ІННОВАЦІЙНІ АСПЕКТИ ПІДВИЩЕННЯ РІВНЯ ЕКОБЕЗПЕКИ

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NEW TECHNOLOGY OF PULSE FOREST FIRE-FIGHTING (PFFF)

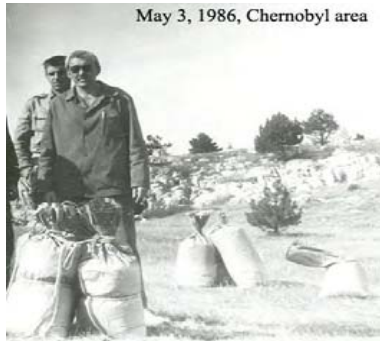
Vladimir Zakhmatov (Brequet), Mikola Sherback
Державна экологічна академия післядипломної освіти та управління Мінприроди Україні. вул. М. Василя Липківського, 35, 03035, Киів,
Zet.pulse@gmail.com.

First extinguishing directional-explosive, pulverizing 200liters bomb was designed by prof. Vladimir Zakhmatov on the First of May, 1986 tested on the Second of May at “Rudy Forest”= high radioactive forest area. It technology save life and health for some hundreds of firemans and soldiers, must be go into “Rudy Forest” for suppressed local fires, inflaming in dry forest fire every hour. The 160-250liters bomb equipped by wet sand, dirty or water with foam and it effective extinguished area was up 100-250sq.m.This high-precisely of bomb provides by little time of pulverization of all extinguishing mass and there shaking of bomb not influence on hit the fire. The helicopter can not to stop under fire. Nowtime this bomb-fire-technology develop for same types of bomb: for precisely bombing the any fire, include fast-spreading upper fire from safety height up to 2000-3000m; bomb for helicopter flying under 500m and ensure with series of volleys large scale, uniform high effective forest-fire-fighting without reinflammations. Final stage of precisely local, forest fire-fighting under fall down & landed trees, in hole of trees, in ravines, holes realize with long-range, universal, handle pulse-pulverizator. The new technolo- gy have great perspectives because of simple, cheap, high effectively; universal precisely pulveri ze of liquids, gel, powders, dust, water not cleaned before, sand, wet sand, earth, dirty, miry.

Новая технология импульсного тушения лесных пожаров. В.Д. Захматов, Н.Г.Щербак. . Первая огнетушащая 200л бомба направленного, взрывного распыления огнетушащего порошка или песка, создана проф. Владимиром Захматовым 1мая 1986г., испытана под г.Иванковым и со 2мая использовалась для тушения локальных возгораний в «Рыжем лесу» наиболее радиоактивном участке зоны, наряду с крышами 3-4аварийных блоков и двором вокруг. Эта технология бомбового тушения спасла сотни пожарных и солдат от тяжёлых радиоактивных поражений. Бомбы емкостью 160-250л снаряжались мокрым песком, водой с пенообразователем, а огнетушащий порошок показал низкую огнетуша- щую эффективность. Высокая точность распыления огнетушащих составов из бомб на очаг пожара обеспечивалась временным микроинтервалом, поэтому на точность распыле- ния раскачивание и тряска бомбы практически не влияла. Поэтому вертолёт мог даже не останавливаться над очагом пожара.. Данная технология имеет два основных типах бомб: для точной бомбёжки фронта верхового лесного пожара с безопасных высот 2000-3000м; бомбы для вертолёта летящего ниже 500м и подрываемые серией залпов, обеспечиваю -щих крупномасштабное тушение без повторных воспламенений. Финальная стадия новой технологии тушения заключается в подавлении повторных воспламенений и локальных пожаров под стволами упавших деревьев, в дуплах, оврагах и ямах. Новая технология имеет большие перспективы из-за ряда причин: простота, дешевизна, высокая эффектив- ность, универсальное распыление любых огнетушащих составов и природных материалов.

