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MEMORANDUM from
President, Combined
Investigation Board

F-I



DEPARTMENT OF THE AIR FORCE
UNITED STATES CENTRAL COMMAND AIR FORCES (USCENTAF)
COMBINED INVESTIGATION BOARD
Al Udeid Air Base, Qatar

19 December 2006

MEMORANDUM FOR General N. Houghton CBE
Chief of Joint Operations
PJHQ
Northwood Headquarters
Sandy Lane
Northwood Middlesex HA6 3HP

FROM: President, Combined Investigation Board

SUBJECT: Request for Copy of Post Mortem Examination Report

1. Pursuant to direction given on 8 December 2006 by Commander, US Central Command, Commander, US Central Command Air Forces on 15 December 2006 appointed me President of a Combined Investigation Board (CIB) to investigate the friendly fire incident that occurred on or about 5 December 2006.
2. By this memorandum I request your assistance to obtain a copy of the Post Mortem Examination (PME) Report prepared for the Oxford Coroner with respect to late of the Royal Marines.
3. Proper consideration of this report by the CIB is critical to assure the findings of the Board. You may be aware that I am obliged to conclude my investigation by 15 January 2007.

~~Rear~~ Admiral, USN
President

F-I

Abbreviated Aeromedical Examination

F-II

**5 Pages
Redacted**

72 Hour History

F-III

12 DEC 06

From: Strike Fighter Squadron ONE THREE ONE
To: ICIB
Subj: FOURTEEN DAY HISTORY

1. 20 NOV 06
Woke up at 0730 for an OEF spare/SSC flight. Flew 1.7 hours, leading the COD (negative tacan) to the ship. Flew an okay pass. Stood two CATCC watches in the evening. Spoke with [redacted] about follow-on joint tour and sent e-mails about the same. In bed by 0130
2. 21 NOV 06
Woke up at 0745 for a [redacted] instructional hop with [redacted]. Flew a 1.3. RTBed uneventfully for an okay pass. Stood two CATCC watches. Worked to figure out a JMPS [redacted] loading issue. In bed by 0100.
3. 22 NOV 06
Woke at 0715 for an OEF spare. Flew a 1.7 SSC flight [redacted]. Flew an okay pass. Debriefed at length with SIAC. Stood a CATCC and also had a 'chalk talk' with our new arrival, LT [redacted]. Went to bed by 0130.
4. 23 NOV 06
Woke at 0930 for a workout. Attended Ops meeting at 1100. Prepared for OEF mission at 1400. Flew a 6.0 hour mission with [redacted]. Flew a coupled approach on the night landing. Did some Ops work and submitted a new tracker for CAG Ops. Attempted to get a LAN line in our new Department Head's room. In bed at approx 0200.
5. 24 NOV 06
Off the flight schedule. Started writing awards for the upcoming end-of-year submissions. Uneventful day. Stood a CATCC watch and worked out in the evening. Worked with flight surgeons on Flight Time Waivers for high-hour pilots, worked with CAG Ops on an OPTAR grant and with PMA-265 for [redacted] NVG brackets. In bed at a reasonable hour.
6. 25 NOV 06
Awoke at 1030 for CAG Ops meeting at 1100. Briefed at 1300 for an OEF Spare. Flew a 1.3 hour SSC mission [redacted]. RTBed for an okay pass. Received an e-mail phone message from my kids and tried to send one back to them. Stood a CATCC. In bed by 0100.
7. 26 NOV 06
Awoke at 0900 to prepare for a 1030 OEF brief leading our new Department Head on his first OEF mission. Flew 6.7 hours [redacted]. Executed a Show of Force and finished up with a presence patrol [redacted]. RTBed at night for a Fair pass. Prepared for No-Fly day training and worked with [redacted] Ops members to ensure that training ran smoothly on the 28th. In bed early (2400) as I had the next morning's alert.

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8. 27 NOV 06

Alert 30 did not launch. Woke up and worked out. Attended 1100 Ops meeting. Helped with an engine turn at noon. Prepared for an 1800 Department Head meeting in my stateroom to discuss awards and awardees and to assign tasking for write-ups for end-of-year-awards. Worked on those awards as they were due to Admin the next day. In bed late, at 0230.

9. 28 NOV 06

No-Fly day for the airwing. Lots of meetings. Swim call at 1030, CDO (U) training at 1130, OIF lectures and All Pilot's Meeting at 1230, OIF talk with all strike leads in CVIC at 1500, VFA-131 ops meeting at 1615 followed by an Human Factors Council at 1745. Ran strike planning at 2000. Worked with our newest pilot as he learned that he would leave the boat soon due to a medical condition. In bed by 0100.

10. 29 NOV 06

Alert 30 did not launch. Awoke at 1030 for Ops Meeting. 1145 brief for OEF spare. Flew 1.4 hours of eventful SSC and returned for an Okay pass. Stood two CATCCs. Worked on a firing report tracker and other Ops functions. In bed by 0200.

11. 30 NOV 06

Woke up and worked out at 0900. 1330 OEF brief with a young JO. Flew a 5.8 hour mission. Flew an Okay night landing. Finished awards upon completion of debrief. In bed by 0100.

12. 01 DEC 06

Awoke at 0800 for an FCF hop. Flew a 1.5 hour mission. Joined up with my Commanding Officer and flew an Okay pass upon RTB. Went to the tower upon landing IOT earn a CDO(U) qualification, but the Tower was busy and I was unable. Worked in Ops for most of the night as GQ was sounded throughout the ship. Stood a CATCC as GQ ended.

