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Обучение чтению литературы на английском языке по специальности «Средства поражения и боеприпасы»

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В методических указаниях приведены оригинальные тексты на английском языке по специальности «Средства поражения и боеприпасы», упражнения на развитие навыков чтения и понимания научно-технических текстов, повторение грамматического материала, освоение технической лексики, а также упражнения на развитие навыков устной речи и умения вести беседу по специальности на английском языке

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ПРЕДИСЛОВИЕ

В методических указаниях содержатся оригинальные тексты из специализированных англоязычных изданий, подготовленные для аудиторной и самостоятельной работы студентов, обучающихся по специальности «Средства поражения и боеприпасы» (V–VII семестры).

Пособие состоит из трех разделов, в каждом представлены тексты и упражнения, целью которых является отработка навыков различных видов чтения (просмотрового, поискового, изучающего), упражнения на закрепление вводимого лексического материала, требующегося для понимания и перевода технических текстов, а также творческие упражнения, предназначенные для развития навыков устной речи на английском языке по специальности «Средства поражения и боеприпасы».

UNIT 1
INTRODUCTION TO EXPLOSIVE MATERIALS

Text 1.1
The Basics

Before you read the text, imagine you need to tell your younger brother or sister, who is still at secondary school, what an explosion is. Try to write a short explanation, keeping it as simple as possible. Then read the text and compare it with your written sample.

The fundamental concept behind **explosives** is very simple. At the most basic level, an explosive is just something that burns or decomposes very quickly, producing a lot of heat and gas in a short amount of time.

A typical explosive charge consists of some explosive material, some sort of **detonation** device and, typically, some sort of **housing**. The explosive material undergoes a rapid chemical reaction, either a **combustion** or **decomposition** reaction, when triggered by heat or **shock** energy from the detonator.

In the chemical reaction, **compounds** break down to form various gases. The **reactants** (the original chemical compounds) have a lot of energy stored up as chemical **bonds** between different atoms. When the compound molecules break apart, the products (the resulting gases) may use some of this energy to form new bonds, but not all of it. Most of the "leftover" energy takes the form of extreme heat.

The concentrated gases are under very high pressure, so they **expand** rapidly. The heat speeds up the individual gas particles, boosting the **pressure** even higher. If the gas expands faster than the **speed of sound**, it generates a powerful shock wave. The pressure can

also push pieces of solid material outward at great speed, causing them to hit people or structures with a lot of force.

The **explosion** actually has two phases. The initial **expansion** inflicts most of the damage. It also creates a very low-pressure area around the explosion's origin — the gases are moving outward so rapidly that they suck most of the gas out from the "middle" of the explosion. After the outward **blast**, gases rush back in to the partial vacuum, creating a second, less-destructive inward energy wave.

In **low explosives**, such as the **propellant** in a bullet cartridge, the reaction occurs relatively slowly and the pressure isn't as damaging. The expanding gases only serve to push a small object. **High explosives**, such as C-4 and TNT, expand more rapidly, generating much greater pressure. In a high explosive, the gas pressure is strong enough to destroy structures and injure and kill people. Explosives experts refer to rapid explosive reactions as detonation and slower explosive reactions as **deflagration**.

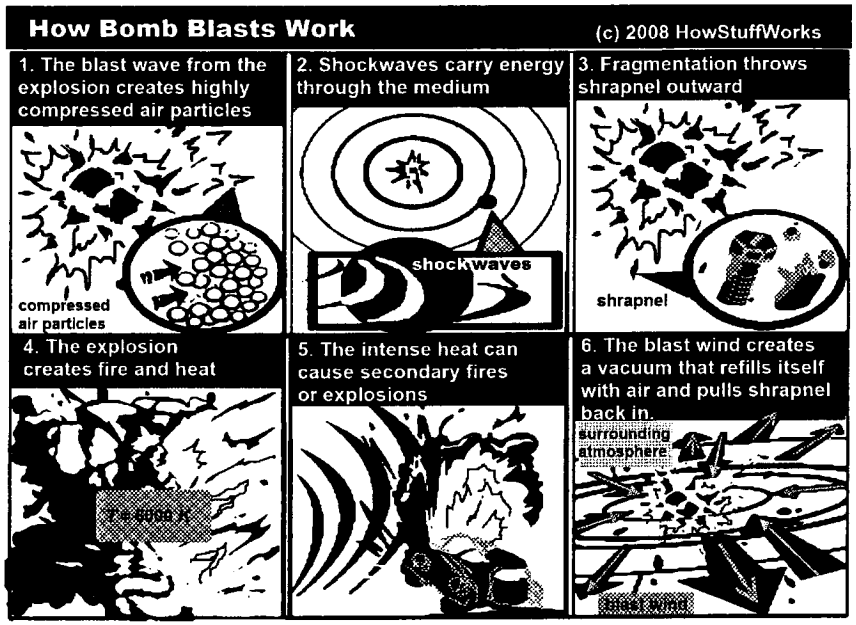
Active vocabulary

blast *n.* [blɑ:st]	bond *n.* [bɔnd]
combustion *n.* [kəm 'bʌstʃən]	compound *n.* ['kɔmpaʊnd]
decomposition *n.* [ˌdi:kɔmpə'zɪʃən]	deflagration *n.* [ˌdɛflə'greɪʃən]
detonation *n.* [ˌdɛtə'neɪʃən]	expand *v.* [ɪk 'spænd]
expansion *n.* [ɪk'spænʃən]	explosion *n.* [ɪk'spləʊʒən]
explosive *adj., n.* [ɪk'spləʊsɪv]	high explosive *n.* ['haɪ ɪk'spləʊsɪv]
housing *n.* ['haʊzɪŋ]	low explosive *n.* ['ləʊ ɪk'spləʊsɪv]
pressure *n.* ['prɛʃə]	product *n.* ['prɔdʌkt]
propellant *n.* [prəʊ'pɛlənt]	reactant *n.* [rɪ'æktənt]
shock *n.* [ʃɔk]	speed of sound *n.* ['spi:d əv 'saʊnd]

Text 1.2
How Bomb Blasts Cause Damage

Look at the picture. Prepare a small written report, describing these events in as much detail as possible, using information from the picture and your personal knowledge. Then read the text and add any

missing information to your report. Note if you have provided extra information not covered in the text.



A bomb is basically some type of **casing** or **shell** that contains explosive material. The casing can be anything from a steel-walled artillery shell to a length of lead pipe that has been sealed shut. It can even be as ordinary as a coffee tin or an automobile. The explosive material inside the shell could be any type of high explosive, be it TNT or C4.

A bomb causes damage in several different ways, depending on the point at which the explosion **impacts**. These different points include the blast wave, shock waves, **fragmentation**, heat and the blast wind.

Blast wave: When a bomb explodes, the area around the explosion becomes overpressurized. This wave will **dissipate** over time and distance and will exist only for a matter of milliseconds. This initial blast wave inflicts the most damage on impact.

Shockwaves: After a blast wave strikes a surface or body, high-velocity shockwaves, or stress waves, will continue to pass through. Shockwaves carry energy through the medium they pass through; they're **supersonic** and transport more energy than sound waves.

Fragmentation: When the bomb explodes, the bomb casing, as well as any additional **shrapnel** (nails, screws or other items included in the bomb), will be violently thrown outward. When these fragments strike buildings and people, they may fragment even further and cause even more damage. This is known as secondary fragmentation.

Fire and heat: The explosion may also create a fireball and high temperatures, which may cause secondary fires or explosions, depending on whether any other fuel sources or **flammable** materials are located near the blast.

