телеграмму тов. Волкова (руководитель испытания) и др., полученную с полигона о проведенном испытании.

Служу,
Е. Славский

Уч. отд. 936/3
31. XII. 57 г.

Приложение в деле № 39.

Граффити на бумаге: "Шо архивело,"

Дата 3.2.58 г.
SECRET 1956 USSR Council of Ministers decision authority to equip their 8000 km range R-7 IRBM with their 2.0 megaton warhead with a mass of 2900 kg, based on their November 1955 "new ablation principle" thermonuclear weapon test.
Boris V. Litvinov showing Putin the world’s smallest diameter (152.4mm) 2.5 kt artillery shell (above), and a 99.85% clean thermonuclear bomb (above right and right), 30 March 2000.

Joe-4 (RD3-6) 400 kt Teller “alarm clock”-design H-bomb photo taken 15 seconds after detonation 12 August 1953.

ЯБП для первой межконтинентальной баллистической ракеты Р-7 NM for the first intercontinental ballistic missile R-7
The thermonuclear charge to equip the first domestic intercontinental ballistic missile (ICBM) R-7. The charge had a capacity of 3 megatons of TNT equivalent. The length of the rocket is 31.4 m. The range of the rocket was 8500 km. It launched Sputnik 1957 and the Vostok-1 spacecraft piloted by Gagarin in 1961.

Temp S: 300 kt Tactical, 12.3m long, 900 km range

SOURCE: http://www.vniief.ru

Note that the 1.6 megaton air burst RDS37 on 22 November 1955 produced ONLY 1% of the fallout doses of the 22 kt near surface burst RDS1. Burst height is more important than yield!

These measurements of the total (infinite time) dose were integrated according to the -1.2 power of time “decay law”. Infinite time dose, D = 5Rt Roentgens, where R is initial dose rate (Roentgens/hour) at time t (hours after detonation).
Противорадиационными укрытиями называют сооружения, обеспечивающие защиту укрывающихся в них людей от заражения радиоактивными веществами и от облучения в зоне радиоактивного заражения местности.

При выборе места для строительства укрытий нужно учитывать влияние рельефа и осадков на зарастание радиоактивного заражения местности.

Население при угрозе нападения противника может своими силами строить из подручных материалов различного рода укрытия.

Простейшие укрытия типа убежищ с однорядной массой особо устойчивы к действиям радиации в 100—300 раз, уменьшают радиус поглощения от ударной волны в 1,5—2 раза.

В районах горнодобывающей и угольной промышленности под укрытия могут быть использованы шахты, рудники, выработки по добыче строительных материалов, катаkomбы, пещеры и др.
ПРОСТЫЕ УКРЫТИЯ И БЫСТРОВОЗВОДИМЫЕ УБЕЖИЩА С УПРОЩЕНИМ ОБОРУДОВАНИЕМ

ЮВАРШИЙЕ УКРЫТИЯ

Способствуют сохранению жизни и сохранности жизнедеятельности людей, их помещений, их имущества, а также животных, находящихся в этих помещениях.

EARTH-COVERED TRENCH SHELTER

ПЕРЕМЕШЕННАЯ ЦЕЛЬ С ЕДИН СТЕН

BASEMENT SHELTER

ПРЫСКОПИОВЫЕ ПЛАНКИ ПЕДИСТРАЛА УБЕЖИЩА С УПРОЩЕНИМ ОБОРУДОВАНИЕМ

ФРУСТРИКУТОВОЙ ЖИЗНИ С ТЕРРИСТОРИИ, КАК ЭКСУМНИКИ И ОБОРУДОВАНИЕ, ЕЩЕ ПЕРЕХИЩЕНИЯ

ПЕРСПЕКТИВА С ПОДОЛЬНОЙ РАБОТЫ ПЕРЕХИЩЕНИЯ

UNDERROAD PEDESTRIAN CROSSING SUBWAY SHELTERS WITH REINFORCED CONCRETE SLAB ROOFS

Мы должны уметь строить простейшие укрытия и быстровозводимые убежища.

ПРОТИВОРАДИАЦИОННЫЕ УКРЫТИЯ

Посадочные ходы, ведущие к радиационно-опасным зданиям.

ПРЫСКОПИОВЫЕ ПЛАНКИ ПЕДИСТРАЛА УБЕЖИЩА С УПРОЩЕНИМ ОБОРУДОВАНИЕМ

УКРЫТИЕ С ПЕРЕХИЩЕНИЯМИ ИЗ ВАЖНОСТИ ЛОКАЛЯ

ПЕРСПЕКТИВА С ПОДОЛЬНОЙ РАБОТЫ ПЕРЕХИЩЕНИЯ

УКРЫТИЕ СО ЗДАНИЙ РАДИАЦИИ ИЗ СООБЩЕСТВА

ПЕРСПЕКТИВА С ПОДОЛЬНОЙ РАБОТЫ ПЕРЕХИЩЕНИЯ

УКРЫТИЕ С СОЗДАНИЙ РАДИАЦИИ ИЗ СООБЩЕСТВА

ПЕРСПЕКТИВА С ПОДОЛЬНОЙ РАБОТЫ ПЕРЕХИЩЕНИЯ

ПЕРСПЕКТИВА С ПОДОЛЬНОЙ РАБОТЫ ПЕРЕХИЩЕНИЯ

Нам должен знать, где расположены ближайшие противорадиационные укрытия по месту работы или жительства.

