

## Part 1

### The secret unfolds - DU investigations & briefings in 2001

This section contains the three main studies that provided the basis for questioning the suspected use of DU in hard target systems, hence in the Afghan War. It also contains two very significant media reports (from Reuters and New Scientist) and two DU warnings posted by the author in November. These show the early evolution of this study as new information became available. Most were written as one-off briefings for other DU researchers, politicians or the media so some basic information and links are repeated. Timing is relevant to actions or inaction by the people or organisations they were sent to e.g. questions to the UK Government included in Part 2.

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End of section & notes

Internet searches

25 February 2001

## Tip of the Iceberg? - apparent use of Depleted Uranium in bombs and missile systems

Dai Williams

These two sources were the first clues to potential use of depleted uranium (DU) in hard target versions of smart bombs and cruise missiles.

### 1. Extracts from Janes' Defence website (February 2001)

Key phrases highlighted in red.

DU is a heavy metal that, when alloyed with titanium (up to 0.75% by weight), becomes a material with a density (18,600kg/m<sup>3</sup>) and ductility suited to making penetrators for kinetic energy anti-tank munitions, or liners for shaped-charge warheads.

During the Balkans operations from 1992 to 1996, only the US Air Force acknowledges its use in some of its 30mm cannon shells fired from the GAU-8A cannon. It is true that some guided weapons used depleted uranium to increase the penetration effect and that the 20mm Phalanx close-in weapon system, used to protect warships at sea from sea-skimming missiles, also has a percentage of DU rounds.

[http://www.janes.com/defence/news/jdw/jdw010108\\_1\\_n.shtml](http://www.janes.com/defence/news/jdw/jdw010108_1_n.shtml)

(Note: This link still has the second paragraph in January 2002. The first paragraph seems no longer available in public pages of the website, most of which is subscription only).

### 2. Extracts from the Federation of American Scientists website

This search contains verbatim extracts from the following website. The Table on the next page summarises the key systems involved and key phrases re dense metal components.

**Source: High penetration weapon system concepts / plans (including "dense metal" penetrators)**

[http://fas.org/man/dod-101/usaf/docs/mast/annex\\_f/part26.htm](http://fas.org/man/dod-101/usaf/docs/mast/annex_f/part26.htm)

**Air Force Mission Area Plan (MAP)**

ANNEX F Common Solution/Concept List (U) [as of 11 July 1997 - Rev 10]

**Questions arising:**

1. Which of the following systems use Depleted Uranium as the "dense metal" referred to?
2. How many of these system concepts have been produced in prototype or production form?
3. How many of these systems or their derivatives have been used in military operations since Operation Desert Storm?
4. How many countries have stocks of these systems?

**Summary: High penetration weapon system concepts / plans, USAF July 1997**

<b>WPNS Project #</b>	<b>Device</b>	<b>Delivery</b>	<b>Notes</b>
104	20,000 lb direct attack bomb	B-52, B-2	Dense metal ballast
113	2250 lb guided bomb unit (gbu) - boosted penetrator warhead	F-117 F-16, F/A-18C/D B-52, B-2	Dense metal warhead
114	1000 lb GBU-32 dense or ballasted penetrator	F22, JSF F-15, F-16, F117 B-1, B-2, B-522	Dense metal case or dense metal ballast for maximum penetration
115	1000 lb penetrator with precursor in GBU-32. Multistage warhead:	F22	shaped charges with follow through penetrator. (see BROACH)
158	LODIS/SWAK/DASS/ Boosted Penetrator. High leverage munitions, mini missiles, Small Smart Bomb 250 lb.	Potential payload for Tomahawk	High density payloads. Same penetration capabilities as a 2000 lb BLU-109 but with only 50 lb of explosives.
169	JASSM (Joint Air-to-Surface Missile) P31 1000 lb advanced penetrator.  The next generation cruise missile.	B-52, F-16, F/A-18 B-1, B-2, F-15E, F117 S3, P3, JSF	Dense metal case or dense metal ballast for maximum penetration.
170	Unitary CALCM - Block II (became AGM-86D). Shaped charge precursor. Precision Strike variant. Feasibility concluded April 97. FCT - UK BROACH warhead .	B-52	Block II programme incorporates a penetrating warhead.
506	AUP 1000 Advance Unitary Penetrator. 2000 lb class penetrator Replaces BLU-109.	Option to BROACH for CALCM  B-52	Applications requiring increased penetration.
510	JASSM w/multistage warhead GBU-32. Develops the BROACH warhead for possible use on numerous platforms.	Multiple	Dual stage, shaped charge with follow-through penetrator.

### **WPNS104 -- 20,000 Pound Direct Strike hard Target Weapon**

**DESCRIPTION:** This concept is a 20,000 lb. class precision guided, adverse weather, direct attack bomb employed on the B-52 and B-2 aircraft. It will make use of the GCU developed by the JDAM program which uses GPS aided INS for adverse weather guidance. Precision accuracy will be attained by using differential GPS (DGPS) technology demonstrated on programs such as Enhanced Differential GPS for Guidance Enhancement (EDGE) and Miniature Munition Technology Demonstration (MMTD). The weapon will make use of the JDAM interface under development for the B-52 and B-2 aircraft and would be carried internally using new suspension hardware within the bay. **The warhead will be a 20,000 lb. penetrator with dense metal ballast.** This concept uses the Hard Target Smart Fuze (HTSF), an accelerometer based electronic fuze which allows control of the detonation point by layer counting, distance or time. The accelerometer senses G loads on the bomb due to deceleration as it penetrates through to the target. The fuze can distinguish between earth, concrete, rock and air.

### **WPNS113 -- 2250 lb Boosted Penetrator**

**DESCRIPTION:** The boosted penetrator is based on achieving maximum penetration without sacrificing operational flexibility. Total system weight will be less than 2,250 pounds so that it can be carried by all AF tactical aircraft and bombers as well as the Navy's F/A-18. The goal is to achieve greater penetration than the GBU-28 with a near term, affordable design. **A dense metal warhead will be used** with a wraparound rocket motor to allow internal carriage in the F-117. Advanced explosives will be used to compensate for the reduced charge weight. This concept integrates the boosted penetrator warhead with a JDAM guidance kit with an adverse weather Synthetic Aperture Radar (SAR). JDAM utilizes a GPS aided INS packaged in a tailkit for accurate navigation and guidance in adverse weather and other battlefield obscurants. The SAR seeker mitigates target location errors and GPS errors improving overall system accuracy. Employing the seeker also gives JDAM a capability against the GPS jamming threat. JDAM is an autonomous direct attack weapon integrated on F-16 C/D, F/A-18 C/D, B-52, F-117, and B-2 aircraft with plans for integration on F-15E and B-1. It is capable of inflight (in route to target area) retargeting and engagement of both horizontal and vertical targets. This concept uses the Hard Target Smart Fuze (HTSF), an accelerometer based electronic fuze which allows control of the detonation point by layer counting, distance or time. The accelerometer senses G loads on the bomb due to deceleration as it penetrates through to the target. The fuze can distinguish between earth, concrete, rock and air.

### **WPNS114 -- 1000 lb Dense or Ballasted Penetrator in GBU-32**

**DESCRIPTION:** This concept is **a 1000 pound dense or ballasted penetrator** integrated with a GBU-32 guidance kit using compressed carriage for internal carriage in advanced fighters (F-22, JSF) or carriage in cruise missiles (JASSM, CALCM, ACM, ATACMS, Tomahawk.) **The warhead would either be designed with a dense metal case or contain dense metal ballast for maximum penetration.** The warhead will be filled with an advanced insensitive explosive to compensate for the reduced charge weight. The warhead will be integrated with the GBU-32, the JDAM tail kit for 1,000 lb class warheads. JDAM utilizes a GPS aided INS packaged in a tailkit for accurate navigation and guidance in adverse weather and other battlefield obscurants, day or night operations. JDAM is capable of inflight (in route to target area) retargeting and engagement of both horizontal and vertical targets. This weapon is designed for internal carriage on the F-22. It is also compatible with the following aircraft: F-15E, F-16, F-117, JSF, B-1, B-2, B-52H, F-14, F/A-18, S3, P3, AV-8B.

