Orizzonte Sistemi Navali

A PERFECT MACHINE.

Sensors

Weapons

Combat Management System

Propulsed Platform

An efficient system is created by organic integration of its parts.

System of Systems Engineering Workshop

**Integration between
main ship design characteristics
and
naval task effectiveness,
during
the warship acquisition phase**

**on 17th June, 2011
in Genoa**

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Presentation Outline

❖Ship Acquisition phase

❖The traditional approach

❖New methodology (ASNET) to approach this phase

❖Expected ASNET impact

ASNET: Application System for Naval Evaluation and Testing

❖ASNET components

❖Ship Synthesis Model (SSM)

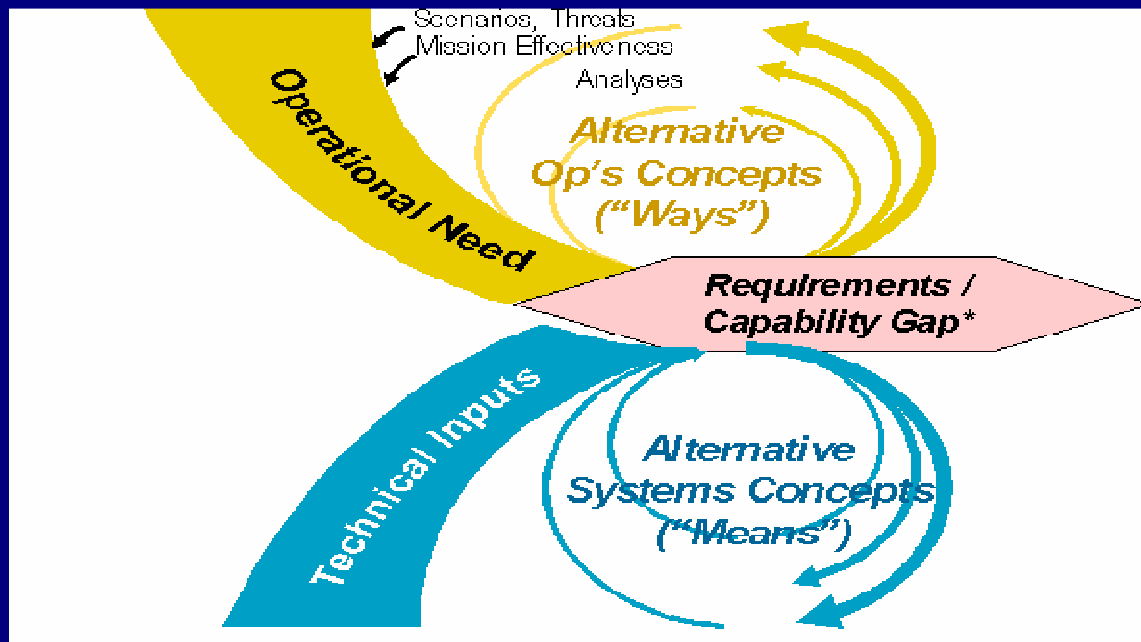❖Operational Evaluation Model (OEM)

❖Decision making Techniques (i.e. JMP)

SHIP ACQUISITION PHASE
(Early Stage Design – ESD)

- The traditional approach

- New methodology (ASNET) to approach this phase

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ASNET COMPONENTS

- Ship Synthesis Model (SSM)

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Operational needs and the technical inputs/constraints are often examined by separate teams and in different phases of the project.

