

# ARCHIVED REPORT

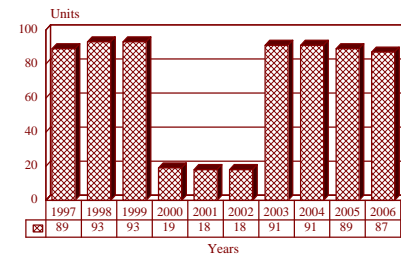
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## Rubber Duck - Archived 1/98

### Outlook

- Very widely used, low-impact system
- Used by US Navy and UKRN (USN designation AN/SLQ-49)
- Widely exported to Third World countries as well
- Upgraded Outfit DLF-3 under development
- Alternative nomenclature *Replica* in export markets

10 Year Unit Production Forecast  
1997-2006



### Orientation

**Description.** Expendable missile decoy system tasked with seducing radar-homing air-to-surface missiles by providing full radar cross-section decoy targets.

#### Sponsor

Ministry of Defence (PE)  
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#### Contractors

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Portsmouth Aviation  
Portsmouth  
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Irvin is the prime contractor and system integrator, Chemring produces the radar reflective mesh coating while Portsmouth Aviation produces the launching system.

#### Licensee

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**Status.** Production and service.

**Total Produced.** Overall, we believe about 660 Rubber Duck systems have been produced to date. However, a large number of these includes early versions which have been replaced by later derivatives. Therefore, the total number of systems produced does not equate to the number of platforms equipped to handle them.

A total of some 120 ships in the UK Royal Navy are believed to be fitted for Rubber Ducks, although many only actually receive the equipment when the need is

perceived. This implies the UKRN has procured an estimated 2,100 linked pairs of decoys.

At least 268 ships in the US Navy have been identified as SLQ-49 platforms. Assuming the same scale of issue as applied in the UKRN, this implies that an estimated 4,300 linked pairs of decoys have been acquired. This is in approximate agreement with known contractual procurement plans.

Additionally, up to 17 platforms operated by export customers are reported to have received, or are intended to receive, the Replica version as it is known in export

markets. This suggests sales of about 270 linked pairs of decoys. Many sales in this category are unreported.

**Application.** Protection of surface ships from sustained missile attack, by providing a long-endurance floating decoy with ship-like radar cross sections. Key factors in the design include the ability for installation on any type of ship with minimum impact on other characteristics of the platform.

**Price Range.** Although no figures are made available, we estimate that a Rubber Duck system with two launch racks and eight pairs of linked decoys costs less than US\$100,000.

## Technical Data

<b>Dimensions</b>	<b>Metric</b>	<b>US</b>
Container diameter:	0.55 m	22 in
Container weight:	67 kg	147.5 lb
Launcher height:	1.4 m	56 in
Launcher width:	1.3 m	52 in
Launcher weight:	173 kg	381 lb

**Design Features.** The system is composed of a broadband response passive octahedral radar decoy reflector mounted in life-raft type containers. Launched from a simple unit and operating in linked pairs, they provide a good horizontal and azimuth response to counter threat emitters.

Photographic evidence suggests that a standard fit includes two rail launchers and eight linked pairs of decoys per ship. Irvin has also developed a remote facility permitting the Replica system to be prepositioned and activated upon command. A self-destruct capability can be included if required.

**Operational Characteristics.** Deployment is effected by suspending the system from the leeward side of the vessel and inflating the unit by means of the ship's compressed air or bottled gas supply. When inflated, Rubber Duck comprises a substantial structure which remains operational for up to three hours in Sea State four conditions.

A lid of the launch container remains attached to each unit acting as a drag anchor. It limits the decoy's drift speed to no more than 1/4 of the prevailing wind speed and prevents the two reflectors from collapsing together. The two decoys are linked to each other by a 4-5meter long cord.

## Variants/Upgrades

**Cygnets** (original training system)

**Replica** (export market designation)

**DLF-1 Rubber Duck** (UKRN designation for original system)

**DLF-2 Rubber Duck** (RN designation for upgraded version)

**DLF-3 Rubber Duck** (RN designation for further upgraded version)

**AN/SLQ-49** (US Navy designation)

An air-launched version of Replica was tested by the US Navy in 1987. This version was intended to be used for the creation of phantom fleets and convoys. It never entered service, however.

