

NORTHROP GRUMMAN

Ship Systems

Systems Engineering Management

*An Israeli
Perspective*

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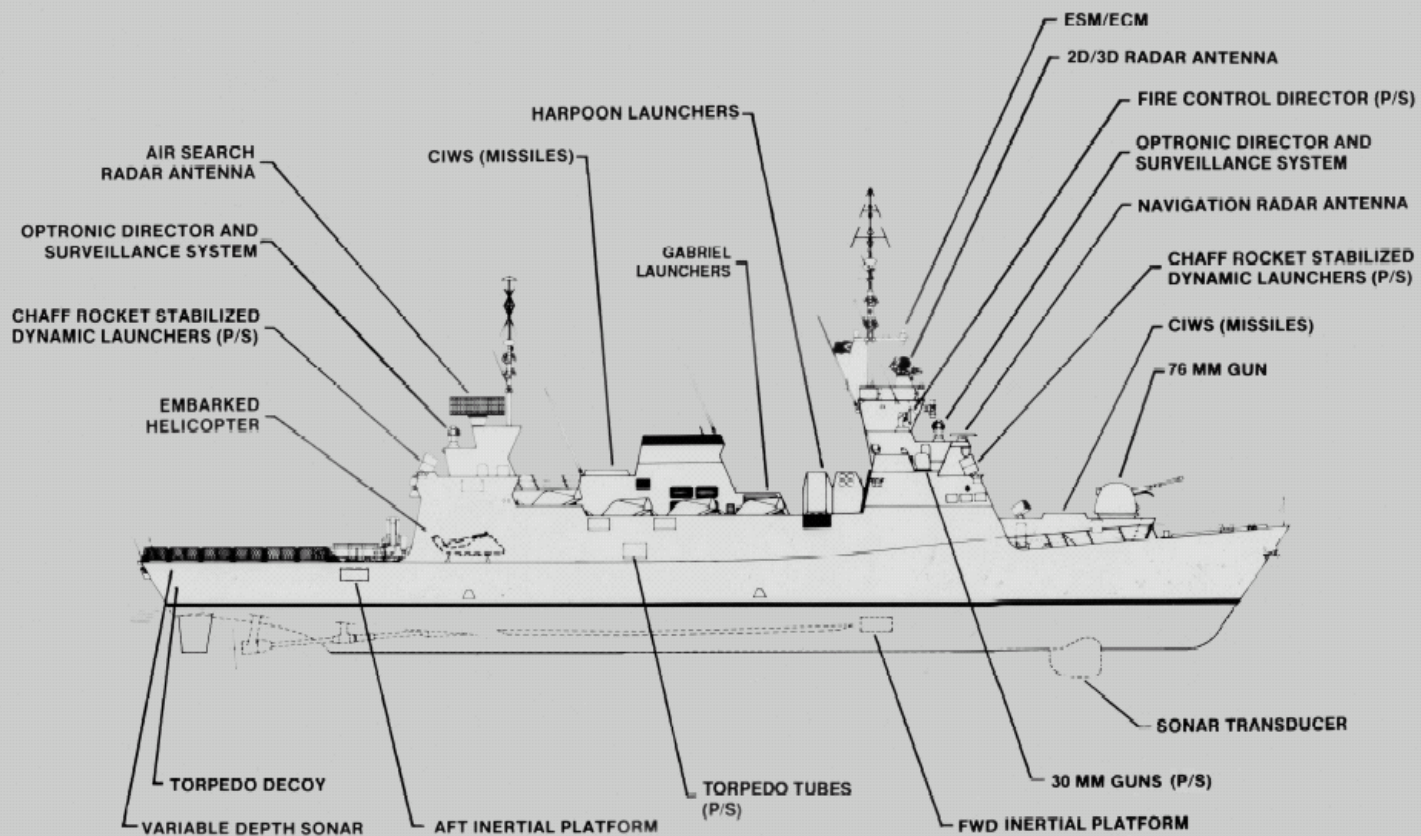


The SA'AR 5





COMBAT SYSTEM ARRANGEMENT



NORTHROP GRUMMAN

Ship Systems



Contract Provisions

Foreign Military Sale
Direct Commercial Contract
Fixed Price
Design & Construct Three Corvettes
Shared Combat Systems Integration
Start 1 May 1989
Third Ship Delivery 1 November 1994
Positive Cash Flow
Some Extended Warranties
On-site Involved Israeli Engineers

NORTHROP GRUMMAN

Ship Systems



Characteristics of SA'AR 5

RCS Signature Reduction

IR Signature Reduction

Extensive Automation

---One Man Control

---Low Manning

Sea Keeping Stability

---Helicopter Safe

---1200 Tonnes, L/B 6.7

Quality Marine Equipment

---Some Foreign Sources

Repairable Sensors

NORTHROP GRUMMAN

Ship Systems



Team Selection Characteristics

Previous Tour in US
PG School Graduate
---Technically Broad
---Business Sensitive
Married
---With Children
Three Year Tour
---First Year Near JJMA
-----Cramped
-----Locked
-----Unmarked
Live Near Each Other



Original Team

CAPT Amiram Raphael

CDR Eitan Karon 100,600

CDR Igel Bodenheimer 200,500

CDR Meir Hanan 300

CDR David Bachar 400,700

LCDR Avner Borman Logistics, Budgets

Secretary (US Temp)

NORTHROP GRUMMAN

Ship Systems



Systems Engineering Management

Vendor brochures
Sensor Selection
Shock Qualification
Hull Weight
Stability Requirements
Diesel Generators
Pipe Selection
Motor Operated Valves
Compartment Arrangement
Technical Manuals
Remanufacturing Requirement
Vendor FATs

NORTHROP GRUMMAN

Ship Systems



Ship Monitoring and Control System

Israeli Navy selected CAE
Two engineers on site
Added young bachelor
On-plant and remote control
Extensive signal list
---3666 sensors
---38 columns per sensor
Helm wheel
Signal interfaces fully used
Extensive logic diagrams
Full software documentation
Lengthy engineering meetings
Extensive HSI review

NORTHROP GRUMMAN

Ship Systems



Ship Monitoring and Control System

One man can start and sail away

One button quite ship

Training mode available on two consoles

Separate network from Combat System

Automatic fire suppression

Fail set

Four AC generators and three DC systems

Multiple acceleration modes

Three levels of access to software

Manning results

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