

French interwar 37mm AA guns and ammunition

Version 3 – with thanks to those who sent me information: Tony DiGiulian of the NavWeaps site, Alan Bates, John Roks, Pierre-Jean Desproges, Jose Juan Aroca, and naval historian John Jordan concerning ACAD.

There are some mysteries and inconsistencies in the currently available information concerning French 37mm AA guns and their ammunition, so this post is a request for help in trying to solve them.

37 x 277R ammunition

What is very well known is that after World War 1 the French Navy selected a manually-loaded AA gun firing powerful 37 x 277R ammunition. This came in two mountings: the single-gun M1925 and the twin-gun M1933. While the gun's designation says 50 cal, the barrel was (probably) 54 cal long (one source says 60 cal) and the 725 g shell was fired at 810 m/s, giving a muzzle energy (ME) of c.240 KJ. The rate of fire (RoF) was low at around 30-40 rounds per minute (rpm). All of this data from the NavWeaps site: http://www.navweaps.com/Weapons/WNFR_37-50_cail_m1933.htm Jordan & Dumas (French Battleships 1922-1956) quote 730 g at 810 m/s, which is close enough, but Campbell (Naval Weapons of World War 2) gives an MV of up to 850 m/s raising the ME to over 260 KJ. Incidentally, the same cartridge case was used in the Army's M1934 Casemate (fortress) gun which is credited with firing a 900 g APC at 815 m/s, developing 300 KJ, but the army may well have loaded the round to a higher pressure to prioritise armour penetration over barrel life.

The ACAD competition

For the rest of the 37 mm AA guns, the best source of information is a contemporary official document concerning the ACAD trials. ACAD stood for *Automatic Contre-Avions Double*, and was a mid-1930s Navy project to find a medium-calibre automatic gun in a twin mounting, to replace the M1933.

There were four candidates tested: 40 mm Bofors; 37 mm Schneider; 37 mm Hotchkiss; and another 37 mm system designed by the government's *Artillerie Navale* at Ruelle (A.N.). Key characteristics were as follows (I have calculated the muzzle energies):

40 mm Bofors: projectile weight 955 g (inc 43 g tetryl); MV 800 m/s; (ME 306 KJ); cyclic rate 142 rpm.

37 mm Schneider: projectile weight 895 g (inc 39 g pentolite); MV 800 m/s; (ME 286 KJ); cyclic rate 190 rpm.

37 mm Hotchkiss: : projectile weight 625 g (inc 57 g tetryl); MV 875 m/s; (ME 239 KJ); cyclic rate 144 rpm (96 rpm in longer bursts).

37 mm A.N. : projectile weight 816 g (inc 50 g HMn); MV 825 m/s; (ME 278 KJ); cyclic rate 165 rpm.

A couple of comments on this: the Hotchkiss' lower rate of fire in longer bursts was presumably because firing had to stop when magazines were changed, whereas the other guns had a feed which allowed topping up the ammo supply while firing. A separate section mentioned that the Schneider had a 45-cal barrel, the A.N. a 70-cal.

The A.N. won the ACAD competition and the gun was given the designation M1935. The only example of the mounting to be fitted to a ship (the sloop *Amiens*, for trial purposes) reportedly did see action during the Dunkirk evacuations. See the entry on the NavWeaps site: http://www.navweaps.com/Weapons/WNFR_37mm_m1935.htm

So, the question is: what ammunition is associated with the three French 37 mm guns? The Schneider is known (albeit from only one or two surviving cases) to have used its own 37 x 296R ammunition. There is some uncertainty, however, over the Hotchkiss and the A.N..

37 x 296R ammunition

The M1930 Schneider was initially rejected by the French Army, but then adopted in a hurry when it became clear that the preferred 40 mm Bofors wouldn't be available for a long time. Seven hundred M1930 mountings were ordered but only twenty had reached service by May 1940 and these were assigned to the defence of Paris. They disappeared during the war and have been largely forgotten since. The cartridge case dimensions are known from a measured sample, the projectile from a drawing. See: <http://www.bocn.co.uk/vbforum/threads/86887-37-x-300R-Schneider-M1930?highlight=Schneider> In the few mentions of the cartridge, it is normally credited with firing a 750 g shell at 800 m/s (240 KJ), but see the ACAD information above. Possibly it started out with the lighter shell, but a heavier one was developed for the ACAD competition. Here is a pic of the Schneider on a wheeled mounting:





The ammunition (from left to right: 37 x 277R service round used in M1925 and M1932 (replica projectile); 37 x 296R Schneider M1930 (replica); 37 x 208 Hotchkiss (replica); 37 x 218R A.N. M1935 (replica); 40 x 311R Bofors.

37 x 218R ammunition

The cartridge normally associated with the M1935 ACAD is the 37 x 218R:
<http://www.bocn.co.uk/vbforum/threads/88881-37-x-218R-Hotchkiss-M1934?highlight=Hotchkiss> This is reinforced by the fact that surviving cases are

headstamped 1935, and I understand that the green projectile colour indicates naval use, so it seems there should be no argument that this is the one.



