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 Inventing an Army under fire

From their birth in May 1948 the Israel Defense Forces (IDF), differed from other armed forces around the world. They were established from the first as a single “service,” with their fledgling ground, naval, and air units all under the same command, instead of the separate armies, navies and air forces that existed elsewhere and persist to this day (except for Canada’s much later and partly rescinded unification), sometimes with a fourth service, such as the US Marine Corps or Italy’s *Carabinieri*.

The IDF were and are also unique in conscripting women as well as men (though with exemptions more easily allowed). They have long relied on women trainers for every skill, including combat training, from the throwing of hand-grenades to the firing of rifles, tank gunnery, and the operation of tube and missile artillery. Women therefore perform the combat instructor function prototypically performed by ultra-masculine “drill sergeant” types in other armies. While many women soldiers perform administrative duties indoors, as many are combat trainers, while others have been volunteering to join combat units instead of just training others to fight, and some serve as air force pilots and naval combatants.

Originally, the conscription of women was simply an imperative demographic necessity: a country that started off with a population of some 650,000 Jewish civilians when it was attacked by several Arab countries had to maximize its human resources by conscripting women as well. It was a simple matter of assigning as many non-combat tasks as possible to women, to release more men for combat. But over the years, it emerged that women provided not only numbers but also particular abilities, from the reduction of the fear factor in showing new recruits how to perform inherently dangerous actions such as throwing hand- grenades, to proto-maternal patience in imparting skills difficult to learn --both examples of recognizing rather than ignoring gender differences.

Yet another fundamental IDF innovation was inspired by Swiss military practice but carried much further: right from the start the IDF was established as a reserves-centered military force.[[1]](#endnote-1) That was only theory in 1948 because war started before any recruits had become trained soldiers to eventually become reservists that could be recalled to active duty, but by the time of the 1956 war there were enough former conscripts to man reserve formations that outnumbered the active-duty units, and that ratio increased further in 1967 and 1973 .

That, of course, is the highly desirable advantage of reserve-centered forces: with any given population, they can be much larger than a conventional army manned only by active-duty personnel. But a much less desirable consequence is that a reserve-centered army must be greatly dependent on advance warning to mobilize the bulk of its forces, a very tricky requirement that not even the best Intelligence services can assure.

Of that the best example was the failure of Israeli Military Intelligence to predict the October 6, 1973, surprise attacks by Egypt and Syria that were the start of full-scale offensives. In the bitter aftermath, that costly failure was blamed on the individuals in charge of Israeli Military Intelligence, who failed to revise their certitudes as the enemy forces facing them kept growing. But Israel's dependence on a reserves-centered army set up an impossible task for Intelligence: at any given time, if a surprise attack is correctly predicted, the IDF mobilizes, and the enemy calls off the attack. At that point, the “indicators”, both technical and human, including any agents-in-place within the enemy camp, that (correctly) predicted the enemy attack are discredited, while the misleading indicators that denied the danger of a surprise attack are validated. Repeated instances of "crying wolf" can blind the intelligence system—improving the enemy’s ability to achieve surprise on the next occasion.

Exactly that sequence occurred in 1973. There had been indications of a coming war but none occurred, then in May 1973 there was a large Egyptian build-up of forces on the Suez Canal facing the Israeli-held Sinai Peninsula, which triggered a large-scale mobilization of IDF reserve formations and individual. That shut down much of the Israeli economy at great cost. When no Egyptian attacks materialized day after day, there was the de-mobilization dilemma: send the reservists home to resume their lives and return to work at the risk that they might have to be recalled to duty again in great confusion, or else wait a while longer as the costs pile up ?

In other words, a reserve-centered force offers great benefits, and inherent risks. Israel is a democracy – criticism in the media for the "superfluous mobilization" in May was remembered by decision-makers in October, as were American admonitions not to exacerbate the situation.

Of all IDF innovations, the single-service structure is perhaps the most important. Its elementary economic advantages are obvious but perhaps not very significant for well-funded armed forces: yes, it is cheaper to have one headquarters’ structure, one set of uniforms, one set of administrative structures and practices and so on, but the real advantage of unified military forces is that unity favors innovation, as we shall see.

Instead of the much controverted, and still incomplete “joining”, or integration of armies, air forces, and navies that has slowly advanced in the United States as in most countries since the end of the Second World War, the IDF were born united right from the start, with no separate services, and of course no separate civilian ministries with different political ministers in charge.

Those ministers, most notably the pre-1947 “Secretary of the Navy” and “Secretary of the Army” of the US, or the British First Lord of the Admiralty, Secretary of State for War, and Secretary of State for Air, as with their equivalents in elsewhere, had every reason to oppose the creation of an overall Defense Department or Ministry of Defense, which would make them subordinates of the one minister (or US “Secretary”) of Defense.[[2]](#endnote-2)

It was the great predicament of the Jews of Palestine, whose state came under attack as soon as it was proclaimed on May 15, 1948, that they had no armed forces up and running, no army, navy, or air force ready for war to defend the new state. But in subsequent decades, it turned out that there was a hidden advantage in that most dangerous absence of an army, navy and air force: it enabled the IDF to start anew as a single structure, achieving a unification still unachieved elsewhere.