This history is correct to the best of my knowledge and is provided freely to the ICIB with full knowledge that it may be used later as evidence in any future proceedings.

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UPDATE FOR _____ HISTORY

01 DEC 06 – Went to bed fairly early, approximately 2400, I believe.

02 DEC 06 – Awoke at 0745 to answer a question from the Squadron Duty Officer. Completed some Ops paperwork and helped our new Material Control Officer with the First Quarter/First Month BOR. Went to Wardroom III for a pre-flight snack.

This update is provided to the CIB with full knowledge of its intended purpose and is accurate to the best of my recollection.

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4. Tuesday 05 DEC 06

- a. 2400 Quick stop at midnight rations for eggs, chicken, cereal, water.
- b. 0015 Went to sleep.
- c. 0710 Woke up.
- d. 0730 briefed for OEF mission.
- e. 0810 Late breakfast. Cereal, salad, water.
- f. 0950 Took off for OEF mission.
- g. 1140 Arrived overhead
- h. 1218 Incident under review.

This history is correct to the best of my knowledge and is provided freely to the ICIB with full knowledge that it may be used later as evidence in any future proceedings.

12 DEC 06

From: , Strike Fighter Squadron ONE THREE ONE
To: ICIB

Subj: THIRTY SIX HOUR HISTORY

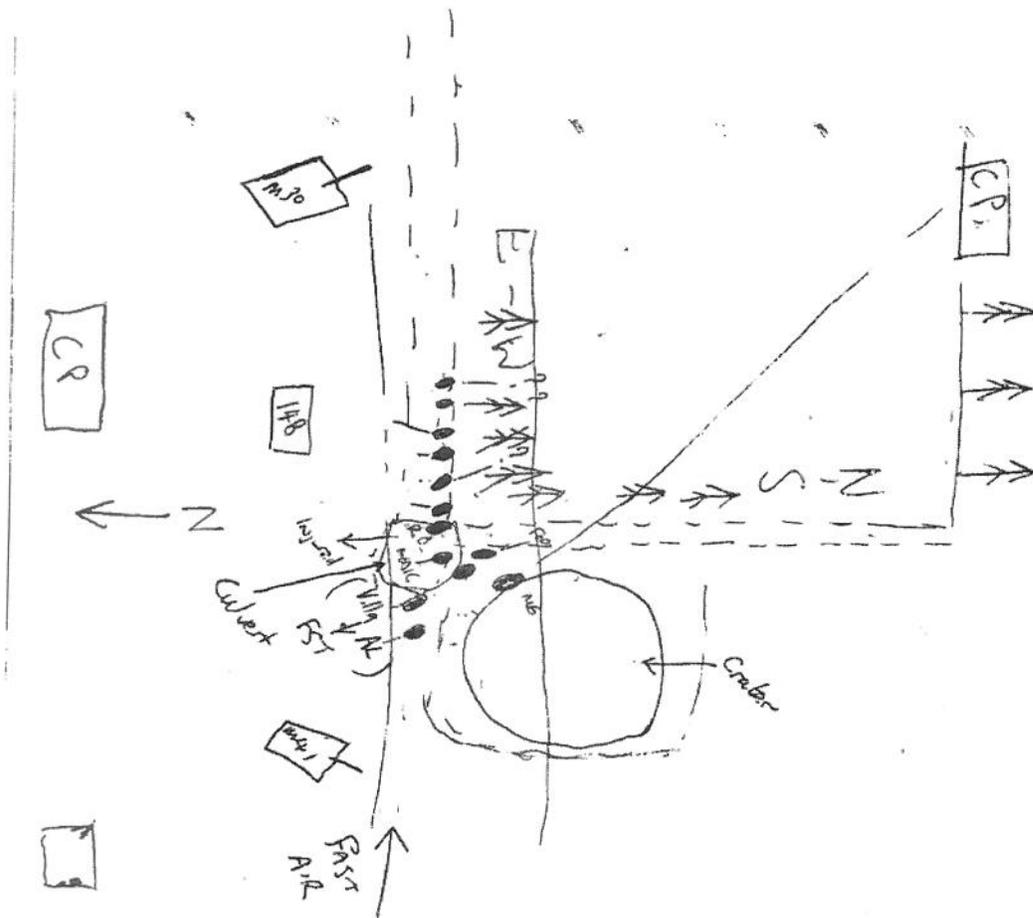
1. Saturday 02 DEC 06
 - a. 1215 Finished post-flight paperwork for a Functional Check Flight (FCF) that landed at 1130.
 - b. 1300 Ate lunch. Two chicken breast sandwiches, peas, water.
 - c. 1400 Worked in squadron.
 - d. 1645 CATCC watch.
 - e. 1730 Dinner. Food unknown.
 - f. 1830 Helped draft flight schedule.
 - g. 1930 Rested in stateroom as I knew I'd be up late watching the Army/Navy game.
 - h. 2130 Stand-in SDO for a JO morale boost.
 - i. 2330 Army/Navy game in WR III. Ate cereal, eggs, fruit, water.
2. Sunday 03 DEC 06
 - a. 0245 Went to bed.
 - b. 0915 Woke up.
 - c. 0945 Briefed for an FCF.
 - d. 1150 Took off on FCF.
 - e. 1215 Landed.
 - f. 1230 Post flight paperwork and debriefing.
 - g. 1300 Brunch. Scrambled eggs, cereal, water.
 - h. 1330 Ops paperwork.
 - i. 1530 XP watch with in CVIC.
 - j. 1900 Break from watch for CATCC and then dinner: two chicken breast sandwiches, corn, potatoes, water.
 - k. 1940 Returned to XP watch after second CATCC watch.
 - l. 2200 Completed XP watch; finished Ops paperwork.
3. Monday 04 DEC 06
 - a. 0030 Midnight rations with scrambled eggs, vegetables, water.
 - b. 0100 E-mail.
 - c. 0130 Went to bed.
 - d. 0945 Woke up and worked out. Lifted and ran (cool down).
 - e. 1030 Showered.
 - f. 1100 Operations Officer meeting in CAG Operations.
 - g. 1145 Lunch. Chicken sandwich, green beans, water.
 - h. 1230 Ops paperwork.
 - i. 1400 personal e-mail in room.
 - j. 1445 Ops project.
 - k. 1715 CATCC watch and then dinner. Meal unknown.
 - l. 1800 Flight preparation.
 - m. 1900 Briefed a 4v4 with VFA-103, 143, 83.
 - n. 2115 Took off. Briefed as dash four, but lead went down for maintenance and I took lead of Blue side.
 - o. 2240 Landed.
 - p. 2330 Debriefed all players in Ready Room 6.

