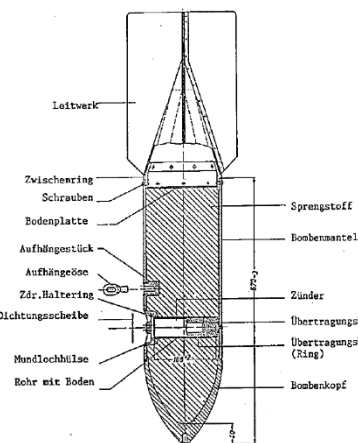


Examples of German Air-Delivered Ordnance

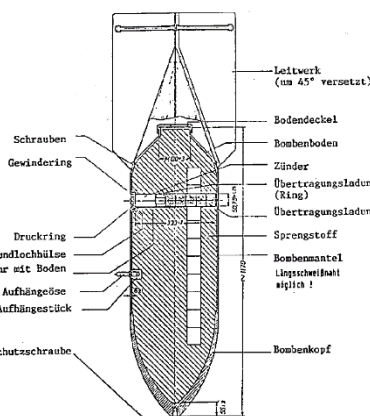
SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



SC 250kg High Explosive Bomb

Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).

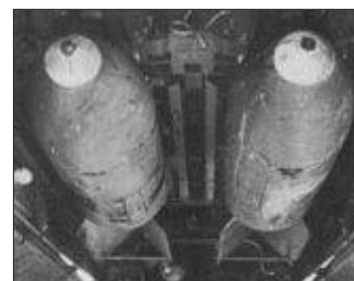
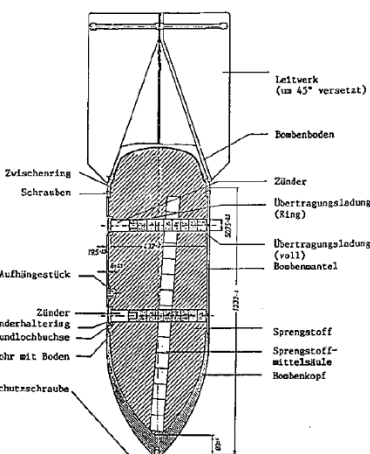


SC250 bomb being loaded onto German bomber



SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, triallene. Bombs recovered with Triallene filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming



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Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

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Project: **Amberley & Harrogate Road, Sunderland**

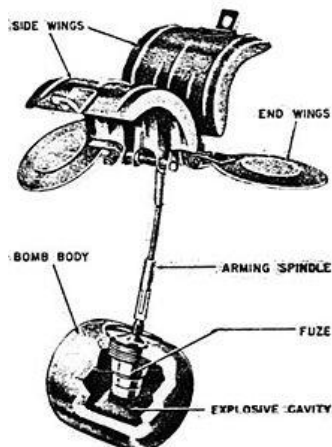
Ref: **DA12188-00**

Source: Various sources

Examples of German Air-Delivered Ordnance

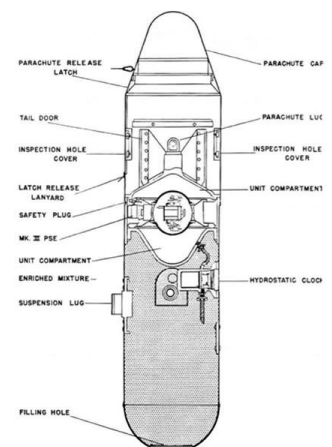
SD2 Anti-Personnel 'Butterfly Bomb'

Bomb Weight	Approx. 2kg (4.41lb)
Explosive Weight	Approx. 7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/ fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Very rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open by springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane which armed the device as it span.



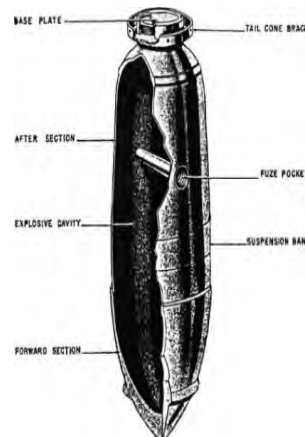
Parachute Mine (Luftmine B / LMB)

Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to cause extensive damage in a 100m radius.



SC 1000kg

Bomb Weight	Approx. 993-1027kg (2,189-2,264lb)
Explosive Weight	Approx. 530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction.