This concept uses the Hard Target Smart Fuze (HTSF), an accelerometer based electronic fuze which allows control of the detonation point by layer counting, distance or time. The accelerometer senses G loads on the bomb due to deceleration as it penetrates through to the target. The fuze can distinguish between earth, concrete, rock and air.

#### **WPNS115 -- 1000 lb Penetrator with Precursor in GBU-32**

**DESCRIPTION:** This concept is a 1000 pound multistage warhead involving two shaped charges with a follow through penetrator warhead. The warhead will be integrated with the GBU-32, the JDAM tail kit for 1,000 lb. class warheads. JDAM utilizes a GPS aided INS packaged in a tailkit for accurate navigation and guidance in adverse weather and other battlefield obscuration, day or night operations. JDAM is capable of inflight (in route to target area) retargeting and engagement of both horizontal and vertical targets. This weapon is designed for internal carriage on the F-22. It is also compatible with the following aircraft: F-15E, F-16, F-117, JSF, B-1, B-2, B-52H, F-14, F/A-18, S3, P3, AV-8B. This concept uses the Hard Target Smart Fuze (HTSF), an accelerometer based electronic fuze which allows control of the detonation point by layer counting, distance or time. The accelerometer senses G loads on the bomb due to deceleration as it penetrates through to the target. The fuze can distinguish between earth, concrete, rock and air.

#### **WPNS158 -- LODIS/SWAK/DASSL/Boosted Penetrator**

**DESCRIPTION:** The High Leverage Munitions (HLM) concepts are a class of next generation weapons designed to efficiently package small, highly lethal mini missiles of the future. They employ direct dispense technology being developed under WL/MN Low Cost Dispensing (LODIS) program as a means of high density loadouts for both internal and external carriage. This low observable/low drag container is capable of incremental or salvo dispensing and has virtual interface capability. Air bags are used to eject the mini missiles. The dispenser serves as a shipping/stores container. Electrical interface to the mini missiles is made via a single 1553 bus. This concept integrates Small Smart Bombs with LODIS for attacking fixed targets. The Small Smart Bomb is a 250 pound weapon that has the same penetration capabilities as a 2000lb BLU-109, but with only 50 pounds of explosive. With the INS/GPS guidance in conjunction with differential GPS (using all 12 channel receivers, instead of only 5) corrections provided by GPS SPO Accuracy Improvement Initiative (All) and improved Target Location Error (TLE), it can achieve a 5-8m CEP. The submunition, with a smart fuze, has been extensively tested against multi-layered targets by Wright Laboratory under the Hard Target Ordnance Program and Miniature Munitions Technology Program. The length to diameter ratio and nose shape are designed to optimize penetration for a 50lb charge. This weapon is also a potential payload for standoff carrier vehicles such as Tomahawk, JSOW, JASSM, Conventional ICBM, etc. This concept upgrades the SSB to add a low cost solid state LADAR (LASER RADAR), which is a terminal, autonomous seeker that is used in the guidance near the end of flight in order to take out the Target Location Error. This seeker is based on the Wright Lab Demonstration of Advanced Solid State LADAR (DASSL) program. The LADAR will provide a three dimensional image of the target. Coupled with INS/GPS during the midcourse guidance, this terminal seeker can reduce the CEP to <3m. This concept incorporates a solid rocket motor to increase the impact velocity of the SSB which will result in increased penetration performance. Two designs are under investigation; one with an inline motor and the other with a wrap around rocket motor to minimize total weapon length. The inline design was extensively tested against multi-layered targets during WL Hard Target Ordnance Program.

### WPNS169 -- JASSM P3I Penetrator

**DESCRIPTION:** This concept is a P3I to the Joint Air-to-Surface Standoff Missile (JASSM) to replace the baseline warhead with **an advanced penetrator** that meets or exceeds the objective penetration requirement specified in the JASSM Operational Requirements Document (ORD) and to add a synthetic aperture radar (SAR) seeker for adverse weather precision attack capability. JASSM is the next generation cruise missile to destroy the enemies war-sustaining capabilities outside the ranges of the area air defenses. The Standoff capability allows us to target key enemy centers of gravity without putting the warfighter in harms way, well beyond the range of current assets. **The warhead concept is a 1000 pound dense or ballasted penetrator. The warhead would either be designed with a dense metal case or contain dense metal ballast for maximum penetration.** The warhead will be filled with advanced insensitive explosive to compensate for the reduced charge weight. The JASSM will be compatible with the B-52, F-16, F/A-18 (threshold), B-1, B-2, F-15E, F-117, S3, P3 and JSF (objective). This concept uses the Hard Target Smart Fuze (HTSF), an accelerometer based electronic fuze which allows control of the detonation point by layer counting, distance or time. The accelerometer senses G loads on the bomb due to deceleration as it penetrates through to the target. The fuze can distinguish between earth, concrete, rock and air.

### WPNS170--UNITARY CALCM--BLOCKII with Shaped Charge Precursor

**DESCRIPTION:** The Conventional Air Launched Cruise Missile (CALCM) is a highly affordable, very long range standoff missile which is produced by modifying surplus AGM 86B, Air Launched Cruise Missiles (ALCM). The CALCM Block I missile, currently in production, incorporates a 3000 LB Class blast fragmentation warhead and Global Positioning System (GPS) receiver for navigation. The Block I system, when launched from CONUS based B-52 aircraft is highly effective against soft, above ground targets like Surface-to-Air Missiles (SAM) or radar sites. **The Block II program is the Precision Strike variant of CALCM. It incorporates a penetrating warhead,** updated state of the art, near-precision, GPS guidance, and a modified terminal area flight profile to maximize the effectiveness of the warhead. The penetrating warhead is augmented with two forward shape charges. To maximize the warheads effectiveness against hardened targets, the Block II will maneuver and dive onto its target in a near vertical orientation. The updated guidance system will increase the systems lethality by obtaining a less than 5 meter CEP. The Precision Strike variant of CALCM was successfully demonstrated in December 1996. A CALCM modified with a new precision GPS implementation flew for 4.5 hours, performed a newly developed steep terminal dive, and impacted the target within 2.5 meters of the aim point. The demonstration clearly showed that CALCM is capable of delivering it's warhead with precision accuracy from extremely long standoff ranges.

**A feasibility study was concluded in April 1997,** in which it was determined the BROACH Warhead on CALCM would offer very significant hard target capabilities. Foreign Comparative Test (FCT) funds have been provided by DoD for a demonstration of **the UK's BROACH Warhead.** The FCT will conclude in early 1998.

The current Block II program is structured for EMD to begin in first quarter FY99 with missile production to commence in third quarter FY00. Total procurement is for 130 missiles.

#### **JUSTIFICATION:**

This program will provide the warfighter a hard and deeply buried target defeat capability from outside theater defenses. The Block II CALCM will be capable of holding at risk high priority assets essential to the enemy's warfighting ability. The system can prosecute these target from standoff ranges well outside theater defenses thereby ensuring deploying aircraft are not placed in harms way.

**WPNS506 -- AUP 1000 pound Warhead Development**

**DESCRIPTION:** Advanced Unitary Penetrator (AUP) is a 2000lb class penetrator warhead intended as an upgrade/replacement for the BLU-109 warhead in applications requiring increased penetration. The AUP is designed to provide increased penetration capability over the BLU-109 warhead while maintaining the same overall weight, mass properties, dimensions, and physical interfaces associated with the BLU-109. This warhead is compatible with the Hard Target Smart Fuze (HTSF) or the Joint Programmable Fuze (JPF). The HTSF is an accelerometer based electronic fuze which allows control of the detonation point by layer counting, distance or time. The accelerometer senses G loads on the bomb due to deceleration as it penetrates through to the target. The fuze can distinguish between earth, concrete, rock and air.

**WPNS510 -- JASSM w/multi-Stage Warhead, GBU-32**

**DESCRIPTION:** Program develops the BROACH warhead for possible use on numerous platforms. BROACH is a dual stage, shaped charge with a follow through penetrator.

