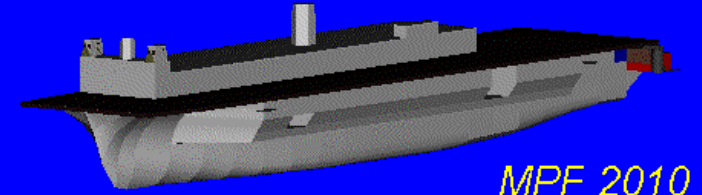






*Total Ship Systems Engineering*

Group 7 - Fall 1998



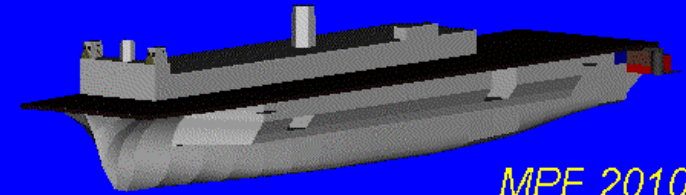
*MPF 2010*

# TOTAL SHIP SYSTEMS ENGINEERING

## Maritime Prepositioning Force 2010 Student Design Presentation

*Naval Postgraduate School*

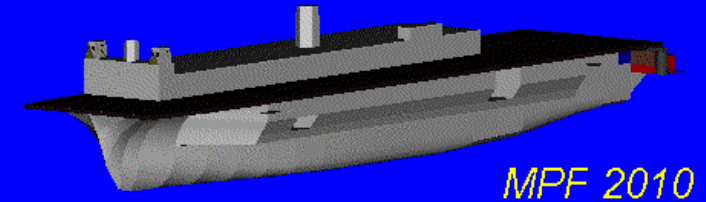
3 December 1998



MPF 2010

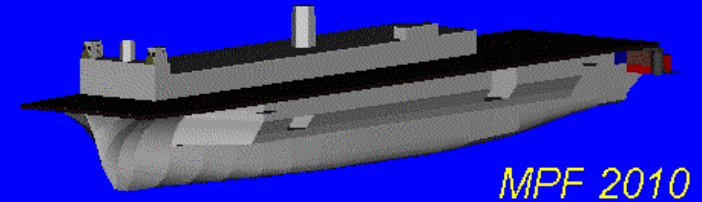
## TOTAL SHIP SYSTEMS ENGINEERING

- Interdisciplinary, sys.-Eng.-Based, design oriented
  - Combatant ship is “system” of interest
- Eight course program
  - Capstone design project; 6-mo.; 2-CRS, team
  - Today’s presentation
- Will tell you “what”; not “why” or “how”
  - 2000 hrs of work in 1 hour presentation
  - Afternoon session



Group 7 - Fall 1998

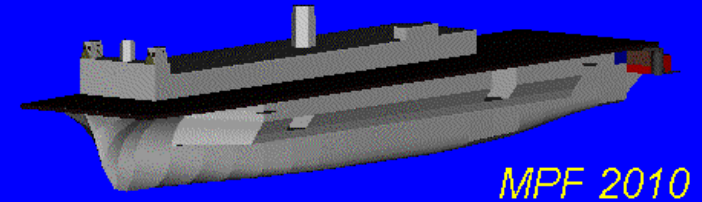
- LT. Tom Anderson - Mechanical Engineering
  - *DDG-51 - Engineering*
  - *FF1092 - Main Propulsion Assistant*
- LT. Jess Arrington - Electrical Engineering
  - *CG 61 - Fire Control Officer*
  - *LHA 2 - Engineering*
- LT. Joe Kan - Space Systems Engineering
  - *COMOPTEVFOR*
  - *SSN 753 - Engineering/Operations*
- LT. Gary McKerrow - Electrical Engineering
  - *LHD 4 New Construction - Engineering*
  - *CGN 37 - Fire Control Officer*
- LT. Rajan Vaidyanathan - Mechanical Engineering
  - *USACOM JIC - Maritime Watch Officer*
  - *SSN 668 - Engineering*
- LT. Randy Weekly - Electrical Engineering (Team Leader)
  - *SUBLANT Operations - Watch Officer*
  - *SSN 702 - Engineering/Operations*



MPF 2010

## THE FACULTY

- Assoc. Prof. Chuck Calvano, TSSE Chair, Ship Design
  - ME Dept
- Assoc. Prof. Bob Harney, TSSE Combat Systems
  - Physics Dept
- Ass't Prof. Bob Ashton, Shipboard Elect. Sys.
  - ECE Dept
- Assoc. Prof. Fotis Papoulias, Navarch; HM&E
  - ME Dept

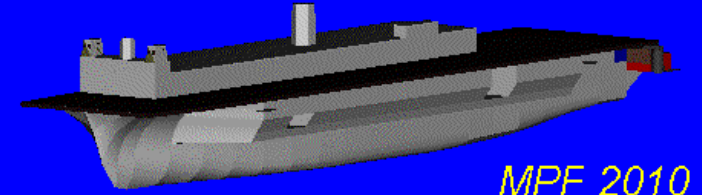


MPF 2010

## MPF 2010

### Major enhancement of capability for USMC

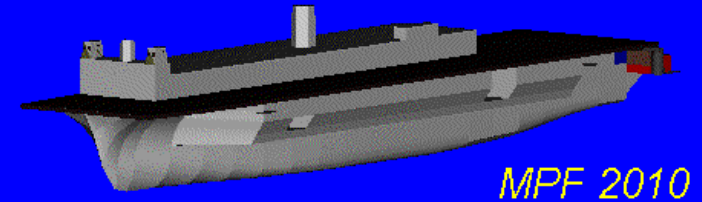
- Frees MPF 2010 from dependence on forward ports and airbases
- Requirements from study by Center for Naval Analysis (CNA) and the United States Marine Corps.



