Tommy Atkins at War Revisited: A Deeper Look at the British in ASL

By Charles Markuss

With MMP's release of *For King and Country*, (henceforth *FKaC*) the revamped British module in Advanced Squad Leader, another look at the British in ASL seems appropriate. Since 'Tommy Atkins at War' first appeared in the Avalon Hill *General* Vol. 25 No. 6 much additional information has come into this writer's possession, to the extent that a major revision seemed desirable. Shortly after 'Soldiers of the Sun' appeared, Rex Martin, then editor of the *ASL Annual*, asked this writer to produce an expanded article on the British with more information on the PTO campaign and the desert war. Eagerly accepting the offer, yours truly soon fell foul of the sheer volume of material that had been accumulated, plus pressures from family and work and a wish to do something else for a change. After a long rest, and the accumulation of even more material, it is perhaps now time to write again about Tommy Atkins. 'Tommy' and 'British' can be taken to mean any troops that fought within the overall structure of the British Army, including Commonwealth, Polish and other personnel unless otherwise specified.

This article will not attempt to change every word or sentence from the original, but will nonetheless try and re-examine *FKaC's* cardboard inhabitants, compare some aspects of this game with its ancestors, *Crescendo of Doom* (hereinafter *CoD*) and *West of Alamein*, (henceforth *WoA*), offer some explanations of the rules and capabilities that are peculiar to the British in ASL and debunk some well-worn myths (perhaps the most enjoyable bit) about the 'Tommy' of world war two. His strengths and weaknesses will be measured against the rather sweeping statement made by Hitler about 'Tommy' after the Dunkirk debacle:

> *The British soldier has retained the characteristics which he had in World War I.*
> *Very brave and tenacious in defence, unskilful in attack, wretchedly commanded.*
> *Weapons and equipment are of the highest order, but the overall organisation is bad*[1].

Certainly Hitler was being rather generous when he praised British equipment, as we shall see, and Tommy's uniform in particular did nothing to improve his image when compared to the often elegant German uniforms of the early war period. The choice of Tommy's often ill-fitting new uniform, called 'Battledress', was made in 1938 and comprised, as one author described it "…the top half of a golfer and the bottom half of a skier along with the most ridiculous head-dress imaginable…There was no escape and the Army went to France dressed as convicts"[2]. The Home Guard uniform, when eventually available made a man either resemble "…an expectant mother or an attenuated scarecrow"[3].

The soldiers depicted on the old *WoA* box-lid, produced by the late and great George Parish appear comical perhaps in their short trousers and resemble over-grown schoolboys from some select English educational establishment, the new box art for *FKaC* makes use of a painting by David Pentland and shows Scottish infantry wearing the comfortable but inelegant battle-dress, marching down a dusty road in Normandy during Operation 'Bluecoat', accompanied by the wail of the bagpipes, which are no doubt drowned-out by the purr of a 15th (Scottish) Division Dingo scout car and the roar and clatter of a Churchill Mk IV belonging to the 6th Guards tank Brigade. This module, unlike *WoA*, contains no desert boards or desert scenarios.

The generic 'Tommy Atkins' nickname is often, but wrongly, attributed to the celebrated encounter between the future Duke of Wellington and the dying Private Thomas Atkins in 1794, but the term actually dates back to at least 1743[4], along with less enduring but more colourful names like 'Thomas Lobster' (because of the traditional red coat worn by troops) and 'John Tar'[5], which were both in use by 1740, or some 29 years before the future Duke, Arthur Wellesley, was even born!

Infantry

The most obvious difference between the *FKaC* and *WoA* and *Crescendo of Doom* (hereafter *CoD*) is the squad counter artwork; those boring static poses are now gone and Tommy is now doing something more strenuous than idly standing about waiting for the tea to brew. In addition, the crew counters have also been revamped to show the now familiar 'standard' gunners' poses. Of much more importance, the British Elite and First Line squads now have some very useful and welcome smoke-generation exponents, while the old 6-3-8 Airborne and Commando squads have a longer reach as 6-4-8s. Bear in mind, however, that most commandos (Army as well as Royal Marine) actually carried rifles, not SMGs, and should therefore be represented by 4-5-8s[6]. The Gurkhas have quite rightly been 'promoted' from 4-4-7s to Elite status too (more on this later), so the 4-4-7 squads are no longer used to represent these fierce fellows, but rather the less well-trained, less cohesive units like some, but not all, of those in the hastily-expanded Indian Army of the early war years (more on this later too). The ASL rulebook reveals further changes like Tommy's immunity to Cowering if Elite or First Line, Stealth advantages for the ANZACS and Gurkhas to reflect their renowned stealth and ferocity in close combat, and that helpful +1 drm to nocturnal recce attempts to 'spot' enemy defenders. The immunity to Cowering reflects stoicism (more on this later), while the latter simulates the British flair for reconnaissance and night patrols (a legacy of World War I trench raids – more on these anon too).

The cool-headed British also score well on Heat of Battle drms, and are less likely to go 'Beserk' and more likely to become 'Heroic' than most other nationalities, although these traits are all of course stereotypes to a large degree. Certainly some Gurkha, ANZAC, Irish, Scottish and French-Canadian troops earned a reputation for their fiery tempers and sometimes exhibited far less self-restraint towards wounded or captured enemy personnel than other British soldiers. That said, like the American GI even the usually more restrained British personnel would murder prisoners[7] or civilians[8] on occasions. A celebrated, and controversial, British Lieutenant Colonel Colin ('Mad Mitch') Mitchell and veteran of Aden and Northern Ireland once observed that the British Empire spanning one third of the world's land surface was not won by being nice to people, and a veteran naval officer observed that Britons are "when roused from lethargy, a barbaric people"[9]. In Burma, one British officer, aware that some junior US officers wanted to 'frag' their blustering US colonel, deliberately took him into an area infested with Japanese snipers – but without 'success'[10]. Certainly any local civilians caught robbing British dead or wounded during the war were usually given short shrift[11], but balanced against such ruthlessness a Brigadier General was court-martialled and reduced to the rank of private for inflicting violence on captured German bomber crews[12].

Leaders

A notable omission from ASL is *CoD's* automatic motorcycle experience for British leaders. The writer considered this a nice rule, simulating British Army requirements that all junior officers be competent motorcyclists. The different counter art for the 6+1, 10-2 and 10-3 leaders is an inspired touch (like all the men wielding bayonets on the Japanese squad counters yet sporting a mixture of different head-dress to emphasise equipment shortages); these officers brandish nothing more lethal than a cane and would probably frown on a Japanese officer being so ill-mannered and theatrical as to wield a sword. In reality, many officers in France[13]and Burma[14] during the early war period had to privately-purchase their own side-arms, if opportunity and time allowed[15], and the counter artwork also brings to mind the more eccentric breed of British officer who, like their Japanese counter-parts, believed in adopting a deliberately-conspicuous leadership profile despite the obvious hazards from enemy snipers; for example the use of hunting-horns to spur-on or rally their men[16] in Normandy and Arnhem, or the major who led his men into battle at Arnhem wearing a bowler-hat and carrying a battered umbrella for, as he later claimed, identification purposes[17], or the company commander in Burma who toted a shepherd's crook and thus "stood out like a biblical prophet"[18]. Such behaviour was partly fostered by pre-war Indian army drills which demanded that infantry officers lead attacks by waving their walking-sticks in the air as they advanced to encourage their men[19]. In Italy the commando officer Colonel Jack Churchill wielded both a sword and bowler-hat![20]. Small wonder then that German[21] and Japanese[22] snipers were able to identify and pick-off British officers with ease until some at least swallowed their pride and both dressed and behaved to better resemble their subordinates, like those on the lower-ranking British leader counters in ASL.

Other examples of this often casual attitude towards the hazards and grim realities of war include the Colonel who attempted to catch partridges in a minefield[23] and the battalion CO in the desert whose unit was overrun by the Germans because he had insisted on stopping the retreat at dawn to have break-fast![24]. The above examples to little to improve the poor historical reputation of British officers as all

being high-born idiots, based on their antics in the Napoleonic and Colonial Wars, and on the 1914-1918 "lions led by donkies" stories, however much all these might be very sweeping generalisations. One British CO in Normandy risked the wrath of his men when he insisted that they 'unnecessarily' risk enemy fire to pick up paper and other litter before handing over their positions in a 'tidy' manner to a relieving formation[25], but there was method in his apparent madness. A veteran RAF photo-recce pilot testified that US trenches especially were always easy to spot (and hence vulnerable) due to the vast amount of litter strewn about from ration packing[26] – the 'K' ration being notorious in this respect[27].

All armies have their share of idiots, particularly in wartime when standards inevitably fall, but the evidence shows that most British officers were good at their job despite a degree of apparent eccentricity in foreign eyes. Certainly by 1918 British officers commanding front-line troops were very young, professional and both eager and willing to adopt and teach to other units *Stosstruppen* style infiltration tactics that saved their men's lives and continued the advance against the Germans as efficiently as possible after so much fruitless slaughter in the previous years' failed offensives. The British platoon training manual of February 1917, SS 143, was described as "a storm trooper's handbook'[28]. The troops themselves were hard, cunning, skilled in night attacks and determined to sell their lives dearly – scouting talents and the ability to use the Lewis gun and feed its insatiable appetite for ammunition were highly prized qualities[29].

Some senior officers may have been mediocre at the start of world war two, but staff work became at least adequate after a poor start. However, the British army was (and until the 1990s still was) hampered by the stubborn refusal to develop a doctrine based on the experiences of previous wars - certainly many of the painful lessons of the 1914-1918 war had been forgotten by 1939 – or to define its precise role[30]. Moreover, pre-war theories envisaged only a minor, supportive, role for the British army (even when the obsession with colonial defence began to wane) and Germany was supposed to be defeated with a modified re-run of the Great War – a naval blockade, British bombers and then the French army to go in for the final kill, if the confidently-awaited collapse of the German economy in the first 18 months of the war did not materialise[31]. In keeping with this perception, the British Expeditionary Force (henceforth BEF) sent to France in 1939-1940 was composed largely of infantry reservists[32] (cheaper to deploy than tanks and better at holding ground), whereas that of 1914 contained the cream of Britain's professional soldiers. When these strategies proved illusory and the army had to be rapidly expanded for a new and greater role there were insufficient trained staff officers. The absence of meaningful pre-war exercises compounded matters and during the war there was an understandable reluctance among commanders to release their brightest subordinates for staff college courses. On a tactical level, similar shortcomings allowed old methods and inadequate officers to linger on. Even in 1944 officers in the UK were taught "how to command a battalion from a coal-cellar"[33], rather than near the front line, although experienced desert veterans knew better[34]. Many pre-war officers were expected, even pressured[35], to participate in polo matches, fox hunting, pig-sticking or other 'machismo' sports rather than encouraged or instructed to study their profession seriously[36]. Ambition in an officer was seen as an unsavoury trait[37], and in 1942 some officers in Burma were still expected to ride and hunt with hounds[38].

If these 'sporting' officers ever read (or wrote in) any military journals they chose as their subjects such compelling themes as 'Hunting [foxes] as Training for War'[39] (which at best might have developed an eye for terrain) and this did little to rid many officers of the habit of treating soldiering and war as merely a gentleman's game or sport[40]. On one occasion senior British officers were seen to be picking-off enemy soldiers as if they were shooting pheasants[41]. In army life and language fox-hunting or other 'sporty' terminology abounded[42] and many BEF officers went to France with their horses, dogs, golf-clubs or tennis equipment[43]. One lieutenant colonel even took his shotgun and golf clubs to Arnhem, and a sergeant his football[44] and French officers manning the Maginot Line in 1940 criticised the British tendency to view their time in the line as an adventure or sport[45]. Even Commonwealth officers were not immune to such attitudes, and ANZAC soldiers were initially unwilling to accept advice on a need for more training[46]. Furthermore, their over-aggressiveness and "romantic determination" to outshine their fathers' heroism in the Great War stemmed from bad examples that would cost them unnecessary casualties in the desert[47]. As late as 1944 one British commander in Burma had to be removed because he insisted that his troops stand and fight upright "like men" rather than dig in[48]. Even the British High Command suffered from this gentlemanly and Napoleonic mentality and refused until 20 May 1940 (i.e. ten days after the German attack) to permit BEF troops to improve their defences by 'loop-holing' or 'mouse-holing' French buildings by knocking through internal walls to

improve access for the occupants, through a misguided respect for private property[49]. Nor, of course, was any training given to, nor tactics developed by, the BEF to fight in urban terrain for the same reason – with unfortunate results for the poorly-trained defenders at Amiens and Abbeville[50]. Similarly, in Burma, the defences at Kohima were seriously compromised by the Naga Hills civil authorities forbidding the use of barbed wire to hinder the Japanese[51].

Coupled to these dangerously-inappropriate notions, the 'public school' (roughly the same as a US private school) education received by most pre-war officers encouraged the admiration and pursuit of romantic idealism and heroic amateurism[52] and a hostility towards any hint of professionalism except perhaps in the care of horses[53] – Gurkha Battalion officers excepted[54]. Regimental history, jargon and etiquette in the mess took precedence over teaching new officers how to wage war[55], and these attitudes were particularly common in the cavalry regiments, some of whose officers, though by no means all, had fought their badly-managed, frantic and belated mechanisation tooth and nail[56] even though mechanisation was inevitable due to the lack of reserve horses in any conflict[57], and to a lesser extent by the Royal Horse Artillery. These regiments' play-boy officers were selected by private income and class rather than merit[58] since pre-war army pay was insufficient for the expenses of the typical officer in all but the most humble regiment[59], let alone for the horse-orientated life-styles and glittering parade uniforms of the cavalry. This obviously deterred many poorer but otherwise suitable applicants[60]. To some extent these hurdles still exist today, certainly in the Household Cavalry regiments so photographed by foreign tourists[61].

To the cavalry, "the haughty queen"[62] in this "spiritually eighteenth-century army"[63]and this "most mentally inert, unprofessional and reactionary group"[64] within it, a large percentage of the wartime AFVs were entrusted – despite the initial reluctance of the cavalry to accept them[65]. Men such as these were unwilling to fight, much less socialise[66], with 'inferior' regiments and humans – an attitude not even found in medieval Anglo-Welsh armies. Inconvenient or unpalatable orders were disputed, command being exercised more by conference than obedience in the desert and later in Normandy[67], and to General Hobart's chagrin in North Africa 7th Armoured Division officers preferred playing polo to combat training[68]. Small wonder that there was often a mindless insistence on simple, futile, and suicidally-inappropriate tactics[69] until the Axis obligingly and violently removed them from command. Unfortunately some of them were still there in Normandy[70] primarily because only cavalrymen or (exceptionally) Royal Horse Artillery officers were permitted to command cavalry regiments[71], and guardsmen to command Guards divisions[72], regardless of the qualifications of otherwise eligible contenders, of the sheer incompetence of cavalry commanders generally or the growing dearth of experienced and competent officers[73], especially at the higher levels of command[74].

Luckily, the artillery and infantry were less infected by this mental malaise, especially officers in the pre-war Indian army (who were probably far more professional overall than their British home forces counterparts)[75], as were those in Egypt[76]. Certainly at the junior level in particular most officers were as good as their allies, if usually not quite up to the best German standards, particularly when they began to be recruited from a wider social group through modified selection procedures. This is reflected in ASL's British 'Leadership Generation Number' of "5", the best in the game after Germany's "4" and on a par with Japan's value (albeit for different reasons – see my article 'Soldiers of the Sun' in the *ASL Annual* 1992). The better quality of British leaders was due as much to social factors as changes in recruitment as there has always been a reluctance (at least until very recently) among Britain's self-styled 'upper classes' to follow commercial or (God forbid!) technical vocations ("getting one's hands dirty", as it was disparagingly-dismissed) and thus soldiering has usually been more socially-acceptable than in, say, the USA. Social trends therefore placed 'public school' types, sons of professional soldiers and other natural leaders into the armed forces, especially into the 'glamorous' combat formations rather than into 'grubby' (and less prestigious) supporting branches. While men like this found it difficult to adjust to life in the armoured formations[77] of world war two, and were not exactly renowned for their tactical brilliance, they did at least know how to care for, motivate and lead their men properly.

This is not to say that the British army bridged the gulf between officers and men as successfully as the Indian army[78] or the Germans (especially in the better *Waffen SS* formations), and there were numerous complaints of how crassly the differences of rank were flaunted[79]. One British tank officer in Normandy, perhaps harshly, said of infantry brigadiers that they "all... look the same – middle-aged, rather grim, slow thinkers and without any sense of humour"[80] But most officers - however tactically-inept some might have been – were taught in no uncertain terms and took to heart the notion that the

welfare of their men was "a solemn responsibility"[81], not least because the supply of British and Commonwealth personnel was severely limited. Once war was declared almost all aspiring officers had first to serve a term in the ranks[82] (as in the German army, albeit for a shorter period)[83] and this helped the newer officers to appreciate their own men's situation better. Overall, British officers showed far more concern for the welfare of their men than US officers[84], among others, although there were of course exceptions to the general rule[85]. In 1939 the social 'elite' supplied 84% of aspiring British officers (40% of these from 'military' families), but wartime samples showed a fall to only 25%[86] when demand exceeded supply. The equivalent figures for self-recruitment by such families in Germany was 29% in 1933 and 15% in 1939, and 23% for the US army in 1935[87]. A less elitist approach had to be adopted as in 1916-1918 and (albeit reluctantly in some quarters)[88] well-educated 'middle-class' men thereafter comprised the bulk of the officers. German selection procedures were copied, including psychological assessments with great success[89] and officer quality was also enhanced by the recruitment of more worldly-wise individuals[90] who had hitherto followed civilian careers, especially in Africa and the Far East[91]; the latter ensured in part that African, Indian and Burmese formations[92] among others received officers who were experienced at handling personnel, spoke their language and knew their customs and culture.

This pool of officers was also swelled by a significant number of British-born officers who were loaned or transferred to the African, Indian[93] or Burmese[94] forces from the British army for financial or other reasons in the inter-war years, since army pay in the Empire's backwaters far exceeded the living costs even when a comfortable life-style was adopted[95], which as already noted demanded a private income in most pre-war British units situated in the UK. As an example, even in wartime, a junior Guard's officer's UK clothing allowance covered only 54.9% of the cost of the wardrobe, including walking stick![96] Not only was officer's pay in the pre-war Indian army higher than in the UK but only the top 30 officers graduating from any one year were eligible to apply for Indian army service, ensuring that standards remained high irrespective of wealth or connections[97]. Unfortunately, in wartime the different pay-rates between the British, Australian and Indian armies were a powerful disincentive to the transfer of officers between the three armies in order to optimise their skills and experience in the ill-fated defence of Singapore[98] though General Auchinleck then put an end to this pay discrimination[99]. The gradual 'Indianisation'[100] of the Indian army, while resented by many reactionary British officers[101], also gave commissions to many wealthy, well-connected or well-educated men of Indian birth[102]. Those selected (87% were rejected)[103] gave good service even though their "leisurely" training in the early war years concentrated more on gentlemanly behaviour than on producing good officers[104], and similar complaints were made about the training system in the UK[105]. In 1939 there were 3031 British and just 697-1000 Indian officers in the Indian army (sources vary), but by the war's end the numbers were 18572 British and between 13947 and 15740 (sources vary) Indian officers, plus another 14000 seconded from the British army[106].

The Indian and Burmese armies differed from the British in that commissioned officers were not present below the position of second-in-command of a company, and platoons were commanded by 'Viceroy Commissioned Officers' promoted from the ranks, who had no direct equivalent in the British army[107], but who performed admirably once properly trained and experienced. Officer quality in the British army was also enhanced by the many NCO platoon commanders (sergeant-majors) of 1939 who were also commissioned, some rising to command battalions or regiments by 1945, as well as some men who received commissions-in-the-field for outstanding bravery or initiative. However, the commissioning of so many NCOs had drawbacks in the long term because it caused a leadership gap, and the quality of infantry NCOs declined noticeably by 1944[108] not only because those men with leadership abilities had already become officers[109], but because the repatriation programmes before the start of the war and towards it's end understandably sent the veterans home first[110] from places such as Burma. So serious was the shortage of officers that by 1945 some of the newer ones were barely 18 years old[111], despite the fact that a number of Dominion and Commonwealth officers, especially from Rhodesia and South Africa, had been transferred to British units by 1942, and that the 'Canloan' scheme of October 1943 had provided 673 Canadian officers[112] for British units in the ETO and PTO. Under 'Caloan' every British infantry division received about 40 Canadian officers[113]. These were regarded as particularly aggressive patrol leaders[114] and not surprisingly 465 of these became casualties[115]. In addition to almost 1500 South African officers seconded to the British army[116], 168 Australian officers were transferred to the Indian army in 1944 to alleviate the officer shortage[117].

But in the end all this was not enough, especially as the real tactical training of officers was provided only when they joined their units, and this was often patchy. Small wonder that there were continued

complaints about poor officer quality and training[118]. In Burma the toll of 19-21 year old inexperienced junior officers became so great in some 'Chindit' units that their senior NCOs persuaded their commander to leave the NCOs in charge rather than fly in yet more young officers to die needlessly in misguided attempts to 'prove' their courage[119]. Officer casualty rates were probably so high in most units because they had to personally compensate by their own actions for deficient NCO leadership[120], yet nonetheless there were numerous complaints that British officers lacked the force of personality to ruthlessly push their men forwards[121] in the way that the Germans[122], Americans, Soviets or Japanese were renowned for, despite the fact that officer casualty rates in 1939-1945 were (proportionally) higher than they had been in 1914-1918, and roughly double that for enlisted men[123]. Yet the need for so many officers was partly self-inflicted; by 1943 it was unthinkable – at least officially – to have mere NCOs commanding platoons[124] as practised so successfully in the German army, though the Indian army[125] (as related above) was an exception to this British practice. There was also a glut of senior officers due to over-promotion, as in the US army[126]. By contrast, the Germans used their officers much more economically and efficiently[127], delegating far more responsibility out of sheer necessity and giving their NCOs equivalent responsibilities to Allied junior officers or even higher when occasion demanded.

Infantry

Turning now to the multi-man counters, the firepower of British squads in ASL is low (rifle squads 4, airborne 6) due to an over-reliance on bolt-action rifles and the small size of the British infantry squad, as well as for organisational and historical reasons. As far back as November 1926 the British War Office had issued a specification for a new automatic rifle to replace the old Lee Enfield rifle of 1903 vintage, but none of the designs met all the specifications; the best contender had about 2.5-3 times the rate of fire of the old bolt-action weapon -i.e. a practical rate of 35-45 rpm - and might have had a bright future but for the fact that the British Treasury (an organisation that always knows the cost of everything but the value of nothing) objected to the cost of replacing the old rifles, and because the General Staff wished to avoid placing any greater strain on the logistical system that higher ammunition expenditure from automatic weapons invariably brought[128]. Moreover, as Imperial Policeman giving 'Tommy' a bolt-action rifle for dealing with rioters was less destructive / more discriminate and hence politically safer than an automatic weapon[129]. Organisationally, too, the British squad had only 8 men up to 1943, ten thereafter (sometimes 11 in Burma from 1944, personnel permitting)[130], and this compared badly with the 9-man Soviet squad, 10 (later 9) for the German, 12 in the French and US squad, 13 in the USMC squad and 15 or more in the Japanese. This small size, and hence reduced firepower, was mirrored in larger formations too, for the British infantry company TO&E was one of the smallest of any world war two army[131]; at full strength in 1939 it had 129 men if there were 4 platoons, but usually there were just 3 with 100 men between them. By 1944 this had grown to a nominal 125-127 men, whereas foreign equivalents were usually much larger – US infantry divisions had between 193 and 223 men per company, a US armoured division's between 178 and 251, the Germans between 191 and 200 before 1944 and 161 thereafter (but partly offset by a great increase in firepower to offset the manpower reduction). While the Soviet SMG companies boasted only 78-100 men (but had lots of firepower), their rifle companies contained 143 men, the French 190 men, the Italian between 144 and 156 men and the Japanese between 180 and 262 men.

Nor was this the whole story. British rifle battalions were also far more poorly equipped with organic support weapons than their foreign equivalents, as the Support Weapons Allocation Charts in ASL show. The following table demonstrates the serious British deficiencies in MMGs and HMGs.

Weapon	British	US	German	Soviet	Italian	Japanese
Lt Mortar	12**/9	9	9/-	9/6	18	27-36
Med Mortar	2/6	6	6	6/9	--	2*
Hvy Mortar	--	--	-/4	--	--	--
MMG or HMG	+	14	12	12/9	8	8
.5" cal HMG	--	6	--	--	--	--

Numbers separated by "/" denote initial and late-war totals
** = denotes the rarer 4-company TO&E of 1939, otherwise 9
* = sometimes present
+ = motor battalions had 8 after 1941

British MMGs were not organic below divisional level until late in the war, being kept in specialist MG Battalions with 36 or 48 MMGs apiece, and they had little direct contact with ordinary infantrymen, which did little to enhance tactical efficiency. MMGs were doled out downwards to smaller formations 'on loan' as required and in defence this usually sufficed but in fluid situations or in attacks they were rarely in the right place in meaningful numbers when suddenly needed; by 1944 there were MG Companies detached to infantry brigades, but there were never enough of them. Ironically, even in 1914-1918 the Canadians and Germans used a much more generous MMG allocation than the 'specialist' British TO&E[132], but the lesson was ignored – another instance where new weapons of apparently dubious value (like tanks and aircraft) in the eyes of the conservative top brass were quarantined in specialist corps because no established branches of the British army would accept them[133]. This quaint legacy of the Great War ensured, in the case of MG Battalions, that the troops therein were 'technicians' first, soldiers second and infantrymen only a poor third. The crucial importance of such firepower to support attacks is ably demonstrated in the *FKaC* scenario # 102 'Point of the Sword'.

Hopefully this explains the rather odd British MMG and HMG allocations in the ASL charts, with such variations for attackers, defenders or neither. While the earlier 8-man rifle squad was probably not seriously disadvantaged in combat with larger enemy squads, especially when defending, the deficiencies in organic MGs was quite another matter at company level and above, as was the latter's low firepower; in this respect Hitler's observation about bad British organisation was justified. Later on, when the British army assumed an increasingly offensive role it was clear, even against those German squads using the older MG 34, let alone the faster-firing MG 42, that the British squad could not generate enough firepower to suppress these formidable German weapons without significant supportive fire from distant heavier weapons. To say that this caused a feeling of inferiority and a crisis in confidence would be putting it mildly[134]. However, as a humorous aside, at least one British non-elite formation enjoyed unusually high firepower; the 1st American Squadron of the London Home Guard (in which 128 US citizens eventually served their host nation) provided not only their own transport but also Thompson SMGs at their own expense[135]. Whether these were carried in violin-cases is not recorded. The British No 2 Commando were given Thompson SMGs by the Mayor of New York after they had been confiscated from gangsters[136]. For the most part however, unless it was a squad in an elite 'private army' like the Commandos or paratroops, the typical British squad had to make do with just a Thompson or STEN SMG for the leader, and only the BREN LMG to bolster the firepower of the bolt-action rifles, although as in all armies 'scrounging' could improve upon the official weapons issue. The slightly more generous flame-thrower allocation on the SW Allotment Chart reflects the priority given to the PTO in their issue[137], though they proved to be of little real value in the field[138].

In ASL the best British squads still have a range of only 5 hexes, though 'home-grown' Britons (at least) were famous for their marksmanship. 'Tommy's' firearms training was a legacy of his traditional and primary role as Imperial Policeman in situations where sometimes every shot had to count when confronting hordes of unfriendly chaps. But range factors in ASL represent much more than just shooting skill, for pre-1914 British trials had shown that *weight* of firepower mattered far more than *accuracy*; 150 second-class shots could quickly silence 100 crack marksmen, and the men could also be trained faster[139]. Unfortunately there was also another legacy from the colonial wars that militated against tactical efficiency (in ASL, range factors) – the regimental system of the British army. Created largely by Edward Cardwell, the Secretary of State for War in 1868-1874 and the main protagonist for the abolition of army commissions by purchase (rather than merit), this type of organisation was coupled with recruitment on regional, geographic, lines to supply the far reaches of the Empire with sufficient troops; one battalion remained at home refitting while the other served overseas, then *vice-versa*[140]. The 'Regiment', or more precisely a battalion therein, gave 'Tommy' a home (often the best he ever had), a sense of belonging with its emphasis on unique and regional differences, a focus for his loyalty and a boost to his morale when things got bad - for the honour and success of the regiment meant a lot.

But regimental customs, jargon and traditions could also make it difficult for newcomers to fit into what was essentially an army organised into separate and distinct tribes[141]. This fostering of cliques often also undermined the cohesion of larger formations (or even regiments receiving a large influx of replacements), and regimentalism also bred a dislike, suspicion and even hatred on occasions[142] of outsiders, i.e. other regiments or services within the British army - which still persist to this day in their milder aspects (and are certainly not discouraged). One source describes it as "an unprofessional

coalition of arms and services" and as "a number of loosely co-ordinated social groups which mirror the views of the society from which they derive their attitudes to military problems"[143]. Another source refers to the "heartfelt parochialism"[144] of the wartime British army. Small wonder then that in 1942 a British cavalry officer in North Africa loftily refused the offer of assistance from a field artillery unit with the words "We only accept help from the Royal ***Horse*** Artillery"[145]. In 1944 a British tank officer faced with a difficult mission likely to bring heavy losses exclaimed "couldn't you send a less well-known regiment?"[146]. Not so the Germans or Americans, their loyalty was to the division, with all the benefits that accrued from this lack of organisational arrogance at the lower tactical level.

The traditionally regional pattern of recruitment (still practised to some extent today) reinforced this insular outlook during the war, as did the increasingly multi-national character of the British army; the British soldier of all ranks traditionally looked down on the '*sepoy troops*' of the Indian army – with, ironically, increasingly little justification – dismissing its troops as mere "frontier soldiers"[147]. Although wartime necessities eroded regimentalism somewhat and provided a greater mix of personnel within battalions, its members still thought in terms of "regiment" rather than "division", and as a result different types of unit often fought their own bizarre and hopeless little private wars[148] against a fully integrated foe. Pre-war complaints about a lack of inter-arms training to mitigate the effects of such poor teamwork had been ignored[149] and only the PTO provided more consistent and early exceptions to this rule, largely because the type of fighting in dense vegetation against so ruthless and suicidally-brave a foe as the Japanese soldier made inter-arms co-operation plainly mandatory to even the most arrogant 'regimental' die-hard. But even here there were exceptions[150].

Elsewhere though, successive defeats at the hands of the Germans merely prolonged the suspicions and mutual recriminations and it took 'Tommy' a long time to forsake the false notion of 'independence' and learn to fight in larger, division-sized, formations or mixed battle-groups of the sort the Germans wielded so skilfully. The British armour's habit of withdrawing from the battlefield at night to form a defensive leaguer not only put more strain on men and machines and surrendered any gains made to the enemy, but also gave the infantry the (correct) impression that they had been abandoned[151]. The Germans remained where they were at sundown to provide, and receive in turn, support from different arms and to recover unmolested any unserviceable or abandoned vehicles. In western Europe full co-ordination in some formations was not achieved until many bitter lessons of the desert war had been relived in Normandy or later[152], although some Canadians, ANZACS and the troops in Italy had managed this much earlier; even as late as the Arnhem fiasco British inter-arms co-operation was sometimes found wanting[153]. Although the British began fitting telephone sets to the rear of their tanks in July 1944 as tools to aid inter-arms co-operation, photographs[154] show that many vehicles never had them in wartime and the evidence suggests that neither the infantry nor the tank crews used them much; nor were portable infantry radios used much despite being plentiful in 1944, since a radio 'specialist' took away a combat soldier in order to carry around a heavy and unwanted piece of equipment at a time when the company strength was often well below the TO&E. Instead orders tended to be issued in time-wasting 'O Group' meetings where concentrations of officers were vulnerable to attack[155].

Moreover, the Regiment's paternalistic environment helped to stifle personal initiative (and not only among the less educated pre-war 'regulars' – i.e. long-term volunteers) when compared to German and US troops, and this applied as much to officers as men in the ranks[156], if less so among pre-war Indian army officers or those in the PTO generally[157] who had to operate with poorer communication links to their senior officers. Although Canadian, ANZAC[158] and some other Commonwealth troops were often less inhibited (unless raw and untrained), Indian[159] and African[160] troops were sometimes treated like children by patronising officers. One officer wrote that Gurkhas "are not subject to mass suggestion, but require careful training, familiar leadership, and love"[161]. Consequently 'Tommy', like his Soviet ally, was usually hard to dislodge when defending in strong positions but (as the Germans observed, did their best to bring about and then quickly exploited) their combat performance deteriorated when officers became casualties[162]. 'Tommy' expected his officers to lead and in the attack often went to ground if rendered leaderless[163], commandos, paratroops and other elite types excepted. In contrast, the Germans since the inter-war years had trained all men to be able to do the job of someone up to two ranks above their own to minimise the effect of casualties[164], while officer cadets were trained to take command of an infantry battalion if necessary[165]. Thus German troops were EXPECTED, let alone encouraged, to show high levels of personal initiative[166], and US troops often tended to do likewise[167] because of poor leadership by many '90-day wonders'[168], whereas the British army's training methods were enshrined in over-detailed orders and tended to emphasise obedience at any cost and the consolidation of newly-won objectives (a throw-back to the Great War)[169]. All this was very much at

the expense of fostering personal initiative, despite official recognition that personal initiative at all levels was important in modern warfare. This paradox took a long time to resolve, and although personnel for the Recce Corps were selected by IQ tests and were expected to display higher levels of initiative, this branch's role was primarily to gather battlefield information, not to fight[170].

This British weakness was evident in other situations when forceful and formal leadership was absent or impractical; despite using infiltration tactics at Cambrai in 1917[171] and facing similar German tactics a year later, most British line troops never developed effective counter-measures in 1939-1945 (except perhaps in siege-type situations against the Japanese) and were far less willing to use such tactics than German, Japanese or Soviet troops[172] despite such measures being advocated before the war in Captain Liddell-Hart's book *The Future of Infantry*[173]. The closest that 'Tommy' got to infiltration tactics were the nightly raids and patrols, which invariably involved returning to his own lines before daylight rather than remaining behind the enemy's to cause trouble, and even here they were generally very unpopular among troops [174], Australians excepted[175]. Infiltration tactics were second nature to the Germans[176], as were sudden and rapidly-executed counter-attacks to retake lost positions. British equivalents were slower, more deliberate and methodical - and hence less cost-effective. Perhaps the only tactics at which the British excelled were in carefully planned and executed night attacks[177].

Such unimaginative tactics and inflexibility were reinforced by other poor traits. Until 1938 imperial policing by means of a comparatively small, and cheap, army of volunteers was regarded as the British army's first priority, and another long war (requiring a mass conscript army not seen, apart from 1916-1918, since the days of Oliver Cromwell in the English Civil War of the 17th Century), was deemed unlikely due in part to wishful thinking. Thus preparations for such a 'worst case scenario' came low on the list of military priorities, so that the tactics in use even late in the war[178] were based on those of 1918[179]. Similarly, the Indian army and other forces in the Far East were preoccupied with combating public unrest and guarding the North West Frontier and no thought was spared for how to combat a Japanese invasion through jungle terrain[180]. Tactics and equipment reflected these myopic views, and there was a tradition of public sentiment against continental (i.e. European) doctrines of military efficiency[181]; fighting wars was regarded more as an obscene art-form and an unwelcome but brief interruption to the many delights of peacetime soldiering, rather than as a science. Both peacetime and wartime army manoeuvres, which only rarely took place, were similarly unrealistic while memories of the 1914-1918 slaughter bred caution, since officers had nightmares about similar losses from Britain's very limited manpower resources[182]. Indeed official nervousness of this subject even extended to Winston Churchill asking General Eisenhower to avoid heavy British casualties if possible during the liberation of Europe[183]. This must have tested even 'Ike's' renowned diplomacy and patience.

Infantry tactics, in the absence of an official tactical doctrine and with the British army burdened with a poor mechanism for analysing and then distributing the lessons gained in combat[184], were therefore usually over-cautious, unimaginative, inflexible, relatively predictable, slow in their implementation and sometimes very parsimonious with the human resources provided for a military task. A US officer in the ETO observed that the British would send in a company of infantry to take objectives against which an American commander would have sent a battalion[185]. All this paradoxically made British methods, like the tightly controlled but larger and more aggressive Soviet operations, sluggish in execution and expensive in lives and the exploitation of battle-field opportunities was generally poor[186] compared to German or to a lesser extent US performance[187]. *FKaC* scenario # 109 'Dreil Team' is a good illustration of how this parsimony wasted valuable time, which in that particular action the British could not afford to lose. For their part, the British saw the US troops as "slap-happy in their approach. They had a heavy reliance on superior armour and used ten times as much material as they needed to accomplish their targets"[188].

Pre-war, and even war-time, training was no real preparation for fighting a first-rate mechanised army; although the '*1937 Infantry Training Manual*' modernised tactics a little and theoretically allowed commanders more discretion[189] throughout the war there was general dissatisfaction with the adequacy of British (and US) training for the realities of combat. One author observed that "Although capable of marching 20 to 30 miles a day and sticking bayonets into sacks filled with straw, the British infantry in truth was not prepared for modern war"[190]. The finer points of tactics were not taught during basic training, and officers and men alike learned these (if any were indeed ever formally taught) on joining their unit as and when time and inclination allowed[191]. To try and bring some degree of uniformity to training, the War Office began to issue to units a blizzard of training pamphlets and memoranda which were of patchy quality and not always frank and truthful[192], and sometimes even contradictory. Most if

not all remained unread[193] in a lonely corner of the officers' mess. As an example, in 1942 an officer in an armoured regiment was faced with a stack of 300 to get through[194]! Veterans complained of an outdated emphasis being given to 'die for one's country'[195], on 'spit and polish' type menial chores[196], excessive time spent in close-order marching ('square-bashing')[197] or lengthy route marches[198], and unrealistic, often farcical, battle exercises[199] which taught nothing about minor tactics[200]. Worse, time that could have been spent more profitably on tactical or weapons training[201] was wasted in the preparation of static defences or guarding 'vulnerable points' in Britain or France throughout 1939 and 1940[202], or in the Far East in 1941[203] because the British would not pay local labour fair wages to do the manual work instead[204].

When weapons instruction was given, it was less about how the device worked and should be used[205] so much as a charade with "…monotonous sing-song catalogues… [and] …a tendency among instructors to regard the names of [component] parts with the same awe as child regards his catechism"[206]. Major General Percy Hobart complained about this lack of realism when he referred to "military buffoonery" and to "…all this dressing up. This emotional intoxication by bagpipes and bearskins, and the hypnotism of rhythmical movement and mechanical drills. The glorification of the false side of war … [and] the deliberate inebriation to avoid seeing thing as they are"[207]. Another author described pre-war British soldiering as "'Fuss and Feathers'"[208] which centred around Royal birthdays, parades in which "the ordinary soldier was to be a male ballet dancer in a piece of military choreography…"[209]. By contrast, the Germans, particularly the *Waffen SS*[210], had given up this parade-ground nonsense by 1943 to concentrate on weapons training[211], which the British would only began to emulate in 1945 when divisional-based 'battle schools' were created and run under more realistic conditions by combat experienced officers[212]. Prior to that, and by way of example, no British (or US) units received any preparation for fighting in the Normandy *bocage* prior to D-Day, or in the jungle[213], even though many British units in India and mainland Britain had been 'trained' almost stale for years on end[214], and a desert veteran from 51st Highland Division later recalled how he was given just a few minutes' advice from an officer as 'training' in house-clearance and street fighting before being thrown into the *Reichswald* battle in 1944[215]. However, as an illustration of how haphazard and unit-dependent proper tactical training in the British army was, the Home Guard had been thoroughly trained in street fighting tactics years before[216], and the subject had been taught in the centralised British 'battle schools' throughout 1940-1942[217]! A veteran of Arnhem also complained about the months wasted on 'drills', inspections and other nonsense at the expense of training for house-to-house combat[218].

In a similar vein, whereas the Germans conducted training exercises with live ammunition[219] and strove to make the whole business brutally realistic regardless of casualties among the recruits, the western Allies (army commando training excepted)[220] were slow to do likewise due to the constraints imposed by public outcries when accidents occurred – one of the drawbacks of democracy. Although British training methods did become more brutal[221] they lacked one vital ingredient that the Germans routinely included; they (unlike Anglo-US armies) gave each new formation, however raw, a nucleus of battle-hardened officers and NCOs[222] to ensure that training was not only realistic but also up-to-date and they also rotated not just officers and NCOs but also battalions and companies between the battle fields and training commands[223]. The closest the British got to this approach was their LOB ('Left out of Battle') concept which was initiated during the early desert campaign and would withdraw a proportion of experienced officers and men from each infantry battalion before a major attack so that a nucleus to rebuild a battalion was preserved if the rest were wiped out[224]. However, this did nothing to 'export' expertise to newer formations and even in mid-1944 Britain (and the USA) had OBs with completely 'green' units[225] who had spent years conducting mock 'battles' of dubious relevance, but had not benefited from having experienced officers and men from the front transferred to their training establishments[226]. Because British training was very decentralised and much was left to the whim of unit commanders, the quality of training varied much more than the standardised training in German or US formations; a comparison between the 'green' teenagers of Germany's 12th SS Panzer Division in Normandy and similarly 'green', or even veteran, Allied units demonstrated the superiority of German training methods in boosting combat performance[227]. A better example might be the ill-fated Operation Market-Garden, in which improvised German *Kampfgruppen* of 16-17 year olds and old men (of whom on average only 10% had seen any active service) fought British and US elite troops to a standstill and inflicted two enemy casualties for each one suffered[228]. As late as April 1945 Rifle Brigade officers were aghast at the poor field-craft of 45 Royal Marine Commando, which made no attempt to conceal their movement in daylight and brought down German artillery fire to the heavy cost of both units[229].

