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Spanish C90-CR rocket launchers & Alhambra hand grenades in Yemen

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Cover image: Three Instalaza C-90 series weapons captured in Yemen near Raboah, a town on the Yemen-Saudi border (source: Yemen Fights Back, 2016).

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MARK the area to warn others
SEEK assistance from the relevant authorities

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Abbreviations & Acronyms

ARES	Armament Research Services
CONMAT	Conflict Materiel (Database)
D/O	Defensive/offensive
EEEMD	<i>Estadísticas españolas de exportación de material de defensa, de otro material y de productos y tecnologías de doble uso</i> ('Spanish export statistics of defence equipment, other materiel, and dual-use products and technologies') [Spanish]
HE	High explosive
HE-FRAG	High explosive fragmentation
HEAT	High explosive anti-tank
HEDP	High explosive dual-purpose
KSA	Kingdom of Saudi Arabia
OSINT	Open-source intelligence

Introduction

During the ongoing conflict in Yemen, two products from the Spanish defence firm Instalaza S.A. have been identified in the hands of Houthi rebel forces. These two weapons – C90-CR series rocket launchers and Alhambra series hand grenades – are not known to have been held in the inventory of the Republic of Yemen Armed Forces, however they are in service with Saudi Arabia. Saudi Arabia has led a coalition primarily consisting of other Gulf states in a counter-offensive in Yemen, responding to the overthrow of the Yemeni government by the Houthis, a Zaydi Shia movement, in March 2015 (Laub, 2016).

The most likely mechanism for the illicit transfer of these weapon systems from Saudi Arabia to Houthi forces is battlefield capture. This most likely involved the loss of equipment from Saudi troops, or from pro-government forces which Coalition partners have trained and equipped (Lake, 2015; MacLean, 2016).

SYSTEM	QUANTITY	NOTES
C-90C	16+	Majority documented along the Yemen - Saudi Arabia border.
ALHAMBRA HAND GRENADE	5	Majority documented along the Yemen - Saudi Arabia border.

This report will briefly address the technical characteristics of the two weapon systems in question, and examine how and when such weapons may have entered service with the Armed Forces of Saudi Arabia, and how they came to be in the possession of Houthi fighters. This report is primarily based on analysis of open-source intelligence (OSINT), supplemented by interviews with confidential sources and material recorded in ARES' proprietary Conflict Materiel (CONMAT) database.

C90-CR Series Rocket Launchers

The C-90¹ weapons consist of a series of shoulder-fired rocket launchers with a number of different payload options. The original C-90 was designed and developed by the Spanish company Instalaza S.A. in the late 1970s and early 1980s, and adopted for use by the Spanish Army in 1983 (Instalaza, n.d.b), and has been manufactured and offered on the international market since the early 1990s². Along with the Alcotán C-100, they constitute one of the two light and portable short-range anti-tank weapons in service with Spanish forces. The Alcotán-100 is known to be in service with the Force. These can be distinguished from the Spanish equivalents by their tan, rather than olive drab, colouration. Whilst Bahraini troops are present in limited numbers in Yemen, no Alcotán-100 systems have yet been observed. It is difficult to verify the costs and volumes of military acquisitions of certain weapon systems in Spain, as most contracts are "*Negociado Sin Publicidad*", which means neither the type, cost, or number of items is revealed in public sources. In some cases, contracts are entirely missing from public records (Villagrán, 2015).

Various mission-specific variants of the C90-CR series are available, including anti-tank, anti-bunker, combined anti-armour/fragmentation (HEDP), smoke/incendiary, and training (Navarro, 2015). Additionally, the weapon is capable of mounting a night-vision optic, the VN-38C, along with an upgraded variant called the VN-MF. This can be mounted on both the C90-CR and the HK-36E with a 4x magnification, though the default sights of the C90-CR are 2x magnification, during daylight only (Army Infantry School, 2009).



Figure 1.1 CN90-CR-BK (M3) weapon system, showing the general arrangement of the C90 series (source: Estonian Defence Forces).