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**Above extracts from ANNEX F Common Solution/Concept List (U) 11 July 1997 Rev 10**

At [http://fas.org/man/dod-101/usaf/docs/mast/annex\\_f/index.html](http://fas.org/man/dod-101/usaf/docs/mast/annex_f/index.html)

**Related Internet sources**

<http://www.fas.org/man/dod-101/sys/smart/index.html> - FAS Smart weapons Index

<http://fas.org/man/dod-101/sys/smart/agm-86c.htm> - AGM-86C/D

[http://www.af.mil/news/factsheets/GBU\\_15.html](http://www.af.mil/news/factsheets/GBU_15.html) - variant BLU 109

[http://www.af.mil/news/factsheets/AGM\\_65\\_Maverick.html](http://www.af.mil/news/factsheets/AGM_65_Maverick.html) - variants E/F/G/K 300 lb

[http://www.boeing.com/news/releases/1999/news\\_release\\_991202o.htm](http://www.boeing.com/news/releases/1999/news_release_991202o.htm) - Boeing chooses UAP9 for AGM-86D

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Discussion paper

13 March 2001, updated 5 June

## **Use of Depleted Uranium in the Balkans War: Will the UNEP report include "Dirty" DU and missile targets?**

Dai Williams

The international debate about hazards of DU munitions poses a problem for the US, UK and other governments (and munitions manufacturer) with a high investment in DU weapons systems. Expert denials have been used to reduce public concern about hazards of DU weapons.

The UNEP report on its brief study of 11 DU target zones in the Balkans due out today (13<sup>th</sup> March 2001) may raise more concerns, or may come to similar conclusions as the recent EU expert report that supported current US and UK government positions.

The following assessment based on current Internet sources (mainly Jane's defence website) re-visits concerns that began during the Balkans war. Newly located information raises some very serious questions that may or may not be covered in the UNEP report.

### ***Contaminated (or 'Dirty') DU***

The preliminary UNEP report already provided important new clues to the potential hazards of DU - the "Dirty DU" issue. The first lead to this was their location of DU by use of Beta and Gamma detectors (pure DU emits Alphas radiation). This was explained by an interim analysis indicating contamination with fission products that could only come from recycled uranium from reactor rods - U236 and Plutonium. This possibility was picked up by the Military Toxics Project in 1999 but UNEP's study was the first report of this in a DU target zone. US Government analyses suggest percentages are very small and present "minimal risks" to troops and civilians. However it seems possible that older US stocks of DU munitions e.g. used in the Middle East and Bosnia, and those manufactured by other governments e.g. Russia, the UK and Israel may have had minimal quality control for this contamination.

This issue suggests that earlier DU target zones may have contained significant levels of contamination by highly radioactive isotopes in addition to pure DU (U238). Expert and government denials of DU risks based on Alpha radiation hazards only are invalid for "cocktails" of multiple radioactive substances. Theoretically they might have some validity for pure U238. Practically and ethically they have been misleading by error or deliberate omission.

Other Internet sources indicate that other toxic materials like Beryllium may also be used in some DU munitions. This requires a complete toxicological assay of munitions and target zones - not only for Uranium elements and isotopes. These secondary substances, even in small traces, need to be considered in all future further epidemiological studies of suspected DU exposure. Any reference to these or similar materials in the UNEP analyses could be very important.

### ***Use of DU in missiles***

In 1999 Nato spokesmen denied that DU was used in cruise missiles in the Balkans War. Reports that DU had been used in some Tomahawk cruise missiles were discounted on the basis that it was only used as dummy warhead ballast in tests of nuclear versions.

After these enquiries and denials about the possible use of DU in missiles dropped out of subsequent discussions on the Internet (e.g. DU list) and in the media.

However the following points concern me:

### **Lost DU**

Several countries in the Balkans region reported increased levels of airborne radioactivity during the Balkans air war in April-May 1999. For sufficient quantities to be detected over hundreds of miles suggests there must have been significant quantities at source.

These observations seem inconsistent with government, Nato statements and the latest EU Commission Report that radiation levels and hazards in DU target zones in the Balkans were minimal. Will the UNEP studies indicate sufficient ground radiation levels to explain wide dispersion of radioactive dust in the region? If not where did the reported increases in airborne radiation come from in spring 1999?

One explanation for could be that DU was not only used in 30mm shells armour piercing shells as Nato claims but also in missiles. This might account for a substantial tonnage of "lost DU".

### **Other missile systems**

Enquiries to governments about use of DU in missiles need to cover weapon systems involved - not restricted to Tomahawks.

A recent Internet investigation indicated that in 1996 Boeing started to convert nuclear armed AGM-86B missiles to conventional (i.e. non-nuclear) versions re-named **CALCM** (Conventional Air Launched Cruise Missiles) - **AGM-86C**.

One version of these - the **AGM-86D** - uses an "**advanced penetrating warhead to quickly provide theater commanders with a long range weapon to precisely attack an enemy's most valuable facilities.**" (source Jane's website and Boeing via: <http://www.defence-discovery.com> and search for "Defeat of High Value Targets". See also Boeing CALCM AGM-86C).

In the USA in 1998 Lockheed Martin developed an Advanced Unitary Penetrator (**AUP-3M**).

In the UK British Aerospace Royal Ordnance developed a penetrating warhead system known as **BROACH**/Multiple Warhead System (**MWS**). In May 1998 ground tests in Wales indicated that this could penetrate a 12-foot thick concrete target. It was selected for US AGM-86 systems.

Both warhead systems were under competitive evaluation in 1998-99 to win contracts for re-equipping AGM-86 systems. In December 1998 Operation Desert Fox was an ideal opportunity to test these systems in combat. The Balkans war presented many more opportunities in April-May 1999.

High penetration of targets requires high kinetic energy munitions i.e. made of high- density materials. DU and Tungsten are the most commonly referred to materials in reports on kinetic energy munitions. DU has three advantages over Tungsten: easy availability, far lower cost (it is a waste product of nuclear processing) and its pyrophoric quality that makes it an effective incendiary as well as high penetration material.

BROACH warheads weigh approximately 400 kilograms of which 90 are explosives. After control systems this leaves 150+ kilos of penetrating material. If this is DU (clean or dirty) it would create a far higher volume of Uranium oxide dust than A10 anti-tank attacks. Just 20 missiles would match the total quantity of 10,000 GAU-8/A 30mm armour piercing shells that the US admitted to using in the Balkans war (the DU penetrators in these shells weigh just under 0.3 kilograms). Since deep penetration missile warheads also contain explosive charges the likelihood that DU would oxidise is likely to be higher than the percentage of 30mm shells fired that hit hard targets and burned into DU oxide dust.

It seems likely that the AGM-86D system was tested in attacks on command bunkers during Operation Desert Fox in December 1998. Photographs showed that occupants were incinerated suggesting incendiary as well as blast effects.

The map of DU targets in the Balkans war shows a high concentration on the Kosovo - Albanian border. This area is reported to have many deep bunkers built during Tito's regime. If Serb forces used these bunkers they would have been regarded as strategic targets, hence justifying high penetration cruise missile attacks. Even if they were unoccupied they would have been ideal targets for combat testing of the new AGM-86D systems.

If cruise missiles did use DU then the tonnage of DU pollution in parts of the Balkans may be far higher than that declared so far by Nato. And the UNEP team may have been directed away from the most heavily contaminated DU target zones.

**Questions to ask the US Government:**

- a) How many AGM-86C or D missiles were fired in the Balkans air war in 1999?
- b) How many of these were equipped with high penetration warheads? (BROACH, AUP-3M or other).
- c) Which and how many sea-launched missile systems used deep penetration warheads?
- d) How many of any high penetration warheads contained Depleted Uranium?
- e) What was the total tonnage of DU munitions used during the Balkans war of ALL munitions containing DU - in addition to the 30 mm shells so far declared?
- f) What were the target locations of all air- or sea-launched cruise missiles, including strategic or system testing targets in Kosovo and Serbia?

**Questions to ask UNEP, or look for in their report:**

- a) How many of the 11 sites inspected had experienced cruise missile as well as A10 attacks?
- b) Was UNEP given the option to visit cruise missile targets?
- c) The discovery of one or two 30 mm DU penetrators in each location indicates a need for more detailed study when resources permit. 30 mm shells are fired in bursts of 50-100 shells per attack. What happened to the rest?
- d) If the 11 sample locations did not include cruise missile targets will UNEP endeavour to do a follow up study of deep penetration cruise missile target sites as well this year?