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Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
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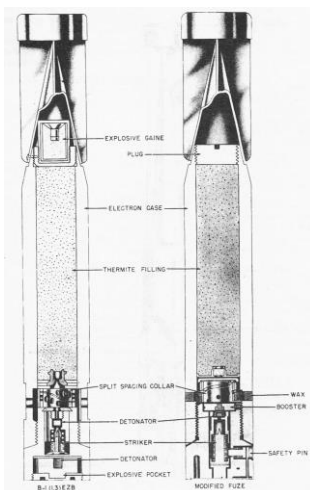
Source: Various sources

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German Incendiary Bombs

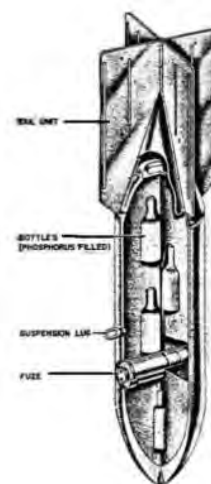
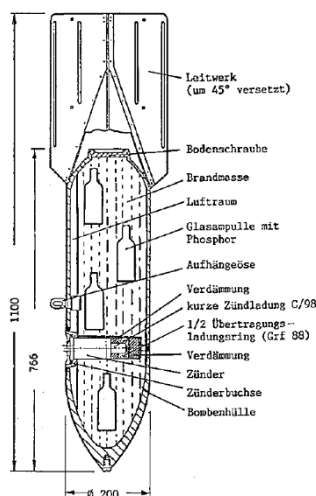
1kg Incendiary Bomb

Bomb Weight	Approx. 1.0 - 1.3kg (2.2 and 2.9lb)
Explosive Weight	Approx. 680g (1.5lb) Thermit 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters on towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



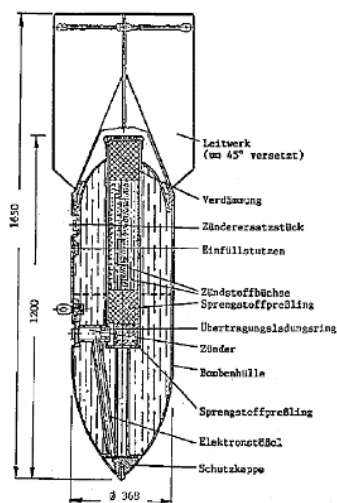
C50 A Incendiary Bomb

Bomb Weight	Approx. 41kg (90.4lb)
Explosive Weight	Approx. 0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against any targets where an incendiary effect is required
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture



Flam C-250 Oil Bomb

Bomb Weight	Approx. 125kg (276lb)
Explosive Weight	Approx. 1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on ground troops, against troop barracks and industrial installations. Thin casing – not designed for ground penetration



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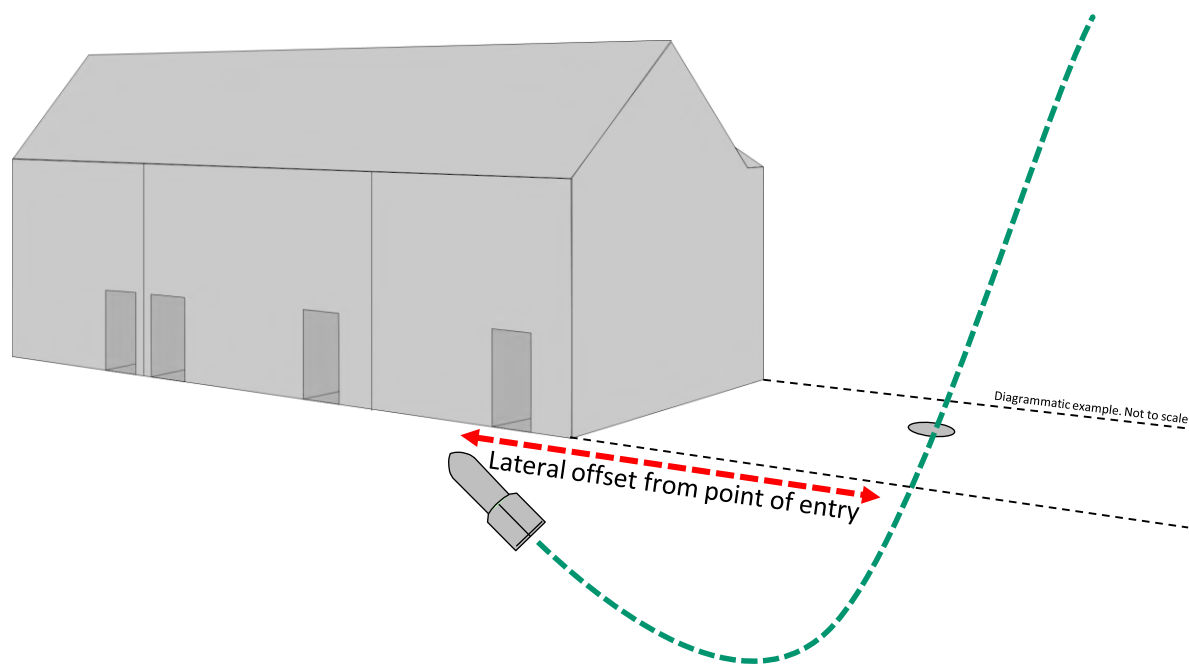
Client: **Arc Environmental Ltd**

