

## Review on GIRAFFEE Radar System

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**Abstract**—The Saab (formerly Ericsson Microwave Systems AB) GIRAFFE Radar is a family of land and naval two- or three-dimensional G/H-band (4 to 8 GHz) Passive electronically scanned array radar-based surveillance and air defense command and control systems tailored for operations with medium- and Short Range Air Defense (SHORAD) missile or gun systems or for use as gap-fillers in a larger air defense system. The radar gets its name from the distinctive folding mast which when deployed allows the radar to see over nearby terrain features such as trees, extending its effective range against low-level air targets. The first systems were produced in 1977. By 2007, some 450 units of all types are reported as having been delivered. Military Technical Institute Belgrade purchased a license for Giraffe 75 and producing a new model with several modifications. Domestic Serbia designation is M85 "Žirafa" on chassis of FAP 2026<sup>[1]</sup>.

**Key words:** Radar System, GIRAFFEE Radar System

### I. INTRODUCTION



Fig. 1: M85 "Žirafa"

M85 "Žirafa" on chassis of FAP 2026 by Serbian Army Saab Electronic Defence Systems (EDS) on May 2014 unveiled two new classes of active electronically scanned array (AESA) radar—three land-based systems (Giraffe 1X, Giraffe 4A and Giraffe 8A) and two naval variants (Sea Giraffe 1X and Sea Giraffe 4A) in X- and S-band frequencies—to complement its existing surface radar portfolio.<sup>[2]</sup>

### II. DESCRIPTION

Giraffe is a family of G/H (formerly C-band) frequency agile, low to medium altitude pulse doppler air search radars and combat control centers which can be used in mobile or static short to medium range air defense applications. Giraffe is designed to detect low-altitude, low cross-section aircraft targets in conditions of severe clutter and electronic countermeasures. When equipped as an air-defense

command center Giraffe provides an air picture to each firing battery using man portable radio communication. GIRAFFE uses Agile Multi-Beam (AMB), which includes an integrated Command, control and communication (C<sub>3</sub>) system. This enables GIRAFFE to act as the command and control center in a defense system, it can also be integrated into a sensor net for greater coverage. It is normally housed in a single 6m long shelter mounted on an all-terrain vehicle for high mobility. Additionally the shelter can be augmented with Nuclear, Biological and Chemical protection and light layers of armor to protect against small arms and fragmentation threats.

### III. VARIANTS

**Giraffe 40** This is a short-range (40 kilometres (25 mi) instrumented) air defense radar with command and control capability. It employs a folding antenna mast that extends to a height of 13 metres (43 ft) when deployed and can be integrated with an Interrogation Friend or Foe (IFF) capability. Coverage is stated to be from ground level to 10,000 metres (33,000 ft) in altitude. In Swedish service the radar is designated PS-70 and PS-701 and provides target data to RBS-70 SHORADS missiles and 40mm Bofors guns. A more powerful version with a 60 kW transmitter is known commercially as Super Giraffe and in Swedish service as PS-707. These radars are no longer marketed.

### IV. GIRAFFE 50AT

This is the model used in the norwegian nallads air defense system which combines the radar and rbs-70 missiles with 20 mm anti-aircraft guns to provide low-level air defense for the combat brigades of the norwegian army. Mounted on a bv-202 all-terrain tracked vehicle this version has an instrumented range of 50 km (31 mi). The antenna extends to a height of 7 metres (23 ft) and the system can control up to 20 firing units of guns or missiles or a combination of both. The command and control system features fully automatic track initiation, target tracking, target identification (iff), target classification and designation, hovering helicopter detection threat evaluation and handling of "pop-up" targets. it can also exchange data with giraffe 75 or amb systems as part of a larger network.

### V. GIRAFFE 75

This features a 13 metres (43 ft.) antenna mast and is normally carried on a 6x6 5-ton cross-country truck which carries the radar and command and control shelter. Instrumented range is 75 km (47 mi) and altitude coverage extends from ground-level to 10,000 meters (33,000 ft). An optional add-on unit extends the radars coastal defense capabilities. In Swedish service the radar is designated ps-90.<sup>[3]</sup> in the greek air force giraffe 75 is used in combination with contrives (now rheinmetall defense) sky guard/sparrow fire control systems. 1 giraffe typically controls 2 sky guard

systems each with 2 twin 35 mm gdf-005 guns and 2 sparrow surface-to-air missile launchers.