Military institutions have no value unless they are sufficiently cohesive to generate and sustain the high levels of loyalty and dedication to duty necessary to fight in war, but those very same sentiments make military institution highly resistant to change--and even if change is imposed on them, there may still be reversions as unchanged mentalities reassert themselves, to restore what was there before the change. That is what happened with the Canadian armed forces-- the only ones that tried to adopt the IDF’s “one-service” structure. Until then as separate as their original British models, the Canadian Army, Navy, and Air Force were unified under the 1968 National Defence Act, which firmly stated that “the armed forces of Her Majesty raised by Canada consist of one Service called the Canadian Armed Forces or *Forces Armées Canadienne*.”[[3]](#endnote-3)

 It was hoped that unification would reduce the cost of socks by buying them in one color instead of three, with similar savings across a couple of millions of other items; and it was hoped that joint war planning, and joint command in combat would be much easier if all concerned belonged to the same uniformed fraternity with the same vocabulary, habits and procedures--The Canadians too had their bitter experiences of combat losses caused by inter-service misunderstandings.

At first it all worked out for the best with everybody in the same “rifle green” uniforms of the unified Canadian armed forces. But atavistic identities persisted under the surface, and finally they won out: on 16 August 2011, forty-three years after their unification, the three “environmental” [sic] commands of the Canadian Armed Forces reverted to their original names: the Royal Canadian Air Force instead of Air Command, the Royal Canadian Navy instead of Maritime Command, and Canadian Army (it was never “royal”) instead of the Land Force Command.

In further deference to tradition, uniforms reverted to their 1968 colors and patterns, complete with dress uniforms in red or blue, gold braid and all the rest.[[4]](#endnote-4) Operationally this reversion is not supposed to mean anything at all, and indeed the separate services have not been formally reinstated—but what happened showed that strong institutional loyalties can override cold cost-benefit calculations, and with good reason: institutional memories and loyalties uphold morale and cohesion (*esprit de corps*) , the two all-important if non-measurable intangibles that differentiate the relatively few armed forces that can actually fight armed enemies, from the great majority that can only turn out on parade—and attack unarmed civilians. The issue of separate uniforms is merely symbolic of the truly problematic issues arising from separate weapon- development programs, separate training facilities and separate, partially duplicative, administrations.

Institutional memories and institutional loyalties powerful enough to sustain combat morale will also impede innovation just as powerfully, if the particular novelty at hand collides with the missions, status, ethos or self-images of those involved. That is where the single-service structure of the IDF really makes a difference in favoring innovation, simply because no “one-service” ethos or self-image stands in the way. Of this the clearest example is Israel’s early leadership in unmanned aviation.

While pilots dominated the IDF “air corps” (*Heyl Avir*) as it then was, as much as pilots dominate almost all air forces, it was not a separate service.[[5]](#endnote-5) Its commanders are subordinate to the single general staff of the IDF, and while pilots might have resisted the introduction of unmanned aircraft, the IDF general staff did not. It was that organizational factor that allowed Israel to become the world leader in the design, development, and service introduction of unmanned aircraft, starting in 1970, when it was still a relatively poor, industrially undeveloped country of three million in all.[[6]](#endnote-6)

Elsewhere, pilot-dominated air forces efficiently strangled unmanned-aircraft projects, even though the required technologies were so amply available that even toy manufacturers could and did offer remotely piloted aircraft with enough range and payload to be of some military use, right out of the box.

Indeed, even now, half a century later, with all manner of unmanned aircraft flying including some that are very large and have intercontinental ranges, air forces everywhere continue to resist the adoption of unmanned aircraft (“drones”) in fighter and bomber roles, striving to reserve them for pilots, while confining unmanned aircraft to less heroic observation roles, but for some missile launches now and then. And that persists even though everyone understands that taking out the humans from the design of combat aircraft can drastically reduce their costs while adding much to their endurance and maneuverability (subtracting discretionary pilot control of course, but that is only important now and then).

Because human g-limits absolutely constrain the design of fighter aircraft, to avoid both reversible grey-out, tunnel-effect and blackout vision incidents, and g-loc descents into unconsciousness and death, fighter aircraft valued for their agility and velocity are severely limited precisely in their agility and velocity, by g-force limits that would not bother robotic aircraft at all, if their airframes are mechanically up to the task.

In spite of this, not one unmanned fighter-bomber is in production, and even the future US intercontinental-range B-21 *Raider* “heavy” bomber meant for the delivery of both nuclear and non-nuclear weapons is to be manned as well as optionally unmanned, thereby adding robotic costs to the man-rating and the return-home costs , a very heavy price to pay to allow a few air force officers to pilot those aircraft , a choice that could only have been made by a pilot-dominated air force.

The impediments to innovation caused by otherwise praiseworthy and indeed essential service loyalties seem to affect navies even more than air forces –and that is readily understandable, given their much older origins. And the costs of naval loyalties have steeply increased in recent times, because they motivate the continued development and production of large and very large surface warships, in spite of their ever-increasing vulnerability to all manner of drastically cheaper weapons, including maneuverable re-entry vehicles launched by ballistic missiles such as the Chinese DF-21D medium range and DF-26 intermediate range missiles, which could destroy any vessel they manage to hit with one descending warhead, including aircraft carriers.

All this was still in the unimaginable future when the State of Israel was inaugurated on May 14, 1948, the fifth day of the month of Iyar of the year 5708 in the Jewish calendar, facing a war already underway without an army, air force or a navy to resist the armed forces of Egypt, Transjordan, Iraq and Syria as well as armed bands both small and very large. It was then that the entirely new, single-service IDF was born, as a necessarily original invention because nothing like it existed anywhere in the world.