The traditional approach

SHIP ACQUISITION PHASE

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ASNET COMPONENTS

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Actors   Main Activity

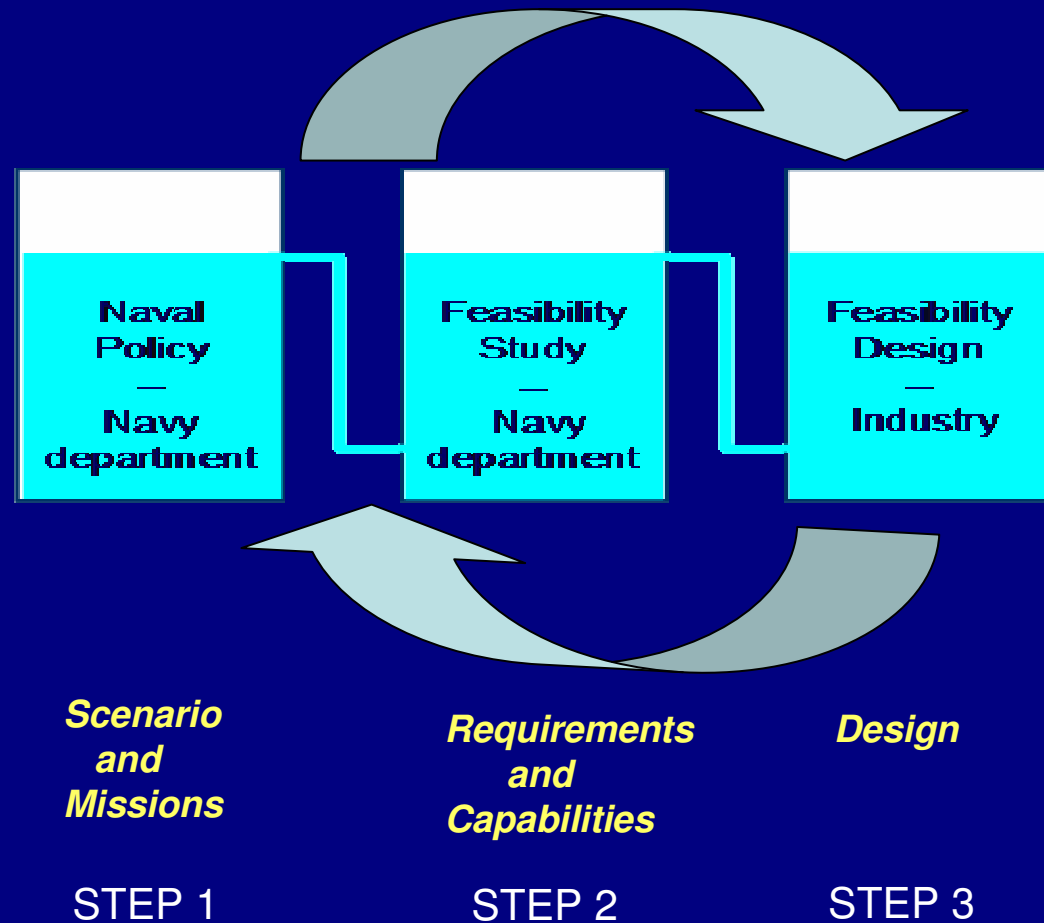|	Actors	Main Activity
Scenario and Missions	**Naval Policy – Navy department**	Defines the overall picture where **the new naval units have to operate**: it includes the political and economical scenario, its characterization in terms of geographical areas and the relevant issues under the national point of view
Requirements and Capabilities	**Feasibility Study – Navy department**	Derives, from the naval policy instructions, **a set of requirements for the new naval units in terms of technical capabilities and other relevant requirements** such as speeds (sustained and endurance), range, & stores period.
Design	**Feasibility Design – Industry**	On the basis of the naval requirements document, sketch the ship which could meet the requirements.

The traditional approach

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Naval
Policy
—
Navy
department

Feasibility
Study
—
Navy
department

Feasibility
Design
—
Industry

*Scenario
and
Missions*

*Requirements
and
Capabilities*

Design

STEP 1

STEP 2

STEP 3

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Commitment and Flexibility

New methodology (ASNET)

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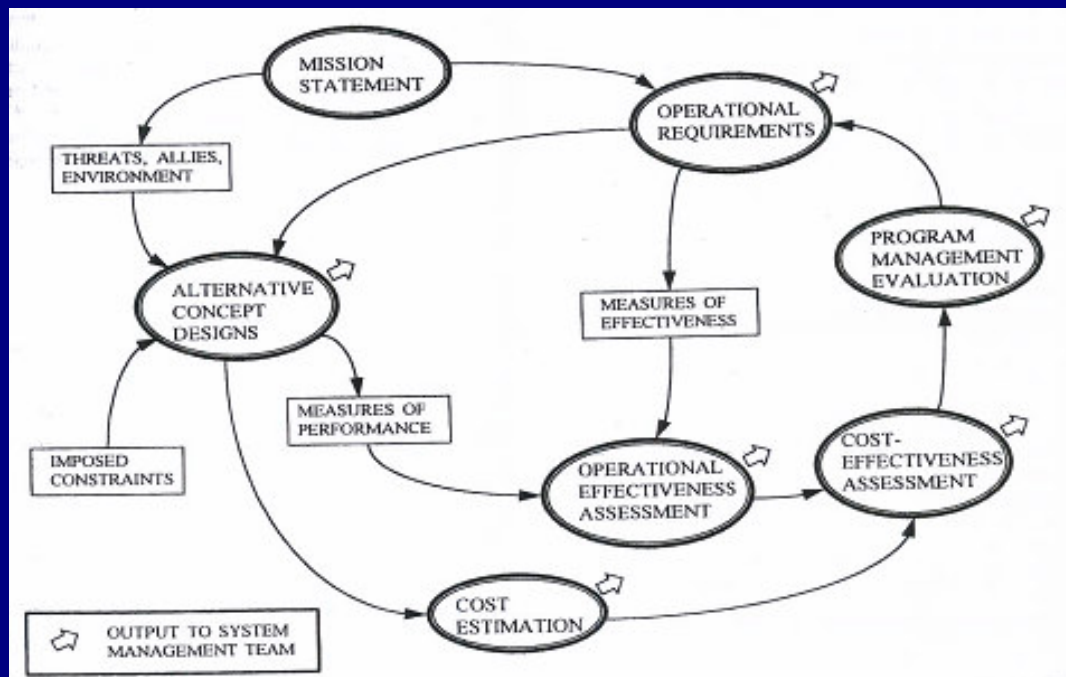
From a seminal paper of W. Hockberger – it is composed by

