# R v DEAN, MAHER, SCOTT & OTHERS

## AGGRAVATED TRESPASS AT LAKENHEATH – 11 MARCH 2003



### CLIENT: BINDMAN & PARTNERS

### REPORT REF NO R3107-A1.DOC

| REVISION Nº | APPROVED | 1ST ISSUE | PRESENT ISSUE |
|---|---|---|---|
| R2 | | 30 August 2003 | **15 DECEMBER 2010** |

**Large & Associates** **The Gatehouse** 1-2 Repository Road Ha Ha Rd Woolwich Common London UK SE18 4BQ
☎ 44[0]20 8317 2860 *fax* 44[0]20 8317 2859 *mobile* 07971 088 086 mailto:largeassociates@msn.com

**R *v* DEAN, MAHER, SCOTT & OTHERS**

**SUMMARY**

In this Statement I discuss why RAF Lakenheath should properly be considered to be just one component of the USAF's strike and air defence capability from the United Kingdom. I show this capability to include Mildenhall and Fairford USAF bases acting in coordination with Lakenheath.

I describe and consider the level and type of activities underway at the USAF air bases around 11 March 2003, that is on or about the date that the defendants allegedly trespassed onto the base, noting that the levels and nature of the activity would be greater and more diverse than in normal times.

I consider the estimates of Iraq nationals killed and injured, both civilian and military, during the course of the conflict and I note that some of these casualties must have arisen as a direct result of the coordinated activities of the three USAF air bases of Lakenheath, Mildenhall and Fairford. These coordinated activities resulted in air-delivered munitions - smart and dumb bombs, cruise missiles, cluster bombs, depleted uranium rounds and fuel-air-explosives - being applied in anger to Iraq.

I provide example of the general types of air-delivered munitions and weapons systems known to have been deployed in the Iraq conflict and I show how these types of weapons function, particularly with regard to the accuracy of placement and if it is possible, by pre-assessment and selection of the targets, along with precision of delivery, from the devastation footprint, and by other factors and considerations to concentrate the damage to the immediate surrounds of a point target and thus eliminate or minimise 'collateral' damage. I conclude that the air-delivered weapons and targeting systems deployed by the Coalition would not have made it possible to entirely safeguard against all unnecessary casualties, both military personnel and uninvolved civilians.

I also examine some of the longer term consequences of the use of the Coalition air-delivered weapons, noting that there is likely to be long term health and environmental consequences from cluster bomblets that failed to detonate, from the dispersal of depleted uranium dusts generated by armour piercing rounds, and from damage wreaked to the power supply, water provision and sanitation infrastructures by so called 'soft' bombs..

Finally, I briefly examine the potential for increase risk to members of the public residing and/or working in the general locality of the UK USAF air bases, noting that the increased and changed nature of the activities during the build-up to the conflict in Iraq would have, in my opinion, justified a full risk and hazard assessment being undertaken by the UK Ministry of Defence. I have asked the Ministry of Defence if it has undertaken such an assessment and, if it has, if a copy is publicly available – to date, I have not received a response on this.

Although I have used my knowledge of weapons systems and munitions to reach my conclusion that any military campaign in Iraq involving air-delivered weapons would bring about a degree of unnecessary death, injury and environmental damage, I believe that the same conclusion could have been arrived at by each of the defendants from information and knowledge already in the public domain at about the time of their alleged trespass of 11 March 2003.

**John H Large**

**R *v* DEAN, MAHER, SCOTT & OTHERS**

## 1 QUALIFICATIONS AND EXPERIENCE

1.1 I am JOHN H LARGE of the Gatehouse, 1 & 2 Repository Road, Ha Ha Road, Woolwich, London SEI8.

1.2 I am a Consulting Engineer, Chartered Engineer, Fellow of the Institution of Mechanical Engineers, Graduate Member of the Institution Civil Engineers, Member of the British Nuclear Society and Fellow of the Royal Society of Arts.

1.3 From the mid-1960s through to the late-1980s I was a full-time member of the academic staff of Brunel University, undertaking research for the United Kingdom Atomic Energy Authority and teaching in the School of Engineering. I continue to occasionally lecture at Brunel and other universities

1.4 Since 1986 I have headed the firm of Consulting Engineers, Large & Associates. Large & Associates provides services relating to nuclear activities, systems failure and engineering defects.

1.5 I have given evidence to a number of House of Commons select committees on nuclear and related environmental topics. In the nuclear area, I acted for the Government of Gibraltar advising on the safety of the repairs being undertaken to the reactor of the nuclear powered submarine HMS *Tireless* whilst emergency berthed at Gibraltar during much 2000 and, more recently, I organised and headed the specialist team assessing the nuclear reactor and weapons hazards of the sunken Russian Federation nuclear powered submarine *Kursk*, advising the Russian Federation government and the salvers Smit-Mammoet through the salvage operations of 2002. I was awarded a commemorative medal by the Russian authorities for my contribution to the successful salvage of the *Kursk*.