Project: **Amberley & Harrogate Road, Sunderland**

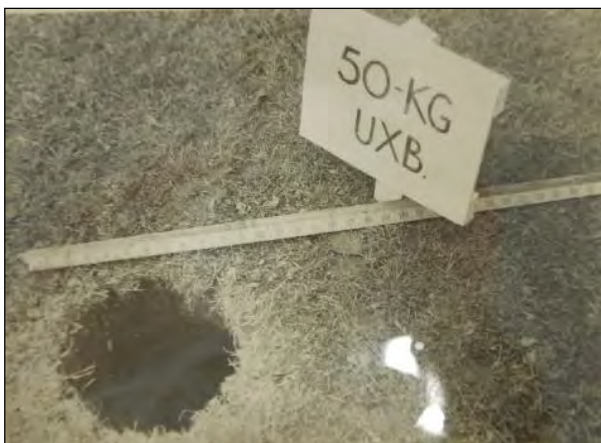
Ref: **DA12188-00**

Source: Various sources

The 'J-Curve' Effect Principle



Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites. The photograph above shows 250kg bomb found in Bermondsey pointing upwards, demonstrating 'J-curve'



One of the most common scenarios for UXO going unnoticed was when a UXB fell into a 'bomb site' (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).



Bermondsey bomb: World War Two device safely removed



An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

March 2015



Bethnal Green WW2 bomb: Experts remove unexploded device



An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

A 200m (650ft) exclusion zone was set up around the device.

August 2016



Bath WW2 bomb scare: Device defused, police say



A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

The discovery of the bomb on Thursday led to the evacuation of hundreds of homes and many road closures in the Lansdown area of the city.

A cordon around the site was lifted on Friday evening, more than 24 hours after residents were asked to leave their homes.

May 2016



London City Airport reopens after WW2 bomb moved



London City Airport has reopened after an unexploded 500kg World War Two bomb was safely moved from the area.

The device was discovered at the King George V Dock on Sunday during planned work at the east London airport.

All flights were cancelled on Monday after an exclusion zone was put in place, with the closure affecting up to 16,000 passengers and nearby residents being evacuated from their homes.

May 2015



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Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: Arc Environmental Ltd	
Project: Amberley & Harrogate Road, Sunderland	
Ref: DA12188-00	Source: BBC News

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

WWII bomb injures 17 at Hattingen construction site



Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of **North Rhine-Westphalia** said.

"The hole was astonishingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told *The Local*. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013



World War II bomb kills three in Germany



A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010



June 2006

SPiegel ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006



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Client: **Arc Environmental Ltd**

Project: **Amberley & Harrogate Road, Sunderland**

Ref: **DA12188-00**

Source: Various news sources

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The Northern Echo

NEWS

16th October 2002

Hitler's bomb brings chaos to city streets

THOUSANDS of people were last night settling down for a second night away from their homes after a massive Second World War bomb was unearthed in a city centre.

But, as bomb disposal experts continued a delicate operation to defuse the device, more than 1,000 residents stayed defiantly in their homes - despite repeated warnings by police and the military to get out.

Emergency services said last night the 1,000lb bomb, found in the Hendon area of Sunderland, remained extremely dangerous and it could take up to two more days before it is finally defused.

Sunderland Police Superintendent Paul Weir said: "A number of people have refused to be evacuated and some are even coming back to their homes in the exclusion zone.

The emergency was sparked when a workman operating a mechanical digger unearthed the bomb on open ground behind the Deerness Park Medical Centre, in Suffolk Street, at 6pm on Monday.

Police immediately declared a major incident and sealed off the road, before throwing a 400m cordon around the site.

The origin of the bomb remains uncertain, but it is believed it could be from the wreck of a Heinkel bomber, which crashed on Suffolk Street during the Blitz.

Captain John Foran, of 33 Engineer Regiment (Explosive Ordnance Disposal), said: "The bomb is very dangerous.

"It lay safe for over 50 years, until it was accidentally disturbed by the digger, which reactivated the fuse."

Cpt Foran said a powerful magnet had been used to stop the timing device to enable experts to identify the fuse.

He added: "But it is still very dangerous because of the condition of the explosives.

"Over the years the chemicals have seeped from explosives, which become very sensitive when it comes into contact with air or metal.

"If it exploded it would cause a crater up to 25ft wide and 15ft deep, and would almost destroy the surgery."

Skips full of sand and water were being placed around the bomb to absorb most of the blast, should the bomb go off during the operation.

Cpt Foran said a 5in disc would be cut out of the top of the bomb and two further discs at the bottom end.