### **Questions to ask the UK Government**

- a) Does the BROACH warhead system use Depleted Uranium?
- b) Did the BROACH warhead tests in South Wales include some experiments with Depleted Uranium components?
- c) If DU is not used in the BROACH system what high-density material is used instead?
- d) If DU is used in the BROACH system what environmental precautions have been taken to protect staff and local communities in South Wales or any other testing location in the UK?
- e) Where are the BROACH warheads manufactured in the UK? Have there been any accidents or incidents during their manufacture? Have these been fully investigated?
- f) Were UK manufactured missile warheads used in Operation Desert Fox or in the Balkans war?
- g) What is the full chemical analysis of components in the BROACH and any other UK manufactured weapon system using Depleted Uranium? i.e. what level of contamination from other radioactive or toxic elements exists?
- h) What UK missile systems use MWS technology (BROACH or other warheads)?

### **Conclusions**

1. In "Defeat of High Value Targets" on the Janes website "***the unique advantages of MWS (multi-warhead system) technology are set to make it the preferred system for cruise missiles throughout the world.***" In April 1999 the US Government awarded Boeing contracts to convert 95 surplus ALCM's to CALCM's.

If DU is being used extensively in high penetration missile systems it is easier to understand the US and UK governments' strong opposition to a global ban on the use of DU in weapons systems. Armour piercing shells can use tungsten as a substitute - as in the Phalanx naval gun system. But deep penetration cruise missiles are of major tactical importance. They would be very reluctant to loose this capability.

2. If DU has been used in cruise missile systems in the Middle East or Balkans wars they may added significantly to the tonnage of DU oxide in the atmosphere around target zones - and hence radiation exposure to troops and civilians.
3. If questions are asked of the US, UK or other governments, or Nato, about the use of Depleted Uranium then every weapon system with high penetration or incendiary effects has to be questioned. They should not be expected to volunteer information.
4. Each military operation is an opportunity to field test new weapons systems in action. The UK Government will use the Official Secrets Act to suppress disclosure of the weapons system it is using or developing. The USA has more public disclosure of information. This information is readily available to potential arms purchasers and the public through Internet information services like Janes. The UK Government's use of the Official Secrets Act to conceal use of controversial weapons systems including Depleted Uranium has to be questioned in the public interest.

5. Tactically and economically DU weapons have many advantages for military purposes, and to reduce nuclear waste stockpiles. It is understandable why they wish to retain the option to use DU munitions.
6. In humanitarian and environmental terms I am deeply sceptical about the completeness and sponsorship of scientific research claiming that DU oxides - alone or in combination with agents - pose no risk to human health.
7. Whether or not our countries should be armed with DU munitions should be a matter for Parliaments, not the military to decide. To make these decisions the public must have full access to the scale of testing, hazards and combat use of DU munitions.
8. If DU has also been used in missile systems in conflicts in the Middle East and Balkans then concealing its use will have put additional people at risk in each target location.
9. The new generation of MWS deep-penetration warheads was only in its trial period during the Balkans war. How many of the world's current stocks of cruise missiles are equipped with depleted uranium warheads? And how many countries have the US and UK exported these systems to?

Other DU researchers may have answers to some of these questions. I look forward to the UNEP report but suspect that the UNEP team did not have all the information they needed to do a full evaluation of DU use in the Balkans war.

30 mm anti-tank shells may be only the tip of the DU iceberg. If we ask the wrong questions we get the wrong answers.

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#### **Footnote** (update on 5 June 2001)

This analysis was first prepared in March 2001 after researching suspected use of DU in smart bomb and missile systems (refer previous paper "Tip of the iceberg? - apparent use of DU in bombs and missile systems).

The final UNEP report indicated low levels of DU contamination on the sites visited and remarkably few 30 mm penetrators. One subsequent report suggests that KFOR troops had partially cleaned up these locations before they were disclosed to UNEP for inspection.

However if DU was used in some cruise missile and smart bomb systems in the Balkans war these would have involved quite different locations, including locations in Serbia as well as Kosovo.

Full disclosure on the nature of the "dense metal" used in any weapons system in the Balkans war is needed to re-evaluate targets zones involved, communities at risk and potentially wider geographic dispersal of DU oxide dust.

Earlier enquiries about the use of DU in bomb and missile systems met official denials. Current data suggests that earlier systems need review for potential DU content and that pre-Balkans War conflict zones - at least since the Gulf War - may need re-evaluation for the levels of DU contamination involved and subsequent exposure risks to civilians and troops.

This paper was forwarded to UNEP on 20 March 2001. Further investigation and wider public discussion are required.

End of section & notes

## **Depleted Uranium in the Afghan War: Are ground troops and civilians at risk in "hard target" smart bomb and cruise missile target zones?**

Dai Williams, 30 October 2001

### **Summary**

Internet sources from 1997 to date indicate that several 'hard target' versions of smart bomb and guided missile systems used by Allied forces in Afghanistan may contain Depleted Uranium (DU) as a major component to increase their penetration effect.

Of particular concern are systems that use the US "Advanced Unitary Penetrator" technology, or UK developed MWS technology with "shaped charge" penetrators.

Reports from the Center for Defence information suggest that at least 500 tons of smart bombs and cruise missiles have been used in the first three weeks of the Afghan war. They are most likely to have been used on "high value targets" e.g. Taliban and Al-Qaeda command centres, airfields and other military installations.

This information is offered for verification with governments and military authorities out of concern for potential DU exposure to UK, US and other Allied ground troops expected to be involved in search missions for Osama bin Laden and other Al-Qaeda or Taliban leaders. Also due to concerns for potential exposure to local civilians, international aid workers and media personnel.(1)

The US and UK governments take the view that use of Depleted Uranium in weapons presents no significant hazards to human health. They have also denied that it is used in missile systems. However information from Jane's Defence indicates that it has been used in at least one anti-tank missile system and in "shaped charge warheads".(2) Analysis of multiple sources suggest that it may be a key component of several recent guided weapon system upgrades.

### **Internet Sources**

This report is based on three direct Internet sources plus links to manufacturers' websites from these prime sites:

- **Jane's Defence Information** <http://www.janes.com>  
General information about weapons systems, manufacturers bulletins and actions in the Balkans (4). Huge range of subjects, informed summaries but detailed information about weapons systems only available to subscribers. More DU information was available during the Balkans war. Good access.
- **Federation of American Scientists** <http://www.fas.org>  
Extensive information about weapons systems (5), historical records of government procurement plans and weapons development. Some pages seem quite old so need verification for most recent progress from other sources (e.g. Jane's).
- **Center for Defence Information**, Washington <http://www.cdi.org>  
Very concise strategic summaries of US military information by ex-military personnel. Its Terrorism Project gives a daily assessment of Afghan war operations and prime systems (6). Not as detailed as Jane's or FAS but easy to access, good links and useful for cross-referencing with other sites.

## **Military uses and health aspects of Depleted Uranium**

DU has been used in weapons systems in the USA, UK, Russia and Israel for at least 15 years and exported to over 20 nations. It has two special qualities for use in military applications:

- a) Very high density (1.7x heavier than lead) which gives it high kinetic energy for its volume.
- b) Pyrophoric properties - DU ignites at high temperature, melting through armour and adding incendiary effects to its munitions.

Depleted Uranium (Uranium 238) is the main by-product of refining Uranium ore for nuclear fuel. It emits high energy but very short range Alpha radiation. In its pure metallic state it is relatively stable and safe to handle (e.g. if ammunition is handled with gloves). However it presents two main health hazards:

- DU ignites at high temperature and burns into DU Oxide - a fine, Alpha-radioactive, toxic dust, easily inhaled, widely dispersed by wind and water, very hard to detect and to remove from the environment or the lungs.
- Military DU is not pure. It includes small quantities of highly radioactive and toxic isotopes including U236 and Plutonium due to recycling nuclear fuel rods in DU processing. It was probably these other elements that enabled the UNEP survey team to trace DU in Balkans target zones.(3)

DU oxide contamination has been suspected as one source of Gulf War syndrome for several years. Other recently acknowledged radioactive elements may be an additional factor in long-term illnesses, cancers and birth defects suffered by civilians and veterans or their children exposed to DU during the Gulf War, and in Leukaemia deaths of some NATO troops following the Balkans war.