Historically too, the British army had regarded training as 'Cinderella' even before the Great War[230],

as well as during it[231] and comparisons with contemporary German methods are sobering[232], indeed the study of German methods was even forbidden before 1914![233] Even in the inter-war years the study of foreign armies was discouraged until 1936[234]. Such British attitudes survived well into world war two, and even the Canadian official history admitted that many of its officers had a "casual and haphazard rather than urgent and scientific"[235] attitude to training and admitted with amazing understatement that the German approach demanded more from their men and was "…perhaps less casual"[236], while US General James Gavin remarked that the British "took the war far less seriously than we"[237]. A good example of this was the large number of head wounds sustained by commandos in Burma through a stubborn refusal to wear steel helmets in place of berets – until order to do so[238]. General Auchinleck admitted that his forces were "not as well trained than the Germans" and blamed this state of affairs on pre-war training, "We don't really train for war in peacetime England – we play at it"[239]. In pre-war Burma too, the training given "…was like playing soldiers"[240]. Britain's first 'battle schools' typified this with obstacle courses, mock explosions and simulated 'tough' conditions like "running up-hill to bayonet straw sacks"[241], thus over-emphasising the physical rather than mental demands of combat.

During the war there was too much preoccupation with the orchestral approach to battle, and the 'correct solution' to a tactical problem from a choice of pre-determined 'drills' was practised. The origins of these drills actually went back to 1918[242], and were first used by Lt Colonel Harold Alexander when he commanded (ironically) a German (!) unit in 1919 fighting against Soviet incursions into Latvia[243]. The drills mimicked German and Indian army practice[244], being intended as merely a wartime training aid in the absence of any official doctrine so that, to use a modern British expression, all units 'sang from the same hymn-sheet' and had at least some tactical awareness, but inexperienced and largely inadequately trained junior officers came to regard them as ends in themselves[245] or a universal panacea[246] and, unfortunately, were allowed to do so by default when senior officers left them to their own devices, so that they were applied far more rigidly than battlefield conditions demanded, sapping initiative[247]. Moreover, by emphasising fire and movement, the infantry had to work purely with their own firepower and so the drills (ironically) undermined inter-arms co-operation based on artillery or other fire support[248], as well as increasing small arms ammunition expenditure[249]. They were not a success, especially in the chaos often created in attacking situations where flexibility, imagination, rapid-decision-making and a willingness to exploit situations an take the initiative were needed, and fell out of favour after 1943 so that the tactical awareness of troops thereafter actually declined and head-on assaults behind ('leaning on' in contemporary parlance) supportive barrages again increasingly became the custom[250]. This, of course, further eroded initiative[251]. Significantly, Rommel observed that the British were better trained for static warfare than for mobile battles[252]; with good reason, for he had his proverbial fingers very badly burned during his initial and forlorn attempts to capture Tobruk thanks to an inspired British, Australian and Polish defence[253].

British training was therefore prescriptive (all tactical problems being categorised into types) and fostered a methodical and set-piece approach to combat, itself a sort of attritional battle using superior material to compensate for a lack of tactical excellence. British officers complained that it was difficult to get their men to do more than the minimum required, whereas the Germans who saw all tactical situations as essentially unique, trained men to continually do more than should have been reasonably asked of them[254]. A typical British attack after the slaughter in Normandy "…had become a short rush forward, dig in and await the inevitable German counter-attack. These were soldiers who would grind the enemy down, or hold a defensive perimeter to the death, but they had acquired neither the battlefield habits nor the confidence in their leaders necessary for a blitzkrieg [sic] - style operation such as Market-Garden"[255]. There was a willingness to 'do their bit' but the loss of so many junior officers and NCOs in Normandy showed an increasing need to "pull men into battle by personal example"[256]. Complaints in Normandy and Burma cited excessive bunching-together by troops and an over-reliance on supporting fire rather than their own weapons[257] (partly, as already observed, because of the British infantry squad's low organic firepower) and the problems of fighting in the Normandy 'bocage'[258] and beyond demonstrated that there were clear limits to the western Allied policy of expending ammunition rather than lives[259], particularly if 'ammunition' of whatever sort was scarce or absent.

As if these deficiencies were not enough, the pressure of events and often poor organisation sometimes meant that mostly raw troops with little or no training faced a much more proficient enemy, especially in Norway in 1940[260], France 1940[261], the Far East[262] and then North Africa[263]. Where training was given it was sometimes wholly inappropriate as for example when Commonwealth, especially Indian,

units were equipped and trained for mountain warfare or mobile desert warfare but were then thrown against the Japanese in the jungle[264]. Attempts to train troops for jungle warfare were usually undertaken reluctantly and were initially both short-lived and unsuccessful[265], discouraging renewed efforts until the Japanese had driven the Allies out of most of South East Asia. A shortage of experienced leaders aggravated this situation, particularly in Indian army units due to the rapid wartime expansion of British and Commonwealth forces[266] which ruthlessly 'milked' existing units of too many experienced officers and men[267]. Their replacements were often unable to even speak the language of their superior officers or men[268] let alone win their confidence (or vice-versa), and this had a disastrous effect on combat performance. The multi-national British army of world war two was never to be entirely free of this linguistic problem, as shown by the communication problems between the British and Poles at Arnhem[269]. In mitigation however, where these language problems had been overcome, the routine use of languages such as Welsh[270], Hausa (used by African troops)[271] Urdu[272], Hindustani or Gurkhali[273] or even English laced with Arabic[274] in British radio communications robbed the Germans and Japanese in particular of very valuable intelligence previously gleaned from poor British radio security[275].

In some African units a dearth of local officers and (especially) NCOs necessitated the use of British and Polish officers[276] and partly explains why in ASL some African, Indian and other native colonial squads only have a '4' range factor in PTO scenarios prior to 1944, despite these being volunteer units. That these forces eventually overcame the deficiencies by means of thoroughly revised training methods from 1942[277] onwards is shown by the fact that the range factor increases to '5' in 1944. As such the Indian army became the largest volunteer army in history some 2.5 million strong[278], and without the Indian *Jawan*[279] the final victory in Burma against Japan would have been impossible. The poor '4' range factor of some African units can be ascribed to a general lack of empathy by some of their (white) officers and NCOs[280] for their religion and customs, and a demonstrable lack of faith in their men's abilities[281], stemming in part from the total unpreparedness for modern mobile warfare that their traditional imperial policing role at home had brought about, and the widespread fatalism shown by these troops[282]. Once better leadership was provided, such African troops fought well[283], though their morale was often fragile[284]. Certainly those African troops used in Burma both by Wingate's *Chindits* and on daring commando-style raids in the Arakan region proved to be ferocious in close combat. In the latter case when deployed as raiding forces, they went into close combat bareheaded and barefooted with machete, rifle and bayonet – they too deserve 'stealth' advantages[285]. However it should be borne in mind that volunteer troops should not automatically qualify for elite status in ASL, for example the raw Canadian troops sent to defend Hong Kong[286], some of the untrained Australian units in New Guinea[287] and Singapore[288], or the Indian army before 1944[289]. This fact has been recognised in ASL scenarios, in some of which the stalwart Gurkhas are a mix of elite and first-line squads, although even green Gurkha troops usually fought well[290]. The patchy quality of some, but not all, of the Burma Rifles battalions in the early stages of the Pacific war was due to the fact that most of the personnel were deliberately recruited from the (comparatively less educated) 'loyal' and 'martial' ethnic jungle tribesmen[291] rather than from the 'unreliable' or 'disloyal' Burmese *per se* who resented all foreigners in Burma, not just the British and Indian presence[292]. These tribesmen later excelled as scouts and guerrillas[293] but were initially out of their depth when deployed defensively as badly trained conventional troops[294]. Matters were not helped by their having had generally poor pre-war officers, described as "natural backwater material"[295], nor by the poor training of some units[296]. For such units '4-3-6' factors are more appropriate than the '4-4-7' values.

The 4-3-6 counters are also ideal for the representation of most of the British LDV (Local Defence Volunteer, and wryly re-named 'Look, Duck and Vanish')[297], but from 23rd July 1940[298] renamed Home Guard. These units tried to make up for a lack of physical fitness and initially-poor training with enthusiastic optimism and perhaps some previous military experience in the Great War[299]; personnel nominally ranged from between 17 and 65 years old (sometimes more)[300]. The 4-3-6 counters can also represent the various private, unofficial, vigilante-style groups of British civilians[301] who searched for imaginary 'fifth-columnists, spies or German paratroopers disguised as nuns in 1940, and included factory or office 'private armies'[302] and the all-female *Amazon Defence League*[303]. Although at least one unit was exceptionally well-trained[304], contrary to the depiction of these units as *ersatz* combat troops, their primary duty was to observe and report enemy activity or undertake security duties rather than to fight[305]. Only after November 1940[306] when the immediate threat of German invasion was over did the Home Guard evolve into a more potent force with the introduction of uniforms, better training, a military command structure and more effective weapons than the initial pitch-forks, clubs and museum-piece firearms that most personnel had toted[307]. Of these re-equipped units, only certain

coastal AA units[308] ever fired their weapons in anger at the enemy. Significantly, when its younger members were absorbed by the regular army when they attained military age, they were retrained from scratch regardless of their previous Home Guard experience[309]. As a military force it was best described as "…a gigantic bluff"[310], particularly in 1940 when Britain faced the greatest perceived danger from invasion. Despite being cheaper to deploy than regular troops by a factor of 40, because they were unpaid and received few monetary allowances, they were in many respects a cost-ineffective exercise[311].

Turning now to morale, 'Tommy's' good morale factors appear to contradict the fact that the majority of troops had little enthusiasm for the war and did not feel the lust for revenge or blind hatred for the enemy that motivated other victims of Axis aggression[312]. However, fighting the Japanese or the *Waffen SS* brought something of an exception to this rule, while Polish, Free French and other 'refugee' contingents in the British army (including Austrian and German refugees) were understandably less philosophical or dispassionate. There had been no rush to volunteer for war service in 1939 as there had been in 1914[313], the grim slaughter of the Great War had seen to that, and in the early war years 'Tommy's' confidence was severely dented by a succession of bitter defeats with a consequent deterioration in morale. In all theatres troops sometimes behaved less than heroically[314] than the popular myths created during and after the war would have us believe. This was due to de-moralisation, a breakdown in discipline and the realisation that enemy fighting prowess had been woefully underestimated, and things were not helped by the shortages of equipment (especially in the BEF in 1940, the PTO, and just after Dunkirk), the often harsh conditions encountered in overseas theatres (for which the temperate climate of the UK was no preparation) and the frequent displays of indifference or even outright hostility shown towards 'Tommy' by local populations or even British civilians who were supposedly being protected from Axis aggression[315]. Examples of this can be found not just in Burma, India and Malaya, but also in many parts of France in 1944[316]. In the latter case, whereas the Germans had behaved correctly[317] to safeguard the area as a valuable food source the liberating allies then knocked everything flat and, as a member of the French resistance put it, began "levelling everything in front of them… …and distributing to the civilian population in the same breath chocolate and phosphorous shells"[318] . In the PTO many troops had already served for up to nine years without home leave when Japan attacked[319], and this did little to enhance morale or a sense of commitment. Draft-dodging was of course not unknown[320] and in all theatres there were sizeable numbers of deserters and malingerers of all ranks behind the lines[321], as well as in Britain[322]. Another factor that certainly affected non-white Commonwealth troops was the racial discrimination that many had to endure; some British writers dwell on the brutal treatment meted out to black American personnel stationed in the UK by white supremacist racists from the southern US states[323], while forgetting that the British army practised a more subtle and less violent racial discrimination too[324].

Given all the above, the reader might be forgiven for thinking that 'Tommy's' morale factor of '7' ('8' for elite and '6' for green), let alone the immunity to ASL's cowering effects, is a trifle generous. However, while the behaviour of a minority of troops was bad, for the most part morale held up remarkably well, even in the dark days of Axis ascendancy in 1939-1942, and against the Germans, Italians and Japanese even inexperienced or outnumbered British or Commonwealth units gave their foes many a bloody nose tactically[325], however irrelevant strategically. A good example of this is depicted in *FKaC* scenario # 92 'Stand Fast the Guards'. In theory 'Tommy' could on average go for 400 combat days (680 calendar days) before breaking down psychologically, the American GI some 200-240 combat days (340-408 calendar days), according to separate wartime studies[326], and this is reflected in ASL by their different, respective, morale values. There are various reasons for these differences in morale factors.

Firstly, there was the environment. Due to geographical proximity the Axis was a more immediate and tangible threat to 'Tommy' and his family than to the average GI, particularly when facing the Germans. Secondly, the two armies used different selection processes to fill their combat units with personnel. The British method lay somewhere in between the two extremes represented by the German (and also to some extent the Japanese) practice on the one hand and the US practice on the other. The Germans deliberately gave their combat units a fair proportion of the high quality personnel of all ranks available (i.e. not all were creamed off into technical, non-combat functions) whereas the US army consciously diverted the cream of the intake, in most cases, away from combat units – particularly infantry units – and into the more technically-orientated branches were rewards and promotion also often came easier with less risk to body and soul[327]. In the British army many of the non-combatant branches had little appeal to the more ambitious individuals since the rewards were comparatively

poor[328] and the British got a somewhat better cross-section of the available personnel into the fighting branches of the army, especially into units with long and distinguished histories, while the Indian army (composed wholly of volunteers) recruited largely from the same families of the 'martial races' by tradition, at least initially[329].

Moreover, efforts were made not to compromise the quality of the British intake despite manpower shortages because experiments had demonstrated the cost-ineffectiveness of doing so[330]. Although some sources state that the quality of the manpower available to the wartime British army suffered from the competition for recruits posed by the RAF, Royal Navy and 'private armies' like the paratroops and commandos[331], in the case of the RAF and navy this had been a problem even before the war. Many volunteers had joined the pre-war forces to escape poverty and learn a trade that they could later use in civilian life; of the three services the army had the smallest percentage of technical personnel and was therefore the least attractive. It should also be remembered that every participant of world war two that created air and naval units to compete with their armies for personnel faced a similar problem. However, it must be admitted that the British were far more reluctant to use specialist, elite, units like paratroops and commandos for prolonged periods as normal infantry[332] than Germany, Italy or the Soviet Union (most of the latter's paratroops were transferred to the Guards Divisions for more frequent and profitable employment)[333], and British 'private army' personnel might have been better used in ordinary infantry units to raise overall standards, especially as paratroop units used far more sergeants per rifle platoon than infantry units[334].

Thirdly, when circumstances permitted the British rotated their combat formations more frequently than the US army did[335] and also had superior psychiatric treatment available to detect, prevent and cure mental breakdowns, as well as a better knowledge on how to distinguish the malingerers from the genuinely-afflicted[336], based on the lessons of 1914-1918 'shell-shock' controversy[337]. Experience showed that this medical support was far more effective than short-lived and unsuccessful attempts to 'toughen' troops by visits to slaughter-houses[338], strewing assault-courses with offal and animal blood[339], 'hate' indoctrination[340] and seemingly endless marches.

Fourthly, Britain's social structure and military traditions made civilians more readily adaptable to military life and discipline than US personnel, and one source states that the US army's disciplinary code was both stricter and more harshly applied than the British equivalent[341], presumably for that very reason. But that is not to say that the British army was a model of restraint in meting out punishments; in the West African Frontier Force and among the 'Chindits' in Burma unorthodox and humiliating punishments were inflicted on defaulters. In the former case, beatings on the bare buttocks with rods[342] was a lawful military punishment, while the eccentric General Orde Wingate brought the harsh physical punishments (including striking defaulters of lower rank, in true Japanese style) from the otherwise excellent pre-war Sudan Defence Force to firstly the pre-war Jewish Gideon Force and then the 'Chindits'[343] with him when he formed the latter for service behind Japanese lines. Here he imposed (without official approval) such draconian measures as tying defaulters to trees, flogging, banishment to the jungle – virtually a death sentence in all but name –and even the threat of summary 'execution' to enforce discipline among the 'Chindits' when behind Japanese lines[344]. Those West African units fighting with Wingate of course had *all* these punishments available to enforce discipline. However, banishment was rarely imposed on 'Chindit' personnel and the death penalty apparently never, as far as is known[345]. Unofficially, strictly illegal physical punishments were meted out in all theatres to enforce discipline, regardless of what military law prescribed[346].

Fifthly, the regimental system – as noted earlier – helped to bolster and sustain morale, and lastly the British officer's greater concern for the welfare of his men was also a contributory factor, going at least a little way to limit the genuine, deep, resentment and harm to morale that the vast differences in pay, rations and comforts between British (but not Australian or Canadian)[347] personnel on the one hand and US troops[348] on the other might otherwise have caused. For example, a US staff sergeant earned as much as a British captain[349], and a US private first class almost four times as much as his British equivalent (though the differences narrowed at more senior ranks)[350]. But for all that, a British infantry unit in the line was more likely to get a hot meal than a US one[351], particularly in the PTO or Italy[352], and the rations were generally considered to be better[353], for all the lavish US rear area support and generous ration portions. It was also routine for British officers, but rare for US officers, to inspect their men for ailments like trench-foot. That said, the writer does not believe, as has been suggested, that European (here, specifically British) troops were necessarily better accustomed to physical hardships than the GIs, particularly as US infantry units were at least if not more likely to contain a

greater proportion of men from impoverished backgrounds than a British unit due to US recruitment policy. Even if it were the case, it would not necessarily make Europeans better soldiers since socio-economic origins are less relevant to combat performance than training, leadership, discipline and tactics. In the PTO especially, but also in the desert and later in Normandy, British commanders (obsessed with the spectre of poor morale, often without foundation)[354] complained about a lack of 'toughness' and 'spirit' among troops facing the Japanese[355] and Germans[356] and in the first two theatres blamed it on the softer living of peacetime soldiering.

In comparing western Allied practice with that of the Germans, rewards and punishments are also illuminating, for while the Germans were amongst the more fair and egalitarian in rewarding *exceptional* courage when combined with *initiative* (heroism alone was no qualification for a medal), they were also the most ruthless towards 'cowards' and deserters. One source estimates that 5,302 men were executed for desertion alone between 1939 and 1945[357] (compared to only about 22 in 1914-1918[358]), of which 1,605 took place in the first nine months of 1944 alone[359]. The total number of German troops executed for all offences in world war two is estimated to range between 10,000[360] and 15,000[361], compared to just 48 in the Great War[362]. Moreover, thousands of men were also either sent to punishment battalions where most died trying to 'regain their honour' or received long prison sentences[363], while their families also faced official persecution or even death[364] under the old German medieval code of *Sippenhaft* (arrest of clan, or kin) which held other family members accountable for the crimes of an individual[365]. By contrast, the British and Americans were amongst the most humane; only one GI was executed for desertion (among much controversy during and since the event) and, despite Churchill's protests, the British army refused to reintroduce the death penalty after it had been abolished in 1930. This was because the experiences of 1914-1918, when about 266 executions for desertion took place[366] cast doubts upon its effectiveness as a deterrent, and experience between 1939 and 1945 vindicated this policy[367].

Statistical analysis after world war two also appeared to confirm this, for the official desertion rate for British troops in the Great War was 1.026%[368], but only .689% in world war two[369]. However, if combat units alone are considered, the desertion rate was about 4% throughout 1939-1945[370], the bulk being infantrymen[371], and consequently Generals Auchinleck and Alexander advocated the restoration of the death penalty for desertion but were overruled by senior officers, for political as well as humanitarian reasons. The harshest prison sentences imposed for desertion were 3 years' jail, but a mere 6 months' was more usual[372], and even though British military prisons were grim, brutal and degrading places[373] (as vividly portrayed in the film *The Hill*, MGM, 1965), few inmates accepted the offer of a remission of their sentences if they agreed to return to combat service[374], although the Canadians appear to have been more successful than the other British or Commonwealth forces in this respect[375]. The *estimated* German desertion rate in world war two was .79%[376], apparently higher than the British, but it is unwise to compare estimated and compiled figures too closely due to differing criteria and compilation methodology. Sources state that on average the German desertion rate was much lower than the US army's[377], and that the British desertion rate was also lower than the US rate[378]; peak rates being British 4.5% (October 1940-September 1941 – the year of defeats in the desert, Crete and Greece)[379], US army 6.3%[380] (paradoxically in 1945, seemingly justifying a lowered ELR for that period), and Germany 2.15% (1944 – not the Third Reich's best year)[381]. Desertion rates were highest in the bloody and static 'side-show' fought in Italy[382] and for British soldiers at least this leniency allowed them to unofficially transfer from one unit to another by deserting and letting themselves be rounded up for random re-assignment to under-strength formations. With so many units short of men by 1944, such replacements were gratefully received without too many questions being asked - enabling 'Tommy' to find a unit to his liking by empirical methods and it was quite widespread in other theatres too[383].

The British Empire's land forces lost 188,241 men killed, 401,211 wounded and at least 353,941 missing / POW in world war two[384], of which the British army proper lost 126,734 killed and 239,575 wounded or, respectively, 67.3% and 59.7% of the total for the whole Empire[385]. This represented only about 25% of the 1914-1918 slaughter[386], but was spread through a much smaller proportion of combat ('teeth') to non-combat ('tail') personnel[387]. The total number of British and Commonwealth troops taken prisoner or otherwise 'missing' is not precisely known, but the estimated figure given above represents 37.5% of the total Empire army losses[388]. The Canadians had the lowest overall percentage of missing / POW as a proportion of total losses[389]. Moreover, they and the Indian and New Zealand contingents were proportionally the hardest-hit due to their smaller non-combatant sections[390] as their support services were mostly provided by British personnel, within the larger structure onto which

Commonwealth units were grafted. In most theatres casualty-rates approached or exceeded 1914-1918 rates on occasions and the shortage of infantrymen who bore the brunt of the losses could only be alleviated partly – as in the US army – by an influx of hastily-trained or even untrained personnel of often inferior quality, by disbanding or amalgamating some units (as with the British pre-war cavalry regiments, albeit less formally) and by transferring AFV crews, artillery-men, rear area personnel, military prison inmates and even surplus RAF or Royal Navy manpower to infantry units, often with only scanty training[391]. To allow for this, late-war British infantry tactics reverted to simpler Great War style set-piece advances behind artillery barrages to compensate for these training and experience deficiencies[392]. A reduction in the overall proportion of non-combat to combat personnel within units (along German, Japanese or Soviet lines) was not attempted, so that – despite the fact that the infantry battalion TO&E manpower total was reduced[393] – their combat strength fell steadily while the non-combat element actually grew[394]. Infantry companies shrank from about 125 men down to 40 or even just 6 men[395], and were then rebuilt with raw 18 or 19 year-old replacements[396]. By 1945 most British infantry companies might have just one veteran left[397], while 45-year old men, previously deemed too old for active military service, were being inducted[398].

This state of affairs reflects the gradual exhaustion of Britain's finite infantry rather than manpower reserves, and in reality the strength of the British army actually *grew* from 2.7 million men in 1944 to 2.9-3 million men in 1945[399], not counting Commonwealth contributions which totalled 1.4 million men during the war[400]. Earlier in the war the British high command had unwisely reduced the ratio of infantry to armoured and artillery formations[401] so that there were not enough infantry units, and had also raised far more units than could be maintained in the long-term[402]. Infantrymen also became scarce because the British (and US) armies had under-estimated the personnel losses that they would suffer in Normandy's 'bocage', especially infantrymen[403], due to an over-reliance on casualty statistics compiled in North Africa[404] and were therefore unable to rapidly replace their losses. Other factors militating against the efficient replacement of casualties included the regimental system's rigidity in allocating replacements to specific units regardless of need[405] and the (political) decision to grant leave to long-serving personnel before the war had actually ended. Although regiments became steadily less fastidious and had to accept 'outsiders' within their ranks[406] there were clearly limits to how far this 'pooling' of replacements could go. This was especially true in the Indian army due to the ethnic and sociological basis of unit organisation that was used to minimise problems otherwise caused by widely differing languages, castes, religions, cultures and (not least) dietary requirements[407].

One US historian, Carlo D'Este, argued that the British appear to have deliberately kept back from the fighting in Europe no less than 38,629 officers and 501,109 men, of whom 6,373 and 109,251 (respectively) were infantry-trained[408] at a time when field commanders in all theatres were clamouring for replacements. However, more recent research had discovered that British infantry shortages actually began to bite as early as 1942[409], but that the UK (presumably for the sake of prestige) was reluctant to admit this so that the USA did not for a time understand the British difficulty[410]. By August 1944 almost all the infantry fit for combat had been sent to NW Europe[411], and D'Este's figures are 'paper' strengths including physically unfit men, instructors and men suffering from battle fatigue[412]. Thereafter, replacements could only come from cannibalising units or hastily 're-training' non-Army or non-combat personnel. Matters were not helped when Canada initially refused to send conscripts overseas[413] and allowed (for a time at any rate) 70,000 trained infantry to languish at home unused[414], but her manpower pool was also exhausted by August 1944. South Africa's decision to forbid non-whites from serving in combat formations[415] also conspired to reduce the overall manpower pool despite the fact that enthusiasm for the war *among whites* was never very high[416]. Moreover, the USA was also facing a self-inflicted infantry replacement crisis[417], in order to protect her economy.

Turning now to British ELR, the British General Horrocks stated that of any ten men, two would lead, seven would follow and the tenth would do almost anything not to be there at all; the leaders would therefore take most of the risks and become casualties[418], while an infantry commander in Burma said that 25% of his men were potentially brave, 5% were potential cowards and the rest were neither but were prepared to nonetheless do their duty[419]. An ANZAC officer observed that all men save about 3-5% could control their fear before combat[420], all of which tends to endorse the relatively good ELR ratings that the British have in ASL for DYO scenarios. On average the British ratings match those for the Germans and Japanese more closely than those of other nationalities. However, given the problems that the British had early in the war after a string of defeats, and later in the war when units were 'tired' and their men wanted to survive a war clearly in its final stages, the ELR factor of '3' for the period 6/39 to 6/42 and then again for 1945 should come as no surprise. On the available evidence[421], a case

could be made for extending the '3' ELR factor for some units back to 7/44-12/44 in the ETO, and for also reducing the US ELR rating to '3' in 1945, because it is plain from reports that even the most enthusiastic soldiers became homesick eventually and often felt that their cause and the country they were deployed in was not worth dying for. 'Tommy' was no exception to this rule and the reluctance to become a casualty statistic grew as the war drew to a close[422]. Worse, as the quality of British and Commonwealth units was often very inconsistent and the relatively lightly-equipped 'private armies'[423] spent comparatively little time in the line under fire, even as late as the end of 1944 the better formations tended to get over-used (despite the British rotation policy)[424], losing their elan and becoming tired and resentful. Such 'war-weariness' which, in extreme cases led to a refusal to obey orders, is also encapsulated in the lower '3' ELR values.

At best, a decline in élan bred over-caution and lower morale, and at its worst led to a refusal to fight or even to mutiny. In the best-known example of this, the so-called 'Salerno Mutiny' of September 1944[425], some 1,200 veterans from North Africa refused to leave for the fighting at Salerno as reinforcements on learning that other personnel were (allegedly) being sent back to the UK on leave. Many of the offenders received prison sentences and even though mutiny still carried the death penalty none were executed, while others deserted before reaching their 'new' units[426]. Other desert veterans sent to fight in Italy or Normandy were equally resentful if a little more co-operative[427] and the combat performance of these veteran formations was so poor at times that it was felt they were living on their previous (North African) reputations, their previous devil-may-care attitude in the desert[428] contrasting sharply with their timidity in the *bocage* of Normandy[429]. Good examples were the 7th Armoured and 50th and 51st Infantry Divisions, which it might have been better to break up and so cascade their combat experience to 'green' formations. Similarly, units that performed well in the early stages of 'Operation Overlord' or were smugly arrogant[430] became rather humble and sluggish after the heavy fighting there. There was also much resentment among desert veterans over Montgomery's indiscreet and wholly unjustified statements before D-Day, which tended to ridicule the quality of the German troops likely to be encountered there[431]. The veterans knew better, and with something of an inferiority complex towards the Germans anyway, even relatively light casualties would lead to British attacks, especially infantry operations, quickly grinding to a halt. British units suffering 40-50% losses would expect to be taken out of the line, whereas many if not most German units on average functioned well even after 75% losses[432].

Weapons

Britain's financial, industrial and human resources became much more rapidly depleted than her major allies (and some enemies) and her capabilities in fighting the three major Axis powers simultaneously were dangerously over-stretched. The reasons for this inability to defend her empire are numerous, and anyone wishing to understand the underlying causes of British weakness would be well advised to consult Correlli Barnett's *The Audit of War: The Illusion of Britain as a Great Nation*, Macmillan London 1986 and Papermac 1987, Clive Ponting's *1940: Myth and Reality* London 1990 and Len Deighton's *Blood, Tears and Folly: In the Darkest Hour of World War Two* London 1993. In brief, as the cradle of the industrial revolution Britain failed to keep up with her emerging overseas economic rivals, investing money abroad (especially in the Americas) rather than in her own increasingly outclassed industries, educated too many students in subjects like Greek and Latin at the expense of applied science and engineering, and suffered appalling industrial relations as industry tried to remain competitive by reducing wages and hence costs. Britons could invent well enough – the steam engine, steam locomotive, steam turbine, tank, ASDIC (SONAR), television, radar, jet aircraft, the hovercraft and more recently 'Chobham' armour all bear testimony to that – but investment to then commercially exploit these discoveries (in US parlance, 'production engineering') and earn wealth with which to modernise, arm and defend the nation was so often very inadequate. Two examples will suffice, firstly a report by the British Board of Trade in June 1943 found that on average a machine tool in the UK was used for 20 years before replacement, compared to only 3 or 4 in the USA; and consequently the *per capita* industrial output of America was 3-4 times higher than Britain[433]. Secondly, whereas the production of the Rolls Royce Meteor tank engine needed 300 machine tools, the US Ford V8 tank engine derived from it needed just 18[434].

Up to the Great War, this underlying weakness did not surface for the Empire paid for all wars and also propped up the British economy, but the spiralling cost of twentieth century attritional warfare finally caught Britain out. Small wonder then that she was financially bankrupt long before Pearl Harbour, even though (or perhaps because) her massive investments in the USA and elsewhere had been

liquidated - at bargain prices - to pay for the war. The conflict cost Britain 25% of her national wealth[435] and ran her railways (barely recovered from the privations and miserly government compensation of the Great War) and her ageing industries back into the ground. 'Victory' merely provided a convenient smoke-screen, together with skilful government deception, to conceal Britain's fundamental economic and military weaknesses and declining influence on the world stage, which her politicians and people only gradually perceived in the ensuing decades and in some ways have still to fully come to terms with[436]. One mechanism used to foster the illusion of continued great power status is the British nuclear weapons programme, and another is the myth of the 'Special Relationship' with the USA.

Despite frantic rearmament after the Munich crisis, the war found Britain unprepared, and ironically it was the infamous 'Ten year Rule' of 1919 (largely Winston Churchill's creation)[437] that by envisaging no likelihood of another war for a decade, and being continually extended each year into the 1930s, that rendered it very difficult to make a good case for military spending. This of course led to the three armed forces trying to outbid each other for the scarce funds that were made available; as an island nation open to attack from sea and air, the army naturally took third place in priorities[438]. Once war was declared, with between 33% and 50% of the British war effort devoted to bombing Germany[439], and most of the rest on the naval war, the British army remained low on the list of priorities for men and material[440]. Moreover a large slice of army resources went into the 12 divisions formed for AA defence. Although deployed close to home, the BEF of 1940 lacked just about every item needed to repel the Germans effectively[441], and a shortage of steel helmets in 1940 for Home Guard units forced officers to stand in line with children and buy them two at a time from high-class toy shops[442]!

It is true that Britain had become heavily dependant on US *tank* production, as we shall see, but even in 1944 61.2% of British munitions were still UK-produced, with another 8.9% from Canada (compared to 90.7% made in the UK and another 3.7% from the Empire in 1940)[443] , so it would be wrong to see Britain as an infirm patient totally dependant on a US life support machine. The Empire produced, overall, 80% of its weapons requirements – including supplies to the USA[444]. Thus, assistance from the USA *was* reciprocated by Britain and the Commonwealth and in some cases even matched or bettered. For example, the British Empire mobilised about 9 million men, a figure never reached by the USA[445], and to equal the Australian contribution alone on a *per capita* basis the USA would have need to mobilise 16 million men[446]. Between 8.12 and10% (sources vary) of New Zealand's 1.7 million population, 10.2% of Australia's 7.1 million population, and 6.1% of Canada's 11.3 million population served in their armies, far higher than the 5.6% of the US population[447], and 50% of the US 5th Army in Italy was actually - British[448]. Contrary to the myths, on VE Day in the ETO British (excluding Commonwealth) land forces alone totalled 2,846,406 men[449], compared to 2,041,000 US ground force personnel on 31st March 1945[450], and between about 2,593,000 to 2,900,000[451] (sources vary due to differences in methodology) US army personnel at the war's end – hardly the American preponderance so readily assumed by modern historians to have existed.

Whereas only about 37-38.3% of US army personnel[452] were ground combat troops, the Commonwealth equivalent varies between 56 and 89%[453]. In the PTO 80% of the allied land forces were actually Australian[454]. In Burma, the British and Commonwealth proportion of the ground troops (roughly 16.98% African, 64.15% Indian and 18.86% British[455]) was 91.2% in April 1944 compared to 7.8% Chinese and 0.9% US, and in April 1945 was still 87.72%, compared to 10.52% Chinese and 1.75% US[456] Although the USA made a very valuable contribution in Burma by providing effective and heroic air support, US manpower was still well out-numbered by British and Commonwealth personnel, even if most aircraft were US built. Reverse Lend-Lease supplied the USA with, among other things, Spitfire and Mosquito aircraft, jet engine technology, rocket propulsion, 57mm APDS ammunition, the Bailey Bridge[457], the Mulberry Harbour, centimetric (airborne) radar, improvements to SONAR, anti-submarine weapons, assistance with the atomic bomb project which was not reciprocated[458], penicillin[459] and 3000 other inventions worth in all an estimated £ 1000 million pounds in uncollected royalties[460] (to the detriment of Britain's post-war economic recovery), ULTRA code decrypts and other intelligence, as well as various technical and tactical advice (often ignored) from British combat experience.

To the end of June 1944 the USA received £ 1000 million worth of aid from Britain, everything from hospitals, air and army bases, transportation to food[461]. By the war's end this total expenditure reached about £ 1500,000,000[462], and Britain's war debt was not surprisingly described by one of President Truman's officials as "a millstone round the neck of the [post-war] British economy"[463]. Whereas

Britain had been the world's lead creditor in 1939[464], in the post-war period it took almost 40 years for the UK economy to recover[465]. Crucially, Britain poured £ 800 million into US industry[466], of which £ 50 million alone went to expand industrial production[467], with fully £ 437 million on the US aircraft industry alone[468]. This funding not only put the US aircraft industry on a war footing and financed Henry Kaiser's Liberty Ship programme, but essentially bankrolled future economic competition for the UK. Australia provided £ 61 million of Reverse Lend Lease to the USA[469], including food for the PTO; eventually 90% of US food requirements in the PTO came from Australia and New Zealand[470] and the USA actually received more meat from this source than it itself exported[471]. Britain also supplied her other allies not counting the USSR with £ 2,500 million in funding[472] to fight the war, and 41 convoys[473] of aid sailed to Russia with supplies worth £ 308,120,000[474], bringing everything from tanks to boots[475] and trade secrets[476]. A list of the main vehicles shipped to the USSR can, of course, be found in Chapter H, though small numbers of 'samples' like Churchill Crocodiles and Comets have been excluded[477]. Much of the material given to the USSR in 1941-42 had been earmarked for the PTO, and in part explains the loss of so much Commonwealth territory to the Japanese in 1942.

Not surprisingly, Britain was slowly bled dry industrially as well as financially; as an example, even railway lines in India were torn up for re-use in North Africa[478] to enhance logistical capabilities there, because they could not be supplied from the UK. Small wonder that 'economy' and 'conservation' became bywords in human and material expenditure; BREN gunners were taught to fire single shots or short bursts whenever possible, British mortars had low official rates of fire because the gradual embedding of the base-plate into the ground 'wasted' ammunition and made constant re-sighting necessary[479] to preserve accuracy during rapid fire, and British paratroops carried no second, reserve, parachute until 1950[480]. The latter did nothing to encourage volunteers, and by 1944 whole battalions were converted to paratrooper units against the wishes of the men in them[481]. At higher levels, the British protested to the USA at the amount of shipping space 'wasted' in providing American troops with a higher standard of living than was needed – in effect about 50% more food than a man could eat (and almost twice the German ration)[482], while her own population and armed forces had to live more frugally. In Normandy the American GI needed 30 lbs of supplies per day, while 'Tommy' managed on 20 lbs, and the German quota sometimes fell to as little as 4 lbs[483]. In order to maintain the high standard of living that US troops were accustomed to, civilians in the UK and Australia (where there was a resultant beef shortage in 1944)[484] went hungry. The British civilian meat ration was 16 ounces per week[485] – compared to the US civilian ration of 28 ounces[486].

It has become fashionable to dismiss all British equipment as second-rate, impractical or obsolete, but this is another sweeping generalisation and all armies used weapons that should have been discarded sooner or, better yet, never built. Certainly the British had to rely on rifles for far too long, as already noted this was because pre-war specifications for something like the M1 Garand were too stringent (even for the M1 to have met), because the emphasis on marksmanship and ammunition conservation was not to be usurped by 'gangster weapons' in the eyes of the conservative military minds, and because there were millions of unused rimmed cartridges unsuitable for such a new weapon[487]. The demands of war extinguished any hopes of such a weapon being produced in the UK[488], and of course even the more progressive Germans were still predominantly rifle-equipped late in the war because demand for automatic weapons always exceeded supply.

Certainly the Boys anti-tank rifle was "ludicrously inadequate" against even the more thinly-armoured of the German tanks, having been designed for the defence of the Egyptian border after the Italian-Abyssinian war. It reflected a General Staff obsession with infantry-held ATW from 1927 onwards (the year that the lance was officially declared obsolete) and was rushed into service despite its shortcomings[489]. Apart from the violent recoil, the noise made the wearing of ear-plugs prudent and the original steel-cored bullet had to be replaced by one of the harder tungsten-carbide to render it even remotely effective[490]. The 1937 training leaflet recommended practice against targets moving at 15-25 mph at up to 500 yards range – extremely unrealistic advice[491]. After Dunkirk troops were taught to hold their fire until the target was just 30 yards away, or aim at the suspension[492]. Its effectiveness in France with the BEF was undermined both by a shortage of ammunition[493], the general availability of only half-charge practice ammunition[494] and insufficient training[495]. But the more enterprising Australians found it useful against the Italians at Tobruk in early 1941 by firing at stone sangars to produce rock fragments[496], and one Aussie, anchored by two of his mates, even fired it at aircraft attacking his troopship[497]. However, its main contribution to the Allied victory was as a field punishment, "…to be given to the company drunk to be carried as a penance"[498]. British troops entering the steep and mountainous Ethiopian terrain were quick to dump them[499], but nonetheless by 1943

nearly 69,000 had been made, even though "… a good crossbow would have been just as useful and far cheaper"[500].

However the main British technical weakness in infantry weapons lay in mortars, as there had been no inter-war research into mortar design or the effects of rain on ignition efficiency. The little 2" mortar was of 1918 vintage, lacked punch like all mortars of so small a calibre, and had rudimentary sights in the form of a white line painted on the barrel. With a theoretical rate of fire of 20-30 rpm, great skill was needed by the user if ammunition was not to be wasted; although it could in theory be fired point-blank horizontally (an unwise procedure occasionally practised against Japanese bunkers[501]), it had a poor range compared to its foreign equivalents:

British	2"	500 yards
French	50mm	503
German	50mm	569
Italian	45mm	586
Japanese	50mm	711
Polish	46mm	875
Soviet	50mm	875
French	60mm	1860
US	60mm	1985

It was the same story with the British 3" mortar; initially it could reach to only 1600 yards, while the German and Italian 81mm mortars could manage 2625 and 4429 yards, respectively[502]. The fact that the British weapon threw a larger bomb and could deliver 200 lb of projectiles in 60 seconds compared to the 25-pdr gun's 125 lb[503] at intensive fire rates was little consolation. However, its range was later increased to 2790-2800 yards, though some crews improved on this through the unorthodox use of captured ammunition[504], or to over 3000 yards (in Burma) by the addition of extra propellant[505]. Only in 1945 was the range officially increased to 3500 yards by means of a stronger base-plate[506] and barrel to cope with yet more propellant[507]. When the 4.2" mortar was introduced only 4100 yards range could be obtained, by which time the Germans already had copies of the Soviet 120mm mortar in service with a range of 6500 yards, a heavier bomb and a lower overall weight[508].

More successful weaponry included the venerable, reliable but slow-firing and heavy Vickers MMG and the BREN LMG. The latter was a modified Czech design already in service when the war began and more plentiful than is sometimes suggested, as the ASL SW Allotment Chart confirms. Produced by a single factory that was never bombed by the *Luftwaffe*, over 30,000 existed by mid-1940 with production increased from 300 weekly in 1938 to over 1,000 per week by 1943[509]. Canadian factories made them too, eventually accounting for 60% of output[510]. Australia also produced BRENs, while most Indian troops used the comparable and visually similar Vickers-Berthier LMG, an Anglo-French design both slightly lighter and slower-firing than the BREN (though some BRENs were later issued too[511]) so that supply kept pace with demand and losses, save just after Dunkirk. US forces would have done well to adopt either in place of the old and ghastly BAR or the flimsy and unreliable Johnson LMG[512] and the BREN was both lighter and more accurate than the German MG 34 and MG 42, though it must be admitted inferior in weight of firepower. The simpler but not inferior BESAL (aka Faulkner, after its designer) LMG, hurriedly designed as a substitute for the BREN, was never needed[513], though in the early war years especially limited use was made of the old Lewis MG despite its unreliability[514]. A lost opportunity to redress the German superiority in LMGs was the Vickers 'K' gun (aka VGO) used by RAF observers in aircraft before being issued to the SAS for use as a vehicle-mounted weapon; weighing about the same as the other British LMGs its cyclic rate of fire of 950-1050 rpm would have given British squads something akin to the very fast-firing German MG 42[515]. 'K' guns did however eventually find their way onto a number of British scout and armoured cars by D-Day[516].