¹ Also written 'C90' or 'C-90-CR' etc. Both formats have been observed on official paperwork and packaging. For this report, we will use 'C-90' and 'C90-CR', consistent with the most recent marketing material and training manuals available.

² Export customers include Colombia, Ecuador, Estonia, India, Italy, and Malaysia.

The original C-90 was upgraded to the C-90-C³, which was in turn upgraded to the C-90-CR series. The latest iterations of these have been designated the M3 series, denoted by 'M3' in parentheses after the weapon designation. Unlike all previous versions, the M3 is designed to be fired with the protective end caps in place (Army Infantry School, 2009). Whilst referred to by the manufacturer and the Spanish Army officially as *lanzacohetes* ('rocket launcher'), the C90 series are sometimes referred to by the term *lanzagranadas* ('grenade launcher'), by military personnel.

The C90-CR (M3) series fire 88.9 mm calibre rockets (considered 90 mm in Spanish service) out to stated ranges of 300 m for point targets, and 800 m for area targets (Army Infantry School, 2009). As a single-use weapon system, once the rocket has been fired, the non-reloadable launch tube is discarded (Cutshaw & Gander, 2002; Instalaza, n.d.). The chance of a successful hit on a standard vehicle target at a range of 50 metres is nearly 100%, and the C90-CR (M3) does not suffer after being exposed to temperatures as high as 50 degrees for a period of 24 hours (Ministerio de Defensa, 2011). Such a quality is highly desirable in an operating environment such as the Middle East.

Table 1.1 – Technical characteristics for C90-CR (M3) series rocket launchers

Variant	C90-CR (M3)	C90-CR-RB (M3)	C90-CR-AM (M3)	C90-CR-FIM (M3)	C90-CR-BK (M3)
Mission	Anti-armour	Anti-armour	Anti-materiel/ Anti-personnel	Smoke + Incendiary	Anti-fortification
Calibre	88.9 mm	88.9 mm	88.9 mm	88.9 mm	88.9 mm
Length					
Transport	983 mm	983 mm	983 mm	983 mm	983 mm
Ready-to-fire	943 mm	943 mm	943 mm	943 mm	943 mm
Weight					
Transport	5.0 kg	5.0 kg	5.0 kg	5.6 kg	5.4 kg
Ready-to-fire	4.7 kg	4.7 kg	4.7 kg	5.3 kg	5.1 kg
Penetration (RHAe)	400 mm	480 mm	220 mm	-	70 mm
Penetration (concrete)	1000 mm	1200 mm	650 mm	-	> 300 mm ⁴
Range					
Point target	300 m	300 m	300 m	-	350 m
Area target	-	-	800 m	750 m	-
Fragments	-	-	> 1,000	-	>400
Lethal area	-	-	21 m	-	8 m

Source: Cutshaw & Gander, 2002.

Notes: There is also a training variant known as the C-90-CR-IN (M3) or TR-90. The TR-90 designation is used for export models, and is shorthand for 'training'.

³ Also written 'C-90 C', as per older Instalaza marketing material (Instalaza, n.d.).

⁴ With follow-through effects.

Export to Saudi Arabia & Presence in Yemen

In the mid-1990s, Instalaza, along with various other Spanish defence sector companies, exported significant quantities of materiel to Saudi Arabia. This included a number of C90-CR rocket launchers; according to a confidential source in Spain, some 5000 C90-CR series weapons were delivered to Saudi Arabia in the early 1990s. Such weapons are not known to have been exported to other countries in the region. The confidential source in Spain indicated that Kuwait, Oman, Qatar, and the UAE had not received any C90-CR series systems. This indicates that Saudi Arabia presents a likely source any such weapons found in Saudi Arabia and neighbouring countries were provided during this time period (Aguirre, 1992).



Figure 1.2 Allegedly Saudi soldier holding a C-90 series weapon in Yemen (source: Al-Qahtani, 2015).