Hard basement shelters in target cities.

Simpler fallout shelters in rural area.
Experts refute CIA—Soviet civil defense

NEW YORK TIMES, 19 February 1988

By Vicki Tass

WASHINGTON—Two experts on Soviet civil defense capabilities dis- agreed sharply yesterday with statements released Friday indicating that the CIA does not place great signifi- cance on the massive Soviet preparations.

Dr. Eugene Wagner, Nobel prize- winning physicist, and retired Gen. George Keegan, former chief of Air Force Intelligence, both disagree with Adm. Stamfield Turner, the director of the Central Intelligence Agency. In

Wagner referred to estimates made by himself and others that only betw een 2 percent and 5 percent of the Soviet Union's population would be vulnerable to a U.S. nuclear attack, while 45 percent of the U.S. population could be hit.

In another telephone interview Gen. Keegan said there was not the
TK Jones became President Reagan's civil defense expert, debunking propaganda:

1. Ostensible Crisis
2. Political, Economic, and Diplomatic Gestures
3. Solemn and Formal Declarations
4. Hardening of Positions—Confrontation of Wills
5. Show of Force
6. Significant Mobilization
7. "Legal" Harassment—Retortions
8. Harassing Acts of Violence
9. Dramatic Military Confrontations
10. Provocative Breaking Off of Diplomatic Relations
11. Super-Ready Status
12. Large Conventional War (or Actions)
13. Large Compound Escalation
14. Declaration of Limited Conventional War
15. Barely Nuclear War
16. Nuclear "Ultimatum"
17. Limited Evacuation (Approximately 20 per cent)
18. Spectacular Show or Demonstration of Force
19. "Justifiable" Counterforce Attacks
20. "Peaceful" World-Wide Embargo or Blockade
21. Local Nuclear War—Exemplary
22. Declaration of Limited Nuclear War
23. Local Nuclear War—Military
24. Unusual, Provocative, and Significant Countermeasures
25. Evacuation (Approximately 70 per cent)
26. Demonstration Attack on Zone of Interior
27. Exemplary Attack on Military
28. Exemplary Attacks Against Property
29. Exemplary Attacks on Population
30. Complete Evacuation (Approximately 95 per cent)
31. Reciprocal Reprisals
32. Formal Declaration of "General" War
33. Slow-Motion Counter-"Property" War
34. Slow-Motion Counterforce War
35. Constrained Force-Reduction Salvo
36. Constrained Disarming Attack
37. Counterforce-with-Avoidance Attack
38. Unmodified Counterforce Attack
39. Slow-Motion Countercity War
40. Countervalue Salvo
41. Augmented Disarming Attack
42. Civilian devastation Attack
43. Some Other Kinds of Controlled General War
44. Spasm or Insensate War

Herman Kahn’s Escalation Ladder of Steps the left will try to engineer to start WWII.
Assumption Variables Versus U.S.S.R.
Civil Defense Effectiveness
Distance Evacuated

As to the reasons why our results differ from those produced by ACDA: ACDA assumed that 30 percent of the Soviet urban population would not be evacuated but that good quality shelters would accommodate only 10 percent. Thus, 20 percent of the Soviet urban population was assumed unevacuated and inadequately protected, which of course subjects them to massive losses. The Soviet plans, which we endeavored to represent in our analysis, indicates that urban residents not sheltered will be evacuated.

A second difference centers around the way in which the Soviets choose to distribute and provide blast protection for their evacuees. The ACDA analysis assumed that the Soviets would cluster their evacuees in hosting areas, which we estimate could result in some concentrations as high as 500 persons per square mile. The evacuees were assumed to have no blast protection, so fatalities would occur at 3 to 7 psi according to the source used by ACDA. Figure 3 shows that a distribution of 500 persons per square mile and 3 psi fatal blast level results in a fatality level almost 100 times greater than a uniform distribution and blast protection to 15 psi (the minimum provided by Soviet expedient shelters). It is important to remember that it is the Soviet Union and not the United States that controls such factors as evacuation, distribution, and sheltering of the Soviet citizens.

The ACDA study of industrial protection, which I have reviewed, is not a competent work. The hardness levels known to be achievable on industrial components are seriously understated while the difficulty of achieving these levels is overstated. The resiliency of industry in recovering from damage is disregarded. The report's fixation on the capability of one-megaton weapons to damage industry is misleading since the U.S. would be able to deliver few of these weapons against Soviet targets. Moreover, the ACDA study fails to assess the impact of protection on the survival and recovery of the Soviet industrial base as a whole.