British and Commonwealth weapons that are not represented in SW counter form in ASL include the STEN SMG; a simplified version of the Lanchester SMG (itself a copy of the German MP28/II). While 'cheap and nasty' with a tendency to mis-feed and jam (which made it less popular then SMGs like the US Thompson, which however cost over 5 to 16 times as much to make[517]), it could also be dangerous even to the user because it had no safety-catch, but could use captured 9mm ammunition. So impressed were the Germans that they not only copied the STEN but also made forgeries for use by 'Werewolf' guerrillas against Allied occupation troops[518]. The Australian Austen SMG took the best features from

the STEN and the German MP 40[519], while its more numerous rival and successor was the excellent and popular Owen SMG, which owed nothing to foreign designs[520].

Another reasonably good if unpopular weapon was the PIAT; heavy and awkward to carry but safer to use if not as powerful as the German *Panzerfaust*, it could also be fired by one man (in ASL it is the only SCAW that can be used by SMC that are not Hero counters) and was safe to use from inside hard cover, unlike other SCAW. It also doubled as an improvised HE and smoke mortar out to 750 yards, or to 350 yards for what was described as 'house-breaking'[521] albeit not very accurately. Given the choice of no back-blast or the ability to fire to lower elevations, the former was a more useful feature in tank hunting since the operator could stay inside buildings or other confined spaces. That said, having to try and re-cock the thing manually if the recoil from a previous shot failed to do this risked a hernia or strained back, since the operator had to use his feet in the way that the less powerful medieval crossbows were re-cocked, but by either standing or by lying horizontal[522]. In Burma, PIAT gunner and Victoria Cross winner Ganju Lama actually managed to do this twice in succession, standing up, despite wounds to three of his limbs, and so destroying two Japanese light tanks[523]. Although one source observed that an essential ingredient to using the PIAT was that a man "should have suicidal tendencies"[524], analysis showed that PIATs destroyed 7% of German armour lost to the British in Normandy, compared to 6% lost to the much over-rated aircraft rockets[525]. A skilled man could hit a target over 60% of the time at 100 yards[526].

Ordnance

Before continuing the discussion, an error in the British Chapter H notes and counter-mix needs to be mentioned. The 3" mortar, designated 76* in the game (Ordnance note # 2), and the vehicle-mounted equivalents (Vehicle notes # 67 and 71) should in fact read 81*, as the weapon was 3.21" in calibre[527], or exactly 81mm. This explains why later versions could fire captured German and Italian mortar ammunition (by means of a special, more pointed, firing pin)[528]. Unfortunately, this was fact only discovered recently. All '70' artillery support allocations should read '80'.

British ordnance was the same mixture of the Good, the Bad and the Ugly found in all armies, but pre-war development of artillery had suffered from financial stringency, large stocks of 1918-vintage equipment and the excessive influence of those officers responsible for colonial defence. The latter, for example, delayed the introduction of HE to replace the traditional and inferior shrapnel despite a consensus of technical opinion against them[529]. From the early 1920s there was a growing emphasis on anti-tank artillery and even new field or medium-calibre guns had to be capable of 'self-protection' from hostile armour, at the expense of inter-war research in heavy artillery, since it was deemed to be surplus to requirements thanks to (empty) promises of air support. The few designs of any new ordnance type that were sanctioned had very long development times due to the financial climate, so bulk production before 1936 was impossible. The 25-pdr field gun, for instance, was first mooted in 1925 but no detailed specification emerged until 1936 and production only began in February 1940[530].

When war seemed inevitable this process became more frantic, to the extent that the 5.5" gun / howitzer (based on a January 1939 General Staff requirement) was ready for trials the same year but the first carriages were too light to take the weapon and production of a stronger, welded, version was not cleared until April 1941. Haste therefore brought unexpected delays and, due to the high safety factors insisted on by Parliament, British ordnance tended to be cumbersome by foreign standards, especially its weight. Some safety tolerances were, however, relaxed during the war to speed production, conserve scarce materials and boost ballistic performance, but balanced against this was the need to use inferior metals in British shells for strategic reasons, necessitating thicker shell walls at the expense of the explosive filling; the resultant weight increase also partly explains the poor range of British mortars. Moreover, the use of lower grade steel for shells and a TNT shortage in 1941-1942 made it necessary to use the cheaper and inferior amatol (TNT and ammonium nitrate)[531] in shells, with a reduced *blast* effect[532], though amatol gave better *fragmentation* in such low-grade steel projectiles[533]. This compromised the effectiveness of the 25-pdr in particular[534]. The British agonised throughout the war over using either smokeless or flash-less propellant for their anti-tank and field guns; although the latter increased barrel life and reduced muzzle blast and hence dust, flash-less propellant also produced more smoke to hinder observation. From December 1941 to October 1942 it went out of favour for anti-tank guns and when re-instated the priority for use in 25-pdr ammunition was lowered[535]. As a further example of the improvised nature of the BEF, at least one artillery battery in France in 1940 had only training ammunition[536].

The 2-pdr anti-tank gun and its tank-mounted equivalent are often singled out for odium because they failed to penetrate German face-hardened armour at certain ranges (between 300 and 1200 yards, and sometimes over 1800 yards)[537] but this was due to the uncapped AP ammunition rather than due to any inherent weakness in the gun itself. By the time that APCBC ammunition (which did not shatter on impact like AP had) was available, February 1943 for the 2-pdr (April 1943 for the 6-pdr, and August 1943 for the 17-pdr)[538], German armour thickness had increased to the extent that the 2-pdr was fit only for recce vehicles or for use against Japan. The technique for making small-calibre APCBC was not available and demanded more research[539] and the delay in producing this more effective ammunition again exemplifies the pre-war British contempt for technologists and the preference for quantity over quality. Due to production problems even uncapped 2-pdr AP shot was scarce during the 1940 French campaign. In fairness to the British, the USA had similar problems until 75mm M 61 APCBC became available, because the older M 72 AP 75mm shot supplied for the M3 Lee / Grant in the desert also shattered against German armour, and was rarely effective above 500 yards[540].. Even worse, no AFV (Technical) Branch to examine captured vehicles was set up by GHQ Middle East until November 1941, so that when the British captured a German PzKfw IV as early as April 1941, nobody bothered to inspect it until March 1942 – when its face-hardened armour was finally discovered[541]. The US 37mm had, theoretically, less penetration than the 2-pdr but at least had an APC projectile that coped better with the impact of a hit, hence the latter received a higher 'TK' number in ASL. However, some British Lee / Grant crews apparently did not use the 37mm at all, considering it a waste of money, and relied entirely on the 75mm gun[542].

There is no official explanation for the absence of 2-pdr HE for so long, but the reasons are not elusive. With so much pre-war doctrine in the hands of military theorists with little practical experience of tactical or technical problems, it appears that MGs alone were expected to suffice in dealing with enemy anti-tank guns and other 'soft' targets – Liddell-Hart wrote about such guns being "smothered" by one-man tankettes armed with MGs[543]. This unfounded optimism and the obsession with countering the threat of the tank conspired to give the 2-pdr only AP shot (to defeat as much armour as possible)[544] even though an HE round had been developed as early as 1935[545]; it was also more than mere co-incidence that this emphasis on anti-tank capability came at the very time that the guns themselves, together with the responsibility for anti-tank defence in the British army, passed from the infantry to the artillery between 1938 and 1940. Even when HE was finally issued there were still problems because the small explosive filling gave such poor lethality, and this probably also explains why the British did not issue 37mm HE in the desert campaign. The following table, showing the explosive content of various HE ammunition expressed in whole, or fractions of, pounds illustrates the point:

US	37mm	.085
British	2-pdr	.15
British	6-pdr	.44
US	75mm	1.47
British	17-pdr	1.375 (later 1.882 'high capacity')
US	76mm	.86
British	87.6mm 25-pdr	1.125
German	88mm	2.19
US	90mm	2.43-2.67 (later 2.04)
US	105mm	4.8

Later in the war, light armour mounting the by then puny 2-pdr MA presented crews with the difficult choice of either retaining the 'Littlejohn Adapter' – rashly described by its manufacturers as "Britain's real answer to the Tiger [tank]"(!)[546] - for firing APCNR squeeze-shot (which has been omitted from ASL in the interests of simplicity), or removing the Adapter so that HE could be fired, since the latter could not be squeezed down in diameter like the AP shot. As it was hardly sensible to unbutton and remove the Adapter each time HE was required, some recce troops retained the Adapter on one armoured car and left it off the other, while others simply fired APCNR without the Adapter despite the inferior AP performance of this non-squeezed, larger diameter, shot.

To complete the picture of the 2-pdr, the anti-tank gun was harder to conceal[547] than its nearest equivalent - the 37mm PaK 35/36 - although it had 360° traverse, and it was complicated and difficult to mass-produce (taking 2,682 man-hours to produce against the 6-pdr's 1293 and 17-pdr's 2726)[548]. Its weight also impaired man-handling, but then anti-tank guns survive by concealment, not mobility, and

in the hands of resolute crews its small size enabled it to destroy enemy AFVs with daring close-range flank or rear shots (provided it could be deployed in suitable terrain). This was how the 2-pdr was supposed to have been used[549], and the ANZACS were especially good at these tactics – one account in North Africa describing how a fearless, concealed, soldier would jam a short piece of railway line into the sprocket of a German tank and, as the ham-strung *Panzer* slued round, the 2-pdr would fire at the vulnerable side armour. The 2-pdr saw out the Pacific battles as an anti-tank gun because it could deal with any Japanese AFV frontally, and was easier to man-handle in difficult terrain than its larger successor, though 'officially' it should have been phased-out to ease the logistical burden. Those formations unable to hang onto them used the 3.7" howitzer with HEAT ammunition in hilly terrain where the newer but clumsier and less popular 6-pdr could not go[550].

The story of the 6-pdr is one of delay caused by the urgent need to replace the 509[551] 2-pdrs lost in France, rather than disrupt existing production and introduce a new gun at a critical time. Moreover the first versions had barrels 16" shorter than intended because British lathes were old and small; this situation was only rectified when newer lathes from the USA were installed – another example of British technical weakness[552]. It eventually arrived in the desert not a moment too soon to counter then new German AFVs but, again, HE ammunition only came later and its lethality was poor compared to the 75mm HE round as well as being scarcer. There were also problems with HE prematures recorded in British documents dated as late as April 1944 – due mainly to the incompatibility of certain HE fuses with 6-pdr tubes fitted with muzzle-brakes[553]. That said, the 6-pdr proved more useful in destroying Japanese bunkers[554] than its smaller and otherwise more popular 40mm calibre stable-mate, and in the PTO the 6-pdr was fitted with castor-wheels to ease man-handling in rough terrain[555]. Against Japanese bunkers it was found that the gun was effective at 75-300 yards using AP to first enlarge the embrasure, and then 10-50 HE rounds to neutralise the enemy inside[556].

With APDS ammunition this gun had at least a chance against the frontal armour of some of the later German AFVs at close range, though core separation from the sabot made it less accurate than APCBC, and British reports indicated that it tended to hit a target 2 to 3 feet higher up than predicted[557]. Moreover, the discarded sabot pieces were hazardous to any unprotected personnel within the line of trajectory (see under 17-pdr). This prompted the writer to suggest a special rule in ASL, which would have required all 'human' counters to undergo a MC if they were in close proximity to the LOS of an APDS shot, but this was rejected in the interests of simplicity. DS munitions (albeit not for AP use) were actually pioneered in France by Monsieur Brandt of mortar fame to increase the range of projectiles, and perfected for anti-tank use by Permutter and Coppock in the UK just after 6-pdr APCR had been produced, rendering the latter (found to be ballistically unstable)[558] redundant. Germany experimented with discarding sabot ammunition too, but mainly for AA use, and her chronic tungsten shortages would have prevented the production of APDS in any case. The USA also received 57mm APDS from the British, and the US 1st Army fired 6302 rounds between June and July 1944, and 11,428 by VE Day; it was much rarer in Italy but was issued to US 5th Army troops there in December 1944 with just 180 rounds used by the war's end[559].

The 17-pdr is a success story – almost. Available in good time (for a change) to deal with the later German AFVs, it has come to be regarded by some historians as some sort of wonder-weapon in the British and Commonwealth arsenal. Yet combat experience and various Anglo-US firing trials showed that with 'conventional' ammunition (i.e. APCBC) it "frequently" failed to penetrate the Panther's glacis plate armour even at 300 yards[560], while the desert veteran and South African cricket celebrity Robert Crisp (author of the engrossing *Brazen Chariots*, in which he recounted his brief and eventful time commanding Stuart tanks) noted that the 17-pdr needed three good hits on a Panther's hull front to ensure penetration as most rounds merely scuffed the surface[561]. A British study of German tanks destroyed up to 31st August 1944 in Normandy concluded that only 12.5% of hits by the 17-pdr on the Panther's glacis plate penetrated, compared to 50% of hits on the mantlet or turret front[562]. This was very sobering, given that something between 30% and 70% of all Panthers built from about mid-1944 had poorer-quality, more brittle, armour in the first place, according to *World War Two Ballistics: Armor and Gunnery*, by Lorrin Rexford Bird & Robert D. Livingston (Lorrin incidentally was the creator of ASL's 'TK' system). Small wonder then that in ASL the 76LL with conventional ammunition only gets a 'TK' on the Panther's hull front with a '5' or less, barring a CH, a penetration by the barest of margins.

Nor was the introduction of 17-pdr APDS ammunition the end of the problem as this ammunition constituted a hazard to personnel in the line of fire; the 17-pdr's sabot pieces travelled about 250 yards

at an angle of about 6 degrees from the muzzle and were lethal at all but extreme range, whereas the sabot base plate only hit the ground at 600 yards and was lethal well beyond this distance[563]. Not only were many of the early batches ballistically substandard, but accuracy when firing these projectiles fell in trials against static targets from an average of 87% with APCBC to only 53% with APDS, while British tests with Sherman Fireflies showed that 'scatter' with APDS was 70% higher than APCBC[564], partly because it was difficult to spot the tracer of the APDS when buttoned-up so that fire correction was hampered[565], and probably also because the original pattern of muzzle-brake (as on the 6-pdr) did not allow clean separation of the sabot pieces[566]. Other trials indicated that at 400 yards APC gave a 90.5% chance of a hit on a standard target, whereas APDS gave only 56.6%, and at 1500 yards APC gave 25.4% compared to just 7.1% for APDS[567]. The issue of APDS ammunition was usually on a scale of about five[568] to ten rounds per tank[569], depending upon availability, and was obviously accompanied by orders to conserve it, though reports indicate that it was often 'wasted' on targets that APCBC could just as easily have destroyed[570]. Because of this accuracy problem, the US army considered fitting their much more accurate 76mm APCR rounds into British 17-pdr cases in anticipation of also receiving Sherman Fireflies[571]. According to a British munitions expert and author, Ian Hogg, APDS ammunition itself was unsuitable for the rifling of US guns[572]. As an aside, 76mm APCR was first issued (to troops of 3rd US Armoured Division and 746th Tank Battalion) on 11th September 1944[573], but apparently tungsten shortages meant that each crew had on average less than two APCR rounds each before March 1945[574]; similarly the first 1000 rounds of 90mm APCR were not received until 1st March 1945[575], so the ASL allocations are over-generous.

To close discussion of the 17-pdr, HE ammunition was, as with the 6-pdr, overlooked for over a year and, as with all high-velocity weapons, its explosive effect was inferior to low-velocity weapons of identical calibre since the shell walls had to be stronger (i.e. thicker) to resist the greater forces imposed at the expense of the explosive filling. There were reports of a "considerable percentage" failing to explode, even in 1945[576]. Other woes included HE prematures from certain patterns of fuses[577], and spent cartridge case ejection failures caused by the later, lower-velocity, 'high capacity' HE rounds issued in October 1944[578] producing insufficient recoil to work the extractor properly. The towed anti-tank gun was also a beast of a gun to conceal and man-handle, to the extent that a prototype motorised version, (similar to the post-war Soviet 85mm gun) was made albeit not put into production.

One fact often overlooked by many authors when explaining why the guns of the western Allies were less effective against German armour is that the former initially made comparatively little use of HE bursting charges in AP munitions, probably because any cavity bored out for the explosive weakens the projectile, making it lighter and thus degrading performance slightly, and because the HE fuses often failed to work under the shock and damage of impact. The British had abandoned bursting charges when their 47mm 3-pdr and its APHE were taken out of service before the war. The Germans and Soviets made much more use of HE fillings, which did far more damage after penetration than the otherwise inert solid AP, APC, APCBC, APCR, APCNR or APDS rounds would. The few western Allied exceptions to this rule were the 75mm M 61 'APC' (actually APCBC/HE) rounds fired by British and US 75mm guns and late batches of M 62 'APC' (actually APCBC/HE-T) for the US 76mm gun and 90mm M 82 APCBC/HE-T, but even here the first batches of 75mm M 61 were delivered inert for want of a fuse[579]. Moreover, when it finally had one the British initially removed the explosive from the 75mm rounds and substituted inert material to (marginally) boost AP performance[580]. As a temporary expedient, when it was found that the initial uncapped M 72 AP round for the Grant's 75mm gun had problems piercing German face-hardened armour, the British adopted an idea by the Australian Major Northy to modify captured German APCBC/HE ammunition from the 75mm L/24 (ASL 75*) tank gun and fire it back at its owners. With the help of US Major Jarrett this was achieved by machining-down the thicker German rotating bands on special slow-turning lathes (to prevent the fuses from arming) and about 15,000 rounds of this '75 mm AP-Composite' were thus produced[581]. The combination of the piercing cap, ballistic cap and the HE filling made the round far more effective than contemporary Allied munitions. On the other hand, the solid and inert British shot was more effective against German spaced armour, as used on the PzKfw III gun mantlet and driver's plate, since an HE bursting charge often prevented the penetration of the inner plate[582].

Other British guns of excellent quality included the celebrated 25-pdr, which made a passable anti-tank gun in the desert for want of anything better. Its special turntable, an ingenious feature , permitted rapid traverse by a single crewman and greatly enhanced its anti-tank capabilities as did the fitting of a modified open (as opposed to dial) sight for use in poor light in January 1942[583]. But the 60-second set up and 3-minute limber-up times and low rate of fire (due to two-piece ammunition) were all inferior to

'pure' anti-tank guns, however creditable for a field gun. The AP allocation was, however, officially low; 8[584] (later 12)[585] rounds for the towed gun in 1941 and 11 for the Bishop[586] and 18 for the Sexton[587]. This anti-tank capability owes its origins to a decision made in 1938 that all 25-pdrs of the divisional artillery were to be primarily responsible for their own anti-tank defence[588], and experience in France showed that one field regiment's 18/25-pdrs "was consistently successful" against German tanks "so long as it withheld its fire until the enemy was within 600 yards and conserved its AP shot"[589]. This was asking a lot with just 8 rounds per gun, as the gun's curved trajectory rendered it less accurate in the anti-tank role, while the high silhouette usually denied it sufficient cover in the desert to remain undetected long enough for close ranges shots where hits were more likely to be obtained. It also lacked killing power against fortifications when firing indirect compared to 105mm artillery, primarily because its good range as a field gun came at the expense of shell weight[590].

The 4.5" and 5.5" gun / howitzers were also excellent weapons when their (common) carriage had been perfected, although their reputation suffered a short set-back when prematures caused many burst barrels (attributed to worn gun-tubes, erosion in the bore and dirty or otherwise defective ammunition)[591] The 5.5" gun in Burma was especially prone to prematures when firing the heavier (100 lb) of its two shells[592]. In Burma sometimes the British removed 24" of the 5.5" barrel and, with a delayed action capped HE round, used them for direct fire over open sights against Japanese bunkers to devastating effect[593]. Apparently an average of 15 (!) shots were needed to destroy a bunker[594]. However, one veteran confessed that he never liked the 5.5" gun because crews were "expected to fling it in and out of action as if it were a field gun"[595]. Speaking of Japanese bunkers, combat experience showed that both the 25-pdr and 3.7" AA (of which more below) were both effective against them in the direct fire role with fused HE at 600 yards, and could be 'softened up' first, to break up the outer shell of logs, with 25-pdr AP[596].

The 3.7" AA gun, first mooted in 1920 but not produced until 1938, was one of the best AA guns of its day[597] and a lost opportunity to field a more powerful British version of the famous and deadly German 88mm Flack 18 or 36, albeit a less mobile one. On rare occasions it was used against Axis armour in France and the desert[598], and was issued with steel AP shot for self-defence against tanks[599], though lacking the correct sights and crew arrangement for a true dual-purpose role. Significantly, the official British War Office report on wartime artillery performance tends to mention only small-calibre AA guns used in the anti-tank role, though there is reference to the 3.7" gun being used successfully to harass Axis road traffic during the siege of Tobruk, and for counter-battery fire. This led to low-angle range tables being issued in May 1942[600]. According to the official history of the Mediterranean campaign, 60 3.7" guns were fitted with sights for the ground role in April 1942, for the Battle of Gazala[601]. The gun's air-burst capability cost Japanese troops dear at the hands of Heavy AA batteries in Burma, when it was re-deployed in the ground support role there, one unit being known as 'The Twelve Mile Snipers'[602]. In the ETO its air-burst capability was also very effective against German mortars and other ground targets[603]. The obsolete 3" 20 cwt AA gun of Great War vintage was also a potentially excellent anti-tank gun, but never used in anger. The larger British guns were not particularly good or new, save the Anglo-US 7.2" howitzer Mk VI, which arrived only late in the war.

The British were also poorly equipped in SP artillery because development had ceased in the early 1930s in favour of conventional towed weapons, thanks to poorly defined doctrines and conservatism. The 18-pdr SP 'Birch' gun, developed between 1925 and 1928, for example, was a potentially sound basis for later SP weapons but with funds lacking and a gulf emerging between the tank and artillery factions of the British army, the Royal Artillery refused to adopt it after arguments over ownership. Moreover, to artillery men it looked too much like a tank[604], and "if such a thing were taken on, Gunners would have to dress themselves in dungarees, cover themselves in grease and develop new smells"[605], as well as give up their beloved horses. The tank faction, convinced that the tank would prevail on the battlefield without any outside help, rejected the very notion of artillery support, and so gave the project no backing[606]. Although the un-armoured 2-pdr *portee* had been successful in Greece, where the terrain was suitable for hit-and-run tactics as at Proasterion Ridge[607], in the desert both the 2-pdr and 6-pdr *portees*, were found to be horribly vulnerable as crews tended to misuse them as tanks[608], with predictable results. Eventually firing *en portee* was discouraged, particularly in the case of the more conspicuous 6-pdr version[609], and when so used as many crewmen as possible would dismount, since the impact of a direct hit would throw the gun backwards and kill or injure everyone in its path[610].

The high-sided and ponderous Deacon and the crude Bishop were clumsy and inefficient improvisations; the latter was so cramped that the rear doors had to be kept open in hot weather to

provide ventilation while firing. The Priest, while welcome as a useful and versatile addition to the British arsenal at Second Alamein, fired non-standard ammunition and suffered from a short barrel life and vulnerable recoil gear, which also wore out rapidly[611]. This led directly to development of the Sexton. While more efficient, with a better firing range, more ammunition and superior internal layout than the Priest[612], the Sexton was under-gunned for its size and weight, while the Archer got a mixed reception; M10 crews in Italy disliked its thin armour, rear-ward facing gun and limited traverse, describing it as "quite useless" albeit after only initial impressions[613], though a post-war British report stated that crews liked its low silhouette and few maintenance demands, while the open top and rear-facing gun removed the temptation to misuse it as a tank[614], an aggressive role for such an egg-shell armed with a sledge-hammer that British anti-tank doctrine discouraged[615]. This was a British *Panzerjäger* – a hit and-run ambush weapon, but given that the British army had to adopt an increasingly offensive role to take the war to the enemy and recapture and liberate lost territory, and then invade Germany, heavily-armoured assault vehicles like the Soviet ISU series or the German *Jagdpanzer* vehicles were sorely missed.

Artillery organisation and doctrine

The Germans had taught the British much about artillery doctrine in the Great War, and by the end of this conflict British artillery was very skilled at laying-down 'creeping' barrages to support the infantry and in executing counter-battery fire[616]. Unfortunately amid the complacency of victory many of the lessons of the war were then forgotten and had to be re-learned. In 1944 British counter-mortar units, used so successfully in the desert and Italy, were disbanded for 'Overlord' to conserve manpower and only reinstated in August 1944 after experience showed that German mortars had inflicted 70% of all British casualties[617]. But the main flaw in British artillery practice was an organisational blunder imposed in 1938 (by bureaucrats, not soldiers) whereby field artillery regiments were re-organised into two batteries of 12 guns apiece, instead of the traditional four batteries of 6 guns each, in the interests of 'economy' and technical convenience regardless of tactical considerations. The idea came from an Indian army practice called 'linking' whereby the fire of two adjacent batteries could be controlled from one point, temporarily, until more conventional 'survey' (plotting and calculation) was completed. A new system based on permanent 'linking' and scrapping all the survey work promised significant economies, without the traditional but lengthy and involved method of scientific gun control. It was argued that 'survey' methods were too slow for modern warfare and simple, old-fashioned observed fire would give better results than trigonometry. However, because the basic role of these regiments was to support the infantry brigades containing THREE battalions there were problems dividing two batteries into three without disrupting administration and fire control. This defect of anonymous parenthood was only remedied after Dunkirk by changing to three 8-gun batteries; it was felt that 12-gun batteries were too large a target for German dive-bombers even when divided into two 6-gun 'troops', so 8-gun batteries were split into two troops of 4 guns each[618]. But this could not be done overnight; one source claims that the two-battery TO&E lingered on until 1942 in the desert[619].

As to personnel, the British artillery probably contained the cream of the available intake of the land forces, and from 1926 onwards the promotion ladder for a British artillery officer demanded not only technical competence but was also dependent on passing difficult technical examinations after very thorough training[620], resulting in far higher standards than found in the officer colleges for the infantry and other branches of the army. Junior artillery officers were thus often better qualified than their seniors, though standards did decline as shortages took effect[621]. In their artillery at least the British were numerically as well as qualitatively superior to even their German counterparts.

If British ordnance was of mixed quality it was well handled most of the time, although anti-tank guns were rarely used as imaginatively as German weapons. Ironically, the tactic of luring enemy tanks onto a hidden screen of anti-tank guns was first used by the truck-mounted Central India Horse against the Italians[622] and then by the wily British and Commonwealth defenders in Tobruk in April 1941[623] after which they appear to have forgotten the trick for far too long – a much chastened Rommel did not. With a shortage of heavy artillery for most of the war, and with the RAF indifferent (if not hostile) towards tactical air support in the first half of the war (despite the lessons of 1917-18) due to an obsession with their bombing crusade against Germany, there was an over-reliance on field artillery for both fire support and anti-tank work initially. Not only was it over-worked, it was too thinly spread to provide more than token support well into the desert campaign and even during the liberation of Europe there were complaints that British artillery lacked killing power against dug-in defenders[624].

Once suitable time fuses became available in November 1941 the British adopted the German method of using air bursts to range their artillery to improve accuracy[625]. Time fuses had been dropped in 1935 when shrapnel was abolished[626] and were deemed to be too complicated for less well-trained, conscripted, personnel[627]. However, demands for such fuses in 25-pdr HE ammunition were not made until March 1940[628], and it was late 1943 before the supply became satisfactory[629]. Official preference for the use of delayed action fuses to deal with entrenched enemy personnel followed in October 1943[630]. Luckily the 3.7" AA gun could be used in this role, as stated above, until other guns received time fuses. Even with such fuses, in Normandy whereas two German air-bursts were normally needed to find a target, the British used only one gun per 8-gun battery to do the ranging and if the officer was not particularly skilled 20 rounds might be needed to find the range to a target, which by then might well be long gone[631].

The main problem for the British was how to retain effective control in fast-moving mobile warfare and quickly direct fire to where it was needed, and they solved this brilliantly. Based on the Indian 'linking' system but on a larger scale, not only the adjacent batteries in the same regiment shot as one, but other units would add their firepower too. The use of forward observers was combined with radio communication to revolutionise fire control, but from December 1942[632] the British put senior rather than mere junior officers up front with infantry commanders as well as observers to make the rapid decisions necessary and issue appropriate *orders* for the supportive firepower of an entire corps if necessary, without having to make time-consuming *requests* through the normal command chain[633]. But even then, junior officers could supply fire corrections by radio[634]. The simple and ingenious system was devised by Colonel H.J. Parham who commanded a field regiment in Belgium in 1940 where he used it unofficially and experimentally against German armour; ordering all his batteries to fire 10 rounds per gun without taking any ranging shots into a wood full of *Panzers* engaged in refuelling[635]. With Parham's help Brigadier S. Kirkham then devised a simple drill enabling the forward observer to have control of the regiment's firepower in 3 to 4 minutes[636], compared to the 30minute delay of the inter-war years[637]. Although the system demanded good radio links it enabled every gun in range to quickly smother even a small target with what was effectively a shotgun approach, speed and weight of bombardment to provide hammer-blows in emergencies mattered more than accuracy.

After a near-disaster during a demonstration for the top brass[638] this centralised fire control system was approved and used for the first time at the battle of Second Alamein[639], and came into general use in 1943[640], by which time British artillery was no longer thinly-spread in 'Jock column' battle-groups but concentrated at divisional level or above. Known as the 'U' system ('Uncle' in radio language) it did not replace 'survey' methods, normal ranging or fire-plan techniques – 'Uncle' was reserved for emergencies or targets of opportunity. A call for regimental support (24 guns against an 'Uncle' target) could be answered in just 60 seconds[641], and divisional support (72 guns against a 'Mike' target) in 3 minutes[642], once the system was perfected, and even heavier fire concentrations[643] included 'Yoke' for Army Group Royal Artillery (AGRA) level, 'Victor' for Corps level fire by 150-250 guns, and 'William' for Army level (according to one author probably only used once in Italy)[644]. In Normandy, a German artillery battery would be bombarded with an average of 20 *tons* of shells[645] to silence it, while at Kohima in Burma a month or so earlier that year the British fired 11,500 shells in just 2 days at a time when Japanese mountain guns had an allowance of only 6 rounds per day[646]. To simulate this level of firepower in ASL would utterly destroy playability, but the OBA rules do now give the British the edge over other nationalities, and rightly so. By comparison Soviet artillery methods resembled those of the British in 1916-1918[647], with the bulk of the artillery, especially the heavier calibres, controlled more clumsily *en masse* at higher levels.

The British system was the most advanced in the world at the time and superior to even German techniques, and the US army was quick to adopt it, although their forward observers remained junior in rank[648]. Not only that, but British artillery was usually better-supplied[649] with ammunition than US artillery by a factor of about two[650], in keeping with Britain's 'concentration' on a narrow front compared to the US 'broad front' strategy. This was probably just as well, because experience in Italy and Normandy demonstrated (not surprisingly) that accurate fire was far more effective than hasty and excessive fire concentration, which, if not properly controlled, could in many cases easily degenerate into an abuse of the system - leading to unjustifiably-high ammunition expenditure[651]. To give just one example, it took 25,500 shells to kill just 17 German defenders at Crisot on 26th June 1944[652].That said, its effects on the enemy can be gauged by the fact that German veterans from the eastern front were awed by the heavy casualties inflicted by British artillery in Italy, complaining that 60% of losses were

from this cause[653]. So rapid and heavy was the British shelling that many German prisoners in NW Europe were convinced that the 25-pdr (firing at up to 17 rounds per minute)[654] had power-loading or was belt-fed[655].

Armour

Although all nations produced their share of expensive junk (the inevitable fate of all weapons systems eventually) for most of the war British tank design was a national scandal. Britain's Chief Technical Liaison Officer to US Army Ordnance, G. MacLeod Ross, later wrote "…little of the labour and materials expended on the 25,000 British-built tanks helped to win the war"[656]. A contemporary authority on British tanks of world war two observed that "…anyone who attempts to chronicle the development of British tanks in an entirely positive way should really move over to writing novels… [as] …any researcher is likely to develop a jaundiced view"[657]. Without the US tank arsenal to fall back on, the Empire would never have struck back for even at 2nd Alamein US-made tanks, material and fuel made a decisive contribution. The growing dominance of US-built tanks can be shown by the fact that by 1944 up to 32 British regiments in NW Europe had Shermans, 12 had Churchills or AVREs and 9 had Cromwells. In 1945 the equivalent figures were 25 (minimum), 11, and 8 – while another 4 eventually had Comets[658]. Nor is this the whole story for it ignores the Stuarts found in all RHQs, or the fact that most tanks used in Italy or the PTO were US-built, and that three Churchill units in the ETO were disbanded before VE-Day after heavy losses. Moreover, many British-built tanks used components made in the USA[659]. British tank losses illustrate this further, for although the British only used US built tanks in the second half of the war, of the 15,844 tanks lost by British and Commonwealth forces up to 30th June 1945 from all causes (including losses at sea and scrapping) in all theatres[660], at least 7020 (44.3%) were US-built, and this figure excludes Lee / Grants lost in North Africa after 23rd December 1942 and Lee / Grants lost in Burma, whose losses could not be determined by this writer. Put another way, although no US built tanks saw action until November 1941 fully 29.7% (1258 of 4235)[661] of the British tanks lost between the start of the war and 23rd December 1942 were US built.

The reasons for the British tank fiasco are many and varied, and can only be discussed briefly here. Firstly, as the pioneer of the tank and victors of the Great War Britain had rested on her laurels and allowed her tank producing infrastructure to decay in the locust years between the wars; little equipment was still being made by specialist firms and only one privately-owned (i.e. non-government controlled) tank manufacturer, Vickers-Armstrong, remained since AFVs – especially tanks – were non-commercial propositions in peacetime. Consequently neither prestige nor money was to be made by designing or producing them and the business, such as it was, attracted little design talent. Thus, when re-armament began many heavy engineering and automotive concerns became designer / producers to restore the lost capacity despite their inherent unsuitability. Most had inadequate design facilities and fairly idle plant of patchy quality. Anyone, the assumption went, could design and build tanks and contracts were often awarded on the basis of how to lift ailing companies out of the economic doldrums into which they had sunk in the Depression. The automotive industry in Britain, for example, could in no way be compared to its US counterpart; it was smaller, less efficient and traditionally more concerned with aesthetics than significant technical innovation, while heavy engineering firms such as shipyards and railway workshops had little if any experience of vehicle mass-production.

Secondly, with pre-war research and development severely curtailed financially, there was a deliberate preference for light tanks and armoured cars, individually cheaper both to build and operate, at the expense of more combat-worthy vehicles. The former were also easier to transport and ideal for colonial 'peace-keeping', so they got priority. As few Britons relished or expected involvement in a European war, heavier tanks to cross the trenches, shell-holes and wire of another (static) Great War were given relatively scant attention.

Thirdly, there was a vicious spiral of demand caused by the dearth of pre-war prototypes and the lack of a coherent design policy, coupled with an over-reliance on the French army and its industrial base in Britain's rather hurried war plans. When France fell the British haste to rearm became so frantic that quantity was allowed to totally suppress quality for a critical period. This led to the mass-production of untried designs like the Covenanter, the Crusader and the Churchill, all of which were effectively still prototypes; their components performed well enough in bench-tests but not under combat conditions when assembled together. The deficiency was particularly acute in power units and, for a shorter

period, transmissions (the heart of any AFV); until the arrival of the GMC diesel and the Rolls-Royce Meteor, under-powered commercial engines had to suffice. Because optimistic rearmament forecasts could not be met, technological corners were cut, with lamentable results. Some 1771 (sources vary) Covenanters were built[662], a machine best described as 'junk' (as we shall see later).

Fourthly, there was muddled direction and conflicting requirements. At first there was hesitancy in choosing between French-type heavy tanks and the light, more agile, German machines. Only the defeat of France finally crystallised official opinion in favour of the latter to meet most future requirements. To compound matters, the responsibility for the development and production of tanks passed from the War Office to the new Ministry of Supply shortly before the war began, depriving the soldiers at a stroke of all technical advice and control of specification policy[663]. Consequently, the soldiers could now ask only for what the Ministry of Supply could (and would) deliver, a reversal of previous and normal practice. The Tank Board, created to help formulate policy and liase between the War Office and Ministry of Supply, had only powers of recommendation (if even consulted at all) and its ever-changing members had, mostly, little interest in or knowledge of tank design[664]. It can be dismissed as "an AFV discussion group"[665] or at best little more than a rubber-stamping body[666]. Only user criticism and the bitter experiences of the battlefield gradually freed tank R&D from the jealous clutches of the Ministry of Supply and re-established the War Office's old position, but it was 1943 before any real progress was made and more battle-worthy tanks appeared in significant numbers. With weak overall control of requirements, with most tank producers unskilled at adapting or redesigning existing models, and with the obsession for quantity at any price well into 1941, there was a considerable delay in converting user criticism or requests for improvements into reality, and this was never properly resolved.

For an industrialist or bureaucrat, far from the bloody realities of the battlefield, it was anathema to introduce improvements just when production of the current model had been placed into high gear, and the US tank-building industry displayed a similar reluctance[667]. The large number of Churchill and Cromwell Marks is not so much a chronology of steady improvements as a long series of vehicles belatedly 'reworked' up to approximately acceptable standards of mobility, reliability, gun-power and protection, and the Crusader probably suffered from this more than any other British tank[668]. The lower usage numbers for AFV-produced smoke on the earlier Churchill and Valentine marks reflects the patchy execution of these and other retrospective modifications, about which no complete records appear to have survived. The rather conservative approach to design and production of tanks meant that new features like sloped and welded armour were adopted much later than in most other countries[669], even though the latter had been developed as early as 1930[670] because almost all builders and the army itself lacked enthusiasm[671] when even less complex steels had long been wrongly deemed "un-weldable"[672] and often lacked the expertise, the trained welders or the equipment[673].

Only when reports were received between 1935 and 1937 of armour being welded in Australia, France and Germany were the British stirred into beginning trials, drawing on Australian experience[674]. Even then, one post-war report states that "the "big stick" had to be brought in" before one firm would accept a contract to build armoured cars with welded armour[675]. In 1937 the prototype A10 heavy cruiser had been built with a well-sloped hull front marred only by a vertical driver's visor[676], but the War Office then reconsidered and demanded that a hull machine gun be fitted - in keeping with the tank's infantry support role, so the tank went into production with a vertical hull front[677], creating an unfortunate precedent. Certainly the poorly-sloped hull front of the Comet (like on its predecessors, used in order to provide decent sights for the hull machine gun)[678] beggars understanding so late in the war, and one wonders if British designers ever knew that vehicles like the T-34 or Panther even existed; the Soviets obligingly shipped a sample of their medium tank to the UK in the early war years but British designers did not take the hint. Similarly, despite user criticism of this feature, the British also persisted with the polygonal, and angular, shaped turrets with steeply-sloped sides on vehicles like the A13 Mk II, Covenanter, Crusader and Grant which compromised ballistic protection by providing excellent shot-traps along the area above the turret-ring largely merely to increase the internal space slightly[679].

Fifthly, tank design was hampered by, initially, severe AFV size and weight restrictions. The latter were based on the available engineering equipment (of 1918 vintage, prior to the introduction of the excellent pre-fabricated Bailey Bridge which gave a generous clearance of 11' 4'' and a weight capacity up to 70 tons)[680] that was only slowly replaced and could only accommodate light AFVs. When it came to size, the AFVs had to be rail-transportable because the very dense British railway network had considerable over-capacity and promised quicker, cheaper and easier transportation than

the contemporary less developed road network. Unfortunately, however, Britain (still) pays the price as the pioneer of railways with very tight height and, especially, width restrictions through bridges, tunnels and between multiple tracks – limiting the width of tanks and hence their turret rings so that problems arose when up-gunning became imperative. Whereas the western European 'loading gauge' (i.e., permissible width) is 10' 4", and North America's is 10' 9", in Britain it is only 8' 10" overall, and mostly 9' maximum[681], even though all these areas save Spain and Ireland share the same rail track gauge of 4' 8.5".

Thus Churchill tanks with their side air-intakes removed could just be accommodated, as could the taller Grants and Shermans on special low-slung flat wagons[682], but even when the width restriction was relaxed to 9' 6"[683] at the cost of some disruption to two-way rail traffic on selected routes, the Cromwell and Comet could not unless equipment protruding beyond their tracks was first removed, despite their narrow turret rings. That the Sherman could combine a larger turret ring with a width suitable for British rail transportation speaks volumes for US designers. Ironically, in practice the rail transportation of tanks was largely confined to machines leaving the factory for overseas or storage, and those already adopted by formations usually went by road on tank transporters for greater flexibility and convenience, and from March 1942 road movement became the rule for all new tanks[684], except during the D-Day build-up. Freed of these unnecessary restrictions, the British produced the 11' wide Centurion, a copy of the Panther (albeit slower) which just missed war time service but, progressively up-gunned and up-armoured outclassed all opposition for the next two decades.

Sixthly, firepower was of less concern to the tank builders than to the soldiers manning them; production statistics mattered more to just about everyone else and the gun became almost an after-thought[685]. Thus, a lack of foresight rendered the earlier tanks, especially, incapable of being quickly and easily up-gunned. For example, the turret rings (which determined the size and power of the main armament) in the Matilda II and Valentine were only 50" in diameter, 54.25" in the Churchill, 55.5" in the Crusader, 57.2" in the Cromwell, 64" in the Comet, 66.75" in the Challenger, but a generous 69" in the Sherman, up to 70" in Australia's home-grown Sentinel, and 74" in the Centurion I. Even worse, when the soldiers 'out-flanked' the Ministry of Supply and by what amounted to illegal financial dealings[686] got extra 6-pdrs produced for tank use there were no vehicles immediately available to mount them[687] because the only serious contender, the Valentine, had been re-designed prior to production with a smaller turret. The original turret was probably unacceptable (no one knows the official reason why) because the 2-pdr barrel overhung the hull front[688], a feature that most contemporary designers except the Soviets avoided at all costs. The Churchill was originally conceived as a mounting for various weapons, including the 6-pdr, but this was not permitted until 1941[689], resulting in a year's delay in improving the gun-power at heavy cost in lives and machines. When the 6-pdr was, eventually, first squeezed into the Valentine turret the only MG fitted inside was a locally produced improvisation. Using a shortened empty 6-pdr cartridge-case with a hole bored in it, a .3" Browning was inserted and aimed with the 6-pdr gun sight, a similar improvisation to the MG fired from inside the early German Tiger-Elefant SP gun. Although the British gadget worked well, it was less than ideal[690].