Ship Synthesis Model

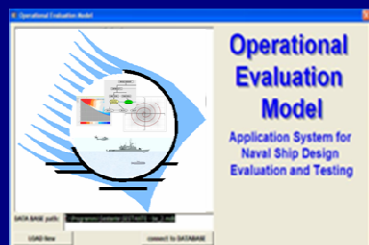**Operational Evaluation Model**

Important to define the link between SSM and OEM

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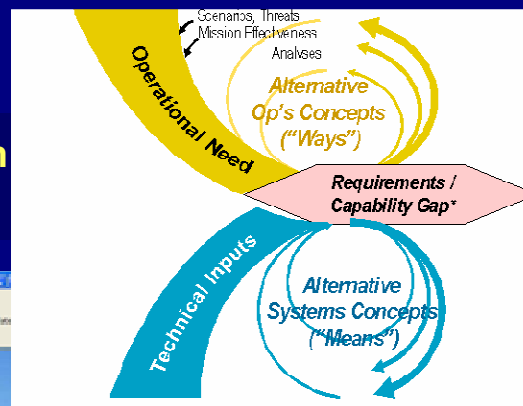
ASNET COMPONENTS

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Operational Evaluation Model
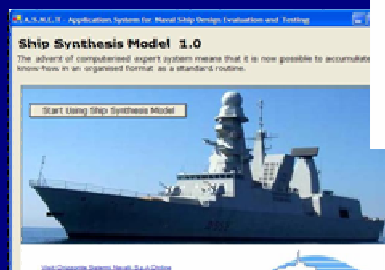
Ship Synthesis Model

tries to solve

Decision making Techniques

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ASNET

Application System for Naval Evaluation and Testing

An attempt

to involve operational experts, naval

architects

and combat system designers

into a unique environment.

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Operational Effectiveness

Time on Station

$$NS = \frac{TM * VC}{RP * FUF}$$

$$TS = TM - (INT[NS]+1)*2\frac{DA}{VC}$$

$$NS = \frac{(15\times24)\times15}{3000\times0,85} = \frac{5400}{2550} > 2$$

$$TS = (15\times24) - 3\times2\times\frac{100}{15} = 320$$

$$\%\_Time = \frac{320}{360} = 0,88$$

$$NS = \frac{(15\times24)\times15}{4000\times0,85} = \frac{5400}{3400} > 1,5$$

$$TS = (15\times24) - 2\times2\times\frac{100}{15} = 333$$

$$\%\_Time = \frac{333}{360} = 0,92$$

Dr. A. Rains: Fleet Mix Mission Effectiveness Analysis

Requirements

M.o.p.

Vessel Typology: **OPV**

Cruise speed: **15 kn**

Endurance: **15 days**

Operational Availability: **0,99 %**

Range : 3000 nm

New Range : 4000 nm

Ship Characteristics
(Abt.)

Length LwL	beam B	depth D	displ. WFL	Acqui. cost
80 [m]	12 [m]	8 [m]	1700 [t]	XXX

A faesible ship configuration generated by the Ship Synthesis Model (SSM)