T. K. Jones

BOEING

TK JONES EXPOSED
THE EVIDENCE
DEBUNKING FAKE US
ACDA/FEMA ANTI-
CIVIL DEFENSE
EFFECTS "DATA",
USING EVIDENCE

<table>
<thead>
<tr>
<th>USSBS Report 92, v2</th>
<th>MAE's</th>
<th>Radii of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hiroshima buildings</td>
<td>in square miles</td>
<td>MAE's in feet</td>
</tr>
<tr>
<td>Multistory, earthquake-resistant</td>
<td>0.03</td>
<td>500</td>
</tr>
<tr>
<td>Multistory, steel- and reinforced-concrete frame (including both earthquake- and non-earthquake-resistant construction)</td>
<td>0.05</td>
<td>700</td>
</tr>
<tr>
<td>1-story, light, steel-frame</td>
<td>3.4</td>
<td>5,500</td>
</tr>
<tr>
<td>Multistory, load-bearing, brick-wall</td>
<td>3.6</td>
<td>5,700</td>
</tr>
<tr>
<td>1-story, load-bearing, brick-wall</td>
<td>6.0</td>
<td>7,300</td>
</tr>
<tr>
<td>Wood-frame industrial-commercial (dimension-timber construction)</td>
<td>8.5</td>
<td>8,700</td>
</tr>
<tr>
<td>Wood-frame domestic buildings (wood-pole construction)</td>
<td>9.5</td>
<td>9,200</td>
</tr>
<tr>
<td>Residential construction</td>
<td>6.0</td>
<td>7,300</td>
</tr>
</tbody>
</table>
50% PROBABILITY OF SEVERE DAMAGE (COLLAPSE) FOR CITY BUILDINGS
(SOURCE: NORTHROP, EM-1 NUCLEAR WEAPON EFFECTS HANDBOOK, 1996,
TABLE 15.6, AND FIGURES 15.10, 15.18, SURFACE BURSTS)

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>Oscillation Period (ms)</th>
<th>Static yield resistance (psi)</th>
<th>Ductility ratio (u)</th>
<th>Peak overpressure (ksi)</th>
<th>20 KT</th>
<th>1MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.2.2, 3-8 Story Reinforced Concrete Building (Concrete Walls)</td>
<td>300</td>
<td>3.0</td>
<td>7.5</td>
<td>15</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>15.2.10, 3-10 Story Steel Frame Building</td>
<td>600</td>
<td>2.0</td>
<td>10</td>
<td>23</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

THE ORIGINALLY SECRET EM-1 SHOWS THAT MODERN CITY BUILDINGS REQUIRE FAR HIGHER PEAK OVERPRESSURES, EVEN AT MEGATON YIELDS, THAN THE WOODEN HOUSES IN HIROSHIMA FOR COLLAPSE

Fig 3 Variation of mortality index with size of incident for explosives (from Table E)

For low yield explosions, there is no time to duck and cover over most of the danger area before the blast arrives. For nuclear explosions, there is no time to duck and cover from the blast, because of the larger area.

Table E Mortality indices

<table>
<thead>
<tr>
<th>Mean quantity of explosive per incident</th>
<th>Mortality index (per ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.955</td>
<td>7.25</td>
</tr>
<tr>
<td>0.389</td>
<td>3.96</td>
</tr>
<tr>
<td>0.95</td>
<td>7.21</td>
</tr>
<tr>
<td>0.389</td>
<td>3.96</td>
</tr>
<tr>
<td>9.68</td>
<td>1.79</td>
</tr>
<tr>
<td>24.77</td>
<td>1.27</td>
</tr>
<tr>
<td>82.1</td>
<td>0.10</td>
</tr>
<tr>
<td>247</td>
<td>0.06</td>
</tr>
<tr>
<td>1966</td>
<td>0.075</td>
</tr>
</tbody>
</table>

In WWII, Britain's fired 170 million shells, of which 1.5 million were fired before the Battle of the Somme. In 1917 alone, Britain produced 50 million shells containing 185 kilotons of explosive. 943,947 shells were fired in a 24-hour period by the British on 28-29 September 1918. From 1914-17 Britain fired 290 kt at German trenches.

The "equivalent megatonage" of these small bombs is immense because the area of destruction and thus casualties scale by only about the 2/3 power of energy, not directly with yield, and each average shell contained only 3.7 kg of explosive. Thus, the equivalent megatonage of Britain's shellings in 1917 alone is:

50,000,000 x 3.7 x 10^9 x 2/3 = 120 separate 1 megaton nuclear weapons.

In the whole of WWII, the British Army fired 170 million shells, with equivalent damage to:

170,000,000 x 3.7 x 10^9 x 2/3 = 408 separate 1 megaton nuclear weapons.