Then in a long and delicate operation, the contents of the bomb will be steamed out, before the fuse is finally disarmed.



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The Northern Echo

NEWS

17th October 2002

Digger driver tells of amazing bomb escape

Digger driver Charlie Farn was last night counting himself "the luckiest man alive" after coming within a hair's breadth of being blown up by a 1,000lb bomb.

The Northern Echo tracked down Mr Farn, who described his horror at learning that he had reactivated the fuse of the Second World War bomb when his digger struck the device.

"A digger driver finds all manner of things - but the chances of coming across a bomb like this must be millions to one."

Mr Farn described how he had unearthed the German bomb while excavating foundations for an extension to the Deerness Park Medical Centre in Suffolk Street, Hendon, Sunderland.

And in a terrifying moment, the bomb - which had lain undisturbed for more than half a century after being jettisoned by one of Hitler's Heinkels - started ticking.

The site was immediately sealed off by police and a 400 metre cordon was set up as bomb disposal experts managed to stop the fuse and stabilise the bomb.

Skips packed with sand and water were placed around the bomb to absorb the force of the blast.

Then, in scenes reminiscent of The Blitz, more than 100 police, Army personnel and council staff began the massive logistical operation of evacuating 4,000 men, women and children from the blast area around the site.

Mr Farn who runs Charlie Farn JCB Hire, from Shotton Colliery, said: "Peter Fowle, the managing director of the contractors who I was carrying out the work for, asked us to be very careful not to disturb the sewer. We are trained to look for anything that comes out of the bucket.

"I got an eerie feeling that I could not quite put my finger on when a lot of old canvas and pieces of aluminium started to emerge."

Mr Farn was digging the last hundred centimetres required when triangular pieces of metal started emerging. He said: "I felt my digger hit something solid. The manager of the practice, Eric Harrison, poked his head out of the window to ask what the problem was.

"When I told him we had hit something solid, he said lots of bombs had fallen in the area and joked, had we come across one?"

Mr Farn said the object looked like a Calor gas container but had some writing on it and a cylindrical "thing" with screws.

"I called Mr Fowle who told us to stop working immediately and went on thinking nothing further of it until I got a call at home. It was Mr Fowle who said, "Do you know how lucky you've been."

The bomber which dumped the device is thought to have been shot down over the city.

Wearside was pounded during the war because of its shipbuilding yards.