## **Suspected of DU in hard target guided weapons**

Since the Gulf War it has been known that several weapons systems use DU e.g. 30 mm armour piercing shells fired by A10 planes and 120 mm shells fired by tanks. Both were used in the Gulf war. 30 mm shells were the only DU munitions declared by the USA / Nato during the Balkans war.

The use of DU in smart bombs and cruise missiles was denied by Nato spokesmen during the Balkans war. However, as a result of anomalies between UNEP findings early this year and radiation reports during the Balkans war this possibility was researched again in January and February this year.(2)

The US and UK governments have been reluctant to discuss military uses of DU and its potential hazards. Both declare that research proves DU is not a hazard to troops or civilians but take radiation precautions when using it in test situations.

In April 1999 Greek scientists reported a dramatic increase in atmospheric radiation levels two weeks after the start of the Balkans air war. I have been informed that they subsequently lost their jobs and their research was closed down.

One explanation for the Greek measurements might be that DU has been used in larger weapons systems, and therefore in far larger quantities and different locations than previously declared or studied.



## Hard target guided weapons used to date in the Afghan War

First clues to the potential use of DU in guided weapons were picked up in the following document on the FAS website:

[Air Force Mission Area Plan (MAP)]

**ANNEX F Common Solution/Concept List (U)**

**[as of 11 July 1997 - Rev 10]**

at [http://fas.org/man/dod-101/usaf/docs/mast/annex\\_f/part26.htm](http://fas.org/man/dod-101/usaf/docs/mast/annex_f/part26.htm)

This included references to introducing or upgrading at least 9 systems to include "dense metal" penetrators or ballast to increase their penetration effect and hard target capability. NB most cruise missile and guided bomb systems have several warhead options e.g. for blast, sub-munitions (e.g. cluster bombs) or hard target capability. It is the hard target versions that are of concern here.

Only two high-density metals are usually mentioned in descriptions of kinetic energy weapons - DU and Tungsten. Both are similar in density (Specific Gravity 18+) but very different in material and manufacturing costs. They may also be used in alloys.

Study of the Jane's, FAS and CDI websites indicates a number of smart bomb and guided missile systems with upgraded features matching those described in the 1997 concept document. [NB: Abbreviated names / code numbers may be confusing. Some refer to guidance systems, some to the main vehicle and some to warhead types. The following notes have tried to make these distinctions clear].

Of these hard target systems the following have been reported on the CDI website, or expected to have been used by the Jane's website, in Afghanistan since 7 October 2001.

**For health and safety reasons the crucial question to ask the US and UK governments is this: Is the 'dense metal' used in any of these systems Depleted Uranium, or an alloy including DU?**

### 1. Laser or GPS Guided Bombs

**GBU 28 Bunker Buster bombs** and the upgraded version **GBU 37**: 5000 lb bombs of which 4,400 are "dense metal" penetrators. The GBU-37 upgrade uses a **BLU-113 penetrator**, improving on the converted gun barrels used for the original GBU-28 version improvised in the Gulf War.

CDI's Action Update for Oct 11 refers: "Underground bunkers were also targeted using the 5,000 lb bunker buster... B-52's and B-1's with cluster and other penetrating bombs (possibly the BLU-109 and BLU-113 - DoD would not specify); enormous secondary explosions reported."

**GBU 24 Paveway III**. 2000 lb bombs using the **BLU-116 Advanced Unitary Penetrator (AUP)** weighing 1700 lbs. "The AUP features an elongated narrow diameter case made of a tough nickel-cobalt (steel) alloy called Air Force 1410. The AUP maximises sectional density by reducing the explosive payload and using heavy metals in the warhead case." (Note: this FAS description is the most explicit about the combination of alloy casing and dense metal ballast that seems to define the AUP penetrators, produced in several sizes). Designed to destroy hardened aircraft hangers and underground bunkers. Designed to replace the BLU-109.

## 2. Joint Direct Attack Munitions (JDAM)

GBU 29, 30, 31, 32 feature 250, 500, 2000 and 1000 lb bombs respectively with all-weather GPS guidance systems. Originally designed by adding control fins to the BLU-109 and 110 hard target bombs. The new AUP warheads are designed to be direct substitutes for the 109 and equivalent bombs with twice the penetration power for the same size and weight. Refer 1997 proposed specifications on the FAS website and summary table in Tip of the Iceberg (2). Are AUP warheads now in use in JDAM systems?

CDI reported 500 JDAMs used in week 1.

## 3. Cruise missiles

**AGM-86D CALCM** (air-launched cruise missile). New version converted by Boeing from earlier nuclear warhead versions to include a **2000 lb Lockheed Martin Advanced Unitary Penetrator** (AUP-3M) using "dense metal ballast". Long range missiles for hard target capability e.g. underground command bunkers. Most likely for targeting command posts in mountain caves as well as open locations.

Jane's reports expects use of CALCM's in the Afghan operation but CDI reports do not mention them, except perhaps included in total cruise missile numbers (50-60 in week 1).

US Navy sources denied use of DU in BGM-109 **Tomahawk missiles** during the Balkans war except for testing dummy nuclear warheads. But the **Tactical Tomahawk Penetrator Variant** commissioned in May 1999 "will be modified to incorporate the government-furnished penetrator warhead (AUP?) and the hard-target smart fuze". Delivery was scheduled for 2003 so it seems less likely that DU has been used in Tomahawk attacks in Afghanistan yet - unless for testing pre-production prototypes. This increases the likelihood that the AGM 86D has been the cruise missile of choice for strategic "high value targets".

The 1997 procurement plans included a series of **Small Smart Bombs (SSB's)** weighing 250 lbs with 'the same penetration capabilities as the BLU 109' - using "boosted penetrators with high density payloads". Proposed applications included delivery as sub-munitions by Tomahawks and Joint Stand Off Weapons (JSOWs). Whether these have been actually been developed for use in Tomahawks or JSOW's is not known.

Jane's refer to other guided systems in Afghanistan that include sub-munitions options with anti-armour capability or shaped charge penetrators e.g. the **AGM-154 JSOW** (Joint Standoff Weapon), and **SLAM-ER** (Standoff Land Attack Missile - Expanded Response). There is insufficient data to know whether these systems include suspected DU components. However the UK BROACH warhead system (see below) was evaluated for the JSOW in 1998.

The **AGM-158 JASSM** (Joint Air to Surface Standoff Missile) has not been referred to in Jane's or CDI reports. However its 1000 lb P31 penetrator with "dense metal case or dense metal ballast" was specifically identified in the 1997 procurement list. So far there is insufficient information to know whether it has been discontinued, is under development, or has been used in prototype or production form in Afghanistan. It may be included in the unspecified air launched systems used in Afghanistan. If so it is another potential DU based missile system. Further information required.

## Potential UK involvement in DU guided weapons systems

Another form of hard target system is the UK developed **BROACH** two stage MWS (Multiple Warhead System) with a "shaped charge" penetrator.

The **2000 lb** version was developed to prototype trial stage in summer 1998 for competitive evaluation with the Lockheed Martin AUP for the upgraded **Boeing AGM 86D CALCM**. It was ground tested in South Wales and may have been field tested in the Operation Desert Fox and the Balkans War. But British Aerospace Royal Ordnance lost the Boeing contract to Lockheed Martin later in 1999.

The 1997 procurement list source suggested that a **1000 lb** version of this alternative **MWS** hard target technology was also under consideration for other applications e.g. the AGM 158 JASSM. It is not known whether BAE-RO have continued development or production of BROACH /MWS warheads.

The BROACH system needs similar DU investigation with the UK government, even if it has been discontinued. If it is currently in use, in production or prototype form, and if it has or may be used in Afghanistan, its "dense metal" specifications need to be investigated. It is very curious that Jane's' description of DU uses included "shaped charge warheads" in February 2001 (quote below) but that this description has been edited out of the current website version (link below):

### Extracts from Jane's Defence website (Feb 2001)

**DU is a heavy metal** that, when alloyed with titanium (up to 0.75% by weight), becomes a material with a density (18,600kg/m<sup>3</sup>) and ductility suited to making penetrators for kinetic energy anti-tank munitions, **or liners for shaped-charge warheads.** \*

During the Balkans operations from 1992 to 1996, only the US Air Force acknowledges its use in some of its 30mm cannon shells fired from the GAU-8A cannon.