Blast wind: At the explosion **site**, a vacuum is created by the rapid outward movement of the blast wave. This vacuum will almost immediately refill itself with the surrounding atmosphere. As this void is refilled, it creates a high-intensity wind that causes fragmented objects, glass and **debris** to be drawn back in toward the source of the explosion.

Active vocabulary

casing *n.* ['keɪsɪŋ]	debris *n.* ['deɪbri:]
dissipate *v.* ['dɪsɪˌpeɪt]	flammable *adj.* ['flæməbəl]
fragmentation *n.* [ˌfrægmɛn'teɪʃən]	impact *n.* ['ɪmpækt], *v.* [ɪm'pækt]
shrapnel *n.* ['ʃræpnl]	shell *n.* [ʃɛl]
supersonic *adj.* [ˌsupə'sɔnɪk]	site *n.* [saɪt]

Exercise 1
True or false?

1. Explosives are materials that are capable of decomposing rapidly.
2. Explosive reactions usually start spontaneously, without any external impulse.
3. When the chemical bonds in a molecule of explosive break, most of this chemical energy turns into heat.
4. The majority of products in an explosive reaction are compressed gases.
5. A shock wave is supersonic.

6. The expansion of the gaseous products creates a high-pressure area in the center of the blast wave.
7. Deflagration is the fastest explosive reaction possible.
8. A sound wave transports as much energy as a shockwave.
9. Secondary fragmentation occurs when fragments of the bomb casing break up upon impact.
10. After the explosion, there will most likely be some debris where the bomb used to sit.

Exercise 2
Answer the questions.

1. What is an explosive?
2. What does a detonation device do to the explosive?
3. What is the difference between reactants and products of a chemical reaction?
4. Where does the heat produced by an explosion come from?
5. When is a shock wave generated?
6. What is the difference between high and low explosives for the end user?
7. What are the factors that cause blast damage?
8. What factor causes the most damage?
9. What does 'secondary fragmentation' mean?
10. What is the source of the 'blast wind'?

Exercise 3
Put these events in order:

• shock waves are generated in surrounding structures
• high-pressure gaseous products rapidly expand
• compound molecules of the explosive break up
• a detonation wave starts moving quickly through the charge
• a detonator triggers the decomposition reaction in the explosive charge

Vocabulary practice

Exercise 1
Match the words and their definitions:

propellant	combustion that rapidly propagates through a gas or an explosive, driven by the transfer of heat
low explosives	a supersonic exothermic reaction front accelerating through a medium
detonation	explosive materials that detonate
explosion	something that propels or provides thrust
high explosives	mostly solid combustible materials that decompose rapidly, but do not normally explode
deflagration	a sudden, often violent release of energy

Exercise 2
Use the correct form of the words from the box to fill the gaps.

product / expand / blast / shock / impact / compound

1. The scientists studied the effect of the ... wave upon vehicles.
2. A molecule of a ... is made when two or more different atoms form a chemical bond.
3. When there is an explosion underwater, the gas bubble ... rapidly until it either reaches the surface or until the pressure inside it becomes smaller than the pressure of the water around it.
4. If an asteroid hits a planet, the energy that creates an explosion comes from its speed on ....
5. After an explosion, when reaction ... come in contact with atmospheric oxygen, full combustion of the carbon occurs.
6. The explosive did not respond to ... loading.

Exercise 3
Translate from Russian into English.

1. Опасность может представлять не только дробление оболочки взрывного устройства, но и перенесение обломков с места взрыва волной давления в воздухе.

2. По мере движения ударной волны ее энергия рассеивается и она превращается в звуковую волну.
3. При разложении какого-либо соединения разрушаются химические связи между составляющими его атомами.
4. Следует осторожно обращаться с горючими веществами.
5. При сгорании вещества расширение продуктов реакции происходит намного медленнее, чем в том случае, если бы оно взорвалось.
6. Скорость выше скорости звука называется сверхзвуковой.

UNIT 2
EXPLOSIVE REACTIONS

Work in groups.Choose one of the topics (texts 2.1–2.4). In Russian, make a list of words and expressions you might need when speaking on this topic. Read the text under the heading of your choice and try to find the English equivalents to the expressions on your list.

Text 2.1
Explosive Chemistry

Chemical reactions that release energy are known as **exothermic** reactions. If the reaction proceeds slowly, this energy will be dissipated and there will be few noticeable effects other than an increase in temperature. On the other hand, if the reaction proceeds very rapidly, a great quantity of energy can be deposited into a relatively small volume. This is what distinguishes chemical explosions from other exothermic reactions. Chemical explosions must also provide a means to transfer the energy into mechanical work, usually through expanding gaseous reaction products.

Since most of the energy release comes from oxidation reactions, the amount of oxygen available is a critical factor. If there is insufficient oxygen to react with the available carbon and hydrogen, the explosive is considered to be oxygen deficient. A quantitative measure of this is called the **oxygen balance (OB)**. As a general rule, the oxygen balance should be near zero to get the maximum amount of energy release. However, TNT is an example of a relatively powerful explosive that is oxygen deficient.

Some explosives are mixtures of chemicals that do not react and are known as **composites**. A common example is composite B-3. It has an

oxygen balance of –40.5%. Nevertheless, composite explosives generally have oxygen balances that are closer to the ideal case of zero.

Text 2.2
Categories of Explosives

If the energy release is extremely rapid, the explosive reaction will be characterized by a very sharp (short duration, high pressure) shock wave and large fragment velocities. This rapidity of reaction is called the brisance, or shattering potential of the explosion. It is a property of the material and the degree of confinement (if an explosion is restrained initially, it can build up a large pressure and achieve the same effect). Brisance is used as a method of classification of explosive materials.

Explosive materials which are **brisant** are known as high explosives. They are used solely for their destructive power. In contrast, there are some materials that react more slowly, known as low explosives. They release a large amount of energy, but due to the relatively slow rate of reaction they are more useful as propellants where the expansion of the gases is used to move **projectiles**. An example would be gunpowder, which although quite energetic, is classified as a low explosive and used primarily as a propellant.

Text 2.3
Initiation of the Explosive Reaction

Although the oxidation reactions that release energy in explosive reactions are energetically possible, they do not occur spontaneously. There is usually some small barrier that must be overcome by the input of energy that will start the reaction, which then will continue by itself until completion. The input of energy to overcome the barrier is known as **initiation**. Sometimes only mechanical force is required. In other situations, it requires heat like from a match or electricity. The ease of which an explosive may be detonated is its **sensitivity**.

For safety considerations, explosive materials are separated into three categories: those which will detonate easily, called sensitive or **primary** explosives; those which require slightly more energy to detonate, called **intermediate** explosives; and those which require relatively more energy to detonate, called insensitive or **secondary** explosives. The terms refer to how the different materials will be physically configured in a working explosive device.

Primary explosive materials are used to detonate the entire explosive device. That is, they are usually connected to some external device which starts the detonation. In this capacity, the primary explosive is called the **fuse**. The energy from the explosive detonation of the primary material is used to set off the **booster** which in turn sets off the main charge which is made up of secondary explosive (relatively insensitive material).

Text 2.4
The Explosive Train

The combination of a small quantity of sensitive material used to set off a large amount of secondary material is known as the **explosive train**. It is called a train because the events occur in sequence. The main charge must be made up of insensitive material for the safety of those handling the device. In practice the fuse is rarely stored with the device until it is required for use. In this manner the device remains relatively safe, since it is only made up of secondary (insensitive) material and cannot be detonated.