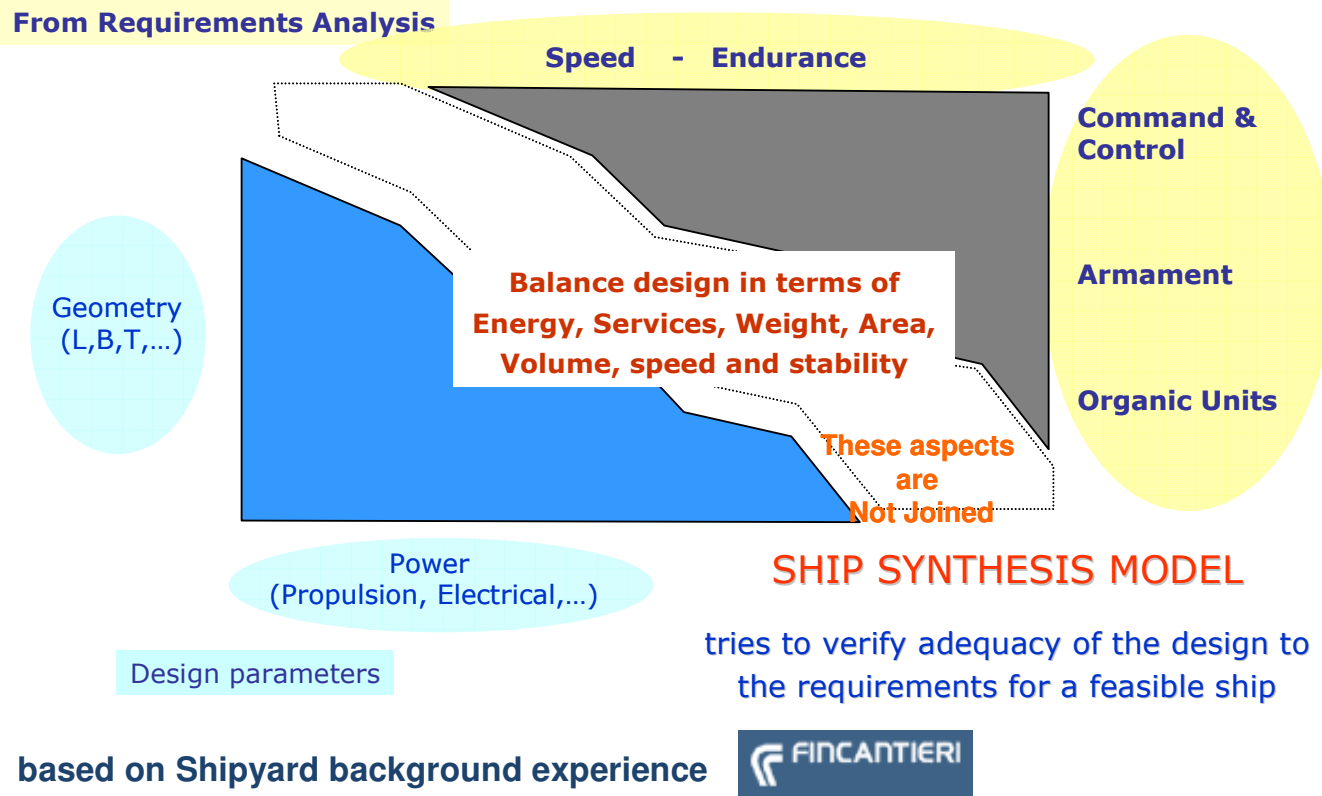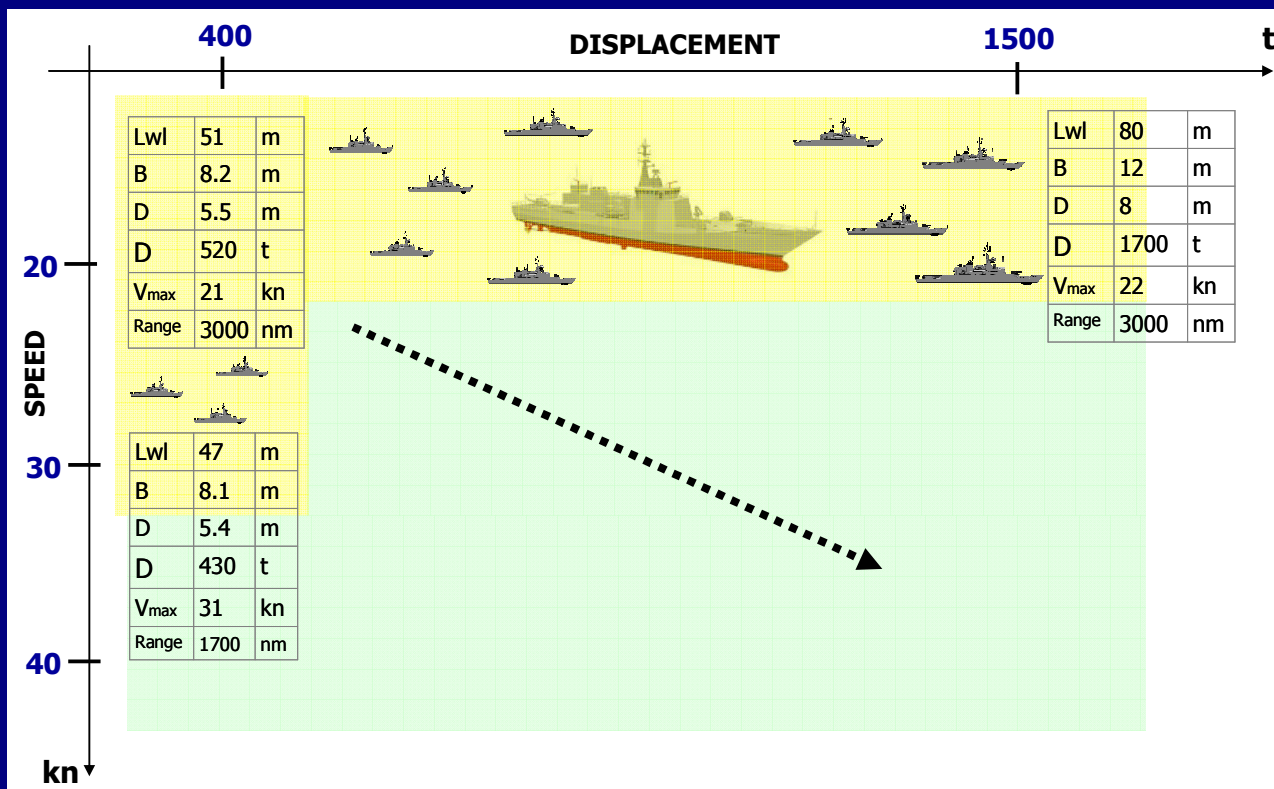| LwL	beam B	depth D	displ. WFL	Acqui. cost
85 [m]	12 [m]	8 [m]	1800 [t]	ΔXXX