1.6 My work on the *Kursk* recovery is relevant to this matter for I was required to assess the risks and hazards associated with the conventional munitions and

weaponry carried on board the submarine at the time of its foundering – the weapons manifest includes 23 fully armed SS-19-Granit cruise missiles, up to 17 fully armed 533/630 mm torpedoes possibly damaged and broken by the foundering explosion that sank the *Kursk*, together with a diverse range of smaller munitions and explosive arrays deployed in submarine warfare.

1.7 In a similar venture, I was a member for the working party convened by the Russian authorities to assess the risk and hazards of the two nuclear tipped torpedoes lost on board the nuclear power submarine *Komsomolets* which foundered in the Barents Sea in 1989.

1.8 I have also prepared and given evidence at the Court of Human Rights at Strasbourg relating the blast, thermal and radiation damage of the Grapple series atmospheric nuclear test series at Christmas Island in 1958 as these related to UK Armed Forces Services personnel attending those tests; I presented evidence relating to bomb making and final devices in matter of an intended act of terrorism brought before the criminal justice system in the late 1990s; I have reported to an international environmental organisation on the environmental damage of war in (then) Yugoslavia; and I have contributed to a number of missions (although not in Iraq) for an international safeguards agency.

1.9 In the early 1990s I undertook and completed a comprehensive study of the safety of the transportation and storage of nuclear weapons in the United Kingdom.

1.10 I consider myself adequately qualified and sufficiently experienced to provide opinion on this matter.

## 2 INSTRUCTIONS

2.1 I have been instructed on this matter by Mrs J Hutcheon of Bindman & Partners.

2.2 On 22 September 2003 Mrs Hutcheon asked if I could provide a statement on this matter, providing a number of documents for me to refer to. For this statement I shall give particular regard the '*Skeleton Argument on Behalf of the Defendants*' and the

*'Defence Statement on Behalf of Martha Scott'*, the latter which I consider to be typical of the defence statements of the other Defendants.

2.3 In framing my statement and presenting my opinion I have strayed into broader issues of the tactics and logistics of warfare and conflict. That said, it should be noted that I do not consider myself to possess expert knowledge of these issues and, accordingly, these areas of my statement should be considered to be included for introductory and background purposes.

## 3 UNITED STATES AIR FORCE BASES IN THE UNITED KINGDOM

3.1 Lakenheath, Fairford and Mildenhall are United States Air Force (USAF) air bases in the United Kingdom.

3.2 Lakenheath is the largest of these bases providing airfield and logistics facilities for the USAF 48th Fighter Wing, with an armed services personnel strength of about 5,000 and 2,000 or so civilians in support during normal times.

3.3 In terms of its military role, Lakenheath itself should not be considered in isolation from the USAF bases at Mildenhall and Fairford. Together and to some extent in combination with USAF air bases and military facilities in Europe and further abroad,[1] these bases should be considered to act together to provide the United States with a comprehensive strike and air defence capability from the United Kingdom that is capable of extending to the Middle East region.

3.4 In this integrated role, Mildenhall provides logistic and air-to-air refuelling facilities[2] and Fairford acts as a forward operating location for B-52 bombers.

## 4 USAF AIR BASE ACTIVITIES DURING NORMAL, PREPARATION FOR & IN CONFLICT

4.1 In times of peace each of these air bases operates at relatively low activity:

1 Such as permanent bases in Turkey, temporary facilities established nearby the conflict zone, and sea-borne fleets.

2 100th Refueling Wing with C135s tankers able to refuel bombers and fighter-bombers, 627th Air Support, 95th Reconnaissance and 488th Intelligence Squadron.

4.2 **Fairford** is effectively shut down being designated a 'standby base' with no permanent aircraft and aircrews present but maintaining on site a level of skeletal manning that is capable reactivating the base to full operational status within a short time.

4.3 **Mildenhall** and **Lakenheath** are maintained operational with aircraft being permanently stationed, although it is unlikely that any 'armed' missions would be flown, with flying activities essentially being maintained for training and for aircrew to maintain what are referred to as 'perishable' skills.

4.4 In times of alert and preparation for conflict these bases would be rapidly brought up to full capability. During times of conflict operational capacity would be maintained at maximum availability.

4.5 In fact, policy and political decisions made in Germany and, later, in Turkey ruled out direct operations against Iraq from these countries, so the expectation would have been then that the UK USAF bases would have been very much in the fore during the conflict.

4.6 Mildenhall and Fairford were heavily deployed during the conflict but it seems that Lakenheath's involvement was less than generally expected although, that said, it is believed that at least one squadron of the 48th Wing was deployed elsewhere (believed to be a USAF base in Italy or RAF Akrotiri in Cyprus).