In the British forces, the ones best known to Palestinian Jews because so many had volunteered to join them during the Second World War, the Royal Navy, the Army and the Royal Air Force each had its entirely separate administrative, cultural and even political existence, and indeed differed not only in their appearance but more profoundly, in their mentalities.

Not surprisingly, inter-service cooperation was difficult and sometimes simply impossible [[7]](#endnote-7), and only improved slowly during the long years of war, from disastrous non-communication at the start in the 1940 Norway campaign, to mere quarreling by 1944, even though Winston Churchill had established the world’s first “Minister of Defense“ position in 1940—wisely nominating himself for the post.[[8]](#endnote-8) Even so, civil servants and budgets remained with the very separate Secretary of State for War, the First Lord of the Admiralty, and the Secretary of State for Air right through the war—in other words, there was a Defense Minister, Churchill no less, but there was no actual ministry with its own staff or a single ministerial budget. A ministerial staff was provided in 1946, but the three service Secretaries remained firmly in control until 1964, and it was only then that integration if not unification could begin--with no plans laid down to progress very far down that road.

The British model was therefore irrelevant for the one-service IDF, as was the brand-new American model established by the 1947 National Security Act, which instead of driving service unification, converted the US Army’s Air Forces into a separate service as the US Air Force, alongside the Army and the Navy, with its increasingly independent Marine Corps. The 1947 Act did also establish a single Department of Defense, but it did not abolish the separate service Secretaries, with their secretariats and budgets, so that successive Secretaries of Defense and their ever-growing staffs had to strive mightily over the decades to progress towards common planning and purchasing, with research and development even harder to unify.

As for the US structure for military command in war—the essential thing for Israel in 1948 with a war already underway in conditions of potentially catastrophic unpreparedness—it too was divided. The U.S. Joint Chiefs of Staff belatedly established in 1942 on the model of the British Chiefs of Staff Committee, could at most try to coordinate the separate planning and command of each service, because very literally, there was nobody actually in charge. Its head was neither a Commander in Chief (that being the President’s prerogative) nor an executive Chairman—that would only come forty years later with the sweeping 1986 reforms.[[9]](#endnote-9)

With no operational staff, and no military officialdom of his own, the first Chairman Willian D. Leahy had more influence on broad strategy as the President’s personal advisor than in the direct conduct of the war, because he had no effective authority over the Chief of Staff of the U.S. Army, the US Navy’s Chief of Naval Operations, or the Commanding General of the U.S. Army Air Forces.

In the absence of any valid model to follow—the Americans and British themselves kept saying at the time that they had won the war in spite of their command structures, not because of them, while too little was known of the much-admired Red Army[[10]](#endnote-10)—the Israelis of 1948 boldly disregarded all established practice and ignored all traditions to invent their own structure : one service, one general staff, one commander with the title “head of the general staff,”[[11]](#endnote-11) under the immediate authority of the Minister of Defense, under the overall authority of the Prime Minister as head of the Cabinet, or the Cabinet as a whole in the gravest matters.

While all other ex-British territories followed the prestigious model of the ever glorious and newly victorious British armed forces, Israel’s leaders preferred to leap into the unknown with their own entirely original single-service IDF, a thing never before seen.[[12]](#endnote-12) Thus, the Israelis were the first to venture on the path of service integration that others would follow in their own time, for their own reasons.

One important consequence easily overlooked because it is a silent absence, is that the IDF never had to strive to harmonize different military services by maintaining “joint” command headquarters, a process that absorbs energies better used otherwise in perpetual strivings to maintain proper staffing balances between the services, and a “fair” allocation of command slots.

In contrast, the IDF has its institutional “joint-ness” built in, which makes it easier for different kinds of forces to cooperate logistically in peacetime, even if in war the soldiers on the ground, in combat aircraft above them, and in ships offshore will still have entirely different fields of vision, drastically different operational timelines, and weapons whose effective ranges vary from a few hundred line-of-sight meters to thousands of kilometers, so that operationally coordination is still very difficult, and will always remain imperfect even if all concerned answer to the same command structure.

Hence coordinated air-ground fighting still needs much planning and much training, but at least in the IDF such efforts are not impeded by dysfunctional barriers between different institutions. It is to avoid that problem that the US Marine Corps fiercely holds on to its own “air wings” with their Marine-flown fighter squadrons, to provide close air support to Marines fighting on the ground, instead of relying on the US Air Force or indeed Navy pilots for that most difficult task. Even among fellow Marines there is still the need to coordinate different “environmental” perspectives and timelines, but communications are easier within the same military family and, critically, combat risks are more likely to be shared fairly between Marines above and below, with pilots taking risks to reduce risks on the ground, and vice versa. That was famously demonstrated in the Korean War, when vastly outnumbered units of the 1st Marine division fought their way south from the Chosin reservoir in November 27-December 13, 1950, with Marine pilots ignoring massed machine-gun fires to deliver their munitions with maximum accuracy to support fellow Marines on the ground.

Much the same thing occurred in October 6-10, 1973, when the Israeli air force sent its fighter-bombers to attack advancing Syrian forces on the Golan Heights even though they were protected by an abundance of Soviet-supplied anti-aircraft missiles that could not be suppressed beforehand. Hugely outnumbered Israeli ground forces were thus able to resist, if only just, at the price of many pilots killed in their destroyed aircraft. As with the Marines, there was no institutional separation to diminish the urge of the pilots to help the soldiers on the ground, notwithstanding extreme risk.