A floating decoy is also in service with the Russian navy. This is the system from which the original Rubber Duck decoy was initially derived.

## Program Review

**Background.** The original DLF-1 Rubber Duck system was a direct copy of equipment originally put into service by the then-Soviet navy. The original differs from today's Rubber Duck only in that the inflatable envelope surrounding the radar reflector is spherical rather than octagonal. It also is carried in individual canisters along the ship's side, rather than in deck racks. Rubber Duck was originally designed to a commercial standard but was later re-developed to UKRN's more exacting requirements after the Falklands war.

The designation DLF-1 is applied to this commercial-standard version which saw only limited life. The funding received during the original Rubber Duck procurement assisted the development of DLF-2 to the current specification. In the export market Rubber Duck is known as Replica.

The Rubber Duck system is currently in operation with the UKRN. The DLF-2 is currently in production and installations extend throughout the UKRN. Replica has also been successfully exported to the United States, with manufacture shared between Irvin GB and the Irvin Industries Inc subsidiary in the US.

During 1987/1988 the US Navy conducted trials of the DLF-2 and subsequently procured the system under the designation SLQ-49. Irvin intended that US production would be shared by its US and UK companies. The system is being offered to NATO and other approved countries. A training system has been developed for an unidentified major world navy, and sales of the system continue.

In 1988, the Saudi Arabian navy ordered three Sandown class minehunters from Vosper Thornycroft, with

options on a further three. The UKRN has diverted ships from its own Sandown class minehunter program to fulfill this Saudi Arabian order. The Saudi navy and UKRN will receive ships alternately as they are completed, although the Saudi ships have a number of marked differences in their equipment fit from the ships in British service.

During this period the French navy also ordered the Rubber Duck for installation on its own ships and those for export. The Saudi Sandown class received some of these as part of their French-supplied electronic warfare suite. Reports in the European naval press suggest that the Spanish Bazan-designed mine warfare vessels also will at some point carry Rubber Ducks.

In 1991 development of a further upgrade of the basic system was initiated. Designated DLF-3, this retains the basic characteristics of the original Rubber Duck but features enhanced radar cross-section and greater service durability. In September 1992, bids for the development and initial production of DLF-3 were invited from Marconi Defence Systems, Thorn-EMI, Chemring, Dowty, Woodville Polymer Co and Irvin Great Britain. Some of these bidders claim that the demand for a greatly enhanced RCS will result in a significantly larger structure than DLF-2, although Irvin denies this. These bids were received by April 14, 1993, and Irvin won the appropriate development and initial production contract in December 1993.

Since that time, there has been little overt activity in this program, while the new variants of Outfit DLF and SLQ-49 are being readied for service.

## Funding

It is assumed that the original development of the floating radar decoy was funded by the Soviet navy. Duplication of the Soviet system, modification to UKRN requirements and subsequent development of Rubber Duck and Replica were funded by the UK Ministry of Defence.

## Recent Contracts

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Irvin Industries USA	2.0	Oct 1988 - US Navy contract to fabricate, assemble, and deliver SLQ-49 decoys to be delivered over a five-year period.
Irvin GB Ltd	1.9	Oct 1988 - US Navy contract to fabricate, assemble, and deliver SLQ-49 decoys.

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Irvin Industries USA	2.8	Oct 1993 - US Navy contract for the remanufacture of between 70 and 350 quantity of SLQ-49 decoy systems over a five-year period.
Irvin GB Ltd	4.9	Aug 1993 - US Navy contract for SLQ-49 systems.
Irvin GB Ltd		Dec 1993 - UK MoD contract for the design, development and initial production of an Advanced Inflatable Decoy.

