

The dunes of Saudi Arabia, 1987. An AMX 40 tank fires 12 shots at a target and misses all. A British Challenger 1 hits 1 out of 12; a M1A1, 5/12; a fourth tank, 8/12. Months of trials for the Saudi Army's new main battle tank are coming to an end.¹ The AMX-40 and Challenger 1 are discarded, leaving the other two on a short-list for potential acquisition.

The fourth had "*outperformed the Challenger as well as the French AMX 40 and proved at least as good as the US M1A1*"². It was known as *Al-Fahd* to the Saudis and *Osório* to its creator, the Brazilian arms company Engesa. They were overflowing with enthusiasm and for the next years the news spoke of an imminent sale of several hundred tanks.

Yet in 1990 Saudi Arabia signed the contract for the M1A2. In 1993 Engesa went bankrupt. By the turn of the millenium most of Brazil's defense production had deindustrialized into nothingness. What went wrong?

For a "dust to dust" approach, let's look at this from the other end. It is 1964. The Army mostly consists of divisions of foot infantry and horse cavalry wielding American WWII surplus. Almost all of Brazil's arms output is from a few Armed Forces institutions. However the new military dictatorship has wide ambitions of authoritarian capitalist development and national power. This must include strong defense companies and lead to a modern military, influence in external markets and definitive proof that elites are competent.

What enabled them was the preexistence of supporting industries like steel and automobiles, new advances in capital goods production, the economic miracle of the early 70s and the decreasing availability of American armaments. The developmentalist state allied with private entrepreneurs, giving them the Armed Forces market, public R&D output, credit and subsidies. Three giants emerged: Embraer in aircraft, Avibras in rockets and missiles and Engesa in trucks and armored fighting vehicles. All were in São Paulo; Rio de Janeiro produced corvettes and frigates at Navy installations. Together with the production of radar and navigation systems, this was one of the most diverse Third World defense industries.

Embraer and Avibras were headquartered right next to the Air Force Technological Institute (ITA), established in 1950 precisely to spawn such giants: one of the

¹ By itself this final accuracy test doesn't mean much.

² Ogorkiewicz, Richard M. *Tanks: 100 years of evolution* , 2015, Osprey Publishing, ch. 10.

most demanding centers of higher education in the country, the plan was to create engineers who would kickstart an industrial complex. Embraer was a state enterprise with an output of transport, trainer and light attack craft, such as the Tucano and AMX International jointly developed with Italy. Avibras was privately owned and, though originally meant for aircraft, chose not to compete with Embraer. Its relationship with the Air Force wasn't the best. It's most notable for the ASTROS II multiple rocket launcher.

Engesa — Specialized Engineers S.A. — has the most colorful origin story. Founded by the young engineer José Luiz Whitaker Ribeiro in 1958, it began with just eight people making components for the oil industry. The need to cross poor roads to supply remote installations led it to refit its vehicles, increasing their off-road performance. This was so successful the vehicle upgrades themselves began to be sold. The Army and later the Navy noted them and in 1968 hired Engesa to refurbish their trucks. This work greatly expanded in the following years.

Meanwhile, in the late 60s Army R&D together with private industry were investing in AFV technology, beginning with modifications on existing imported vehicles, such as replacing the engine and transmission on the M8 Greyhound. Next was the development of wheeled vehicles, and in the future, tracked. Engesa contributed to the development of a Greyhound successor and in 1971 inherited the results, thanks to Whitaker Ribeiro's political skills, connections and ideological alignment with the regime. They became the *EE-9³ Cascavel* recon car, in series production by 1975. Likewise another inherited Army project became the *EE-11 Urutu* amphibious APC.

Applied Third Worldism

The rise of Engesa and other companies, together with what was taking place in the past decades — the establishment of oil production, a national road system and overall economic growth — allowed the military to modernize, with the last horse cavalry regiments being mechanized in the 80s. But national armaments demand wasn't that great, particularly with the large debt burden acquired by the late 70s. The industry had to find markets abroad, and such markets did exist; thus at its heyday in the 70s and 80s it became very external-oriented.

Arms exports overall were in the rise, and for a Third World armaments provider, this stage of the Cold War was perfect for selling to other developing states. The

³ Because it weighed 9 tons.

demand for technological sophistication was modest, technology transfers were common, former colonies had untapped potential, America restrained its sales for internal political reasons and smaller First World providers like West Germany, France and Italy were winning bigger stakes.

Brazil found its niche in reliable, low-cost weapons systems sold with no end-user conditions to anyone regardless of ideology. Anyone means anyone, from Pinochet to Saddam and Gaddafi. Through the latter Engesa AFVs found their way into conflicts in West Sahara and Chad. For Whitaker Ribeiro, this was not his problem as his clients had sovereignty. America was not pleased and the CIA monitored his production by satellite.

The Middle East in particular was a bountiful market. The oil price boom gave its militaries plenty to spend and encouraged the rest of the world to export to compensate. Brazil had to resort to bartering goods for oil, and among those were armaments. In the 80s the Iran-Iraq war ramped the region's demand even further. Although Brazil faced recession in its first years and as a whole it was a lost decade, the defense sector was completely unfazed.