Now consider WWII, where London alone received about 18.8 kilotons in roughly 188 thousand separate 100 kg explosives in the 1940 Blitz:

188,000 x 10^7 x 2/3 = 4 thermonuclear weapons, each 1 megaton.

The 1.3 megatons of conventional bombs dropped on Germany in WWII was likewise equivalent to:

13,000,000 x 10^7 x 2/3 = 280 separate thermonuclear weapons, each 1 megaton.

The Advisory Committee on Major Hazards, Second Report:

HER MAJESTY'S STATIONERY OFFICE 1979

The "equivalent megatonage" or equivalent to 1 megaton nuclear weapons, isn't just 0.29 megaton, but is immense because the area of destruction and thus casualties scale by only about the 2/3 power of energy, not directly with yield, and each average shell contained only 3.7 kg of explosive. Thus, the equivalent megatonage of Britain's shellings in 1917 alone is:

50,000,000 x 3.7 x 10^9 x 2/3 = 120 separate 1 megaton nuclear weapons.

In the whole of WWII, the British Army fired 170 million shells, with equivalent damage to:

170,000,000 x 3.7 x 10^9 x 2/3 = 408 separate 1 megaton nuclear weapons.

Now consider WWII, where London alone received about 18.8 kilotons in roughly 188 thousand separate 100 kg explosives in the 1940 Blitz:

188,000 x 10^7 x 2/3 = 4 thermonuclear weapons, each 1 megaton.

The 1.3 megatons of conventional bombs dropped on Germany in WWII was likewise equivalent to:

13,000,000 x 10^7 x 2/3 = 280 separate thermonuclear weapons, each 1 megaton.

In total, 74.2 kilotons of conventional bombs were dropped on the UK in WWII causing 60,000 casualties, equivalent to 16 separate 1 megaton nuclear weapons, confirming the British Home Office analysis that - given cheap-type civil defence - you get about 3,750 casualties for a one megaton nuclear weapon. Naturally, without civil defence, as in early air bombing surprise attacks or the first use of nuclear weapons against Hiroshima and Nagasaki, casualty rates can be over 100 times higher than this. (For example, Glasstone and Dolan, in The Effects of Nuclear Weapons, 1977 point out that in Hiroshima the 50% lethal radius was only 0.12 mile for people under cover in concrete buildings, compared to 1.3 miles for those caught totally unprotected outdoors. The difference in area is over a factor of 100, indicating that the casualties in Hiroshima could have been reduced enormously if the people had taken cover in concrete buildings, or simple earth covered WWII shelters which offered similar protection to concrete buildings.)

The Effects of Atomic Weapons

KINETIC ENERGY INTERNAL ENERGY

AN APPROXIMATE METHOD OF COMPUTING THE DEFORMATION OF A STRUCTURE BY A BLAST WAVE

\[ E = 4\pi \int_0^R \left( \frac{1}{2} \rho u^2 \right) r^2 dr + 4\pi \int_0^R \frac{p}{\gamma - 1} r^2 dr \]

\[ R \]

SHOCK FRONT

SLIGHTLY WEAKENED SHOCK FRONT

Figure 5.3. Behavior of blast wave upon striking cylindrical structure: (a) before striking the structure; (b) after striking the structure; (c) after passing the structure; (d) wave completely past the structure.

APPENDIX A

AN APPROXIMATE METHOD OF COMPUTING THE DEFORMATION OF A STRUCTURE BY A BLAST WAVE

\[ \frac{1}{M} \int [u(1) - F_0] dt \]

Figure A.2. Mass supported on plastic spring equivalent to single-story structure.

Glasstone's 1950 Effects of Atomic Weapons explained the basis of blast attenuation clearly.

Appendix A then gives a specific calculated example: a reinforced concrete building of 952 metric tons, 75x75ft, 38 ft high, resisting force 4psi, subjected to a peak overpressure and dynamic pressure loading of 32psi decaying to zero in 0.32 second. Calculated peak deflection of middle of the building was 0.88 foot.

Glasstone's 1950

Appendix A calculates deflection of building, allowing energy absorbed to be calculated from:

\[ E = \int F \, dx = \int PA \, dx \]

Figure A.5. Displacement of center of mass as function of the

Blast is not the only thing that is attenuated severely in a city: radiation including thermal and nuclear, is also attenuated. Although some scattered radiation gets through, it is usually degraded in energy and only comes from the small area of sky above you in a city street with tall buildings.
### Table B-1. Severe/Moderate Blast Damage Radii for Surface Bursts (meter)