C-90 series weapons have not been exported from Spain to Yemen. The Spanish Ministry of Economy issued a series of documents called *Estadísticas españolas de exportación de material de defensa, de otro material y de productos y tecnologías de doble uso* ('Spanish export statistics of defence equipment, other materiel, and dual-use products and technologies'; or EEEMD)⁵. EEEMD reports suggest that there have not been significant defence materiel exports, particularly of ordnance, from Spain to Yemen. Whilst the issuance of detailed EEEMD reports is a relatively recent practice, earlier export reports and contemporary and modern sources indicate defence ties between Spain and Yemen have been near non-existent (Rodríguez, 2016).

⁵ EEEMD reports are archived by SIPRI, and available at: <https://www.sipri.org/databases/national-reports/Spain>

In the case of those C-90 series weapons documented in Yemen, it is likely that were supplied by, or captured from, the Kingdom of Saudi Arabia (KSA). The C-90 series fulfils a multitude of roles dependant on the user. As employed by Saudi forces, it proves useful in counter-sniper applications, repelling ambushes in hilly terrain, and the destruction of fortified positions. Rebels may employ it in an ambush or light anti-armour capacity. Significant numbers of these weapons are currently being used by Saudi forces (see Figure 1.2), and at least some are now in service with pro-Hadi forces and Houthi rebels (see Figure 1.4).

KSA forces have been observed armed with C-90 series systems in Yemen with some frequency. In addition to the use of these weapons by



Figure 1.3 Instalaza C-90 series weapon carried by KSA special forces in Al-Tuwal ('Abraxas Spa', 2016).

The C-90 series acquired by Houthi forces have almost certainly taken place via battlefield capture of systems either provided to pro-Hadi Yemeni forces, or in service with KSA forces. Houthi forces have successfully captured relatively advanced small arms and light weapons from KSA forces on several previous occasions, including the capture of Canadian PGW Defence Technologies LRT-3 12.7 x 99 mm anti-materiel rifles and Timberwolf .338 Lapua Magnum precision bolt-action rifles; and Heckler & Koch G36 series self-loading rifles, both seized by rebel forces near the Saudi border in late 2015 (Smallwood, 2015).

Houthi forces have been documented in possession of the C-90 series on a number of occasions. Figure 1.4 shows a Houthi fighter displaying a captured C-90 series weapon. Other weapons, including heavy machine guns and rifles, were reported to be in possession of Houthi forces at the time. Among other materiel (including a range of western rocket launcher systems), at least three C-90 series weapons were captured from Saudi forces in Yemen (Alsahat, 2016). The exact number of these and other systems captured remains unclear, however. Beyond photographed examples, several publicly available videos show C-90 systems captured from assumed Saudi or Yemeni army positions (Almasirah, 2016). Captured C-90 series systems have often been pictured alongside other weapons known to be in Saudi service or supplied to pro-Hadi forces, including Heckler & Koch G3 series and Steyr AUG series self-loading rifles (see Figures 1.6 and 1.7).



Figure 1.4 A Houthi fighter holding a captured Instalaza C-90 series weapon near the Asir region on the Saudi-Yemeni border (Terror Monitor, 2016).



Figure 1.5 Three Instalaza C-90 series weapons captured in Yemen near Raboah, a town on the Yemen-Saudi border (source: Yemen Fights Back, 2016).



Figure 1.6 Three Instalaza C-90 series weapons captured from Saudi forces in Yemen (source: Alsahat TV, 2016).



Figure 1.7 An Instalaza C-90 series weapon in Al Tuwal, a town near the Yemen-Saudi border. Note also the Steyr AUG type self-loading rifles, in service with Saudi forces (source: Yemen Fights Back, 2016).

In April 2016, an image was uploaded to a Yemeni Twitter account displaying evidence that the Saudis or other Coalition forces had delivered arms by parachute over the besieged city of Taiz. Among the several crates documented on social media, there were a number of C90-CR series weapons. The images indicate that at least some of those systems delivered were of the C-90-CR-RB variant. This variant is primarily intended for anti-tank applications.