Saddam bought rocket artillery from Avibras hoping to win an edge in the war as well as hundreds of Engesa AFVs. Engesa was more flexible than traditional European providers. It established informal channels with regime figures, provided instructional videos and color-coded ammunition for the barely literate conscripts, made whichever modifications the clients demanded, produced parts for other weapon systems (even spare parts for T tanks and MiG jets) and was psychologically attuned with its Iraqi counterparts. When the Iraqis made mistakes, they'd describe how they went through the same before instead of criticizing them.

The most numerous Engesa exports were in fact trucks, but what's impressive is the EE-9 Cascavel, a resounding success both with national mechanized cavalry and foreign armies in Latin America, Africa and the Middle East. 1,738 were built, some of which have seen combat as recently as Iraq's campaign against ISIS and the Second Libyan Civil War. The EE-11 Urutu, not as popular, had 888 units.

All this talk of export success must be put into perspective. The industry fed the media overblown numbers to aggrandize itself, and today those few who remember these golden years believe them, such as "fifth greatest armaments exporter". In fact, it was the tenth. Given how the sector was concentrated, this meant just one

percent of the market.⁴ The number of employees peaked at 39 thousand, 0,4% of the industrial workforce, with a similar GDP participation and little evidence of civilian spin-off.⁵ As reliance on imports was very high, it is doubtful there was even a positive impact on the balance of trade.

Trying too hard

The last step in national AFV development was tracked vehicles, taking place in the 1980s, but like with wheeled, preceded by experience refurbishing existing models. The Army's main tracked AFVs were the M113 APC and M41 Walker Bulldog light tank. They were to be replaced by Moto Peças' *Charrua* APC and Bernardini's *Tamoyo* tank. Note Engesa's absence; it specialized in the wheeled sector. Bernardini was its closest competitor and yet had an order of magnitude less employees, a lower technological capacity and a greater dependency on the Army.

The *Tamoyo* is a second generation model, not a tank fit for competing with the Abrams. It's a development on the M41, weighing 30 tons and firing a 90 or 105 mm gun. It was meant for a Third World budget and infrastructure and barely qualifies as a MBT. Its counterpart is the Argentine TAM, a 30-ton Marder chassis with a 105 mm gun. Not impressive either, but it beat the *Tamoyo* on a competition in Ecuador and actually entered production. Though the *Charrua* and *Tamoyo* were deemed adequate by the Army, there wasn't enough money or willpower to get them past the prototype stage.

And this is where Engesa dreamt big. In the early 80s Saudi Arabia opened an international competition for a new MBT after West Germany refused to sell the Leopard 2 to a non-NATO member. There was further tank demand in the UAE, Oman, Greece and Turkey. If wheeled armor had worked out so well and there was money to invest, why not break into the tracked sector and sell to the Saudis?

In 1982 Engesa announced it'd enter this market. It planned to sell a cheaper version with a 105 mm gun to the national army, though the weight (>40 tons) exceeded what military authorities set as the limit (36), and a competitive version with a 120 mm abroad.

Going from wheeled to tracked was more than changing a vehicle component. The wealthy Saudi Army demanded not a "reliable, low-cost" item but a sophisticated MBT. National industry couldn't provide this level of technology; it'd have to be acqui-

⁴ See [SIPRI](#) data.

⁵ Conca, Ken. "Technology, the Military, and Democracy in Brazil." *Journal of Interamerican Studies and World Affairs*, vol. 34, no. 1, 1992, p. 147.

red abroad. A partnership was sought. Thyssen-Henschel made an offer but it was just a Marder chassis (see the TAM). The West German government wouldn't let an alliance with Porsche. Finally, Vickers agreed to make the turret. The rest would be designed by Engesa's engineers with foreign components. The result was that in amazing speed⁶ a prototype was ready (the 105 mm version in 1984), and the tank was a Frankenstein of different providers — Brazilian chassis and armor, British suspension, turret and 105 mm gun, German engine, transmission and treads, French sights and 120 mm gun, British or Dutch fire control and so on.

"The manufacturers purchased some of the best components available from abroad to produce a potentially formidable tank. Firepower in mobility in particular are first class".⁷ It was a third generation MBT on par with the latest technology.

It had two-axis gun stabilization, computerized fire control based on the "coincidence window" concept and using environmental and meteorological inputs. The commander could seek a second target while the gunner fired. What gave it an advantage was that it began development later than its competitors, making it safer to employ onboard electronics; for instance, those were used to reduce engine power if temperatures got too high and to control braking.

The power-to-weight ratio and off-road performance were also good. Armor had to be sacrificed and, though the aim was to have it resist 120 mm APFSDS, it could only withstand 105 mm APFSDS. No source says this directly but I find it possible it had weaker protection than the Abrams. The weight may be a hint — over the 40-ton mark, whereas the Abrams and Challenger 1 were around the 60-ton mark. On the upsides it had good angles, a low silhouette, an anti-fire system and compartmentalized ammunition storage that exploded upwards instead of towards the crew. Optionally it could use an active protection system. There were smoke grenades. Reactive armor was considered but not implemented.