Нова технология гасиння лисових пожеж. В.Д. Захматов, М.В. Щербак. Перша вогнегасна бомба 200л вибухового розпілення вогнегасного пилу, песку створена проф. Владимиром Захматовым 1травня 1986г., віпробувана під м.Иванковым, 2травня віконувалась для гасиння локальніх пожеж у «Рудому лису» наібільш радиаціному. . Ця технологія вибухового гасіння спасла сотни пожежніх, солдат від радіації. Бомбы емкістю 160-250л снаряджені мокрым піском, водой с пенообразователем, а вогнегасній піл має низку здатність. Вісока точність розпілу вогнегасніх речовин на очаг пожежі врахована мікроінтервалом розпилу, ликвидуючим залежність точності розпилу від качяння, тряскі бомб. Потому гелікоптер може даже не зупінятіся над осередком пожежі. Дана технологія базуется на двох типах бомб: для литака зупіняющого фронт верхній лісовой пожежі з безпечніх вісот 2000-3000м; бомбі для гелікоптеру летящего ніж 500м и подріваємие залпово, забезпечивающі велико-масштабнє гасіння. Финальна стадія нові технології гасіння рятує від повторніх воспламенювань и локальніх пожеж під стволами упавших деревьев, в дуплах, оврагах и ямах. Нова технологія має більш перспектів як: простота, дешевизна, вісока эфектівність, универсальне розпиление вогнегасних речовин та натурніх матеріалів.

Experts say that Russia has long been invented bombs to extinguish fires, and special technology by which to eliminate any forest-fire, power. However, responsibility for fire safety officials in no hurry to purchase such non-lethal, risqué, active, high-precisely, fire-fighting ammunition for decrease every year, great economy and Ecology losses. The first bomb was designed, field-produce and used numerously since 2 of May 1986 for fast, remote control, high-precisely extinguishing of inflammations at “Rudy Forest” – highest radioactive forest-area at Chernobyl Zone. Burned in Chernobyl ecological safe fast forest fire-fighting Technology, created during first days of Chernobyl catastrophe …



Pict.1. First extinguishing directional-explosive, pulverizing bomb of 200liters capacity

Pict.2. “TSA-500” blow flame at area up to 1000m2, but after 5-10min there can be re-inflammations

First extinguishing directional-explosive, pulverizing bomb was designed by prof. Vladimir Zakhmatov – Brequet on the 1-th of May, 1986 tested on the 2-th of May at “Rudy Forest”= high radioactive forest area with 1000-2500 roentgens per hour. Capacity of this bomb is not more than 2001iters. The bomb equipped by wet ground, sand, dirty or water with foam. The ef-

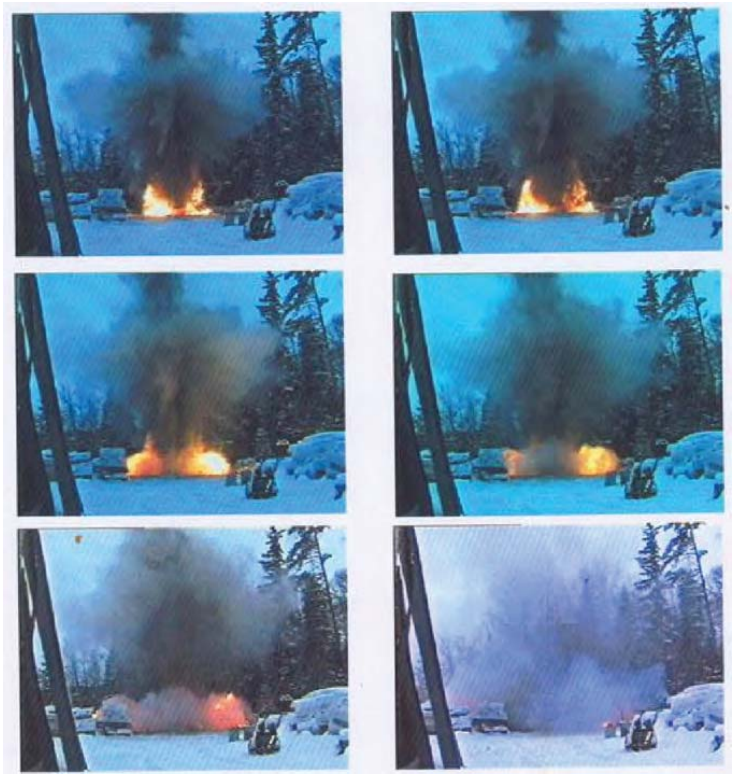
fective extinguishing square was up to 150sq.m This high-precisely of bomb provides by little time of pulverization of all extinguishing mass and there shaking of bomb not influence on hit the fire. The helicopter can not to stop under fire.