Moreover, the ever-changing specifications usually put gun-power low on the list of priorities[691]; until 1942 the roles of tanks and anti-tank guns were to defeat enemy armour, hence the issue of only solid AP shot. But the folly of this over-specialist doctrine was obvious by late 1941 from desert experiences, and a flood of requests for HE to deal with enemy anti-tank guns followed. As good AP and HE performance are, to some extent, mutually-exclusive much argument and official soul-searching followed before the British embraced the 'dual-purpose' US 75mm weapon as standard a year later. Official requirements in February 1943 called for the majority of tanks to carry his gun but by May 1943 this was lowered to only 30%, with 50% of tanks having 6-pdrs or 17-pdrs, and the rest Close Support (henceforth CS) howitzers. By May 1944, however, the proportions had been changed again to 65%, 25% and 10%, respectively[692]. Montgomery's unfortunate signature on a telegram stating, "…the 75mm gun is all we require" was, alas, taken too literally. In effect this was a rather euphoric over-reaction to the Bad Ol' 'AP shot' days, and the Bad Ol' 'dual purpose' days followed.

Having finally produced the Comet, British designers were then instructed to develop a version with a reduced diameter 57" turret ring to mount the less potent 6-pdr, 75mm or 95mm CS guns already carried in the Cromwell, but fortunately this retrograde step remained only a paper project[693]. More alarming, the fighting in Tunisia and then Europe gradually revealed the need for good AP performance - but many Churchill tank units had already been issued with kits to convert their

machines from 6-pdr to 75mm guns[694] because official thinking prior to D-Day[695] and then initial (and optimistic) reports of the fighting after D-Day concluded that only 75mm guns, and no 6-pdrs, were required in them. It was intended to cease supply of 6-pdr Churchills to units in Normandy as Mk VII production gradually came on stream and replaced losses, and at the same time thus also cease to supply 6-pdr APDS ammunition[696]. On 30th June only 125 Churchill tanks in Normandy had 75mm guns out of 858 vehicles available (492 in service, the rest in reserve) but 386 75mm conversion kits had already been issued[697]. Thereafter 6-pdr Churchill tanks steadily declined in numbers and the few left were used in the role of *ersatz* tank-killers to support the 75mm and 95mm versions on the basis of one per three-tank troop[698]. As if the fighting there had not yet rammed the lesson home, there were also arguments about whether the new Centurion should mount a 17-pdr or the less potent 'dual-purpose' 77mm version[699].

Seventhly, inter-departmental rivalry (at times the War Office and the Ministry of Supply were not even on speaking terms), non-co-operation, stupidity or official inertia and plain 'bad luck' also played their part. A few examples are worth mention. The Cromwell could have been in service by 1942 but for the fact that Leyland Motors, who accepted 'parentage' of the project, argued "tenaciously" in a prolonged dispute for the installation of their modified version of the obsolete US Liberty engine, rather than the superior Meteor[700]. When the Meteor was finally selected, this adaptation of the famous Merlin engine was causing Rolls Royce problems so in December 1942 the industrialists agreed, over lunch, to exchange their respective engine programmes[701]. Although this enabled Rolls Royce to retain their aero-engine specialism, and Rover their tank engines[702], the resultant chaos that this arrangement brought kept the Cromwell out of the war until Normandy[703]. Not only that, but having developed the Meteor from the Merlin, Rover found that the RAF got priority in receiving engines, so production of Meteors had to wait until the RAF "was glutted"[704] with Merlins. To add insult to injury, Rolls Royce had first been asked to produce a 600 hp tank engine way back in 1933 but had done nothing until 1940[705]. The introduction of the Comet was also delayed because the Challenger was given priority over it and because of prolonged arguments over the choice of main armament (contenders included the US 75mm (!), US 76mm, 17-pdr and, eventually, its 77mm variant), over whether the hull should be welded or not and about other "irritating changes to the specifications"[706]. A similar fate befell the Centurion; the need for such a tank was acknowledged in the summer of 1942[707] but thanks to a government ban on any new projects that would not be ready to enter service before 1944[708] no authority to proceed was given until July 1943. So the tank that could have been in service two years earlier finally appeared just after the war in Europe ended, delayed even further over disputes concerning the main and secondary armament[709].

Apart from the Centurion, the best tank the allies never had was probably the Sentinel. This Australian design of late 1941 was the right tank in the wrong place at the wrong time and so made way for other inferior British and US designs that – in the PTO at least – were adequate. The Sentinel was an excellent design with considerable potential, low-slung, with a high top speed and capable in the last version (thanks to an enlargement of the turret ring from 54", then 64" and finally 70") of mounting the 17-pdr gun. Using cast armour extensively, it was a considerable technical (pioneering) achievement for a nation with only limited industrial capacity[710], and deserved a better fate. Quarantined on the Australian mainland, the British would have done well to swallow their national pride and adopt and develop the design instead of the Cromwell but then the 'professional' British designers thought that they knew best (forgetting that an 'amateur' built Noah's Ark while the 'professionals' built the *Titanic*).

If the Sentinel's qualities were wasted through a lack of interest and a perceived glut of Shermans (more on this delusion later), resources in Britain were squandered on the inferior British version of the American 75mm gun; based on a re-bored 6-pdr it had numerous teething-troubles (some inherited from the 6-pdr) and special firing trials were held as late as October 1944 after user criticism. Troops preferred the US version, especially the mounting, side-opening breech for faster loading and the electric firing system[711]. Another example of needless waste in production capacity was the "diabolical" and "troublesome" two-wheeled un-sprung *Rota-trailer*, designed to extend the range and combat duration of tanks in North Africa. But the fuel carried in its hollow wheels leaked out and the ammunition carried in the box between them was shaken around (or soaked by incoming rain water) until useless. Towing the trailers badly affected the tanks' performance and made driving on wet roads difficult and dangerous, especially when reversing. Despite appeals to stop using up valuable shipping space by sending any more *Rota-trailers*, they kept arriving – only to be quickly and unceremoniously

dumped by tank units eager to be rid of them as soon as possible. An 'improved' version was also produced for the Cromwell, but thankfully never used[712].

The AEC armoured cars were also white elephants, and can be regarded as Winston Churchill's folly. A post-war British technical report admits that "As far as is known the AEC never played an important part in the struggle and… …hardly ever went into action"[713]. Produced initially because of Churchill's personal intervention, only the crisis in British tank armament in 1942 kept it in production since it could be adapted to take the 6-pdr gun, but once the Sherman arrived official interest in it evaporated[714]. Documents suggest that the AEC I was not issued to units (experimental vehicles excepted) until January 1943 and were only really useful for pulling other vehicles out of sand as unofficial recovery vehicles[715]. Nonetheless 629 vehicles in three versions were built, but only two armoured car units landed with them in NW Europe with just 8 apiece[716], while the other two used M3 75mm half-tracks[717]. They appear to have been quickly discarded after the breakout[718], though a third unit had them until VE Day, according to photographic evidence[719]. In Italy, although there is a vague reference to AEC IIs being used there[720], details are scanty. In any case, and the superior cross-country performance of the M3 75mm half-track was valued more[721]. The best thing that can be said about the AEC armoured cars is that their engines were exceptionally reliable, going 10,000 miles before overhaul compared to about 6,000 for other British and US armoured cars[722] (though equalled by the White Scout Car)[723].

Then there was the problem of how to mount the 17-pdr in a tank. Far-sighted and desperate soldiers finally got this mounted in the obsolete Sherman as a temporary solution, but the bureaucrats had been asked to do this as early as July 1942[724], so that although the British army eventually got more than the 2100 initially requested they often arrived piecemeal only shortly before D-Day; but in Normandy the 8th Hussars, 13/18th Hussars and probably 2nd Northants Yeomanry went into action without any at first[725], though most units had one per troop, or 20-25% of regimental strength, rising to at least 50% (often more) by VE Day[726]. The Challenger was a poor and unpopular substitute[727] due to its inferior armour and a tendency to shed its tracks thanks to an unfortunate combination of rear sprockets, excessive track and hull length and its Christie suspension (which dispensed with return rollers – a fault avoided on the Comet). Another drawback was its poor ammunition stowage, for it carried only 42-48 rounds for the 17-pdr whereas the Firefly had up to 78 (though some units in Italy removed the 14-15 round front hull stowage bin in the Firefly to improve maintenance access and carry an additional crewman[728], and because in some tanks these rounds were inaccessible from inside anyway)[729]. The stowage in the Challenger was the exact opposite; 31 rounds were in the hull front, three in the hull sides and just 14 readily available in odd corners of the turret[730], and while the tank's second loader was a help in feeding the gun, its rate of fire was not surprisingly too low to warrant a '1' ROF value in ASL, unlike the Firefly. As for the de-rated '77mm' 17-pdr in the Comet, its AP performance was seriously compromised by the absence of APDS ammunition in wartime; small quantities were manufactured from early 1945 onwards[731] but there is no evidence that it was ever issued. It was some consolation that the gun's accuracy and its HE round were both superb, and that fortunately by the time Comet was in service, German AFV targets were comparatively rare.

Eighthly, and last, the British engaged in over-experimentation and the production of 'dead-end' designs that wasted resources, the former activity in part due to the unpleasant experiences caused by the mass-production of tanks straight off the drawing-board earlier in the war. Examples of this wastage included the Tetrarch and similar Harry Hopkins, TOG I and II (an enlarged version of the French Char B, only even uglier), the Cavalier, Centaur, Valiant (the end of the Valentine line with a hull front like the Soviet IS 3 but the usual 'pea-shooter' 75mm armament in a two-man turret), the SP 95mm Alecto, the Challenger, Avenger (a lower-slung Challenger with no other worthwhile improvements), Tortoise (a super-heavy 3.7" SP gun with the mobility of Fort Knox), Nellie (a 131-ton trench-digging machine, the A[mphibious] T[ank] 1 – an ungainly cross between an LVT and a Covenanter tank, and the Black Prince (a widened Churchill with 17-pdr gun). None of these gave the British army a battle-worthy AFV like the Soviet T-34 family. With hindsight it is easy to criticise of course, but no British tank that saw action in the war combined such good qualities as the Soviet *Schneekönig* ('Snow King', its German nick-name).

The Matilda II, for example, was a contemporary vehicle and Britain's best tank when war began. It is true that it had good armour and for a short time was superior to any German tank, but even here the British erred. Inadequate testing had fostered the delusion that it could resist the German 88mm FlaK gun above 440 yards range, whereas it was actually vulnerable at over 2000 yards[732]. This was finally

and tragically demonstrated in 1941 when Matilda IIs were confidently sent in against dug-in 88mm guns – at 'Battleaxe' 99 of 104 Matildas deployed were lost[733]. The tank's small turret ring prevented up-gunning with a more versatile weapon to execute its infantry-support role and even the CS versions were more smoke-layers than HE weapons since the HE round was of poor quality and also scarce. This left only the inadequate CMG to deal with 'soft' targets out to 800 yards at most. The turret ring was also badly protected against 'splash' from incoming projectiles, rendering it very prone to jamming[734]. Nor was the Matilda designed for the rigours of mobile warfare, but as a slow-moving assault tank to be used for short periods only between lengthy spells of maintenance and preparation; its steering clutches were nowhere near rugged enough although this was less of a problem in open desert terrain than on roads. It also had high ground pressure and was not particularly reliable, though its pre-Dunkirk tank crews, mechanically better trained than their followers[735], did much to save its reputation. Matildas were also difficult to mass-produce owing to the many armour castings utilised and were probably the most expensive British tanks to see combat in the war[736]. This was not exactly good value.

The British AFVs have low rates of fire in ASL not just because their small turret rings made for cramped interiors, but also because doctrine called for radios to be fixed in the turret rear and for the main armament to be fitted well into the turret to help balance it for the purpose of power traverse (more on this later) and for the gun to be housed well inside the turret to help balance it for the purpose of free gun elevation[737]. This all conspired to reduce internal space. In addition, British tank interiors were criticised in a post-war report for being far too cluttered with stowage[738]. Moreover, official doctrine emphasised accuracy and ammunition conservation and crew safety, all of which kept rates of fire low. Inadequate field testing meant that while rapid gun-laying was theoretically possible through the use of the special shoulder-rests that gave free elevation for tank gunners operating 2-pdr and some 6-pdr weapons, the device was actually very tiring to use and detrimental to performance. Worse, the misalignment of the gun-sights in 2-pdr armed tanks was only discovered after nearly two years of fighting, causing the shot to fall short and nullifying any hope of a first-round hit. Ironically, it was an ex-artillery officer who discovered this defect but he then had to overcome official resistance to even admitting a problem existed, let alone implementing a solution[739]. British wartime gun mountings had a poor reputation for reliability; poor design meant that the recoil of the gun tended to disturb the elevation setting on 2-pdr and 6-pdr guns[740], and a post-war report states that this was aggravated by slip-shod workmanship and poor materials, particularly in the early Crusader, which needed field modifications to 2-pdr and 6-pdr guns before the recoil systems worked properly[741]. Initially the British practised firing on the move, hence the demand for free elevation, but German tanks in the desert (which fired while stationary), soon showed this to be a waste of ammunition, tanks and their crews since accuracy was so poor. The British appear to have made little if any use of the unpopular[742] and "imperfect"[743] gyro-stabilisers fitted to their US-built AFVs except in Italy[744] to a limited extent, but said that this equipment was excellent for producing spraying fire[745], indicating a lack of faith it its ability to improve gun accuracy.

In ASL the overall reliability of British AFVs is justifiably scored lower than US vehicles; even when improved types like the Valentine, the de-bugged Churchill and Cromwell arrived, they still demanded lengthier maintenance than the Sherman (the latter described by one Korean war veteran as "the perfect conscript's weapon")[746]. One major problem concerned the accessibility of components for inspection, maintenance or replacement, particularly in the Crusader. So unreliable was this tank that commanders in the desert had to plan operations on the basis of a 25% reserve to allow for those out of action in the workshops[747], and as late as March 1943 over half of 8th Army's 717 Crusaders were unserviceable[748]. In contrast, the mechanical reliability of the (in this respect) superb Czech LT vz 38 chassis and the US vehicles in general are better than the British and Soviet AFVs in ASL with good reason; the LT vz 38 needed just 30 minutes of maintenance each day[749], and the Sherman about an hour[750] (though it often got by on less). In comparison the Crusader, Grant and Valentine needed about 3.25 hours[751]. But the real 'prima donnas' among Allied tanks were the Covenanter, the Churchill and the early Soviet KV 1s; the British tanks needed 4 hours of daily[752] attention if mechanical tantrums were to be avoided, while the latter's engine needed lubrication after only 1-2 hours' running [753]. That is not to say that US vehicles were free from mechanical woes, particularly the transmissions on early Grants and Shermans[754], some patterns of tank tracks [755] and the transmissions in the early Staghound armoured cars[756], but US industry was far better at implementing speedy remedies.

Thanks to British amateurism in technical matters[757], the mechanical reliability of British tanks was very poor and in 1940 75% of British tanks left in France were lost through mechanical break-down[758];

in the early desert battles it was still 60%[759], compared to losses through break-downs AND ditching of 60-63% at the battle of Cambrai in 1917[760]. The lack of tank transporters until 1942[761] to cut-down non-tactical movement also conspired to increase wear-and-tear, as did the nightly routine withdrawals from the battlefield. Experience in the desert and Greece also showed that the tracks of the early and often worn-out[762] British cruisers were too fragile, and sharp turns could easily snap them[763], and to minimise tracks breakages speed had to be limited to 10-12 mph[764], whereas the elated British crews of new Stuart tanks failed to snap the tracks despite deliberate attempts to do so in tests[765]. The early Churchill's battle debut was considerably delayed due to the evil reputation that it had gained for poor reliability even in the cooler UK climate, and there was great (with hindsight, unjustified) reluctance at first to send it to the desert, even after running trials there with two samples had gone well[766]. The Crusader's inherent mechanical weaknesses were worsened by often poor workmanship[767], while two British tanks in particular – the wretched Covenanter and the Light Tanks Mark I to VI shared an unfortunate tendency to 'reverse-steer' (i.e. turn in the opposite direction to that desired) in certain conditions[768], although it was not unknown on the other steering systems used prior to the Crusader's. The Light Tanks were also dangerously top-heavy[769], but then so was the Sherman (especially the 76mm version)[770]. If the Covenanter's compressed air steering and braking system ran out of air while running down-hill it could have potentially catastrophic consequences[771], while the turret lid's safety-catch was unreliable and likely to decapitate the commander[772] or at least rob him of some fingers[773]. Ventilation was also a problem and the badly positioned cooling system roasted the crew, especially the driver[774]. None of the foregoing can have done much to inspire crew confidence. Later designs were not necessarily free from problems either; both the Challenger and Comet suffered from front idler assembly failures, and the Comet also from final drive gear failures, to the extent that many Comets had spare Cromwell final drive gears substituted to cure the problem[775].

Other factors contributed to British woes, including a total lack of standardisation. On the eve of war Britain had two types of light tank, five types of cruiser, three infantry tanks either in production or development using six different suspension types, seven different engines, four different transmissions plus numerous different track systems which demanded a huge variety of spare parts, repair and maintenance requirements and driving techniques[776]. By 1942 there were even more, with 16 different types in service, but of which just 3 were if US origin[777]. Worse, the supply of spare parts was often chaotic, and not soundly based on running trials but on the basis of analogy with other vehicles with quite different characteristics[778]. Even in 1944 the British had a plethora of tank types mixed within units, or operating in the same theatre. This quartermaster's nightmare cannot have helped reliability, especially as British manufacturing techniques were often poor with a 'craft' approach that mass-produced parts to only crude tolerances before relying on hand-finishing to make the parts fit[779].

Attention to detail was also a major problem. As a country that boasted an Empire covering one-third of the world's land surface, British logistics were generally excellent if sometimes improvised[780] but important lessons were forgotten for a time. Tanks were often moved around dockyards under their own power with empty radiators, to the detriment of the Crusader's delicate cooling system in particular[781]. Worse, while US tanks sent overseas were thoroughly water-proofed, British tanks arriving in the desert were often in a shocking state after being stowed as deck cargo with no attempt made to protect them from the elements, or in holds without being properly secured against movement (hence collision) in rough weather. A post-war report stated that up to early 1942 tanks arrived with many damaged parts due to careless stowage, the ingress of water or the growth of rust and mould, and items like tool kits had often been stolen. Of 111 Crusaders landed, 78 needed 30-60 man-hours of repair work each, and 14 needed over 100 man-hours, all 24 Valentines in a batch needed an average of 80 hours, and two between 80 and 250 hours, while of 11 Matildas received four needed at least 200-250 hours, five 250-400 hours, and 2 more than 400 hours. The cause was attributed to difficulties in ship loading during bombing attacks, and the long 5-month sea journeys during which the vehicles could not be given any attention. A marked improvement soon occurred, after Churchill's personal intervention, from April 1942[782]. Even then, British tanks were still shipped to the desert in UK camouflage[783] paint, and without desert-pattern fittings like dust filters to try and confuse imaginary enemy agents as to their real destination. This obsession with secrecy then demanded considerable effort by desert workshop staff to refit and repaint the vehicles for desert conditions[784]. A report concluded that the Crusader's air filters were placed in the worst position possible to keep out dust, and to escape damage from enemy fire[785], and by way of a later example, the Challenger could not be used on D-Day because no deep-wading gear had been produced for it[786] and the long guns prevented conversion of Challengers (or Fireflies) to DD status. Fortunately the Firefly at least was given deep-wading equipment[787].

Another example of this weakness is the use of the leaky British 'flimsy' 4-gallon gasoline container. Produced by a local firm in Egypt, this was a ghastly product compared to the leak-proof German 'jerry-can'[788]. Calculations showed that on a 250 mile journey between 25%[789] and 33%[790] of the fuel being transported to the front would be lost. One veteran commenting on the desert war said of the flimsy (and British logistics) said

> *"The general waste was fantastic. I have seen a petrol lorry loaded with these disposable petrol cans with petrol running off the tail board as if a tap had been turned on. Danger of fire, particularly in shelling, was great. Usually there was a lorry to be seen somewhere on fire*".[791]

The combination of the 'flimsy' and the poor range of the early Stuart tank were particularly unfortunate for British crewmen[792]. However, just to show that wastefulness was not merely a British trait, in NW Europe by early September 1944 half of roughly 22 *million* (!) jerry-cans shipped there by US forces to carry fuel had been lost through careless handling[793].

Speaking of fire, the later British tanks burned more slowly when penetrated than German or US tanks (even allowing for the fact that the Germans made more use of explosive-loaded AP ammunition than the British), giving their crews more time to bale-out. This was attributed to British trials in the desert in 1941 with wrecked tanks filled with fuel and ammunition[794] from which the British took steps to improve ammunition stowage to reduce the hazards from fire. The British also filled the Crusader's auxiliary external fuel tanks with water, reducing the fire hazard and creating a useful reserve of this rather precious commodity in the desert, while Crusader IIIs were also fitted with 'home-made' steel ammo bins to reduce the risk of fires from hot splinters if the armour was penetrated[795]. The crews in early Crusaders especially tended to fight with open hatches to make escape easier, and the extra (side) escape hatches on Churchills were especially welcome too. British studies revealed that between 80%[796] and 100%[797] of Shermans caught fire when hit (compared to only 50% of Comets[798] and about 60% of Churchills)[799] and the British wryly named their Shermans '*Ronsons*' after the cigarette-lighter manufacturer whose slogan was "lights first time", while the dry-humoured Germans called them '*Tommy-cookers*'. Yet a late-war analysis of an admittedly small sample of 333 destroyed British tanks and 769 injured crewmen revealed that despite the Sherman's evil reputation for catching fire more quickly than tanks like the Churchill (typically claimed to be between 3 and 5 seconds for the Sherman, and 10 for the Churchill)[800] it apparently made little impact on the overall statistics for crewmen suffering *burns* in this study[801] (see further discussion below).

However, leaving *burn* casualties aside for a moment, another study of 3710 destroyed British tanks did indicate that Sherman crews fared worse overall than men in other knocked out tanks. Of those tanks lost to mines, in Shermans 24.6% of their crews suffered casualties (wounded or killed), though Stuart crew casualties were even higher at 34.6%, while the figure for Churchill crewmen was only 14.7%, and for Matilda, Valentine Grant and Cromwell crews lumped together 17.4%. AT guns inflicted casualties on 41.4% of crewmen in destroyed Shermans, 29.8% of Stuart crews, 34.4% of Matilda/ Valentine/Grant/Cromwell crews, 38.5% of Crusader crews, but oddly enough fully 45% of Churchill crews. This anomaly is not explained, though it could be due to a reluctance of AT guns crews to engage the thick-skinned Churchills from the front, and rely instead on more devastating side or even rear shots. Among losses due to enemy tanks, 41.7% of Crusader crews suffered casualties, (unusually again) as many as 46.7% of Churchill crews, 51.7% of Stuart crews, but a grim 60.5% of Sherman crews. For losses to SP guns, 30% of Churchill crews became casualties, compared to 54.3% of Sherman crews. Finally, SCATW inflicted casualties on only 14.7% of Churchill crews, but on 44.7% of Sherman crewmen. To put these into perspective, and illustrate how varying terrain features affected tank losses, of 1734 destroyed British tanks examined in North Africa, 19.5% were lost to mines, 40.3% to AT guns, 38.2% to enemy tanks and 2% to other causes. In Italy, of 671 wrecks examined, fully 30% fell victim to mines, 16% to AT guns, only 12% to enemy tanks but 26% to SP guns, 9% to SCATW and 7% to other causes. In NW Europe of 1305 wrecks examined, 22.1% were mine victims, 22.7% fell to AT guns, just 14.5% to enemy tanks, 24.4% to SP guns, 14.2% to SCATW and 2.1% to other causes[802]. One conclusion that British experts came to was that very few hits on Sherman tanks by German AP shot failed to penetrate, and that there were many complaints that the armour had low resistance, even to .3" or .5" Browning MG rounds. But more telling perhaps, the report admitted that "it is at present the practice to recondition for service partially-brewed up tanks

whose quality of armour might often be low" [803], due of course to the fires softening the plates. British 'economy' again?

In the late-war study already mentioned, examination of British wrecks revealed that 50% of *Panzerfaust* hits were on the turret, as against 30% for other weapons, and that 50-60% of all hits penetrated. 38% of crew casualties were fatal, with an average of 1.4 deaths from armour-piercing shot, and 1.3 from hollow-charge weapons. 25% of all casualties were burns, with no apparent difference between Sherman crews or any others, and certainly the statistics for Churchill tank crew casualties were no better than those for the Sherman, however much superstitious crewman might have thought otherwise[804]. Wet stowage Shermans might have increased crew confidence but comprised only 7.7% of those supplied to Britain[805], and not all of these saw action. Moreover, a post-war British report stated that wet-stowage Shermans used in the Mediterranean theatre were no less combustible than dry-stowage types, and attributed this to the fact that the Sherman IIA carried most ammunition low in the hull rather than in the more exposed panniers located above track level used in other dry-stowage types. Most fires were blamed on poor ammunition stowage discipline by crews, as many British, US[806], and German[807] vehicles carried far more ammunition than had been authorised. Certainly the 1st Battalion Coldstream Guards, part of 5th Guards Armoured Division, suffered only 5% 'brew-ups' during 'Operation Bluecoat', and attributed this to a policy of not carrying any ammunition outside the armoured stowage bins in their dry stowage Shermans[808]. Both British[809] and German[810] analysis revealed that while the fitting of spare track plates to augment a vehicle's own armour might boost morale, it made little difference to overall protection, and on vertical or near-vertical armour could actually compromise it[811]. But the British at least did not waste time trying to convince superstitious and sceptical crews of this fact, who could not help but notice that whereas the Germans usually added *appliqué* steel or concrete armour when up-grading their older AFVs, most British vehicles were incapable of bearing – officially at least – this extra weight[812]. Certainly two independent British studies concluded that the *appliqué* added to the side of Sherman tanks to give extra protection to the ammunition bins brought no improvement[813] and at certain impact angles sometimes even acted as a shot-trap[814].

There were, of course, more deserving 'home-grown' scapegoats than the Sherman when it came to poor 'crew-friendliness', and many of the horribly-vulnerable Light Tank Mk VICs went to France in 1940 largely without armament, with the holes in their turret fronts plugged with plywood, and with their crews armed only with pistols and rifles. Some met the *Panzers* in this condition[815]. The price of misusing such light vehicles as battle tanks is illustrated in *FKaC* scenario # 96 'The Crux of Calais'. Like the Sherman[816], the Covenanter and early Cromwells had hatches for the driver and co-driver that could not be opened when the turret was turned to certain angles[817]. This greatly reduced a hull crewman's survival chances if the vehicle caught fire, and is reflected in ASL's lowered Crew Survival number of '5' for the Centaur and Cromwell IV as opposed to '6' for the later models. Also, the auxiliary MG turrets fitted to some early British cruisers and Crusaders were officially condemned as being "unfit for human habitation"[818] even in cooler European conditions, let alone the desert heat, especially as the British BESA MG produced more (toxic) fumes than other types in use[819].

In addition, many early Crusaders had armour of very poor quality compared to US armour plate[820], and a post-war British technical report stated that the 'Composite plate' used on Crusaders - with a harder outer plate bolted onto a softer welded inner structure - was ballistically unsound, as two plates butted together offer less resistance than a single plate[821]. There is evidence that some Churchills had poor quality armour[822], and in Tunisia cases of the steel flaking badly when penetrated were reported[823]. Although some Churchill VIIs were available by D-Day, they were comparatively rare outside Crocodile units not just because of slow output and a desire to use up older types first, but because a number had to be withdrawn for field modifications in July 1944 due to the poorly secured glacis plate armour that could fall inwards under the shock of impact[824]. Some Cromwells too suffered from sub-standard armour made by an inexperienced manufacturer, though this batch of vehicles at least saw no action[825]. It should be stressed that poor quality armour was a problem faced by most combatants at some stage; a British post-war report stated that it was a common saying in the desert war that when Italian armour was hit "the whole of the side fell out"[826], and a wartime report observed that the armour flaked very badly and "whenever one of these machines [M13/40] had been penetrated by a small shell, the whole crew has been cut to pieces"[827]. British experts also noted inconsistencies in the quality of the Panther's hull front armour, and also observed that German welding of armour was usually of poor quality[828] Despite pressures forcing a reduction in the use of scarce non-ferrous metals like nickel, molybdenum and chrome, strict British production controls usually avoided a later fall in

armour plate quality[829] even though almost all armour was manufactured by the open hearth method of steel production which made quality control more difficult[830].

Having dwelt so long on the negative aspect of British tanks, it is only fair to discuss the good points for the sake of balance. The BESA MG with its telescopic sight was preferred over the slower-firing US .3" Browning, which lacked sights and was regarded as fine for spraying fire only[831]. The BESA was much better for economical, aimed, bursts[832] as expenditure could be very high – in one "brisk engagement" in Italy a British Sherman unit expended 93,000 MG rounds[833]. In comparing the Sherman and British tanks from a mechanical standpoint, the latter's lower silhouettes (in at least some instances) and off-road mobility were superior; the Churchill in particular often surprised the enemy by appearing unexpectedly in apparently 'tank-proof' terrain like the steep Tunisian, Italian and, later, Korean hills or the muddy *Reichswald* forest. The Churchill was under-powered, slow and most, later, versions had only a five-speed gear-box but with closely-spaced gear ratios. The engine moreover had the high-torque characteristics at low speed normally found only in diesel engines[834]. In addition, it was very sure-footed thanks to heavily-ribbed and wide steel tracks with a long ground contact length, hence Churchills has a slightly lower ground pressure than many contemporary allied tanks (though not sufficient to warrant lower GP ratings in ASL) but still plenty of grip, with the ability to make a 'neutral turn' (spin on their axis). All this gave Churchill crews immense confidence to tackle rough terrain, and the Churchill's capabilities have now been recognised in ASL with new rules for the Churchill when hill-climbing. One German officer even complained that it was "unfair" of the British to use tanks in the *Reichswald*[835]. Given that the British made only little use of the Culin Hedgerow Device[836] since it was not available to them until the end of August 1944[837], the Churchill's ability to cope with Normandy's *bocage* better than other tanks was very welcome[838]. In fact two separate British reports contradicted each other on the effectiveness of Culin's device ('Prongs' in British terminology), but the Churchill in particular was deemed to perform better without it[839]. In comparison, the Sherman fitted with only standard-width tracks needed good roads to be really effective when conditions were muddy or 'soft'[840], and a good example of how road-bound Shermans could limit the tactical options is the *FKaC* scenario # 108 'Guards Attack'. The best automotive feature of British tanks was the British Merritt-Brown transmission (from which the Tiger's more temperamental system was developed)[841] which gave the Churchill, Centaur, Cromwell, Comet and Centurion the unique ability to spin on their axis, whereas the Stuart, Lee / Grant and Sherman had the cruder Cletrak system that often gave an insufficient turning circle for Europe's narrow lanes or Burma's and Italy's many hair-pin bends, even in bottom gear[842].

Nor were the British blind to these faults in foreign designs, though British criticism sometimes went too far, to the point of being churlish. While the Stuart was adequate in the desert, by 1944 it was outdated and less well regarded; in Normandy it was described as an "atrocity on tracks" with a gun incapable of harming "anything tougher than a water-truck"[843] and too tall and conspicuous even for the intercommunication, let alone recce, roles now assigned to it. The Lee / Grant was described with justification as standing out "like a fairy on a rock cake, visible for miles around"[844] and "as high as the Tower of Babel"[845]. In July 1943 the Sherman was unwisely dismissed as "…less reliable than the Valentine [doubtful], more vulnerable than the Matilda [probably untrue], slower and more conspicuous than the Crusader" [true, assuming the latter had not broken down], and had "… a proneness to catch fire [true], [an] indifferent gun-sight [true], inferior secondary armament [true, no decent sights on the hull MG], vulnerable hatches and louvres"[846]. The reliability of the radial-engined Shermans was also deemed inferior to the Cromwell[847], but all other sources disagree[848], and at the end of the day these US vehicles did the job asked of them. One British official even had the nerve to tell an American counterpart that the UK resented the USA "forcing Shermans on them" after alleged over-production led them to push the surplus off onto Britain and, as self-appointed spokesman, alleged that no more were wanted[849]. He failed to explain how Britain could have managed without them, and may not have known (but should have done) of the great efforts by British officials in the USA to get a share of these tanks, and to have their national preferences incorporated into the design[850]! Nor was such ignorance confined to the war years; the modern historian Russell A. Hart wrongly argues that the USA supplied Britain with only its "reject" Shermans in Normandy, implying that these alone were the inflammable types[851], and lists only the M4A1, M4A3 (not used by the British in Normandy) and the M4A5[852] (in fact a 'paper' designation for the Canadian Ram tank) instead of the M4A4, whereas the British also used the M4 and the M4A2[853].

Perhaps the most significant British advantage lay in turret traverse systems, and this has now been recognised in ASL following extensive research by this writer long after *WoA* was released, and

explains why the Challenger and Comet have now been given fast turret traverse in ASL. Britain developed an hydraulic turret traverse system based on power turrets fitted to RAF bombers, and later also an electrical system, both having a specification demanding 360º traverse in 20 seconds (though this time varied, depending on the size and weight of the turret). The hydraulic system was first tested on an A9 cruiser in 1938 but the War Office specification of a full rotation in only 8 seconds proved to be over-ambitious and a slower speed had to be accepted - after a lot of work[854]. These systems gave a range of creep speeds so that power could actually be used for the fine laying of the gun, which speeded-up the firing process in situations where a split second could mean the difference between life and death. In comparison German, Soviet and early US systems were less effective, the former being dismissed in a British post-war report as "exceedingly cumbersome and inefficient. Training by power was never attempted, possibly because German turrets were usually wildly out of balance"[855]. Hydraulic traverse systems in the British army (at least) gave way to electric gear because of the wish to avoid oil leakage[856], and to lessen the fire risk if a vehicle was penetrated[857].

In short, German, Soviet and early US turrets were slued round in the general direction of the target and sighting adjustments were then made by hand. Britain sent a sample of the hydraulic version to the USA in 1940, and from this with considerable British pressure and input[858] the Oilgear system was developed, along with the inferior Loganport hydraulic and Westinghouse electrical systems (both of which suffered from tight spots and variations in friction, especially the Loganport gear)[859]. It is no wonder that US crewmen tried to get into a Sherman with an Oilgear mechanism[860]. The systems used on vehicles like the T-34s, Valentines, Lee / Grants and those (later) versions of the Stuart that had power traverse suffered from considerable 'back-lash' in the mechanisms; even after British modifications the hand traverse and elevating gear on the early Stuarts was so poor that crew were reluctant to traverse the turret in action[861]. When the Lee / Grant's 37mm gun was used at all, crews also preferred to use manual rather than power traverse[862]. The Italian L6/40 and M11/39, the first batches of Soviet T-34/85s[863], the German PzKfw III family, the US M 10 and Staghound had only hand traverse; the PzKfw III needed 88 hand turns in high gear to traverse 360º, and 132 in low gear for fine laying[864] while the M 10 gun crew needed about 80 seconds to turn the turret just 180º[865]. The German hydraulic systems were directly dependent on engine speed, while the PzKfw IV used a crude electrical system. Another German disadvantage was that their better but more complicated sighting equipment[866] took a little longer to operate and this could give allied vehicles an edge in a gun duel. One advantage of US traverse systems over British equipment was that they were run from batteries, and so could be used 'silently' with the tank's engine turned off[867]. Yet according to a report by a US Tank Destroyer officer, his M36 crews used power traverse only in training, and preferred manual traverse in combat (which was far smoother than the M 10's manual system)[868]. Little data on Italian systems seems to have survived, but Italian sources state that their hydraulic systems turned the turrets only slowly, were badly sited in the centre of turrets, were large and cumbersome (especially the earlier of two versions) and often removed by crews who regarded them as "almost useless"[869].

The superiority of the British systems (with some exceptions) can be seen in the following table, gleaned from numerous published and unpublished sources[870]:

Vehicle	Fastest traverse time (seconds) 360º using power	Control Quality (and type)
Tiger II	<10 @3000 engine rpm**	Poor (H)
A 13	10	Good (H)
Crusader	10	Good (H)
Valentine 2-pdr	10 left / 12 right	Poor (E)
AEC I	10 left / 12 right	Poor (E)
AEC II and III	11	Poor (E)
Challenger	12 @ 2700 engine rpm	Good (E)
T-34/76	13.8 left / 13.6 right*	Poor (E)
Matilda II	14	Good (H)
Stuart M5A1	14.4 left / 14 right	Poor (H)
Cromwell	14-15	Good (H)
A9	15	Good (H)
A10	15	Good (H)
Churchill	15	Good (E)
Sherman	15 Oilgear type	Good (H)

Sherman	15 Loganport type	Poor (H)
Sherman	15 Westinghouse type	Poor (E)
M 18 TD	15 Oilgear	Good (H)
M 36 TD	15 Oilgear	Good (H)
M 24 Chaffee	15 Oilgear	Good (H)
T 26 / M 26	15	Good (H)
Panther A	15 @> 2500 engine rpm (forbidden 11/44 >)**	Poor (H)
Stuart M3A3	15.4 left / 15.92 right	Poor (H)
Valentine 6-pdr	16.9	Poor (E)
Panther G	18 left / 17 right	Poor (H)
Panther A	18 @< 2500 max engine rpm (max from 11/44)**	Poor (H)
Tiger II	19 left / 18 right @ 2000 engine rpm	Poor (H)
Lee / Grant	20	Poor (H)
Ram	20	Poor (E)
T-34/85	21.1	Poor (E)
Comet	24	Good (E)
PzKfw IV	25.07	Poor (E)
S35 Somua	36	Poor (E)
Char B bis	36	Poor (E)
Char D2	36	Poor (E)
Panther D	60	Poor (H)
Tiger I	60	Poor (H)
KV 1	60-70	Poor (E)

(H) = hydraulic mechanism, (E) = electric motor.

* One source gives 10 seconds for all T-34/76 versions, which does not seem to take increasing turret weights of successive versions into account; this figure probably therefore only applies to the earlier M 1940 version with smaller and lighter turret. ** To preserve engine life German crews were eventually restricted to 2500 rpm when traversing; whether they obeyed this official edict is another matter.

The mounting of the 17-pdr in AFVs also allowed the British to engage and defeat the German armour in Normandy (most of which was concentrated against them) more effectively than the US army's less potent AFVs. It is also one aspect of the tank war that the British were and still are very self-righteous about. The USA at first ignored British offers of 200 17-pdr barrels per month if Uncle Sam would build his own Sherman Firefly turrets[871] and US forces were never to use this "shot-gun wedding of a British gun to American reliability"[872]. It has been customary to blame the US army's initial in-difference to the Firefly on a 'Not Invented Here' policy but recent research suggests there were also other reasons. Firstly, a lower threat perception of continuing German AFV development, partly due to a lack of combat experience compared to the British, making the USA complacent[873]. Secondly, British military opinion was widely held in contempt in the USA concerning tank technology[874]; so hostile to anything British were certain 'patriotic' US officers that when the British suggestion for comparative trials against US weapons was finally granted, the 90mm gun had its performance secretly boosted by the addition of propellant taken from British 17-pdr rounds [875]. National pride, it seems, counted for more than American lives. Thirdly, various 76mm weapons with two sets of non-interchangeable ammunition were already being produced in the USA, not to mention the 90mm gun, and the 17-pdr would only further complicate logistics. Moreover, the inadequate performance of these weapons against the Panther was not yet known. Ironically, the M 10 had been designed to mount the 17-pdr[876], but none were so used by US forces. Fourthly, the 17-pdr's fierce muzzle blast and an alarming flashback at the breech end suggested design problems[877] – with hindsight, unfounded – though the British at one stage considered issuing crews with naval-style anti-flash clothing[878]. Fifthly, 76mm APCR was the great white hope that would render the gun's performance close to the 17-pdr's – or so it was thought. When the fighting in NW Europe revealed the 76mm gun's shortcomings, even with APCR, the wishes of US field commanders were ignored, or frustrated, and many American tank crews were condemned to a needless death by this policy.

The US army subsequently twice requested Fireflies from the British and about 100 of the initial order for 160 conversions were started using, preferably, the M4A3 (W) and some M4s too but none arrived in time to see combat in American hands. 'C' company of the US 755th Tank Battalion had 12 M4s (British ICs) allocated in April 1945 in Italy, by which time the war was effectively over and they were

never used in anger[879]. This delay was caused by various factors. According to Ross, by October 1944 the US army had lost 1400 tanks in NW Europe, 90% being burned out (i.e. irreparable), plus another 400 in December and 510 more during the Battle of the Bulge[880] and had not anticipated losses on this scale, causing in turn a critical shortage of 75mm Shermans (which by then the USA was no longer producing as production had been scaled down)[881]. Britain had also lost far more tanks than anticipated in Normandy. This ironically conspired to reduce the number of tanks otherwise available for conversion to Fireflies when Britain was forced to return many 75mm Shermans to US ownership and to also forego her promised share of 3 months' new tank production[882]. With hindsight, Canadian Ram tanks might have been used to replace 75mm Shermans, had they been earlier up-gunned[883]. It must also be said that the British had taken their revenge for America's initial rejection of the Firefly by deciding, in July 1944, to equip their own tank troops with two Fireflies each before they would countenance supplying any to the US army[884], and also that earlier US fears about a possible shortage of 17-pdr ammunition for any Fireflies given to US forces were borne out[885]. Unofficially however, British Fireflies (referred to in at least one British unit as 'Mayflies', a term sometimes also used when referring to M10 Achilles), and Churchill Crocodiles, were sometimes despatched to support US units in combat[886].