**Unified Structure and Innovation**

When it comes to innovation, the benefits of the IDF’s institutional unity are direct, simply because its research and development funds are not parceled out to the separate services which mostly use them to improve existing weapons vehicles and sensors—and especially their “iconic” platforms, as with the US Army’s battle tanks, the US Navy’s aircraft carriers and submarines, and the US Air Force fighter jets and manned bombers.

Such incremental innovation, soundly based on the remediation of specific shortcomings that have emerged over the years, or the straightforward replacement of old sub-systems with new ones (as when an older jet engine is replaced with a new one that fits in the same volume) is much less risky than “macro-innovation,” that is the research and development of something entirely new, which might fail entirely because of irremediable technology gaps, or simply because costs keep increasing with no end in sight.

Moreover, macro-innovation has another and weighty disadvantage: something really new will require the retooling of maintenance facilities, and the retraining of their personnel, as well as the training of operating crews *ab initio* as they say, costly and time-consuming in itself.

But macro-innovation offers one very great advantage over incremental innovation that can greatly outweigh all its risks and costs: if the weapon or device is truly new, there will be no counter-measures nor counter-weapons already in service with enemy forces to resist, counter or outmaneuver the new capability.

That absence suspends the entire predicament of war that makes it so hard to win battles and wars, namely the existence of opposing forces and opposing minds ready and waiting to observe and negate whatever is attempted.

Such a “countermeasures’ holiday” occurred on November 20, 1917, the first day of the battle of Cambrai on the Western Front, when 378 *Mark IV* tanks of the British army marked the first appearance of the macro-innovative battle tank in significant numbers. In the absence of anti-tank guns that had yet to be developed (low-slung guns, with high velocity rounds to pierce armor), in the absence of anti-tank mines, let alone the anti-tank rockets that came in the next war or the anti-tank missiles that arrived later still, those 378 *Mark IV*s flattened the forests of barbed-wire that had defeated so many infantry assaults, drove right over the trenches that had harbored the riflemen and machine-gunners that had previously cut down attacking infantry, and entirely negated both the bullets fired at them, and the splinters of artillery shells with their steel plate armor. Since the introduction to battle of the first tanks a year earlier during the Battle of the Somme, the British attacks had used only a few dozen tanks at any one time, and the Germans had been attempting to develop an anti-tank response. Of all the counter-measures employed, deploying light cannon to fire directly at the tanks had proven the most effective – and one such “anti-tank” battery delayed a British tank force at Cambrai considerably. But the few batteries available at the front could not defeat a massed attack by hundreds of tanks.

That is the reward of macro-innovation, which can win battles even entire campaigns if applied on a large-enough scale, by military leaders ready to take the risk of allocating important resources to the new and untried. Mostly they do not, because the really new weapon, as the tank was, will not enhance existing forces, will not affirm an existing way of war.

That is why the introduction of the first machine-guns was resisted: none of the existing forces could use them. They were too heavy for the infantry to carry into battle, too clumsy to be mounted on a horse, and too piddling for the artillery that fired powerful explosive shells and not mere bullets. The same was true of the tank, a concept that the British Army refused to invest in, essentially because it threatened to displace the socially dominant horse cavalry and was bound to take away guns from the artillery while overshadowing the infantry: those being the three branches that controlled the British Army, its leaders refused the idea—and so the first tank was developed by the Royal Navy at the insistence of Winston Churchill.

Simply because the IDF is not a military service or a federation of military services but rather a unified military body, it can accept macro-innovations and fund them, inevitably at the expense of the forces that already exist, because those separate forces with their separate identities are simply not in control.

That is the ultimate explanation of the long list of Israeli military innovations. At the very start on May 15, 1948, some 650,000 Jews with a poor agricultural economy and hardly any industry could not develop or manufacture anything that exceeded the scope of a modest number of modest blacksmithing, welding and mechanical workshops, with just a few veritable factories, none large, to produce textiles and clothing, canned food, agricultural hand tools and such.

But at least the choice of what to develop and manufacture was easy indeed, because all the IDF had at the start were the meager caches of ill-assorted weapons secretly accumulated by the pre-state militias, the dominant *Haganah* and its much smaller rival the *Irgun*, the result of a 1931 political split. The *Haganah* (“The Defense”) enrolled men and women of all ages in its *Heyl HaMishmar* (guard corps), fit young people in its *Heyl HaSadeh* (field corps) and a few thousand in the select *Plugot Maḥatz* (*Palmach* – strike units).[[13]](#endnote-13) The much smaller *Irgun Tsvai Leumi* (National Army Organization) only had a few organized units, while *Lohamei Herut Israel* (Fighters for the Freedom of Israel), Lehi. a.k.a. the Stern Gang of the poet Yair Stern, did not exceed 300. Aside from odd lots of pistols, revolvers, some submachine guns, rifles of different calibers, shotguns and a handful of machine guns, there was very little except for some trucks and buses protected with bolted-on steel plates.