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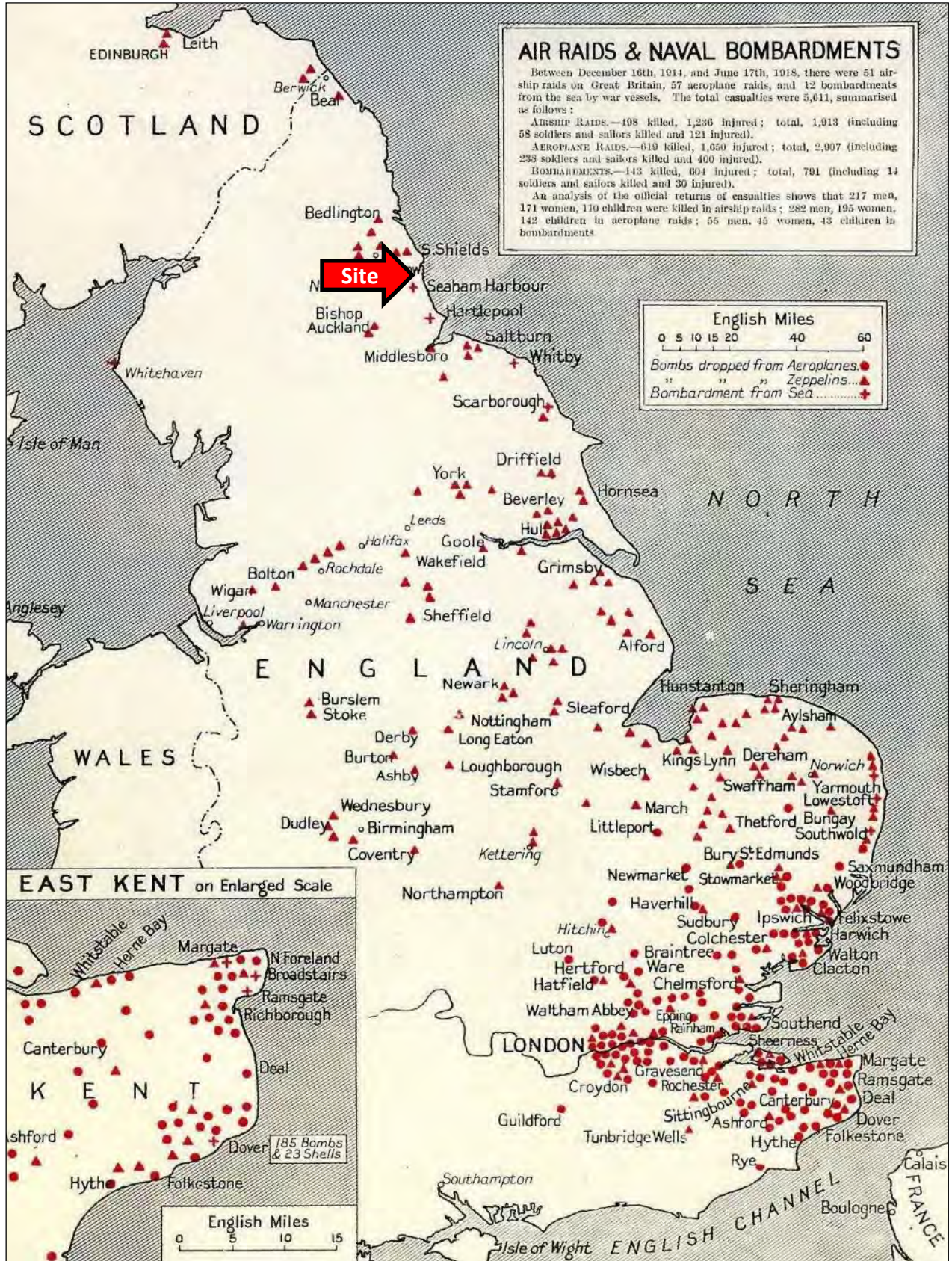
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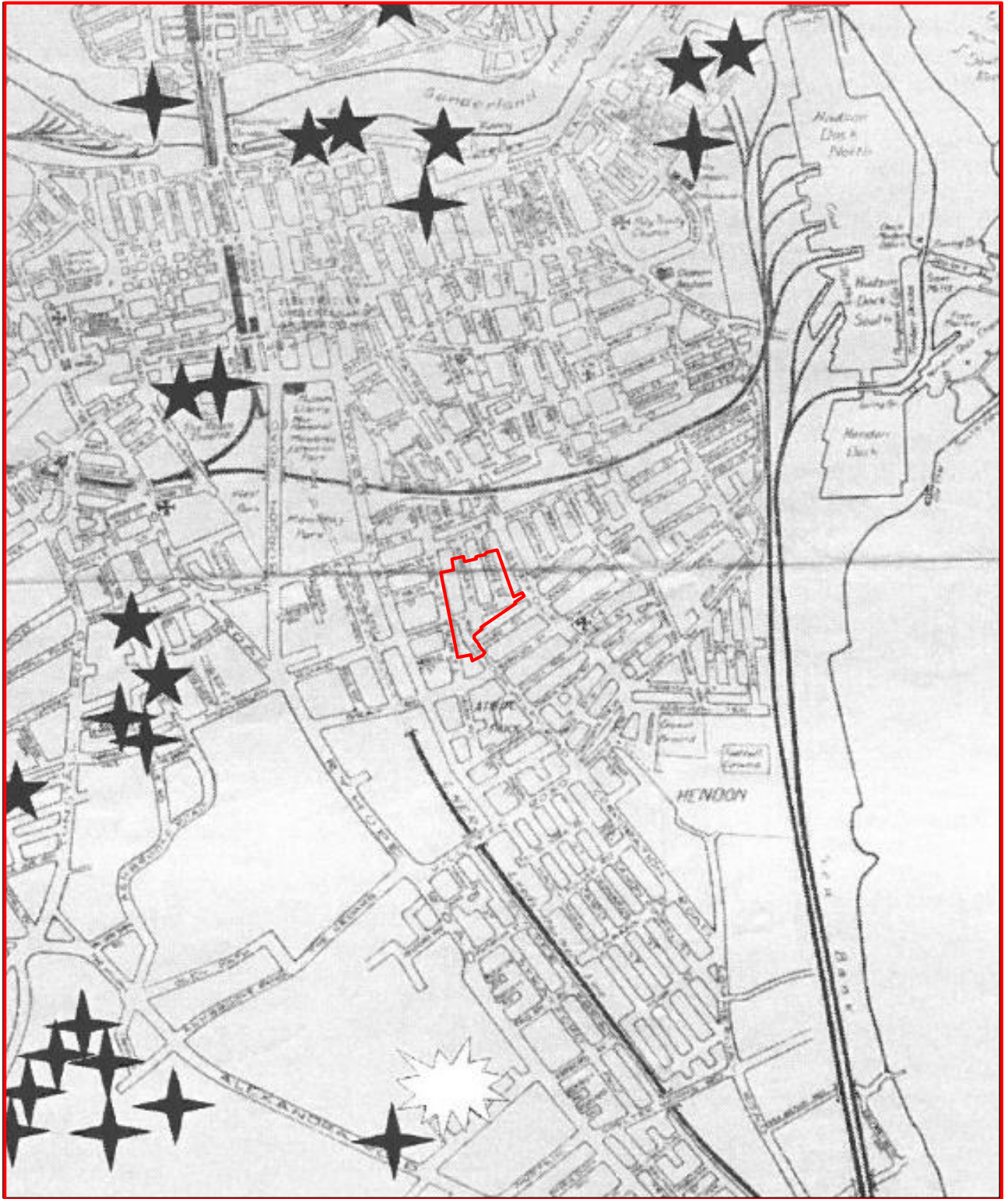
Client: **Arc Environmental Ltd**