Contrary to the myths, the British actually built far more Fireflies than the 600 previously asserted by authors - who ignored primary sources; at least 2139 and possibly 2239 were produced, including those latterly earmarked for the US army. Despite being regarded as only a temporary expedient, the British were very fastidious about which versions of the Sherman were used, and rejected diesel-engined and other 'minority' types because of their smaller interior space (M4A1 and M4A2) and perhaps because there would be long-term spare parts problems (M4A3). Only the M4 and M4A4 appear to have been used, though trials were conducted on other types and in the post-war years many Firefly turrets were dropped onto any old Sherman hull to create museum exhibits. Many Fireflies previously thought to be on the M4A1 hull are in fact late-production M4s (i.e. with cast and rolled hull sides forward of the turrets) and thus very similar in appearance at first glance to the M4A1, especially as the amount of outside stowage hung on many British tanks make it hard to tell many Sherman types apart, especially if their engine decks are obscured from view. The British also insisted that only the Oilgear traverse gear was used in Fireflies for reasons already explained and because, of the three otherwise interchangeable types used in Shermans, it was also the most compact[887]. Because only late-production 105mm Shermans had power traverse, and it was a minority type in British service anyway, they were not used for conversions.

All but two (with 1st Polish Armoured Division) of the 338 Fireflies in Normandy on 30th June 1944 were M4A4 types, but thereafter M4s predominated by the war's end due to losses of M4A4s and conversion of more M4s, so that there were eventually roughly two M4s for every M4A4 in service[888]. Because only gasoline-powered Shermans were converted, those units with 75mm diesel-engined Shermans had the additional complexity of having to use two different fuels for their tanks, though many un-armoured vehicles in such tank units had to be supplied with gasoline fuel anyway. The main drawback with the Firefly was the conspicuously long gun, and the British attempted various disguises for the barrel such as foliage, light-coloured paint on the front half of the barrel, special camouflage schemes, or tin can-like objects halfway along the gun tube[889]. The Germans were not fooled and naturally gave Fireflies their best, urgent, attention; so much so that 1st Polish Armoured Division was later forced to augment about 40 Fireflies[890] with 76mm Shermans to replace heavy losses[891] (a type unsuitable for conversion to Firefly standards). Understandably, they camouflaged their 76mm barrels too[892], and the paint scheme was also used on some Churchills[893], and on Archers in Polish units[894].

Other British successes included the 'Funnies', and the British excelled in producing such specialised armour, notably the DD tank, the Crab mine clearing flail tank, the Crocodile flame-thrower, the AVRE assault vehicle and a host of bridge-layers. Again the US army was offered equal shares but initially took only DD tanks on the grounds of crew unfamiliarity with British equipment – and so suffered terribly on D-Day; the US used small numbers of Crabs later. In Tunisia British infantry battalions would often march across anti-personnel minefields in line abreast without losses[895] but later mine technology, especially the use of wooden or concrete casings, rendered mine detectors less effective and made this a suicidal business in Europe. The early Crab had a 65% mine-destruction rate, while the contour-following Crab II had a 90% rate[896] – at least until the chains were all blown off, but the wily Germans often sowed their devilish anti-personnel 'S' mines in ground too soft for Crabs to negotiate[897]. The Churchill's roomy hull interior (one veteran told this writer "you could play football in one")[898] and its good off-road capability made it ideal as a beast of burden for assault engineers and

their volatile baggage. The formidable Churchill Crocodile was feared and hated by the Germans to the extent that captured Crocodile crews were often shot[899]; one captured German officer expressed surprise that the British would stoop to use such an "un-British weapon"[900]. FKaC scenario # 106 'Kangeroo Hop' simulates a set-piece attack that lets us play with the various 'Funnies'.

Britain and the Commonwealth also produced thousands of nimble, low-slung and silent recce vehicles used with great dash and success by the army and RAF in all theatres. If British tanks were often under-gunned, British armoured cars were veritable eggshells armed with sledgehammers in comparison, and carried welded armour from an early date[901]. The exceptions included the Morris CS9 used in France and the early desert war; their crews dubbed them "suicide boxes"[902], and while the massive AEC was outstandingly reliable as we have seen, it was under-powered, slow, very tiring to drive and essentially road-bound due to its bulk, 'crash' gearbox and leaf-spring suspension (revealing the truck ancestry of the chassis)[903]; it possessed "great potential for blocking the roadway"[904]. Note that the new Chapter H notes have extended the availability of the Marmon-Herrington III variants up to the end of the Sicily campaign, as the 47mm gun version was hastily deployed there by the 5th Recce Regiment[905].

Technical development of wheeled vehicles was not really spectacular although the Daimler armoured cars were something of an exception here and the supply of these superb machines never met demand. As a result the inferior Humber scout and armoured cars were produced as substitutes, despite barely meeting official specifications on account of their commercial chasses being incapable of taking heavier loads[906]. Most British AFVs suffered from this problem as long as they were regarded as tanks on wheels, but once the General Staff lost interest in light tanks after Dunkirk, because tougher vehicles were needed to resist the expected German invasion, wheeled vehicles gradually usurped the recce role. These vehicles sacrificed armament and armour for accommodation, speed and range and the British enthusiasm reflects not only their lower unit cost but also the greater need for fresh information by senior officers who, in the early was years at least, were far happier to let their subordinates run the war up front without the sort of unannounced visits and interference that many German generals were famous for. In addition, the British infatuation with these vehicles was rooted in their tradition of horsemanship and élan – a scout car or armoured car was the military equivalent of a well-bred 'hunter' horse or a sports car. Whatever his other failings, 'Tommy' excelled at recce.

Apart from a heavily armoured tank-killer, the only other serious omission from the British armoured repertoire was a good APC, and they relied far more on their poorly protected carriers (with their small load-carrying capacity) than on US half-tracks; the latter were mostly reserved for more supportive and less risky roles. The Canadian-inspired Ram Kangeroo and the later adaption using the Priest were useful stopgaps, but access to the vehicles (only from above) was not ideal, as these rear-engined vehicles could not be fitted with rear doors. Plans were also drawn up to use Centaurs and Churchills as Kangeroos[907]. Carriers were used more as 'battle taxis' than *ersatz* APCs, with their crews dismounting at the first opportunity to render them less vulnerable and less conspicuous. Players tempted to fire their 2" mortars from inside their vulnerable carriers might care to remember this. This absence of an APC in part explains the poor British infantry / armour co-operation, when tanks quickly out-ran the supporting infantry advancing on foot.

The Loyd carrier appears to have been very unreliable, according to post-war British reports of its use in the Mediterranean theatre; its weak steering compromised further by towing too heavy a load like the 6-pdr gun and its ammunition, and the catalogue of woes included unreliability, poor tractive power, a weak suspension and rear axle and brake fading – all attributed to "abuse" through over-loading[908]. Its cousin, the Universal Carrier was similarly overloaded and abused[909]. The wheeled tractors used to tow field guns were plagued by a poor cross-country performance[910] and were hard and tiring to drive[911], so that carrying the 25-pdr *en portee* was even mooted. In North Africa the British first encountered jeeps when found many abandoned by US forces (along with 16 Stuart tanks)[912] after the Kasserine debacle and 'adopted' them, but they had a poor reputation for reliability since many troops drove them much too fast and over-loaded them in preference to using their own mediocre 15 cwt trucks[913]. Most but not all[914] British trucks were generally reliable, if not sparkling performers; again these were commercial adaptations rather than purpose-built vehicles and they lacked the rugged construction and higher performance of US vehicles. General Horrocks, the CO of XXX Corps commented favourably on the high speed of the US 6-wheeled trucks of the 'Redball Express' compared to the slower British convoys with their smaller 4-wheelers[915]. 38% of British motor transport came from Canada, 20% from the USA and 42% from Britain[916]. Truck standardisation was,

again, poor and pre-war tax regimes had encouraged manufacturers to produce less powerful lighter, two-wheel drive, trucks at the expense of heavier and more powerful types[917]. Although they were better suited to the desert than their foreign equivalents, as the ASL desert rules show, the reliability of British trucks, and hence the performance of armoured and motorised units in the desert, was not helped by a failure to produce sufficient spare parts during late 1941 and early 1942[918], because (as with the Red Army on the eve of war) the total output of vehicles seemed to matter more than stock-piling spare components.

Vehicle counters

Many vehicles have had to be omitted from *FKaC*, as was the case with *WoA*, for historical reasons and to keep the cost down. The 'rattle-trap' Light Tanks Mk I to VIB are all pretty similar in game terms (all were death-traps in real life), so a 'generic' Mk VIB counter suffices. The Cavalier's only use in action was as an (unarmed) OP tank in Normandy, while the venerable but vulnerable Medium Mk II saw little or no action (which was just as well for its unfortunate crewmen). The US M 8 Greyhound only saw limited action because the British refused to issue it until something was done to improve the protection against mines (special additional belly plates were made), though crews issued with them in September 1944 praised their cross-country performance and ability to cross light bridges. Apart from the thin flooring, they also disliked the difficulty experienced in reversing it[919] – a bad feature for a recce vehicle - and British troops also found that the middle set of wheels flicked spent cartridges lying on the road into the upright position, and these then punctured the rear wheels[920]. The M24 Chaffee saw only limited British service, just two being lost in action[921], as did the Valentine DD tank (just 75 Mk IXs were used operationally in Italy when Sherman DDs were scarce)[922].

It is doubtful whether the Covenanter, the Staghound III, Valentine X or Sherman III (L) saw combat; certainly the Sentinel and the Centurion did not, while the Fordson armoured car was visually similar to the Rolls Royce and is indistinguishable in game terms. The Churchill IX to XI 'reworks' with appliqué armour to roughly Mk VII standards and either early 8 AF, or with later 14 AF Mk VII, turrets, were apparently built so late in the war and in only very small numbers; none saw any action[923]. The SOD (Sawn off Daimler), an armoured car with the turret removed and capable of 70 mph on roads, was a minority and strictly unofficial type used during the Normandy breakout but deemed too vulnerable for recce after the Rhine crossing[924]. These omissions have made way for more deserving inclusions like the India Pattern carriers, the Loyd Carrier, Humber LRC, Rolls Royce armoured car, Valentine II/IV and III/V, Sherman Dozer and the Priest Kangeroo. However pressures on counter space forced out various Churchill Bridge-layers, the Matilda Frog flame-thrower used so effectively by the Australians against the Japanese, and a host of hastily-improvised AFVs of dubious value hurriedly converted to resist the expected German invasion of Britain in 1940. Captured tanks have also been excluded; those used by the British were mainly Italian M 13/40s[925] in the desert when their own stocks were low, but in the ETO one Tiger and two Panthers (wryly renamed 'Cuckoo' and 'Deserter') were used until their breakdowns became incurable.

Tank doctrine

Britain's handling of armour suffered for far too long from a lack of commanders who really understood how to use it properly; one junior officer testified that he had received almost no training in this subject as an officer cadet in the 1920s and was discouraged from joining tank units as their officers were "not very nice people". As late as 1935 Staff College courses barely mentioned the subject in what this same officer, now promoted, described as "disgraceful" teaching[926]. This phobia was also partly a symptom of the long-overdue and often unpopular mechanisation of the cavalry from 1937 onwards. Pre-war interest in tanks was seen by most officers as unhealthy, freakish and fanatic, and there was a dearth of pre-war exercises (most of which bordered on farce), at least until after Dunkirk[927], while the shortage of land in the overcrowded wartime British Isles, caused by the greater agricultural demands amid the U-boat blockade[928], made it difficult for larger British and US formations to train and practice as a body. Simulating the harsher but more open and flatter desert conditions was impossible. The pre-war pioneers like Fuller and Liddell-Hart had left the army and could only influence events by writing, or had been moved to positions in the army where they had little influence; Hobart's many talents were unceremoniously discarded in 1938 after he had worked very hard to make British mechanised units in the desert so efficient, and he languished as a corporal in the Home Guard until Winston Churchill rescued him to raise new armoured divisions, including the 79th Armoured Division of specialised assault vehicles[929]. When British generals admitted that their

own forces were "…still an army of amateurs fighting professionals"[930] it was as much a confession of the poor handling of armoured units, as it was an indictment of bad small-unit tactics.

The performance of British armour was not helped by organisational blunders; in late 1941 divisions in North Africa were re-organised into brigade-sized units with only weak tank strength and artillery support. They were doled out along the front and expected to accomplish all that their larger predecessors had failed to do against an enemy who believed in the concentration of force – the Germans just gobbled them up piecemeal. Inspired by the exploits of 'Lawrence of Arabia' and the sometimes wild and vague theories of Liddell-Hart and Hobart, British commanders (when they were not experimenting) chose to fight a sort of mechanised guerrilla warfare and dispersed their armour and sometimes their artillery too into weak 'Jock Columns', grossly over-estimating the dangers that concentration would face from air attack, and practised 'mobility' for its own sake by driving about to no useful purpose and to the steady mechanical detriment of their vehicles – 'swanning about' in British slang – which ingested sand at the rate of one pound per five miles travelled[931]. Many Grants were already worn out in this way in training exercises before they ever met the enemy[932]. This dispersion also encouraged excessive and undisciplined use of radio communication, which the Germans were very adept at intercepting and exploiting.

None of this was really appropriate against concentrated doses of *Panzer Division*. The British also reorganised their desert formations far too often and only 11 of the 20 or so divisions' worth of tanks (up to 2nd Alamein) had fought in more than one large battle, and only 4 in more than two thanks to rest periods, diversions to other theatres, or losses. Thus whereas Axis units remained essentially the same in the desert, the British units were not particularly experienced; 7th Armoured Division, for example, had some 17 different armoured regiments and 9 infantry battalions rotated through it in just 2 years. The 5th Indian Division had 23 changes in brigades involving 11 different formations in a 4-week period, attached for a night, a week, or even for just a few hours[933]. All that can be said in mitigation is that thanks to General Hobart, CO of the poorly-equipped Mobile Division Egypt in 1939, the British were better-equipped and a lot more competent than the generally less mobile and more epicurean Italians in waging desert warfare, though this availed them little against Rommel.

When the British armour was then reorganised on a divisional basis, it was for much of the war a tank-heavy TO&E with inadequate infantry support and hence flexibility – 'pure in race' as the Germans (who preferred mixed battle-groups containing all elements)[934] wryly described it when taking a subtle swipe at Nazi dogma. Consequently British commanders eventually knew how to command tanks but for far too long afterwards still not how to handle the infantry and artillery elements that all armoured divisions needed to function effectively[935]. The separation of tanks and regiments into 'infantry' and 'cruiser' types did nothing to improve tactical doctrine by confusing things with over-specialisation; co-operation between these two armoured branches was often lacking because the more amateur cavalry and the more professional RTR units shared a mutual dislike dating back to the Great War, and this rift took time and the deeds of a greater 'enemy' to heal. Each, separate, role was executed in a rigid manner while the different performance characteristics of the vehicles concerned caused headaches for commanders like the early mixtures of T-34s and KV-1s did in the Red Army. The 'I' tanks downgraded mobility (at least until the Churchill arrived), surprise and flanking movements while the cruiser units, confident that their speed was a substitute for thinner armour and reassured by official statements that their 2-pdrs would pierce German armour at under 500 yards range[936], would trundle or charge, respectively, unsupported and with their pennants flying into enemy killing-grounds like French medieval knights, and just as slow to learn the lessons. A good (European) example of this stupidity is *FKaC* scenario # 91 'Ad Hoc at Beaurains'. Small wonder that one British officer, disillusioned at the way so many Crusaders had been shot out from under him in the desert, attempted to lead his tank platoon from a 3-ton truck in order to improve the survival chances of his crew; he was quietly sent to the rear for psychiatric treatment[937]. There he met a 'shell-shocked' officer who had survived nine such losses[938]; while another crew survived seven knock outs[939] and yet another had ten tanks destroyed under them in just 30 days[940]. US analysis revealed that the average man could only tolerate 2-3 burn outs, and only a few men 6 to 8, before breaking down psychologically[941].

Even in Normandy, where common sense should have prevailed, and where the British could afford to lose 6 tanks for every *Panzer* destroyed[942], they initially 'charged' German defences[943]. Having then been painfully bitten, British armour quickly became very shy and the lack of training in aggressive tactics of the sort practised routinely by German, Soviet and US armour became very evident during the liberation of Europe. That said, the British were probably better-suited temperamentally than the

Americans to the bloody, grinding, attrition of the Normandy battlefields[944] and they possessed, initially, more tanks (deemed 'expendable')[945] than the US forces landed on D-Day for that very purpose[946], though it must be said that casualties were proportionally at least as high in US units[947]. In Normandy the British faced 7 *Panzer* Divisions and lost about 1530 tanks, the US army faced 2 *Panzer* Divisions and lost about 875 tanks[948]. But the British did systematically destroy the German armour embroiled there as planned, albeit at terrible cost; the self-sacrifice of the British, Canadian and Polish troops allowed a rather over-critical, ungrateful and boastful Patton to race across France largely unopposed. One US historian says of Patton, "Principally, he occupied ground rather than destroying armies"[949], and General Bradley[950] at least was mindful of the British contribution, which seems to have been forgotten, or played-down and ridiculed in some recent US war films.

Events after the attrition and break-out showed that men like Horrocks, Roberts and even the ultra-cautious Montgomery could handle armour with the dash and skill shown by O'Connor in the early desert battles and by German or US commanders; for example the British 2nd Army under General Dempsey achieved an average rate of advance of 66.6 miles per day, compared to Patton's best of 14.6 miles per day[951] although such comparisons are rather meaningless. The handling of British and Commonwealth armour in Burma and the PTO became both aggressive[952] and inspired, especially in the later stages of the war, and infantry-tank co-operation (after the fiasco known as the Arakan Offensive) was of a much higher standard than in the ETO. Here, Stuarts and even Lees and Grants were driven, or dragged and / or winched by bulldozers up steep slopes to catch the Japanese with their proverbial trousers down and demolish their formidable bunkers in terrain thought by them to be safe from tank attack[953]. According to Japanese sources, in the final battles of 1945 their forces lost 1401 POWs and 16,919 dead (compared to only 419 British and Commonwealth casualties, of whom just 49 were killed)[954].

Conclusion

It is ironic, if typical, that some of the British army's severest critics are fellow-countrymen. Writing of the 8th Army the historian Corelli Barnett described it as "a cumbersome and inferior fighting instrument, capable of winning against German troops only in a carefully rehearsed, tightly controlled set piece operation with ample margins of numerical and material superiority"[955]. The historian Max Hastings writing about 'Overlord' makes similar comments[956]. The historian Stephen Ashley Hart cites the analysis of others who describe it as being "not very good"[957] in the war and he ranks its performance in NW Europe as "relatively unimpressive" by German standards[958] but makes the point that this is all that could be expected from a mass conscript army, given its limitations[959]. Hitler for his part was more generous, melodramatic and prophetic when he observed that the spirit of the British people was such that the army would struggle on for however long it took, and by whatever means was necessary, to victory "even though the actual equipment at hand may be utterly inadequate when compared with that of other nations"[960]. There was more than a grain of truth in all these observations.

We have seen that 'Tommy' and his Commonwealth and 'refugee' comrades in arms had problems; the British are a very self-critical and self-disparaging people who tend to dwell more on the negative than the positive, and usually love to deflate their own heroes. But for all its many faults the British army also had strengths; while it could not accept casualties like the Soviets, Germans or even Americans it was nonetheless filled with men determined enough to fight on in dogged fashion without any allies for nearly 12 months. Tommy and his country were prepared to 'muddle through' – if not to victory, at least to impoverished national survival, sustained by a wry and very cynical sense of humour. Equipped with a mix of good and bad weapons 'Tommy' was eventually able to take on his opponents on more or less equal terms once his confidence, dented by earlier defeats, was restored. The, traditionally, small and neglected army was greatly expanded to play a far more vital role than most people had foreseen; never as professional as the Germans nor as lavishly-equipped with military hardware as the US army, it was not decisive in itself and could never have been mistaken for a more genteel version of the Red Army.

If its overall, strategic, contribution to the land war against Germany was only marginal, it still made an important contribution to victory by taking the heat off Britain's allies at critical times. It also inflicted stunning defeats on all its enemies at times, especially against the Italians and Germans in North Africa, and in Burma where, after being defeated and chased out by the Japanese, a mixed force of predominantly Indian troops was reorganised, re-trained and re-equipped to later return and give Japan the worst drubbing suffered in any of her land campaigns. As such 'Tommy' is a worthy opponent for

your cardboard Germans and other Axis troops. So when your cardboard AFVs go forth for their cardboard King and Country to support the 'thin khaki line' may they always 'Fear Naught' and pass safely 'Through Mud and Blood to the Green Fields Beyond' as the Royal Tank Regiment's official and unofficial mottos, respectively, so eloquently advocate.

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Notes

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[15] Neave p. 65.
[16] Martin Blumenson *Liberation* Chicago 1980 edn p. 192, *Overlord* p. 223, McKee *Caen* p. 38 and 324, Ryan p. 139, 176 and 335, and Colvin p. 145 and 238 for examples.
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[34] William Moore *Panzer Bait: With the 3rd Royal Tank Regiment 1940-1944* London 1991 p. 151.
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[42] For examples, see *Crucible* p. 189-190, Whiting *'45* p. 58-59, *PBI* p. 85, *Overlord* p. 249, *Normandy passim*, McKee *Caen passim*, Keegan p. 194, *Desert* p. 58, Gardiner p. 107, Moore *Panzer Bait* p. 65, Hart p. 89, French p. 215, Doherty p. 66-57 and 79, Russell & de Normann p. 28 footnote, Daglish *Goodwood* p. 14, Richard Holmes *Battlefields of the Second World War* London 2001 p. 57, Lucas-Phillips *Alamein* p. 355, and C.E. Lucas Phillips *The Raiders of Arakan* London 1973 edn. p. 194-195 (henceforth *Arakan*).
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[46] French p. 235.
[47] *Crucible* p. 138-139 (Australians), *IWM Desert* p. 131-132 (Australians), and Gardiner p. 81 (Maoris).
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[58] *Rude Mechanicals* p. xii (citing General Sir J. Hackett), *New Excalibur* p. 228, *Crucible* p. 11 (probably citing *Desert* p. 103), *Firepower* p. 157, 190-191, 227-228, D'Este *Normandy* p. 293-294, Carew p. 22-23, and *Bounce the Rhine* p. 61.
[59] *Firepower* p. 156-157, Ellis p. 330, Pitt p. 11, Carew p. 22-23, Carew *Hong Kong* p. 30-32, Royle p. 27, Sykes p. 43 and 53, French p. 131, *Battlefields* p. 57, *Year Alamein* p. 188-190, *New Excalibur* p. 228, Lunt p. 281, Roberts p. 11, *Desert* p. 103, and for a wartime example Brutton p. 11-12.
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[62] *Desert* p. 104.
[63] *Desert* p. 104.
[64] *Firepower* p. 227.
[65] D'Este *Normandy* p. 291-296 and 355, and Russell F. Weigley *Eisenhower's Lieutenants: The Campaigns of France and Germany, 1944-1945* London 1981 edn. p. 15.
[66] *Firepower* p. 153, 190-191, 227-228, Carew p. 22-23, D'Este p. 293-294, Hammerton p. 51, *Overlord* p. 145, and Norman Smith *Tank Soldier: The Fight to Liberate Europe 1944* Lewes 1989 p. 39 and 59.
[67] For desert, see *Desert* p. 143, 150-153, 155-156, 159-160, 163, 165-166, 186, 189, 191, 222-223 and 248, Moore *Panzer Bait* p. 95, *Crucible* p. 262, Macksey *Afrika Korps* p. 65, 75, 79 and 94-95, *Year Alamein* p. 36, 40, 48-50, 61-62, 71-75, 103, 107-108, 117, 151, and 161-165, Lucas-Phillips *Alamein* p. 53 and 118, French p. 229-230 and 252, *IWM Desert* p. 130-131,and *Firepower* p. 245; for Normandy see D'Este *Normandy* p. 273 and 335.
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[69] *Firepower* p. 227-228, Moore, p. 106, D. Fraser *And We Shall Shock Them* London 1983 p. 200 and 225, Kenneth Macksey *Afrika Korps* London 1968 p. 100, John Ellis *Brute Force: Allied Strategy and Tactics in the Second World War* London 1990 p. 269 (citing *Firepower* p.227) and W. Murray *Luftwaffe: Strategy for Defeat 1939-1945* London 1985 p. 113.
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[72] Place p. 126.
[73] D'Este *Normandy* p. 279, 282-283, and 286-287, and French 230-231..
[74] D'Este *Normandy* p. 286-290, 292-294 and 296, Moore p. 96 and 134, Roberts p. 167, Ellis p. 37, *Overlord* p. 32, 56, 117, 144 and 235, and *PBI* p. 133.
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[83] For the German system, see *PBI* p. 130-131, James F. Dunnigan (Ed) *The Russian Front: Germany's war in the East, 1941-45* London 1978 p. 112-113, and Martin van Creveld *Fighting Power: German and US Army Performance 1939-1945* London 1983 p. 121-146. For German combat excellence compared to their enemies, see Dunnigan p. 82-84, *Overlord* p. 24-25, Weigley p. 28-31, Colonel T.N. Dupuy *A Genius for War: The German Army and General Staff 1807-1945* London 1977, and T.N. Dupuy *Understanding War: History and Theory of Combat* Barnsley 1992.
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[85] French p. 65 and 128-131, 'Battle-cries' BBC Television 13 October 1992, Richard Gough *SOE Singapore 1941-42* London 1985 p. 174, John Keegan 'Who's calling who Yellow?' in *The Daily Telegraph* 15 February 1992, and Lane p. 11-12, 43, 101-102, 118, 121, 128-129, 144-145, 170, 177 and 197.
[86] *PBI* p. 239, and Ellis p. 192.

[87] See van Creveld p. 23-24.
[88] *New Excalibur* p. 228.
[89] Ellis p. 226-227, French p. 74, Deighton p. 212, and Fraser p. 100-104.
[90] *Rude Mechanicals* p. 75, Carew p. 23-24, and Lunt p. 55 and 81.
[91] Carew loc cit, and Lunt loc cit.
[92] Carew p. 23 and 87, and *POH* p. 44 and 222.
[93] Roberts p. 11, Lunt p. xx, Carew p. 23.
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[95] Roberts p. 11, Carew p. 23-24 (henceforth *Longest Retreat*), Carew *The Fall of Hong Kong: The Lasting Honour of a Desperate Resistance* London 1976 edn. (henceforth *Hong Kong*) p. 30-32, Royle p. 27 and 52-53, and Lunt p. xxii.
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[99] Mason p. 511.
[100] Mains p. 129-130, Carew p. 91, Mason p. 454 ff, and 511, Raymond Callahan *Burma: 1942-1945* London 1978 p. 24, and David Rooney *Burma Victory* London 1992 p. 130.
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[104] Carew p. 92, and Julian Thompson *The Imperial War Museum Book of the War in Burma: 1942-1945 – A Vital Contribution to Victory in the Far East* London 2002 p. 403 (henceforth *IWM Burma*). For later training, see Callahan p. 98 and Perry loc cit.
[105] French p. 58 and 75.
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[107] Lunt p. 48, *IWM Burma* p. xix-xx, Mains p. 130-131, Perrett p. 26, Harry Seaman *The Battle of Sangshak: Burma March 1944 Prelude to Kohima* London 1989 p. 140, and Lucas Phillips *Arakan* p. 200.
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[112] Delaforce p. 3, Mollo p. 229, D'Este *Normandy* p. 253 and in less detail Perry p. 144, McKee *Caen* p. 159 footnote , and *Rhineland* p. 93-94.
[113] Delaforce loc cit.
[114] *PBI* p. 283, and Perry p. 67, *Scheldt* p. 256n. For similar praise of Canadian transferees, see D'Este loc cit, who refers to only 200 Canadian officers.
[115] Mollo loc cit, D'Este loc cit; *Rhineland* p. 94 and *Scheldt* loc cit both state 20% were killed and 75-76% became casualties.
[116] Perry p. 197.
[117] Perry loc cit.
[118] French p. 72-75, and *Rhineland* p. 286.
[119] For Chindits see Ready Vol. II p. 136, and Michael Calvert *Chindits: Long Range Penetration* London 1974 edn. p. 141. For non-Chindits see John McCann Echoes of Kohima Oldham 1989 p. 342, and Hill p. 39 and 101.
[120] D'Este *Normandy* p. 279-280, 283 and 287, *IWM Europe* p. 84, *Rhineland* p. 286, French p. 76-78, *Battlefields* p. 142, Calvert *Fighting Mad* p. 154, and *Overlord* p. 149.

[121] D'Este p. 132-133, 144, 194, 274, 282-284, 287-289 (also citing two exceptions), 290, 292, and 296 (also citing two exceptions), Daglish p. 151, *Battlefields* p. 143, *IWM Europe* p. 206, *Overlord* p. 56, 114-115, 117, 122, 144 and 294 (also citing one exception), Ryan p. 358-360, 393-394 and 410, Roberts p. 167, Place p. 126, Middlebrook p. 413, 422 and 443-444, Moore *Panzer Bait* p. 96 (citing H. Pyman *Call to Arms* London 1971 p. 43) and 134 (citing Roberts p. 167), Kirby p. 129 and 132, French p. 253 and 281, *Year Alamein* p. 117 and 182, Lucas-Phillips *Alamein* p. 55, *Desert* p. 103 and 152-153.
[122] *Overlord* p. 32, among others.
[123] Ellis *Sharp End* p. 162 and 164, *PBI* author's note / Preface.
[124] Fraser p. 101.
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[127] *Overlord* p. 184-185 and John A. English *A Perspective on Infantry* New York 1981 p. 87 and 198 footnote 108, among others.
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[132] *Firepower* p. 22, 50, 55, 122-123 and 126.
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[135] Mollo p. 67.
[136] Robint Neillands *The Raiders: The Army Commandos 1940-46* London 1989 p. 30.
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[140] Blaxland p. 5, Hill p. 10, Hickey p. 26, and David Ascoli A *Companion to the British Army 1660-1983* London 1983 p. 43-44.
[141] Fraser p. 92 and English p. 89, among others.
[142] *Year Alamein* p. 72, 75, 121, 158-159, 205, 207, 274, 313 and 328, Macksey *Afrika Korps* p. 34 and 100, Colvin p. 63 and 108, English p. 89, Bruce p. 189 and 279, Latimer p. 16-17, *IWM Burma* p. 160-161, Harrison *Tobruk* p. 152, How p. 187, *Guerrillas in Uniform* p. 203, Atkin *Dieppe* p. 15, Reynolds p. 47-48 and 163, Doherty p. 30 and 32, *IWM Desert* p. 61-63 and 133-134, Michael Carver *El Alamein* London 1963 p. 28, Barrie Pitt 'Monty's Foxhounds' in *War Monthly* March 1981 p. 33, French p. 145, Griffith in Harris & Toase p. 71 and 79, Bryan Perrett *The Valentine in North Africa 1942-43* London 1972 p. 11, Lucas-Phillips *Alamein* p. 53-54, Allen *Burma* p. 33, *Overlord* p. 47, Ellis p. 135-136, 330-331 and 341, *Year Alamein* p., 121, 158-159, 205, 270, 274, 313 and 328, McKee *Alamein* p. 33, 61, 74 and 141, *Firepower* p. 241, Lucas *Desert War* p. 47 and 62, *Chindit War* p. 45, 111, 115-116, 147 and 159, Lane p. 25, Mains p. 39, Moore *Panzer Bait* p. 106 (citing the New Zealand Sir Howard Kippenberger), Duncan Crow *British & Commonwealth Armoured Formations (1919-46)* Windsor 1971 p. 74 (citing Kippenberger), Macksey *Tank Force* p. 107-109, Macksey *Afrika Korps* p. 34 and 100, Perry p. 181, Fraser p. 220, Whiting *'44* p. 79-80, Bryan Perrett *Through Mud and Blood: Infantry / Tank Operations of World War II* London 1975 p. 97-100, Geoffrey Powell *Men at Arnhem* London 1986 edn. p. 17, Daglish *Goodwood* p. 18, and 179, and private information to this writer.
[143] *Firepower* p. 295 and 294, respectively, and *Battlefields* p. 33, citing *Firepower*.
[144] *Desert* p. 104
[145] *Firepower* p. 228, comment made to one of the authors.
[146] Not attributed, see Reynolds p. 163.
[147] *Desert* p. 77-78; for other examples see Carew *Longest Retreat* p. 79-80, Lunt p. xx, Mains p. 111, Mason p. 509, Kirby p. 130, Allen *Burma* p. 122 and 319, Callahan p. 94-96 and 101, and *Chindit War* p. 52.
[148] Frank Harrison *Tobruk: The Great Siege Reassessed* London 1999 edn p. 132-133 and 195, Carver *Alamein* p. 28, French p. 166, 214, 221-225, 227, 232-233, 262, 279 and 281-282,, *Crucible* p. 341-342, 365, 371-372, 381, 394, 398, 408, 440-449, 454, 456, 462-463 and 479, Humble *Crusader* p. 98 and 177, *Year Alamein* p. xv, xx, xxiv, 17-18, 35-36, 38-40, 45, 50, 63-66, 75, 91, 120, 124, 126-127, 139, 151-152, 156, 158, 163-164, 166-168, 213, 263, 315, 325, 327, 330-332, 349,and 391-392, *Battlefields* p. 59, 76 and 81-82, McKee *Alamein* p. 22 and 179, Latimer p. 4, (citing R. Walker *Alam Halfa & Alamein* Wellington 1967 p. 7), 6 and 16, Macksey *Afrika Korps* p. 34, 73, 75, 78, 81, 84 and

100, Griffith in Harris & Toase p. 77-84 and 86-87, Gudgin *With Churchills* p. 94-95, *IWM Desert* p. 100-103, 117, 134 and 136, Weigley p. 15, 19 and 29, Ellis *Brute Force* p. 238, 240-242, 246-247 and 250, *Firepower* p. 214-215, 221-225, 228, 231-232, 237-241, 243, 256-257, 260, 275-276, 288-289 (a few exceptions are cited, p. 254-256), Moore *Panzer Bait* p. 103, 105-107, Roberts p. 51, 89, 159, 164 and 184, Blaxland p. 14 and 147, Lucas *Desert War* p. 26 and 47, Colvin p. 108, Lucas-Phillips *Alamein* p. 52-53 and 244, English p. 156 and 180, Reynolds p. 47-48 and 179, Doherty p. 167, Donald E. Graves *South Albertas: A Canadian Regiment at War* Toronto 1998 p. 83-84 and 99, Brigadier A.L. Pemberton *The Second World War 1939-1945 Army: The Development of Artillery Tactics and Equipment* War Office 1950p. 109, Walker p. 118, 122, 124, 147-148, 166 and 197, Place p. 1-2, 92-93, 101, 105, 110-111 and 128-175, *IWM Burma* p. 29-30, 45 and 48, *Overlord* p. 114, 124, 126, 131, 133-136, 217-218, 233, 235 and 237, Kirby p. 95, Carew *Longest Retreat* p. 162-163, 174 and 252, Ready Vol. II p. 98, *Desert* p. 74-75, 87-89, 97, 99, 101, 107-108, 136 (report by General Gott), 137, 141-143, 151-152, 155, 158, 186-188, 191, 221-222, 224, 228, 262, 270 and 280-282, Badsey p. 21, Bryan Perrett *The Stuart Light Tank Series: Osprey Vanguard # 17* London 1980 p. 20, citing Rommel, Bryan Perrett *British Tanks in N. Africa 1940-42: Osprey Vanguard # 23* London 1981 p. 9 and 22, citing Rommel, David Fletcher *The Great Tank Scandal: British Armour in the Second World War* Part 1 HMSO London 1989 p. 82 (henceforth *Tank Scandal*), and Ian Hogg *Armour in Conflict* London 1980 p. 102 (citing Brigadier S. Bidwell *Gunners at War* London 1970, no page reference). *Overlord passim*, D'Este *passim*, Smith *Tank Soldier* p. 90-91 and 199-200, Badsey p. 21, 42 and 65, McKee *Caen* p. 22, 25, 167, 264 and 277, *Black Bull* p. 32, 68, 106-107, *Scheldt* p. 206, Roberts p. 159 and 184, James Lucas and James Baker *The Killing Ground: The Battle of the Falaise Gap August 1944* London 1978 p. 30-31, Ellis *Sharp End* p. 135-141, Delaforce p. 3 (Godfrey Harland testimony), 60-61, 78-79, 107 (Creagh Gibson testimony) and 109 (Lt Sydney Jary Testimony), French p. 262, 265-266, 269-273, Daglish *Bluecoat* p. 26 (citing Roberts *Desert to Baltic* p. 159), 29, 69-72 and 75, Daglish *Goodwood* p. 42 and 166, Place p. 92-93 and 153-175, Hart p. 124, How p. 57 and 69 (citing McKee *Caen*), Warner p. 211, and Russell & de Normann p. 115, 119, 121, 123-124, and 137-138 . For exceptions, see Moore *Panzer Bait* p. 133 and 161, *Black Bull* p. 9, 24-25, 77, Delaforce p. 61 and 129, Daglish *Bluecoat* p. 30-44 and 68-71, Daglish *Goodwood* p. 43, 175-177, and 184, French p. 265-266, and *IWM Burma* p. 26. For rare failures in the PTO, see Hill p. 164-165.

For exceptions see Pitt 'Monty's Foxhounds' p. 33-36, Perrett *Valentine* p. 28-66, *Crucible* p. 439, *Year Alamein* p. 142, 144, 356-366, 380, 385-386 and 396, Lucas *Desert War* p. 213-223, Carver *Alamein* p. 146-150, Macksey *Afrika Korps* p. 35-36.

[149] *Firepower* p. 170 and 189, French p. 29, 34, 41-42, 168-169 and 172-173..

[150] *IWM Burma* p. 313, for example.

[151] Harrison p. 13, 198, 201, 255 and 274, Ian W. Walker *Iron Hulls, Iron Hearts: Mussolini's Elite Armoured Divisions in North Africa* Marlborough 2003 p. 96 and 124, *Battlefields* p. 66, Forty *Tanks Across the Desert* p. 146-147 note 1, *Overlord* p. 207 and 299, and *Rhineland* p. 164.

[152] *Overlord passim*, D'Este *passim*, Ellis p. 135-141, Smith *Tank Soldier* p. 90-91 and 199-200, Badsey p. 21, 42 and 65, McKee *Caen* p. 22, 25, 167, 264 and 277, How p. 69, citing McKee no page, *Black Bull* p. 32, 68, 106-107, Graves loc cit, *Scheldt* p. 206, English p. 180, Roberts p. 159 and 184, James Lucas and James Baker *The Killing Ground: The Battle of the Falaise Gap August 1944* London 1978 p. 30-31, McKee *Alamein* p. 179, *Overlord* p. 294, Ellis *Sharp End* p. 136 and 138-139, Delaforce p. 3 (Godfrey Harland testimony), 60-61, 78-79, 107 (Creagh Gibson testimony) and 109 (Lt Sydney Jary Testimony), Reynolds p. 47-48, French p. 262, 265-266, 269-273, Daglish *Bluecoat* p. 26 (citing Roberts *Desert to Baltic* p. 159), 29, 69-72 and 75, Daglish *Goodwood* p. 42 and 166, Place p. 92-93 and 153-175, Hart p. 124, How p. 57, Warner p. 211, and Russell & de Normann p. 115, 119, 121, 123-124, and 137-138 . For exceptions, see Moore *Panzer Bait* p. 133 and 161, *Black Bull* p. 9, 24-25, 77, Delaforce p. 61 and 129, Daglish *Bluecoat* p. 30-44 and 68-71, Daglish *Goodwood* p. 43, 175-177, and 184, French p. 265-266, and *IWM Burma* p. 26. For rare failures in the PTO, see Hill p. 164-165.

[153] Whiting *'44* p. 118, *Battlefields* p. 152 and *Rhineland* p. 164.

[154] Various sources.

[155] Reynolds p. 35-36, and Daglish *Goodwood* p. 16.

[156] *Crucible* p. 479-480 (citing German assessment in I.S.O. Playfair *The Mediterranean and Middle East Vol. III* HMSO London 1960 p. 154), *Year Alalmein* p. 18 (citing Playfair loc cit), 63 and 443, Lunt p. 255 (citing report by Michael Calvert in John Strawson *A History of the SAS Regiment* London 1984 p. 281) and 280, *Black Bull* p. 6, citing German report, and *POH* p. 177, Latimer p. 17-18, who cites French, French *passim*, Bruce p. 122, Place p. 5, 75 and 110 (tank officers), and Colvin p. 63.

