




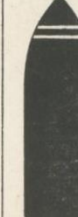
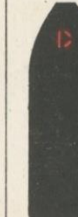
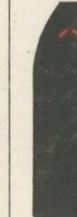

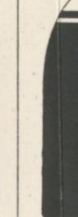
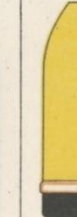




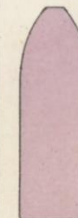




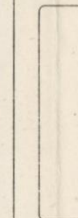
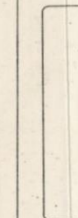
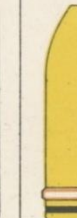
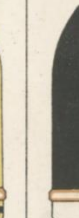



DISTINGUISHING MARKS FOR SHOT AND SHELL.

EMPTY.

<p>SHRAPNEL IRON OR STEEL.</p> 	<p>PRACTICE SHRAPNEL</p>  <p style="text-align: center;">①</p>	<p>COMMON SHELL.</p> 	<p>PRACTICE PROJECTILE WEIGHTED.</p>  <p style="text-align: center;">① ⊗</p>	<p>COMMON POINTED SHELL STEEL.</p> 	<p>A. P. SHELL STEEL. CAP TO BE PAINTED BLACK FOR CAPPED SHELL.</p> 	<p>PROJECTILE, DAY TRACER. IN ADDITION TO ALL OTHER APPROVED MARKING.</p>  <p style="text-align: center;">①</p>	<p>PROJECTILE, NIGHT TRACER. IN ADDITION TO ALL OTHER APPROVED MARKING.</p>  <p style="text-align: center;">①</p>	<p>PRACTICE SHOT.</p>  <p style="text-align: center;">①</p>	<p>A. P. SHOT. STEEL. CAP TO BE PAINTED WHITE FOR CAPPED SHELL.</p> 	<p>BASE ADAPTER SHELL.</p> 	<p>12", 3" AND 6" SHELL.</p> 	
<p>HIGH EXPLOSIVE.</p> 	<p>HIGH EXPLOSIVE DRILL.</p> 	<p>A. P. SHELL WITH CAP. HIGH EXPLOSIVE.</p> 	<p>GAS SHELL.</p>  <p style="text-align: center;">⊠</p>	<p>SMOKE SHELL.</p> 	<p>INCENDIARY SHELL.</p> 	<p>3 1/2", 6" & 60mm & 4.5" SHELL. BANDS TO DESIGN-- R.L. 28, 291; R.L. 28, 290; R.L. 28, 285; R.L. 28, 272; A.B. R.L. 28, 276, RESPECTIVELY.</p>  <p style="text-align: center;">⊗</p>	<p>SHOT, FLATHEADED. OR SHOT PROOF.</p> 	<p>SHOT, CASE. IRON BALLS. NOT TO BE PAINTED.</p> 	<p>SPECIAL SHOT, CASE CHILLED IRON BALLS. NOT TO BE PAINTED.</p> 	<p>STAR SHELL. SUITABLE FOR FULL CHARGE.</p> 	<p>12" & 6" SHELL.</p>  <p style="text-align: center;">①</p>	
						<p>TRACER MARKING WILL BE IN BLACK ON H.E. SHELL. THE "O" TO BE THE SAME SIZE AS THE SEMICIRCLE ON PROJECTILES WITH NIGHT TRACERS.</p>	<p>TRACER MARKING WILL BE IN BLACK ON H.E. SHELL. INTERNAL RADIUS OF SEMICIRCLE-- 7.5 IN. & ABOVE 15" 6 IN. & 6 1/2 IN. 14" 5.75 IN. TO 7 IN. 8" 3 IN. & 6 IN. 6" THICKNESS OF SEMICIRCLE, 7.5 IN. & ABOVE 5/8" 6 IN. TO 7 IN. 3/4"</p>			<p>H.E. SHELLS WHOSE BASE ADAPTERS HAVE BEEN INSERTED OR IN-INSERTED WITH THOSE COATED WITH GUN OIL HAVE THEIR BACK ENDS PAINTED BLACK.</p>	<p>H.E. SHELL HAVING BOTTOM OF CAVITY COATED WITH GUN OIL, HAVE THEIR BACK ENDS CHECKERED 2 BLACK 2 YELLOW ALTERNATELY.</p>	<p>WHERE A GUN AND MOUTH OF THE SAME CALIBRE EXIST H.E. GAS AND KEROSENE SHELLS SUITABLE FOR THE GUN/WHETHER ALSO SUITABLE FOR THE MOUTH (WHEN USED) ARE TO BE DISTINGUISHED BY A BLACK BAND 2 INCHES WIDE IMMEDIATELY IN FRONT OF THE DRIVING BAND.</p>
						<p>TWO BLACK STRIPES 1/8 IN. WIDE EXTENDING FROM SHOULDER TO DRIVING BAND ON OPPOSITE SIDES OF THE SHELL, EXCEPT WHICH SHELL ARE PAINTED BLACK IN WHICH CASE THE STRIPES ARE WHITE.</p>	<p>SEE TOP OF DRIVING BAND STENCILED ON IN WHITE PAINT. SIZE OF STENCILLING-- 3" & BELOW .302 IN. 4" TO 6" INCLUSIVE .30 IN. ABOVE 6" TO 10" .32 IN. 12" & ABOVE 1.00 IN.</p>			<p>BASE ADAPTER SHELL HAVING THE BOTTOM OF CAVITY FITTED WITH A PAD OF CEMENT TO BE DISTINGUISHED BY A BLACK RING 2 1/2 INCHES ON THE BACK END MIDWAY BETWEEN DRIVING BAND AND BASE.</p>	<p>BACK END PRINTED WHITE.</p>	<p>STENCILLING TO BE THE SAME SIZE AS THAT SHOWING FOR DRIVING BAND DESIGN ON SHOT PROOF.</p>
						<p>REMARKED SHOT AND THOSE ACCEPTED DIVISION SPECIFICATION WILL HAVE A YELLOW BAND PRINTED ROUND CENTRE OF BODY.</p>			<p>PLAN. WHITE DISC</p> 			