Project: **Amberley & Harrogate Road, Sunderland**




Ref: **DA12188-00**

Source: The National Archives





Bombs that fell on the Town Centre during the Raid of 16th May 1943 (Those shown white did not detonate)

 Parachute Mine
  Incendiary Devices
  High Explosive



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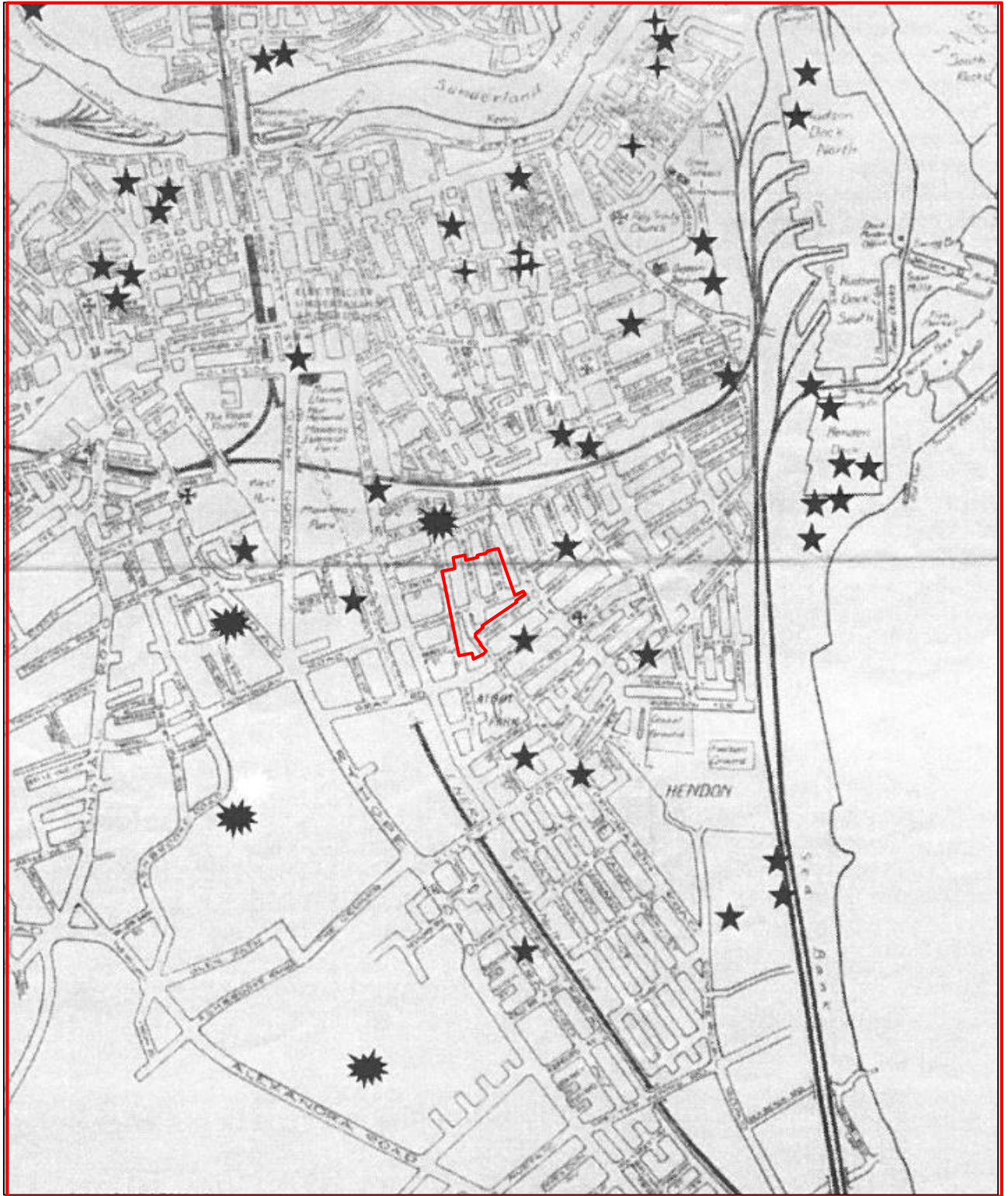
 **Approximate site boundary**