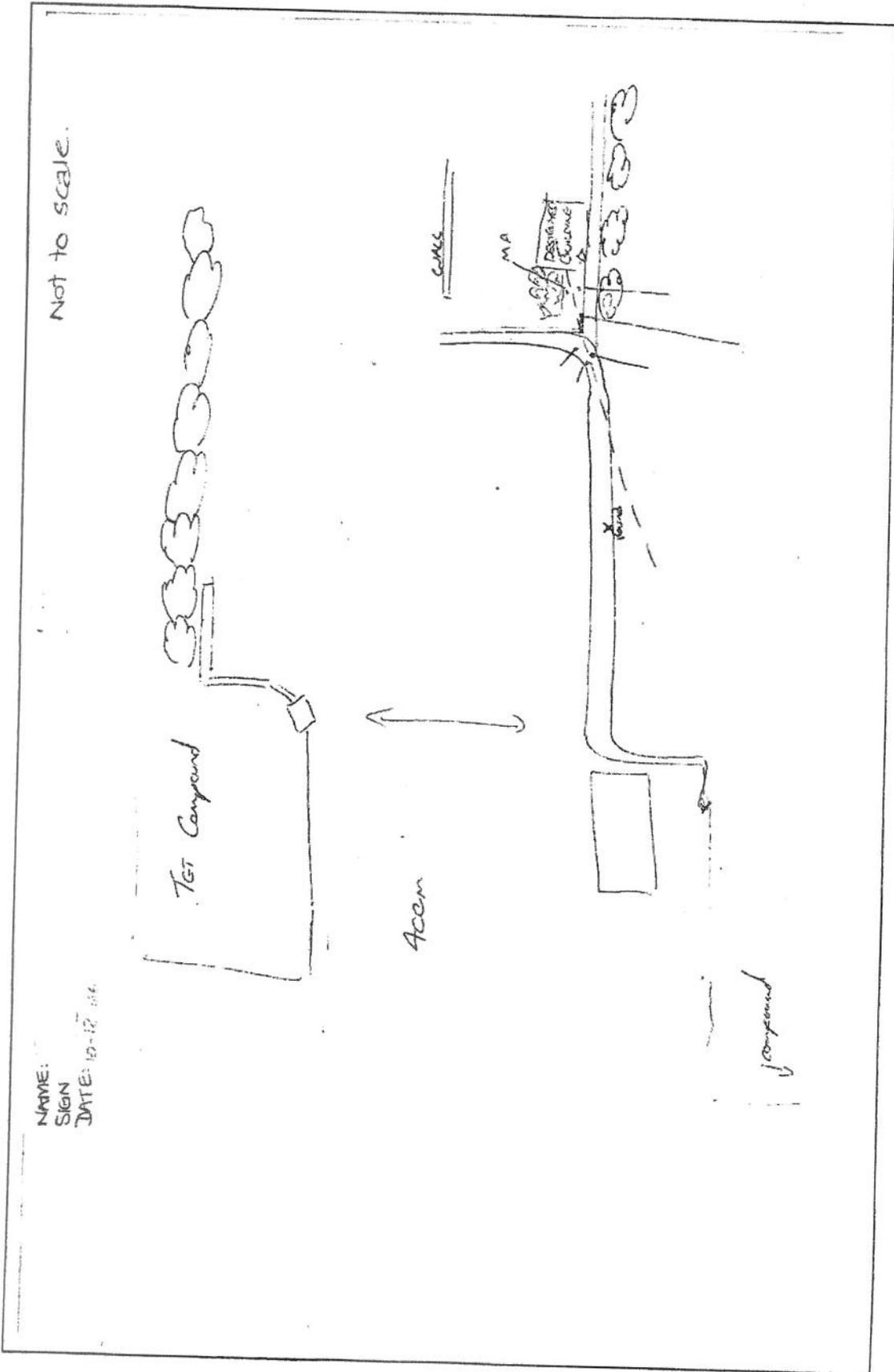
F- III

Sketched Diagram of ops area
, 5 Dec 06

F-IV

Sketch Plan
of Contact





Medical
Records

F-V

**31 Pages
Redacted**

Observation of

F-VI

The following medical observations were made upon review of the postmortem photographs and the postmortem chest/pelvic x-rays provided by British Special Investigative Branch (SIB) agents. These observations are limited as direct visualization of the body was not done and an autopsy was not performed when these conclusions were made. Also, neither shrapnel fragments nor body armor were available for analysis.