COMMON POINTED SHELL FOR PRACTICE WILL BE SIMILARLY MARKED FOR PRACTICE PROJECTILES AND REMARKED PROOF SHOT. MOUTH OF YELLOW BAND TO BE 2 IN. FOR 6 IN. AND 4 INCH. FOR 3 IN. UNDER 8 IN. TO 10 IN. AND 3/4 IN. FOR UNDER 10 IN. PROJECTILES WITH NIGHT TRACERS SHALL HAVE THEIR BACK ENDS CHECKERED 2 BLACK 2 YELLOW ALTERNATELY. CAPS FROM 12" & 6" SHELLS SHALL BE TO HAVE A LIGHT BROWN DISTINGUISHING RING 5/16 IN. WIDE. PAINTED MOUTH HOSE 1/8 IN. FROM JAW.

WW1: AMMUNITION PRODUCTION & DEVELOPMENT

LTCOL (Ret'd) David Brook

Outline

- Factors – August 1914
 - Lessons & Legacy
 - Industrial Base
- Nature of Targets
- Ammunition Improvement
 - Metallurgy
 - Exterior Ballistics
 - Wire Cutting
 - Fuzes
 - Propellant
 - Explosive Fill
- Australian Manufacturing
- Epilogue
- Conclusions

The Basics

- The Weapon of Artillery is the Projectile
- Effect at Target depends on
 - Rate of fire
 - Total number of rounds
 - Type of round
 - Timing of detonation



As of August 1914

- Field Artillery lessons not embraced:
 - Boer War
 - Russo-Japanese War
 - Franco-Prussian War
 - American Civil War
- Reasons
 - Policeman
 - Envisaged enemies – e.g. tribesman

Industrial Base

- Good research capability – Royal Arsenal Woolwich
- Limited ammunition manufacturing base
 - Not prepared for expansion
- Ammunition Holdings
 - 13-pr & 18-pr – 1000rpg
 - 4.5-in How – 800rpg
 - 60-pr – 500rpg
- Shell Scandal

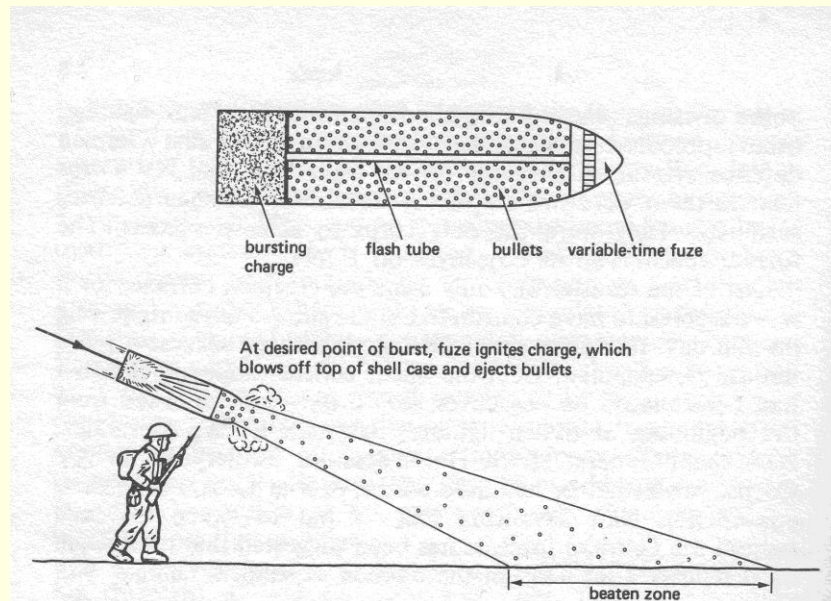
Industrial Base

- By War's end there were 12 National Filling Factories, 4 Projectile Factories, and 2 Explosives Factories
- A huge increase considering there were only three Royal Ordnance Factories in 1914