MPF 2010

## OUTLINE

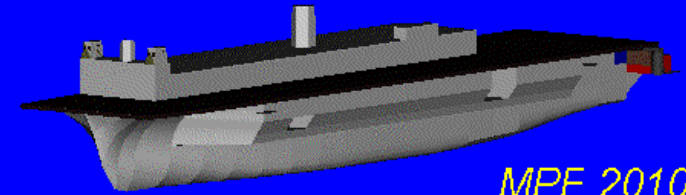
- Introduction
- MPF 2010 and beyond concept
- MPF 2010 ship characteristics
- Cargo and vehicle operations
- Flight deck operations
- Combat systems
- Propulsion, auxiliaries, and electrical
- Questions and answers



## MPF 2010 AND BEYOND.... CONCEPT

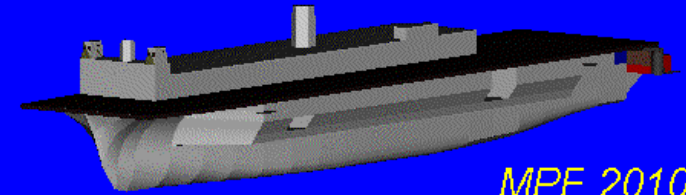
- Embraces Marine Corps Tenets of Operational Maneuver From The Sea (OMFTS) and Ship To Objective Maneuver (STOM).
- OMFTS concept developed in mid 1980. The sea is used as maneuver space to bring troops as close as possible to the objective.
- STOM refers to the direct movement of personnel and equipment directly from the ship to the objective without requiring a beachhead to be secured or defended.





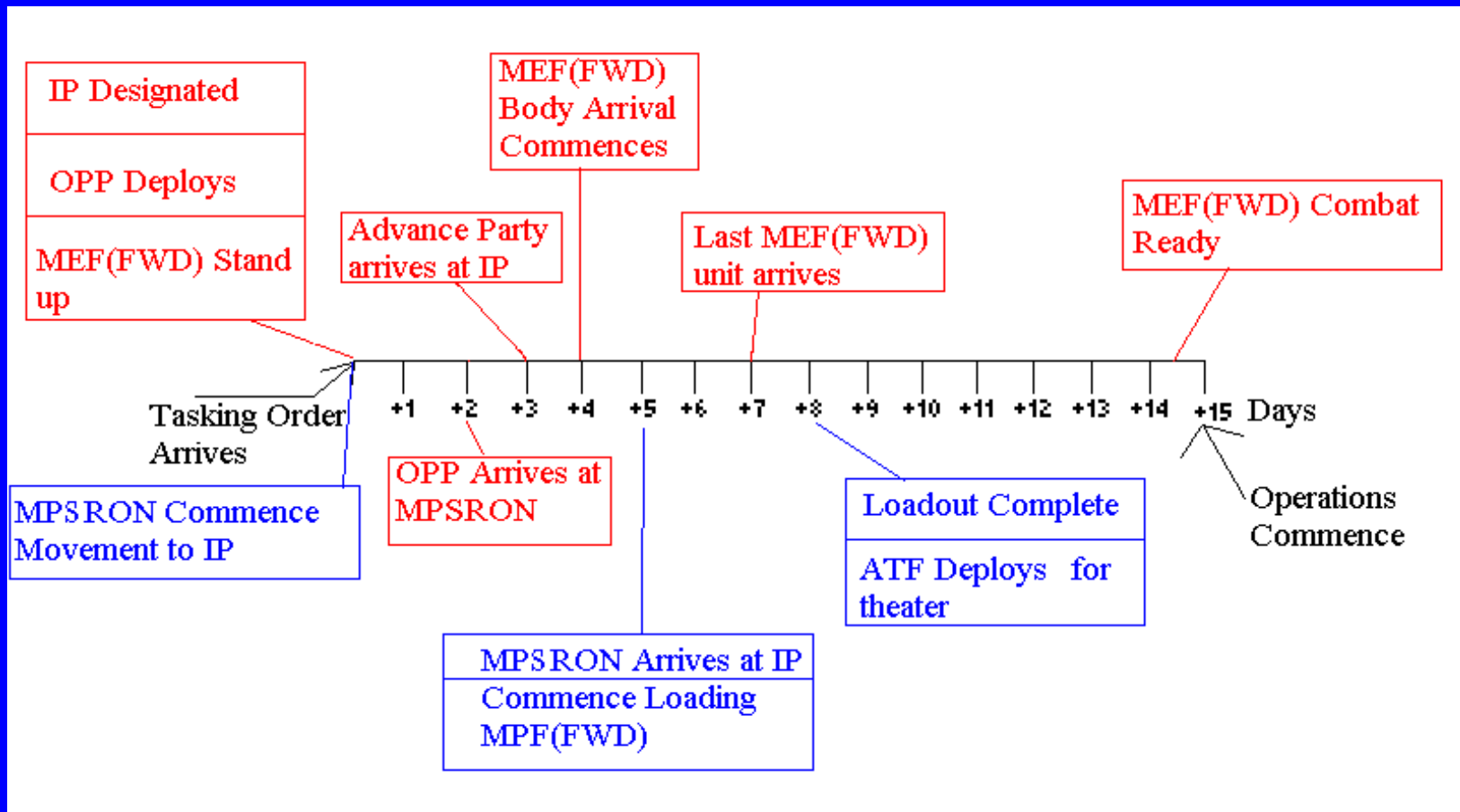
## MPF 2010 AND BEYOND.... CONCEPT

- Based on four pillars
  - Force closure
  - Amphibious Task Force integration
  - Indefinite sustainment
  - Reconstitution and redeployment
- Triad of capabilities
  - Fast deployment
  - Reinforcement
  - Sustained sea basing