Once the fuse is installed, the entire device requires great care in handling to prevent inadvertent detonation. Often the device is configured so that the explosive train must pass through a small physical port that connects the fuse to the main charge. This port can be blocked until the device will be used. As an example, the port may consist of two rotating plates with off-center holes. When the plates are aligned, the two holes will line up and permit operation. This is called **arming** the device. Otherwise the holes will not be aligned and the device will be safe. The mechanism with plates is called the **safing and arming device.** Other configurations exist, but they all accomplish the same function: to prevent inadvertent detonation and permit detonation when authorized.

Active vocabulary

arming *n.* ['ɑ:mɪŋ]	booster *n.* ['bu:stə]
brisance *n.* ['bri:zəns]	brisant *adj.* [brɪ'zɑnt]

composite *n.* ['kɔmpəzɪt]	degree of confinement *n.* [dɪ'gri: əv kən'faɪnmənt]
exothermic *adj.* [ˌɛksəʊ'θɜ:mɪk]	explosive train *n.* [ɪk'spləʊsɪv 'treɪn]
fuse *n.* [fju:z]	initiation *n.* [ɪnɪʃɪ 'eɪʃən]
intermediate *adj.* [ˌɪntə'mi:dɪɪt]	mechanical force *n.* [mɪ'kænɪkəl 'fɔ:s]
oxygen balance *n.* ['ɔksɪdʒən 'bæləns]	primary *adj.* ['praɪmərɪ]
projectile *n.* [prə'dʒɛktaɪl]	safing and arming device *n.* ['seɪfɪŋ ənd 'ɑ:mɪŋ dɪ'vaɪs]
secondary *adj.* ['sɛkəndərɪ]	sensitivity *n.* [ˌsɛnsɪ'tɪvɪtɪ]

Exercise 1
True or false?

1. Slow exothermic reactions usually have very noticeable effects.
2. In an explosive reaction there is a lot of energy released into very little space.
3. An oxygen rich explosive has more oxygen than required to react with the carbon and nitrogen.
4. TNT is an example of a very weak oxygen deficient explosive.
5. Composite explosives are popular because their components react with each other and create the perfect mix.
6. The casing of an explosive device has no influence on the power of the explosion.
7. High explosives are used to demolish buildings because of their low brisance.
8. Some explosives detonate easier than others.
9. Primary explosives are widely used as fuses.
10. There are special devices that prevent unwanted detonation of bombs and munitions.

Exercise 2
Answer the questions.

1. How do you call those chemical reactions that release energy?
2. If such a reaction proceeds slowly, will there be an explosion and why?

3. What are all the requirements for an exothermic reaction to become explosive?
4. How is the transfer of energy into mechanical work usually accomplished?
5. Why is the amount of oxygen available in the explosive so important?
6. What should the oxygen balance be to get the maximum energy release?
7. What is one of the ways to obtain that perfect oxygen balance?
8. What does 'brisance' mean?
9. What are low explosives generally used for?
10. How are explosive materials classified according to sensitivity?
11. What is 'the explosive train'?
12. Why is the fuse usually stored away from the explosive device?

Exercise 3
Look at Table 1; imagine you need to design an explosive device and have to choose explosive materials for this. Describe what explosives you are going to use, in what parts of your device and why.

Table 1. Common explosives and their uses.

Primary H.E. (detonators)	Intermediate H.E. (boosters)	Secondary H.E. (main charges)
Mercury fulminate ['mɜ:kjʊrɪ 'fʌlmɪˌneɪt; 'fʊl-]	Tetrytol ['tɛtrɪˌtɔl]	RDX
Lead azide [lɛd 'eɪzaɪd]	PETN	Comp-A,B,C
Lead styphnate [lɛd 'sti:fˌneɪt]	Tetryl ['tɛtrɪl]	Ammonium Picrate [ə'məʊnɪəm 'pɪkreɪt]
Tetrazene ['tɛtrəˌzi:n]	TNT	HMX
DDNP (diazodinitrophenol) [daɪˌæzəʊ daɪˌnaɪtrə 'fi:nɔl]		C-4

Vocabulary practice

Exercise 1
Match the words and their definitions:

oxygen balance	an explosive that is extremely sensitive to stimuli such as impact, friction, heat
primary explosive	a large-amplitude compression wave, as that produced by an explosion or by supersonic motion of a body in a medium
shock wave	the beginning of the deflagration or detonation of the explosive
initiation	the degree to which an explosive can be initiated by impact, heat, or friction
brisance	an expression that is used to indicate the degree to which an explosive can be oxidized
sensitivity	a measure of the rapidity with which an explosive develops its maximum pressure

Exercise 2
Use the words from the box to fill the gaps.

train / secondary / projectile / fuse / confinement / composite

1. The smaller size of the charge is compensated for by higher explosive power of … B.
2. The basic high explosive …. consists of the detonator, booster, and main charge.
3. A ... is an object intended to be or having been fired from a weapon.
4. This is a type of ... designed to detonate a bomb above ground level.
5. Thick steel cylinders were employed to simulate the maximum degree of ... solid explosives would encounter in practical applications.
6. A ... explosive is less sensitive than a primary explosive.

Exercise 3
Translate from Russian into English.

1. Гремучая ртуть детонирует от приложения механической силы.
2. Бризантные ВВ, такие, как октоген и гексоген, обычно употребляются для изготовления основного заряда.
3. Ракетное топливо — это метательное ВВ.
4. Применение тетразена в производстве детонаторов вызвало заболевания легких у рабочих.
5. Взрыв — это быстро протекающая реакция с выделением теплоты и быстрым же расширением продуктов реакции.
6. Предохранительное устройство в конструкции снаряда предотвратит несчастные случаи на складе.

UNIT 3
BOMBS FOR BEGINNERS

Text 3.1
Types of Bombs

Hold a micro-conference at class: let every student choose a bomb type (or several) and describe it in brief, using material from the text and personal knowledge. Have other students ask questions for further information.

An **aerial** bomb [bɔm], in modern military language, is a kind of **ammunition** usually designed to be dropped from an airplane. It consists of an explosive filler enclosed in a **casing**. Bombs are generally classified according to the ratio of explosive material to total weight. The principal classes are **general-purpose** (GP), **fragmentation**, **penetration** and **cluster bombs**.

Approximately 50-percent of the **General Purpose [GP]** bomb's weight is explosive materials. These bombs usually weigh between 500 and 2,000 pounds and produce a combination of blast and fragmentation effects. The approximately one-half-inch-thick casing creates a fragmentation effect at the moment of detonation, and the 50-percent explosive filer causes considerable damage from blast effect.

Only ten to twenty percent of a **fragmentation bomb's** weight is explosive material; its heavy casing breaks into predictably sized pieces. The fragments, which travel at high velocities, are the primary cause of damage.

Penetration bombs have between twenty-five and thirty percent explosive filler. The casings are designed to penetrate hardened targets such as bunkers before the explosives detonate. Penetration is achieved

by either kinetic energy of the entire projectile or the effects of a **shaped charge**.

Cluster bombs carry many **submunitions** — such as grenades, mines, or small bombs — in a container designed to spread the submunitions over a relatively large area.

Other types of bombs are:

Chemical Bombs

contain smoke-producing agents or other chemicals. Such a bomb usually has a small explosive charge to shatter the case, allowing the contents to escape.

Demolition Bombs

are large, thin-cased bombs filled with such explosives as TNT or RDX. They demolish large buildings by the blast effect of their explosions.

Depth Bombs

are designed to be dropped in the water to destroy submarines.