Fig. 2: GIRAFFE 75

1988, a Republic of Singapore Air Force's GIRAFFE S 3D radar on display at Paya Lebar Air Base.

#### VI. GIRAFFE S

Optimized as a mobile radar for un-manned remote-controlled applications as a "gap-filler" in air defense early warning systems concentrating on small, low-flying targets over a long distance. It can also be employed as a coastal surveillance radar where targets are small surface vessels and sea-skimming missiles or aircraft. A new antenna extends range coverage to 180 km (110 mi) with altitude coverage from ground level to 6,000 metres (20,000 ft). The antenna mast extends to 8 metres (26 ft).

#### VII. GIRAFFE AMB

Giraffe Agile Multi Beam is a passive electronically scanned array radar, providing multi-beam 3-Dimensional air coverage at 5.4 to 5.9 GHz with instrumented ranges of 30 km (19 mi), 60 km (37 mi) and 100 km (62 mi), the altitude coverage is extended from ground-level to 20,000 metres (66,000 ft) with 70-degree elevation coverage. Data rate is 1-scan per-second. Its maintained pulse density suppresses high cluttering in adverse weather conditions. Ultra-low antenna side-lobes combined with pulse-to-pulse and burst-to-burst frequency agility provides some resistance to jamming. As in previous Giraffe radars automatic hovering helicopter detection is provided as is an artillery and mortar locating function, allowing the radar to detect incoming rounds and give 20 seconds or more of warning before impact. Giraffe AMB is the principal sensor of the Swedish RBS 23 BAMSE air defense missile system but is available for many other applications. A skilled crew can deploy the radar in around 10 minutes and recover it in around 6 minutes.

#### VIII. ARTE 740

This is a coastal defense radar based on the Giraffe 75 antenna and Giraffe AMB processing system optimized for surface and low-altitude coverage for the Swedish

Amphibious Forces (formerly the Coastal Artillery). It is mounted on a MOWAG Piranha 10x10 armored vehicle. 6 systems are in service.

#### IX. SEA GIRAFFE AMB

Saab's Sea GIRAFFE AMB is the naval variant of their Giraffe radar with 3D AMB technology. It can detect air and surface targets from the horizon up to a height of 20,000 metres (66,000 ft) at elevations up to 70°, and can simultaneously handle multiple threats approaching from different directions and altitudes, including diving anti-ship missiles. Also, it is specialized for rapidly detecting small, fast moving targets at all altitudes and small surface targets in severe clutter. Sea Giraffe AMB is installed on the Republic of Singapore Navy's upgraded *Victory*-class corvette and US Navy's *Independence* class of Littoral Combat Ships, and has the designation AN/SPS 77 V(1) for LCS 2 and 4, and AN/SPS 77 V(2) for LCS 6 and higher.<sup>[4]</sup> The radar has an instrumented range of 180 kilometres.<sup>[5]</sup> Its roles include:

- Air surveillance and tracking
- Surface surveillance and tracking
- Target identification for weapon systems
- High-resolution splash spotting

#### X. GIRAFFE 8A

Saab Electronic Defence Systems (EDS) in May 2014 unveiled two new classes of active electronically scanned array (AESA) radar—three land-based systems (Giraffe 1X, Giraffe 4A and Giraffe 8A) and two naval variants (Sea Giraffe 1X and Sea Giraffe 4A). At the top end of the range is the Giraffe 8A, a long-range S-band 3D sensor that can be produced in fixed, transportable and fully mobile configurations. Intended primarily for remote operation as part of an integrated air defence network, Giraffe 8A can also be operated locally. It has an instrumented range of 470 km and an altitude capability of more than 40,000m, bringing true long-range air defence capability to the Saab radar family for the first time. Giraffe 8A produces 15 stacked beams to provide elevation coverage from ground level to more than 65°. It can operate in a continuous 360° scan mode, rotating mechanically at 24rpm, or can be steered electronically across an operator-specified sector of 40° to 100°. More than 1,000 air defence tracks can be maintained, and the system also has anti-ballistic missile capability, in which case more than 100 tracks can be followed. Saab has paid special attention to Giraffe 8A's electronic counter-countermeasures properties. The radar generates very low sidelobes and incorporates sophisticated frequency agility in pulse-to-pulse, burst-to-burst and scantoscan regimes. It also switches and staggers pulse repetition frequency and transmits random jitter to further confuse countermeasures. It automatically selects the least jammed frequencies and can transmit intermittently or randomly. The radar offers a passive detection and tracking capability against jammers.