Author worked since 1983 with State Scientific-Production Enterprise (SSPE) "Basalt" for investigation of processes of explosive, directional pulverizing of special agent. On the base of results of abovementioned, author's experience of bombing forest, fire-fighting at Chernobyl area there in SSPE "Basalt" started Project of "TSA-500" (aircraft fire fighting) since 1987. Russian defense workers have demonstrated this bomb for foreign military attaches in October 1999 and bring them to the state final sample began in the year 2000. It bomb pulverize water all over round area up to 1000m2 (diameter 30-32m) and blow flame completely, but no ensure cooling of scorched, carbonized wood's surface all over it area, therefore after 5-10min at area there can be re-inflammations. From other side the metallic, not thin body of "TSA-500" create numerous high speed splinters, defeated at range up to 200m – non-safety area increase blowing flame area in 100-120times. Therefore "TSA-500" can use very limited – only for fast stop of front of upper forest fire by precisely bombing the front from safety height – 2-3km. Nowtime there is no other way of operation.

TSA-500 bomb containing less half a ton of fire-fighting compounds and ability to repay a fire in an area of 1 thousand square meters. meter was invented at the State Scientific-Production Enterprise (SSPE) of Basalt. The bombs were supposed to do in combat aircraft as teaching, they planned to use to extinguish fires. The explosion of such a bomb in the air, sprayed fire-fighting compound, which puts even the strongest of the flame. The normal discharge from the aircraft extinguishing agents because of the rising flow of hot air he gets to fire only partially. As noted by the designers from "Basalt", TSA-500 provides one hundred percent delivery of mass extinguishing agents in fire zone, but really it up 30% thin pulverize, small water droplets delivery to carbonized wood upper lay – main target ot forest fire-fighting. The explosion also creates an additional factor of fire – air shock wave and high-speed, defeated splinters of bomb's body, the newspaper "Komsomolskaya Pravda".

According to experts, at the same time, such weapons are no safe for humans. Recent examples of TSA-500 can be reset, not only with combat aircraft, but also with civil IL-76 or AN-12. Despite the reasonable performance of such bombs, the question of procurement at the state level has not been resolved. According to the newspaper, five years ago, the state administration "Avialesookhrana" considering buying bombs TSA-500, but it never took place. MOE, having considered the option of fire arms, too, eventually abandoned the purchase. According to the "KP", scientists were asked to increase the power of bombs on the order to the area of its action was not less than 10 hectares but it no can be done with lonely great, high-cost bomb. It can be done with numerous cheap WB. Technology forest-fire-fighting, developed by scientists, are the successive application of different methods of extinguishing. First bombers dropped TSA put out the blaze. Then, IL-76 and Be-

200 is shipped smoldering areas. The Mi-26, Mi-8 and Ka-32P point Dumping water eliminated some small pockets. According to calculations, the entire operation to the complete elimination of the vast source of fire may be no more than an hour.



Pict. 3. Water Bomb 160-liters water capacity (WB-160) from 15m height ensure forest fire-fighting at 250sq.m (range=15m) of pines forest from 3-5m height.

Author prolonged the investigation and create the new other water, extinguishing bomb, well tested at ravines at field-range's area of Kalush chemical plant, close to Carpthian mountains and after at these mountains; pine forest close to Staleva Vola, Poland; Crimea mountains close Jalta, Ukraine; plate of Karmal mountain, close to Haifa, Israel; Volga, Saratov and Samara regions, Russia. The water bomb with plastic, firm body made of ordinary, plastic barrel capacity 160 or 220liters, with radial-profiled bottom. These bomb ensure effective extinguishing at square 200-300m2. Volley with four bombs,