Project: **Amberley & Harrogate Road, Sunderland**

Ref: **DA12188-00**

Source: Sunderland Local Studies Centre



Bombs that fell on the Town Centre during the Raid of 24th May 1943 (Those shown white did not detonate)

 Parachute Mine	 Incendiary Devices	 High Explosive
--	--	---



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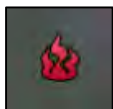


Ref: **DA12188-00**

Source: Sunderland Local Studies Centre



Image © 2021 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO



Bombs that fell with pictures and descriptions



Stories of people of Sunderland collected by library staff



Targets from 1942 Luftwaffe Target Map



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Source: Google Earth™ Mapping Services, Sunderland Public Libraries

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Above: 23.15 hrs 5th September 1940 Front of 55 ½ Suffolk street, showing result of fire after German aircraft had crashed in the backyard



The German bombers did not have it all their own way, however. Pictured are the wheels of a Heinkel bomber shot down by anti-aircraft fire over Sunderland in 1940. It fell in Suffolk Street and here soldiers examine the undercarriage as the wreckage is cleared away.



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Source: Sunderland Public Libraries





Above: A Heinkel He 111 P-4 (same variant as that which crashed near the site) in Chartres, France in April or May 1941 with a 500kg bomb being loaded by a captured French light carrier.

Below: An MG-15 shown mounted in a Heinkel He 111 over Poland in 1939. Next to it is the 7.92x57mm Mauser small-arms ammunition that it fired. These machine guns were the most common kind mounted on the He 111.





1 x German SC 500 kg bomb / C50 fuze. Fuze immunized, bomb removed to GR 414541 and destroyed.
 Deerness Pk Med Centre, Suffolk St, Hendon, Sunderland, Tyne & Wear

DBID	EOC 438
Latitude	54.899879456
Longitude	-1.3731110096
Grid Ref final	NZ403563
Date	14-Oct-02
County	
UXO L	
UXO E	
MAP SHT/GR	88/403563
Ha	
Start	
End	
Cert	
TASK No	60801
IND	-1
FILE No	R13/4/63
AUTH	
PRI	
CAT	
TYPE	
CURRENT SITUATION	
RECCE DATE	
ACT	
UNIT	
RECCE COMMENT	
P CL DATES	
A CL DATES	
LAST VISIT	
DURATION	
Ha REM	
CL C DATE	
NFA	
FileCloseDate	
Informant	JSEODOC
Action	15 - 17/10/02
Actioned By	WO2 Perks
Dist/Div	
No	
S'RCH	
SAA	
ADWPN	
LSO Scrap	
Dom Scrap	



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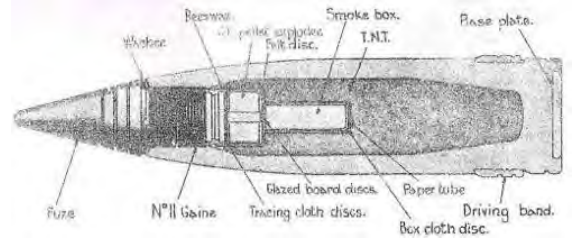
Ref: **DA12188-00**

Source: 1st Line Defence

Examples of Anti-Aircraft Projectiles

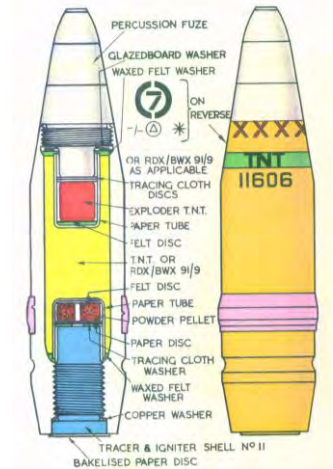
3.7 Inch QF Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army.
Ceiling	30,000ft to 59,000ft



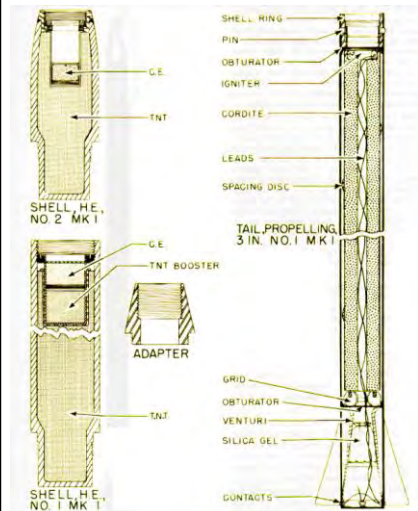
40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft



3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor



Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Arc Environmental Ltd**
Project: **Amberley & Harrogate Road, Sunderland**
Ref: **DA12188-00** Source: Various sources