The Jews could not legally import any weapons until British rule ended on May 15, 1948, and, because of a UN embargo, neither could their new state import weapons after May 15: even with the invasion of four Arab armies underway, it was nevertheless British policy, vigorously backed by the US Government, to stop any weapons at all from reaching the belligerents, ostensibly to limit the violence, but actually to ensure the victory of the invading Arab armies that already had their equipment. That emerges very clearly from the authorized history of the British Secret Intelligence Service.[[14]](#endnote-14) (The doings of intelligence services are rarely very consequential, but they do reflect actual policy aims more accurately than diplomatic declarations or even documents.)

Given what had very recently happened to millions of their co-religionists in Europe, the British stance towards the local Jews was more than harsh, but its motives were not deliberately malevolent—the British were merely being practical: at the time, they still had large military bases in the Canal zone of Egypt they meant to keep, and imperial possessions east of Suez. They had trained and equipped the Egyptian Army of King Farouk which was then poised to drive to Tel Aviv; and the British had also funded, trained and equipped the smaller “Arab Legion” of the Hashemite Kingdom of Transjordan, commanded by LTG Sir John Bagot Glubb (“Glubb Pasha”) and his deputy Norman Oliver Lash, both British citizens, as were the 35 officers who commanded the Legion field units that crossed the Jordan to invade Palestine, attack Jewish settlements, and try to conquer Jerusalem.[[15]](#endnote-15)

Iraq, much larger than Jordan and already oil-rich, was also ruled by a Hashemite king installed by the British. Its army had also been equipped and trained by the British, and its government was dominated by Nuri al-Said, sturdy ally of British interests in Iraq until his murder a decade later.

With all those valuable British assets on one side, and some 650,000 oil-less Jews on the other, the British decision to support the Arabs and deny weapons to the new Israeli state was quite rational, as was the decision of US Secretary of State, the five-star general, former Army Chief of Staff and future Nobel Prize winner George Catlett Marshall, Jr. to back State Department officials who sided with the British against the White House in believing that President Truman’s immediate recognition of Israel on May 15, 1948 was a great mistake that Israel’s destruction by victorious Arabs would soon correct.[[16]](#endnote-16) The British Foreign Secretary Ernest Bevin had already preemptively blamed impractical Zionist dreams for the inevitable massacre of the Jews.

It was therefore very unfortunate that Marshall’s tenure (January 1947–January 1949) coincided almost exactly with the most critical phase of Israel’s emergence. Though devoid of any personal animosity, let alone antisemitism, Marshall’s opposition was absolute and relentless.[[17]](#endnote-17) When Israel’s envoy asked for an audience, he refused—he was much too busy with the nascent Cold War to waste any time over an ephemeral mini-state that would soon be destroyed.

That was Marshall’s prediction as an expert strategist, in which the newly established CIA fully concurred, and one he himself did much to bring about because US diplomats worldwide, as well as the very new Central Intelligence Agency, vigorously joined the British in preventing any weapons at all from reaching Israel.[[18]](#endnote-18) Europe was then still littered with abandoned but still very usable weapons of all kinds, in all sorts of depots or under tarpaulins in the open, everything from rifles, artillery and tanks to functioning or repairable combat aircraft. And Europe’s impoverished postwar governments would eagerly have sold any weapons they had to the new Israeli state, which from May 15, 1948, had the legal right to buy anything it wanted. But as soon as word of a sale reached them, British and US diplomats would intervene, with their then immense prestige, successfully in all cases but one: Czechoslovakia, a small country with world-famous small arms’ factories eager for business.

That was indeed important because the newborn state could not hope to equip effective armed forces with the odds and ends that smugglers brought in —small batches of weapons of different calibers, often old and worn out, or missing parts. Nor could smugglers hope to bring in combat aircraft, armored vehicles or field artillery—all too big to pass undetected. So extreme was the need for weapons once the Arab invasions started on May 15, 1948, that two antique French 65 mm howitzers (*Canon de 65 M model 1906*) with missing sights, which fired feeble ten-pound (4.4 kg) shells at a leisurely 330 m/s muzzle velocity, were viewed as weapons of strategic importance reserved for the highest-priority tasks, starting with the defense of the Degania sector on the Jordan River against the invading Syrian army on May 15-21, 1948.

Marshall’s expert prediction might well have proven accurate had it not been for the coalition government of Czechoslovakia, which ignored Anglo-American pressures and sold weapons to Israel from its extensive stocks of weapons, both those produced by its sizeable and innovative military industries before 1938, and those produced under wartime Nazi direction thereafter.[[19]](#endnote-19) Soon chartered transport aircraft flown by intrepid volunteer pilots delivered 34,500 German *Mauser* rifles that Israelis still call *Czehi*, along with 5,515 MG 34 medium machine guns, 500 ZGB 33 light-machine guns, 900 ZB 53 medium machine guns, and more than a million rounds of ammunition.

The Czechs also had fighter aircraft to sell, 61 British-made *Spitfires* Mk IXs that had equipped the Free Czechoslovak Air Force squadrons of the Royal Air Force and were still first-line aircraft in 1948, and 25 locally made Messerschmitt *Bf 109s* (re-uniting both protagonists of the Battle of Britain) and more dubious *Avia* S-199s.[[20]](#endnote-20) In addition, the Czechs provided training for 81 pilots and 69 ground crew, as well as an airfield for the transshipments to Israel. It was not much as compared to the inventories of the Arab armies, and it was impossible to airlift any of the locally plentiful armored vehicles in light transport aircraft, but the Czech shipments were enough to make all the difference by providing homogenous sets of small arms for IDF field units, leaving the odds and ends accumulated over the years for the local-defense units.