placed at fixed position, can to stop fire on the area up to 2000-2500m2. It is final extinguishing, because of penetrating, blast pulverization of numerous water droplet into scorched, carbonized wood's surface all over it area, therefore at the area there are no re-inflammations. From other side the plastic, thin bodies of "WB-160", "WB-220" create small no-defeated splinters, flying at range up to 5m inside extinguishing area. Therefore "WB-160", "WB-220" can use no limited for extinguishing low and upper forest fire by cower bombing step-by-step the forest fire area from safety height 200-1000m. This bombs completely safe for forest, bush, animals and human. The effective height of pulverizing blasting from 8 to 25 m. It we use bomb with short delay blasting helicopter can flight on height up to 1000 m. Nowadays its most perfect design of water bomb on the base for of which industrial water bomb can be produced nowadays.

Pict. 4. Water bomb 220liters water capacity (WB-220) from 20m height ensure forest fire-fighting at 310m2 (diameter = 20m) of pines forest of 3-5m height.

Analyse of abovementioned investigations showed a novel approach of dispersing agents, including liquids, foam, powder and at first viscous, sticky agents(most effective for forest fire-fighting) and at first ecology clean natural materials – sand, ground, dust, snow, employing propelling energy to pulverize directly these agents and materials to small particles ranging (in size from 5 to 100 micron) and discharge its uniformly over large square, ensuring definite parameters speed, angle, concentration of contacting the extinguishing front with scorching, carbonized various surfaces of firing trees, bushes, grass.

The propelled energy of directional blast wave penetrates into the mass of extinguishing substances contained in a specifically designing light container, create high-precisely dispersing abovementioned, various extinguishing agent or natural material onto the definite firing square to obtain fast and reliable forest fire suppression. The pulse-pulverizing devices not create the long range, defeating fragments. The Pulse Forest Fire-Fighting Technology main features are:

1).Conventional and environment friendly cheap fire extinguishing agents in many times (50 to 100) smaller quantities than their usual requirement.

2). Effective forest fire-fighting with natural, ecology clean materials ground, sand, dirty, miry, dust, snow, dispersed ice.

3). Effective, uniformly, long-range, large-square dispersing and pulverization of viscose and sticky agents most effective for forest fire-fighting.

4). No need for pressurized cylinders and piping and other expensive pneumatically and hydraulically equipment.

5). Increased effectiveness on a weight volume basis.

6). Discharge range is triple that of the conventional systems.

7). Rapid discharge and suppression time-from 0,1 sec to 1 sec.

8). Large volume or area rapid coverage, long distance or height of 100m and over.

9). Cost effective-low cost of ownership-life cost cycle.

10). Simple installation and minimal maintenance required.

11). Operates with high precisely and efficiency at hard-to reached areas of– emergency's.

12). Long shelf-life over 10 years.

We present **stage-by-stage PFFF Technology** realize with complex usage abovementioned water bombs and original extinguisher: **First stage** – stop and localization of front of upper fire with mass (cover) bombardment by sighting throw down largest (battle type) extinguishing bombs -"TSA-500" from civil airplanes and military, including bombardiers flying at safety height from 1000m to 2000 m. It bombs can ensure the effective usage for forest fire-fighting of military airplanes and helicopters, at first. Really it's unique technology – lonely can to stop the front of upper forest fire. It technology prepare the real possibility of widely usage of most effective aircraft forest fire-fighting from low height usage of suspended, cone-pulverized bombs.

Second stage – helicopter's suspended bombs and multi-bombs units for high-precisely pulse-pulverizing from low height or bombing from any height. Sighting bombardment step-by-step for effective extinguishing-final blowing flame, destruction and cooling of carbonized, scorching wood upper lay by directional pulverization of numerous water droplets, penetrating inside the upper lay – all over, uniformly forest fire area.

There are two versions of frame design: as a simple sack and sack with firm round upper part, for example made of rubber tiers. This is most safe and cheap design of frame, compact for transporting when water charged into frame only before usage. There designed and well tested at field-range and real fire 2versions of bomb's body made of large sacks, fixed at upper round base – rubber car's tire, for example. There are most cheap, safety and simple construction of extinguishing

bombs – compact, suitable for transport and final charged with extinguishing agent or natural material at lace, close to upper line at airport.