**It is true that some guided weapons used depleted uranium to increase the penetration effect** and that the 20mm Phalanx close-in weapon system, used to protect warships at sea from sea-skimming missiles, also has a percentage of DU rounds.

Current description at [http://www.janes.com/defence/news/jdw/jdw010108\\_1\\_n.shtml](http://www.janes.com/defence/news/jdw/jdw010108_1_n.shtml)

\* Note: the reference to shaped charge warheads has been removed since February (see original quote in Tip of the Iceberg). These are referred to in Mavericks and the first stage of the BROACH MWS warhead.

## Evaluation of potential DU hazards in Afghanistan

One disturbing comment from Jane's was that the Military do not always know the materials used by manufacturers since some may be used interchangeably. Since the US DoD and UK MoD both take a public view that DU is not hazardous (at least in its metallic form) then the Military do not need any special instructions for munitions that may contain DU. If this logic is sustained there is no reason to conceal the past or current use of DU in smart bomb or cruise missile systems.

However if Military commands from any of the Allied forces have doubts about the potential use of DU munitions against hard targets in Afghanistan this will be a matter for urgent and full information exchange between the forces and governments concerned.

Note: although this paper concerns guided weapons that may contain DU any use in conventional systems e.g. armour-piercing shells from the AC 130 gunship matter too. The immediate operational concern is the likelihood that Special Forces will be expected to enter and inspect strategic target locations, underground bunkers and caves if accessible. Unlike anti-tank shells which leave distinctive entry holes there may not be obvious way for troops to distinguish potentially DU contaminated locations from other bomb damage.

Local geography and climate may be important if significant quantities of DU have been used. Afghanistan has more in common with Iraq than the Balkans - arid terrain prone to strong winds and dust storms. 300 tons of DU was declared in the Gulf War. Elevated radiation readings are still reported in some areas, years later.

The new generation (post 1997) of guided bombs and cruise missiles with hard target capability may be using DU in considerable quantities to achieve the increased penetration effects claimed by several upgraded systems - possibly 50% of the overall weight.

The majority of hard target bombing appears to have been accomplished in the first two weeks of the campaign. What's done is done. Potential DU use remains to be acknowledged, quantified and target locations identified. The 18 months delay for the UNEP survey after the Balkans war will not be psychologically or politically acceptable in the current conflict. However if DU has been used and this becomes known to the Taliban and Al Quaeda it may encourage them to evacuate strategic target locations at the earliest opportunity, and not attempt to return.

If DU munitions have been used in populated areas then contamination levels need to be assessed at the earliest opportunity - not only for Allied troops but for the welfare of local civilians, aid and media workers. Scarce water supplies are a special concern.

Unlike anti-tank shells guided bombs and missiles containing DU seem likely to oxidise most of the ballast load and to dissipate the resulting DU oxide (and embedded isotopes) over a considerable area in debris and dust-clouds.

Weapons designers and commissioning forces should have already evaluated these effects if the DoD and MoD acknowledge the potentially toxic and carcinogenic effects of DU oxide dust. No DU safety evaluation data for these systems has been located yet.

## Questions for the US and UK Governments

The basic questions asked in Tip of the Iceberg remain to be asked and answered publicly:

1. Which guided weapons systems (i.e. guided missiles, smart bombs and sub-munitions) use Depleted Uranium as the "dense metal" involved in hard target penetrators, by itself or in alloy with other metals?
2. How many of the 1997 hard target system concepts have been produced in prototype or production form, or are still under development?
3. How many of these systems or their derivatives have been used in live tests and military operations since Operation Desert Storm?
4. How many countries currently have stocks of DU in guided or other weapons systems?

And now these questions about its suspected use in Afghanistan:

5. Which and how many weapons containing DU have already been used in the current Afghan War, and where? Have DU weapons been used there before?
6. What is the estimate dispersal pattern of DU oxide fallout for each weapon? Will independent observers e.g. UNEP be allowed to commence environmental monitoring immediately?
7. What precautions will be taken to protect Allied ground troops from potential exposure to DU contamination?
8. What precautions will be taken to protect civilians and international aid teams, media, water supplies and agricultural land in potentially contaminated regions?

These concerns were submitted to the UK Government by Sir Paul Beresford MP at my request last week. Their answers are urgent in view of the imminent despatch of UK and other Allied ground forces, and the welfare of those already there.

These questions also have implications for communities and veterans involved in several recent conflicts who may have been in the vicinity of smart bomb or cruise missile targets. They may require fundamental re-evaluation of the consequences of DU health hazards and whether DU weapons systems comprise weapons of indiscriminate effect.

The potential use of DU in hard target guided weapons has obvious tactical military advantages. But its potential effects in large scale bombing campaigns may cause long term hazards for troops and civilians that seriously outweigh most military justifications.

Dai Williams, independent researcher  
Surrey, UK

#### **References to previous discussion papers available from the author**

1. Need for a DU Civilian Safety Handbook. 10 January 2001
2. Tip of the Iceberg? - apparent use of Depleted Uranium in bombs and missile systems. 25 Feb 2001. Includes more links to original sources.
3. Use of Depleted Uranium in the Balkans War: will the UNEP report include "Dirty" DU and missile targets? 13 March 2001, updated 5 June 2001

#### **Links used in this report**

4. Janes report on Air and Missile strikes in the Afghan war  
[http://www.janes.com/security/international\\_security/news/jdw/jdw011007\\_1\\_n.shtml](http://www.janes.com/security/international_security/news/jdw/jdw011007_1_n.shtml)
5. FAS links to guided missile and bomb specifications:  
<http://www.fas.org/man/index.html>
6. CDI Terrorism Project Action Update:  
<http://www.cdi.org/terrorism/actionupdate.cfm>

End of section & notes

First suspected DU casualties report from Kabul

October 29, 2001

## Taliban Claim U.S. Using Chemical Weapons

by Sayed Salahuddin

KABUL (Reuters) - Afghanistan's ruling Taliban accused the United States on Monday of using chemical weapons and invited foreign observers to check the claim.

But one deputy minister acknowledged that the war-shattered country did not have the facilities to test for chemical use. "We have some patients with superficial injuries with symptoms of chemical weapons," doctor Wazir of Kabul's Wazir Akbar Khan hospital, told a news conference.

Public Health Minister Mullah Abbas also said the hardline Muslim militia had proof that chemical weapons were being used. "Our findings prove that this is true. These bombardments have radioactive rays and chemical materials that also cause cancer," he told the same news conference.

Both men cited cases of chemical poisoning. None of the claims could be independently verified.

Deputy public health minister, Sher Mohammad Abbas Stanikzai, said the government did not have testing facilities and would welcome outside observers. "If there are more cases coming, we hope to be able to invite delegations to verify it and test it," he told Reuters Television.

Doctors said such cases had been reported in several hospitals across Afghanistan, and Stanikzai cited between 10 and 15 cases. "We can give details to people and doctors who understand for explanation. But we have several cases of acute diarrhea and also cases of breathing problems. In some of the cases it happened that people died," Stanikzai said.

"We do not have sophisticated laboratories in Afghanistan to test the blood of people and analyze it," he said, adding that the Taliban could not trust neighboring countries to carry out the testing because they backed U.S.-led attacks against them.

Wazir described the case of a 10-year-old boy with superficial wounds, but with respiratory problems who died after six hours. He said a 50-year-old woman who had minor injuries had also died.

"They were both toxic cases," he said. "We don't have the ability to make a diagnosis, but clinically we see symptoms as such."

Source: [http://dailynews.yahoo.com/h/nm/20011029/wl/attack\\_afghan\\_health\\_dc\\_1.html](http://dailynews.yahoo.com/h/nm/20011029/wl/attack_afghan_health_dc_1.html)  
(Yahoo & Reuters)

### Other reports

Another report of this press conference is on the khilafa.com website, source AFP at <http://www.khilafah.com/1421/category.php?DocumentID=2528&TagID=6>

This referred to three other patients who only had slight injuries but died with hours of arriving at the hospital after developing breathing problems and internal bleeding - "two girls aged 12 and 15 and a boy aged 15". The Public Health Minister said "the Taliban was also worried that US forces were using depleted uranium shells and that areas of Afghanistan would be left permanently contaminated".