Incendiary Bombs

contain material such as magnesium or jellied gasoline (napalm) that burns fiercely. Such fires are hard to put out. Thousands of small incendiary bombs were dropped on Japanese cities in World War II to start fires.

Nuclear Bombs

produce blast, heat, and radiation through nuclear fission or fusion.

Active vocabulary

aerial *adj.* ['eərɪəl]	ammunition *n.* [ˌæmjʊ'nɪʃən]
casing *n.* ['keɪsɪŋ]	chemical (bomb) *adj.* ['kemɪkəl]
cluster (bomb) *noun adjunct* ['klʌstə]	demolition (bomb) *noun adjunct* [ˌ demə'lɪʃən; di:-]
depth (bomb) *noun adjunct* [depθ]	fragmentation (bomb) *noun adjunct* [ˌfrægmen'teɪʃən]
General Purpose (bomb) *noun adjunct* ['dʒenərəl 'pɜ:pəs]	incendiary (bomb) *adj.* [ɪn'sendɪərɪ]
kinetic *adj.* [kɪ'netɪk]	nuclear (bomb) *adj.* ['nju:klɪə]

penetration *n.* [ˌpɛnɪ'treɪʃən]	ratio *n.* ['reɪʃɪəʊ]
shaped charge *n.* ['ʃeɪpt 'tʃɑ:dʒ]	submunition *n.* [ˌsʌbmjʊ'nɪʃən]

Text 3.2
Anatomy of a Bomb

Skim through the text and make a diagram that describes all the options a designer has when creating a new bomb.

The best **circular error probable (CEP)** free-fall bombs can achieve (even using a **bombsight** specifically designed for high-altitude precision bombing) is 447 feet, while for guided bombs the CEP is only 23 feet. However, not every new bomb is a guided bomb these days because the matter of cost is very important, so designers still create a lot of cheaper free-fall bombs.

Free-fall bombs have three sections. The bomb body is the casing containing the explosive material. The fuze section can be located in the nose and/or the rear of the bomb and determines the timing of the explosion. The tail section, or **fins**, determines how the bomb flies through the air. Desired weapons effects are achieved by selecting a particular combination of bomb body, fuzing, and tail section.

Bomb Bodies

Bomb bodies vary in size, weight, and thickness of casing. GP bombs have a thinner case and more explosive filler than penetrating bombs, whereas cluster bombs generally come in **dispensers** that open to release **bomblets** at predetermined altitudes. The bomb body casing (except for cluster munitions) houses the explosive filler.

Fuzes

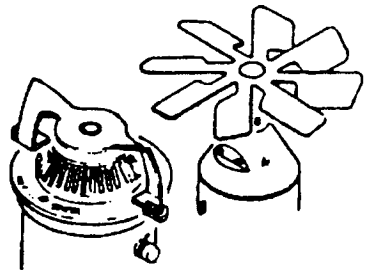
A fuze initiates bomb detonation at a predetermined time and under the desired circumstances. Fuzes are located in the nose or tail of the munition, or both. They are armed by one, or a combination, of the following methods:

• The **arming vane**, a small propeller, is rotated by airflow after weapon release. A specified number of rotations arms the fuse.

• The **arming pin** is ejected or withdrawn by a **spring** action releasing the arming mechanism and allowing the fuze to arm.

• The **inertia fuze** is armed by abrupt changes in the velocity of the bomb caused by the deployment of stabilizing devices.

• The electric fuse is armed by a **time-delay circuit** powered by a thermal battery activated by extraction of the **arming lanyard** upon bomb release.



Arming vane assemblies

Different effects are obtained by mating different bombs to different fuzes.

An **impact fuze** is designed to function on or after impact. **Detonation upon impact** is selected for targets such as supply dumps when the main destructive energy desired is blast. For a building, a **delayed detonation** might be selected so the bomb can penetrate several floors before exploding.

A **proximity fuze** contains a miniature doppler radar set that senses height above the ground. When the explosion occurs above the ground, most of the destructive effect is caused by the bomb casing fragments. Proximity-fuzed bombs are used against targets such as troops in **trenches**, radars, trucks, and other vehicles.

In a **time fuze**, the delay is normally initiated at bomb release rather than on impact. The timing element is a mechanical or electrical device.

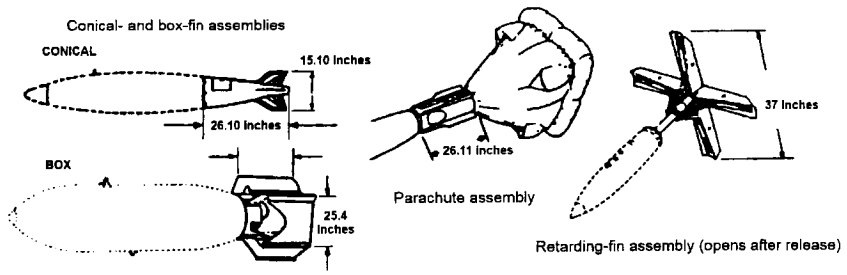
A **hydrostatic fuze** is employed in depth bombs used for underwater demolition work.

Stabilizing Devices

Bombs are stabilized in flight by either fin or parachute assemblies that help them to land nose-down. Two common types of fin assemblies are the conical- and box-fin assemblies. The conical fin assembly allows the bomb to exhibit the best effects of low drag and stabilization after release. The retarding-fin assembly is used by the US for most of its general-purpose bombs.

Two types of high-drag retarders were used in Desert Storm. The first was the air-inflatable retarder tail assembly containing a **ballute** (the term is derived from a combination of the words *balloon* and *parachute*) device. The second type of retarding fin was the Snakeye, which had four metal vanes that opened into the windstream. These

high-drag retarder tail assemblies were used to reduce the chance of an aircraft being damaged by its own bomb fragments.



Active vocabulary

arming lanyard *n.* ['lænjəd]	arming pin *n.* [pɪn]
arming vane *n.* [veɪn]	ballute *n.* [bə'lu:t]
bomblet *n.* ['bɔmlɪt]	bombsight *n.* ['bɔm,saɪt]
circular error probable (CEP) *n.* ['sɜ:kjʊlə 'erə 'prɔbəbəl]	delayed detonation *n.* [dɪ'leɪd]
detonation upon impact *n.*	dispenser *n.* [dɪ'spensə]
fin *n.* [fɪn]	fuze *n.* [fju:z]
hydrostatic fuze *n.* [,haɪdrəʊ'stætɪk]	impact fuze *n.*
inertia fuze *n.* [ɪn'ɜ:ʃə; -ʃɪə]	proximity fuze *n.* [prɔk'sɪmɪtɪ]
spring *n.* [sprɪŋ]	time fuze *n.*
time-delay circuit *n.* ['taɪm dɪ'leɪ 'sɜ:kɪt]	trench *n.* [trentʃ]

Exercise 1
True or false?

1. There are no bombs that produce considerable blast and fragmentation effects simultaneously.
2. A fragmentation bomb has no blast effect at all.
3. Kinetic energy of a penetration bomb helps it to do its job.
4. Cluster bombs are containers with many smaller bombs inside.
5. Depth bombs are bombs that detonate deep in the ground.

6. Some bombs have a fuse situated in the rear.
7. One has to rotate the arming vane by hand in order to arm some bomb fuses.
8. There are no electrical devices in any free-fall bomb.
9. If bombs had no fins, it would be very difficult to make them land nose-down.
10. One type of air-inflatable retarder tail assembly used in the USA is called Snakeye.

Exercise 2
Answer the questions.