Pict. 5. First stage of PFFFT is stop and localization of upper fire's front by bombing with numerous "TSA-500" precisely bombing from safety height 2-4km.

Pict. 6. Second stage – uniform pulse pulverization step-by-step local area after local area.

Third final stage of forest-fire-fighting precisely extinguishing of local forest fires and reinflammations by little helicopters with suspend lonely bombs- couple of sacks or 4-bombs unit. More effective, simple and cheap are parachute-landing firemans and jeep-transported firemans, but best is crossroad, fasted and popular

firemans on motor-cycles equipped with long-range, universal pulse extinguishers shoot-pulverizing wet or dry the natural materials – ground, miry, dirty, snow, ice. dust and etc. For example if shoot-pulverize 1kg sand the range horizontal up to 30m, and vertical up to 14m. At first it ensure compete independence of fire-fighting process from transport of extinguishing agents and give real possibilities for fast extinguishing of numerous fire searches at large areas and zones not reached for transport. Up now time the longitudinal and power of fire-operation in main depend from extinguishing agents delivery by aviation, lorry, jeeps and fire-mans, volunteers at hard-to-reached areas – hills, ravines, mountains, canyons. At first it ensure fire-fighting operations – completely independence, longitudinal, practically not limited for period, power. This new extinguisher can and may to do the fire-mans on motorcycles most effective, fast, popular for forest fire-fighting and may be other fires too.

Pict. 7. Water bomb with plastic soft body-sack capacity up to 300-500liters.

Pict.8. Professional, universal shoot-pulverizator of various, natural, materials: ground, dirty, sand, dust, snow, ice and etc. Best equipment for Fireman on motorcycle-crossroad, fasted transport in European countries with well numerous road's net.

Additional stage – protection the important industry objects from spreading front of forest fire. The forest fire-

fighting can accomplish above-mentioned all stages of forest fire-fighting It stage is high important – because it protect the important objects and at potential area covering by forest fire spreading front.

Pict.9. At first all over World – instant for 1sec: extinguishing local fires at area of 15m2 with 2kg dust and 1,1m2 scorched wood with single liter of clean water.

Multibarrels modules, mounted on the tank-chassis, caterpillar-chassis, cross-road jeep-chassis for forest-fire-fighting along roads and protection of objects: military, industry, state, nuclear power stations, villages, cottages, suburbs from forest-fires. Multi-barrels modules ensure volleys-pulse directional pulverization of ecology clean agents and some natural materials ensure real, large scale, autonomy, flexible control activity for forest fire-fighting, protection the objects, risqué the fireman's and peoples out of firing area. The mutibarrels modules attain high extinguishing effectively by small size particles with great surface summary square, high speed of extinguishing particles and vortex ability to influence multiply at same place and penetration inside complex structure and narrow slits. This way ensure large scale, high effectively FFFPT with small mass of cheap agents and ecological safe natural materials.

Pict. 10. Multibarrels unit on the tank-chassis for protection of military, industry, government, nuclear power stations, villages, cottages, suburbs from forest-fires.

Pict.11. 50-barrels «Impulse-3M» – remote control extinguishing for 1,5sec of 2 local fires 200×2=400sq.m witn volley-shot pulverization of 200kg extinguishing powder from distance of 60m.

Proposed method and pulse-pulverize technique overcame in many times the effectivity of traditional aviation technology pouring great water mass, including salt, sea water onto forest fires (see table 1). Single-stop IL-76 or Boeing-747 pouring off up to 30-40tons of water from minimal height 500m. It provides suppression flame on the area of 8-10 hectares. But after 5-10min there will numerous reinflammations. It operation need timely support of some fire-machines or aviation bombing with WB-160 (220 or 350) liters.

Pict. 12. This one-stop IL-76 or Boeing-747 pouring off up to 30-40tons of water from minimal height 500m. It provides suppression flame on the area of 8-10 hectares. But after 5-10min there will numerous reinflammations. It operation need timely support of some fire-machines or aviation

Conclusion: the new technology of forest fire-fighting with various extinguishing bombs at first ensure important advantageous: simplicity, cheap, flexible control, high precisely, high safety when fighting of various forest fires, shortest period of various forest fire-fighting operations.