It is interesting to note that the packaging crates displayed in Figure 1.8 are labelled in English; however, this is common for international arms exports from around the world. Further, the date of production indicated on the crates. This is consistent with information provided by the EEEMD and ARES' confidential Spanish source. The marking format and packaging (three C90-CR weapons per crate) are consistent with the manufacturer's practice for those systems accepted by the Spanish military (Army Infantry School, 2009; Instalaza, n.d.a).



Figure 1.8 Two packaging crates, each containing three C90-CR-RB systems, allegedly delivered by parachute over the besieged city of Taiz in April 2016 (source: Al-Omeisy, 2016).

The C90-CR-RB is the only variant of C-90 series weapon specifically identified in Yemen at the time of publication. Whilst the CR-RB is indeed the dedicated anti-tank variant of the C90-CR series, it lags behind other modern light anti-tank systems in terms of armour penetration. As a result, it is primarily a threat to second generation main battle tanks (typically those produced prior to 1980), and lacks the capability to penetrate the frontal hull and turret armour of modern tanks. Importantly, such weapons are still somewhat useful in anti-fortification role, and may also aid in both the laying and repelling of ambushes.

Alhambra Series Hand Grenades

Alhambra series hand grenades are produced by Instalaza and have been in service with the Spanish Army for more than a decade. There are two versions, the older Alhambra (see Figure 2.1), and the Alhambra D/O (defensive/offensive), which is relatively new and is believed to have been supplied to the Spanish army since 2007 or 2008 (Instalaza, 2007).

The Alhambra features a conventional high-explosive fragmentation (HE-FRAG) body design, whilst the main body and charge of the D/O model is surrounded by a removable fragmentation sleeve. The D/O may be employed either in the 'defensive' configuration, with the fragmentation sleeve in place, or in the 'offensive' configuration, with the sleeve removed. This allows the operator to employ the grenade from a safe position – in the defensive configuration, the grenade cannot be thrown far enough so as to protect the user from fragmentation without some manner of cover – or during an assault or room-clearing operation, with the fragmentation sleeve removed to limit the danger to the user. The ability to switch between configurations is only applicable to the Alhambra D/O model; the Alhambra grenade, on the other hand, has an integral fragmentation shell which cannot be removed (Fuerzas Armadas, 2007). Fragmentation for both models is achieved by some 3,500 spherical steel pre-formed fragments, held in a light metal matrix (see Figure 2.2).

Both the Alhambra and the Alhambra D/O models feature an electro-mechanical fuze assembly designated the ALH-LLI (see Figure 2.1). An electrical generator located in the grenade body is activated upon release of the arming lever, and the firing assembly is physically moved in line with the firing pin. This mechanism of action ensures that no arming action can take place prior to the release of the grenade by the user (Fuerzas Armadas, 2007; Rottman, 2015). Both the Alhambra and the Alhambra D/O are visually similar. They can be distinguished by the markings on the outer fragmentation shell (see Figure 2.1).



Figure 2.1 Markings applied to Alhambra (left) and Alhambra D/O (right) hand grenades. Note the image at right shows the removed fragmentation shell from an Alhambra D/O (sources: Infodefensa; original source unknown).

Table 2.1 – Technical characteristics for Alhambra series hand grenades

Variant	Alhambra & Alhambra D/O in defensive configuration
Height	95 mm
Diameter	65 mm
Weight	400 g
Weight of explosive	115 g
Weight of fragments	Approx. 130 g
Number of pre-formed fragments	>3,500
Lethal radius ⁶	10 m
Safety radius	20 m
Delay time	4 s ± 0.3 s
Throwing safety delay	3.5 s ± 0.3 s
Fuze	Electro-mechanical
Operational temperature range	-46 to +71°C
Packaging	Outer packaging (crate): 48 Inner packaging (tube): 4

Sources: Cutshaw & Gander, 2002; Fuerzas Armadas, 2007.



Figure 2.2 Internal view of an Alhambra D/O fragmentation shell, showing the pre-formed fragments (spheres) in the fragmentation matrix (source: original source unknown).