1. How are bombs generally classified?
2. Why does a fragmentation bomb have so little explosive inside?
3. What are the basic elements of a bomb?
4. How do cluster bombs differ from all the other types in terms of casing?
5. What is the purpose of a fuze?
6. How is safety maintained when deploying bombs?
7. Name some of the popular ways of arming a bomb fuse.
8. What is the main purpose for selecting a delayed detonation mode when using an impact fuse?
9. How are bombs stabilised in flight?
10. What is the biggest advantage of guided bombs?

Exercise 3
Look at the following two pages, featuring pictures of bombs used in the USA and designer notes that contain a lot of various information; choose two or more bombs. Speak about what they have in common and how they differ. Consider:

- bomb type
- mass
- shape of the body
- stabilizer type
- intended use
- etc

Bombs used in the USA

MK-36 500 lb Destructor mine

BSU-49 500 lb "Baloot"

BSU-50 2000 lb "Baloot"

MK-82 500 lb Snakeye

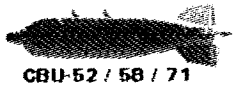
MK-82 500 lb LDGP

MK-88 2000 lb LDGP

BLU-107/B Durandal

BLU-109/B

Mk-20 ROCKEYE



CBU-52 / 58 / 71

CBU-87 / 89 / 97

BL-755

Designer Notes

The CBU-87 is a 1,000-pound, Combined Effects Munition (CEM) for attacking soft target areas with 202 detonating bomblets, effective against armor, personnel and material. Each bomblet contains a shaped charge, scored steel casing and a zirconium ring for anti-armor, fragmentation and incendiary capability.

The designation "BLU" stands for Bomb Live Unit, as opposed to "BDU" (Bomb Dummy Units) used for practice.

The MK-82 is a free-fall, nonguided general purpose [GP] 500-pound bomb.

MK-20 Rockeye is an antiarmor cluster bomb consisting of three components: the MK-7 dispenser, the 339 mechanical fuse, and 247 separate MK-118 bomblets. Each bomblet explodes into a copper slug that can fly 800 feet and penetrate 7.5 inches of armor.

The CBU-52, loaded with 220 antimaterial, antipersonnel bomblets, weighs 785 pounds and can be used with a variety of proximity fuzes.

All MK-80 series bombs are similar in construction. MK-80 series bombs are cylindrical in shape and are equipped with conical fins or retarders for external high-speed carriage. They are fitted for both nose and tail fuzes to ensure reliability and produce effects of blast, cratering, or fragmentation.

DMGB Dual Mode Guided Bomb

LDGP Low Drag General Purpose (unguided aerial bombs)

CBU Cluster Bomb Unit

Destructor Mines are general purpose low-drag bombs converted to mines. For example, with the MK 75 Modification Kit installed, a MK 82 bomb (500 pounds) becomes a MK 36 DST. They can be deployed by air, either at sea as bottom mines or on land as land mines.

The BLU-109/B is a hardened penetration bomb. It is intended to smash through concrete shelters and other hardened structures before exploding.

BSU-49/B for use with the Mk 82 227 kg (500 lb) BSU-50/B for use with the Mk 84 907 kg (2,000 lb) bomb. The Ballute bomb retard system was developed to be a reliable and safe retard system for Mk 82 and Mk 84 general purpose bombs. It is a new type of air-inflatable retard system (called a Ballute) in a container shaped like a conventional bomb tail unit.

The 272kg (600lb) BL-755 comprises a finned casing containing 147 High Explosive Anti Tank (HEAT) bomblets packed in seven sections of 21 rounds each.

BLU-107 Durandal weapons are purpose-built for creating craters in concrete, primarily runways. The weapon deploys a parachute to stabilize it.

Vocabulary practice

Exercise 1
Match the words and their definitions:

shaped charge	a fuse which can be arranged to ignite the charge at a certain interval after being ignited itself
impact fuze	a bomb with only 10 to 20 per cent explosive and the remainder consisting of casings designed to break into many small high-velocity fragments
ballute	an explosive charge shaped to focus the effect of the explosive's energy
fragmentation bomb	any munition that, to perform its task, separates from a parent munition
submunition	an inflatable device that provides a large drag area to slow a vehicle entering the atmosphere
time fuze	a fuse that detonates upon striking an object

Exercise 2
Use the correct form of the words from the box to fill the gaps.

time-delay / slug / inertia / fins / ammunition / aerial

1. "Ammo" is an informal short form of "...".
2. When the bomb hits the wall, a ... circuit is activated to make the bomb detonate in several seconds.
3. Depending on the angle, a shaped charge can produce jets or ....
4. When an impact fuze proves to be unreliable, an ... fuze is used instead.
5. The "Snakeye" bomb ... assembly is used with low-drag general purpose bombs to retard, or slow, their fall.
6. Bombing is an integral part of ... warfare.

Exercise 3
Translate from Russian into English.

1. Установка взрывателя на мгновенное действие позволяет осуществить осколочное поражение цели.
2. Бомбовая кассета в кассетной бомбе несет в себе множество боевых элементов.
3. Без применения прицела даже отличный пилот не сможет обеспечить требуемое круговое рассеяние.
4. Бетонобойная бомба обычно требует установки взрывателя на замедленное действие, поскольку вначале главную роль играет ее кинетическая энергия.
5. Атомная бомба не предназначена для борьбы с пехотой в окопах.
6. Каково обычно отношение диаметра к длине для артиллерийского снаряда?

SUPPLEMENTAL MATERIAL FOR UNITS 1 AND 2

A. Case study: Composition 4

Work in groups. Let the teacher assign two or three paragraphs of text to each group. Read your part of the text and decide on a heading for each paragraph. Prepare a short talk telling your classmates about the facts that you have learned from your portion of the text. Use a dictionary if needed.

1. A polymer-bonded explosive, also called PBX or plastic-bonded explosive, is an explosive material in which explosive powder is bound together in a matrix using small quantities (typically 5–10 % by weight) of a synthetic polymer ("plastic"). Note that despite the word "plastic", polymer-bonded explosives are not generally hand malleable after **curing**, and hence are not a form of plastic explosive.

Speaking of plastic explosives, C-4, or composition 4, is one of these. It is a high explosive designed for military use. Its ingredients are listed in Table 2.

2. The basic idea of plastic explosives is to combine explosive chemicals with a **plastic binder** material. The binder has two important jobs. First of all, it coats the explosive material, so it's less sensitive to shock and heat. This makes it relatively safe to handle the explosive. It also makes the explosive material highly **malleable**. You can **mold** it into different shapes to change the direction of the explosion.

Table 2. C-4 Ingredients.

Compound	%
RDX ($C_3H_6N_6O_6$, cyclotrimethylene-trinitramine) [ˌsaɪklətraɪˈmɛθəˌliːn traɪˌnaɪtrəˈmiːn]	91
Dioctyl sebacate [daɪˈɔktɪl ˈsɛbəˌkeɪt]	5.3
Polyisobutylene [ˌpɔlɪˌaɪsəˈbjuːtɪˌliːn]	2.1
Motor oil	1.6

3. The explosive material in C-4 is **RDX** (which stands for "royal demolition explosive" or "research development explosive"). The additive material is made up of polyisobutylene, the binder, and dioctyl sebacate, the **plasticizer** (the element that makes the material malleable). It also contains a small amount of motor oil and a tiny amount of a special organic compound that dogs can detect, which functions as a chemical marker for security forces.