Comparison Table of Aviation systems for forest fire extinguishing.

System // Parameters.	Explosive-pulverize aviation bomb-author's patents.		Traditional pouring off Jettisoning pulverization
	TSA-500 (Bazalt)	WB-160, WB-220, WB-350	
% effective usage exiting. agent Bomb's Agent.Mass/ Specifi cal. mass kg/sq.m	10 – 30 330 / 2 – 3	60-90 160 / 0,5 – 0,7	1 – 3 3000 / 10 – 50
Height air-apparatus flight, m	100 – 3000	100 – 3000	< 200
Pulverize height from ground, m "Bombing" precisely Square Extingh. Sq.m. Timely Blowing Flame sq.m.	1 – 3 High 80 – 110 1000	10 – 30 High 220 – 350 250 – 310	10 – 50 Poor 100 – 150 1500 – 2500
Firefighting cost per m^2, USD.	0,4-0,5	0,9 – 1,4	20 – 30
Pulverizing agent and materials	Water, solutions	Water,solution, gel, wet sand, dirty, miry	Water, solution
Ensure evacuation way peoples Blow wave and splinters defeat	dangerous for life of people	Effective- safe for people	Poor effective

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PROBLEMS OF ORGANISATION OF TEST PERFORMANCE IN SENSOR NETWORKS APPLIED FOR ENVIRONMENT MONITORING

Mashkov V.A., Mashkov O.A., Abidov S.T.
University J.E.Purkyne,
Ceske mladeze 8, Usti nad Labem 40096,
Czech Republic
Державна екологічна академія післядипломної освіти
та управління Мінприроди України,
вул. Урицького, 35, 03035, Київ, dei2005@ukr.net
Державна екологічна академія післядипломної освіти
та управління Мінприроди України,
вул. Урицького, 35, 03035, Київ, dei2005@ukr.net

Currently sensor networks are widely used in many areas such as aerospace, automation, weather forecast, medical monitoring, natural event monitoring, object tracking, monitoring product quality, combat field reconnaissance, military command and control and environment monitoring. Working conditions of sensor networks applied for environment monitoring have placed new challenges to sensor networks developers due to the low availability of resources and mobile nature of sensor nodes. Harsh environment where the sensor nodes are deployed often leads to sensor node failures. Requirement to continue monitoring even when some sensor nodes have failed increases to a great extent the requirement to ensuring fault-tolerance of sensor networks. Technical diagnosis is considered as a major part of the facilities allowing providing fault-tolerance of any complex system. Any omitted error can lead to failure of a complex system such as sensor network is. Mostly, detection of faulty sensor nodes can be performed by network itself without external facilities. Such diagnosis requires appropriate organization of individual test performance. In the paper we consider different organization of tests performance in complex system such as sensor network**.** Each possible organization of tests performance is evaluated and the corresponding recommendations about its applicability are given. **Keywords:** diagnosis, sensor networks, environment monitoring, environment.

Проблеми організації виконання перевірок у сенсорних мережах, яки застосовуються для екологічного моніторингу. В.А. Машков, О.А. Машков, С.Т. Абідов. В даний час сенсорні мережі широко використовуються в різних областях – аерокосмічна, автоматичне управління, прогноз погоди, моніторинг в медицині, моніторинг різних явищ у природі, дотримання об'єктів, контроль якості на виробництві, військова сфера, моніторинг навколишнього середовища. Умови роботи сенсорних мереж, які застосовуються для моніторингу навколишнього середовища, висувають нові завдання перед розробниками сенсорних мереж, пов'язані з низькою доступністю і мобільним характером елементів мережі. Можливі суворі умови роботи сприяють виникненню відмов сенсорів. Вимога забезпечити безперервний екологічний моніторинг навіть при відмовах окремих сенсорів мережі веде до підвищення вимог до забезпечення відмовостійкості сенсорної мережі. Діагностика відмови сенсорів розглядається як головна частина коштів, що забезпечують відмовостійкість комплексних систем. Будь-яка допущена помилка може призвести до відмови всієї сенсорної мережі. У багатьох випадках при виявленні відмови сенсорів можливе виконання власними засобами самої сенсорної мережі без залучення зовнішніх