Injury summary:

Observations:

(witness and physician interview data) and also appears superficial as there are no underlying structures (bone, lung, fat, blood vessels) visible on the photographs. There is surrounding bruising which is consistent with venous pooling. This wound does not have the appearance of a direct gun shot or shrapnel wound but is more consistent with a large abrasion as if something either compressed or ran across the skin, thereby injuring it.

It is difficult to say what caused the wound because of its unusual character; however, it can easily be concluded that the wound was not caused by a direct hit from a 20mm round. The lack of depth of the wound, as well as the relatively small amount of damage to the body, contradict a direct hit. A direct hit from a large caliber round would have caused massive trauma which would have torn the body into pieces. The other curious feature of the wound is that its location on the body overlaps with the location of the modified smaller rear plate of the British Osprey body armor. Witness interviews state that was using the smaller plate in his body armor on the day of his death.

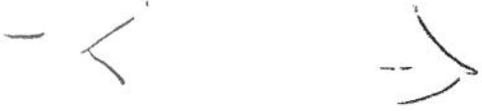
The wound on the was described as a "through-and-through" shrapnel wound (physician interview data); however, it is difficult for me to draw any conclusions from the photographs provided by SIB.

The Chest and pelvic films provided to me by the SIB showed

objects (shrapnel or bullet fragments) observed on either the chest or pelvic films. SIB reported that full body scanning fluoroscopy (X-ray) was performed at the Bastion medical facility which did not show any retained foreign body anywhere else in the body.

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The above injuries contradict a direct hit from a 20mm round. The chest X-ray and suggest a powerful blunt force impact to . Together with the the pattern suggests shrapnel injury. Also, the was not likely caused by the sustained that received prior to arriving at the medical facility. A large force impact, possibly from a ricocheted bullet or other shrapnel fragment, applied to the rear body armor plate with subsequent transmission to the body resulting in could possibly explain the constellation of physical findings. led to vascular which resulted in .



Photos of

F-VII

WARNING

GRAPHIC PHOTOS

**25 Pages
Redacted**

Death
Certificate

F-VIII

1 Page Redacted

Clearance Notice and ENCL
13

F-IX

**1 Page
Redacted**

MEMORANDUM For Record

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Memorandum for the record

At the time of this report (30 December 2006), several pieces of medical evidence are not available for consideration.

The CIB has requested access to Royal Marine One's combat body armor. It was last seen in the trench after the strafing incident several weeks ago. Retrieval is not currently available since the area remains dangerous with enemy forces throughout. The risk of searching for the gear outweighs the benefit it would provide. This may at a later time become available for evaluation.

The CIB has requested access to the UK Coroners report. Currently, this information is not available. The Armed Forces Medical Examiners office routinely works with the Oxfordshire coroner and is attempting to obtain relevant evidence to make a statement about the cause of death and injury for each Royal Marine.

Royal Marine Two's medical records of care during his stay in Camp Bastion were requested to help determine the mechanism of injury. Currently, that information was provided without photographs. At this time no definitive conclusion can be drawn about the cause of Royal Marine Two's injury.

Blood samples for Incident Pilot One were collected aboard USS Dwight D. Eisenhower after the incident strafe. The samples were sent by certified USPS mail to the Armed Forces Institute of Pathology for toxicology evaluation. At this time the samples have not been received. The samples will be valid for analysis once received.

The Armed Forces Medical Examiner does not have evidence to support any conclusions at this time. However, an opinion about cause of death for Royal Marine One is available. At this time, the medical examiner states, "If the injury is limited to the surface and doesn't penetrate the chest cavity. This is most consistent with a large impact striking the plate (armor) and causing a crush injury. A 20mm round is certainly a possibility. The wound on the arm looks like a through and through shrapnel wound, but would need to see autopsy report." He further reports that _____ did not sustain a gunshot wound which suggests shrapnel from the strafing incident caused his injury.

We have evidence that shows a typical PGU-27 round is 1550 grain. Given the attitude and speed of the aircraft, we have calculated the terminal velocity of the projectile would be 894 feet per second. After converting these values, the maximum kinetic energy available at the time of the strafe would have been 3728.8 Joules ($KE = \frac{1}{2} MV^2$).
_____ of the Armed Forces Medical Examiners office has stated that this could have caused the injuries to

F-X

PGU Series 20mm – Statement of Facts and Analysis

The PGU series is multi-purpose ammunition developed to be more effective in the air-to-ground mission. The PGU-27 Target Practice (TP) projectile is composed of a steel body with a solid aluminum nose piece swaged or crimped to the steel body. The PGU-28/B Semi-Armor Piercing High Explosive Incendiary (SAPHEI) projectile incorporates a steel body with an internal cavity filled with a sponge zirconium pallet. The aluminum nose contains RS 41 incendiary mix and is threaded into the steel body.

On 05 December 2006, at location _____ a projectile was recovered and retained by the Royal Marines. This was one of several projectiles discovered post friendly strafe incident in the vicinity ditch occupied by the British forces.