4.7 **Flight Operations and Sorties:** At **Lakenheath** this would be accompanied by greater flying activity, the delivery and increased storage capacity of a range of munitions for both the McDonnell Douglas F-15E Strike Eagle[3] fighter-bomber and the F-15C Eagle[4] tactical fighter.

---

3 For air-to-ground missions, the F-15E can carry most weapons in the Air Force inventory, including the 2,000-pound GBU-15, the AGM-130, and the GBU-28 "Bunker Buster." It can also be armed with AIM 7F/M Sparrows, AIM-9L Sidewinders, and AIM-120 advanced medium range air-to-air missiles (AMRAAM). The "E" model also has an internally mounted 20mm gun which carries 450 rounds of ammunition.

4 One M-61A1 20mm multi-barrel gun mounted internally with 940 rounds of ammunition; four AIM-9L/M Sidewinder and four AIM-7F/M Sparrow missiles, or a combination of AIM-9L/M, AIM-7-F/M and AIM-120 missiles

4.8 The 48th Wing comprises 3 squadrons of F-15 (about 2:1 disposition in favour of the F-15E fighter bomber), each of about 30 aircraft or about 90 aircraft in total. At any time, a proportion of these aircraft would be grounded for routine maintenance and repairs, although in the build-up to conflict a greater availability of operational aircraft would be sought.

4.9 I understand number of sorties during normal times from Lakenheath would be two per day, unless night flying was in place whereby an additional evening sortie would be flown. The number of aircraft or 'ships' being flown per sortie varies, normally 3 or 4 ships, sometime larger, depending on the nature of the training mission.

4.10 During preparations for conflict, I would expect the number of sorties, and the number of ships per sortie, to increase. Perhaps an additional 2 or more sorties would be flown per day, and up to 14 or 15 ships could be managed per sortie.

4.11 The nature of the sorties would also change during conflict preparation, with more aerial combat and ground attack sorties being flown. Ground attack and bombing training sorties would be carried out over the Wash and, possibly, at two ranges in Scotland. Some of these bombing and ground attack sorties would be undertaken with live munitions.

4.12 **Ordnance and Munitions:** Weaponry for all three bases is normally delivered by air via Mildenhall, although shipments can be direct from the source of origin to the specific air base, particularly at **Lakenheath** which provides reserve air traffic capacity (landings) for Mildenhall.

4.13 During normal times the stockpile levels of munitions held at Lakenheath would be commensurate with its activity, that is at relatively low levels from munitions being used in live training and for the need to replace munitions that have exceeded their 'safe' validation (ie sell-by) date.

4.14 During preparations for conflict munitions and weaponry stockpiles would increase, with the build-up and replenishment of stocks being by air, from Mildenhall and incoming air direct, and by road freighted ISO container. It is believed that munitions were drawn from stockpiles from the arsenal at RAF Welford and transported by road to Lakenheath and Fairford.

4.15 Also, since the capacity of USAF bases on German and Turkish soil was denied to the Coalition, it may have been necessary for Lakenheath to provide additional runway capacity for air dispatches of munitions and military equipment to staging posts in the Middle East.

4.16 In this respect, at Lakenheath the role of the 48th Wing, in terms of its operation from the UK, may have been overshadowed by the logistic demands of the base serving as a staging and storage post for outgoing munitions, military spares and equipment. Under these circumstances, it could have been that part of the 48th Wing was moved forward to a base closer to the intended theatre of conflict.

4.17 I would also expect that the number of specialist personnel, weapons artificers and their like, would increase during the preparatory stages for conflict.

4.18 Although both the USAF and the UK Ministry of Defence neither confirm nor deny the presence of nuclear weapons, it is generally understood and accepted as fact that Lakenheath maintains a stockpile of nuclear warheads.[5] Certain of these warheads, specifically the tactical versions of the B-61 free drop thermonuclear (H) bomb, may be deployed by the nuclear qualified F-16E fighter bomber of the 48th Wing.

## 5 MATTERS RAISED BY DEFENCE SKELETAL ARGUMENT & DEFENCE STATEMENTS

5.1 I now refer to the *Skeleton Arguments on Behalf of the Defendants* and the *Defence Statements*:

[5] The type and number of nuclear warheads held in store at Lakenheath is subject of much speculation, although it has 33 nuclear-specific weapons stores (WS3) each normally capable of holding at least 2 complete warhead assemblies – if so, the potential nuclear arsenal held at Lakenheath is 60 or so warheads.

5.2 Para 7, p2 **'believed to be engaged in preparations for war in Iraq'**

5.3 If my recollection is correct, Coalition Forces bombing and cruise missile attacks commenced on 20 March 2003, that is about one week following the actions of the Defendants.

5.4 The complexity and logistical needs of aerial warfare would require the UK USAF air bases to be in preparation in the week, weeks and months prior to 20 March, 2003.