<table>
<thead>
<tr>
<th>Material classification</th>
<th>ALPHA 0.01</th>
<th>BRAVO 0.05</th>
<th>CHARLIE 0.10</th>
<th>DELTA 0.50</th>
<th>ECHO 1 KT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field fortifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth covered surface shelters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monumental-type multi-story wall-bearing bldgs.</td>
<td>Mod 35</td>
<td>55</td>
<td>70</td>
<td>85</td>
<td>125</td>
</tr>
<tr>
<td>Multistory, wall-bearing bldgs (apt house type)</td>
<td>Sev 85</td>
<td>60</td>
<td>65</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Multistory, reinforced bldgs (small window area)</td>
<td>Mod 150</td>
<td>210</td>
<td>250</td>
<td>350</td>
<td>675</td>
</tr>
<tr>
<td>Multistory, steel frame office bldgs.</td>
<td>Sev 100</td>
<td>185</td>
<td>200</td>
<td>275</td>
<td>400</td>
</tr>
<tr>
<td>Wood frame bldgs.</td>
<td>Mod 65</td>
<td>100</td>
<td>130</td>
<td>200</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>Sev 140</td>
<td>195</td>
<td>250</td>
<td>350</td>
<td>690</td>
</tr>
</tbody>
</table>

**SOURCE:** U.S. ARMY FIELD MANUAL "FM 5-26, EMPLOYMENT OF ATOMIC DEMOLITION MUNITIONS (ADM), AUGUST 1971".

**PROTECTION (CASUALTY REDUCTION FACTOR) = \[
\frac{\text{AREA OF SEVERE DAMAGE FOR HIROSHIMA'S WOOD FRAME BUILDINGS}}{\text{AREA OF SEVERE DAMAGE FOR EARTH COVERED SURFACE SHELTERS}} = \frac{690^2}{100^2} = 6.9^2 \approx 50 \text{ FOR A 1 KILOTON SURFACE BURST.}
\]**

SO MOVING TO EARTH COVERED SHELTERS REDUCES CASUALTIES TO 2%, AND THEY ALSO PROVIDE RADIATION SHIELDING. IN ADDITION, THE "FIRESTORM" AND ITS "SOOT NUCLEAR WINTER" FANTASY, WERE DEBUNKED BY GEORGE R. STANBURY, WHO PLANNED THE GERMAN FIRESTORMS; YOU NEEDED 50% IGNITION OF MEDIEVAL WOODEN HOUSES IN HAMBURG TO START A FIRESTORM, WHEREAS THE SIMPLE FIREBALL SHADOWING OF HIGH-RISE MODERN CITY SKYLINES REDUCES THIS TO 5% OR LESS, PREVENTING FIRESTORMS AND CLIMATIC EFFECTS. THIS IS SUPPRESSED BY THE NUCLEAR EXAGGERATIONS BIAS OF JOURNALISTS.

---

### Nuclear Weapons Employment Doctrine and Procedures

**Radius of Vulnerability (emergency risk criterion: 5% combat ineffectiveness)**

**Figure 54. Radii of Vulnerability.**

**CATEGORY PERSONNEL (LL) IN—**

**(Based on Governing Effect)**

Radii listed are distances at which a 5 percent incidence of effect occurs. HOB used is 60W/2 meters.

<table>
<thead>
<tr>
<th>Yield (KT)</th>
<th>Open Foxholes</th>
<th>Open APCs</th>
<th>Open Tanks</th>
<th>Earth Shelter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>700</td>
<td>600</td>
<td>600</td>
<td>500</td>
</tr>
<tr>
<td>1</td>
<td>1200</td>
<td>900</td>
<td>900</td>
<td>800</td>
</tr>
<tr>
<td>10</td>
<td>3200</td>
<td>1300</td>
<td>1300</td>
<td>1250</td>
</tr>
<tr>
<td>20</td>
<td>4000</td>
<td>1500</td>
<td>1450</td>
<td>1400</td>
</tr>
<tr>
<td>100</td>
<td>8000</td>
<td>1900</td>
<td>1800</td>
<td>1800</td>
</tr>
<tr>
<td>200</td>
<td>12000</td>
<td>2000</td>
<td>1900</td>
<td>1900</td>
</tr>
<tr>
<td>300</td>
<td>14000</td>
<td>2100</td>
<td>1950</td>
<td>1950</td>
</tr>
</tbody>
</table>

**Example:** for 300 kt, the protective factor of open foxholes is equal to \((14,000)^2/(2.100)^2 = 44.4\).

<table>
<thead>
<tr>
<th>Yield (KT)</th>
<th>Open Foxholes</th>
<th>Open APCs</th>
<th>Open Tanks</th>
<th>Earth Shelter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>1.36</td>
<td>1.36</td>
<td>1.96</td>
<td>5.44</td>
</tr>
<tr>
<td>1</td>
<td>1.78</td>
<td>1.78</td>
<td>2.25</td>
<td>5.76</td>
</tr>
<tr>
<td>10</td>
<td>6.06</td>
<td>6.06</td>
<td>6.55</td>
<td>12.6</td>
</tr>
<tr>
<td>20</td>
<td>7.11</td>
<td>7.61</td>
<td>8.16</td>
<td>16.0</td>
</tr>
<tr>
<td>100</td>
<td>17.7</td>
<td>19.8</td>
<td>19.8</td>
<td>32.7</td>
</tr>
<tr>
<td>200</td>
<td>36.0</td>
<td>39.9</td>
<td>39.9</td>
<td>64.0</td>
</tr>
<tr>
<td>300</td>
<td>44.4</td>
<td>51.5</td>
<td>51.5</td>
<td>76.6</td>
</tr>
</tbody>
</table>

Calculation of the injury-averting protective factors by simple open foxholes and earth shelters, as a function of weapon yield. Most countermeasures are relatively ineffective against tactical nuclear weapons (due to the predominating neutron radiation effect at 0.1 kt yield), but are extremely effective against strategic nuclear weapons with yields of 100, 200 and 300 kt (protective factors of 44 to 77).