[157] Hill p. 157, Lunt p. 281 and *Chindit War* p. 117, Royle p. 59-60 and 122. French p. 283 argues that radios could also stifle initiative.
[158] Adrian Gilbert (Ed) *The Imperial War Museum Book of the Desert War: 1940-1942* London 1992 edn p. 131 and 137 (henceforth *IWM Desert*).
[159] Ellis *Sharp End* p. 328, Mains p. 111, Lunt p. 281, Allen *Burma* p. 607 and Ready Vol. II p. 122.
[160] *POH* p. 145-146, *Chindit War* p. 198 and (reliance on white NCOs) p. 278, and Field Marshal Sir William Slim *Defeat into Victory* London 1957 edn p. 168-169.
[161] *IWM Burma* p. 424 note 1, citing John Masters *The Road Past Mandalay* London 1963 p. 151..
[162] D'Este *Normandy* p. 279-281 (citing observations in Normandy by Brigadier J. Hargest, Liddell-Hart and Major General Roberts), 283-284 (citing Brigadier Shelford Bidwell), 286-287, *Overlord* p. 147 (citing War Office report 8th July 1944, quoting German combat units in Italy), 150 and 316, *PBI* p. 132 and 187-188, *Crucible* p. 480 (citing Playfair op cit p. 154), Ready Vol. II p. 20, and Delaforce p. 6 (also citing War Office report) and 186 (testimony of William Gould).
[163] D'Este loc cit, *Long March* p 61 and 120, Ready Vol. II p. 20, Middlebrook p. 209-210 and 256-257, and Delaforce p. 182 (testimony of Martin Lindsay).
[164] Van Creveld p. 122, *Rhineland* p. 85. Dr S. Hart, Dr R. Hart & Dr M. Hughes *The German Soldier in World War II* Staplehurst 2000 p. 8 states "his superior's job".
[165] French p. 58-59.
[166] Among others, *Firepower* p. 215-216, van Creveld p. 29-40, Kershaw *September* p. 41 and 65, French *passim*, D'este *Normandy* p. 284 (citing *Firepower*), *Overlord* p. 148, English p. 87 and 182-183, Hart, Hart & Hughes *German Soldier* p. 9-10, and *IWM Europe* p. 86 and 88.
[167] van Creveld loc cit.
[168] *Overlord* p. 25 and 248, English p. 169, and *Battlefields* p. 34.
[169] French p. 12, and 24-25, and Daglish p. 41 (Normandy examples).
[170] Doherty p. 8, 10 and 133.
[171] *Firepower* p. 93, among others.
[172] D'este *Normandy* p. 282, 286-287; for rare exceptions see *Overlord* p. 138, McKee *Caen* p. 113, Reynolds p. 99, Gudgin *With Churchills* p. 127 and, in the PTO, Rooney p. 92-93.
[173] English p. 49 and 76.
[174] D'Este *Normandy* p. 282, Carlo D'Este *Fatal Decision: Anzio and the Battle for Rome* London 1991 p. 317 (henceforth *Fatal Decision*), Ellis p. 55-57, *Scheld*t p. 148, Bruce p. 162-163, and Lucas *Desert War* p. 74.
[175] Harrison p. 48 and 123.
[176] Among others, *Firepower* p. 216, Daglish p. 93-95 and 165, Reynolds p 99 and D'Este *Normandy* p. 284.
[177] *Battlefields* p. 153, Lucas *Desert War* p. 82, and C.E. Lucas Phillips *Alamein* London 1962 p. 39.
[178] D'este *Normandy* p. 90, *IWM Europe* p. 220-221 and Willam Moore 'Operation Veritable' in *War Monthly* No. 32 1976 p. 5 (henceforth *Veritable*).
[179] Blaxland p. 118, English p. 78, Kirby p. 94, Place p. 170, Russell & de Normann p. 112, 128 and 136-137, Doherty p. 89, Reynolds p. 36-37, *Desert* p. 213 (obsession with linear objectives), and Louis Allen *Singapore: 1941-42* London 1977 p. 192 (citing Major General Gordon Bennett).
[180] Mains p. 110, Colvin p. 229, French p. 244-246, *IWM Europe* p. 220-221, *POH* p. 90 and Callahan p. 22.
[181] *Firepower* p. 15, 18 and 158-159 (citing complaints from artillery officer), and M.M. Postan, D. Hay & J.D. Scott *Design & Development of Weapons* London 1964 p. 240-241
[182] D'Este *Normandy passim*, *Overlord passim,* Weigley *passim*, Lucas & Barker p. 34 (citing an unidentified US artillery officer in Italy and NW Europe), *Battlefields* p. 25-26 and 59, *Crucible* p. 11, Perry p. 76, Weigley p. 33, 51-52, 55, 175, 288 and 538, Daglish *Goodwood* p. 15-16 and English p. 155.
[183] D'Este *Normandy* p. 266 (citing Major General Sir Kenneth Strong, Eisenhower's G-2 intelligence officer in *Intelligence at the Top* London 1968 p. 149).
[184] Beale *Death by Design* p. 201-202, French *passim*, and Place *passim*.
[185] Lucas & Barker loc cit.
[186] *Overlord* p. 114, 122, 127, 145-147, 150 and 242, *Black Bull* p. 6, citing German report, Reynolds p. 64-65, 102, 107-108, 139, 153, 155, 195, 201, 237, 244 and 251-252, Weigley p. 293-294, 315, 565-566 and 684, *Battlefields* p. 142, Kershaw *September* p. 105, 165, 169, 215 and 236, D'Este *Normandy* p. 132, 197, 274, 283, 287-288, 290-291, 295, 297, 356, 426, 478 and 482, Ryan p. 358-360 and 410 (henceforth *Bridge too Far*), Cornelius Ryan *The Longest Day* New York 1959 p. 299, *Rhineland* p.

265-266 and 286, Lucas & Barker p. 36 and 105, Whiting *'45* p. 117-118 and Daglish p. 78 and 103 (exception proving the rule), for examples.
[187] For poor US battlefield exploitation, *Overlord* p. 183 and *Rhineland* p. 265-266 and 286. Also German report in *Black Bull* p. 6.
[188] Delaforce p. 186, William Gould testimony.
[189] F. Myatt *The British Infantry: 1660-1945* London 1983 p. 198.
[190] English p. 78.
[191] Delaforce p. 103-104, Lt Sydney Jary testimony, Place p. 40-63, and 66, and Daglish p. 86-87.
[192] Place p. 8, 14-15 and 17.
[193] French p. 200-202.
[194] Place p. 16.
[195] Smith *Tank Soldier* p. 92.
[196] Smith *Tank Soldier* p. 27, 39 and 91, Roach p. 27 and 120, *Battlefields* p. 142 (citing Roach), Hill *Unknown* p. 18,Place p. 46 and 55, Calvert *Fighting Mad* p. 13, *PBI* p. 71, Whiting *'44* p. 24, and Louis Hagen *Arnhem Lift* London 1993 p. 38.
[197] *PBI* p. 13 and 131, Reynolds p. 141, Roach p. 120 and 174-175, Deighton p. 169, Place p. 66, Neillands p. 11, Whiting *'44* p. 24, Hagen loc cit, Lunt p. 45-47, Allen *Singapore* p. 192 (citing major General Gordon Bennett), Michael Glover *An Improvised war: The Ethiopian Campaign 1940-1941* London 1987 p.51, and John Vader 'The ANZAC Soldier' in *Purnell's History of the Second World War* Vol. 7 No. 16 London 1968 p. 3125 (example), henceforth cited as PHSWW.
[198] *Overlord* p. 127, McKee *Caen* p. 18, *IWM Burma* p. 236 (Chindits), and McCann p. 33.
[199] *Overlord* p. 139, *PBI* p. 10, Hogg *Conflict* p. 56, Macksey *Tank Force* p. 26-27, Crucible p. 16-17 (citing Macksey *Armoured Crusader* p. 111-112), Charles Messenger *The Art of Blitzkrieg* London 1976 p. 74-76, French p. 169-174 and 200, and Place p. 19-29, 34, 36 and 46-47.
[200] Place p. 28-39.
[201] *PBI* p. 18, Hickey p. 54, and *Scheldt* p. 218-220, 222-223 and 333.
[202] Respectively, Blaxland p. 58; *PBI* p. 18 and 29, French p. 200, Deighton p. 170, Place p. 41-43 (including harvesting in the UK), and *Rude Mechanicals* p. 44.
[203] Carew *Longest Retreat* p. 66, Hickey p. 54, Raymond Paull *Retreat from Kokoda* London 1960 edn. p. 26, 32 and 35, Lida Mayo *Bloody Buna* London undated p. 7, Russell Grenfell *Main Fleet to Singapore* London 1987 edn. p. 82, and Stanley Falk *Seventy Days to Singapore* London 1975 p. 48, 53, 124 and 207.
[204] Blaxland p. 41 (France), and Kirby p. 42-43, 93, 95-99, 112 and 225, Falk p. 48, 53, 207 and 211, and Lane p. 102 (PTO).
[205] Ellis *Sharp End* p. 16, Hickey p. 55, Baillie p. 45-46, and *Scheldt* p. 218-220, and 333.
[206] Ellis loc cit (citing C.W. Valentine *The Human Factor in the Army* Aldershot 1954 p 36-38), and Place p. 47.
[207] *Crucible* p. 17 (citing K. Macksey *Armoured Crusader* London 1967 p. 91), Barrie Pitt *Churchill and the Generals* London 1981 p. 51 (citing Macksey op cit p. 111-112), and Alan Wykes 'The British Soldier' in *PHSWW* Vol. 7 No. 16 London 1968 p. 3111.
[208] Alexander McKee *Alamein: ULTRA and the Three Battles* London 1991 p. 111, (henceforth *Alamein*), and Latimer p. 17.
[209] McKee loc cit.
[210] *PBI* p. 13 and 131, Reynolds p. 20 and 33, *Firepower* p. 225-226, and James Lucas & Matthew Cooper *Panzer Grenadiers* London 1977 p. 82 (citing 12th SS Panzer Division training 1943-44).
[211] *PBI* loc cit , How p. 24.
[212] *PBI* p. 239.
[213] *IWM Burma* p. 274.
[214] *Overlord* p. 36, Place p. 75, Reynolds p. 47-48 and 98, Hart p. 32, Beale *Tank Tracks* p. 82 (demonstration given as late as 31st July 1944), *IWM Europe* p. 9-10, Weigley p. 51-52, Bruce p. 263, Roach p. 140 ('bocage' training only after landing), D'Este *Normandy* photo caption facing p. 287, and 341 footnote, *IWM Europe* p. 9-10, Weigley p. 51-52, Roach p. 140, Reynolds p. 47-48 and 98, Beale *Tank Tracks* p. 82 (example of belated training on 31st July 1944, and Chester Wilmot *The Struggle for Europe* London 1954 edn p. 336-337.
[215] *PBI* p. 240 (citing R. Grant *51st Highland Division at War* London 1977, no page), and Bruce p. 149 (poor mountain / street warfare training in Italy)..
[216] Blaxland p. 130.
[217] Colonel Michael Dewar *War in the Streets: The Story of Urban Conflict from Calais to Khafji* London 1992 p. 24-25.

[218] Hagen p. 38, *Battlefields* p. 139 (citing Hagen), and Middlebrook p. 20.
[219] Dunnigan p. 112.
[220] Neillands p. 89.
[221] *PBI* p. 68-70, 130 and 132, Whiting *'44* p. 23-24, Ellis *Sharp End* p. 16, D'Este *Normandy* p. 283-284, Callahan p. 98, French p. 205-206, and *Scheldt* p. 220.
[222] *PBI* p. 130, Whiting *'44* p. 152, Keegan p. 62, and *Scheldt* p. 216.
[223] *PBI* p. 130-132, and van Creveld *passim*.
[224] Ellis p. 371 (footnote # 69 top p. 297), Lucas *Desert War* p. 67, *Year Alamein* p. 17-18, Hart p. 33 and Russell & de Normann p. 40 and 46-47.
[225] Ellis *Sharp End* p. 338, *Overlord* p. 48 and 206, How p. 22 and 61, *PBI* p. 130, 132, 190 and 235, McKee *Caen* 21, 35,144, 171, 215 and 248, D'Este *Normandy* p. 505, *IWM Europe* p. 7-8, Keegan p. 170, and *Rhineland* p. 159 (citing Major J. Pigott).
[226] *PBI* p. 132, and Lunt p. 236 - only 2 of the 40 instructors in India had any experience of fighting Axis troops.
[227] *PBI* p. 131 and 190, Whiting *Bounce the Rhine* p. 76-77, Keegan *passim*, *Overlord* p. 317, D'Este *Normandy* p. 240 and 244, and Place p. 74. These sources do not confine their praise to any single German formation
[228] Kershaw *September* p. 310-311.
[229] *Black Bull* p. 222, Noel Bell testimony.
[230] *Firepower* p. 2-3.
[231] Ibid p. 2-117.
[232] Ibid p. 41-43.
[233] Ibid p. 41.
[234] French p. 46.
[235] *Overlord* p. 300 (citing C.P. Stacey *The Canadian Army in the Second World War* Vol. III Ottawa 1960 p. 275).
[236] *Overlord* p. 317 (citing Stacey loc cit); see also D'Este *Normandy* p. 194 for a similar criticism of the British 7th Armoured Division's pre-D-Day training.
[237] *Overlord* loc cit (citing James Gavin *On to Berlin* London 1978 p. 71), and Whiting *Long March* p. 66 (also citing Gavin, no page).
[238] *IWM Burma* p. 343-344.
[239] Cited in *Desert* p. 288, and Haworth p. 28-29 and 32..
[240] Lunt p. 54.
[241] Ellis *Sharp End* p. 17, and English p. 78.
[242] Place p. 49-62.
[243] Ibid p. 49.
[244] French p. 21, 21 footnote 44, 45-46, 204-205, and 234.
[245] Myatt p. 211, Place p. 64-65, George Forty *British Army Handbook: 1939-1945* Stroud 1998 p. 27, and English p. 156-158. John Gooch in Place p. vii Preface argues that there was too little drill.
[246] Place p. 64.
[247] Place p. 75.
[248] Place p. 67
[249] Place p. 75, and 78-79.
[250] Place p 78-79.
[251] Delaforce, p. 104, Lt Sydney Jary testimony.
[252] Desert p. 228, and B.H. Liddell-Hart (Ed) *The Rommel Papers* London 1953 p. 262 and 298.
[253] Ian V. Hogg *Armour in Conflict* London 1980 p. 101, Lucas Desert War p. 75, and Macksey Afrika Korps p. 26.
[254] Comparisons in *Overlord* p. 179 and 183-186, *Rhineland* p. 85, and Beale p. 178-183 and 195.
[255] *Battlefields* p. 142.
[256] Ibid loc cit.
[257] Roach p. 181 (citing Geoffrey Picot), *IWM Europe* p. 94, Place p. 68 and 74, Hart p. 38, 40-41, 67, 92-94, 97, 101 and 189, *Battlefields* loc cit, Beale *Death by Design* p. 179, 183 and 195 (citing Hargest), D'Este *Normandy* p. 281 and 295 (citing in part Hargest and Lord Lovat *March Past* London 1978 p. 310), Allen *Burma* p. 231 footnote, Whiting *'44* p. 46; according to *Firepower* p. 16 bunching and a reluctance to advance in the face of enemy fire are the typical symptoms of untrained, inexperienced and unmotivated soldiers.
[258] Wilmot p. 441-442 and footnote, *Overlord* p. 36 and 127, D'Este *Normandy* p. 172, 194, 271-274, 277, 284, 286, 296, 341-342, Moore p. 168-169 (citing Wilmot), and Weigley p. 52.

[259] *Overlord* p. 12, 24, 137, 147, 305, 317-318, Badsey *passim*, Lucas & Barker p. 32-33 and 35, D'Este *Normandy* p. 287, English p. 155, Place p. 69, Weigley p. 381, Reynolds p. 201, French p. 243-244, 262 and 266-267, How p. 196, Pemberton p. 232, Keegan p. 58, Delaforce p. 7, *Firepower* p. 288-291, Whiting *Bounce the Rhine* p. 158, Whiting *'45* p. 56, and TVS Television Documentary *The War Within* 1990; the limits of this Allied policy are explored in Ellis *Brute Force*, *passim*.
[260] *PBI* p. 62, Kersaudy p. 26-27, 57, 87, 98, 114, 116, 128 and 169 (citing Norwegian sources), Jack Adams The *Doomed Expedition: The Norwegian Campaign of 1940* London 1989 p. 13 and 38-39, Richard Petrow *The Bitter Years: The Invasion and Occupation of Denmark and Norway April 1940-May 1945* London 1974 p. 84, Warner p. 48, and for a general comment English p. 78.
[261] *PBI* p. 10, 17-18, 30, 61 and 63, *New Excalibur* p. 44, Blaxland p. 4, 53-54, 58, 1113, 130, 139, 217, 225 and 356, Warner p. 4, 17, 86, 89-90, 93, 137, 153 and 210, D'Este *Normandy* p. 17 (citing Montgomery), Ellis *Sharp End* p. 263, Neave p. 15, 34-35, 44, 48, 64-65 and 242; for general comment see English loc cit.
[262] *PBI* p. 75, 95, 100 and 102, Hill *Unknown* p. 18, 33 and 134, *IWM Burma* p. 5-7, 14-15 and 63-65, Rooney p. 13 and 19, Mains p. 34, 38-39 and 50, Carew *Longest Retreat* p. 1, 4, 54, 66, 96, 162 and 232, Carew *Hong Kong* p. 74 and 152, Lunt p. xx, 44 footnote 5, 47, 54, 85, 88, 94-95, 99 and 119 footnote 4, 140, 151, 161, 170, 280, 283 and 295 footnote, Kirby p. xiii, 33-35, 57, 92-96, 104-105, 110-112, 116-118, 130-131, 147, 150-151, 163, 184, 198, 215, 217, 221, 225-226, 235, 246 and 251-252, Ellis *Sharp End* p. 264, Ready Vol. II p. 13-14, 20 and 40, Allen *Burma* p. 31, 113, 115-116, 121, 148 and 633 (citing Callahan p. 164), Slim p. 121-122, Arthur Swinson *Defeat in Malaya:The Fall of Singapore* London 1969 p. 8, 43, 53, 75, 85, 92, 120, 124 and 150, Raymond Paull *Retreat from Kokoda* London 1960 edn. p. 11, 21, 26, 29, 32-33, and 98-99, Mayo p. 7, Callahan p. 24-25, 29, 59-60, 63-64 and 97-98, John Vader *New Guinea: The Tide is Stemmed* London 1972 p. 37-38, 43, 78 and 89, Gough p. 40 and 73, Partrick Turnbull *Battle of the Box* London 1979 p. 5 and 32, Allen *Singapore* p. 154, 158, 161, 186-187, 200, 207-210 and 247, *POH* p. 85 and 90, Grenfell p. 82-83, 141-142 and 146, Adrian Stewart *The Underrated Enemy: Britain's War with Japan December 1941-May 1942* London 1987 p. 54 and 66, J.P. Cross *Jungle Warfare: Experiences and Encounters* London 1989 edn. p. 40, Sir Andrew Gilchrist *Malaya 1941: The Fall of Fighting Empire* London 1992 p. 24, 64, 147 and 160-161, Falk p. 22, 30, 48, 53, 125, 137, 169, 183-184, 210, 237, 248 and 265-267, Hickey p. 27, 29, 31, 54-55 and 78, White p. 10, 35, 43, 148, 165, 170, 178-180 and 184, *Chindit War* p. 21, and Lane p. 76, 106 and 131. For exceptions, see Kirby p. 96 footnote 124, Lunt p. 135, 154 and 170, and Carew *Longest Retreat* p. 65.
[263] *Desert* p. 65, 73, 76, 78, 84, 87, 91, 93, 97, 128, 131-1332, 137, 144, 154-155, 173, 197-198, 211, 221-222, 225-228, 265 and 270, *Battlefields* p. 49-50, Moore *Panzer Bait* p. 74, Mason p. 482, 488 and 490-491, and Ellis *Brute Force* p. 238 and 242; for Ethiopia see Glover p. 54. For exceptions see *Desert* p. 108.
[264] Rooney p. 13, Carew *Longest Retreat* p. 24-25, 66, 94-96, 162 and 232, Lunt p. 47, 54-57, 70-72, 76, 85, 88, 94-95 and 119, Kirby p. 57, 92-94, 163 and 215, Keegan in *Daily Telegraph*, Slim p. 24, 39, 121 and 123, Callahan p. 22-23, 25, 29 and 63, Vader *New Guinea* p. 78-79, Grenfell p. 142, *POH* p. 85, Allen *Burma* p. 319, Brigadier Sir John Smyth 'The Long Retreat: The First Burma Campaign' in *PHSWW* Vol. 3 No. 3 London 1967 p. 956*,* Perry p. 108, Falk p. 175, Mason p. 486 and 494, Kickey p. 54, White p. 148, 165, 178-180 and 184, *Chindit War* loc cit, Lane p. 76, Don Moser *China-India-Burma* Chicago 1980 edn. p. 23, and David Fletcher *The Universal Tank: British Armour in the Second World War* Part 2 HMSO London 1993 p. 64 (henceforth *Universal Tank*). For some rare exceptions see Kirby p. 96, Slim p. 32, 43 and 216, Allen *Burma* p. 319 and 348, Keegan in *Daily Telegraph*, Cross p. 40, Callahan p. 20, Hickey p. 30, and F. Spencer Chapman *The Jungle is Neutral* London 1950 p. 24. For deficiencies in Chindit training see *IWM Burma* p. 235-236 and 270, and Sykes p. 367.
[265] Carew *Longest Retreat* p. 25 and 35, Lunt p. 56-57 and 70-72, Paull p. 105-107, Vader *New Guinea* p. 78, and *POH* p. 85. For jungle-trained units see Chapman p. 24, Cross p. 40, Callahan p. 20, Slim p. 32, and *Guerrillas in Uniform* p. 175.
[266] Carew *Longest Retreat* p. 87, Callahan p. 22-24, Turnbull P. 32, Perry p. 200-202, 208 and 235-236, Gilchrist p. 24 and 63, Mason p. 482 and Hickey p. 27, 29 and 54.
[267] *IWM Burma* p. 5-6 (citing Major General S. Woodburn-Kirby *The War against Japan Vol. II: India's Most Dangerous Hour* HMSO London 1958 p. 440-441), 64 and 143, Mason p. 490-491, Mains p. 38-39 and 57, Carew *Longest Retreat* p. 66, 87 and 161, Lunt p. 55-56, 75, 94-95, 119, 170 and 279-280, Kirby p. 91-93, 96 and 226, *Guerrillas in Uniform* p. 182, Callahan p. 23-24, 59-61 and 97, Turnbull p. 32, Allen *Singapore* p. 154, 190 and 193, Smyth p. 955-956, Swinson *Malaya* p. 53, Neave p. 48, Perry p. 104, 106 and 108-109, Blaxland p. 4, Gilchrist p. 24 and 63, Mason p. 482, 488 and 490-491, Hickey p. 27-29, 31, 77, 182 and 184 and Stewart p. 54.

[268] Callahan p. 23, Gilchrist p. 2, Allen *Singapore* p. 154 and 190, Allen *Burma* p. 148, Lunt p. 48, 95 and 281, Perry p. 201, Hickey p. 54, Glover p. 101, Colvin p. 198, and *Chindit War* p. 275.
[269] Hagen p. 50-51, 63 and 64, and Middlebrook p. 274 and 410.
[270] Brutton p. 13 and *IWM Burma* p. 54
[271] *Chindit War* p. 212 and *IWM Burma* p. 235.
[272] Lunt p. 41 and 281, and Hickey p. 54, 96 and 184.
[273] Allen *Burma* p. 148.
[274] *IWM Desert* p. 63-64, and Paull p. 271.
[275] *Battlefields* p. 74, Moore p. 95-96, *Crucible* p. 289-290 and 471, *Year Alamein* p. 48-49 and 75, McKee *Alamein* p. 35, *IWM Burma* p. 13, Griffith in Harris & Toase p. 84 and 248 footnote 33, French p. 208-209, 227, 232 and 264, *Firepower* p. 229, McKee *Caen* p. 164, Lucas Phillips *Alamein* p. 35, Macksey *Afrika Korps* p. 36, 61, 65 and 79, Humble *Crusader* p. p. 63, Bryan Perrett *Desert Warfare: From Its Roman Origins to the Gulf Conflict* London 1988 p. 117, Walker p. 80, *Desert* p. 150, *Overlord* p. 200, and Beale *Tank Tracks* p. 62 and 77.
[276] Perry p. 201.
[277] Lunt p. 285-286, Callahan p. 77, 97-98, 100-103 and 163, Turnbull p. 5, 33 and 45, *POH* p. 90, Seaman p. 13, Allen *Singapore* p. 265, Mason p. 488-489 and 509-513, Hickey p. 1, 71, 79, 81, 91 and 182 (also Foreward therein by Slim).
[278] Patrick Turnbull *Battle of the Box* London 1979 p. 32-33, Mason p. 13, 495, 509 and 522, Hickey p. 2, 71 and 182, Ready Vol II p. 169 and 204, Allen *Burma* p. 554, 632-634 and 637, Callahan p. 147, Perrett *Tank Tracks* p. 23, and Swinson p. 156.
[279] Turnbull p. 95.
[280] *Chindit War* p. 198 and 278, and *IWM Burma* p. 112 and 336..
[281] Slim p. 168-169, Hickey p. 82, *POH* p. 145-146, Ready Vol. II p. 98 and Cross p. 56, citing Calvert (*POH* p. 145-146).
[282] *Chindit War* p. 198.
[283] *Chindit War* loc cit, *POH* p. 78-79, 81, 128, 138 and 145-146 and Ready Vol. II p. 98.
[284] Turnbull p. 82.
[285] *IWM Burma* p. 125, *POH* p. 128, Mike Calvert *Fighting Mad: One Man's Guerrilla War* Shrewsbury 1996 edn p. 163, and Lucas Phillips *Arakan passim*.
[286] Carew *Hong Kong* p. 22, 134-135, 137 and 200-201, Ready Vol. II p. 14-20, *PBI* p. 95-98 and 117, and Stewart p. 54, 59 footnote, 62 and 66.
[287] Paull p.11, 21, 25-26, 29, 32-33, 35, 37, 98-99, Vader *New Guinea* p. 37-38, 43 and White p. 10, 35, 43 and 170.
[288] Allen *Singapore* p. 187-188, Kirby p.57, 91-95, 104, 112, 116, 118, 130-131, 141, 150-151, 163, 184, 198, 215, 217, 221, 225-226, 235, 246, and 251-252, Grenfell p.82 and 146, Ready Vol II p. 15 and 20, Stanley Falk *Seventy Days to Singapore: The Malayan Campaign 1941-1942* London 1975 p. 22, 53, 125-126, 137, 149, 169, 175, 183, 211, 231, 233, 237-238, 248, 267 and 269, and *PBI* p. 100 and 102.
[289] Carew *Hong Kong* p. 21-22.
[290] Ready Vol. II p. 40, Carew *Longest Retreat* p. 61-62, 71, 81 and 118, Mains p. 38 and 118, Lunt p. 229-230, Hill p. 176.
[291] Carew *Longest Retreat* p. 21, Hickey p. 14-15 and 28, Mains p. 33-34 and Lunt p. 41, 44, 48-49 and 56.
[292] *IWM Burma* p. 4, Lunt p. xix, 24, 35-39, 159, 284 and 287.
[293] *Chindit War* p. 53, 125, 175-177, 188-189, 191 and 193, Sykes p. 371, 392, 403, 413, 425 and 443, *IWM Burma* p. 4, 41 and 381, Carew *Longest Retreat* p. 59, Mains p. 106, Lunt p. 71, 119, 169, 197 and 261, Rooney p. 115, Slim p. 119, 353 and 485, Ready Vol. II p. 62, 116, 131, 133-134 and 176, Gough p. 56-57, 195ff and 200, Calvert *Fighting Mad* p. 123, 125 and 161, Allen *Burma* p. 121 (citing Fergusson *Trumpet in the Hall* p. 143, no other details), 148 (citing General Orde Wingate) and 319, Moser p. 23 and 11 (photo caption), Hickey p. 64, 85 and 150, and Fergusson p. 257-258.
[294] Fergusson loc cit, Colvin p. 9, *Guerrillas in Uniform* p. 183, Lunt p. 47, 119 and 169, and *IWM Burma* p. 41. For good performance of early units, see also Allen *Burma* p. 34.
[295] Carew *Longest Retreat* p. 22-23.
[296] Carew *Longest Retreat* p. 66.
[297] Longmate p. 28.
[298] Ibid p. 45.
[299] Longmate p. 22, 85-86, 91, 93, 115-118 and 125-126.
[300] Ibid p. 7 and 20.

[301] Ibid p. 35, 37, 91 and 115.
[302] Ibid p. 117.
[303] Ibid p. 115.
[304] Neillands p. 30.
[305] Longmate p. 27-29, 34-35, 37-40 and 96.
[306] Ibid p. 57, 86, 89, 96, 103-105 and 107.
[307] For Home Guard weapons, see among others Longmate p. 20, 63-70, 72-80 and 83, and Michael Wright (Ed) *The World at Arms* London 1989 edn. p. 45.
[308] Longmate p. 112-114, and Peter Mead *Gunners at War: 1939-1945* London 1982 p. 31.
[309] Longmate p. 126.
[310] Ibid loc cit.
[311] Longmate p. 39-40 and 126.
[312] See for example McKee *Caen* p. 203 and 240, McKee *Alamein* p. 84 (citing War Correspondent Denis Johnston), Humble *Crusader* p. 199, and French p. 126, 151-152 and 154, .
[313] Mckee *Caen* p. 17, McKee *Alamein* p. 24, *Battlefields* p. 8, *PBI* p. 11, Whiting *'45* p. 178, and French p. 122 and 126.
[314] For Norway see Kersaudy p. 169 (citing the Norwegian General Thule and War Office reports), for France 1940 see Moore *Panzer Bait* p. 12 and 27, *PBI* p. 32, 48-49, and 59, Blaxland p. 219, 257 and 324, Ponting p. 92, Neave p. 127, and Ellis *Sharp End* p. 263 (citing F. Knight *The First Casualty* New York 1975 p. 232, who in turn cites R. Collier *The Sands of Dunkirk* London 1963 p. 41, 76, 123-124, 156 and 177-179). Post-Dunkirk see Ponting loc cit, *PBI* p. 68 and 74-75 and Ellis loc cit. For the desert see *PBI* p. 175-176, Whiting *Long March* p. 61, Ellis *Sharp End* p.257 and 266-267, Ready Vol. I p. 76, Moore *Panzer Bait* p. 101 and 104-105, Glover p. 54, Hickey p. 66, and Barnett p. 193. For Greece see Moore *Panzer Bait* p. 41. For Dieppe see Aitken p. 117, 121, 164-165, 224, 229 and 232. For the PTO see *PBI* p. 95, 101, 105-106, 108-110, 151, 171, 174-175 and 201-202, Callahan p. 63 and 95, Paull p. 29 and 98-99, Gough p. 111, 171, 174, 178-180, 183 and 185-186, Kirby p. 246, Swinson p. 139, Allen *Burma* p. 34, 44-46, 73, 114 and 116, Mains p. 124-125, Lunt *passim*, Carew *Long Retreat passim*, Carew *Hong Kong* p. 70, 74, Ready Vol. II p. 15, 20-21 and 40, Keegan 'Who's calling who yellow?', Lee Martin & Michael Smith 'Australian troops accused of cowardice' in *Daily Telegraph* 14th February 1992 p. 1 and 2, Colvin p. 65 and 67-68, John McEwan *Out of the Depths of Hell: A Soldier's Story of Life and Death in Japanese Hands* Barnsley 1999 p. 27, McCann p. 52, 84, 96 and 112, Falk p. 231 and 248, Gilchrist p. 154-155, Hickey p. 78, Lane p. 87, 102, 104, 107-108, 114-118 and 123, and C.E. Lucas-Phillips *The Raiders of Arakan* London 1973 edn. p. 16 and 21(henceforth *Arakan*). For NW Europe see *PBI* p. 189, Whiting *'44* p. 58 and 120, Whiting *'45* p. 58, McKee Caen p. 185-186, 230 and 326, Reynolds p. 120, How p. 140-141, Ellis *Sharp End* p. 261, D'Este *Normandy* p. 282-283 footnote *, *Overlord* p. 121, 144-145, 147-150 and 225, Hagen p. 45 and 51-52, *Scheldt* p. 194 and 199, Powell, *Men at Arnhem* p. 110, Middlebrook p. 209-210, 215, 325-326, 334, 373 and 384, and Whiting *Bounce the Rhine* p. 4 and 151. For Italy see David Mason *Salerno: Foothold in Europe* London 1972 edn. p.76, D'Este *Fatal Decision* p. 42, 201 and 472, Ellis *Sharp End* p. 262 and 267-268, *PBI* p. 178-181 and 202, Wright p. 280, Whiting *Long March* p. 64-65 and note 283. For general comments see Ellis *Sharp End* p. 367 note 65, and *PBI* p. 3 (men locked in barracks to prevent desertion).
[315] Malaya see Hill *Unknown* p. 56 and 135, *PBI* p. 102 and 151, Swinson p. 44 and 117, Gough p. 18, Kirby p. 16, 29-30, 37, 40-41, 43, 73, 189-190, 227-229 and 232-233, Allen *Singapore* p. 166, 186, 215, 218 and 253, Falk p. 41 and 48, Gilchrist p. 21-24, 25 and 29 footnote, Lane p. 9, 61, 106 and 124. For Burma see *PBI* p. 151, Sykes p. 94-95, Carew *Long Retreat* p. 18 and 21, Carew *Hong Kong* p. 15, Allen *Burma* p. 9-15, Lunt p. xix, 24, 35-38, 42, 49, 119, 169, 178, 190-191, 195, 201-203, 207, 218-219, 240, 259, 269, 277, 284 and 287, Perrett *Tank Tracks to Rangoon* p. 28, Mains p. 33 and 105, Slim p. 122, Moser p. 22-23, 27-28 and 31, Hickey p. 29, 64 and 238, *IWM Burma* p.4, McEwan p. 10 and 12-13, Calvert *Fighting Mad* p. 108, and Chindit War p. 179. Elsewhere, see *PBI* p. 61, 149, 151 and 202 (India and Italy), McCann p. 52, 84, 96 and 112 (India), Gardiner p. 37-39 (South Africa), Petrow p. 86 (Norway), and Eric Morris *Guerrillas in Uniform: Churchill's Private Armies in the Middle East and the War against Japan 1940-1945* London 1989 p. 148 and 152 (Tunisia) and 168 (Far East generally). For UK see Roach p. 127-129 and 132, and Deighton p. 154.
[316] For 1940, see Neave p. 31-32, 36, 38 and 144-145, *PBI* p. 34-35 and Blaxland p. 95, 159, 177, 217 and 235. For NW Europe 1944-45 see Smith *Tank Soldier* p. 70-71 and 125, Delaforce p. 92 (testimony of Kenneth West), Daglish p. 64, McKee *Caen* p. 58, 120-122, 152-153, 185, 207, 320 (photo caption), and 360, *Overlord* p. 198-199, 258 and 288-289, Whiting *'44* p. 52, 97, 104-105, Whiting *'45* p. 40, 44 and 77, Whiting *Bounce the Rhine* p. 137,and Keegan *Six Armies* p. 188.

[317] McKee *Caen* p. 153, 216 and 359.
[318] Max Hastings *Das Reich: Resistance and the March of the 2nd SS Panzer Division through France, June 1944* London 1981 p. 220, citing Charles Tillon, *Les FTP* Paris 1962 p. 364. For graphic descriptions of damage to French towns and civilian casualties see McKee *Caen passim*.
[319] Carew *Long Retreat* p. 23, 95 and 167, Callahan p. 63, Allen *Burma* p. 116, Hickey p. 28, Ellis *Sharp End* p. 298, Middlebrook p. 27 (India), Perry p. 119, 145-146 and 233, and Lane p. 275 'Conclusion'. Lunt p. xx states that the pre-war 'norm' was 3-4 years for British officers 'on loan' to the Indian army, whereas Fraser p. 109 gives up to 9 years. By 1944 some RHA desert veterans had served for about 6 years – Forty *Tanks Across the Desert* p. 122.
[320] *PBI* p. 71-72 and 237. For the Home Guard see Longmate p. 60.
[321] *PBI* p. 88-89 and 108-109, Ellis p. 367 note 65, Kirby p. 246, *Overlord* p. 247, Blaxland p. 324, D'Este *Normandy* p. 278, D'Este *Fatal Decision* p. 310-311, *Scheldt* p. 324-325, Whiting *'44* p. 58 and 102-103, Whiting *Long March* p. 106, Lane p. 108, Lucas *Desert War* p. 59 and 63, *Battlefields* p. 96-98, French p. 138-139, Deighton p. 311, and private information to this writer.
[322] BBC News web-site article on ID cards, 23rd September 2003.
[323] For example, John Campbell (Ed) *The Experience of World War II* London 1989 p. 201.
[324] Ellis *Sharp End* p. 328-329, and Allen *Burma* p. 559-600, 606-607 and 633, Allen *Singapore* p. 247-256, 261-262 and 270, Hill *Unknown* p. 39, *IWM Burma* p. 143 and 423-424 footnote 2.
[325] See Blaxland *passim*, Warner p. 96, 105, 137, 150-152, 156, 174-177, 195, 210, 213-215 and 217, Neave p. 106, 141, 163, 195, 197 and 242, Moore *Panzer Bait* p. 25 , *PBI* p. 40 and 44, English p. 155-156 and *Overlord* p. 15-16. For the PTO see Lunt *passim*, Mains *passim*, Carew *Long Retreat passim*, Carew *Hong Kong* p. 67, 85-86, 94, 96, 112, 125, 128, 130-131, 138, 180, 185, 196-198, 203 and 215, Harry Howarth *Where Fate Leads* Bolton 1983 p. 130, *IWM Burma* p. 10, 39 and 41, Kirby *passim*, Allen *Burma* p. 67, Allen *passim*, Stewart, Paull passim, Ready Vol. II passim, *PBI passim*, *POH* p. 302, Falk p. 79-80, 129, 132, 145, 147, 153-156, 166-168, 172, 179-180, 185, 187-188, 191-192, 236, 238, 247, 249 and 252, Gilchrist p. 24 and 156, and Hickey p. 63. For the desert, see *Desert* p. 127 and 148, and Gardiner p. 82-83, 85, 94-95, 170 and 172. For Crete see Gardiner p. 63-74, G.C. Kopoulos *Ten days to Destiny: The Battle for Crete* London 1985 passim, Edmund L. Blandford *Green Devils-Red Devils: Untold Tales of the Airborne in World War II* London 1993 edn. p. 61-103, and Bruce Quarrie *Airborne Assault: Parachute Forces in Action 1940-91* London 1991 p. 20-25. For Greece Moore *Panzer Bait* p. 35-36.
[326] Ellis *Sharp End* p. 248, PBI p. 239 and W. Moore *The Thin Yellow Line* London 1974 p. 230 (henceforth *Yellow Line*). Hill p. 133 and 168 gives only 30-60 days, while *Chindit War* p. 68 and 156 gives 90 days for the Chindit *War* (according to Wingate's calculations). However, both of the latter two sources relate to warfare in the harsher Burmese environment.
[327] Van Creveld p. 105, 113 and 145-146, French p. 80 (citing van Creveld), Weigley *passim*, English p. 181 and 186, Ellis *Sharp End* p. 12, *Overlord* p. 50, 166-168 and 246 (citing General G.S. Patton), *Battlefields* p. 33, and S.D. Badsey 'The American Experience of Armour 1919-53' in Harris & Toase p. 132-133.
[328] Lunt p. 165; French p. 66 and 80, disagrees. Latimer p. 5 states the mechanisation of the 1930s put many of the best men into maintenance.
[329] Carew *Hong Kong* p. 22, Callahan p. 23, Colvin p. 3, Lunt p. 281, Hickey p. 31, Perry p. 83-84, 93, 97, 106-107, 115-117, 1199, 202, 229-230, Mason p. 24, 165, 341-361, 512 and 529, *Chindit War* p. 197-198, IWM *Burma* p. 405, Royle p. 96-97 and 105-106, and Lucas Phillips *Arakan* p. 200.
[330] Moore *Yellow Line* p. 229-230 and Ellis *Sharp End* p. 10-11.
[331] Anthony Farrar-Hockley *Airborne Carpet: Operation Market-Garden* London 1970 ed p. 35, D'Este *Normandy* p. 283, *Overlord* p. 37, Neillands p. 31-32, Battlefields p. 144, French p. 64, *IWM Europe* p. 84 and 251, Bruce p. 25-26 and 34, *Crucible* p. 317 and 319, *Year Alamein* p. 18, Perry p. 267 (on officers) and 221-222 (citing Slim) and Slim p. 529-530. For a critique of this theory, see Eric Morris *Churchill's Private Armies: British Special Forces in Europe 1939-1942* London 1986 p. 243-244, and in less detail *IWM Desert* p. 200.
[332] English p. 199 footnote and 128 (citing McKee *Caen* but page reference given is spurious), and Neillands p. 104. For complaints when they were see Moulton *Antwerp* p. 79.
[333] John Weeks *The Airborne Soldier* Poole 1982 p. 23 (photo caption) and 29, and Quarrie *Airborne Assault* p. 44-45.
[334] Middlebrook p. 23.
[335] *PBI* p. 239 and 297, Moore *Yellow Line* p. 232 and Ellis *Sharp End* p. 41 and 248.
[336] *Overlord* p. 246-247, *PBI* p. 239-240 and Whiting *'45* p. 27-28.
[337] Moore *Yellow Line* p. 225-233.