4. To make C-4 blocks, explosives manufacturers take RDX in powder form and mix it with water. They then add the binder material, dissolved in a **solvent**, and mix the materials. They remove the solvent through distillation, and remove the water through drying and filtering. The result is a relatively stable, solid explosive with a consistency similar to modelling clay.

5. Just as with other explosives, you need to apply some energy to C-4 to kick off the chemical reaction. Because of the **stabilizer** elements, it takes a considerable shock to set off this reaction; lighting the C-4 with a match will just make it burn slowly, like a piece of wood (in Vietnam, soldiers actually burned C-4 as an improvised cooking fire). Even shooting the explosive with a **rifle** won't trigger the reaction. Only a detonator, or **blasting cap** will do the job properly.

6. When the chemical reaction begins, the C-4 decomposes to release a variety of gases (notably, nitrogen and carbon oxides). The gases initially expand at about 26 400 feet per second (8050 meters per second), applying a huge amount of force to everything in the surrounding area. At this expansion rate, it is totally impossible to

outrun the explosion like they do in dozens of action movies. To the observer, the explosion is nearly instantaneous — one second, everything's normal, and the next it's totally destroyed.

7. Less than a pound of C-4 could potentially kill several people, and several military issue M112 blocks of C-4, weighing about 1.25 pounds (half a kilogram) each, could potentially demolish a truck. Demolition experts typically use a good amount of C-4 in order to do a job properly. To take out one 8-inch (20.3-centimeter) square steel beam, for example, they would probably use 8 to 10 pounds (3.6 to 4.5 kilograms) of C-4.

8. People apply C-4's explosive power toward all kinds of destruction. One common application is military demolition — soldiers pack it into cracks and crevices to **blow up** heavy walls. It has also been widely used as an anti-personnel weapon, in battle and in terrorist attacks. In Vietnam, for example, soldiers used a number of C-4-based bombs and grenades. One notable weapon, the claymore mine, consisted of a C-4 block with several embedded ball bearings. When the C-4 was detonated, the ball bearings became deadly flying shrapnel (this sort of weapon was also featured in the movie *Swordfish*).

9. Unfortunately, C-4 will keep making headlines for years to come. Because of its stability and sheer destructive power, C-4 has attracted the attention of terrorists and guerilla fighters all over the world. A small amount of C-4 can do a lot of damage, and it's fairly easy to smuggle the explosive past light security forces. The U.S. military is the primary manufacturer of C-4, and it tightly guards its supply, but there are a number of other sources for similar explosive material (including Iran, which has a history of conflict with the United States). As long as it is readily accessible, C-4 will continue to be a primary weapon in the terrorist arsenal.

Active vocabulary

blasting cap *n.* ['blɑ:stɪŋ 'kæp]	blow up *v.* ['bləʊ 'ʌp]
cure *v.* [kjʊə]	malleable *adj.* ['mælɪəbəl]
mold *v.* [məʊld]	plastic binder *n.* ['plæstɪk 'baɪndə]
plasticizer *n.* ['plæstɪˌsaɪzə]	RDX *n.*

rifle *n.* ['raɪfəl]	solvent *n.* ['sɔlvənt]
stabilizer *n.* ['steɪbɪˌlaɪzə]	

Vocabulary practice

Exercise 1
Match the words and their definitions:

blasting cap	an additive that makes an explosive less sensitive to shock and heat
plasticizer	a liquid that dissolves other materials
stabilizer	an explosive nitroamine widely used in military and industrial applications, also known as cyclonite, hexogen and T4
solvent	an additive that coats the grains of an explosive material and holds them together
RDX	a small sensitive primary explosive device generally used to detonate a larger explosive charge
binder	an additive that increases the plasticity of the material to which it is added

Exercise 2
Use the correct form of words from the box to fill the gaps.

stabilizer / rifle / mold / malleable / cure / blow up

1. Not every polymer-bonded explosive is hand ... .
2. The soldiers used C-4 to ... the bridge.
3. A composition containing styrene monomer forms an excellent, non-brittle plastic binder for explosives when ... .

4. The figure shows the ... explosive charge after the explosive has been put into the shaping apparatus.
5. As a soldier he would spend hours ironing his uniform, shining his boots and polishing his ... .
6. At present no ... is known for Tetrytol.

Exercise 3
Translate from Russian into English. Use a dictionary if needed.

1. Церезин — распространенный флегматизатор.
2. Заряд ВВ на основе гексогена с полимерным связующим можно подвергать механической обработке.
3. Без капсюля-детонатора мы не сможем подорвать мост.
4. После отверждения этот состав уже не будет таким податливым.
5. Можешь очистить свое ружье от ржавчины этим растворителем.
6. Сколько зарядов отливают на этой фабрике за день?

B. Project work: How to calculate explosive characteristics

Put your engineering skills to test: for an explosive of your choice, using the following guide and reference material, find its oxygen balance, balance its combustion and determine its heat of explosion. Present the result of your calculations to the class.

1.

Since most of the energy release comes from oxidation reactions, the amount of oxygen ['ɔksɪdʒən] available is a critical factor. If there is insufficient oxygen to react with the available carbon and hydrogen ['haɪdrədʒən], the explosive is considered to be oxygen deficient. The converse is considered oxygen rich. A quantitative measure of this is called the oxygen balance, defined as:

$$OB = -(100\ \%)MW(O)/MW(\text{explosive})\ [2C + H/2 + M - O]$$

where:
C, H, M & O are the number of moles of carbon, hydrogen, metal and

oxygen in the balanced reaction and MW is the molecular weight of oxygen (= 16 g/mol) or the explosive.

Example: find the oxygen balance for TNT.
$OB = -(100\ \%)(16/227)[2(7) + 5/2 - 6] = -72\ \%$

2.

Most chemical explosions involve a limited set of simple reactions, all of which involve oxidation (reaction with oxygen). A relatively easy way to balance chemical explosive equations is to assume that the following partial reactions take place to their maximum extent (meaning one of the reactants is totally consumed) and in order of precedence, according to Table 3.

Table 3. Priorities of explosive reactions.

Priority	Reaction (to completion)
1	Metal + O = (*give*; *form*; *yield*) Metallic Oxide (ex: ZnO ['zɪŋk 'ɔksaɪd]or PbO ['lɛd 'ɔksaɪd])
2	C + O = CO (*carbon oxide* ['kɑ:bən 'ɔksaɪd], gas)
3	2H + O = H_2O (water, gas)
4	CO + O = CO_2 (*carbon dioxide* ['kɑ:bən daɪ'ɔksaɪd] , gas) (The CO comes from reaction (2))
5	Excess O, H & N = O_2, N_2, & H_2 (*molecular oxygen* etc., gases)

Example: balance the combustion of TNT: $C_7H_5N_3O_6$.
No metals, so *start with* priority 2:
6C + 6O = 6CO, leaving 1C, 5H, 3N;
No oxygen left, *skip* priorities 3 and 4.
Lastly, the gases combine:
3N = 3/2 N_2
5H = 5/2 H_2, leaving 1 C not consumed.
Overall:
$C_7H_5N_3O_6 + 3O_2 = 6CO + 5/2\ H_2 + 3/2\ N_2 + C$.

3.

The total amount of energy released in the reaction is called the *heat of explosion* (ΔE). It can be calculated by comparing the heats of formation (ΔE_f) before and after the reaction

$\Delta E = \Delta E_f$(reactants) – ΔE_f(products)

The heats of formation for the products and many common explosives (reactants) are given in Table 4. The heat of explosion is defined so that it will be positive for an exothermic reaction. Its unit is kilojoule ['ki:ləʊ,dʒu:l] per mole.