The definition of protective factor used here is the factor by which casualties numbers are reduced.
Intelligence Memorandum
Office of Transnational Issues
30 August 2000

Evidence of Russian Development of New Subkiloton Nuclear Warheads

Since 1995, evidence has accumulated in the open media that the Russian nuclear arsenal includes warheads with yields of 0.1-0.5 kilotons. The evidence is primarily public statements by Russian military officials, United States intelligence reports, and a study by the Carnegie Endowment for International Peace, which concluded that Russia had a 0.15-kiloton weapon in 1995.

A key development was the testimony of Gen. Nikolai Bulavin, former head of Russia's GROM mechanized forces. He stated that a 0.1-kiloton warhead was a possible option for use against small forces. Although this statement does not directly link to a specific type of weapon, it suggests a potential capability.

Other sources include the Congressional Research Service, which noted that Russian military officials have hinted at the development of such warheads. The Central Intelligence Agency has also reported in 1995 that Russia was developing a new generation of nuclear weapons with lower yields.

The development of these weapons could have several implications. It could increase the nuclear threat, as Russia could use them in low-intensity conflicts or to target non-nuclear states. It could also undermine efforts to reduce nuclear stockpiles, as these weapons could be used as a demonstration of Russia's nuclear capability.

Recent statements from senior Russian officials suggest that the country is developing a new generation of nuclear weapons with lower yields. This could have implications for South Asia, where India and Pakistan are developing nuclear capabilities.

The possible diversification of Russia's nuclear arsenal is a concern, as it could increase the risk of nuclear proliferation. The United States and its allies need to continue to monitor these developments and work to prevent any potential misuse of these weapons.

WASHINGTON SCENE...

While it is difficult to assess the full impact of these developments, it is clear that the Russian nuclear arsenal is evolving. The United States and its allies need to continue to monitor these developments and work to prevent any potential misuse of these weapons.
The cross-section for Li-6 T production by 14.1 MeV fusion neutrons is only 0.026, compared to 0.3 for Li-7.

The ripple II nuclear test secret: why lithium-7 is actually better in boosted clean secondaries than lithium-6! For 14.1 Mev neutrons from T+D fusion, lithium-7 has a 0.3 barns cross-section, compared to just 0.026 for lithium-6! Plus, it gives ANOTHER neutron UNLIKE lithium-6.

John H. Nuckolls discovered isentropic compression theory for clean thermonuclear weapons from 1967-62 and he successfully tested 99.9% clean 10 megatons Housatonic on 30 October 1962, using 0.3 kev x-rays (to avoid radiation wall losses) on a non-pusher (pure ablator).
РАЗРАБОТКА ЯДЕРНЫХ БОЕПРИПАСОВ

DEVELOPMENT OF NUCLEAR MUNITIONS

CONTENTS

Chapter 1. Development of Nuclear Munitions

1. Introduction to Nuclear Weapons
2. Nuclear Explosives
3. Nuclear Warheads
4. Nuclear Delivery Systems
5. Nuclear Explosives for Non-Military Applications

Chapter 2. Research and Development of Nuclear Munitions

1. History of Nuclear Munitions Development
2. Nuclear Munitions Research and Development
3. Nuclear Munitions Testing
4. Nuclear Munitions Safety and Security

Chapter 3. Nuclear Munitions Applications

1. Nuclear Munitions in War
2. Nuclear Munitions in Peace
3. Nuclear Munitions in Civilian Applications

Chapter 4. Nuclear Munitions and International Law

1. Nuclear Munitions and the Non-Proliferation Treaty
2. Nuclear Munitions and the Nuclear Non-Proliferation Treaty
3. Nuclear Munitions and the International Atomic Energy Agency

Chapter 5. Nuclear Munitions and the Environment

1. Nuclear Munitions and Environmental Impact
2. Nuclear Munitions and Radioactive Waste
3. Nuclear Munitions and Human Health

Chapter 6. Nuclear Munitions and International Security

1. Nuclear Munitions and Nuclear Deterrance
2. Nuclear Munitions and Nuclear Deterrence
3. Nuclear Munitions and Nuclear Disarmament

Chapter 7. Nuclear Munitions and International Relations

1. Nuclear Munitions and International Relations
2. Nuclear Munitions and International Cooperation
3. Nuclear Munitions and International Law