The main problem with accepting that the 37 x 218R was the one used in the M1935 concerns the ballistics, which don't readily fit. The 37 x 218R cartridge was much smaller than the 37 x 277R of the M1925/33, so would have held less propellant and developed much less muzzle energy (other things being equal). It would also have only needed a relatively short barrel (other things being equal, the more propellant, the longer the barrel needed to maximise the muzzle energy), but the official ACAD study says 70 calibres, which seems unnecessarily long for such a small cartridge.

I would have expected the 37 x 218R to have developed around 200 KJ muzzle energy, similar to the US M1 and Italian Breda 37 mm AA ammo of comparable size. But the ACAD report says the A.N. 37 mm developed 278 KJ – far more than I would expect from the case size, and more even than the big M1925/33 (see the comparative photo above). The contrast with the Bofors 40 x 311R case is even more marked, and that benefits in terms of interior ballistic efficiency from having a slightly larger calibre. If the Bofors case were necked-down to 37 mm calibre with other parameters remaining the same as the ACAD round, I would expect it to have generated around 280-285 KJ.

Something doesn't look right here: while the 70-cal A.N. barrel would have extracted the maximum possible velocity, that seems unlikely to be able to entirely explain such a high performance from such a small cartridge. Either the chamber pressures were notably higher than any similar AA gun at that time, or the M1935 used a significantly bigger cartridge case than the 37 x 218R.

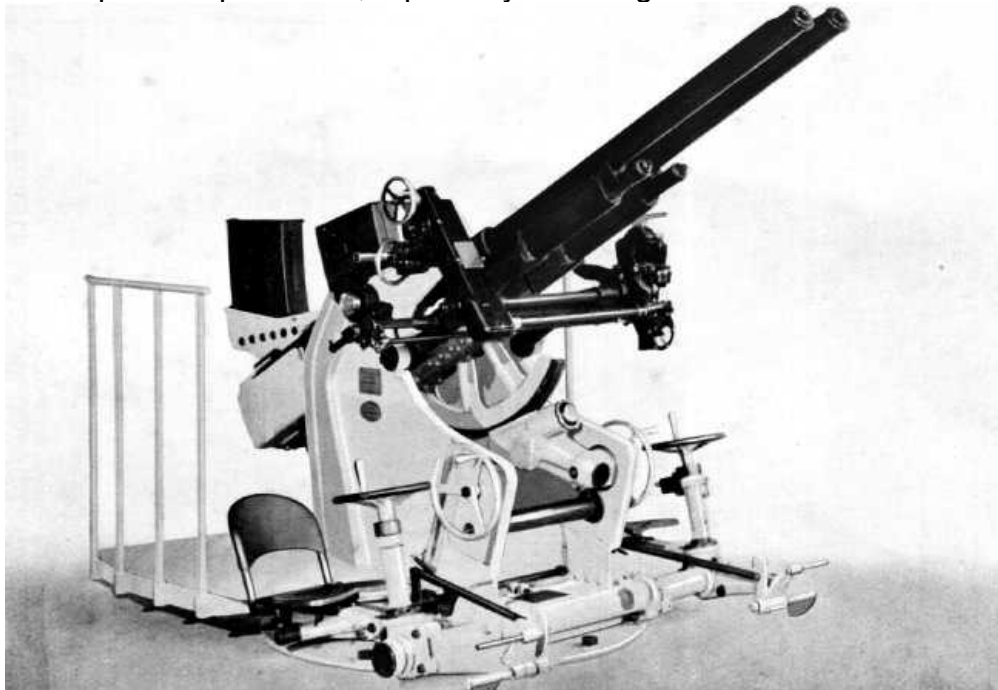
The chamber pressure issue has its own uncertainties. According to NavWeaps, the pressure of the M1935 was 19 tons per square inch or around 42,000 psi, roughly the same as the 40 x 311R Bofors. However, the Bofors ballistics in the ACAD tests were lower than those seen in World War 2, when the standard MV was in the 850-880 m/s range with a 900 g projectile (325-348 KJ – equivalent to around 300-320 KJ if necked-down to 37 mm). Furthermore, I understand that the case of the 37 x 218R was unusually heavy with a thick base, presumably able to withstand high pressures. So the combination of high pressure (by mid-1930s standards) and a long barrel just might have reached the stated ballistics for the M1935, but it's a stretch.