## Timetable

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	1982	Adaptation of system to RN requirements started
	1987	Installed on RN Hunt class minesweepers
	1988	US Navy trials commenced
	1989	US Navy production contract awarded
	1991	Development of DLF-3 initiated
Sep	1992	Contract bids for DLF-3 invited
Aug	1993	US Navy contract for additional SLQ-49 systems
Dec	1993	Contract for development of DLF(3) awarded

## Worldwide Distribution

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The following distribution list is obtained from the Forecast International World Naval Electronic Warfare Database. It indicates known or projected platforms for the systems. Many of these may not yet have received their projected outfits. The usual outfit is two systems each with two launch racks and eight linked decoys. Deployment is made more difficult by the fact that a Replica or Rubber Duck in its canister is visually difficult to distinguish from a life raft and becomes impossible to detect once its specific markings have been erased.

### Replica:

**Saudi Arabia** (6 Sandown MCMV)

**Spain** (8 Bazan MCMV)

**Thailand** (3 Khamronsin FFL)

Replica/Rubber Duck systems have also been supplied to the **Netherlands, France and Italy**, but the scale of issue is highly uncertain. Certainly the Italian destroyer *RIM Francesco Mimbelli* does carry the system; equally certainly the French frigate *FS Aconit* does not (both confirmed by personal observation).

### Rubber Duck:

**UK** (2 Fort Grange AOR, 2 Fort Victoria AOR, 4 Leaf AOR, 2 Ol AOR, 2 Rover AOR, 1 Diligence AR, 12 Type 42 DD, 10 Type 22 FF, 16 Type 23 FF, 1 Fearless LPD, 1 Argus LPH, 4 Knight LST, 13 Hunt MCMV, 12 Sandown MCMV, 2 Castle OPV, 7 Island OPV, 1 Polar Circle OPV, 1 Sentinel OPV.)

### SLQ-49:

**USA** (9 Nimitz CVN, 1 Enterprise CVN, 1 Forrestal CV, 1 John F Kennedy CV, 3 Kitty Hawk CV, 1 Bainbridge CLN, 2 California CLN, 1 Truxtun CLN, 2 Virginia CLN, 26 Ticonderoga CL, 4 Kidd DD, 3 Coontz DD, 29 Arleigh Burke DD, 51 Oliver Hazard Perry DD, 31 Spruance FF, 46 Knox FF<sup>(a)</sup>, 2 Blue Ridge LCC, 1 Coronado AGI, 1 La Salle AGI, 1 Newport AGI, 7 Iwo Jima LPH, 5 Tarawa LHA, 5 Wasp LHD, 4 Sacramento AOR, 4 Supply AOR, 7 Wichita AOR.)

<sup>(a)</sup> Many Knox class ships listed here have been transferred to other navies; it is not known whether they retained their SLQ-49 decoys on transfer.

## Forecast Rationale

The Rubber Duck/Replica system has continued to enjoy considerable success and the installations in the UKRN have been expanded from most surface combatants and mine warfare vessels to include under-

way replenishment vessels, repair ships and offshore patrol craft.

The scale of issue in the US Navy has followed that of the UKRN, with virtually every surface ship in the fleet

of any significance being scheduled to receive the SLQ-49. The original contract was for 6,000 systems to be delivered over a five year period that started in 1989. This equates to 375 ship sets. Of these 268 are accounted for by existing, planned or projected USN installations, with the balance of 107 being for Coast Guard vessels and for new construction not yet authorized.

Both the US Navy and the UKRN regard the Rubber Duck/SLQ-49 programs as vital, and a continuous program of further developments and improvements of the product is intended. However, we assume that specifications for the US versions of Rubber Duck will steadily diverge from those adopted by the UKRN because of the differing operational techniques and environments of the forces.

The concept of Rubber Duck can only be described as brilliant. Unlike chaff rockets and the later generations of radiating decoys, Rubber Duck provides sustained protection against radar homing missiles. It can also be installed on virtually any imaginable ship, the only essential equipment being that needed to launch a rubber raft. Replica is also the most suitable system for installation on a merchant ship — the lack of pyrotechnics and rockets remove legal and safety objections to the fit. The low-cost and minimal impact on the platform will appeal to many nations where cost factors are paramount. The duplication of function will also permit the optimization of space in small vessels.