The Osório program cost 50–150 or even 250 million dollars. Meanwhile Engesa embarked on a massive expansion of its workforce, research, productive capacity and subsidiaries, with the entire group peaking at 10–11 thousand employees in the middle of the decade. It had other projects: the EE-3 Jararaca, a small 4x4 wheeled recon car, the EE-17 and EE-18 Sucuri, a wheeled tank destroyer with a 105 mm gun (see the Italian Centauro), and, strangest of all, the tracked and air-transportable EE-

⁶ Also owed to CAD/CAM usage, in its time a novelty in tank design.

⁷ Gelbart, Marsh. *Tanks: Main Battle Tanks and Light Tanks*, 1996, Brassey's, p. 14.

T4 Ogum, comparable only to the Wiesel. Only 63 Jararacas were built; it turned out to be technically flawed. The Sucuri and Ogum just weren't popular concepts in their time and didn't get past the prototype stage.

The fall

All of this investment kept a lot of capital immobilized, only to return if sales could go ahead. But they wouldn't. Engesa's problems long predated the Osório's failure and began from the inside out. Its technological edge was owed in large part to aggressively capturing qualified manpower with better wages, then allowing engineers to remain in the technical sector while rising to management-level wages ("Y carrier"). Over time engineering continued to develop while management didn't keep track. This wouldn't have mattered in the first years because decisionmaking was ad hoc, centralized on Whitaker Ribeiro's charismatic leadership. But in the 80s the company was too large and complex for ad hoc administration, leading to poor judgement and internal subversion of the founder's rule.

Outside, military rule ended in 1985. Measures against rampant inflation hurt exporters. Abroad, Arab purchases declined with falling oil prices, Saddam's development of a native arms industry and in 1988 the end of the Iran-Iraq war. There were rising markets in India and the Koreans, but out of reach. Instead the industry's established markets had increasingly fierce competition. Then came the end of the Cold War. Global arms exports declined and the market became one of shrinking demand and booming supply. It turned out there were insufficient economies of scale to sustain a technological leap such as the Osório.

Sure enough, there was the civilian market. Embraer had its firm stake in civilian aircraft while Avibras made items such as antennas. Engesa sold tractors, trucks and jeeps, though it never put much effort as Whitaker Ribeiro didn't value the sector.

By the late 80s Engesa was buried in debt and on those contracts it did sign it often failed to deliver the vehicles or follow up with spare parts, sending its reputation to the bottom. From 1987 the entire industry's crisis was visible in red balance sheets and mass dismissals. By the early 90s Engesa, Avibras and Embraer were on the march to bankruptcy. Embraer was privatized in 1994, turned its fate around and today exports the Super Tucano. Avibras had better management than Engesa and just barely survived. Engesa didn't make it. According to very patriotic people this happened because American political pressure on the Saudis made the Osório, which had "proven itself superior", fail and this in turn brought bankruptcy.

Did it? It is very much true Engesa lost in the political field. But one cannot deny agency to the Saudis. The tests did not conclusively establish the Osório's superiority, only that it was fit for purchase, and the Saudis bought the M1A2, not the M1A1 which competed in the desert. Nor is mere technical performance, which doesn't even vary that much, the sole factor in deciding which weapons system to buy.

There's geopolitics — the Gulf War deepened Riyadh's trust in Washington for its defense and Engesa was a major supplier of the Iraqi enemy — and safety — the Abrams was battle-tested and had production lines running, whereas the Osório was a prototype that'd have to draw on a huge, vulnerable supply chain to be mass-produced by a company with zero MBT experience. There were risks of delayed production and, once it entered service, of early technical difficulties. Engesa should have predicted at least some of this all the way back in 1982, but it didn't.

It took more than just the Osório to bring it down: the loss of government support, Saddam's 200 million dollar default after the Gulf War and, of course, years of bad decisions. Its smaller sidekick Bernardini had the same fate. Exports went all the way down. In the 90s imports regained their centrality in national Armed Forces purchases.

There was a recovery of productive capacity in the 2000s, but Engesa is only an obscure historical subject and memory. Its story and that of the arms industry it was part of is one of boom and bust, of how far a Third World industry can go under favorable conditions and how its mistakes and weaknesses can expose its fragility to an international crisis.

Further reading for Anglophones

Franko, Patrice. "[Defense production in Argentina, Brazil and Chile: A comparative perspective](#)". *Defense Analysis*, vol. 12, n. 3, 1996.

US Congress, Office of Technology Assessment. [Global Arms Trade](#), 1991.

US Department of State & Department of Defense. [Sale of Abrams tanks to Saudi Arabia](#), 1989. Background on why the Saudis wanted a new tank.

Henry, James S. *The blood bankers: tales from the global underground economy*, 2003, Four Walls Eight Windows. Very clueless and mistaken on military matters but has information on Engesa's use of corruption to secure credit and clients.