MPF 2010

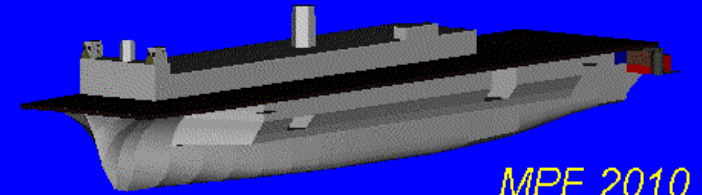
# MPF 2010 AND BEYOND NOTIONAL TIMELINE





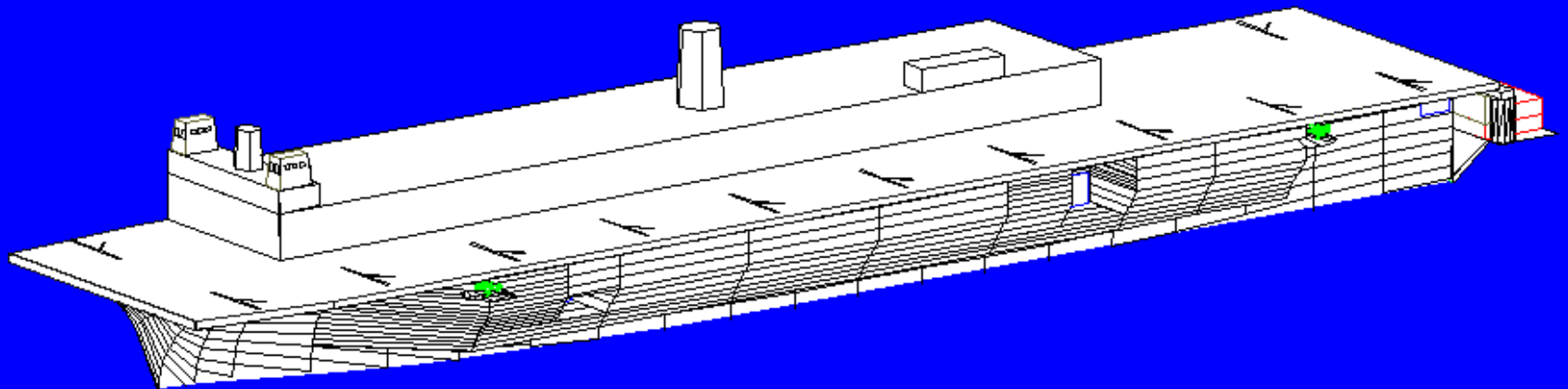
Group 7 Fall 1998

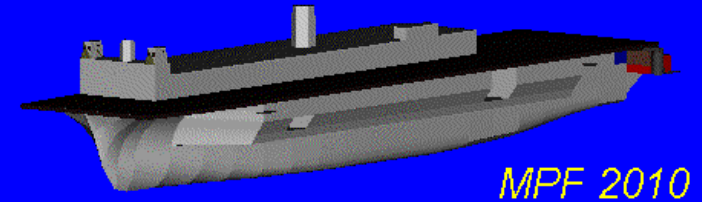
# MPF 2010 AND BEYOND



MPF 2010

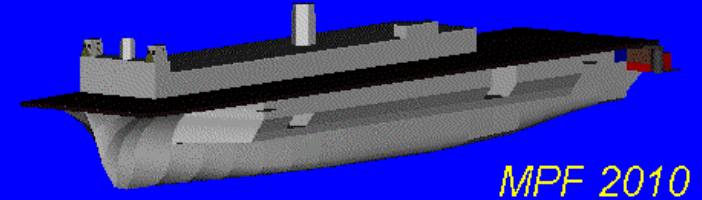
- FIVE SHIPS PER SQUADRON REQUIRED TO SUPPORT AN ENTIRE MARINE CORPS MEF(FWD)
- ALL SHIPS HAVE THE SAME DESIGN BUT DIFFER IN LOAD OUT





## MPF 2010 SHIP CHARACTERISTICS

- Length Between Perpendiculars (LBP) = 950 ft
- Length Overall (LOA) = 1000 ft
- Beam
  - 140 ft at Waterline
  - 220 ft at Flight deck
- Depth = 106 ft
- Displacement
  - 48,152 LT..... Light Load
  - 86,291 LT..... Full Load

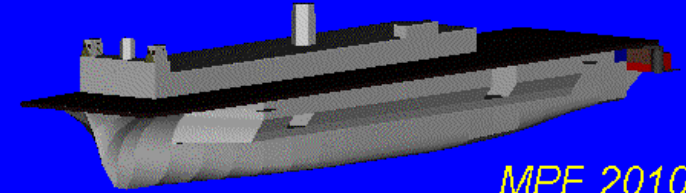


MPF 2010

## MPF 2010 SHIP CHARACTERISTICS

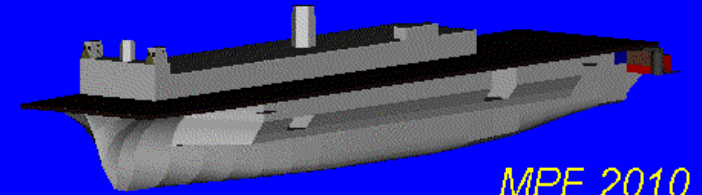
### Cont'd

- Maximum Draft = 35 feet
- Maximum Speed = 27.5 knots
- Sustained Speed = 25.0 knots
- Endurance = 12000 nm @ 20.0 knots
- Transmission type: Electrical Drive
- Lead Ship Acquisition Cost = \$816 Million