Table 4. Heats of formation.

Name	Formula	MW (g/mol)	ΔE_f(kJ/mol)
carbon oxide	CO	28	–111.8
carbon dioxide	CO_2	44	–393.5
water	H_2O	18	–240.6
Nitroglycerin [,naɪtrəʊ'glɪsə,ri:n]	$C_3H_5N_3O_9$	227	–333.66
RDX	$C_3H_6N_6O_6$	222	+83.82
HMX	$C_4H_8N_8O_8$	296	+104.77
PETN	$C_5H_8N_4O_{12}$	316	–514.63
TNT	$C_7H_5N_3O_6$	227	–54.39
Tetryl	$C_7H_5N_5O_8$	287	+38.91

Notes:

1) CO, CO_2 and H_2O are assumed to be in gaseous form.

2) ΔE_f for N_2,H_2,O_2 and all other elements are all zero.

Example: find the heat of explosion for TNT.

Before: $\Delta E_f = -54.4$ kJ/mol

After: $\Delta E_f = 6(-111.8) + 5/2(0) + 3/2(0) + 1(0) = -670.8$ kJ/mol

$\Delta E = (-54.4) + 670.8 = 616.4$ kJ/mol,

Since $\Delta E > 0$, the reaction is exothermic, and the heat of explosion is + 616.4 kJ/mol.

SUPPLEMENTAL MATERIAL FOR UNIT 3

Case study: Damage Mechanisms

Work in groups. Choose a target, such as: enemy troops, enemy base, etc. Skim through the text and find the best damage mechanism for dealing with your target. Prepare a short talk using information from the text.

There are five general categories of munitions damage mechanisms: blast, fragmentation, cratering, penetration, and **incendiary** effects. A given target is usually most vulnerable to one particular damage mechanism, though it may be vulnerable (to a lesser extent) to several damage mechanisms. The factors governing determination of the primary damage mechanism for a given target are: target construction, target location (relative to the point of warhead detonation), warhead damage effects pattern, and the desired type and level of damage.

Blast is caused by tremendous dynamic overpressures generated by the detonation of a high explosive. Complete (high order) detonation of high-explosives can generate pressures up to 700 tons per square inch and temperatures in the range of 3,000 to 4,500° prior to bomb case fragmentation. It is essential that the bomb casing remain intact long enough after the detonation sequence begins, so that the bomb could contain the hot gases and achieve a high order explosion.

A consideration when striking **hardened** targets is that deformation of the weapon casing or fuze may cause the warhead to **dud** or experience a **low order detonation**. Approximately half of the total energy generated will be used in swelling the bomb casing to 1.5 times its normal size prior to fragmenting and then imparting velocity to those fragments. The remainder of this energy is expended in compression of the air surrounding the bomb and is responsible for the blast effect. This

effect is most desirable for attacking walls, collapsing roofs, and destroying or damaging machinery.

The effect of blast on personnel is confined to a relatively short distance (110 feet for a 2000 pound bomb). For surface targets blast is maximized by using a general purpose (GP) bomb with an instantaneous fuzing system that will produce a surface burst with little or no confinement of the overpressures generated by excessive burial. For buildings or bunkers the use of a delayed fuzing system allows the blast to occur within the structure maximizing the damage caused by the explosion.

Fragmentation is caused by the break-up of the weapon casing upon detonation. Fragments of a bomb case can achieve velocities from 3,000 to 11,000 fps depending on the type of bomb (for example, GP bomb fragments have velocities of 5,000 to 9,000 fps). Fragmentation is effective against troops, vehicles, aircraft and other soft targets. The fragmentation effects generated from the detonation of a high-explosive bomb have greater effective range than blast, usually up to approximately 3,000 feet regardless of bomb size. The fragmentation effect can be maximized by using a bomb specifically designed for this effect, or by using a GP bomb with an **airburst** functioning fuze.

The **cratering** effect is normally achieved by using a GP bomb with a delayed fuzing system. This system allows bomb penetration before the explosion. Since the explosion occurs within the surface media, it is the energy of the blast that causes the formation of a crater. This effect is most desirable in interdiction of lines of communication (LOC).

Armor penetration is accomplished by shaped charges or kinetic energy penetrators. This is an effective damage mechanism for tanks, assault guns, armored personnel carriers, and other armored targets. A major problem associated with both shaped charges and kinetic energy penetrators is the lack of visible damage. This may result in repeated attacks to produce battlefield evidence that a target is no longer a threat.

Fire is effective in interrupting operations of enemy personnel and in damaging supplies stored in the open. Incendiaries produce intense, localized heat designed to ignite adjacent combustible target materials. The true incendiary produces no fireball and relatively little flame. The basic damage mechanism of firebomb weapons comes from the fireball and burning residual fuel globules, impact momentum of the fuel and container, and damage from fires started by the weapon.

The sharp cutoff of casualty-producing mechanisms outside the incendiary pattern allows delivery close to friendly troops, usually parallel to the forward line of battle, with minimum risk. Munitions have been developed with full fragmentation and penetrating capabilities coupled with reactive incendiary devices. These improved incendiaries are highly effective against fuel and other flammable targets. A drawback, however, in planning for the employment of incendiary weapons is that incendiary/fire effects are not evaluated in current weaponeering methodologies.

Active vocabulary

airburst *n.* ['ɛəˌbɜ:st]	cratering *n.* ['kreɪtərɪŋ]
dud *n.* [dʌd]	fragmentation *n.* [ˌfrægmɛn'teɪʃən]
hardened *adj.* ['hɑ:dənd]	incendiary *adj.* [ɪn'sɛndɪərɪ]
low order detonation *n.*	munition *n.* [mjʊ'nɪʃən]

Vocabulary practice

Exercise 1
Match the words and their definitions:

incendiary	the material fired, scattered, dropped, or detonated from any weapon
munition	explosive forming of pits and cavities in the ground surface
dud	an explosion of an artillery round or missile in the air (above its target)
airburst	designed to cause fires
low order detonation	a bomb, shell, or explosive round that fails to detonate
cratering	either incomplete detonation or complete detonation at lower than maximum velocity

Exercise 2
Use the correct form of the words from the box to fill the gaps.

dud / fragmentation / hardened / incendiary / munition / shaped charge

1. To make a ... you need a concave metal hemisphere or cone (known as a liner), high explosive, and a steel or aluminum casing.
2. The primary objective of a ... structure is to resist the effects of enemy weapons.
3. Anti-personnel cluster bombs rely on ... in order to kill troops.
4. The bomber runs were made at night, at low altitude and delivered a mixture of penetration and ... bombs.
5. A farmer found a ... bomb in his field.
6. More range, higher precision and controlled lethality are the guidelines for development of new tank ... .

Exercise 3
Translate from Russian into English.

1. Бессмысленно настраивать зажигательную бомбу на воздушный разрыв.
2. После бомбардировки на взлетной полосе наблюдаются глубокие воронки.
3. Кумулятивный заряд может помочь поразить укрепленную цель.
4. Что произойдет с оболочкой боеприпаса, если произойдет низкоскоростная детонация содержащегося в нем ВВ?
5. Бывают ли кумулятивные снаряды с хорошим осколочным действием?
6. По результатам испытания ни один снаряд не сработал.