5.5 It is known that the B52 USAF air base at Fairford was actively involved in the aerial bombing campaign, flying from Fairford on or about 20 March.

5.6 For these missions each B-52 aircraft would require aerial refuelling by C135 tanker aircraft from Mildenhall together with F-15 fighter cover from Lakenheath. Fighter cover would also be required for the aerial refuelling C135 aircraft out of Mildenhall.

5.7 Before engaging in conflict, the aircraft and ground crews for the B52, C135 and F-15 aircraft would undertake specific training and preparatory actions – flying roles would be practised, communication protocols established, practise bombing and other aerial manoeuvres trained for, weapon artificers engaged, and so on and so forth.

5.8 As it transpired central to all of this activity was to be the role of the B52s flying out of Fairford. During the 3rd and 4th of March, fourteen B52 bombers arrived at Fairford so joint training and preparations with Mildenhall and Lakenheath would have commenced from about that time.

5.9 In other words, all three USAF bases in the United Kingdom were engaged in coordinated preparations for the Iraq conflict from about 3rd/4th March, an activity that would have continued through to the B52 bombing campaign over Iraq which commenced on 20 March.

5.10 The individual bases would have been in preparation for conflict for some time (weeks, if not months) before the arrival of the B52s at Fairford.

5.11 In summary, there is nothing to suggest that the USAF air base at Lakenheath was not engaged in *preparations for war* at the time of the 11 March actions taken by the Defendants.

5.12 Para 10, p3 **'activities . . . which would kill and maim numerous Iraqi people'** and Para 109, p37 **'cause great human suffering and numerous civilian casualties. . '**

5.12.1 Casualty figures for both Iraqi military personnel and civilians arising directly from the conflict have not been published by the Coalition, although estimates drawn from a number of usually reliable sources[6] give between 6,000 to 7,000 civilian fatalities and military fatalities at between 10,000 to 40,000. Serious injuries are usually taken to be three to four times the fatality numbers.

5.12.2 Some proportion of these military and civilian casualties must have arisen as a direct result of the coordinated activities of the three USAF air bases of Lakenheath, Mildenhall and Fairford.

5.12.3 Thee estimates of civilian fatalities do not account for casualties that have arisen from the breakdown of essential health services (water, sanitation, hospital facilities, etc) in the post-war period.

5.13 Para 19, p6 **'activity . . being . . security of the establishment'**

5.13.1 As I have previously noted, the main activity being undertaken at Lakenheath on or about 11 March would have been with the training and preparations for conflict. Such activities would have included *'security of the establishment'* but which would extend considerably beyond that specific activity.

6 Iraqi Red Crescent (Islamic Red Cross).

5.14 Para 20, p6 **'Transporting munitions for an imminent war . . . different from everyday functions of the base.'** and para 105, p36 **'transport of munitions and the dispatching of munitions and other equipment was a crucial preparatory step. . '**

5.14.1 I consider that it is most likely (probable) that the amount of munitions transported to and stockpiled at the base during the preparations for conflict would have been very significantly greater than during normal times. I also noted that munitions and equipment was delivered to Lakenheath by road, which is a departure from the established air shipment practice of normal times.

5.14.2 The munitions delivered to Lakenheath were required for deployment at i) Lakenheath for use by the resident F-15C and F-15E aircraft and, as I speculate, b) at locations abroad for use by other aircraft and weapons platforms for which Lakenheath played a part in the transportation and delivery chain.

5.14.3 If it is accepted that the activities at Lakenheath are but part of a highly integrated war effort coordinating the three main USAF air bases in the United Kingdom, then the reactivation of the normally closed base at Fairford and the delivery of a range of munitions (free fall bombs, JDam[7] and cruise missiles, cluster bombs, fuel-air weaponry, etc..) would have considerably departed from the normal or everyday function of the base(s).

5.15 Para 106, p36 **'Defendants . . . unlikely to cause more than minor disruption to the loading of munitions. . '**

5.15.1 Any disruption to incoming deliveries of munitions and equipment for stockpiling at Lakenheath or for transhipment abroad would have been minimal because incoming shipments could have been diverted to Mildenhall.

7 Joint Direct Attack Munitions (JDam) – essentially a conversion kit that renders a free-fall bomb into a smart bomb guided by GPS satellite positioning.

## 6 EXAMPLES OF THE WEAPONRY DEPLOYED BY COALITION FORCES IN IRAQ

6.1 Paragraph 6 (p2) of the *Skeleton Argument for the Defence* states that the *"defendants are opposed to war in Iraq because it would have devastating human and environmental consequences."*.

6.2 Yet, to the contrary, the military authorities have and continue to promote to the public at large that the combination of 'smart' weaponry and target selectivity is able to minimise so-called collateral damage.