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End of section and notes



## **DU Warning to Aid Agencies**

### **Message to Red Cross and Oxfam in UK**

5 November 2001

Re my call I attach my most recent analysis of suspected Depleted Uranium (DU) use in the Afghan war and a copy of my letter to the Prime Minister on the same topic of last Thursday.

### **Context**

I am an independent Occupational Psychologist with parallel interests in Occupational Health. I was involved in introducing an occupational health monitoring scheme in Shell's Vancouver refinery some years ago so I may be a little more concerned than most about low dose toxic substances.

I became concerned about the military use of DU at the start of the Balkans War and discovered extensive Internet sources, mostly starting from concern for Gulf War syndrome. These vary greatly in reliability so I double or triple check sources, including phone calls to key researchers. My analyses were used by BBC Radio 4 and Alex Kirby for raising the DU issue during and after the Balkans war.

I encountered widespread prevarication and dis-information from official sources in the US and UK during these researches. There are powerful vested interests involved - military, political and commercial - as well as the angst of veterans groups and some over-enthusiastic if not subversive organisations. These were illustrated by the 18 month delay before UNEP were allowed to survey Balkans DU target zones last November.

Anomalies in the UNEP reports alerted me to the possibility that DU was used in much larger weapons systems than declared by Nato / US during the Balkans conflict. Further research indicated that these were likely to be the new generation of "hard target" smart bombs and cruise missiles. (These systems come in several versions - not all have hard target capability). I asked my MP to seek clarification from Government on 16 October. No reply has been received yet.

I attach my most recent report - DU in the Afghan war (30 Oct 01) - circulated to other DU researchers, the media and several MPs last week. This explains my concerns and the questions that need to be answered by the US and UK governments.

I also attach my letter to The Prime Minister of last Thursday with potential implications for troops, civilians and of potential concern for yourselves - Aid workers.

To date the UK media have declined to report these concerns except Radio 4 Any Answers on Saturday. However the same concerns are being expressed, though less precisely, in Australia and Pakistan yesterday.

I am contacting my Occupational Health network contacts in the UK and International Forums for Organisational Health to evaluate these issues from a Health perspective. **The new weapons systems involved, and increasing evidence of contaminated or 'Dirty DU' alter all previous health risk assessments.** Re-assurances in the UNEP and Royal Society reports this year are compromised for failing to evaluate these dimensions. (I advised these concerns to UNEP in February but they have been ignored in subsequent statements).

## Practical implications for Aid organisations

The first point is that I am raising questions about the possible use of DU in these new weapons systems. No precise data is available about the "dense metal" they are based on. But it could only be DU or Tungsten in view of their enhanced performance (double impact for the same size implies double density materials). I am not scare-mongering. But I find sufficient evidence to make me deeply concerned for the health of anyone exposed to hard-target weapons target zones - sufficient to risk my professional reputation in raising the issue publicly.

## DU risk scenarios in Afghanistan

There are two main scenarios for these risks:

1. That DU is still only used in systems already declared - 25 or 30 mm armour piercing shells used by the AC-130 gunships against armoured vehicles. This would be equivalent to the reported use in the Balkans. Immediate target zones are potentially hazardous, requiring similar precautions for troops and civilians as recommended after the Balkans war.

Basically stay clear of wrecked armoured vehicles. Overall risk relatively low compared to other war hazards e.g. cluster bombs. (Some cluster bombs also use DU but this is a technicality for casualties injured by them).

2. That DU is being used in some, but not all, hard target munitions. The prime suspect systems concerned are identified in the attachments. The majority of hard target locations were hit in the first 2-3 weeks e.g. command centres, bunkers, ammunition supplies etc. These locations should be fairly evident by their prior use, bomb craters etc. The new hazard is that these targets may have far higher concentrations of DU contamination (100x greater) than low calibre anti-tank targets in the Balkans. Where possible it would be wise for all civilians to stay well away from these areas (several hundred yards) and any water supplies near them.

Weather conditions at the time of bombing could be highly significant. Winds can carry DU oxide up to 25 miles from studies in the US. Downwind areas are suspect.

## DU casualty Symptoms

The nature of injuries and sickness reported by civilians and aid workers may give clues to exposure to toxic hazards. Low doses of Depleted Uranium are one suspected source of Gulf War syndrome. They may include **flu-like symptoms** in the first few days, then slow developing ailments with non-specific causes. Medical personnel will be aware of previous reports of these symptoms, and that they may have non-DU causes. Relatively low short-term risk but long term health monitoring seems desirable.

**Of increasing concern is the possibility of more severe symptoms developing far more rapidly than previously associated with DU.** The far higher concentration of DU (if it has been used) could accelerate respiratory and toxic disorders, either due to the chemical toxicity of Uranium Oxide and related contaminants (Plutonium etc) or depending on the level of contamination in the DU batch due to radiation exposure.

Such **acute exposures** could cause serious illness within days, and death within months as reported for some Nato troops after the Balkans War (Italy, Spain, Portugal).

Their deaths were said not to be related to DU. But since DU was not suspected in bomb and missile targets this was omitted from analysis of their cases (i.e. their levels of exposure).

A Reuters report from Kabul last Monday was consistent with acute DU exposure (see separate report). Unfortunately Taliban sources are not considered reliable but this seemed like a naive account of potentially significant symptoms.

These latter points are probably most relevant for alerting medical personnel in the field, or treating staff who have returned from DU combat zones to the possibility of more acute versions of DU poisoning. It may also be relevant for epidemiological follow-up of personnel involved in previous conflict zones e.g. Iraq, Bosnia and the Balkans.

## **Scenarios for Government disclosure**

There are two scenarios for government disclosure:

- 1) **Denial** - probably expected in view of the political consequences of disclosure.
- 2) **Disclosure** - with the opportunity to establish hazardous locations, environmental and epidemiological implications.

I hope that media concern and parliamentary questions will get some disclosure of the suspected use of DU in Afghanistan. But it would seem appropriate for Aid organisations to approach the Government (Foreign Office or Ministry of Defence) for facts and advice e.g. areas to avoid, as eventually happened in the Balkans war.

In the meantime I offer this information as a factor that your HR and Occupational Health advisers may wish to check. It may be prudent to put medical staff on alert for possible DU-related symptoms and in some way to alert field personnel to report unexpected health problems in recent bombing locations. I appreciate the need to avoid undue anxiety beyond the obvious hazards they already face.

Please contact me if you would like copies of the two earlier reports that contain further sources that led to these concerns. You are welcome to copy, forward or refer this message and attachments as you think appropriate.

yours sincerely

Dai Williams, Chartered Occupational Psychologist  
Woking, Surrey UK

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*Layout edited and corrected from original Email message*

End of section and notes

## Mystery metal bombs may cause Afghan war syndrome

Media release 15 November 2001, Dai Williams

The rapid retreat of the Taliban may be partly due to a **mystery metal** used in new "hard target" weapons in the Afghan bombing campaign. It has been kept secret by the US and UK governments since 1997 but latest analysis of Afghan war reports and military information websites indicate that it is probably **Depleted Uranium (DU)**.

If DU has been used then UK troops, aid-workers and media teams in former Taliban locations may be entering toxic disaster areas. Without immediate environmental monitoring they risk the same health hazards suffered by Gulf War veterans and Iraqi civilians - an **Afghan War syndrome**. So what is the mystery metal? The UK Government was asked this question three weeks ago but has not answered it.

### Hard target weapons

The new generation of "hard target" smart bombs and cruise missiles can penetrate 10 feet of reinforced concrete before exploding. They were used to attack Taliban bunkers, caves, command centres, fuel and ammunition stores. They use "dense metal" warheads to double their penetrating power on hard targets.

The 2 ton GBU-37 Bunker Busters and 2000 lb GBU-24 Paveway smart bombs, plus the Boeing AGM-86D, Maverick AGM-65G and AGM-145C hard target capability cruise missiles all use "advanced unitary penetrators" (AUP-113, AUP-116, P31) or BROACH warheads with the mystery high density metal in alloy casings.