Preliminary visual and photographic analysis of the recovered projectile indicates that it is most likely a 20MM PGU-27 – commonly referred to as a TP (practice round). The distinct characteristics of the slender iron rotating band clearly identifies this 20MM projectile as being from the PGU A/B series family – a series designed for and utilized by aviation assets for air-to-ground missions – compared to the M50 series series.

Preliminary analysis of the projectile further refines it as a PGU-27 (TP) vs. a PGU-28 (SAPHEI) round. Current analysis reveals that the projectile has no fuse nor does it contain any form of explosive expected in an HEI round. X-ray analysis of the recovered device does not demonstrate the unique thread pattern and internal disc characteristics that would be present in a PGU-28 round.

The round appears to be recently expended compared to previously deposited battlefield ordnance. Historically, expended PGU rounds subjected to ambient conditions begin to corrode within weeks based on NAVAIR tests. Despite corrosive conditions present in the battlefield, the round does not exhibit corrosion one would expect of a round that had been present on the ground for weeks.

The USN F/A-18 utilizes the 20MM PGU series. Current directives dictate aircraft attached to CVW-7 utilize 20MM PGU-28 “Semi-armor piercing high explosive incendiary” (SAPHEI) rounds in the battle space. There is no explanation as to why a 20MM PGU-27 round would be utilized and discovered in the battle space.

Current analysis indicates that there have been no other sources of 20MM ordnance expenditures in or around location _____ during the preceding two weeks and that the recovered projectile from 05 December 2006 is most likely a PGU-27 round from a USN F/A-18 that was expended on or around 05 December '06.

CDR USN

F/A-18 _____, 20061205

Comment [b1]: NAVAIR 11-1-119 paragraph 6-9

Comment [b2]: British Investigative report. Witness statement of _____

Comment [b3]: Email from _____ labeled Initial analysis Email. Photographs and x-ray of recovered projectile and photographs and x-rays of known PGU-28 A/B rounds

Comment [b4]: Statement of _____ and x-rays of recovered projectile and known PGU-28 x-ray

Comment [b5]: Oral statement by _____ to _____

Comment [b6]: Analysis of photograph of recovered projectile

Comment [b7]: NWP 3-22.5-F/A18 Vol. I page III-1-2

Comment [b8]: ATO (evidence misc ATO) and IRR load plan (Evid. Maint folder)

Comment [b9]: Analysis of Previous Combat engagement in area

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**2 Pages
Redacted**

Table 6-2. PGU Series Configuration Ammunition Characteristics

Cartridge		Approximate Unit Weight (gr)							Total wt (gr) (approx)
Designation	Type	Weapon	Pack- ing	M103 case	M52A3B1 Electric primer	Propellant (585 gr)	Projectile	Chamber Pressure	
PGU-27B	TP	M61A1A2, M197	Bulk Link	1,855	22	Ball, WC 867	1,550	Not to exceed 90,500 psi	3,855
PGU-29B	SAPHEI	M61A1A2, M197	Bulk Link	1,855	22	Ball, WC 867	1,550	Not to exceed 90,500 psi	3,900
PGU-30B	TP-T	M61A1A2, M197	Bulk Link	1,855	22	Ball, WC 867	1,554	Not to exceed 90,500 psi	3,960
PGU-30A/B	TP-T	M61A1A2, M197	Bulk Link	1,855	22	Ball, WC 868	1,554	Not to exceed 90,500 psi	3,900
PGU-27A/B	TP	M61A1A2, M197	Bulk Link	1,855	22	Ball, WC 868	1,550	Not to exceed 91,500 psi	3,900
PGU-25A/B	SAPHEI	M61A1A2, M197	Bulk Link	1,855	22	Ball, WC 868	1,522	Not to exceed 91,500 psi	3,900

1. Packing

Bulk

250 cigs, M548 container

Link, M14

100 cigs, M548 container

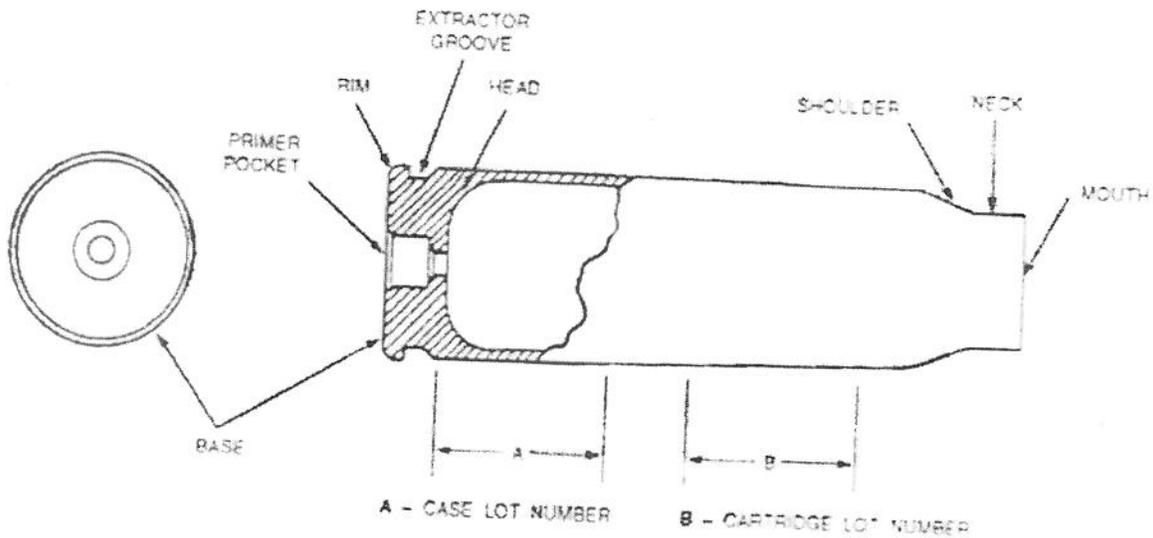


Figure 6-4. M103 Cartridge Case

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SPECIAL STAFF

From:
Sent: Friday, December 29, 2006 7:14 PM
To: SPECIAL STAFF
Subject: Re: RE: RE: RE: RE: RE:

Yes.