Chapter 8. Nuclear Munitions and International Law

1. Nuclear Munitions and International Law
2. Nuclear Munitions and International Relations
3. Nuclear Munitions and International Security

Chapter 9. Nuclear Munitions and International Cooperation

1. Nuclear Munitions and International Cooperation
2. Nuclear Munitions and International Law
3. Nuclear Munitions and International Relations

Chapter 10. Nuclear Munitions and International Security

1. Nuclear Munitions and International Security
2. Nuclear Munitions and International Relations
3. Nuclear Munitions and International Law

Chapter 11. Nuclear Munitions and International Cooperation

1. Nuclear Munitions and International Cooperation
2. Nuclear Munitions and International Law
3. Nuclear Munitions and International Relations
Milestones of the VNIIEF Efforts and Achievements

1948 - government resolution issued on April 9 to establish the country's first specialized research and production center (KB-11) for design and manufacturing of jet engines (RB-1).

1948 - KB-11 began preparation for the test fire of the first jet engine.

1949 - KB-11 began development of the first jet engine.

1950 - KB-11 began development of the first jet engine.

1951 - KB-11 began development of the first jet engine.

1952 - KB-11 began development of the first jet engine.

1953 - KB-11 began development of the first jet engine.

1954 - KB-11 began development of the first jet engine.

1955 - KB-11 began development of the first jet engine.

1956 - KB-11 began development of the first jet engine.

1957 - KB-11 began development of the first jet engine.

1958 - KB-11 began development of the first jet engine.

1959 - KB-11 began development of the first jet engine.

1960 - KB-11 began development of the first jet engine.

1961 - KB-11 began development of the first jet engine.

1962 - KB-11 began development of the first jet engine.

1963 - KB-11 began development of the first jet engine.

1964 - KB-11 began development of the first jet engine.

1965 - KB-11 began development of the first jet engine.

1966 - KB-11 began development of the first jet engine.

1967 - KB-11 began development of the first jet engine.

1968 - KB-11 began development of the first jet engine.

1969 - KB-11 began development of the first jet engine.

1970 - KB-11 began development of the first jet engine.

1971 - KB-11 began development of the first jet engine.

1972 - KB-11 began development of the first jet engine.

1973 - KB-11 began development of the first jet engine.

1974 - KB-11 began development of the first jet engine.

1975 - KB-11 began development of the first jet engine.

1976 - KB-11 began development of the first jet engine.

1977 - KB-11 began development of the first jet engine.

1978 - KB-11 began development of the first jet engine.

1979 - KB-11 began development of the first jet engine.

1980 - KB-11 began development of the first jet engine.

1981 - KB-11 began development of the first jet engine.

1982 - KB-11 began development of the first jet engine.

1983 - KB-11 began development of the first jet engine.

1984 - KB-11 began development of the first jet engine.

1985 - KB-11 began development of the first jet engine.

1986 - KB-11 began development of the first jet engine.

1987 - KB-11 began development of the first jet engine.

1988 - KB-11 began development of the first jet engine.

1989 - KB-11 began development of the first jet engine.

1990 - KB-11 began development of the first jet engine.

1991 - KB-11 began development of the first jet engine.

1992 - KB-11 began development of the first jet engine.

1993 - KB-11 began development of the first jet engine.

1994 - KB-11 began development of the first jet engine.

1995 - KB-11 began development of the first jet engine.

1996 - KB-11 began development of the first jet engine.

1997 - KB-11 began development of the first jet engine.

1998 - KB-11 began development of the first jet engine.

1999 - KB-11 began development of the first jet engine.

2000 - KB-11 began development of the first jet engine.

2001 - KB-11 began development of the first jet engine.

2002 - KB-11 began development of the first jet engine.

2003 - KB-11 began development of the first jet engine.

2004 - KB-11 began development of the first jet engine.

2005 - KB-11 began development of the first jet engine.

2006 - KB-11 began development of the first jet engine.

2007 - KB-11 began development of the first jet engine.

2008 - KB-11 began development of the first jet engine.

2009 - KB-11 began development of the first jet engine.

2010 - KB-11 began development of the first jet engine.

2011 - KB-11 began development of the first jet engine.

2012 - KB-11 began development of the first jet engine.

2013 - KB-11 began development of the first jet engine.

2014 - KB-11 began development of the first jet engine.

2015 - KB-11 began development of the first jet engine.

2016 - KB-11 began development of the first jet engine.

2017 - KB-11 began development of the first jet engine.

2018 - KB-11 began development of the first jet engine.

2019 - KB-11 began development of the first jet engine.

2020 - KB-11 began development of the first jet engine.
Specimens of Nuclear Weapons (Exhibits of the VNIIEF Museum)

**Первая атомная бомба СССР**

First A-bomb

The nuclear change was tested at the Semipalatinsk Test Site on August 29, 1949. Yield: up to 20 kt.