6.3 Put another way, if the target is identified as a specific building, bunker or whatever, that is a 'point' target, then munitions delivered directly to that point would be surgical, having little impact and consequences on the nearby and surrounding property and population. This is because precision-guided weapons are able home in within 10 to 20 meters or so of the point target, doing so by using sophisticated dead-reckoning, laser guidance from either an overhead aircraft, ground platform, or via a global positioning satellite (GPS).

6.4 There are a number of flaws in this claim. I can demonstrate this by briefly describing how a number of general types of air-delivered munitions function when deployed in conflict – these general types of weaponry could have been deployed from aircraft operating out of Fairford and Lakenheath, or being delivered to the theatre of conflict from Mildenhall and Lakenheath.

### 6.5 Targeting Errors

6.5.1 I do not have sufficient information relating the extent of targeting errors (nor do I believe that this has been openly published) arising during the chain of target identification, assessment and acquisition functions carried prior to air strike delivery.

6.5.2 Errors in targeting could have resulted in both human and environmental consequences.

## 6.6 Types of Air Delivered Weaponry

6.6.1 The general types of air delivered weapons include:

a) Dumb, Free-Fall Bombs
b) Precision guided munitions, such as JDam bombs and cruise missiles
c) Submunitions, such as cluster bombs
d) Fuel-Air-Explosive Weapons
e) Depleted Uranium Rounds

## 6.7 Dumb, Free-Fall Bombs

6.7.1 Although the Coalition has not released data on the amounts of different types munitions delivered, it is most likely that dumb, free-fall bombs made up a significant proportion of the total weight all weapons explosives delivered in Iraq.

6.7.2 These are generally dropped for high-altitude in batches, impressing an explosive footprint that shadows the bombing aircraft's overhead path. The accuracy of delivery is primarily linked to the positioning of the bombing aircraft and the extent scatter during the descent of the bomb –bombing from high-altitude would, typically, result in a impact footprint of 200 to 300m width, and from each exploding bomb would be generate an air pressure blast (fatality) zone extending 200 to 350 meters, and a fragmentation zone made up of bomb shrapnel and other debris out to 600 to 700 meters.

6.7.3 Dumb bombs were available in a range of TNT explosive equivalents from 750 lb (M117) dropped singularly or in batches, to the single drop 15,000 lb Daisy Cutter (BLU-82) deployed from a C130 military cargo aircraft – it is believed that a larger 40,000 lb version was delivered during Afghanistan

BLU-82 Daisy Cutter Dumb Bomb

conflict by a B52 bomber.

6.7.4 These so-called Daisy Cutter bombs were first developed to clear helicopter landing areas in Vietnam (hence 'daisy cutter'), although this properly applies to the fusing system that initiates detonation at 50 to 100m and higher above ground, being deployed for mine clearance and large area impact clearance (ie troops dispersed on the ground). The air pressure blast wave fatality and immobilising injury radii can extend 1,500m or more.

## 6.8 Precision Guided Munitions

6.9.1 There is a wide range of precision guided munitions, including JDams and cruise missiles, both of which can be deployed by B52 bombers.

6.9.2 Example of a precision guided bomb is the 2000 lb (GBU-15) which specifically qualified for the F-15E bombers based at Lakenheath. The bomb is locked on to an identified target prior to release from the aircraft, or following bomb release with the target being subsequently identified. The guidance system is a combination of tv, infra-red with some variants being fitted with GPS.

GBU-15 slung on a F-15E underwing pylon

6.9.3 Precision guided munitions are relatively expensive with the GBU-15 unit costs being of the order $240,000 in addition to the sophisticated target interrogation and lock-on equipment required in the carrying F-15E. Such relatively high cost reserves this weapon for so-called *high-value* targets.

6.9.4 The USAF have stated that (as of 15 April 2003) coalition air forces had used 18,275 precision-guided munitions (67% of all munitions deployed) and around 8,975 unguided munitions, although it should be noted that in terms of explosive

weight (equivalent tonnes TNT), generally unguided, dumb bombs are of higher explosive yield. So, probably, dumb bombs predominated in total explosive yield.

## 6.10 Submunitions

6.10.1 This general category of munitions is where a carrying device, such as a bomb-shaped pod, is launched from the carrying aircraft to descend in either free-fall (dumb) or guided mode to near proximity of the target, then the pod opens up to release a number of sub-munitions that either scatter or are specifically guided to ground based targets.

6.10.2 Targets and functions of submunitions include anti-personnel cluster bombs which typically scatter 200 or more bomblets with high shrapnel yields; armour piercing projectiles that can be self-seeking to specific targets, usually carrying four to twelve self-targeting units; road and runway penetrators; and filament filled devices to initiate electrical power line blackouts by shorting out and vaporising overhead power cables and exposed electrical distribution equipment.