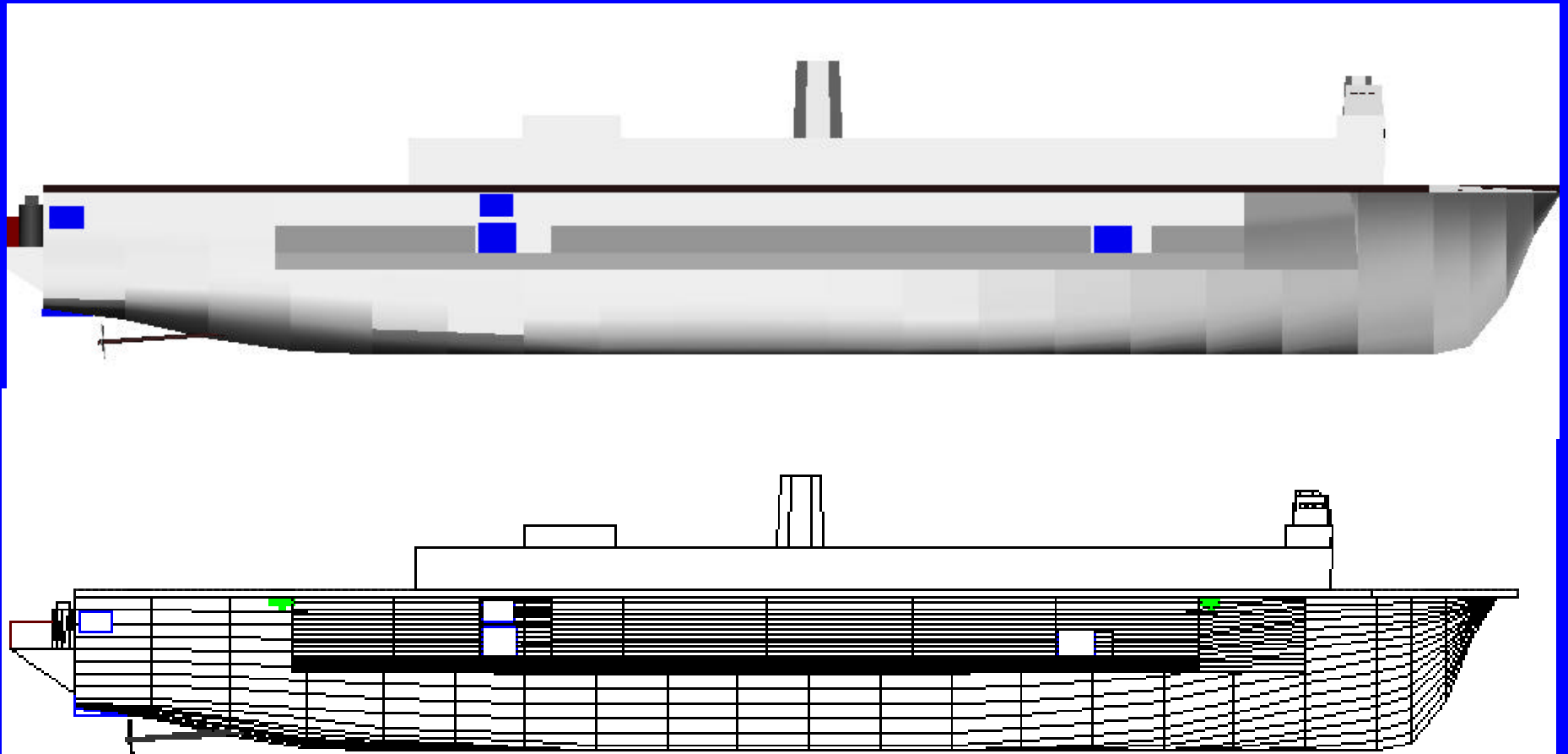
## MPF 2010 SQUADRON LIFT REQUIREMENTS

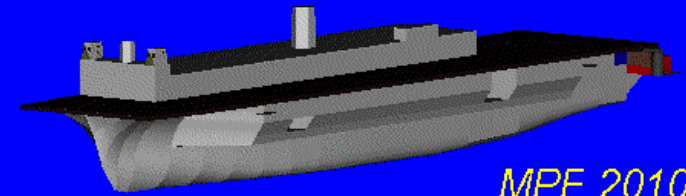
- 19,000 + sailors and marines
- 148 aircraft
- 4166 Cargo Containers (30 Day Supply)
- 1172 Vehicles for a MEF (FWD)
- 6.1 million gallons fuel
- 400,000 gallons potable water