[338] Ellis p. 17 and *PBI* p. 68.
[339] *PBI* p. 68, Whiting *'44* p. 23-24, Place p. 57-58, and Ellis *Sharp End* loc cit.
[340] Ellis *Sharp End* loc cit, French p. 134 and 154, and Place loc cit.
[341] *Chindit War* p. 81.
[342] Ibid p. 198 and 247,
[343] Sykes p. 64, 152 and 250, and Royle p. 64-66, and 129-130.
[344] *Chindit War* p. 19, 84, 136-137 and 246-247, in less detail Guerrillas in Uniform p. 200, Allen *Burma* p. 138 and 339 footnote, Rooney p. 128, *PBI* p. 167 and Hickey p. 125.
[345] *Chindit War* p. 246-248.
[346] French p. 140-141.
[347] *Battlefields* p. 29 for Canadian, *IWM Desert* p. 135 for Australian.
[348] Private information from veterans, also Carew *Hong Kong* p. 32, *Battlefields* p. 29, Middlebrook p. 48, French p. 130-131, *IWM Europe* p. 17, Reynolds p. 45, McEwan p. 11, 17 and 20 (poor UK pay), *Overlord* p. 34-35, 49, 197 and 201, Ellis *Sharp End* p. 294, 303 and 372 note 81, Smith *Tank Soldier* p. 135 and 167, Whiting *'44* p. 19 and 21, Howarth p. 55, and Charles B. MacDonald 'The US Soldier' in *PHSWW* Vol. 7 No. 16 p. 3112, and Alan Wykes 'The British Soldier' op cit p. 3110..
[349] *Overlord* p. 49.
[350] Reynolds p. 45-46, and in less detail Douglas Botting *The Second Front* Chicago 1981 p. 108.
[351] Hart p. 40, and Ellis *Sharp End* p. 283.
[352] Ellis *Sharp End* loc cit.
[353] *IWM Burma* p. 410-411. On the calorific deficiencies of the US 'K' ration, see Ellis *Sharp End* p. 280-284 and *IWM Burma* p. 236-237.
[354] French p. 122-123 and 242.
[355] See Lunt p. xix, 47, 70, 95, 161, 280 and 284, Mains p. 39, Grenfell p. 142-143 and 146, Allen *Singapore* p. 140 and 190, Carew *Longest Retreat* p. 95 and 227, Ready Vol. II p. 13, Allen *Burma* p. 113-116 (especially citing Irwin's criticisms) and 148, Kirby p. 92 and 141, Callahan p. 64 (citing Irwin), *PBI* p. 102 and 111-112, Falk p. 265 (citing Wavell), and Hickey p. 78.
[356] Kersaudy p. 169, *PBI* p. 62 (citing Auchinleck), 68-69, 74-75 and 85.
[357] Van Creveld p. 114.
[358] Ibid p. 113.
[359] Ibid p. 114 and *Overlord* p. 247-248, who cites no source.
[360] Whiting *'44* p. 150; van Creveld p. 114 gives 11753.
[361] Omer Bartov *Hitler's Army: Soldiers, Nazis and the War in the Third Reich* Oxford 1991 p. 96, who gives 13000-15000. The author deals extensively with political indoctrination, war crimes and the ruthlessness of German military discipline in world war two. Hart, Hart & Hughes p. 11 gives "close to 30,000". French p. 153 gives 13,000-15,000. *Battlefields* p. 38 gives 15,000 formal and "thousands" more informal executions, citing Hew Strachan in Paul Addison & Angus Calder (Eds) *Time to Kill* London 1997, no page.
[362] Van Creveld p. 114.
[363] Bartov loc cit, and Whiting *'44* p. 150, Hart, Hart & Hughes p. 11, among others.
[364] Whiting *'44* p. 151 (citing Milton Shulman *Defeat in the West* 1947 and 1986, no page), Shulman London 1986 edn. p. 244-246, Keegan *Six Armies* p. 229-230, Scheldt p. 24 and 266, Gerald Rawling *Cinderella Operation: The Battle for Walcheren 1944* London 1980 p. 44, and Moulton *Antwerp* p. 48 (citing Shulman).
[365] See Fey von Hassell *A Mother's War* London 1990 p. x-xii, xiv and 123, Keegan *Six Armies* loc cit, and in less detail McKee *Caen* p. 292, Scheldt p. 24 and Rawling loc cit.
[366] J. Keegan & R. Holmes *Soldiers* London 1985 p. 55-56, Fraser p. 106, and Deighton p. 130-131 and footnotes p. 607-608. Moore *Yellow Line* p. 250 give a minimum of 266 executions. Bartov p. 96 gives 346 executions, but this is for *all* types of offence, not just desertion, that carried the death penalty.
[367] Chindit *War* p. 246, and p. 295 footnote 2 citing Robert H. Arheneldt *Psychiatry in the British Army in the Second World War* London 1958 Appendix B.
[368] D'Este *Fatal Decision* p. 311.
[369] Ellis *Sharp End* p. 244, Moore *Yellow Line* p. 229 (both calculated from data tables), and D'Este *Fatal Decision* p. 311.
[370] Ellis *Sharp End* p. 244.
[371] Ellis loc cit, Fraser p. 107, and Myatt p. 214.
[372] Ellis *Sharp End* p. 245, Moore *Yellow Line* p. 229, French p. 141 and Fraser p. 105-109.
[373] *PBI* p. 72-74, Lucas *Desert War* p. 59, *Battlefields* p. 72 and Vader 'The ANZAC Soldier' in *PHSWW* p. 3124.

[374] *PBI* p. 192.
[375] *Overlord* p. 54.
[376] Van Creveld p. 115.
[377] Ibid p. 115-116.
[378] Ellis *Sharp End* p. 243-244.
[379] Ellis *Sharp End* p. 244 and Moore *Yellow Line* p. 229; Fraser p. 106 asserts that the British conviction rate was highest in 1944-45 but his (less detailed) statistics appear to contradict this.
[380] Van Creveld p. 116.
[381] Ibid p. 115.
[382] Myatt loc cit, Fraser loc cit, and Field Marshal Lord M. Carver *The Seven Ages of the British Arm*y London 1984 p. 251.
[383] Private information from veterans.
[384] Ellis *Sharp End* p. 376-377 (tables).
[385] Ibid loc cit.
[386] Ellis *Sharp End* p. 156 and Fraser p. 109.
[387] Ellis *Sharp End* p. 156-159, 162 and 164.
[388] Ellis *Sharp End* p. 376-377 (tables). D'Este *Normandy* p. 260 gives 42% of all casualties between September 1939 and 30th June 1944 as being POW's, citing War Office statistics.
[389] Ellis p. 16 and 376-377 (tables).
[390] Ibid p. 160, 253 and 363, and Deighton p. 314.
[391] D'este *Normandy* p. 250, 252, 257, 262-263, 265-267, 269, 278 and 283, Ellis *Sharp End* p. 41, 296 and 338, Henry Maule *Caen: The Brutal Battle and the Breakout from Normandy* Newton Abbott 1976 p. 82, *Black Bull* p. 71, 203, 207, and 210, *Overlord* p. 54, McKee *Caen* p. 249, Mollo p. 222, Hill p. 23, Lucas & Barker p. 33, *PBI* p. 215-216 and 239, Callahan p. 146-147, Keegan *Six Armies* p. 190, 251 and 324, Roberts p. 200 and 233, Moore *Panzer Bait* p. 186, Smith *Tank Soldier* p. 91-92, Ready Vol. I p. 334-335, Perry p. 70-71, 74, 77, 114, 143 and 219, Moore 'Veritable' p. 8, Whiting *'44* p. 98, Whiting *'45* p. 6 (author's note) and 20, *Battlefields* p. 142, Delaforce p. 139 (Hart Dyke testimony), *Scheldt* p. 98, 102, 172-173, 189-190, 205, 213-213, 215-233, 273, 333 and 375, *Chindit War* p. 159, Russell & de Normann p. 63-65, *IWM Burma* p. 280, Doherty p. 166, *Rhineland* p. 159, French p. 64-65, 70-71, 188-189 and 244, *IWM Europe* p. xii, 94, 211-212 and 220-221, Bruce p. 125-126, 156, 280-281 and 287, POH p. 215, English p. 175 and footnote 76 p. 193-194 and footnote 83 p. 195, Daglish *Goodwood* p. 16, Moulton *Antwerp* p. 87-88, James Lucas *Last Days of the Reich: The Collapse of Nazi Germany* London 1986 p. 180 (henceforth *Last Days*), Sir Brian Horrocks *Corps Commander* London 1977 p. 144, and 'The War Within'.
[392] *IWM Europe* p. 220-221, Place p. 78-79, Delaforce p. 104 (Lt Sydney Jary testimony), and Russell & Normann p. 128.
[393] Perry p. 70, French p. 113-115, and Ready Vol. I p. 335.
[394] Ellis *Sharp End* p. 156-157, and French loc cit.
[395] Among others, McKee *Caen* p. 327 (Normandy), Doherty p. 157 (8 men left), Colvin p. 94 (Burma), *Scheldt passim*, Hill p. 143 and 164 (Burma). How p. 201 8 men platoons on Hill 112, citing Kemsley & Riesco *The 15th Scottish Reconnaissance Regiment* Bristol, no date or page.
[396] *PBI* p. 188-189 and 215, Whiting *'44* p. 98 and 167, Whiting *'45* p. 6, 8-9, 58 and 182, and Charles Whiting *The Last Battle: Montgomery's Campaign April-May 1945* Marlborough 1989 p. 287.
[397] *PBI* p. 188-189 and 215 and 239, Whiting *'45* p. 152. *IWM Europe* p. 211 5 veterans left in 2/East Yorks by 21.11.44.
[398] *PBI* p. 216, and Whiting *'45* p. 76.
[399] D'Este *Normandy* p. 252 and Mollo p. 221, French p. 64, Perry p. 62, 74-75 and 226. *Overlord* p. 23 gives the limit of growth of the British army as 2.7 million men in May 1944.
[400] Ellis *Sharp End* p. 376-377 (tables); Keegan *Six Armies* p. 324 gives 3 million men, but no date.
[401] D'Este *Normandy* p. 253, Bruce p. 125-126, and Perry p. 65. In less detail McKee *Caen* p. 250 and How p. 196.
[402] Perry p. 230 and 235-236.
[403] D'Este *Normandy* p. 250, 260 and 388-389, *Overlord* p. 210 and 238-239, Place p. 175 (citing Hastings), Badsey p. 50 and 57, Mckee *Caen* p. 249-250, Lucas & Barker p. 32, Perry p. 232, Hart p. 5, How p. 196, Maule p. 19, 66 and 80-82, English p. 175-176 and 180, *Firepower* p. 288, *Scheldt passim*. *PBI* p. 259 states that infantrymen made up only 20% of the armies landed in Normandy but took 70% of the casualties.
[404] D'Este *Normandy* p. 252-270, Ellis *Sharp End* p. 296, Perry p. 219, English p. 175-176 and *Scheldt* p. 212-233.

[405] D'Este *Normandy* p. 260-261, French p. 125, and Delaforce p. 139 (Hart Dyke testimony).
[406] Hill p. 137, Carew *Longest Retreat* p. 259, Mason p. 509, Colvin p. 70 and 104, Carver *Alamein* p. 108, *Desert* p. 104, *Battlefields* p. 80, *IWM Europe* p. 211-212 and 220, French p. 123 and 145-146, Bruce p. 33, Badsey p. 57, Ellis *Sharp End* p. 341-342, Perry p. 53 and 66, Whiting *'44* p. 79-80, Whiting *Bounce the Rhine* p. 75, and Keegan *Six Armies* p. 320.
[407] Moser p. 93, Lunt p. 41, Guerrillas in Uniform p. 228, and Hickey p. 194.Dietry requirements *POH* p. 40-41 and 213.
[408] D'Este *Normandy* p. 268-270.
[409] Hart p. 51-52, 53-54 (tables), 56-59, 60-61, and 69-71.
[410] Ibid p. 52, 69 and 71.
[411] Ibid p. 56-58, and for similar comments McKee *Caen* p. 218 and 249, and Daglish *Goodwood* p. 15-16. For manpower shortages, see Weigley p. 51, 53, 58, 135, 144, 171, 288, 321, 351-352, 354, 538 and 668, *Overlord* p. 238, Ellis p. 218 photo caption, Pemberton p. 161 and 232, How p. 195-196, English p. 155, 175, 180, 186 and 196 footnote 96, Sykes p. 370 and 443, and Ready Vol II p. 169-170.
[412] Hart p. 57-58.
[413] *Scheldt* p. 213 and 223.
[414] Ibid p. 217, 228 and 233-234.
[415] Perry p. 193 and 195-197.
[416] Ibid p. 192 and 197, and Ready Vol. I p. 3-4.
[417] Weigley p. 143, 379, 373-375, 400-401, 420, 436, 464, 551, 567-571, 598 and 659-665.
[418] Horrocks p. 34, *Scheldt* p. 307 and Delaforce p. 3 (both citing Horrocks).
[419] Hill p. 165.
[420] Gardiner p. 172.
[421] Hart p. 38, D'Este *Normandy* p. 276, and Daglish *Goodwood* p. 19 and 41.
[422] Gilchrist p. 159-160, *Firepower* p. 189, *POH* p. 240 and 300, Hickey p. 72, D'este *Normandy* p. 271-273, 276-278, 281-282, 285, 287 and 290-291, *Black Bull* p. 225, Russell & de Normann p. 65, 113, 115 and 138, Moulton *Antwerp* p. 51, Forty *Tanks Across the Desert* p. 130, Hart p. 29 and 34-35, Moore *Panzer Bait* p. 161 and 186, *Scheldt* p. 223 and 225, Gardiner p. 136-137, *PBI* p. 118, 149 and 201-202, Whiting *'45* p. 58, Alan Moorehead *Eclipse: An Eyewitness Account of the Decline and Fall of Nazi Germany, 1943-45* London 1978 edn. p. 196, Ellis *Sharp End* p. 41 and 259-261, Hill p. 22, *Overlord* p. 137, 141, 150-151 and 300, Vader *New Guinea* p. 152-153 and 156, Callahan p. 147, 161-162 and 179 footnote, Powell p. 110 and Ryan *Bridge too Far* p. 126 and 128. For USA see Weigley *passim*.
[423] Neillands p. 104 and 106.
[424] Ellis *Sharp End* p. 297, *Battlefields* p. 142 and Hart p. 29-33.
[425] *PBI* p. 174-176, 179-183 and 191, Ellis *Sharp End* p. 262, Howarth p. 208, Bruce p. 159-160, *Battlefields* p. 96-97, Wright p. 280, D'Este *Fatal Decision* p. 42 and 472 footnote, H. Pond *Salerno* London 1974 p. 298, Fraser p. 107-108, Whiting *Long March* p. 64-65. For other incidents see Ellis *Sharp End* p. 261, Ready Vol. II p. 194, Callahan p. 95, Perry p. 119, Hastings p. 125, Mason p. 513-514, Gardiner p. 136-137 and 143, Keegan *Six Armies* p. 267 and Whiting *Long March* p. 80.
[426] *PBI* p. 178-182, and Wright loc cit.
[427] *Overlord* p. 48, 50, 135, 150 and 293, *IWM Europe* p. 8, 16-17 and 83-84, D'Este *Normandy* p. 277-278, French p. 142-143, and 146-147, Reynolds p. 47, Bruce p. 40, Hart p. 32-33, Roach p. 135, *Battlefields* p. 142 (citing Roach), *PBI* p. 187, 189 and 191, Moorehead *Eclipse* p. 24-25, Mckee *Caen* p. 185-186 and Lucas & Barker p. 32.
[428] Ellis *Sharp End* p. 118, French p. 243, *Crucible* p. 339, Hart p. 32, and D'este *Normandy* p. 192-193.
[429] Reynolds p. 47-48, 107-108 and 111-112, Daglish p. 2, Hart p. 28-32, Delaforce p. 37, D'Este *Normandy passim*, McKee *Caen passim*, *Overlord passim*, Lucas & Barker *passim*, Geoffrey Reagan *The Guinness Book of More Military Blunders* London 199* p. 177, Whiting *Bounce the Rhine* p. 75, D'Este *Fatal Decision* p. 505 footnote no. 46, and Ellis *Sharp End* p. 259-260.
[430] Ellis *Sharp End* p. 260, Lucas-Phillips *Alamein* p. 112, How p. 22 and 123, Reynolds p. 47-48, D'Este *Normandy* p. 272-273 and 275, D'Este *Fatal Decision* p. 17, Maule p. 25, Howarth p. 83 and 100, Moore *Panzer Bait* p. 168-169, Daglish p. 24, Hart p. 29 and 32-33, Whiting *Bounce the Rhine* p. 74, Whiting *Long March* p. 36 and *Desert* p. 152. For arrogant officers posted from Africa to Burma, see *IWM Burma* p. 272.
[431] Smith *Tank Soldier* p. 53-54, 69 and 212, and French p. 150-151.
[432] *Overlord* p. 183-185, Moore Panzer Bait p. 157, Daglish p. 86-87, 89 and 135-136, Hart p. 41, and D'Este *Normandy* p. 287.

[433] Correlli Barnett *Audit of War: The Illusion of Britain as a Great Nation* London 1987 edn p. 267-268 (henceforth *Audit*).
[434] G. Macleod Ross *The Business of Tanks* Ilfracombe 1976 p. 233.
[435] F.S. Northedge *Descent from Power* London 1974 p. 38.
[436] Northedge *passim*, and Barnett *Audit passim*.
[437] Kirby p. 11, 14, 16 and 22, Hickey p. 33, Ponting p. 20-21, Pemberton p. 23, Kersaudy p. 14, *Firepower* p. 150, 167 and 185, and Richard Overy & Andrew Wheatcroft *The Road to War* London 1989 p. 65, 68 and 71.
[438] Kirby p. 14-15, 22 and 33, Ponting p. 22 and 28, *Desert* p. 105 and D'Este *Normandy* p. 19.
[439] See, respectively, Max Hastings *Bomber Command* London 1979 109 and 349 (citing A.J.P. Taylor *The Second World War* London 1975 p. 129, and J.C.F. Fuller *The Conduct of War 1789-1961* London 1972 edn. p. 286; known for his fascist / falangist sympathies, Fuller's estimate might be too high.
[440] Kenneth Macksey *Military Errors of World War Two* Poole 1987 p. 18 (henceforth *Errors*), D'Este *Normandy* p. 19, *New Excalibur* p. 235-236, and Postan, Hay & Scott p. 240.
[441] *PBI* p. 30 and 60-61, Neave *passim*, Blaxland *passim*.
[442] Longmate p. 53.
[443] *Overlord* p. 23; David Fletcher *The Great Tank Scandal: British Armour in the Second World War* Part 1 HMSO London 1989 (henceforth *Tank Scandal*) p. 87 citing Postan Hay & Scott no page gives 69.5%.
[444] Dorothy Crisp *The Dominance of England* London 1960 p. 12 and 23 (henceforth *Dominance*).
[445] *Dominance* p. 11; also figures in George Forty *US Army Handbook 1939-1945* Stroud 1995 edn p. 19, Macksey *Land Warfare* p. 167 (table), and Weigley p. 13 and 667-668.
[446] *Dominance* p. 20.
[447] Ellis p. 376-377 (tables), and *Dominance* p. 20.
[448] *Dominance* p. 13.
[449] *Dominance* p. 18.
[450] *Dominance* p. 11 and 19.
[451] Respectively, Weigley p. 667 (calculation), and *Dominance* p. 18.
[452] Respectively, *Dominance* p. 16 and Ellis p. 157, and Ellis loc cit.
[453] Respectively, *Overlord* p. 159 (Normandy August 1944) and *Dominance* loc cit.
[454] *Dominance* p. 20.
[455] *Dominance* p. 19.
[456] Hill *China Dragons* p. 71 136 and 171 (Appendix A, citing SEAC report p. 277).
[457] *Dominance* p. 36, and Brian Harper *A Bridge to Victory: The Untold Story of the Bailey Bridge* HMSO London 1991 *passim*.
[458] Among others, *Dominance* p. 36.
[459] *Dominance* p. 34 and 36.
[460] *Dominance* p. 34.
[461] *Dominance* p. 23.
[462] *Dominance* p. 231; but p. 26 states "about fifty per cent" of £ 2,078,500,000.
[463] *Dominance* p. 26.
[464] John Keegan *The Battle for History: Re-fighting World War Two* London 1995 p. 97 (henceforth *Re-fighting*).
[465] *Re-fighting* loc cit.
[466] *Dominance* p. 25.
[467] Ibid loc cit.
[468] Ibid loc cit.
[469] Ibid loc cit.
[470] Ibid loc cit.
[471] *Dominance* p. 26.
[472] *Dominance* p. 22.
[473] Ibid loc cit.
[474] Ibid loc cit.
[475] Ibid loc cit; for a more detailed list of British aid sent to the USSR, see *Dominance* p. 121-125.
[476] *Dominance* p. 125.
[477] RAC half-yearly report July 1944-June 1945, courtesy of the Tank Museum, Bovington.
[478] Mason p. 494.
[479] Letter from the School of Infantry, Warminster, to this writer 1st June 1987.

[480] Ellis *Sharp End* p. 64, Bruce p. 203; Keegan *Six Armies* p. 88 and Middlebrook p. 22 comparing with US paratrooper equipment.
[481] Ellis loc cit.
[482] *Overlord* p. 34-35, 197, 201 and Chapter 5 footnote 16, p. 325.
[483] *Overlord* p. 197; see also English p. 177-178 on over-supply to infantrymen.
[484] *Dominance* p. 21.
[485] Tim Healey *Life on the Home Front*, Journeys into the Past series, London 1993 edn p. 124.
[486] Healey p. 63.
[487] Postan, Hay & Scott p. 257, and French p. 80-81 and 84-85.
[488] J.B. King & Jon Batchelor *Infantry at War* London undated (c. 1970) p. 18.
[489] Postan, Hay & Scott p. 240 and 257-259, *PBI* p. 30 and 37, Blaxland p. 119, *Rude Mechanicals* p. 18 and 44, John Weeks *Men Against Tanks* London 1975 p. 83-84, Glover p. 38, Moore *Panzer Bait* p. 71, Perrett *Tank Warfare* p. 105, and Mason p. 487.
[490] Weeks p. 32.
[491] Weeks loc cit.
[492] French p. 88.
[493] Blaxland p. 7.
[494] Blaxland p. 116 and 119, and *Rude Mechanicals* p. 44.
[495] Blaxland p. 7, and Neave p. 39
[496] *Crucible* p. 154, and Peter Chamberlain & Terry Gander *Anti-tank Weapons* London 1974 p. 42 (henceforth *AT Weapons*).
[497] Vader 'ANZAC Soldier' in *PHSWW* p. 3125.
[498] *New Excalibur* p. 249.
[499] Glover p. 114.
[500] *Rude Mechanicals* p. 18.
[501] Lucas Phillips *Arakan* p. 196. For use at 45º at close range, Ibid p. 143.
[502] Playfair Vol. 3 p. 427ff, French p. 88 and Glover p 79. Pemberton p. 231 gives 2600 yds for the German 81mm mortar, and p. 287 1600 yds for the British 3" mortar.
[503] Pemberton p. 140.
[504] Postan, Hay & Scott p. 300, and Pemberton p. 231.
[505] *POH* p. 203-204.
[506] Pemberton p. 288.
[507] Pemberton p. 314.
[508] Postan, Hay & Scott p. 301.
[509] John Weeks *Infantry Weapons* London 1971 p. 117 and 119.
[510] King & Batchelor p. 26.
[511] Ian V. Hogg *The Encyclopedia of Infantry Weapons of World war II* London 1977 p. 74 (henceforth *Infantry Weapons*), and *IWM Burma* p. 406 (John Randle testimony).
[512] Ibid p. 75, Ian V. Hogg & John Weeks *Military Small Arms of the 20th Century* London 1981 4th edn. p. 253, and Peter Chamberlain & Terry Gander *Machine Guns* London 1974 p. 54.
[513] Hogg & Weeks p. 230-231, King & Batchelor p. 26, and letter to this writer from the School of Infantry, Warminster 27th January 1988.
[514] Hogg & Weeks p. 222, White p. 132, Lane p. 82, Lunt p. 44, Neave p. 35 and 237-238, Blaxland p. 356 and Paull p. 63. For Home Guard use, Longmate p. 73.
[515] Hogg & Weeks p. 227, and Chamberlain & Gander *Machine Guns* p. 39.
[516] *Tankette* Vol . 33 # 6 p. 8, Vol. 37 # 4 p. 3, and letter dated 23rd May 1999 from Eric W. Knowles, ex-Inns of Court Regiment to Steve Irwin.
[517] Respectively Postan, Hay & Scott p. 267, and Hogg *Infantry Weapons* p. 55. Sten jamming at Dieppe, Atkin p. 143 and 158.
[518] Hogg *Infantry Weapons* p. 52-53, Hogg & Weeks p. 82-83, 86-89 and Peter Chamberlain & Terry Gander *Sub-Machine Guns and Automatic Rifles* London 1976 p. 41-43 (henceforth *SMGs*).
[519] Hogg *Infantry Weapons* p. 54, Hogg & Weeks p.68 and Chamberlain & Gander *SMGs* p. 3.
[520] Ibid loc cit.
[521] Ladd p. 241, Terry J. Gander *The Bazooka: Hand-held Hollow Charge Anti-Tank Weapons* London 1998 p. 52, Peter Chamberlain & Terry Gander *Anti-Tank Weapons: World War two Fact Files* London 1974 p. 44, and Ian V. Hogg *Encyclopedia of Infantry weapons of World War II* London 1977 p. 149. In less detail Doherty p. 129.
[522] Myatt p. 201, Weeks *Men against Tanks* p. 85, Hogg *Infantry Weapons* p. 148-149, Chamberlain & Gander *AT Weapons* p. 44, and Gander *Bazooka* p. 52-54.

[523] Ready Vol. II p. 126, and Hickey p. 270, among others.
[524] Beale *Tank Tracks* p. 30.
[525] French p. 89
[526] French loc cit.
[527] 'Maintenance Manual for the M.L. 2-Inch, M.L. 3-Inch and S.B. 4.2-Inch Mortars', Land Service, War Office, 21st September 1946, p. 48
[528] Ibid, p. 25.
[529] Postan, Hay & Scott p. 240.
[530] Ibid p. 355, and in less detail Pemberton p. 12 and 23.
[531] *Firepower* p. 98, and Ian V. Hogg *The Illustrated Encyclopedia of Ammunition* London 1985 p. 148 and 183 (henceforth *Ammunition*).
[532] French p. 90.
[533] Hogg *Ammunition* p. 148.
[534] French p. 90-91.
[535] Pemberton p. 48 and 173.
[536] Warner p. 123.
[537] Macksey *Afrika Korps* p. 40, and in less detail Lorrin Rexford Bird & Robert D. Livingston *World War Two Ballistics: Armor and Gunnery* New York 2001 p. 5 and 30.
[538] Pemberton p. 173.
[539] Colonel F.W.S. Gordon-Hall report 1st January 1946 'Armoured Fighting Vehicles in the Mediterranean Theatre 1939-1945' for School of Tank technology p. 33, supplied courtesy of the Tank Museum Bovington.
[540] R.P. Hunnicutt *Sherman: A History of the American Medium Tank* California 1978 2nd edn. Novato 1978 p. 89.
[541] Macksey *Errors* p. 80, Kenneth Macksey *Tank versus Tank* London 1988 p. 94, and Moore *Panzer Bait* p. 80..
[542] David Fletcher *Universal Tank: British Armour in the Second World War Part 2* HMSO London 1993 p. 14 (henceforth *Universal Tank*).
[543] *Firepower* p. 192, citing B.H.L. Liddell-Hart *The Memoirs of Captain Liddell-Hart* London 1965 p. 178.
[544] T. Gander 'In Defence of the 2pdr' in *Military Modelling* June 1981 p. 458, and Postan, Hay & Scott p. 315.
[545] Hogg *Conflict* p. 103.
[546] *Rude Mechanicals* p. 185.
[547] Postan, Hay & Scott p. 325.and Gander 'In Defence of the 2pdr' p. 460.
[548] Postan, Hay & Scott p. 360.
[549] Ibid p. 317.
[550] Letter to this writer from the Royal School of Artillery, Larkhill 25th July 1988. 3.7" HEAT, Pemberton p. 299, and 6 pdr in PTO Pemberton p. 287 and 299; for 6 pdr use at Kohima 9th May 1944 Colvin p. 195 and 204.
[551] Pemberton p. 42 (table).
[552] Hogg *Infantry Weapons* p. 118 and 124, *Mr Churchill's Tank* p. 59, and Ian V. Hogg *British & American Artillery of World War 2* London 1978 p. 85 (henceforth *B&AAWW2*).
[553] 'RA Notes' 15th April 1944, courtesy of the RSA, Larkhill.
[554] Colvin p. 204.
[555] Pemberton p. 299.
[556] Pemberton p. 291.
[557] *Mr Churchill's Tank* p. 165.
[558] Postan, Hay & Scott p. 347.
[559] Letter to this writer from Bob McNamara dated 13th May 1987, citing US army ammo expenditure reports.
[560] Trials by 23rd Hussars, see among others McKee *Caen* p. 309, How p. 14 and Ian Daglish *Operation Goodwood: The Great Tank Charge July 1944* Barnsley 2004 p. 47 (all citing regimental history Geoffrey Bishop *The Story of the 23rd Hussars* BAOR 1945 / London 1946 p. 67).
[561] cited in *Universal Tank* p. 111-112.
[562] WO 291 1331, Operational Research I North West Europe No. 2, ORS 21 Army Group, Report No. 17, 'Analysis of German Tank Casualties in France: 6th June 44 – 31st August 44', section 19 'Distribution of A.P. Penetrations and Failures on Enemy Tanks', Table X, p. 206, courtesy of Ian Daglish.

[563] *Challenger I – Armament Training Pamphlet*, AFV School, Bovington, May 1945 p. 107 – catalogued Challenger A30/11 623.438.3 (41) in Tank Museum archives.
[564] Bird & Livingston, p. 91and 92.
[565] Information from Lorrin Bird via Matrix Games website, citing War Office report.
[566] Information from Phil Greenwood, via Mark Hayward, in emails on the latter's book *Sherman Firefly: Medium Tank* Tiptree 2001 (henceforth *Firefly*), also *Firefly* p. 76, and Bird & Livingston p. 92.
[567] *Firefly* p. 35.
[568] *Firefly* p. 134.
[569] Letter from Major D.F. Currie, Italian front veteran, to this writer dated 1st February 1988.
[570] Letter dated 19th January 1994 to this writer from Tank Museum Bovington, and RAC half-yearly reports.
[571] US Army report on Isigny gun trials, 30th August 1944, recommendation 6d.
[572] Ian V. Hogg *The Guns: 1939-1945* London 1969 p. 76-77.
[573] Zaloga *M4 (76mm) Sherman* p. 19.
[574] Ross p. 291, and Major Irl D. Brent *Final Historical Report: Armored Fighting Vehicles and Weapons Section, Headquarters European Theater of Operations U.S. Army 6 June 1944 to 24 May 1945* p. 20.
[575] Brent loc cit.
[576] *Firefly* p. 17, citing War Office report 11th May 1945.
[577] Royal Artillery reports, courtesy of RSA Larkhill.
[578] *Black Bull* p. 162 (David Swiney testimony).
[579] Hunnicutt p. 89.
[580] Gordon-Hall p. 104 and Bird & Livingston p. 33..
[581] Hunnicutt p. 89-90, and in less detail George Thayer *The War Business* London 1969 p. 34 footnote.
[582] Ross p. 56, citing Ordnance Board Minute Q 2402.
[583] Pemberton p. 113.
[584] Letter dated 20th February 1987 to this writer from the Royal School of Artillery, Larkhill.
[585] Sir Brian Horrocks *Corps Commander* London 1977 p. 237.
[586] D.P.Dyer 'Carrier, Valentine, 25-pdr Gun Mk. I Bishop' in *Bellona Military Vehicle Prints Series 31* Hemel Hempstead 1972 p. 7, and internal stowage diagram p. 12.
[587] Terry Gander 'Sexton' in *Military Modelling* March 1982 p. 236, Chris Henry *The 25-pounder Field Gun 1939-72: Osprey New Vanguard # 48* Oxford 2002 p. 43-44, and B.T. White *British Tanks and Fighting Vehicles 1914-1945* London 1970 p. 248 (henceforth *British Tanks*).
[588] Pemberton p. 16.
[589] Pemberton p. 35 citing A.T.M. No 41, October 1941.
[590] Pemberton p. 12, 226 and 290, Daglish *Goodwood* p. 25 and 98, French p. 90-91, and Russell A. Hart, *Clash of Arms: How the Allies won in Normandy*, Lynne Rienner Publishers, London, 2001, p. 34. Henceforth cites as *Clash of Arms*.
[591] Hogg *B&AAWW2* p. 47, Pemberton p. 129 (4.5" gun), and 320 (5.5" gun).
[592] Pemberton p. 320.
[593] George Forty *XIV Army at War* London 1982 p. 82, and Pemberton p. 290.
[594] Pemberton p. 290.
[595] Hogg loc cit..
[596] Pemberton p. 290.
[597] *B&AAWW2* p. 107.
[598] For France see Blaxland p. 122, French p. 96 and Neave p. 158, and for the desert *Year Alamein* p. 101-102, Moore *Panzer Bait* p. 101. For critical assessments see Brigadier L. Bolton in Carver *Tobruk* p.217-218 and 272, and Terry Gander 'The 3.7" Story' in *Airfix Magazine* February 1980 p. 308-309.
[599] *B&AAWW2* p. 110.
[600] Pemberton p. 114.
[601] Major GeneraI I.S.O. Playfair *The Mediterranean and Middle East*, 5 vols., HMSO, vol. 3 p. 28 footnote.
[602] Forty *XIV Army* loc cit.
[603] Pemberton p. 209 and 252.
[604] Kenneth Macksey & John H. Batchelor *Tank: A History of the Armoured Fighting Vehicle* London 1970 edn. p. 94.
[605] *New Excalibur* p. 225.
[606] *Firepower* p. 173-175.

[607] Pemberton p. 75-76.
[608] Pemberton p. 113, 117, 135 and 329.
[609] Pemberton p. 128.
[610] Perrett *Allied Tank Destroyers* p. 3 photo caption.
[611] Pemberton p. 140.
[612] Pemberton p. 140 and 180.
[613] W. Pratt Paul *A History of the Argyll & Sutherland Highlanders 6th Battalion: 93rd Anti-Tank Regiment RA* London 1949 p. 97, and in less detail B.T. White *British Tanks and Fighting Vehicles 1914-1945* London 1970 p. 250 (henceforth BT White).
[614] Gordon-Hall p. 93.
[615] Bryan Perrett *Allied Tank Destroyers: Osprey Vanguard # 10* London 1979 p. 26, and Daglish *Goodwood* p. 45.
[616] *Firepower* p. 18, 65, 83-84, 90, 109-110, 143, 149 and 195, and *Clash of Arms*, p. 32.
[617] *Clash of Arms*, p. 327.
[618] Blaxland p. 8, *Firepower* p. 195-198 and 253-254, Ian Hogg, Peter Sarson & Tony Bryan *Artillery in Colour 1920-1963* Poole 1980 p. 30, Pemberton p. 10-11, Ian V. Hogg *The Guns of World War Two* London 1976, p. 43 (henceforth *Guns*), *Clash of Arms,* p. 34, and letter from RSA Larkhill dated 24th February 1988 to this writer.
[619] *Firepower* p. 253. Pemberton p. 44, orders to change issued 10/40 but manpower shortages often prevented implementation.
[620] *Firepower* p. 155-156 and 164-165.
[621] Pemberton p. 232.
[622] Mason p. 480. For similar ambushes with tanks lying in wait see *Crucible* p. 205 and 384.
[623] Hogg *Conflict* p. 10 and Frank Harrison *Tobruk: The Great Siege Re-assessed* London 1996 p. 54-57; for a later trap by the Central India Horse against the Germans see Harrison p. 287.
[624] Pemberton p. 144, French p. 90-93, Hart p. 95, and Daglish *Goodwood* p. 25 and 98.
[625] Pemberton p. 101.
[626] Pemberton p 11 and 170.
[627] Pemberton p. 170.
[628] Pemberton loc cit.
[629] Pemberton loc cit.
[630] Pemberton loc cit.
[631] McKee *Caen* p. 229, testimonies of H. Green and Stanley Green.
[632] Pemberton p. 161.
[633] *Firepower* p. 155, 199-201, Pemberton p. 161-162 and 169, Daglish *Goodwood* p. 158, Henry p. 35, and letter from RSA Larkhill dated 25th July 1988 to this writer.
[634] Kenneth Macksey *The Guinness Book of Land Warfare* London 1973 p. 192 (henceforth *Land Warfare*), and Pemberton p. 169.
[635] *Firepower* p. 199, and in more detail Mead p. 16-17.
[636] Macksey *Land Warfare* p. 191-192, Lucas *Desert War* p. 111 (example) and Forty *Tanks Across the Desert* p. 37 (example).
[637] Pemberton p. 5.
[638] *Firepower* p. 200-201, and Mead p. 53-54.
[639] Macksey *Land Warfare* p. 191, French p. 257, Lucas-Phillips *Alamein* p. 302 and 334, McKee *Alamein* p. 91, Macksey *Afrika Korps* p. 114-115, Pemberton p. 138 and 140-141, 143-144, 146, 149-151, 156 and 161-162.
[640] *Firepower* p. 155, French loc cit, Pemberton p. 161-162 and 169, Ellis *Sharp End* p. 122-124, Harris & Toase p. 82-83, 248 footnote 26, citing R.G.S. Bidwell *Gunners at War* London 1970 *passim*.
[641] Hogg *Guns* p. 44.
[642] Ibid loc cit. *Clash of Arms*, p. 310 gives 5 minutes for divisional support and 8 minutes for corps level fire.
[643] Letter to this writer from RSA Larkhill, 25th July 1988, Hart p. 92 footnote 80, 108, 189, *Firepower* p. 196-201, Henry p. 35, and Mead p. 53-54.
[644] Hart p. 108 footnote 80.
[645] Pemberton p. 223, as well as French p. 256 and Daglish p. 178, who cite Pemberton.
[646] Colvin p. 128, 135 and 137.
[647] Dunnigan p. 94.
[648] Letter from RSA to this writer 25th July 1988, and Daglish *Bluecoat* p. 176.
[649] Hart p. 90 and Weigley p. 428.

[650] Hart p. 90.
[651] Pemberton p. 229-230, 279 and 329, and *Clash of Arms*, p. 311.
[652] *Clash of Arms*, p. 333, footnote 42.
[653] *Firepower* p. vii. For similar comments see Edwin P. Hoyt *Backwater War: The Allied Campaign in Italy 1943-1945* Westport 2002 p. 95, Donald Gurrey 'Bou Arada' in *War Monthly* No. 37 April 1977 p. 36, French p. 256 and 258, *Overlord* p. 181 and Schulman p. 134, citing General von Lüttwitz. For the views of a German at the receiving end, McKee *Caen* p. 105-106, and 111, *Black Bull* p. 51-52 (citing Lüttwitz), and How p. 124, 128-131, 138 and 185. For a vivid description from British observers see McKee *Caen* p. 329.
[654] Henry p. 15.
[655] Smith *Tank Soldier* p. 152, Maule p. 27 & 35 (photo caption), McKee *Alamein* p. 91, Lucas *Desert War* p. 101, Daglish *Bluecoat* p. 164, Henry p. 36-37, and McKee *Caen* p. 188.
[656] Ross p. 153, also cited in *Overlord*, p. 191.
[657] David Fletcher, *Mr Churchill's Tank*, p. 6.
[658] Crow p. 97; the Churchill and AVRE figures for 1945 are gleaned from other parts of the text.
[659] *Tank Scandal* p. 88 and 93 with reference to the Valentine, and David Fletcher *Crusader Cruiser Tank 1939-1945: Osprey New Vanguard # 14* London 1995 p. 33 with reference to Crusader and other, unnamed, types.
[660] Copy of RAC half-yearly reports for January-June 1945, courtesy of the Tank Museum, Bovington.
[661] Copy of RAC half-yearly report for July-December 1942, courtesy of the tank Museum, Bovington.
[662] Peter Chamberlain & Chris Ellis *British & American Tanks of World war II: The Complete Illustrated History of British, American and CommonwealthTanks, 1939-1945* London 1969 p. 35 (henceforth *B&AT*), Peter Brown 'Covenanter' in *Tankette* Vol. 19 No. 3 p. 2, Eric Grove *World War Two Tanks* London 1983 edn. p. 82, BT White p. 61, B.T. White *Tanks and Other Fighting Vehicles of World War II* London 1975 edn. p. 141 (henceforth *T&OFV*); Crow p. 83 gives 1365 built, as does Major James Bingham *Crusader – Cruiser Mark VI AFV Profile # 8* Windsor undated c. 1970 6th page, Kenneth Macksey *The Guinness Book of Tank facts and Feats* Enfield 1972 p. 125 (henceforth *Tank Facts*) and Anonymous *British Tanks 1939-1945: The Second World War* Tank Museum 7th 1978 edn. p. 91 Appendix II give 1100; Hogg *Conflict* p. 85 gives "over 3000".
[663] Macksey *Tank Force* p. 59, Ross p. 84, 125-129, 133, 139-140, 185-186 and 189-121, Beale *Death by Design* p. 149-152, and A. Kershaw (Ed.) *The Tank Story* London 1972 p. 48.
[664] Macksey *Tank Force* p. 60, *Rude Mechanicals* p. 59-62, *Tank Scandal* p. 4, and Ross p. 134.
[665] Ross loc cit.
[666] *Universal Tank* p. 118.
[667] Ross p. 263-268, 275 and 284-314, and S.D. Badsey in Harris & Toase p. 133, who cites Ross.
[668] Gordon-Hall p. 60, Barnett *Audit* p.161-162 and 164, *Desert* p. 144, Ross p. 150, *Tank Scandal* p. 66, 79 and 84-86, and Fletcher *Crusader Tank* p. 19-20.
[669] *Universal Tank* p. 5 and Macksey *Tank Facts* p. 101 and 167.
[670] Postan, Hay & Scott p. 307, Staff of T.P. (Armour) Ministry of Supply 'Armour for Fighting Vehicles' June 1941 p. 195, Section (D) The Welding of Armour, and report 'Carbon and Alloy Steels' May 1942 courtesy of the Tank Museum illustrate that welding is not as straightforward as it first appears. Deighton p. 194 gives the date as 1934.
[671] For a general comment and the Cromwell, see Evans, McWilliams, Whitworth & Birch, *The Rolls Royce Meteor – Cromwell and Other Applications*, Rolls Royce Heritage Trust, Derby, 2004 p. 56 and 58. Henceforth cited as *Meteor*.
[672] 'Armour for Fighting Vehicles',loc cit.
[673] Letter to this writer from the Tank Museum Bovington 23rd October 1992, Macksey *Tank Force* p. 113, Macksey & Batchelor *Tank* p. 100, Gordon Hall p. 15-16, *Mr Churchill's Tank* p. 13 and 118, and Brown in *Tankette* p. 2.
[674] 'Armour for Fighting Vehicles' loc cit.
[675] Gordon-Hall p. 16.
[676] *Mechanised Force* p. 119, photo.
[677] Ibid p. 119-120.
[678] Gordon-Hall p. 4, and Fletcher *Universal Tank* p. 112-113..
[679] Major James Bingham *Cromwell and Comet: AFV Profile #25* Windsor 1971 p. 37.
[680] Gordon-Hall p. 9, Harper *Bridge to Victory* p. 30, Macksey *Land Warfare* p. 204, Forty *British Army Handbook* p. 286, and Chris Ellis & Peter Chamberlain (Eds) *Handbook on the British Army: 1943* London 11975 edn p. 63.