6.10.3 Submunitions have quite complex arming and firing systems (AFS). This is because each of the relatively small-sized explosive bomblets and canisters have to be protected against inadvertent explosion prior to launch from the aircraft. For example, each of the 200 bomblets of the M118 or *Rockeye* anti-personnel cluster bomb is fused (primed) by the aerodynamic driven rotation of its stabilising tail fin during its final descent phases and, once fused, detonated by an inertia or impact spike that is driven in when it strikes the ground.

An unexploded but fused Rockeye bomblet showing the inertia impact spike and the twist lock (top) which is rotated by the stabilising fin (out of frame – top)

6.10.3 This type of AFS is only totally effective where ground and vegetation conditions permit - sloping sites, forested and shrubby ground cover result in a high failure

rate of final detonation, leaving up to 30% of bomblets in a fuse primed but undetonated condition. Typically, the carrying pod launch from the aircraft is at high altitude in order to protect the aircraft and to gain some stand-off advantage so, under these conditions the launching pilot is unable to assess the ground conditions and is reliant upon the target assessment that, itself, may have relied upon uncertain aerial or satellite photography taken months previously and/or at a different vegetation growing season. Another difficulty is that this type of submunition is often deployed against highly mobile targets (troops and vehicles) for which target assessment has not been previously undertaken.

6.10.4 Another type of cluster bomb is referred to as a *'soft bomb'*. Example of this type is the *Blackout Bomb* (BLU-114/B) comprising about 200 canisters packed with coated carbon filaments. The very fine strands are released above electricity distribution power lines and equipment, floating down to arc across power cables, with carbon filament vaporising and forming an ionising channel to direct a power short that burns through the conducting cables.

One of 200 canisters of a BLU-114/B submunition which deploys coated carbon fibre strands to short-out and burn through overhead power lines

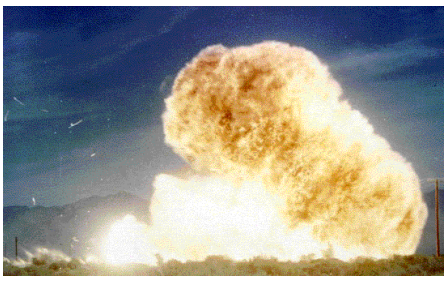
6.10.5 The impact of these so-called soft bombs impact beyond the immediate area. Disrupting and damaging electricity supplies can be region-wide, especially is the system has been run down due to equipment embargo and sanction, and in a war-torn country it may not be possible to implement immediate repairs. Loss of electricity for water pumping and purification can result in very significant health impacts across the region and country as a whole.

## 6.11 Fuel-Air-Explosive (FAE) Weapons

6.11.1 Sometimes referred to as thermobaric bombs, this device is operated about 10 to 20 meters overhead the target by release an air mixing fuel, typically ethylene oxide, into a vapour cloud which is ignited by an embedded detonator when the appropriate air-to-fuel ratio is attained.

Vapour formation Stage of an FAE

6.11.2 From a single point of ignition, the advancing flame front 'pushes' unburnt vapour into crevices and hidden spaces to subsequently violently ignite as a fast deflagration thereby resulting in a longer duration blast wave which is more damaging to built structures than conventional explosives of high brisance.



FAE final ignition stage

6.11.3 Some FAE variants are delivered in pods of submunitions containing three FAE units (BLU-73/B).

## 6.12 Depleted Uranium Rounds

6.12.1 DU rounds are exclusively armour piercing, available for aircraft mounted cannon[8] and as artillery/mounted gun sabot projectiles. The round comprises a depleted uranium sabot, an aluminium alloy barrel guide and tail fin, and a cartridge which is discarded once the round is shot.

6.12.2 Fired at very high velocity, the sabot pierces into the target armour plating by virtue of its extremely high

Cut-Away model of a depleted uranium armour piercing sabot and propellant cartridge

8 The 20mm cannon of the Lakenheath F-15C and F-15E aircraft are capable of firing DU tipped rounds.

kinetic energy, as it enters and by friction it heats up to very high temperatures but is starved of oxygen. Upon breaching the armour it is enveloped in air (oxygen) at which it ferociously ignites killing any crew inside the vehicle whilst forming a very fine uranium dioxide powder, a proportion of which is respirable sized (less than 10μm) and which is dispersed to the environment.

6.12.3 During the first Gulf conflict a total of just over 290 metric tons of DU projectiles were fired, none of this was recovered from the battlefield and I understand that there is no legal requirement for it to be recovered. So long as it remains unbound in the environment, the DU dust remains a radio- and chemo-toxic agent with uptake paths to the human receptor, principally via respiration and drinking of contaminated water.