MPF 2010

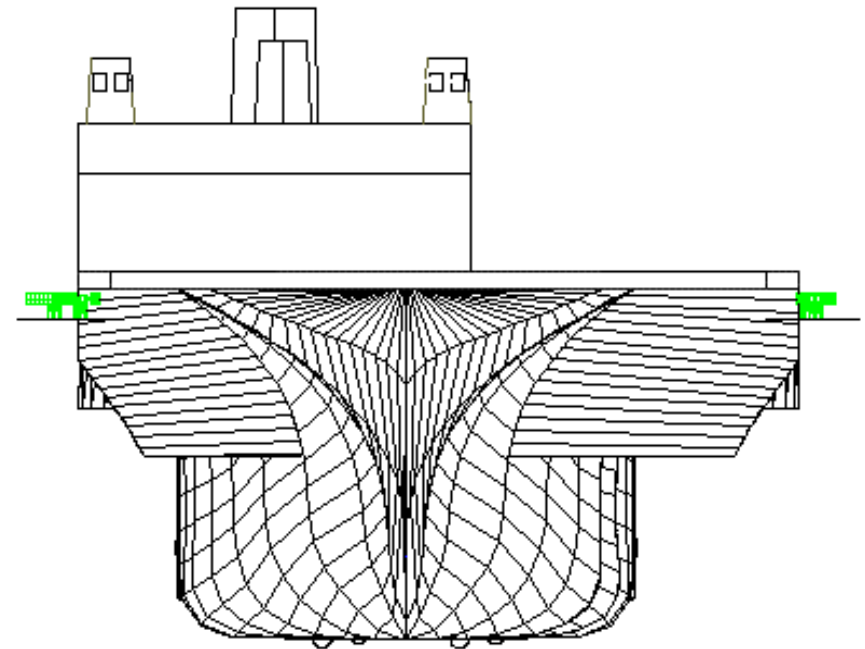
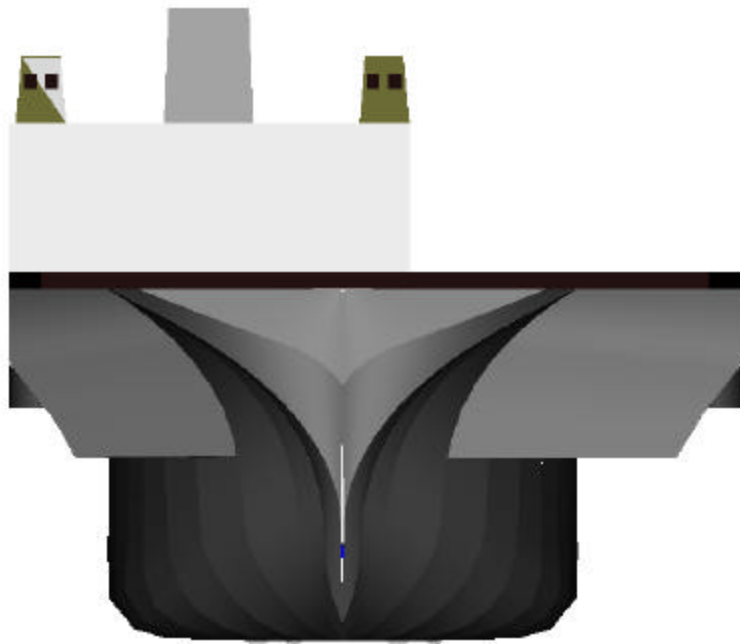
## SHEER VIEW ( STARBOARD )



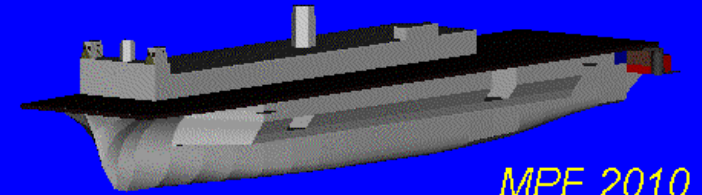


MPF 2010

## BOW VIEW

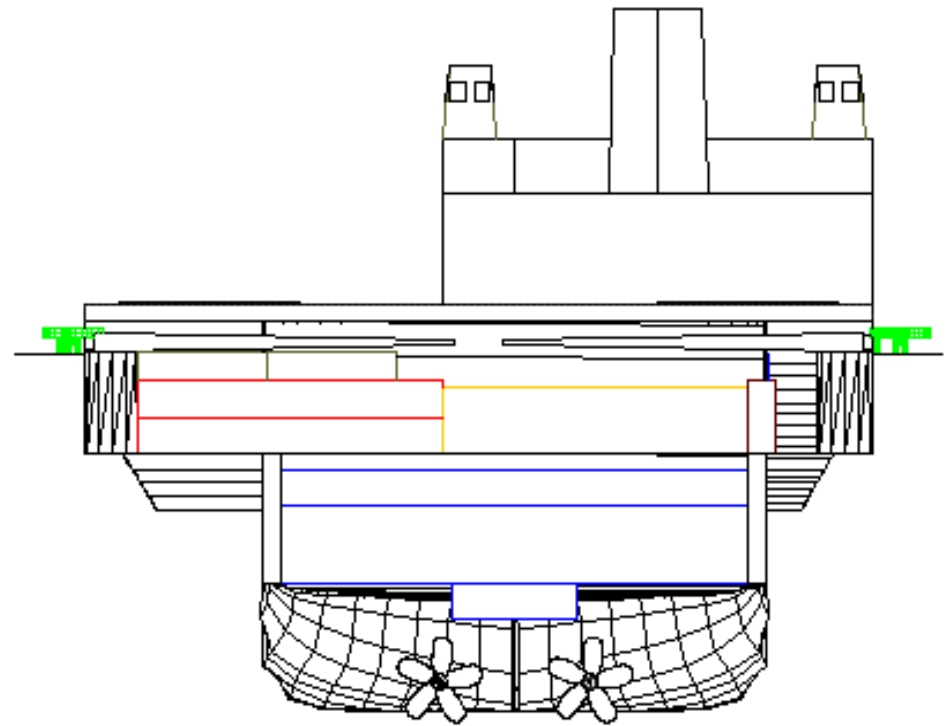
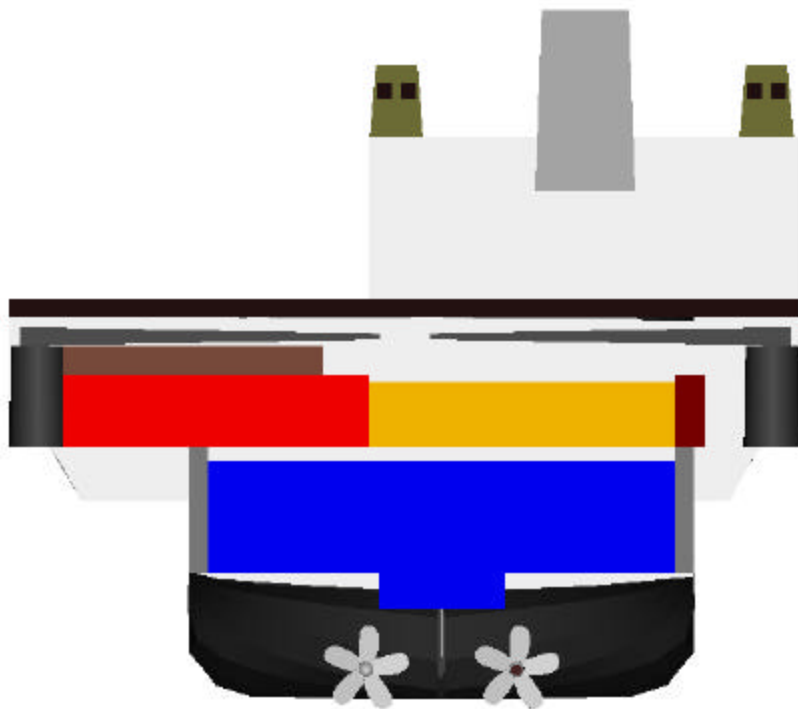