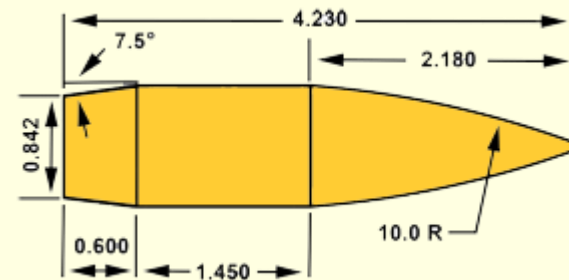
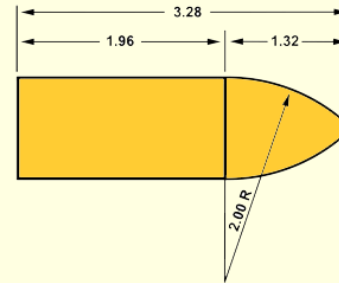
The Nature of Targets & Lessons

- Insufficient ammunition
- Shrapnel – limitations
- Shortage of HE



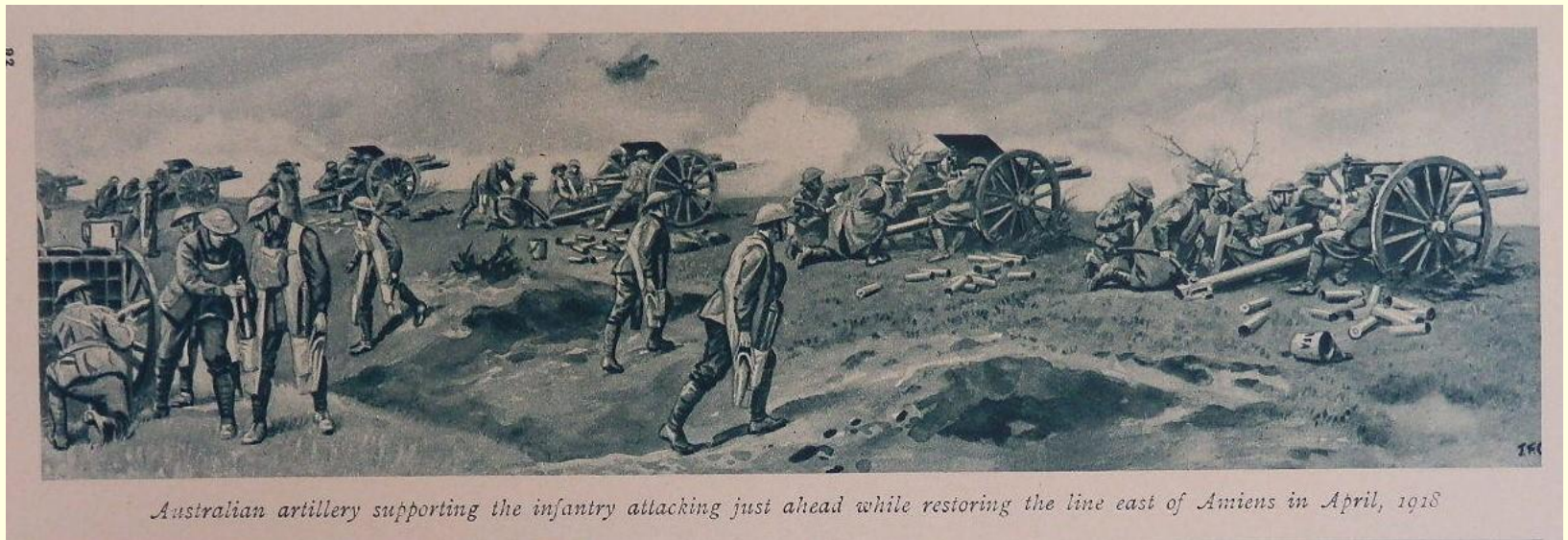
Ammunition Improvements

- Range Tables
- Carrier Shells
- Projectile Metallurgy
- Projectile Shape & Exterior Ballistics
- Wire Cutting
- Fuzes
- Propellant
- Explosives



Australian Manufacturing

- Only 15,000 Shrapnel Shell bodies produced



Epilogue – Rounds Fired

- 18-pr gun – 99,397,670 – 70%
- 4.5-in how – 25,326,276 – 18%
- 60-pr gun – 10,125,322 – 7%
- 8-in how – 4,189,165 – 3%
- 9.2-in how – 3,119,158 – 2%
- Total – 142,157,590

Conclusion – Ammunition Production

- Production capacity was a major limitation
- Fundamental ammunition design improvements did not generally occur
- Main effort in meeting artillery ammunition requirements was in quantity over quality