### Uranium or Tungsten?

The mystery metal must be hard and at least 2x as heavy as steel. Tungsten and Depleted Uranium (DU) are the main options. Both are used by US and UK forces for armour piercing shells. DU is preferred because it burns inside the target to become an incendiary bomb and is far cheaper and easier to manufacture.

### Uranium hazards and Dirty DU

DU (U238) is reprocessed nuclear waste. It burns in military targets and plane crashes to produce Uranium oxides as a fine, toxic, alpha-radioactive dust. The "Dirty DU" found in Balkans War target sites was contaminated with variable traces of U235 plus U236 and Plutonium from reactors. It presents a perpetual health hazard similar to asbestos - especially in the lungs. The UNEP report of DU used in the Balkans War played down its risks. They did not inspect bomb or missile targets.

Uranium oxide dust is a suspected cause of **Gulf War syndrome** and the epidemic of cancers and birth defects in Iraq since the Gulf War where 300 tons of DU were used. UK EOD (bomb disposal) teams in the Balkans were instructed to use full radiation protection (NBC) equipment when inspecting DU targets (Hansard).

### 50-100 times greater hazard than in the Balkans

Reports from the Center for Defence Information in Washington indicate that several hundred tons of smart bombs and cruise missiles have been used in the Afghan bombing including many of the hard-target weapons above.

The mystery metal is 50-75% of the weight of the bombs - up to 1.5 tons in the GBU-37 Bunker Buster bombs. If this is DU then target zones will be 50-100x more contaminated than by the pencil-sized 30 mm (0.27 kg) anti-tank shells used in the Balkans War, and more like the DU ammunition fire in the Gulf War. DU oxide is known to travel up to 25 miles by wind so large areas may be affected by each bomb.

### **Government in denial about DU?**

The UK Government is aware of the problem. They were asked to identify the mystery metal in hard target guided weapons by DU researcher Dai Williams via his MP on 17th October and direct to the Prime Minister on 1<sup>st</sup> November. No answers have been received.

On 24 October Defence Minister Geoff Hoon told Parliament that "we do not rule out the use of depleted uranium ammunition in Afghanistan, should its penetrative capability be judged necessary in the future" (Hansard). He denied that DU has been used, at least by UK forces, on 1<sup>st</sup> and 5<sup>th</sup> November. Can he speak for US forces?

Hard target bombs and missiles have been used extensively in Afghanistan since 7th October. Until the mystery metal involved is identified and independently verified Mr Hoon's denials are not convincing. He is responsible for military, not humanitarian policies. After the bombing political responsibility for the truth is shared by the Cabinet.

### **Political responsibility: minimising a potential health disaster**

This question is an immediate occupational and public health issue for the 4000 UK troops plus aid and media teams about to enter Afghanistan, for those already there and for the civilian population. The first warning was a dying child who led a Taliban doctor to suspect that US forces were using radioactive or chemical weapons (Reuters, 28 October). Many Taliban troops near bombing targets will already be affected if DU has been used. This may be one reason for their rapid retreat.

The US and UK Governments have an immediate political responsibility to disclose the mystery metal used in the Afghan bombing. If DU has been used this will become obvious soon from medical reports. Precautionary action is essential now to minimise a potential health disaster. There is no cure for inhaling DU dust.

In 1999 the UK media questioned the use of DU in the Balkans so troops and aid teams were alert to its potential hazards. They have had copies of this analysis for two weeks but have stayed silent about the mystery metal question in Afghanistan.

In the USA a Bill submitted to the US Congress on 18 October has called for a total ban on DU and facts about its use in Afghanistan. Veteran and environmental groups are waiting for the US Department of Defence's reply.

The Red Cross and Oxfam have been alerted to these potential risks. International aid organisations and allied forces would be wise to assume that the mystery metal is depleted Uranium until there is firm evidence otherwise. DU precautions apply as after the Balkans war (e.g. bottled water) plus avoiding bombed Taliban locations.

Full analysis and sources available from Dai Williams on 01483-222017 or by Email to [eosuk@btinternet.com](mailto:eosuk@btinternet.com) . Internet links include:

- **Jane's** report on Air and Missile strikes in the Afghan war  
[http://www.janes.com/security/international\\_security/news/jdw/jdw011007\\_1\\_n.shtml](http://www.janes.com/security/international_security/news/jdw/jdw011007_1_n.shtml)
- **FAS** (Federation of American Scientists) smart bomb and cruise missile specifications:  
<http://www.fas.org/man/index.html>
- **CDI** (Center for Defense Information, Washington) Terrorism Project Action Update:  
<http://www.cdi.org/terrorism/actionupdate.cfm>

## Bombing Afghan Water supplies

Extract from New Scientist and copy of message to DU researchers on 21 Nov 2001

### Dying of thirst

New Scientist 17 Nov 2001, page 7

by Fred Pearce

#### The plight of Afghans will get even worse if water-supply tunnels are targeted with bunker-busting bombs

"The US bombing raids on Afghanistan could dramatically increase water shortages in this drought-stricken country.

Military authorities are increasingly talking of introducing a new phase to the bombing campaign, using "bunker bombs" to flush out Osama bin Laden, his al-Qaeda group and Taliban fighters from hillside tunnels that riddle the landscape. These same ancient tunnels are a vital source of water for hundreds of villages.

And last month an American bombing raid damaged a hydroelectric power station close to the Kajaki dam, Afghanistan's largest. As well as supplying electricity to the region, the station drives machinery that controls the flow of water along the Helmand, the country's longest river. Concerns are now growing that the attack, or a repeat strike, may damage an irrigation system fed by the dam's reservoir. The system waters the fields that support some half a million people.

Afghanistan, which is in the third year of an unprecedented drought, relies on a mixture of ancient and modern water-supply systems. As well as relying on the Kajaki dam, the south of the country is peppered with hundreds of water-supply tunnels, often running for tens of kilometres into hillsides to tap water reserves deep underground.

The tunnels, known in Pashto as *karez*, are now a target for American warplanes. Military strategists claim that bin Laden and Taliban troops may now be hiding out in the *karez*, many of which are wide enough to accommodate companies of men. They say the *karez* made impenetrable hideouts for the mujahedin during their guerrilla war with Soviet occupiers in the 1980s.

Most of the *karez* are identifiable from the air by the access wells set at regular intervals above them. But a concerted blitz on these tunnels - possibly using the US's much-touted "bunker-buster" bombs - would cause immense harm to rural communities that increasingly rely on them for water supplies.

Often abandoned in favour of more modern water-supply systems, *karez* have become a vital resource as shallower water sources have dried up. Earlier this year the aid organisation Islamic Relief encouraged locals to renovate 75 *karez* in the drought-parched Helmand province in southern Afghanistan, by offering food aid in return for work in the tunnels. Some *karez* were also rejuvenated in Kajaki province, close to the dam hit by the US."

Full article is in the DU Archive at <http://www.newscientist.com> . Archive access requires a subscription - 7 days free subscription available through the site.

**Message sent to DU researchers re New Scientist article,** 21 November 2001

This (article) may explain why bombing continues after most of the Taliban have retreated.

Fred Pearce's report adds urgency to my question to the US and UK governments - What is the dense metal that the GBU-37 bunker buster bombs (and other hard target guided weapons e.g. GBU-24, AGM-86D etc) rely on for their penetration effect?

If water supply tunnels are bombed with DU weapons (1.9 ton dense metal penetrator per GBU 37) they may perpetually poison these water supplies. If they intend to send troops into these underground tunnels to flush out Taliban or Al Queda troops after using DU weapons they will need to operate in full NBC equipment if they are not to risk severe uranium oxide contamination.

This also means that water supplies in the affected regions could be extremely hazardous to the aid teams and troops that the US, UK and other Governments are planning to send to Afghanistan. The DU question must be put to all Governments and aid organisations involved and preferably to the UN. Water pollution monitoring seems an immediate precaution.

Dai Williams

Note: The analysis **DU in the Afghan War** was sent to New Scientist in reply to this article on 21 November, received without comment. A number of New Scientist archive reports about Depleted Uranium were temporarily unavailable for Internet search soon after this article was published but were available again recently.

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