6.13 In the foregoing very brief introduction to the general types of munitions deployed in the most recent Coalition-Iraq conflict, I have endeavoured to demonstrate that, contrary to the public understanding, so called collateral damage cannot be avoided even with the deployment of sophisticated weapons delivery platforms and advanced munitions:

- Free drop, dumb bombs have a wide margin of positional error and, typically of high yield, the blast and fragmentation zones extend hundreds of meters from the impact zone – essential services infrastructures, population and environment nearby targets can be drawn into area of devastation – very large TNT equivalent Daisy Cutter type bombs have a very large (greater than 1,000 to 1,500 m) blast and fragmentation zones.

- Smart or precision-guided munitions are expensive and are generally reserved for *high-value* targets – these weapon guidance systems are themselves prone to error and failure and, even though it is possible to accurately deliver such munitions to within 5 to 10 meters of a point target, the blast and fragmentation zones are large, extending well beyond the pinpoint accuracy of delivery.

- Not all smart weapons delivery systems function to such pin-point accuracy, although certain weapons, including smart submunitions and fuel-air-explosives, may be directed to a particular point target locality at that point the weapon will disperse its submunitions or explosive vapour cloud over a large area – these are area impact munitions (AIMs) which function to maximize the devastation to 'soft targets' over a wide area.

- Generally, submunitions have a high failure rate, with some types leaving bomblets and other submunition devices on the ground in a fused (primed) condition, whereas others lying exposed on the ground deteriorate to instability – unless these unexploded devices are completely cleared, they present a continuing danger and the risk of injury and/or death to non-combatants in future, post-conflict years.

- Certain submunitions, such as the *soft* or *blackout* bomb that disrupts electricity supplies may not immediately result in injury and death on a large scale, but the health and environmental consequences may develop and remain in the interim and long terms because of the collapse of electricity supplies to essential water, sanitation and hospital infrastructures – these interim and longer term casualties my not be accounted for in the overall assessment of the casualties of the conflict.

- The debris and contamination from depleted uranium rounds remains in the environment, being toxic in both radiological and chemo-biological senses, and very persistent in radioactive half-life and chemical volatility – DU rounds are fired at relatively low command levels (tank crews, pilots, etc) so target assessment may not be accurate or reliable (or have been undertaken at all), and localities so contaminated may not be accurately logged and located.

## 7 POST-CONFLICT ENVIRONMENTAL IMPACT FACTORS IN IRAQ

7.1 In the previous sections I touched upon the longer term environmental and health consequences that would be expected to arise from the conflict in Iraq. Although

to date there has been very little assessment of the interim and longer term environmental impact, it is most probable that this will include the following:

## 7.2 Unexploded Ordnance (UXO) and Captured Ordnance

7.2.1 Typically 3 to 5% of bombs, rockets and shells (both dumb and smart) fail to explode and soft sand, scrub covered and inclined terrains may have increased this rate to impact detonated cluster submunitions 15% to 30% in some cases. The total number of unexploded ordnance may range from 10,000 to 40,000 individual pieces (excluding submunitions).

7.2.2 Unexploded/captured ordnance is likely to be destroyed in-situ by burning in the open air or by detonation by coalition forces with both these forms of destruction releasing contaminants into the air and the soil.

## 7.3 Hazardous Waste

7.3.1 It should be assumed that the conflict generated significant quantities of hazardous waste that may still have significant consequences for the environment and human health. Such wastes would have arisen around targeted industrial and military facilities, and from plants and processes (oil refineries, factories, sewerage works, etc) that were abandoned during the conflict and which have not been recovered since.

7.3.2 The principal sources of hazardous waste include oil and petrochemical complexes, fertilizer plants, refineries and chemical plants, as well as small and medium-sized industries such as electroplating facilities, tanneries, workshops and garages.

7.3.3 Although there is no reliable data on the quantities of hazardous waste generated in Iraq, some countries in the region do publish hazardous waste inventories that suggest that Iraq would generate between two and eight times more hazardous waste per capita than the United States.

7.3.4 The oil industry produces a range of hazardous wastes so the Coalition's intention of increasing the output to revitalize Iraq's economy would, in the absence of retrofitted abatement technology, increase the waste discharges for which the present back-end treatment plants are inadequate.

7.3.5 Clean-up programmes are very expensive and require considerable expertise to implement effectively. In the immediate and interim post-conflict periods, Iraq may not have sufficient funding or expertise available with which to implement effective clean up programmes.

## 7.4 Physical Degradation of Landscapes

7.4.1 Pre-conflict preparations by Iraq armed services would have entailed the construction of a considerable number and array of bunkers, trenches and weapons pits. Also, numerous columns of tanks, armoured personnel carriers of both Iraqi and Coalition forces would have caused considerable disruption of desert sands and soil layers, and bombing increases the vulnerability of light soils to erosion by wind and water.

7.4.2 In extreme, severe land desolation could result in migration of agrarian rural populations to the cities in search income and there are other potential effects such as the clearing of woodland for fuel, disruption of irrigation systems with loss of biodiversity and the loss of young plants in afforested areas.