Ship Synthesis Model – SSM   1/2

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From Requirements Analysis

Speed   -   Endurance

Command & Control

Armament

Organic Units

Geometry (L,B,T,…)

Balance design in terms of Energy, Services, Weight, Area, Volume, speed and stability

These aspects are Not Joined

Power (Propulsion, Electrical,…)

Design parameters

SHIP SYNTHESIS MODEL

tries to verify adequacy of the design to the requirements for a feasible ship

based on Shipyard background experience

FINCANTIERI

Ship Synthesis Model – SSM
(State of art)   2/2

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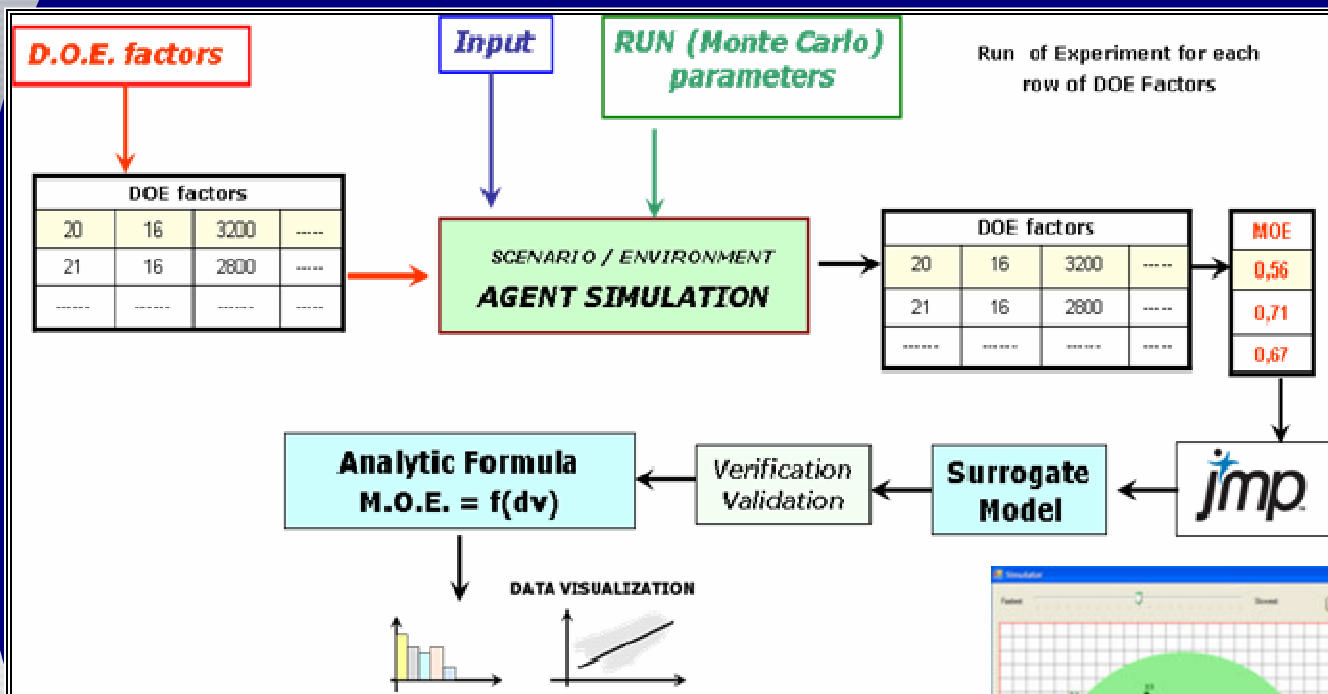
- *Decision Making Techniques (JMP)*