Not all the fighter aircraft survived the perilous transit (only possible at all because of a secret re-fueling airstrip made available by Tito’s Yugoslav government) but enough did to allow courageous pilots to immediately go over to the offensive against the Egyptian air force. Equipped and trained by the British over the years, the Egyptians had already bombed Tel Aviv’s central bus station on May 18, 1948, killing 41 and wounding 60, to this day a greater casualty toll than any subsequent Arab air attack in seven decades of intermittent wars.[[21]](#endnote-21)

All-important as they were, the Czech shipments did not include any artillery or armored vehicles, both of which were essential to resist the invading Arab forces and then to go over to the offensive. That is how Israel’s history of military research and development started, prompted by imperative necessity rather than technological ambitions, with novel designs imposed by very severe technological limitations rather than any striving for originality for its own sake.

The *Davidka* mortar, the very first weapon developed from scratch, exemplified both characteristics. Three-inch mortars (actually 3.209 inches/ 81.5 mm) were standard in the British Army and the *Davidka* too had a base plate and a 3-inch tube. But there was no available supply of three-inch bombs, and none could be produced in local workshops with the precision needed to avoid deadly in-tube explosions. The highly original solution was to make super-caliber bombs with a caliber-sized rod to propel them that could be safely projected from the mortar’s barrel With four times as much explosive as British 3-inch mortar bombs the *Davidka* made for very loud explosions but lacking in both accuracy and range it was more useful to frighten enemies than to attack their defenses. Only seven were made and they achieved little. As for armored vehicles, aside from two medium *Cromwell* tanks stolen by sympathetic British army drivers during the final British withdrawal, and three defective US *Sherman* M.4 tanks assembled from assorted wrecks left behind by the British army., there were only improvised armored vehicles, made by bolting steel plates with firing slits onto trucks or buses, some with frontal rams to break through obstacles.

 There was even an early anticipation of today’s compound armor in the use of plywood, concrete, rubber, and even glass plate sandwiched between thin metal sheets, with the different densities serving to deflect bullets, while limiting total weight to avoid over-taxing engines and overloading chassis—but as soon as standard face-hardened steel plate could be imported, it was much preferred. [[22]](#endnote-22)

Jeeps could not be armored but they could be armed, and the IDF equipped some with the formidable firepower of two MG-34/41 machine-guns each firing 1,200 rounds per minute—ideal for fast raiding by providing short bursts of very intense fire to intimidate and suppress resistance. They equipped the 89th Commando Battalion formed and initially lead by the subsequent general, chief of staff and Minister of Defense Moshe Dayan [[23]](#endnote-23), who was notably successful in gaining territory by hit-and-run raids.

The jeeps arrived because even the otherwise very effective Anglo-American embargo could not prevent the import of entirely unarmed vehicles from the war-surplus dumps in Europe, even if they had originally been military vehicles. That category included thinly armored ten-ton *M-3* US-made “half-tracks” that combined front wheels for steering with tracks in the real for propulsion, and a protected front cabin with an open-topped rear cargo volume—they could freely be bought in Europe in a disarmed condition just as if they mere trucks. They were to have a very long life in the IDF: while the US Army replaced all its half-tracks with fully tracked vehicles just as soon as it could, the IDF still used many in its 1982 Lebanon war, and some remained in use for another decade beyond that.

More than three thousand half-tracks were imported by the IDF over the years, initially to serve as armored troop carriers but later adapted for many specialized roles: as command carriers with extra radios and a front winch; as weapon carriers for heavy machine-guns, for 81 mm mortars, for locally made heavy 120 mm mortars, for twin 20 mm Hispano-Suiza HS.404 cannon, for rockets and mine-clearing Bengalore torpedoes and finally anti-tank missiles, with yet more variants serving as combat-engineer vehicles, ambulances and more. Half-tracks were modified for all these different purposes because they were cheap and abundant as compared to any other armored vehicle, and because the open-topped cargo area could readily be modified to accommodate weapon mounts or anything else, including armored cabins for the evacuation of the wounded.

What happened with this particular vehicle through all its different modifications illustrates a fundamental aspect of IDF culture that persists vigorously even decades after the arrival of its first new weapons, delivered complete with replacement parts and specific maintenance tools: a proclivity for rehabilitating second-hand military equipment acquired in varied stages of disrepair, by repairing, retrofitting and modifying what arrived till it becomes useful, either for the purposes originally intended, or for something else entirely.

During the years of large-scale wars from 1967 to 1973, the rewards of this proclivity were very substantial, indeed of strategic significance, because the IDF was substantially reinforced with weapons captured on the battlefield. Thus US-made M.48 *Patton* main battle tanks captured from the Jordanians were added to Israel’s M.48s originally delivered by West Germany when its army was re-equipped with much more modern *Leopard* tanks. Over time, both were upgraded with new 105mm guns and eventually re-engine with powerful diesels in place of their original gasoline engines that caught fire all too easily. With those changes, Israel’s M48s were almost as good as the newest *M.60s* which the IDF only acquired much later.