[681] Postan, Hay & Scott p. 305 and 335 and, among others, John Marshall *The Guinness Book of Rail Facts & Feats* London 1975 edn. p. 198.
[682] Postan, Hay & Scott p. 336, and various photos in railway books and film footage in this writer's library.
[683] Postan, Hay & Scott loc cit.
[684] Ibid loc cit, and French p. 99.
[685] See especially Ross p. 138-140.
[686] Ross p. 139.
[687] Ross, p. 138-139, Hogg *Conflict* p. 104 and *Tank Scandal* p. 47, 58 and 64.
[688] D.P. Dyer *Infantry Tank Mark III Valentine Part 2: Bellona Military vehicle Print # 38* MAP 1974 p. 3.
[689] Anonymous *British Tanks* p. 28, and P. Chamberlain & C. Ellis *The Churchill Tank* London 1971 p. 15-16.
[690] *Universal Tank* p. 10-11.
[691] Postan, Hay & Scott p. 323-328.
[692] Ibid p. 327, also 'The Tank Armament Situation 27 June 1944' in RAC half-yearly report January-June 1944, courtesy of Tank Museum Bovington, and Beale *Death by Design* p. 96-98.
[693] *Universal Tank* p. 119.
[694] 'The Tank Armament Situation' and RAC half-yearly report January-June 1944 Appendix 'F' 'Statement of 21 Army Group: U.E. Reserve Entitlement and Holdings' for 30 June 1944, tables for Churchill tank units sheets 9 and 10 of 16, courtesy of Tank Museum Bovington, Beale *Tank Tracks* p. 27, Beale *Death by Design* p. 106, and *Mr Churchill's Tank* p. 129, and 140-141.
[695] 'The Tank Armament Situation', RAC half-yearly report January-June 1944, memos dated 19th May 23rd May and 27th June 1944.
[696] RAC half-yearly reports: January-June 1944, memo dated 23rd May 1944 from R. Briggs, Director RAC to 21st Army Group, courtesy of the Tank Museum Bovington.
[697] 'Statement of 21 Army Group, U.E., Reserve Entitlement and Holdings' for 30 June 1944, sheets 9 and 10.
[698] RAC half-yearly reports: January-June 1944, memo dated 19th May 1944 from Major-General G.W. Richards to the War Office, courtesy of the Tank Museum Bovington, also Gudgin *With Churchills* p. 143 (Italy) and Bryan Perrett *The Churchill: Armour in Action 4, Ian Allen, London 1974*, p. 81.
[699] *Universal Tank* p. 120.
[700] Barnett *Audit* p. 163, citing I. Lloyd *Rolls Royce: The Merlin at War* London 1978 p. 113-115.
[701] John Church, David Fletcher & Dick Harley 'The Cromwell Cruiser Tank Series' in *Tankette* Vol. 14 No. 5 p. 3, and *Meteor* p. 75 and 187.
[702] Church, Fletcher & Harley, loc cit, *Meteor* loc cit, and BT White *British Tanks* p. 67.
[703] Church, Fletcher & Harley loc cit.
[704] *Rude Mechanicals* p. 144 and 164, and in less critical terms, *Meteor* p. 77.
[705] Ross p. 96 and 187-188.
[706] *Universal Tank* p. 112 and David Fletcher 'Britain's Best Tank of the War' in *Military Illustrated* No. 104 p. 45.
[707] *Universal Tank* p. 119-120 and *Rude Mechanicals* p. 205.
[708] *B&AT* p. 52.
[709] *Universal Tank* p. 120.
[710] See Anonymous *British Tanks* p.78-79, *B&AT* p. 179-181, Major James Bingham *Australian Sentinel & Matildas AFV Profile # 31* Windsor 1971 p. 65-74, BT White *T&OFV* p. 271-273, *Tank Scandal* p. 100-103 and *Universal Tank* p. 65-66.
[711] Letter dated 17th December 1987 to this writer from the Tank Museum Bovington, and *Mr Churchill's Tank* p. 119-121 and 129.
[712] Gudgin *With Churchills to War* p. 53, 64-65 and 79, Fletcher *Crusader Tank* p. 23, *Tank Scandal* p. 117-118, *Mr Churchill's Tank* p. 110, and in less detail *Universal tank* p. 92 and 112.
[713] Gordon-Hall p. 80.
[714] Gordon-Hall loc cit.
[715] *Universal Tank* p. 6.
[716] RAC half-yearly reports July 1944-June 1945 showing vehicle holdings for 30th June 1944.
[717] Ibid loc cit.
[718] Knowles letter, and *Universal Tank* p. 74 and 101.
[719] B.T. White *British Tank Markings and Names: The Unit Markings, Individual Names and Paint Colours of British Armoured Fighting Vehicles, 1914-1945* London 1978 p. 31 photo and caption.

[720] *Universal Tank* p. 73.
[721] Ibid loc cit.
[722] Gordon Hall p. 57, and *Universal Tank* p. 20. General comment Gordon-Hall p. 83.
[723] Gordon-Hall loc cit.
[724] *Rude Mechanicals* p. 151.
[725] Among others, *Firefly* p. 59 and 61 and John Sandars *British 7th Armoured Division 1940-45: Osprey Vanguard # 1* London 1977 p. 23.
[726] Crow p. 58 and 94 photos, text p. 99, Sandars *Sherman Tank in British Service* p. 16 Hayward *Firefly* p. 17, 105, 107, 108-110, 140 photo, and David Fletcher 'Panzer Buster: The Sherman Firefly Tank' in *Military Illustrated* No. 98 p. 16.
[727] For a rather more upbeat assessment of Challenger, see *Meteor* p. 93-100.
[728] Hayward *Firefly* p. 41, 53 and 123.
[729] Fletcher 'Panzer Buster' p. 14, and Hayward *Firefly* p. 40-41.
[730] Challenger stowage diagram, courtesy the Tank Museum Bovington.
[731] Letters dated 11th and 23rd March 1988 and 19th January 1994 to this writer from the Tank Museum Bovington, and RAC half-yearly reports July-December 1944 and January-June 1945. The 1944 RAC report stated that production of 5,000 rounds was forecast for December 1944, 8,000 for January and 12,000 for February 1945; the 1945 report that "production continues at about 6,000 per month".
[732] Macksey *Military Errors* p. 81, among others.
[733] Ross p. 40, among others.
[734] Perrett *Mud & Blood* p. 257, Perrett *British Tanks in North Africa* p. 15, Bryan Perrett *Tank Warfare* London 1990 p. 111, *Crucible* p. 106 and 115, Peter Gudgin *Armoured Firepower: The Development of Tank Armament 1939-45* Stroud 1997 p. 216, and Ellis *Sharp End* p. 126.
[735] Postan, Hay & Scott p. 316 and 363, and in less detail Crisp *Gods were Neutral* p. 54-55.
[736] Ibid p. 360-361 tables, Anonymous *British Tanks* p. 90 (tables), and Beale *Death by Design* p. 63-64.
[737] *Tank Scandal* p. 7, and (free elevation point only) Beale *Death by Design* p. 101.
[738] Gordon-Hall p. 95.
[739] Moore, *Panzer Bait* p. 53-54, Ellis *Brute Force* p. 244, citing J.A.I Agar-Hamilton & L.C.F. Turner *The Sidi Rezeg Battles 1941* OUP 1957 p. 39, and in less detail Barnett *Desert Generals* p. 74.
[740] For 2 pdr, see Gordon-Hall p. 34 and Perrett *The Valentine in North Africa* p. 12 and 71, for 6 pdr see *Mr Churchill's Tank* p. 36, 114, 119-121 and 129, and Gordon-Hall p. 34.
[741] Gordon-Hall p. 34-35, *Universal Tank* p. 14, and *Mr Churchill's Tank* p. 114, 119-121 and 129..
[742] Perrett *The Stuart Light Tank Series* p. 15-16.
[743] Lucas-Phillips *Alamein* p. 58.
[744] *Universal Tank* p. 14 and 25.
[745] Macksey *Tank Facts* p. 135, Macksey & Batchelor *Tank* p. 129, *Universal Tank* p. 25 and in less detail Beale *Death by Design* p. 102.
[746] Postan, Hay & Scott p. 329, citing 'Tanks in Korea' in *The Times* 26th July 1950 p. 7.
[747] Barnett *Audit* p. 163, and *Desert* p. 91, and Postan Hay & Scott p. 338 for an identical percentage among those issued to troops in the UK.
[748] *Universal Tank* p. 11.
[749] H.C. Doyle & C.K. Kliment *Czechoslovak Armoured Fighting Vehicles: 1918-1945* Watford 1979 p. 37.
[750] John Sanders *The Sherman Tank in British Service: 1942-1945: Osprey Vangurd # 15* London 1982 p. 27.
[751] Brown 'Covenanter' p. 2.
[752] Ibid loc cit, and *Mr Churchill's Tank* p. 113 (needed an hour's maintenance every 4 hours of running).
[753] Major Michael Norman *Russian KV and IS: AFV Profile #17* Windsor undated c 1969 / 1970 3rd page.
[754] Gordon-Hall p. 66-67, Lucas-Phillips *Alamein* p. 84, *Firefly* p. 59, *Universal Tank* p. 70 and 102..
[755] Gordon-Hall p. 74.
[756] Ibid p. 80 and 84-85, and Fletcher *Universal Tank* p. 20.
[757] Ross p. 81-84, and 197, for a general comment on British tank officers, *Mr Churchill's Tank*, p. 53.
[758] Macksey *Tank Facts* p. 112, Ellis *Sharp End* p. 126, *Rude Mechanicals* p. 51, and Moore *Panzer Bait* p. 28, among others.
[759] Hogg *Conflict* p. 98.
[760] Macksey *Tank Facts* p. 34 and Paddy Griffith *Forward into Battle* London 1981 p. 85.

[761] *Crucible* p. 95, and 465 footnote .
[762] *Crucible* p. 86, 144, 165-166, 189, 217, 249, 277 and 469, and Macksey *Afrika Korps* p. 17.
[763] Robert Crisp *Brazen Chariots: An Account of Tank Warfare in the Western Desert, November-December 1941* London 1960 Corgi edn. p. 16 (henceforth *Brazen*), Moore *Panzer Bait* p. 34-36, Humble *Crusader* p. 44 (citing Crisp *Brazen*), Robert Crisp *The Gods were Neutral* London 1960 p. 32, 85, 93, 101, 110, 117-118, 130, 134, 149, 160 and 178-179, *Year Alamein* p. 6, and Gordon-Hall p. 74, also technical report by Gordon-Hall of visit to Middle East 10th February 1941 to 4th April 1941Appendix A item 4, and report to questionnaire issued for this visit item 6, courtesy of the Tank Museum Bovington.
[764] Various reports by tank officers to Gordon-Hall following visit to Middle East Spring 1941, courtesy of the Tank Museum, Bovington.
[765] *Brazen* p. 18, Griffith in Harris & Toase p. 247 footnote 14, Perrett *Stuart Tank* p. 12-13, Perrett *British Tanks in N. Africa* p. 16, and Humble *Crusader* p. 79-80 (citing Crisp Brazen).
[766] *Mr Churchill's Tank* p. 102-104.
[767] *Rude Mechanicals* p. 62 and 145, Barnett *Audit* p. 161-162, *Desert* p. 9, Postan, Hay & Scott p. 336, *Meteor* p. 79, and *Universal Tank* p. 86. For a general comment on British tracked and wheeled vehicles in the desert, see *Meteor* p. 16, citing Major John Scott, 12th Lancers, 1942.
[768] See Macksey *Tank Feats* p. 125, and Major General N.W. Duncan *Light Tanks Marks I-VI: AFV Profile # 5* Windsor undated c 1970, no page, Bryan Perrett *Armour in Battle: Wavell's Offensive* London 1979 p. 81 (Light Tank Mark VIB), Perrett *British Tanks in N. Africa* p. 8-9, Gudgin *With Churchills* p. 18, and Hammerton p. 22.
[769] *Rude Mechanicals* p. 23 and 36, and Duncan loc cit.
[770] Sandars *Sherman Tank in British Service* p. 61.
[771] Hammerton p. 40-41and Brown 'Covenanter' p. 5, in less detail.
[772] *Tank Scandal* p. 62,and Hammerton p. 44 and Beale *Death by Design* p. 178, in less detail.
[773] Hammerton loc cit.
[774] Hogg *Conflict* p. 85, *Tank Scandal* p. 62, Barnett *Audit* p. 162, Postan Hay & Scott p 312-313, and Brown 'Covenanter' p. 2 and 4.
[775] Fletcher in *Military Illustrated # 104* p. 46.
[776] David Fletcher *Mechanised Force: British Tanks between the Wars* HMSO London 1991 p. 127, and Ibid *Tank Scandal* p. 6.
[777] *Universal Tank*, p. 1.
[778] Postan, Hay & Scott p. 362, and *Meteor* p. 16, citing Major John Scott.
[779] Ross p. 71 and 254, Barnett *Audit passim*, Deighton p. 211, *Meteor*, loc cit., and Beale *Death by Design* p. 78 and 203-204.
[780] French. p. 116-120 and 278, *Clash of Arms*, p. 35, Latimer p. 6, Martin van Creveld, *Supplying War* Cambridge 1977 p. 141-201.
[781] Fletcher *Crusader Tank* p. 19, and *Tank Scandal* p. 85.
[782] Gordon-Hall p. 100-102, *Rude Mechanicals* p. 136, *Mr Churchill's Tank* p. 102 and 191, Fletcher *Crusader Tank* p. 19, *Tank Scandal* p. 110-112, and in less detail *Mr Churchill's Tank* p. 102, Beale *Death by Design* p. 56, McKee *Alamein* p. 35 and 74, and Humble *Crusader* p. 45.
[783] Mike Starmer 'Valentines in Service' in *Tankette* Vol. 39 # 2 p. 13.
[784] *Tank Scandal* p. 79 and 84, Humble *Crusader* p. 44-45, 80, 92 and 192-193, *Crucible* p. 342-3 and 469, *Year Alamein* p. 5-6 and 161, Macksey *Afrika Korps* p. 27, Harrison *Tobruk* p. 136, *Desert* p. 227, Deighton p. 310.
[785] Gordon-Hall p. 59.
[786] *Universal Tank* p. 101 on the Challenger and Sandars *Sherman Tank in British Service* p. 16 on the Firefly, among others.
[787] *Firefly* p. 23, 72 photo # 29 and caption, and 122.
[788] French p. 113, Barnett *Audit* p. 165, Lucas-Phillips *Alamein* p. 41, Lucas *Desert War* p. 97, Humble *Crusader* p. 33-34 and 194, Bruce p. 98, Perrett *British Tanks in N. Africa* p. 10, Moor *Panzer Bait* p. 63, Roach p. 49-50 and 53, Howarth *My God, Soldiers* p. 28, George Forty *Desert Rats at War: North Africa* Shepperton 1975 p. 122, Deighton p. 298-299 (citing Forty loc cit), and McKee *Alamein* p. 79.
[789] Lucas-Phillips *Alamein* p. 41.
[790] Lucas *Desert War* p. 97, and Humble *Crusader* p. 34.
[791] Tom Witherby in McKee *Alamein* p. 79. For a similar comment see Roach p. 53.
[792] Humble *Crusader* p. 66, French p. 100, Griffith in Harris & Toase p. 74, Carver *Tobruk* p. 22, Perrett *Stuart Light Tank* p. 6, *Crucible* p. 380 and 461, and Major J.K.W. Bingham & Werner Haupt *North African Campaign: 1940-1943* London 1968 p. 60.

[793] Weigley p. 270.
[794] Gordon-Hall p. 96-97, Fletcher *Crusader Tank* p. 19, Deighton p. 614 footnote 36, and *Tank Scandal* p. 107 (probably citing Gordon-Hall).
[795] *Universal Tank* p. 11.
[796] Graves *South Albertas* p. 99.
[797] *Firefly* p. 81, photo caption # 42, citing 1945 report from 29th Armoured Brigade.
[798] *Firefly* loc cit.
[799] Wilson *Flamethrower* p. 48, Ellis *Sharp End* p. 153-154 who cites Wilson, and Weeks *Men against Tanks* p. 95. For a general comment on Churchills burning only slowly compared to Panthers "tending to blow up", see *Mr Churchill's Tank* p. 142, citing 9th RTR war diarist.
[800] Ibid loc cit.
[801] *Universal Tank*, p. 115-116.
[802] WO 171 1186, H.G. Gee, 'Army Operational Research Group, Internal Memorandum No. 16, The Comparative Performance of German Anti-Tank Weapons During World War II, respectively section 17 'Personnel casualties' section 18, table 2 'Percentage personnel casualties in different tanks', and section 6, 'Comparative performance of enemy weapons as shown by British tank losses', table 1. Courtesy of Ian Daglish.
[803] WO 291 1331, Operational Research in North West Europe, No. 2 ORS, 21 Army Group, Report No. 12 'Analysis of 75mm Sherman tank casualties suffered between 6th June and 10th July 44', section 3 'Discussion' item 2, p. 200. Courtesy of Ian Daglish.
[804] *Universal* Tan,k p. 116. For criticism of the Sherman compared to the Churchill see Wilson p. 48, Ellis *Sharp End* p. 153-154 (who cites Wilson), Perrett *The Churchill*, p. 78, Weeks *Men against Tanks* p. 95, and *Mr Churchill's Tank* p. 142 and 187.
[805] Hunnicutt p. 526 (tables), and in less detail Crow p. 97.
[806] Gordon-Hall p. 26 and 96-98, French p. 101, *Firefly* p. 17, Perrett, *The Churchill*, p. 126 (testimony of W. A. Windeatt, 48th RTR), and Cross p. 95 for British crews, and Steven J. Zaloga *The Sherman Tank in US and Allied Service: Osprey Vanguard # 26* London 1982 p. 18 and 20 for the US army.
[807] McKee *Caen* p. 165.
[808] WO 291 1331, 'Analysis of 75mm Sherman tank casualties…', section 3 'Discussion' item 1.
[809] Gordon-Hall p. 105-106, and *Universal Tank* p. 99, citing Gordon-Hall, and *Mr Churchill's Tank* p. 150 (unattributed, but without doubt also citing Gordon-Hall).
[810] Tom Jentz & Hilary Doyle *Kingtiger Heavy Tank - 1942-1945*: *Osprey New Vanguard # 1* London 1993 p. 19.
[811] Ibid loc cit.
[812] *Tank Scandal* p. 109, and *Universal Tank* p. 3.
[813] Gordon-Hall p. 27, and in less detail WO 291 1331, 'Analysis of 75mm Sherman tank casualties…', loc cit.
[814] Gordon-Hall, loc cit.
[815] Crow p. 28-29, citing regimental histories, Moore *Panzer Bait* p. 7 and Beale *Death by Design* p. 130-131.
[816] Bruce p. 123 and Sandars *Sherman in British Service* p. 30.
[817] Respectively, Brown 'Covenanter' p. 5, Church, Fletcher & Harley in *Tankette* Vol. 14 # 5 p. 5 and *Meteor* p. 86, and in less detail Smith *Tank Soldier* p. 41, Beale *Death by Design* p. 144, and Sandars *Sherman Tank in British Service* p. 30.
[818] *Tank Scandal*, p. 79.
[819] Gordon-Hall, p. 99.
[820] Barnett *Audit* p. 162.
[821] Gordon-Hall p. 13, 16 and 18.
[822] Bird & Livingston p. 8, also *Mr Churchill's Tank*, p. 79 (German report of tanks left at Dieppe) and 90 (British report).
[823] *Mr Churchill's Tank* p. 109, also Perrett, *The Churchill*, p. 51; report on tank T-31793 *Apollo*.
[824] *Mr Churchill's Tank* p. 148 and 150, and Macksey & Batchelor *Tank* p. 144.
[825] *Rude Mechanicals* p. 164.
[826] Gordon-Hall p. 14.
[827] Gordon-Hall Report on Visit to Middle East 10.February 1941 to 4. April 1941, and Walker p. 47-48.
[828] Gordon-Hall p. 15 and 16, respectively. See also Bryan Perrett *The PzKfw Panther* London 1981 p. 9, and Bird & Livingston p. 28, 66, 92 and un-paginated Appendix.

[829] Macksey *Tank Force* p. 113, Macksey *Tank Facts* p. 167, Postan, Hay & Scott p. 344-345 and 362 (table), Kenneth Macksey & John Batchelor *Tank: A History of the Armoured Fighting Vehicle* London 1970 p. 119, and Gordon-Hall p. 14.
[830] Gordon-Hall p. 14.
[831] *Universal Tank* p. 19, and Gordon-Hall p. 40.
[832] Ibid loc cit.
[833] Gordon-Hall p. 41.
[834] Ibid p. 56.
[835] Bryan Perrett *The Churchill Tank: Osprey Vanguard # 13*, London, 1980 p. 20, 22, 26, and 31, B.T. White *Churchill – British Infantry Tank Mk IV: AFV Profile # 1* Leatherhead undated c 1970 last page of text, Perrett *Mud & Blood* p. 151 and 241, *Rhineland* p. 93, Perrett *The Churchill* p. 9, 49-50, 94, 118-124 and 135, Griffith in Harris & Toase p. 74, Daglish *Bluecoat* p. 44-45, and *Mr. Churchill's Tank* p. 108-109, 150-151 and 175-180.
[836] John Sandars *British Guards Armoured Division: Osprey Vanguard # 9* London 1979 p. 19-20, John Sandars *Sherman Tank in British Service* p. 17, Sandars *Guards Armoured Division* p. 19-20, and *Universal Tank* p. 98.
[837] *Universal Tank*, p. 98.
[838] Perrett, *Churchill Tank* p. 29-30, Ibid *Tank Warfare* p. 138, French p. 105, Place p. 162, *Mr Churchill's Tank* p. 146-147, Sandars *Guard Armoured Division* p. 18, and Sandars, *Sherman Tank in British Service* p. 17.
[839] *Universal Tank*, p. 99.
[840] *Universal Tank* p. 106 (comparison between Churchill and Sherman), also trials in Gudgin *With Churchills* p. 111, and N.W. Kuhns 'Comparison of Cross-country Performance by Sherman, Churchill & Panther' in *Tankette* Vol. 23 ##3 p. 14-15, also Belton Y. Cooper *Death Traps: The Survival of an American Armored Division in World War II* New York 1998 edn p. 99, 153, 161, and 337-338.
[841] David Fletcher (Ed) *Tiger! The Tiger tank: A British View* HMSO London 1986 p. 34-35.
[842] *Tank Scandal* p. 84, *Universal Tank* p. 19 and 26, *Mr Churchill's Tank* p. 19-20, 29 and 45, Bruce p. 129, Macksey *Tank facts & Feats* p. 169, and Gordon-Hall p. 68, among others. For Cromwell, see among others Bingham *Cromwell and Comet* p. 25. For the Merritt-Brown system described, see Macksey & Batchelor *Tank* p. 102 and 123.
[843] Daglish *Goodwood* p. 50, citing John Pilborough *First In last Out* London 1986, no page.
[844] Lucas *Desert War*, p. 100.
[845] *Tank Scandal*, p. 90.
[846] *Firefly*, p. 37.
[847] Ibid p. 59, among others.
[848] Among others, Sandars, *Sherman Tank in British Service*, p. 26-27. Gordon-Hall p. 56 comments favourably on diesel-engined Shermans, while *Universal Tank*, p. 81 describes how US tanks put British vehicles to shame in various running trials, especially 'Exercise Dracula'. *Meteor* p. 79-80 is both less scathing and detailed on 'Dracula'.
[849] Ross p. 286.
[850] Ross *passim*.
[851] *Clash of Arms*, p. 309.
[852] Ibid p. 331, footnote 26.
[853] RAC half-yearly reports January-June 1944, 'Statement of 21 Army Group, U.E., Reserve Entitlement and Holdings' for 30th June 1944, sheets 1 to 5 on Sherman allocations.
[854] Captain J.N. Berkeley-Miller, *Interim Report of Power Traverse Equipment (by Power Mountings Ltd) as fitted to Cruiser tank A.9.E.1*, 30th March 1938, and papers on A9 and A10 by M.J. Verrall 1989, courtesy of the Tank Museum, Bovington.
[855] Gordon-Hall p. 35.
[856] Gordon-Hall loc cit.
[857] Among others, letter to this writer from Tank Museum, Bovington, 6th October 2004.
[858] Ross p. 246-247. The Matilda's system made an impression in the USA, *Tank Scandal* p. 90.
[859] Hunnicutt p. 137.
[860] Cooper *Death Traps* p. 86.
[861] *Tank Scandal* p. 84, and Daglish *Goodwood* p. 50 (not attributed).
[862] *Universal Tank* p. 14.
[863] Steven J. Zaloga & Jim Kinnear, *T-34/85 Medium Tank: 1944-1994*, Osprey New Vanguard # 20, London 1996 pp. 19-20.
[864] Bryan Perrett *The Panzerkampfwagen III: Osprey Vanguard # 16* London 1980 p. 14.

[865] S.J. Zaloga *M 10 and M 36 Tank Destroyers 1942-1953: Osprey New Vanguard # 57* London 2002 p. 23.
[866] Bryan Perrett *Tank Warfare* London 1990 p. 63-64, Macksey *Tank Facts & Feats* p. 170, Gordon-Hall p. 36-37, Macksey *Tank Force* p. 131, and Smith *Tank Soldier* p. 96.
[867] Gordon-Hall p. 35.
[868] *Supplement to Technical Services Armaments letter, Issue # 16*, February 1945, 'US Tank and Anti-Tank Artillery Development', 'M36 and M10 GMCs – Report by a Tank Destroyer Commander' p. 5, courtesy of the Tank Museum, Bovington.
[869] Dr Nicola Pignato & Filippo Cappellano, *Gli Autoveicoli da Combattimento dell' Escercito Italano*, vol. 2, SME 2002, p. 196, 244 and 248, courtesy of Ulric Schwela, and letter from Dr Pignato to this writer, 2nd May 2005.
[870] General comment on British, French and Soviet systems in Richard M. Ogorkiewicz *Technology of Tanks* (2 Vols.) London 1991 p. 191. Data in various documents from the Tank Museum, Bovington on the A9, A10, A13, T-34/76, T-34/85, Panther, Tiger, King Tiger, Stuart, Valentine and Challenger tanks, Hunnicutt *Sherman* p. 137, 528-536 (tables), 553 (tables), Richard P. Hunnicuut *Pershing: A History of the Medium Tank The 20 Series* Berkley CA 1971 p. 214-221 (tables), R.P. Hunnicutt *Stuart – A History of the American Light Tank* Vol. 1 Novato CA 1992 p. 485 and 489, Matthew Hughes & Chris Mann *The Panther Tank* Staplehurst 2000 p. 36, Walter J. Spielberger *The Panther and its Variants* Atglen PA 1993 p. 76 and 234, Walter J. Spielberger *Tiger and King Tiger Tanks and their Variants* London 1991 p. 62-63, Steven Zaloga & James Grandsen *T-34 in Action* Carrollton TX 1981 p. 40, Steven J. Zaloga & James Grandsen *Soviet Heavy Tanks: Osprey Vanguard # 24* London 1981 p. 22, Steve Zaloga *T-34/76 Medium Tank 1941-1945: Osprey New Vanguard # 9* London 1994 p. 41, Steven J. Zaloga & Jim Kinnear *KV-1 & 2 Heavy Tanks 1941-1945: Osprey Vanguard # 17* London 1995 p. 10, Matthew Hughes & Chris Mann *The T-34 Tank* Staplehurst 1999 p. 45 and 93, Bryan Perrett *The Panzerkampfwagen IV: Osprey Vanguard # 18* London 1980 p. 18, Bryan Perrett *The Tiger Tanks: Osprey Vanguard # 20* London 1981 p. 16, Bryan Perrett *The PzKfw V Panther: Osprey Vanguard # 21* London 1981 p. 16, Major James Bingham *Infantry Tank Mk II Matilda: Armour in Profile # 15* Great Bookham 1967 p. 4, Major James Bingham *Cromwell Mk 4: Armour in Profile # 5* Great Bookham 1967 p. 8, B.T. White *Churchill - British Infantry Tank Mk IV: AFV Profile # 1* Great Bookham undated c 1969 technical specifications, no page number, Major James Bingham *Crusader – Cruiser Mark VI: AFV Profile # 8* Windsor undated c 1969 'description of Crusader' no page number, Major James Bingham *Cromwell and Comet: AFV Profile # 25* Windsor 1971 p. 25 and 44, Major James Bingham *Australian Sentinel and Matildas: AFV profile # 31* Windsor 1971 p. 73, Major James Bingham *Chars Hotchkiss, H35, H39, and Somua S35: AFV Profile # 36* Windsor 1971 last page, Major Michael Norman *Russian KV and IS: AFV Profile # 17* Windsor undated c. 1970 last page, technical specifications, Perrett Valentine p. 71, *Mr Churchill's Tank* p. 36, 'Armoured Car AEC Mk I' *Bellona Military Vehicle Print Series Sixteen* Bracknell 1968 p. 8, White *British Tanks* p. 136 (use of Valentine turret and traverse mechanism on AEC armoured cars), B.T. White *Armoured Cars: Guy, Daimler, Humber, AEC: AFV Profile # 21* Windsor 1970 15th page, and letter dated 11th May 2004 to this writer from Bovington Tank Museum on AEC Mk II and III.
[871] See among others Hogg *Conflict* p. 167-168, Hunnicutt *Sherman* p. 213, Zaloga *M4 (76mm) Sherman* p. 9, Ross p. 286-324, and Hayward *Firefly passim*.
[872] Ross p. 324.
[873] Zaloga *Sherman in US and Allied Service* p. 11, and Zaloga *M4 (76mm) Sherman* p. 8 and 10.
[874] Zaloga *Sherman in US and Allied Service* loc cit.
[875] Ross p. 289.
[876] Zaloga *M 10 and M 36 Tank Destroyers* p. 8 and 38, and Hunnicutt *Sherman* p. 365.
[877] Zaloga *M4 (76mm) Sherman* p. 9.
[878] *Firefly* p. 56.
[879] Hayward *Firefly* p. 35, who erroneously refers to the 555th Tank Battalion, and in more detail Zaloga *M4 (76mm) Sherman* p. 36-37.
[880] Ross p. 279-280.
[881] *Universal Tank*, p. 70.
[882] Ross p. 280, Brent p. 21-36, *Firefly* p. 19-20 and 22, Zaloga *M4 (76mm) Sherman* p. 17-18, 33 and 38, and *Universal Tank* p. 103-104.
[883] For trial 75mm conversions of the Ram, see *Universal Tank*, p. 18, Chris Ellis & Peter Chamberlain, Ram & Sexton: AFV Profile # 13, Profile Publications Ltd, Windsor, undated, p. 5,6 and 14 (unnumbered); these sources state that only one Ram was ever converted, whereas Joe Sauve, 'Canada's Ram Cruiser Tank', Part 1, *Airfix Magazine* March 1979 p. 390 and op cit 'Ram Tank in

Service: 1942-1945', *Airfix Magazine* April 1976 p. 477 states that in fact 40 Rams were successfully converted.
[884] Ross p. 289, and *Universal Tank* p. 102.
[885] Ross p. 291, *Firefly* p. 17 and 33-34, Zaloga *M4 (76mm) Sherman* p. 10, and copies of US army documents on the Firefly issue.
[886] Hogg p. 168, among others.
[887] US army document dated 26th July 1944 by Captain Irl D. Brent, report on 17-pdr conversion, and Hayward *Firefly* p. 47-50.
[888] 21 Army Group and 15 Army Group strength returns in RAC half-yearly reports June-December 1944 and January-June 1945, and *Firefly passim*.
[889] Photos in various sources, *Universal Tank* cover photo and p. ii caption, Sandars Sherman Tank in British Service p. 30-31, Peter Chamberlain & Chris Ellis *M4 Medium (Sherman): AFV Profile # 29* Windsor 1971 p. 60 photo, Krzysztof Barbarski *Polish Armour 1939-45: Osprey Vanguard # 30* London 1982 p. 24-25, artwork G2 and text p. 36, Zbigniew Lalak, *Polish Armoured Forces 1939-45: Organisation and Order of Battle' Lexicon of World War II Armed Forces Vol. 1*, Pegaz-Bis & OK Media, English edition, Warsaw undated (c. 2004), front paper, p. 79, 83 and rear cover, Wojciech J. Gawrych & Wojciech Luczak, *Polskie Shermany (Polish Shermans) Vol.* 1, Wydawnictwo Militaria, Warsaw 2000, front cover, p. 12, 50-53, 56, 58, 61 and artwork p. 64,66 and 68, Hunnicutt *Sherman* p. 305 drawing, and photo with caption p. 308, Maule *Caen* p. 125 photo, Mike Starmer, *British Army Colours & Disruptive Camouflage in the United Kingdom, France and NW Europe 1936-45*, privately published, Piddington, 2005 p. 30 and (drawing) 31, and *Firefly* p. 54-55.
[890] *Firefly* p. 111.
[891] Zaloga *Sherman Tank* p. 31, and Zaloga *M4 (76mm) Sherman* p. 38-39.
[892] Zaloga, illustration D1 and text p. 36, Barbarski *Polish Armour* illustration F2, p. 22 and text p. 35, Lalak, front cover and p. 54 and 55, and Starmer, *British Army Colours* etc., p. 30, who states it was used on some British M4 76mm Shermans.
[893] Starmer, loc cit, and photo in *Mr Churchill's Tank*, p. 177.
[894] Lalak, p. 78, and Barbarski, artwork D1 between pages 24 and 25.
[895] *Universal Tank* p. 107.
[896] *Universal Tank* p. 93.
[897] Ibid p. 107.
[898] Stanley Jackson to this writer c. 1970.
[899] Wilson p. 52, Andrew Wilson 'Return to Normandy' in *Sunday Times Magazine* June 1969 p.16, Hastings, p. 211 citing Wilson, Perrett *The Churchill* p. 80, ibid *The Churchill Tank* p. 9, *Overlord* p. 211, and Kershaw *D-Day* p. 235, citing Wilson. Perrett, *The Churchill*, p. 96, cites one exception at the Ondia Factory in Boulogne.
[900] Nigel Duncan *79th Armoured Division: Hobo's Funnies* Windsor 1972 p. 27. Perrett in *The Churchill*, p. 94 quotes the German officer as saying it was "un-English"; which is more likely.
[901] White *Armoured cars: Guy, Daimler, Humber, AEC:* p. 58-59, White *British Tanks* p. 94 and 132, Gordon-Hall p. 16, and 'Armour for Fighting Vehicles' p. 195.
[902] Blaxland p. 72.
[903] Among others, Gordon-Hall p. 83, general comment. Mileage figures p. 57.
[904] Macksey & Batchelor p. 136.
[905] Jeremy Taylor *This Band of Brothers* Bristol 1947 p. 109, Doherty p. 66, and letter dated 15th February 1989 from Tank Museum Bovington.
[906] Postan, Hay & Scott p. 342-343. For user comments see Roach p. 129.
[907] *Universal Tank* p. 106.
[908] Gordon-Hall p. 89-90. See also Nick Balmer & Paul Middleton 'M10's, AA Tanks & the Argylls' in *Tankette* Vol. 32 # 6 1997 p. 4, *Tank Scandal* p. 42, and *Universal Tank* p. 24-25.
[909] David Fletcher, *Universal Carrier: 1936-1948*, Osprey New Vanguard # 110, London, 2005, p. 17-18, and 37-38.
[910] Pemberton p. 139.
[911] Bruce p. 172-173, and 178, and Pemberton p. 139, 216 and 240.
[912] Gudgin *With Churchills* p. 112, and in less detail *PBI* p. 160.
[913] Lt. Colonel G.J.P. Kerswell 'From Alamein to Tunis with an LAD' in *REME Journal* No. 38 April 1988 p. 51, courtesy of the RSA Larkhill, Moulton *Antwerp* p. 62, Weigley p. 281 and *PBI* p. 160.
[914] For exceptions, see *Rude Mechanicals* p. 200, Ryan *Bridge too Far* p. 64, and Whiting *'44* p. 84 and 98.

[915] Horrocks *Corps Commander* p. 69-70, French p. 112-113, Weigley p. 428 (general comment) and Keegan *Six Armies* p. 11-12.
[916] French p. 109.
[917] French p. 112-113, and *Mr Churchill's Tank* p. 21.
[918] French p. 113, and *Meteor* p. 16.
[919] Gordon-hall p. 85, Crow p. 104, and *Universal Tank* p. 21 and 74, who probably draws on Gordon-Hall..
[920] Gordon-Hall loc cit, and *Universal Tank* p. 21, probably drawing on Gordon-Hall.
[921] Reports of British tank losses, 1939-45 from RAC half-yearly report, January-June 1945, courtesy of the Tank Museum Bovington.
[922] Crow p. 87, and BT White *British Tanks* p. 220; *Universal Tank* p. 56 gives the mark and numbers.
[923] *Mr Churchill's Tank*, p. 190-191.
[924] White *British Tanks* p. 135, *Universal Tank* p. 116-117, and Eric Knowles letter 23rd May 1999.
[925] Dr Nicola Pignato & Colonel Cesare Simula *Armour in Profile # 14: M13/43* Great Bookham 1967 p. 10, George R. Bradford *Armor camouflage & Markings Volume One: North Africa 1940-1943* Ontario 1971 p. 11 (photo) and 13., *Crucible* p. 150, 219 and 249, Humble *Crusader* p. 23, French p. 108, Perrett *British Tanks in N. Africa* p. 39, Macksey *Afrika Korps* p. 17, *Desert* p. 48 and 65, *Rude Mechanicals* p. 83, and Walker p. 72.
[926] Testimony of Major General Nigel Duncan cited in Beale, *Death by Design* p. 176-177.
[927] French p. 205.
[928] Macksey *Tank Force* p. 89, among others.
[929] *Tank Scandal* p. 74,.*Scheldt* p. 283-285, *Crucible* p. 17-18, 39-42, *Rude Mechanicals* p. 12, 21, 24, 66, 72, 117, 150, 172-175, Duncan p. 1, Geoffrey W. Futter*, The Funnies: A History, with Scale Plans, of the 79th Armoured Division* Hemel Hempstead 1974 p. 3, Col. Victor J. Croizant *Across the Reef: The Amphibious Tracked Vehicle at War* London 1989 p. 191, Perrett, *The Churchill*, p. 90, and Kenneth Macksey *The Tank Pioneers* London 1981 p. 144-146, 153-154, 172 and 185-220.
[930] *Desert* p. 244.
[931] Phillip Guedalla *Middle East 1940-1942: A Study in Air Power* London 1944 p. 194, and *Rude Mechanicals* p. 113, un-attributed, but probably cites Guedalla.
[932] Forty *Tanks Across the Desert* p. 45.
[933] Harris & Toase p. 83-84, French p. 217 and 227-228, and Ellis *Sharp End* p. 122.
[934] *Firepower* p. 176, 192 and 215, and Weigley p. 14-15.
[935] Beale *Death by Design* p. 188.
[936] Macksey *Military Errors* p. 81.
[937] *Crucible* p. 294-295, and in more detail Humble *Crusader* p. 43, citing Sir David Hunter *A Don at War* London 1966 p. 61-62.
[938] Humble loc cit.
[939] *IWM Desert* p. 169.
[940] Forty *Tanks Across the Desert* p. 4.
[941] Colonel Robert J. Icks *Famous Tank battles: From World War I to Vietnam* Windsor 1972 p. 341.
[942] Sandars *Sherman Tank in British Service* p. 5, John Sandars *British Guards Armoured Division1941-45: Osprey Vanguard #9* London 1979 p. 19.
[943] See Ellis *Sharp End* p. 141-142, McKee *Caen* p. 268, Keegan *Six Armies* p. 209 and 215, Eddy Florentin *The Battle of the Falaise Gap* London 1965 edn. p. 157 (comment by General Kurt Meyer, CO 12th SS Panzer Division).
[944] Lucas & Barker p. 15.
[945] *Overlord*, p. 56 and 126.
[946] Macksey, *Tank Force* p. 137 and Weigley p. 117, among others.
[947] D'Este *Normandy* p. 261 and 517, and *Overlord* p. 313.
[948] Zaloga *M4 (76mm) Sherman* p. 16.
[949] Weigley, p. 245.
[950] McKee, *Caen* p. 71, 98, 166, and 177, and Weigley *passim*. On Patton, *Battlefields* p. 36
[951] Macksey *Tank Facts* p. 148; Moore *Panzer Bait* p. 170 gives 60 miles per day for 11th Armoured Division. Pemberton p. 234 gives 250 miles in 6 days. French p. 263 states Montgomery's armour averaged 26 miles per day for 12 days whereas the Germans in 1940 averaged 21 miles per day. *IWM Europe* p. 143 states 250 miles in one week for 21st Army Group.
[952] Steven J. Zaloga *Armour of the Pacific War: Osprey Vanguard # 35* London 1983 p. 30 (general comment) and Perrett *Tank Warfare* p. 45 and 47; see also sources footnoted below.

[953] Allen *Burma* p. 254-258 and 271-273, *IWM Burma* p. 192-195, Patrick Turnbull 'Imphal-Kohima 1944' in *War Monthly # 37* April 1977 p. 21, Rooney p. 171-176 and 178, Pemberton p. 301, Perrett *Tank Tracks* p. 113-155, Bryan Perrett *The LEE / GRANT Tanks in British Service: Osprey Vanguard # 6* London 1978 p.20-39, Bryan Perrett *Stuart Light Tank* p. 32, and in less detail Crow p. 90 (photo caption) and 95.
[954] Allen, *Burma* p. 645 (tables).
[955] *Desert* p. 313.
[956] *Overlord* p. 24-25.
[957] Hart p. 6, citing M. Howard in R.H. Kohn (Ed) 'The Scholarship on World War II: Its Present Condition and Future Possibilities' in *Journal of Military History* 55 # 3 July 1991 p. 379
[958] Hart, p. loc cit; for similar comments Hart, p. 71 and 118.
[959] Hart p. 6-7.
[960] Cited in McKee *Alamein* p. 181.