#### XI. GIRAFFE 4A

While the Giraffe 8A occupies the high end of the family, Saab has introduced new radars in the medium-range category in the form of Giraffe 4A and Sea Giraffe 4A for

naval use. Employing similar S-band technology to the larger radar, Giraffe 4A offers true 3D multirole capability, combining the air defence and weapon locating tasks in a single unit. Able to be airlifted in a single C-130 load, Giraffe 4A can be deployed by two people in less than 10 minutes. It can operate as a standalone.

## XII. GIRAFFE 1X

To complete its new line-up, Saab has introduced two short-range radars, Giraffe 1X and Sea Giraffe 1X. Working in the X-band, Giraffe 1X is intended primarily as a highly mobile radar that can work with very short-range air defence systems in the battlefield or at sea. Weighing less than 300 kg, Giraffe 1X can be mounted on a small vehicle or vessel or in fixed installations such as on a building or a mast. The radar has a sense-and-warn function and can be optionally configured for weapon location.<sup>[6]</sup>

## XIII. USERS

- 1)  Algeria: Sea Giraffe AMB G-band 3-D surveillance radar will equip MEKO A-200 frigates for the Algerian National Navy<sup>[7]</sup>
- 2)  Australia: Sea GIRAFFE installed on Anzac-class frigates and ordered as a ground-based system.<sup>[8]</sup>
- 3)  Brazil: In use by the Marine Corps since 1989, in the 50AT version, with a BV-206D tractor. To be replaced by the Saber M60.
- 4)  Canada: Sea GIRAFFE is used on *Halifax*-class frigates.<sup>[9]</sup>
- 5)  Croatia
- 6)  Estonia: GIRAFFE AMB - 5 mobile truck mounted units used within the Estonian Air Force's air surveillance system.
- 7)  Finland: Jantronic J-1000 target acquisition systems with Ericsson GIRAFFE Mk IV radars on a XA-182 Pasi APC. Sea GIRAFFE installed on four Rauma-class missile boats
- 8)  France: GIRAFFE AMB in use by the French Air Force.<sup>[10]</sup>
- 9)  Indonesia: Indonesian Army
- 10)  Ireland: Irish Army, GIRAFFE Mk IV on BV 206.
- 11)  Latvia
- 12)  Lithuania
- 13)  Greece
- 14)  Malaysia: Sea GIRAFFE is installed on Lekiu class frigate.<sup>[11]</sup>
- 15)  Norway
- 16)  Pakistan
- 17)  Philippines: Sea GIRAFFE AMB radars to be installed on the Gregorio del Pilar class frigates<sup>[12]</sup>
- 18)  Poland: Sea GIRAFFE is installed on Orkan class fast attack crafts.
- 19)  Serbia Producing one domestically upgraded and modernization variant based on purchased licence by Military Technical Institute Belgrade
- 20)  Singapore: GIRAFFE S and AMB in service with the Republic of Singapore Air Force's air-defence radar network;<sup>[13][14]</sup> Sea GIRAFFE AMB aboard

the Republic of Singapore Navy's Victory class corvettes.<sup>[15]</sup>

- 21)  Slovenia
- 22)  Sweden: used in coastal defence. Visby class corvettes also use Sea GIRAFFE.
- 23)  Thailand: GIRAFFE S and AMB used in Royal Thai Navy
- 24)  UAE: UAE Navy Baynunah class corvette also use Sea GIRAFFE
- 25)  United Kingdom: The British Army and Royal Air Force jointly operate the G-AMB radar in 49 (Inkerman) Battery.<sup>[16]</sup>
- 26)  United States: Sea Giraffe AMB installed on the Independence-class littoral combat ship as AN/SPS-77(V)1<sup>[17]</sup>
- 27)  Venezuela: GIRAFFE 75 Under control of the Aerospace Defense Command FANB.

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