## 7.5 Loss of Power Supplies

7.5.1 Iraq is an urbanized society, so much so that a significant proportion of its population is dependent upon reliable supplies of municipal power, water and sanitation services. The already weakened water supply and sanitation systems (by sanctions and the incompetence of the Saddam regime) were subject to further direct degradation during the conflict and continuing irregular supplies of electricity in the post-conflict period.

7.5.2 Millions of civilians have been deprived of basic services and there is likely to be a continuing elevated risk of disease epidemics,[9] as well as an increased pollution burden on the Tigris River.

## 8 THE RISKS AND HAZARDS IN THE UNITED KINGDOM

8.1 So far I have considered the risks and hazards arising during and following the Iraq Conflict to the people (both civilians and services personnel) and environment of Iraq.

8.2 I should also note here that Coalition armed services personnel, staff of the United Nations and those working with international aid agencies would also be subject to certain of the health risks that I have outlined, although the exposure would be short or interim term depending on their period of stay and the activity undertaken in Iraq.

8.3 Now I return to the United Kingdom to consider the risks and hazards associated with the increased activity during the build up to and preparations for the Iraq conflict.

8.4 I have opined earlier that on and around the time (11 March) of the actions of the defendants, the USAF bases in the United Kingdom would have been actively preparing for the Iraq conflict, that certain of these activities would not have been undertaken during normal times, the number of flights and sorties to and from bases such as Lakenheath would have increased, and that USAF aircrews would have been most certainly involved in training with live munitions, flying to bombing and firing ranges out over the Wash and/or in Scotland.

9 On 9 April, the International Committee of the Red Cross (ICRC) estimated that only 20% of Baghdad's five million citizens had access to electricity, while the following day the organization was planning to visit the Medical City hospital complex 650 beds), which was *"still experiencing water shortages"*. The ICRC was also attempting to fill public water tanks in areas of the capital currently not connected to the water-supply network. On 16 April, ICRC reported that Al-Rashad hospital in the east of Baghdad *"lacks sufficient drinking water, has no water for washing or cleaning....and only limited food is available for patients"*. ICRC provided 30,000 litres of water for drinking and cleaning. In Basra, the ICRC and coalition forces had partially reconnected the city's water supply by the end of March. However, on 10 April the ICRC stated that *"the water supply to parts of Basra and reportedly also to most towns in southern Iraq remains disrupted"*. A week earlier, the BBC reported the water and humanitarian situation in the southern town of Umm Qasr to be *"a shambles"*. The ICRC, working with local technicians, restored supplies

8.5 USAF bases in the UK have previously contributed to armed conflicts,[10] the most recent being the Afghanistan campaign in 2001. However, in the intervening two years and, particularly because Iraq was believed to be a militarily organized enemy, both tactics and weaponry would have rendered a number of aspects of the overall activity at Lakenheath in and about 11 March 2003 unique to the earlier preparations for the Afghanistan campaign.

8.6 It follows that the risks and hazards arising from operations at Lakenheath (and the other two USAF UK air bases) would have differed from those risks and hazards pertaining to the base activities during normal times. The change in the risk-hazard composite would include consideration of the following risks:

- increased number of aircraft movements
- increased number aircraft in each sortie
- increased number of training activities (flying crew, arming artificers, etc)
- increased number of armed aircraft undergoing operations
- increased number of weapons on site

and, similarly, the hazard potential would have included:

- weaponry on the armed aircraft in training
- types of weaponry in store and/or transit
- the probable presence of nuclear weapons on site

8.7 In terms of risk, moving from normal to build-up/preparatory activities for conflict involves an increase in risk and, in addition, being so readily identified as an air base that was to contribute the impending Iraq conflict, Lakenheath must have been considered candidate for attack, either by the forces of Iraq (responding as a State

to the Al-Sadr region of Baghdad on 17 April, coinciding with a call from the UN Secretary General for coalition forces to do everything possible to ease the humanitarian situation.

whose sovereign territory was under threat of war), or by international terrorists whose actions could be provoked by the threat of impending war.

8.8 In this respect, I consider that it would been appropriate for the UK Ministry of Defence to have conducted and made publicly available a risk/hazard assessment relating to the increase level of activities at Lakenheath (and also for the other two USAF bases), particularly how these activities might result in personal harm and injury to members the public living and working in the general locality of the base.

8.9 I have requested a copy of the Risk and Hazard Assessment that I assume must have been undertaken by the UK Ministry of Defence but, to date, I have not received a response that such an assessment was undertaken and, if it were, whether it is available for be to consider In this Statement.

**JOHN H LARGE**

[10] 1986 Libya – 1991 Gulf War – 2001 Afghanistan – Lakenheath probably also supplied armed escort fighter support for the Yugoslavia and smaller conflicts.