For indicative purposes – not to scale

- Low Risk
- Medium Risk
- Low-Medium Risk of German SAA & LSA

All Risk Areas:

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works
- UXO Risk Management Plan

Medium Risk Area:

- Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works
- Intrusive Magnetometer Survey of all Borehole and pile locations down to a maximum bomb penetration depth



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Tel: +44 (0)1992 245 020

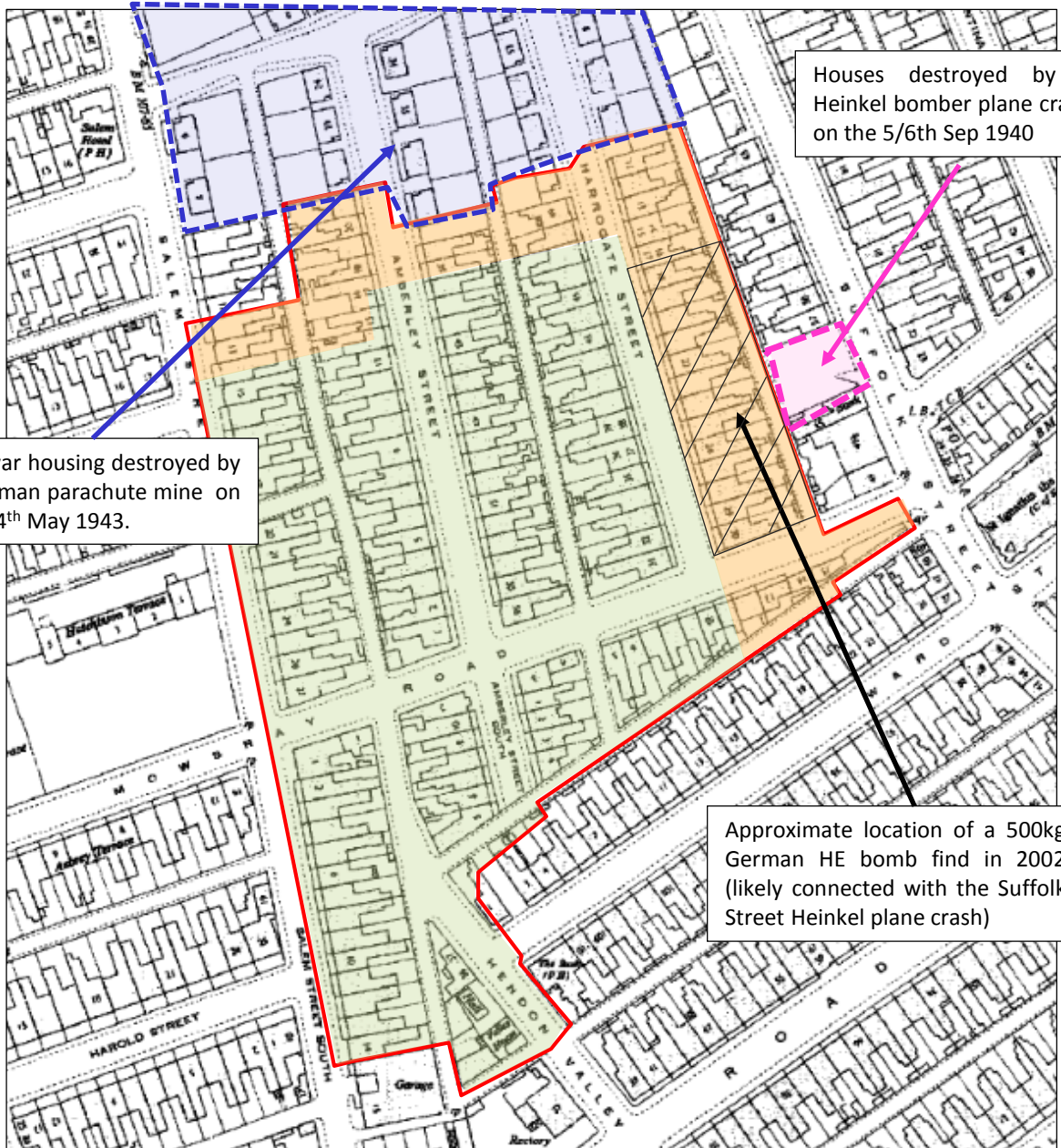
Client: **Arc Environmental Ltd**

— **Approximate site boundary**

Project: **Amberley & Harrogate Road, Sunderland**

Ref: **DA12188-00**

Source: 1st Line Defence



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1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road
Hoddesdon
Hertfordshire
EN11 0EX
Tel: 01992 245020

www.1stlinedefence.co.uk



APPENDIX IV

Conceptual Site Model (CSM)