Against its virtues must be set the fundamental limitations of a floating decoy system. Although the Rubber Duck simulates the radar signature of a frigate or other platform, its motion and behavior patterns once in the water do not resemble those of a ship. Any missile radar seeker with even rudimentary MTI will be able to discriminate on the basis of these differences and evade the decoy. Furthermore, Rubber Duck has no infrared signature so will not seduce missiles using infrared guidance or having an IR backup to the radar seeker. These are not insignificant points — the Silkworm missile, which in itself is hardly the most sophisticated on the market, that was fired at the *USS Missouri* and shot down by *HMS Gloucester* was coming in on infrared guidance and was, thus, unaffected by Rubber Duck or the large volumes of chaff fired at it. Presumably these factors are being addressed as part of the current DLF-3 upgrade program.

The deployment of USN and UKRN warships to the Persian Gulf and their participation in the Desert Shield/Desert Storm underlined the importance of

Rubber Duck. Because the system can be installed so quickly and with such minor impact on the ship, it is a convenient last-minute augmentation of the defensive aids system. All British warships deployed to the Persian Gulf area, for example, were equipped with Rubber Ducks. In the end, however, no sustained or large-scale attacks were made on the coalition naval groups and the efficiency of their defensive EW systems remained largely untested.

Future campaigns of this type are unlikely to see this level of immunity repeated, though; the political implications of sinking a warship are too significant to pass. It is therefore likely that in future, the importance of the Rubber Duck will be even more clearly demonstrated as part of a fully integrated EW suite.

Our forecast refers to ship sets of equipment, rather than individual decoys. Replica and Rubber Duck procurement is expected to continue through the forecast period. The UKRN can be expected to acquire two Rubber Duck systems per ship for its entire surface fleet to give a total requirement of 150 systems over the next five years. To this requirement must be added systems to replace older and less effective versions of Rubber Duck. We also assume that British warships sold for export will be fitted with Replica.

The US forecast line is based on the completion of the existing contract in 1993. A follow-on contract for an advanced derivative of SLQ-49, analogous but not identical to UKRN's DLF-3, was placed in August 1993. Also as we projected, the new equipment is being designated in the SLQ-49 series to avoid budgetary complications. This equipment will replace older versions in the medium and long term. A large order is now expected to be in the works from the US Navy. That estimation is also supported by the fact that the USN budget shows a jump from \$2.4 million to \$15.1 million in antiship missile systems, between FY96 and FY97. For all practical purposes, this particular line item goes to a large extent for AN/SLQ-49.

The unattributed line represents both yet-to-be-determined export orders and orders that were won in the past but were never disclosed. No forecast line is included for the installation of floating decoys on Russian warships. With the collapse of the Soviet Union and the implosion of their armed forces, it is likely that relatively modern and powerful ex-Soviet ships will be sold on the international market. Maintaining and supporting their floating decoy systems could thus represent an unexpected market opportunity for Rubber Duck.

# Ten-Year Outlook

<u>ESTIMATED CALENDAR YEAR PRODUCTION</u>													
<u>Designation</u>	<u>Application</u>	<u>thru 96</u>	<u>High Confidence Level</u>				<u>Good Confidence Level</u>				<u>Speculative</u>		<u>Total 97-06</u>
			<u>97</u>	<u>98</u>	<u>99</u>	<u>00</u>	<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>	
REPLICA	DD/FF/MCMV (EXPORT)	30	4	6	6	6	6	6	6	6	4	4	54
REPLICA	MCMV (SAUDI ARABIA)	3	0	1	1	1	0	0	0	0	0	0	3
REPLICA	MCMV (SPAIN)	0	0	1	1	2	2	2	0	0	0	0	8
RUBBER DUCK	CVHG/DD/FF/MCMV/AO R (UK)	100	10	10	10	10	10	10	10	10	10	8	98
SLQ-49	WARSHIPS (US NAVY)	525	75	75	75	0	0	0	75	75	75	75	525
<b>Total Production</b>		<b>658</b>	<b>89</b>	<b>93</b>	<b>93</b>	<b>19</b>	<b>18</b>	<b>18</b>	<b>91</b>	<b>91</b>	<b>89</b>	<b>87</b>	<b>688</b>