----- Original Message -----

From: SPECIAL STAFF

Subject: RE: RE: RE: RE: RE:

> Classification:

>
> Sir,

> We have determined the weight of the bullet to be 1550 grains or
> .100KG and traveling at 894 ft/sec or 272.5 m/s (terminal velocity)
> which calculates to 3728.8J of energy.

> We have reasonably good evidence the round was solid target practice
> rounds and strong suspicion the rear armor plate did not crack.
> Assuming he was struck with a glancing blow or direct blow, is this
> enough energy to cause the wound pattern on

> V/R

> -----Original Message-----

> From:
> Sent: Friday, December 29, 2006 2:25 PM
> To: SPECIAL STAFF
> Subject: Re: RE: RE: RE: RE:

> I wish I could be more specific, but this is definitely
> not a gunshot wound. As for other possibilities, we need that
> additional evidence.

> R/

> ----- Original Message -----

> From: SPECIAL STAFF
> Date: Friday, December 29, 2006 8:18 am
> Subject: RE: RE: RE: RE:

> Classification:

>
> Sir,

> Thank you, we will proceed with the premise was
> killed

> by the strafe attack. Could you comment on the wounds to
> I do not have evidence to support the idea that a dud
> 20mm

> round caused his wound. What could a dud 20 mm round do to cause
> his

> wound or is it more consistent with accurate small arms fire
> from 460

F. X

> > m or less away?

> >

> > I received

> > much help

medical report today which was not

> > indicating a gunshot wound from front to back with debris on the
> > posterior arm but otherwise uneventful hospitalization.

> > Very Respectfully,

> >

> >

> >

> >

> > -----Original Message-----

> > From:

> >

> > Sent: Friday, December 29, 2006 12:30 PM

> >

> > Subject: Re: RE: RE: RE: SPECIAL STAFF

> >

> > LCDR : The Oxfordshire Coroners Office is closed until

> > next

> > week. Wish we could take four day off. We'll keep trying, but it

> > is

> > doubtful that we will be able to get a report until next week.

> >

> > As for the fragmentation wound it could have come a fragment of

> > the

> > vest plate or solid round that fractured and was propelled on

> > impact.

> > We've seen such secondary missiles on multiple occasions.

> >

> > I agree that HEI rounds wounds, if the detonated, would have

> > made a

> > different type of wound. Aren't there records about what type of

> > rounds were loaded into that aircraft?

> >

> > Based on the evidence available, the most likely cause of the

> > wound was

> >

> > an impact by the 20mm round. In court, this would be hard to

> > substantiate without the additional evidence requested.

> >

> >

> >

> > CAPT, MC, USN

> > AFME

> >

> > ----- Original Message -----

> > From:

> >

> > Date: Friday, December 29, 2006 0:16 am

> >

> > Subject: RE: RE: RE:

> >

> >

> > Classification: --

> >

> > The area remains extremely dangerous. No one has been able to

> > return.

> > We have asked several times but no one,

> > is

> > interested in going to get it since the preponderance of the

> > evidence

> > suggests the strafe caused the injuries. Additionally the

> > incident

> > occurred several weeks ago and is likely not there.

> >

> > It would still be important to know how it could have done that

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> > since
> > > we have evidence approx 200 rounds of 20mm were in the area with
> > one
> > > fatality and one injury. If it was HEI then more injuries should
> > have
> > > occurred if it was target rounds (Solid) then how do you get
> > fragment
> > > wounds?

> > >
> > >
> > > V/R

> > > -----Original Message-----

> > > From:

> > > Sent: Thursday, December 28, 2006 7:04 PM
> > > To: SPECIAL STAFF
> > > Subject: Re: RE: RE:

> > > : I have read all the statements and while useful,
> > the
> > > reason we exist is that statements, especially in high
> > pressure
> > > situations, are less than reliable. If the coroner retained any
> > of the

> > > wound tissue, we can send it to our environmental toxicology lab
> > and
> > > they may be able to detect metallic fragments not visible on
> > > radiographor by examination.

> > > If that area is safe, someone needs to go and get that vest.

> > > ----- Original Message -----

> > > From:

SPECIAL STAFF

> > > Date: Thursday, December 28, 2006 12:07 pm
> > > Subject: RE: RE:

> > > > Classification:

> > > > Sir,

> > > > The troops withdrew from the fighting and did not retrieve the
> > > > body
> > > > armor due to its weight. There are several statements about
> > > the
> > > > condition of the vest and armor. discusses

> > > > conditionnear the end of his statement that it was undamaged,

> > > > was the last to leave the ditch and picked up his body
> > > armor

> > > > and saw a small plate fall out of its compartment consistent
> > > with the

> > > > type he was wearing. further describes the
> > > condition of

> > > > his gear prior to removing his armor.