Operational Evaluation Model - 1/3
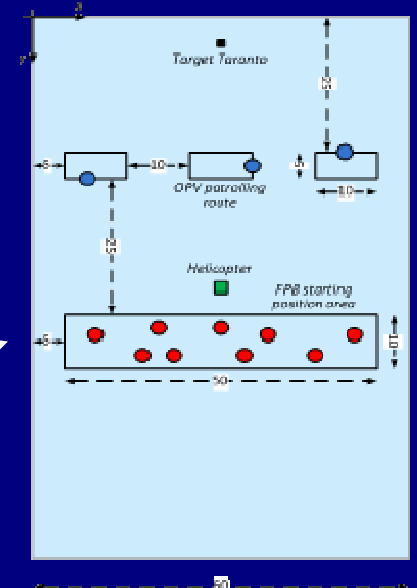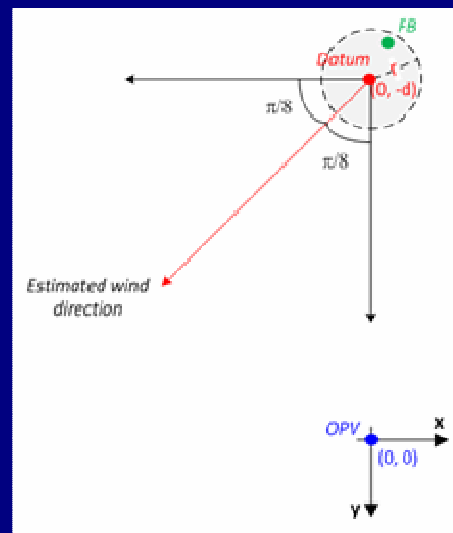
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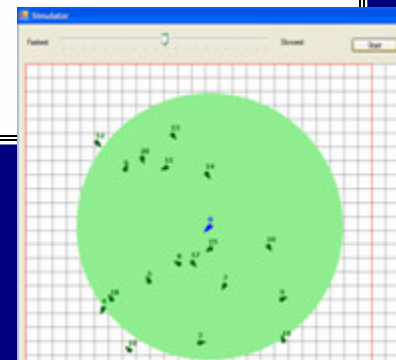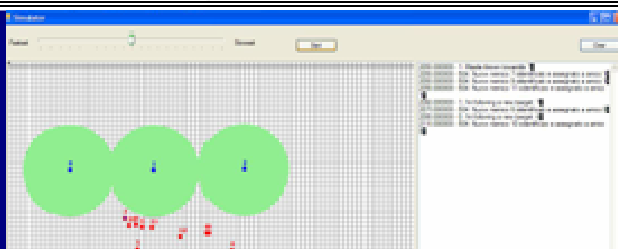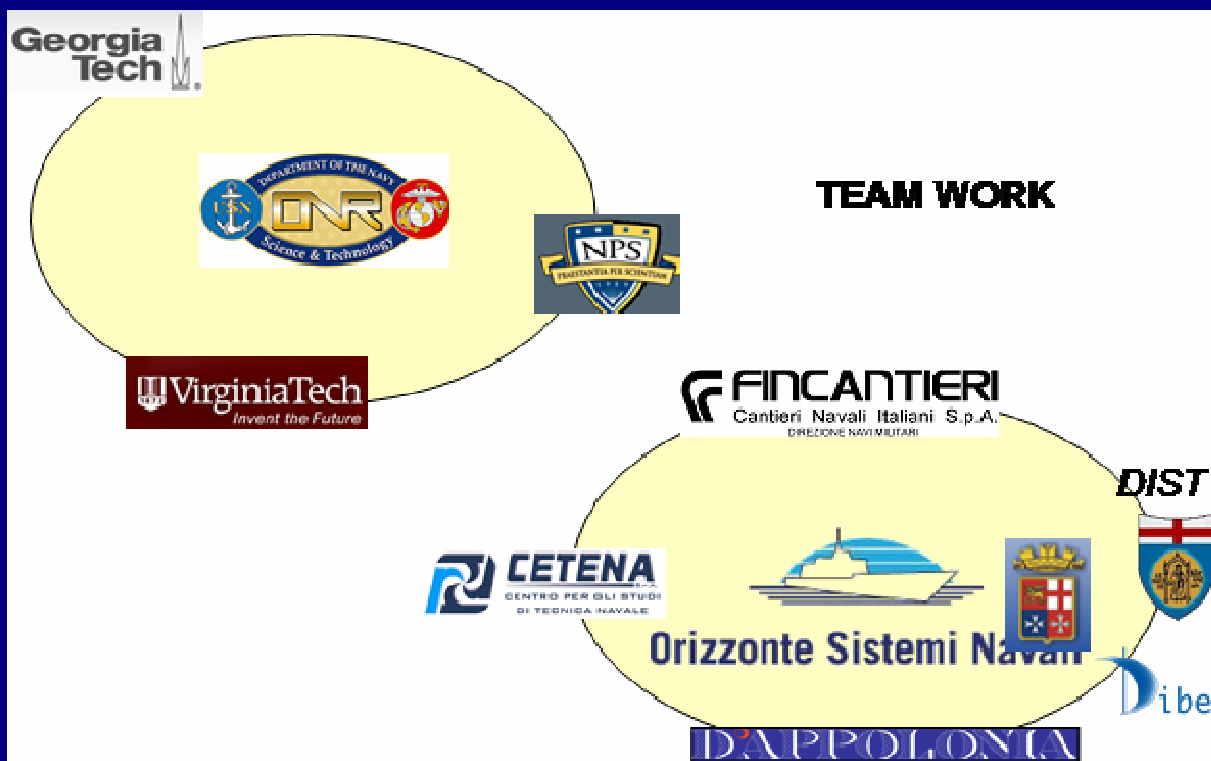
Operational Evaluation Model – 3/3

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ONR & OSN Activity

Search And Rescue
(SAR)

Anti Surface Warfare
(ASuW)

Research Program sponsored by ONR & OSN

TITLE: evaluate the benefits of Integration of Major Ship Design Characteristics and Naval Task Effectiveness, during the Ship Design Phase.