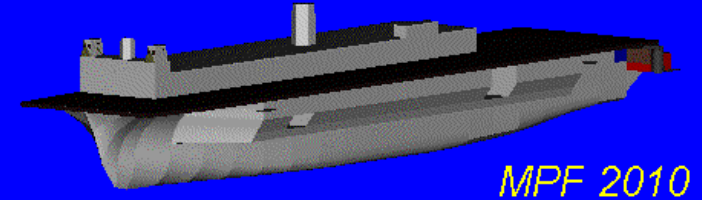




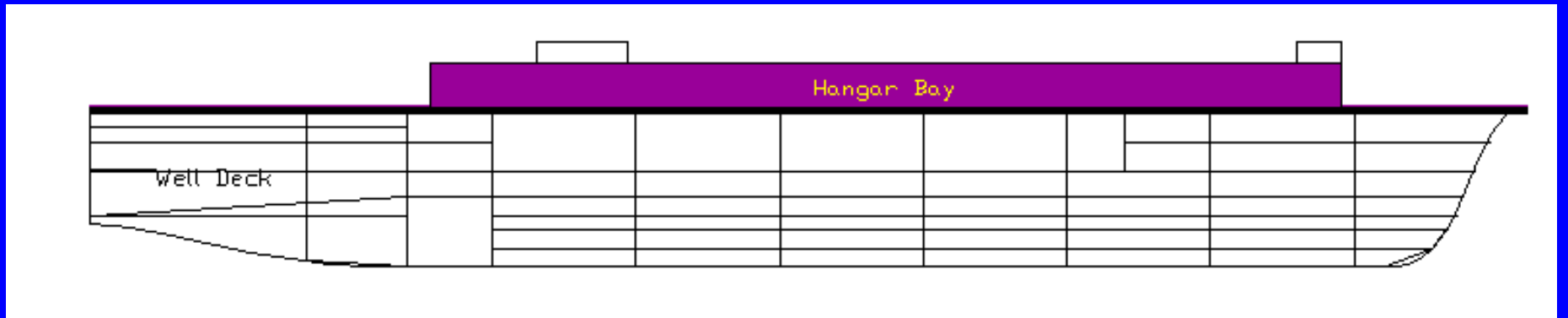
MPF 2010

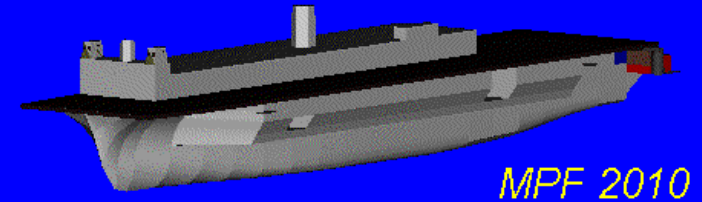
## STERN VIEW





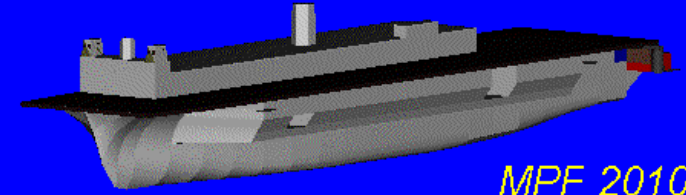
# Aviation





## AVIATION

- Load Out
- Automation
- Flight Deck Arrangements
  - JSF (Load out variant A)
  - Rotary wing (Load out variant B)
- Hangar Arrangements



MPF 2010

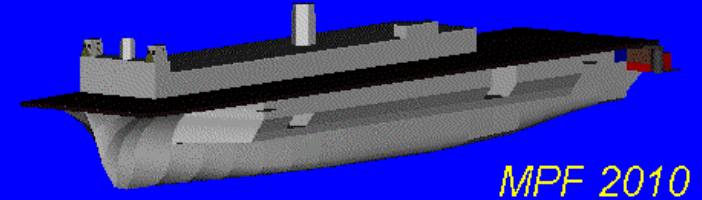
## AIRCRAFT LOAD OUT

### Load out variant A

- Two ships in the squadron will carry loadout variant A:
  - 30 JSF
  - 4 SH-60B/F

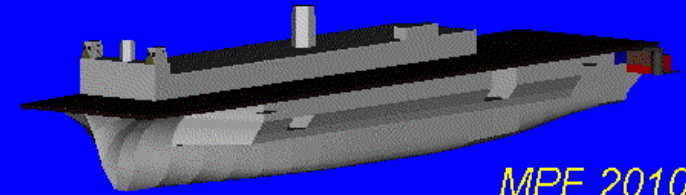
### Load out variant B

- The remaining three ships will carry loadout variant B:
  - 12 MV-22
  - 4 SH-60B/F
  - 3 CH-53E
  - 6 AH-1W
  - 2 UH-1N