⁶ Against 0.2 m² target (Fuerzas Armadas, 2007)

Export to Saudi Arabia and Presence in Yemen

A number of Instalaza hand grenades have been observed during the recent conflict in Yemen. There are indications that these may have been exported from Spain to Saudi Arabia in 2004, as evidenced by a report outlining a total of EUR 23.2 million (USD 28.2 million⁷) in arms exports to Saudi Arabia in that year, including munitions and explosives (Font, 2014). This figure is confirmed in the 2004 EEEMD report.

As with the C-90 series rocket launchers, these likely originated in Saudi Arabia. Confidential sources in Spain indicate that the Alhambra series hand grenades have not been exported to other Coalition members. Additionally, the limited images available show the Alhambra series hand grenades alongside other materiel typically employed by Saudi forces, including Rheinmetall MG3 general-purpose machine guns, M2 heavy machine guns, Heckler & Koch G36 series self-loading rifles and MG4 light machine guns, and M67 type hand grenades (see Figure 2.3).



Figure 2.3 Four Instalaza Alhambra series hand grenades (at front left), along with other modern western materiel, allegedly captured by Houthi fighters from Saudi Forces in Yemen (source: Alsahat TV, n.d.⁸).

Additionally, an Alhambra-Instalaza hand grenade was discovered among the belongings of a claimed Yemeni Republican Guard soldier, killed while attempting to cross the Yemeni border into Saudi Arabia (69oio, 2015)⁹. Note the stencilled "HE" and "ALH" (See figure 2.4).

⁷ Amount given as per EUR-USD exchange rate as of 1 July 2004

⁸ Source no longer available publicly.

⁹ Images suggest grenades were found on the bodies of deceased combatant



Figure 2.4 An Alhambra-Instalaza hand grenade located among the belongings of a Yemeni combatant.

Thus far, only the original Alhambra type hand grenades have been conclusively identified in Yemen. The grenade in Figure 2.4, for example, is readily identified as an Alhambra, rather than an Alhambra D/O, by the markings on the exterior of the fragmentation shell. The grenades seen in Figure 2.3 could feasibly be either Alhambra D/O or Alhambra models. It is not known whether or not Alhambra D/O model hand grenades have been exported from Spain to Saudi Arabia or other armed forces in the region.

Conclusions

It is clear that Spanish weaponry, specifically C-90 series rocket launchers and Alhambra hand grenades, have been acquired by Houthi rebels, almost certainly by way of battlefield capture. These were likely obtained from either materiel supplied to the armed forces of Yemen by Saudi Arabia, or by direct capture from KSA forces. Such a conclusion is consistent with the export of these systems from Spain to Saudi Arabia as outlined in the EEEMD and confirmed by confidential sources. Additionally, such a transfer method is broadly consistent with other cases of Saudi materiel captured by Houthi fighters from both pro-Hadi forces and KSA forces themselves.

It is reasonable to suggest that the capture of the weapons as outlined in this report likely represent only a fraction, albeit perhaps one significant for its types, of the total inventory of Spanish weaponry in Houthi rebel position. It is also reasonable, therefore, to anticipate that Yemeni forces may come into contact with more of these weapons in future.

Both the Alhambra series grenades and, in particular, C-90 series rocket launchers will prove useful to Houthi forces. Despite the latter's shortcomings, in a theatre like Yemen where few modern armoured fighting vehicles are the present, the limited armour penetration capability does not detract too significantly from the usefulness of these weapons. Against light vehicles – such as the civilian 4 x 4 pickup trucks and light tactical vehicles often seen in the region – this lightweight, portable system packs a potent punch. It is ideal for use by irregular infantry and special forces, being light and handy at shorter ranges. As such, it remains a useful weapon system in the hands of both Saudi and Houthi forces.



Figure 3.1 Locations of C-90 series weapons captured by Houthi forces in Yemen (source: ARES/Google Maps).

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Note: A previous version of this report incorrectly stated that the C90 rocket launcher was first introduced in 1990. The first-generation systems were in fact introduced in 1983. This report has been amended accordingly.