GLOSSARY

Unit 1

blast	*сущ.* взрыв; *как опред.* взрывной, фугасный
bond	связь
casing	корпус, оболочка
combustion	сгорание
compound	соединение
debris	обломки
decomposition	разложение
deflagration	дефлаграция
detonation	детонация
dissipate	рассеиваться
expand	расширяться
expansion	расширение
explode	взрываться
explosion	взрыв
explosive	*сущ.* энергетический материал; *прил.* взрывчатый
flammable	горючий
fragmentation	осколкообразование, дробление
high explosive	бризантное (мощное) ВВ
housing	корпус, оболочка
impact	*сущ.* соударение; *глаг.* поражать
low explosive	метательное ВВ
pressure	давление
product	продукт
propellant	метательный заряд, ракетное топливо
reactant	реагент; вещество, участвующее в реакции
shell	оболочка, корпус; артиллерийский снаряд

shock	*сущ.* удар; *как опред.* ударный
shrapnel	шрапнель
site	место
sonic	звуковой
speed of sound	скорость звука
subsonic	дозвуковой
supersonic	сверхзвуковой

Unit 2

arming	снаряжение (перевод в боевое состояние)
booster	промежуточный детонатор, усилитель
brisance	бризантность
brisant	бризантный
composite	*о ВВ*: состав
DDNP	диазодинитрофенол
degree of confinement	прочность и целостность оболочки заряда
detonator	капсюль, детонатор
exothermic reaction	экзотермическая реакция (с выделением тепла)
explosive train	детонационная цепь
fuse	взрыватель, запал
HMX	октоген
initiation	инициирование
intermediate explosive	ВВ, применяемое для промежуточных детонаторов
main charge	основной заряд
mechanical force	механическая сила
mercury fulminate	гремучая ртуть
oxygen balance	кислородный баланс
PETN	ТЭН
primary explosive	инициирующее ВВ
projectile	снаряд, пуля, ударник, метаемое тело
safing and arming device	предохранительное устройство
secondary explosive	вторичное ВВ

sensitivity	чувствительность
shock wave	ударная волна
tetrazene	тетразен
tetryl	тетрил
tetrytol	тетрил + тол

Unit 3

aerial	воздушный
ammunition	боеприпасы
arming pin	чека
ballute	парашютная система стабилизации
bomblet	боевой элемент
bombsight	бомбардировочный прицел
circular error probable / probability	круговое вероятное отклонение, круговое рассеяние
cluster bomb	кассетная бомба
delayed detonation	установка взрывателя на фугасное (замедленное) действие
demolition bomb	фугасная бомба
depth bomb	глубинная бомба
detonation upon impact	установка взрывателя на осколочное (мгновенное) действие
dispenser	бомбовая кассета
fins	оперение
fragmentation bomb	осколочная бомба
general-purpose bomb	многоцелевая бомба
hydrostatic fuze	гидростатический взрыватель
impact fuze	ударный взрыватель
incendiary bomb	зажигательная бомба
inertia fuze	инерционный взрыватель
kinetic	кинетический
lanyard	тросик
nuclear bomb	ядерная бомба

nuclear fission	*сущ.* расщепление ядра атома; *как опред.* атомный, ядерный (об источнике энергии)
nuclear fusion	*сущ.* ядерный синтез; *как опред.* термоядерный
penetration bomb	бетонобойная бомба
proximity fuze	радиовзрыватель
ratio	отношение
shaped charge	кумулятивный заряд
slug	ударное ядро; пест
spring	пружина
submunition	боевой элемент
time fuze	дистанционный взрыватель
time-delay circuit	цепь замедления
trench	окоп, траншея
vane	вертушка

Case Study: Composition 4

blasting cap	капсюль-детонатор
blow up	подрывать
cure	отверждать(ся)
malleable	податливый
mold	отливать, прессовать
plastic binder	полимерное связующее
plasticizer	пластификатор
RDX	гексоген
rifle	ружье
solvent	растворитель
stabilizer	флегматизатор

Case Study: Damage Mechanisms

airburst	воздушный разрыв
cratering	фугасное действие (образование воронки)
dud	*сущ.* неразорвавшийся снаряд; болванка; *глаг.* не сработать

fragmentation	осколочность
hardened	укрепленный
incendiary	зажигательный
low order detonation	низкоскоростная детонация
munition	боеприпас; (военное) снаряжение

REFERENCES

1. Harris, Tom. How C-4 Works // HowStuffWorks.com. 20 June 2002. URL: http://science.howstuffworks.com/c-4.htm (дата обращения: 25.05.2012)
2. Rosenkranz, Keith A. WEAPONS BUNKER // Vipers in the Storm. 2003. URL: http://www.vipersinthestorm.com/html/weapons_bunker_-_page_1.html (дата обращения: 25.05.2012)
3. Sbrocca, Dino A. Castable binder for cast plastic-bonded explosives // US Patent Number: 4115167. Issue Date: 19780919
4. Scheve, Tom. How Blast-resistant Clothing Works // HowStuffWorks.com. 14 April 2008. URL: http://science.howstuffworks.com/blast-resistant-clothing.htm (дата обращения: 25.05.2012)
5. Advanced Tank Ammunition // Defense Update. July 26, 2006. URL: http://defense-update.com/20060726_eurosatory06-tank-precision.html (дата обращения: 25.05.2012)
6. Ballute Bomb Retarding System (BSU-49/50/85/93) (United States), Bombs — Unguided // IHS Jane's: Defense & Security Intelligence & Analysis. Jan 11, 2006. URL: http://articles.janes.com/articles/Janes-Air-Launched-Weapons/Ballute-Bomb-Retarding-System-BSU-49-50-85-93-United-States.html (дата обращения: 25.05.2012)
7. BLU-82 25 // Wikipedia, the free encyclopedia. January 2011. URL: http://en.wikipedia.org/wiki/BLU-82 (дата обращения: 25.05.2012)
8. BLU-107 Durandal // Citizendium. URL: http://en.citizendium.org/wiki/BLU-107_Durandal (дата обращения: 25.05.2012)
9. BLU-109 bomb // Wikipedia, the free encyclopedia. 24 January 2011. URL: http://en.wikipedia.org/wiki/BLU-109_bomb (дата обращения: 25.05.2012)
10. Bomb // HowStuffWorks.com. 29 September 2009. URL: http://science.howstuffworks.com/bomb-info.htm (дата обращения: 25.05.2012)
11. Bombs for Beginners // Federation of American Scientists. April 23, 2000. URL: http://www.fas.org/man/dod-101/sys/dumb/bombs.htm (дата обращения: 25.05.2012)
12. CBU-52 // Federation of American Scientists. February 05, 1998. URL: http://www.fas.org/man/dod-101/sys/dumb/cbu-52.htm (дата обращения: 25.05.2012)
13. Hunting (R)BL-755 // Eurofighter Typhoon. URL: http://typhoon.starstreak.net/common/AG/bl755.html (дата обращения: 25.05.2012)
14. Introduction to Naval Weapons Engineering — Chemical Explosives // Federation of American Scientists. January 20, 1998. URL: http://www.fas.org/man/dod-101/navy/docs/es310/chemstry/chemstry.htm (дата обращения: 25.05.2012)
15. MK 36 DST Destructor Mine // Federation of American Scientists. February 05, 1998. URL: http://www.fas.org/man/dod-101/sys/dumb/mk36.htm (дата обращения: 25.05.2012)
16. Mk82 General Purpose Bomb // Federation of American Scientists. April 23, 2000. URL: http://www.fas.org/man/dod-101/sys/dumb/mk82.htm (дата обращения: 25.05.2012)
17. The Incendiary Bombing Raids on Tokyo, 1945 // EyeWitness to History. 2004. URL: http://www.eyewitnesstohistory.com/tokyo.htm (дата обращения: 25.05.2012)

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