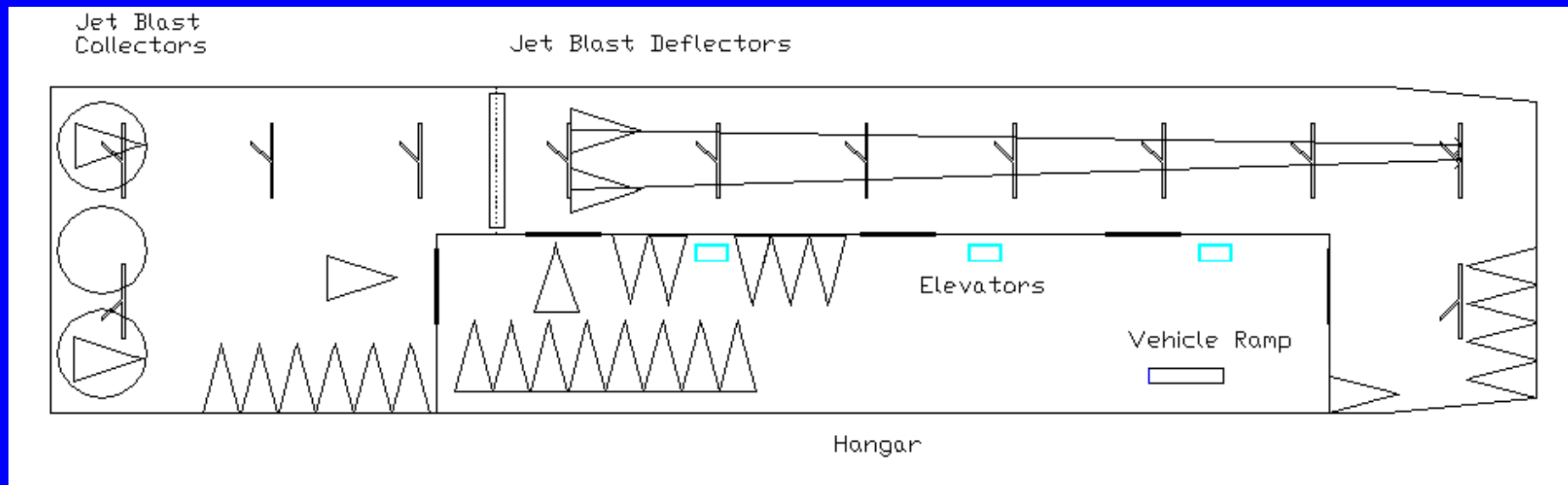
## AUTOMATION

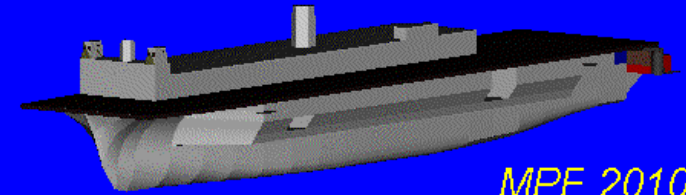
- Tow Robots
  - JSF
  - Rotary
  - All aircraft movement
- Weapons Handling Robots
  - Configured
    - Weapons
    - Aircraft
  - Rearm
  - Aircraft Weapons Removal