> > > > X-rays were sealed and sent with the body to the UK Coroner
> > > for

> > > > inquest. We have not had access to that information.

> > > > ! and discuss the wounds to each member but
> > > no

> > > > operative report or pictures were made available for the

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Assumptions

- PGU-28 fragmentation characteristic
- 5000 feet target elevation
- 2.6mrad gun dispersion
- kinetic energy of fragment for lethal impact ≤ 10 ft-lbf (NAWCAD Range Safety Manual for a probability of fatality $< 1\%$)

Lethal Area

start firing: 7947 to 9934 ft in front of aircraft position at time of firing
 cease firing: 6586 to 8540 ft in front of aircraft position at time of firing

FRAGMENT TRAJECTORY DATA

PGU-27A/B Start Firing			
Fragment Initial Angle (deg)	Dist from projectile impact to frag impact (feet)	frag impact vel (ft/sec)	frag impact energy (ft lbs)
0.	23.	4515.	12672.
1.	823.	229.6	32.8
2.	948.	158.7	15.6
3.	1022.	129.0	10.3
4.	1074.	112.8	7.9
5.	1114.	103.2	6.6
10.	1227.	89.4	5.0
179.	-662.	250.2	38.9
178.	-790.	171.3	18.2
177.	-866.	137.8	11.8
176.	-919.	119.3	8.8
175.	-961.	107.9	7.2
PGU-27A/B Cease Firing			
0.	25.	4769.	14138.
1.	845.	227.0	32.0
2.	970.	157.2	15.4
3.	1043.	127.8	10.2
4.	1095.	112.1	7.8
5.	1135.	102.6	6.5
10.	1246.	89.5	5.0
179.	-630.	254.8	40.4
178.	-759.	174.2	18.9
177.	-835.	139.8	12.1
176.	-889.	120.8	9.1
175.	-930.	109.0	7.4
PGU-27/B Start Firing			
0.	24.	4549.	12863.
1.	826.	229.2	32.6

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2.	951.	158.5	15.6
3.	1025.	128.8	10.3
4.	1077.	112.7	7.9
5.	1117.	103.1	6.6
10.	1230.	89.5	5.0
179.	-658.	250.8	39.1
178.	-785.	171.7	18.3
177.	-862.	138.1	11.8
176.	-915.	119.5	8.9
175.	-956.	108.1	7.3
PGU-27/B Cease Firing			
0.	25.	4835.	14532.
1.	850.	226.4	31.9
2.	975.	156.8	15.3
3.	1049.	127.7	10.1
4.	1100.	111.9	7.8
5.	1140.	102.5	6.5
10.	1251.	89.5	5.0
179.	-622.	256.1	40.8
178.	-750.	175.0	19.0
177.	-826.	140.4	12.2
176.	-880.	121.2	9.1
175.	-922.	109.4	7.4
PGU-28A/B Start Firing			
0.	24.	4531.	12762.
1.	824.	229.4	32.7
2.	949.	158.6	15.6
3.	1024.	128.9	10.3
4.	1076.	112.8	7.9
5.	1115.	103.1	6.6
10.	1228.	89.5	5.0
179.	-660.	250.4	39.0
178.	-788.	171.5	18.3
177.	-864.	137.9	11.8
176.	-918.	119.4	8.9
175.	-959.	108.0	7.2
PGU-28A/B Cease Firing			
0.	25.	4803.	14340.
1.	848.	226.7	31.9
2.	972.	157.0	15.3
3.	1046.	127.8	10.2
4.	1098.	112.0	7.8
5.	1137.	102.6	6.5
10.	1249.	89.5	5.0
179.	-626.	255.5	40.6

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178.	-754.	174.6	19.0
177.	-830.	140.1	12.2
176.	-884.	121.0	9.1
175.	-926.	109.2	7.4
PGU-28/B Start Firing			
0.	24.	4547.	12852.
1.	826.	229.2	32.6
2.	951.	158.5	15.6
3.	1025.	128.8	10.3
4.	1077.	112.7	7.9
5.	1117.	103.1	6.6
10.	1230.	89.5	5.0
179.	-658.	250.7	39.1
178.	-786.	171.7	18.3
177.	-862.	138.1	11.8
176.	-916.	119.5	8.9
175.	-957.	108.0	7.2
PGU-28/B Cease Firing			
0.	25.	4832.	14514.
1.	850.	226.4	31.9
2.	975.	156.9	15.3
3.	1048.	127.7	10.1
4.	1100.	111.9	7.8
5.	1140.	102.5	6.5
10.	1251.	89.5	5.0
179.	-622.	256.1	40.8
178.	-750.	175.0	19.0
177.	-826.	140.4	12.2
176.	-880.	121.2	9.1
175.	-922.	109.3	7.4

Assumptions

- PGU-28 fragmentation characteristic
- 5000 feet target elevation
- 2.6mrad gun dispersion
- kinetic energy of fragment for lethal impact ≤ 10 ft-lbf (NAWCAD Range Safety Manual for a probability of fatality $< 1\%$)