Many of the Soviet *T-54/T-55* tanks captured in 1967 were cannibalized and repaired as necessary to equip new tank units, and then over time they were successively upgraded with new 105mm guns, coaxial machine guns, radios and sundry bits and pieces as the *Tiran* series of recycled tanks. With fewer or no modifications, excellent Soviet small arms including the justly celebrated *AK-47* were also transformed from battlefield loot into properly maintainable weapons that armed entire units, a process which was replicated with captured Soviet artillery, and particularly the 130mm long-range gun.

The recycling of captured Soviet tanks acquired strategic importance because it allowed the IDF to keep up with the rapid post-1967 expansion of the Egyptian, Syrian and Iraqi armored forces, at a time when the US was only manufacturing thirty *Patton* M60s per month, and the United Kingdom offered its Chieftain tanks, initially co-developed with Israel (!) only to Iran and Arab armies. In October 1973 when Soviet anti-tank missiles and RPGs in huge numbers allowed brave Egyptian infantrymen to engage oncoming Israeli tanks, destroying some and immobilizing many more, to the point that Israel’s armored forces were visibly shrinking just as Iraqi armored forces were arriving to join the fight, it was the *Tirans* as well as other captured Soviet tanks that achieved the organizational miracle of fielding a new armored division in ten days, with tank crews and all other essential personnel found by recalling older reservists, quickly retraining tank crews that had lost their tanks, and combing out armor and other combat soldiers who had drifted into administrative tasks.

The can-do, improvisational mentality originally instilled by the compelling necessity of rehabilitating abandoned equipment—everything from small arms to multi-engine aircraft—by repairing, refitting, and retrofitting, has persisted through the decades even as the country acquired increasingly advanced laboratories and factories. It is manifest chiefly in a willingness to act quickly accepting risks along the way—the exact opposite of the “zero risks” mentality that slows weapon development to a glacial pace in Europe and the United States.

These days with Israel sufficiently advanced to sell sophisticated weapons around the world, it must accept drastically different US methods when developing, producing and modifying equipment for the United States. Shaped by countless regulations mandated by the US Congress in order to combat “waste , fraud and mismanagement” in military procurement, the process is declaredly adversarial in imposing exhaustive documentation at each strep, and “objective” testing: instead of quickly making “proof of concept” prototypes and testing them to uncover deficiencies that can quickly be fixed before the next test, engineers must take all the time needed—years sometimes—to perfect what they make even in the prototype stage, because it is tested by an outside Test and Evaluation entity that earns its keep by finding faults. They take their time to test exhaustively, covering all the just-in case possibilities in all weathers and all conditions, and then take more time to compile their reports.

It is only then that the development process can resume after any test failure—unless the project is cancelled on the basis of the report: thus for example the US remained without remotely-piloted surveillance aircraft till Israeli ones were purchased in time for the 1991 Iraq war because the US-designed Lockheed MQM-105 *Aquila* whose development started in 1972 was suspended with fatal effect in September 1985 (after 13 years !) because the system failed 21 of 149 (!) performance specifications, a number that itself proves frivolous excess in mandating outlandish requirements.

The phenomenal rapidity of the development of the anti-rocket *Iron Dome* system, from its first funding in 2007 through research and development, tooling and production, training, and deployment to its first successful combat use in April 2011, shows that the IDF’s high-speed innovation culture is still in good working order: four years to develop a new missile is unheard of, but in this case there was also the extraordinary software that makes all the difference by only launching interceptor missiles against rockets projected to hit people or very valua le objects.

That same example also shows that the other innovation inheritance of 1948 is also still in place, because the phenomenally successful *Iron Dome* was not developed by the ground forces or the air force or the navy—none of which has its own research and development organization but rather by the one and only R&D organization that serves the IDF as a whole.[[24]](#endnote-24) That was just as well because the *Iron Dome* would never have been developed by ground-force officers who naturally prioritize the development of armored vehicles and other ground weapons, or naval officers with surface and submarine warfare on their minds, or by airmen whose solution for every problem is offensive air power.

Anything really new is unlikely to fit comfortably within existing service roles, so the necessary effort to research and develop the really new and bring it to operational status is unlikely to be forthcoming, as the chiefs of each service focus on their own priorities.

What would have happened to the *Iron Dome* in the absence of the one-service IDF is what actually *did* happen with the non-development of US military space satellites, whose critical importance for the US Army, Navy, Marine Corps and Air Force has never been disputed, but which none of the above was willing to develop with its own budgeted funds, preferring to use their funds to ameliorate their existing equipment. And this went on until the Soviet Union launched Sputnik, the first artificial Earth satellite, into an elliptical low-Earth orbit on October 4, 1957, inflicting a colossal shock

This did not happen with the *Iron Dome* because Israel’s military research and development funds are not pre-allocated to different branches of the armed force and can be spent on macro-innovations that being entirely new do not yet have service advocates. Instead of falling between service cracks, once their potential is recognized, macro-innovations can obtain “proof of concept” funding, and from then on, if a new capability is indeed demonstrated, the project can advance to production and deployment.

That is the only way truly large advances can be achieved, because really new equipment is not constrained by the design limits of prior equipment and –much more important—it can benefit from a “counter-measure holiday” before adversaries can react with their technical, tactical, or operational countermeasures.

It is for that reason above all that *macro-innovation* can be very important in a strategic competition: it offers new capabilities in their pristine state before they are counter-measured, and on occasion those capabilities can be decisive in war, or even in peace, e.g. by forcing adversaries to redirect resources from other tasks to the countermeasures’ effort against the macro-innovation.