---

**Первая водородная бомба**

First H-bomb

The nuclear change was tested at the Semipalatinsk Test Site on August 12, 1953. Yield: up to 600 kt.

---

**Первая артиллерийская бомба**

First nuclear warhead for tactical missile


---

**Первая артиллерийская бомба**

First nuclear warhead for medium-range ballistic missile

Yield: up to 400 kt. The range is up to 1,200 km. In service from 1958-1962.

---

**Термоядерный боевой блок**

Thermonuclear combat unit for the first intercontinental ballistic missile with a multiple reentry warhead


---

**Первая термоядерная боевая часть**

First thermonuclear warhead for intercontinental ballistic missile

Yield: up to 3 Mt. Range: up to 8,000 km. In service in 1960-1966.

---

**Разработки ядерных боеприпасов**

Development of nuclear munitions

---

**Образцы ядерного оружия (музей РАН/ВИНИЭФ)**

---

**Спектры оружия ядерных боеприпасов (музей РАН/ВИНИЭФ)**

---

**Первая термоядерная боевая часть**

For the first intercontinental ballistic missile with a multiple reentry warhead


---

**Первая термоядерная боевая часть**

For intercontinental ballistic missile

Yield: up to 3 Mt. Range: up to 8,000 km. In service in 1960-1966.
Самая мощная в мире экспериментальная водородная бомба

Испытана 30 октября 1961 года на полигоне «Новая Земля» на Павлово-Фоминский плоскогорье. Мощность взрыва более 103 МТ пропилена аммиака.

World’s most powerful experimental H-bomb

Tested to half-yield at the Novaya Zemlya Test Site on October 30, 1961. Estimated yield over 100 MT.

Термоядерный боевой блок для ракеты среднего радиуса действия с разделяющейся головной частью


Thermnuclear combat unit for medium-range missile with a multiple reentry warhead

Total yield: up to 400 kT. Range: up to 5,000 km. In service: 1976-1981. Decommissioned under the INF Treaty.

Разработка ядерных боеприпасов

Development of nuclear munitions

Nuclear weapons activities

The VAWEF specialists have succeeded in the following areas:

- Computer-aided simulation of multivariate nuclear explosion and laser physics problems in a complete closed statement with all leading physical processes taken into account, studies into characteristics of turbulence; it has been for the first time that results of a series of experimental investigations of gravitational turbulent mixing using multiprocessor computer systems;

uclear weapons activities

The VAWEF specialists have succeeded in the following areas:

- Computer-aided simulation of multivariate nuclear explosion and laser physics problems in a complete closed statement with all leading physical processes taken into account, studies into characteristics of turbulence; it has been for the first time that results of a series of experimental investigations of gravitational turbulent mixing using multiprocessor computer systems;

- development of multiprocessor computer systems and up-to-date computer networks;

- Исследование характера турбулентности в воздухе путем численного моделирования работы газовоздушных ударных волн взрывной волны, атмосферных волн и демпфирования ядерных взрывов;

- Исследование характеристик турбулентности в воздухе путем численного моделирования работы газовоздушных ударных волн взрывной волны, атмосферных волн и демпфирования ядерных взрывов;

- Исследование характеристик турбулентности в воздухе путем численного моделирования работы газовоздушных ударных волн взрывной волны, атмосферных волн и демпфирования ядерных взрывов;

- Исследование характеристик турбулентности в воздухе путем численного моделирования работы газовоздушных ударных волн взрывной волны, атмосферных волн и демпфирования ядерных взрывов;

- Исследование характеристик турбулентности в воздухе путем численного моделирования работы газовоздушных ударных волн взрывной волны, атмосферных волн и демпфирования ядерных взрывов;
71-й полигон ВВС и военно-морские учения на Тохокон полигоне с применением атомной бомбы

В 1959-1961 годах в Японии проводились военно-морские учения на Тохокон полигоне, в ходе которых применялась атомная бомба. Взрыв осуществлялся в результате катастрофы, которая привела к разрушению большого количества зданий и сооружений. В результате взрыва был причинен значительный ущерб окружающей среде, а также жертвами стали десятки человек.

1911-1945 гг. - издание без аналогов в мире боевых машин. Великая Отечественная война, на которой использовались атомные бомбы, оказала значительное влияние на ход войны.


В 1952 году в Японии проводились военно-морские учения на Тохокон полигоне, в ходе которых применялась атомная бомба. Взрыв осуществлялся в результате катастрофы, которая привела к разрушению большого количества зданий и сооружений. В результате взрыва был причинен значительный ущерб окружающей среде, а также жертвами стали десятки человек.


В 1952 году в Японии проводились военно-морские учения на Тохокон полигоне, в ходе которых применялась атомная бомба. Взрыв осуществлялся в результате катастрофы, которая привела к разрушению большого количества зданий и сооружений. В результате взрыва был причинен значительный ущерб окружающей среде, а также жертвами стали десятки человек.