Lethal Area

start firing: 7947 to 9934 ft in front of aircraft position at time of firing

cease firing: 6586 to 8540 ft in front of aircraft position at time of firing

FRAGMENT TRAJECTORY DATA

PGU-27A/B Start Firing			
Fragment Initial Angle (deg)	Dist from projectile impact to frag impact (feet)	frag impact vel (ft/sec)	frag impact energy (ft lbs)
0.	23.	4515.	12672.
1.	823.	229.6	32.8
2.	948.	158.7	15.6
3.	1022.	129.0	10.3
4.	1074.	112.8	7.9
5.	1114.	103.2	6.6
10.	1227.	89.4	5.0
179.	-662.	250.2	38.9
178.	-790.	171.3	18.2
177.	-866.	137.8	11.8
176.	-919.	119.3	8.8
175.	-961.	107.9	7.2
PGU-27A/B Cease Firing			
0.	25.	4769.	14138.
1.	845.	227.0	32.0
2.	970.	157.2	15.4
3.	1043.	127.8	10.2
4.	1095.	112.1	7.8
5.	1135.	102.6	6.5
10.	1246.	89.5	5.0
179.	-630.	254.8	40.4
178.	-759.	174.2	18.9
177.	-835.	139.8	12.1
176.	-889.	120.8	9.1
175.	-930.	109.0	7.4
PGU-27/B Start Firing			
0.	24.	4549.	12863.
1.	826.	229.2	32.6

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2.	951.	158.5	15.6
3.	1025.	128.8	10.3
4.	1077.	112.7	7.9
5.	1117.	103.1	6.6
10.	1230.	89.5	5.0
179.	-658.	250.8	39.1
178.	-785.	171.7	18.3
177.	-862.	138.1	11.8
176.	-915.	119.5	8.9
175.	-956.	108.1	7.3
PGU-27/B Cease Firing			
0.	25.	4835.	14532.
1.	850.	226.4	31.9
2.	975.	156.8	15.3
3.	1049.	127.7	10.1
4.	1100.	111.9	7.8
5.	1140.	102.5	6.5
10.	1251.	89.5	5.0
179.	-622.	256.1	40.8
178.	-750.	175.0	19.0
177.	-826.	140.4	12.2
176.	-880.	121.2	9.1
175.	-922.	109.4	7.4
PGU-28A/B Start Firing			
0.	24.	4531.	12762.
1.	824.	229.4	32.7
2.	949.	158.6	15.6
3.	1024.	128.9	10.3
4.	1076.	112.8	7.9
5.	1115.	103.1	6.6
10.	1228.	89.5	5.0
179.	-660.	250.4	39.0
178.	-788.	171.5	18.3
177.	-864.	137.9	11.8
176.	-918.	119.4	8.9
175.	-959.	108.0	7.2
PGU-28A/B Cease Firing			
0.	25.	4803.	14340.
1.	848.	226.7	31.9
2.	972.	157.0	15.3
3.	1046.	127.8	10.2
4.	1098.	112.0	7.8
5.	1137.	102.6	6.5
10.	1249.	89.5	5.0
179.	-626.	255.5	40.6

F-X

178.	-754.	174.6	19.0
177.	-830.	140.1	12.2
176.	-884.	121.0	9.1
175.	-926.	109.2	7.4
PGU-28/B Start Firing			
0.	24.	4547.	12852.
1.	826.	229.2	32.6
2.	951.	158.5	15.6
3.	1025.	128.8	10.3
4.	1077.	112.7	7.9
5.	1117.	103.1	6.6
10.	1230.	89.5	5.0
179.	-658.	250.7	39.1
178.	-786.	171.7	18.3
177.	-862.	138.1	11.8
176.	-916.	119.5	8.9
175.	-957.	108.0	7.2
PGU-28/B Cease Firing			
0.	25.	4832.	14514.
1.	850.	226.4	31.9
2.	975.	156.9	15.3
3.	1048.	127.7	10.1
4.	1100.	111.9	7.8
5.	1140.	102.5	6.5
10.	1251.	89.5	5.0
179.	-622.	256.1	40.8
178.	-750.	175.0	19.0
177.	-826.	140.4	12.2
176.	-880.	121.2	9.1
175.	-922.	109.3	7.4

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Logbook

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MONTH: December YEAR: 2006

Blockner, B

DAY	FRAME	SERIAL NUMBER	KIND OF FLIGHT CODE#	PILOT TIME			SPE COAL GRW TIME	INSTRUMENT FLIGHT		LANDINGS			STD INST APPR. COMPLETED		REMARKS					
				TOTAL PILOT TIME	FIRST PILOT	CO-PILOT		A/C COMDR	ACT	SIM	NIGHT TIME	CARRIER	TRG	PT		SEA/LAND	GAULT	NO	TR	IN
1	F/A-18C	[REDACTED]	2K2	1.5	1.5															
2	F/A-18C	[REDACTED]	2K2	0.5	0.5															
4	F/A-18C	[REDACTED]	2K6	1.2	1.2															
5	F/A-18C	[REDACTED]	612	6.3	6.3															
6	F/A-18C	[REDACTED]	1A7	1.2	1.2															
TOTAL THIS PAGE				10.7	10.7															
BROUGHT FORWARD				2751.1	96.3	96.3														
TOTALS THIS FISCAL YEAR				107.0	107.0	107.0														
TOTALS THIS FISCAL YEAR				37.0	0.6	1.2	4/1													
TOTALS THIS FISCAL YEAR				48.1	22/17/2/0	49.3	26/18/2/0													
TOTALS THIS FISCAL YEAR				41/0	38	45/0	43													

*See page 2 for codes

CO. or authorized deputy

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