1. Switzerland and Finland, not coincidentally two stalwartly independent countries, also have reserve-centered armed forces, in which the active-duty portion is even smaller than in the IDF because their conscripts serve for less than a year. [↑](#endnote-ref-1)
2. Jehuda L. Wallach, *Called to the Colors: The Creation of a Citizen Army in War Time, The American Civil War and the Israel War of Independence, a Comparative Study* (Tel Aviv: Ma’arachot, 1997), 50. [(H)] [↑](#endnote-ref-2)
3. National Defense Act (R.S.C., 1985, c N-5), at: <https://laws-lois.justice.gc.ca/eng/acts/n-5/page-3.htm> [↑](#endnote-ref-3)
4. *Canadian Forces Dress Instructions* (Ottawa: Department of National Defense, 2011), 5-1-2. [↑](#endnote-ref-4)
5. Still not a separate service, it is now called the "Air and Space Arm" *Zroa HaAvir VeHahalal*, [↑](#endnote-ref-5)
6. That is when Aryeh Dvoretzky (1916 – 2008), a leading mathematician then serving as the IDF Chief Scientist, proposed the use of radio-controlled mini-aircraft with stabilized video cameras to photograph Egyptian anti-aircraft missile batteries, in place of manned aircraft. One of the present authors (ENL) brought him the idea in June 1970. [↑](#endnote-ref-6)
7. A Chiefs of Staff Committee, formed in 1923, was a mere talking shop—it lacked a multi-service G-3 to coordinate operations. [↑](#endnote-ref-7)
8. Its 1936 predecessor, the staff-less, budget-less “Ministry for the Coordination of Defense,” was ineffectual. [↑](#endnote-ref-8)
9. The Goldwater–Nichols Department of Defense Reorganization Act of October 4, 1986. [↑](#endnote-ref-9)
10. The songs of the Red Army were fervently sung but its command structure was unknown. [↑](#endnote-ref-10)
11. *Rosh HaMateh HaKlali.* [↑](#endnote-ref-11)
12. As in the Egyptian and Iraqi forces, which later migrated to the Soviet model. Michael J. Eisenstaedt and Kenneth M. Pollack, "Armies of Snow and Armies of Sand: The Impact of Soviet Military Doctrine on Arab Militaries," in Emily Goldman and Leslie Eliason (eds.), *The Diffusion of Military Technology and Ideas* (Palo Alto, CA: Stanford University Press, 2003). [↑](#endnote-ref-12)
13. *Palmach* was established by the British in 1941, equipped and trained to serve as commandos and reconnaissance units for them, after the defeat of Rommel in late 1942 theBritish tried to dismantle the force. *Palmach* went underground – masquerading as a volunteer agricultural assistance organization for the Israeli kibbutzim. Training continued secretly as originally taught by the British though with less resources. [↑](#endnote-ref-13)
14. Ken Jeffery, *The Secret History of* *MI6* (New York: Penguin Press, 2010, 689-697). [↑](#endnote-ref-14)
15. When the leading role of British officers in the fighting became a scandal in London, they publicly withdrew only to immediately return quietly. *The Spectator*, 18 June 1948, page 6: “The Arab Legion “By one of its officers.” [↑](#endnote-ref-15)
16. Gerald M. Pops; “Marshall, The recognition of Israel” at <http://marshallfoundation.org/library/wp-ntent/uploads/sites/16/2015/01/Israel_Pops.pdf> [↑](#endnote-ref-16)
17. Unlike his State Department subordinates, Marshall favored Jewish immigration to the US. [↑](#endnote-ref-17)
18. CIA anticipated that Jewish resistance could not last more than two years:” The Consequences of the Partition of Palestine” SECRET 28 November 1, 47. At: https://www.jewishvirtuallibrary.org/cia-report-on-the-consequences-of-partition [↑](#endnote-ref-18)
19. A greatly underestimated figure, Ehud Avriel, aka Georg Überall, sent to Prague to buy arms at age 30 did so with the support of Foreign Minister Jan Garrigue Masaryk until his March 10, 1948, defenestration. Stalin’s lack of enthusiasm for Jews was outweighed by his anti-British priorities and sales continued after the murder and communist takeover. [↑](#endnote-ref-19)
20. Re-engined *Messerschmitt Bf 109s* which remained in production--when the original engines run out, they were re-engined with ill-matched  [Jumo 211F](https://en.wikipedia.org/wiki/Junkers_Jumo_211F) replacements that caused landing accidents Nevertheless, the IDF’s first five air combat victories were achieved with those very *Avia S-199s*. [↑](#endnote-ref-20)
21. https://blog.nli.org.il/en/hoi\_egypt\_tel-aviv/ [↑](#endnote-ref-21)
22. See description and photos of the IDF Armored Corps Museum in Latrun <https://yadlashiryon.com/armored-corps/armored-corps-ever-since/armored-corps-establishment.> [↑](#endnote-ref-22)
23. Moshe Dayan was IDF chief of staff during the 1956 Sinai Campaign and defense minister in the 1967 and 1973 wars; as foreign affairs minister 1977-1979 he directed the secret negotiations that led to Anwar Sadat’s visit to Israel. [↑](#endnote-ref-23)
24. “The Administration for the Development of Weapons and Technological Infrastructure,” abbreviated MaFat, a joint body of the civilian Ministry of Defense and the uniformed Israel Defense Forces. [↑](#endnote-ref-24)