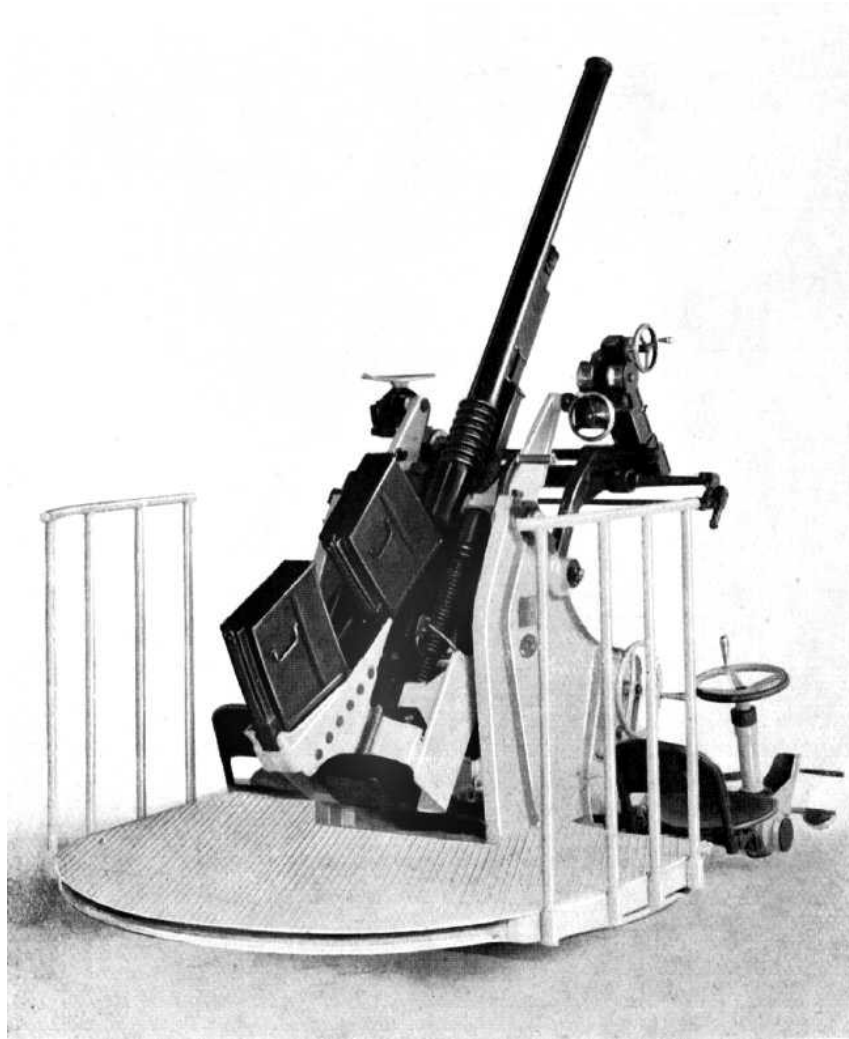
If a larger cartridge was used by the A.N. gun, what might it have been? The obvious option was to use the same 37 x 277R case as the M1925/33, as that was already in service. A slightly different loading could still have retained interchangeability, which would have been attractive to the Navy – and A.N. was a government establishment with no interest in marketing their own ammunition (unlike commercial companies). If this had happened, there would probably be no physical evidence because they would have used standard M1925/33 headstamped cases for the development work.

What was the Hotchkiss gun – and its ammo?

This leaves us with the problem of the Hotchkiss 37 mm automatic gun, the least powerful in the ACAD trials. Clearly there was (at least) one, but what was it and what ammo did it use?

The Hotchkiss, available in mountings with single or twin guns (see below), did achieve a couple of export sales, reportedly including Romania.





The French Navy rejected it for the ACAD but there was another naval project at around that time, as described in NavWeaps: the 37 mm *zénithaux* (zenith). *"This was a Hotchkiss design for a quadruple mounting intended for use against dive bombers. This mounting was unusual in that the guns could not depress past +45 degrees. The mounting would have been countersunk in the deck and loaded from beneath, similar in concept to the British BD (Between Deck) designs. The surrender of France in 1940 halted development and this weapon never made it off the drawing board."*

One obvious possibility is that the zenith mounting may have used four of the same Hotchkiss guns rejected for ACAD.

What ammo did the Hotchkiss use? I have in my files some drawings of a rimless Hotchkiss 37 mm cartridge with a case length of 208 mm, plus a projectile weighing 625 g, all dating from the 1934-37 period, and have had a replica cartridge made. Could this have been the one used in the ACAD trials? It would seem to fit in terms of timescale and cartridge case capacity but, as far as I know, there is no physical evidence in the form of cartridge cases to prove that it was ever made.

There is another possibility; if the A.N. ACAD did use the 37 x 277R case, the Hotchkiss might have used the 37 x 218R cartridge – the round is popularly (and I had assumed wrongly) known as the Hotchkiss, after all.

To sum up, the following questions still need answers:

1. Is it possible to obtain absolute confirmation of the ammunition used in the A.N. M1935 naval gun in the ACAD mounting - the 37 x 218R or something else?
2. Is it possible to obtain absolute confirmation of the ammunition used in the 37 mm Hotchkiss guns - the 37 x 208 or something else?

All responses gratefully received, as ever!

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