Design space exploration

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▶ **ONR & OSN activity**

Min	Max		DSM	EEZ	SAR	MIO	AAW sd	ASuW
22	40	Vsust.	■		■	■	■	■
1000	2000	Endurance	■	■				
13	23	Mast H.	■			■	■	
SAM1	SAM2	SAM	▤				▥	
Y	N	MCG					▥	▥
SSM1	SSM2	SSM	▤					▥
Y	N	HELO	▤		▥	▥		
f(Subsystems)		Crew Num.	■					
		Length	■				■	
		Beam	■					
		Draft	■					
		Cx	■					
		Cp	■					
		Displ.	■					
		Error in Power	■					
		Error in Endurance	■					
		MOE EEZ		■				
		MOE MIO				■		
		MOE AAW sd					■	
		MOE ASuW						■
50	200	Distance to Base EEZ		▦				
25	100	Distance to SAR Loc			▦			
EEZ1	EEZ2	Area of Operations for MIO				▦		
Type 1	Type 2	Type of Illegal Vessel MIO				▦		
Sub	Super	Type of Threat Missile					▦	
FP1	FP2	Type of Incoming Fast Patrol Boat						▦

SAM: Sea Sparrow & MICA
SSM: MARTE & Exocet

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Commitment and Flexibility

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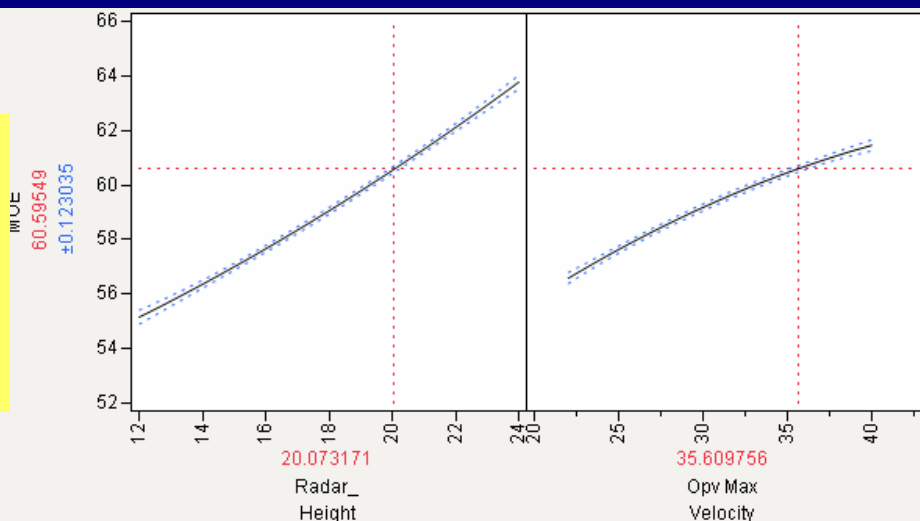- *New methodology (ASNET) to approach this phase*

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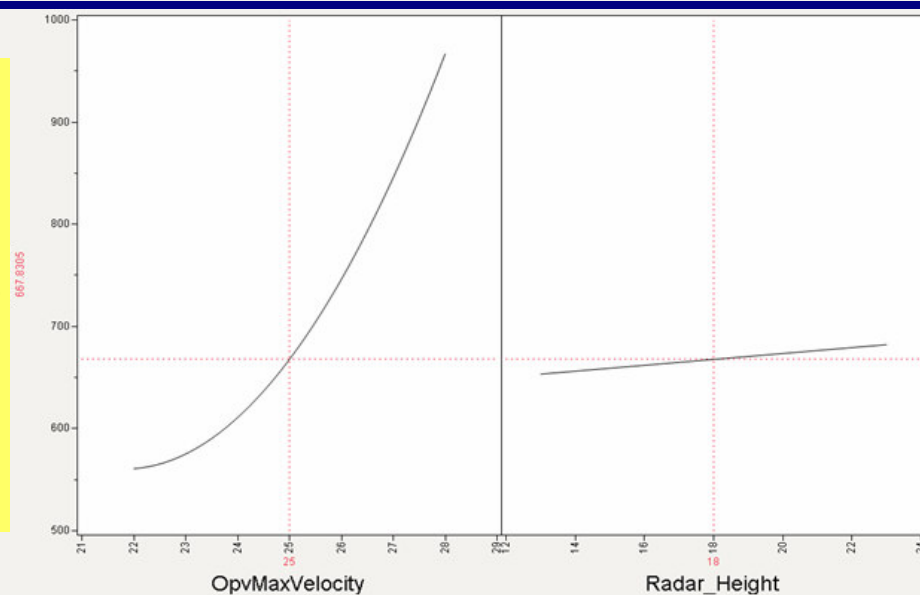- *Ship Synthesis Model (SSM)*

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▶ **ONR & OSN activity**
- *Decision Making Techniques (JMP)*

EEZ - MOE

OPV - Displacement

Link between SSM and OEM (in progress)

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Commitment and Flexibility

Link between SSM and OEM (in progress)

Constrains:
- MOE   > 55 %
- Displacement < 650 ton
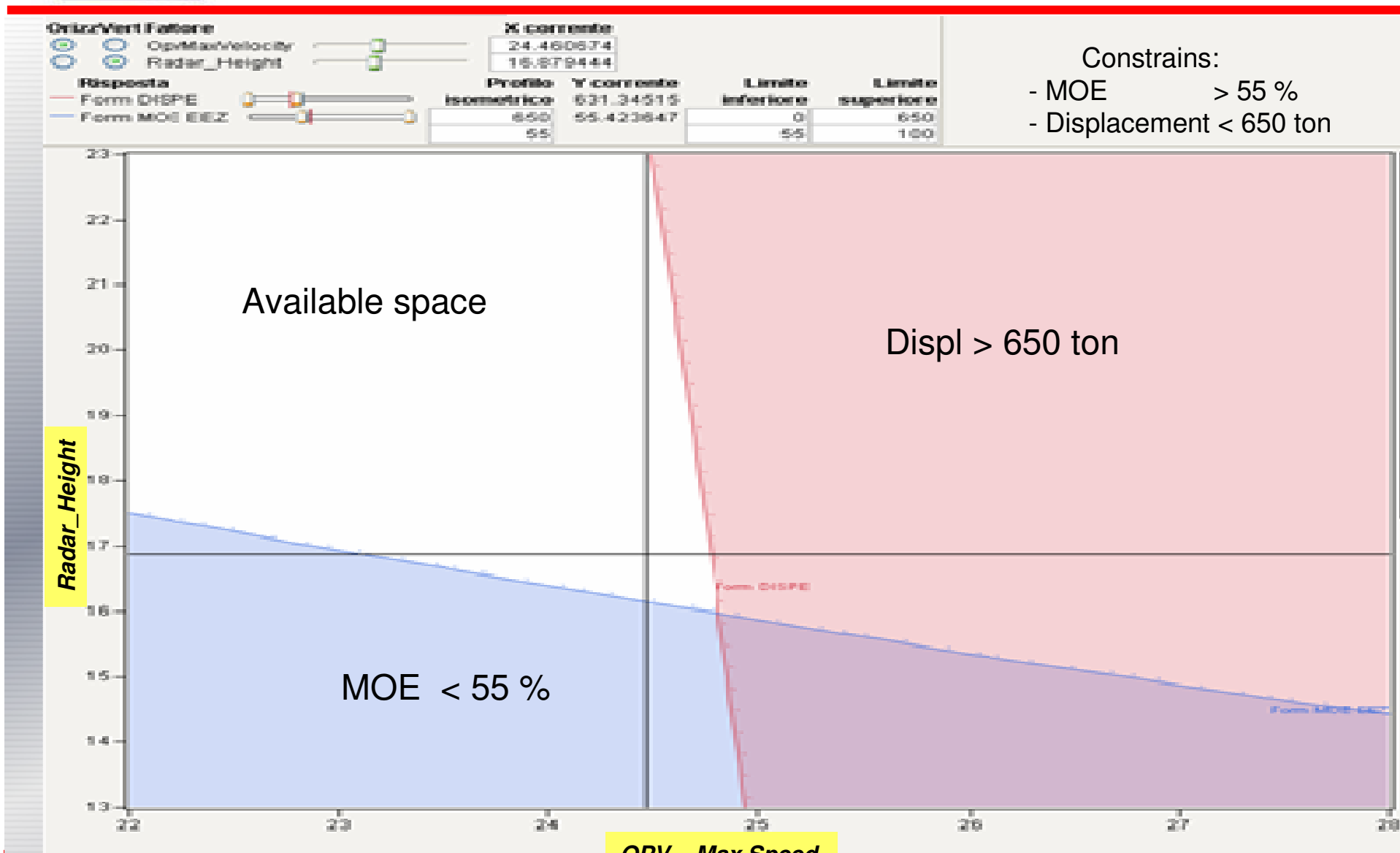
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Thank you

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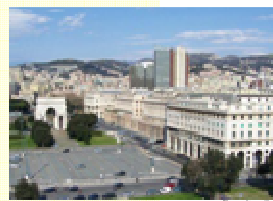
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