MPF 2010

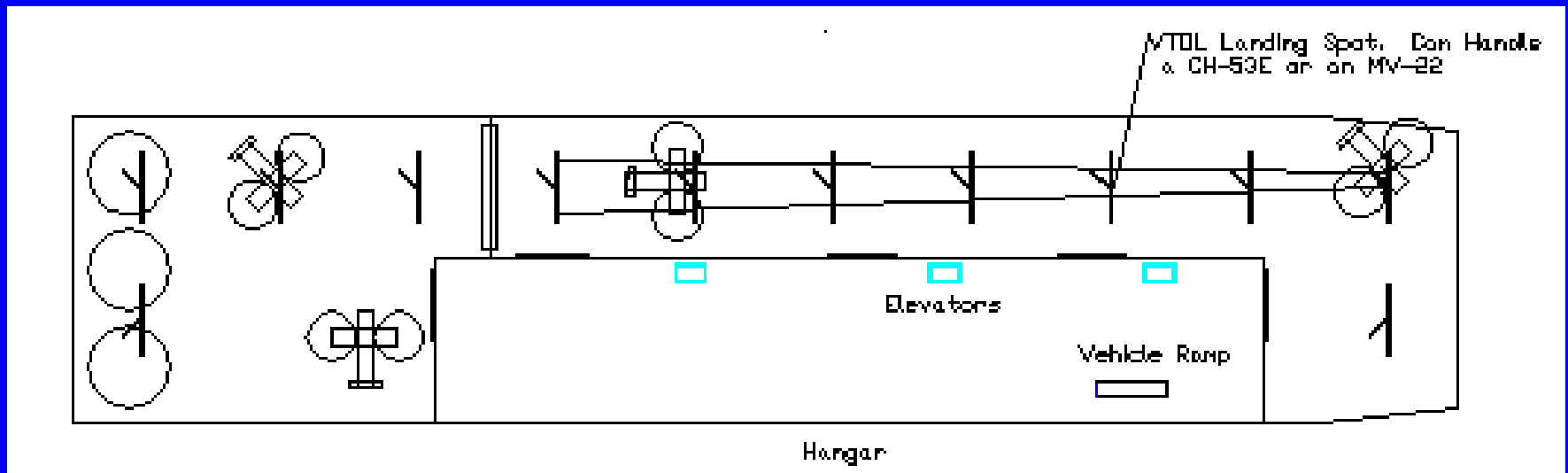
## FLIGHT DECK - JSF

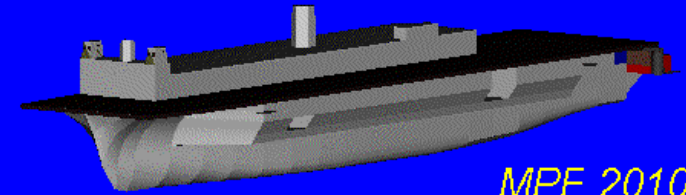




MPF 2010

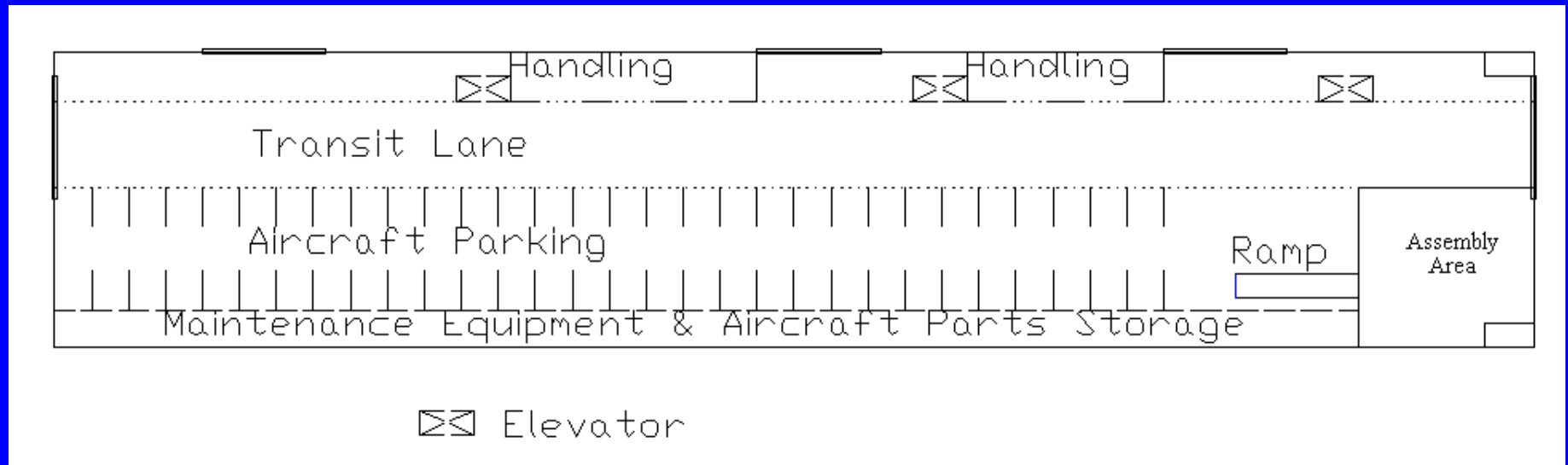
# FLIGHT DECK - ROTARY



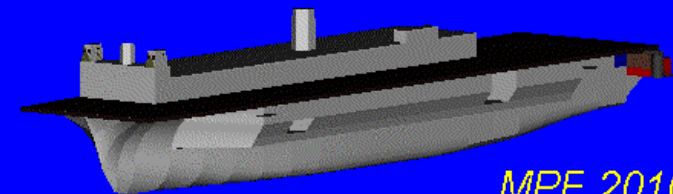


MPF 2010

# HANGAR

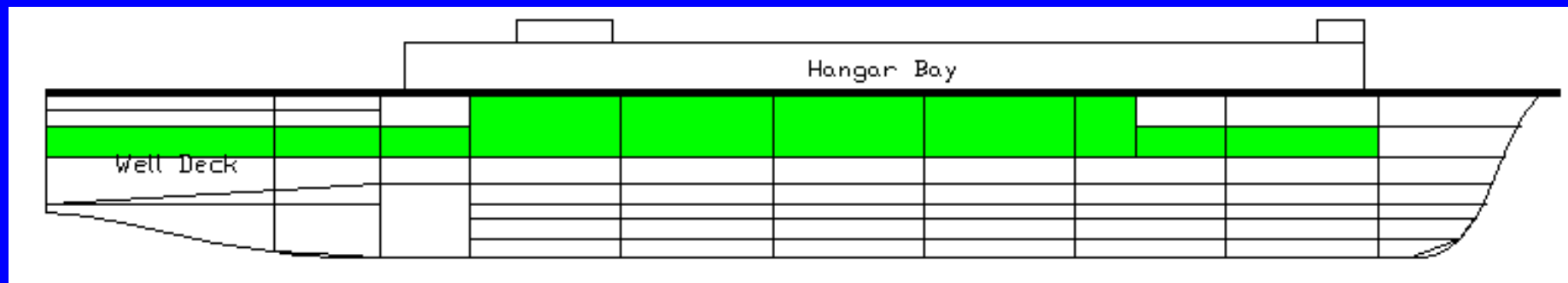


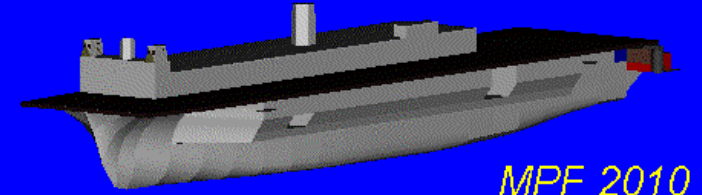




MPF 2010

# Cargo Deck

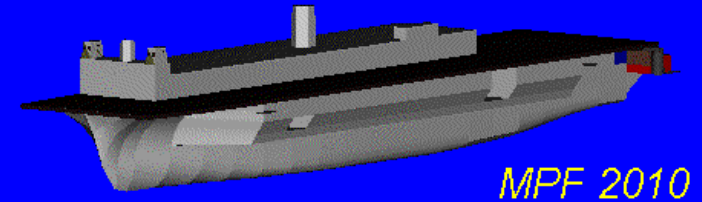




MPF 2010

## CARGO DECK GOALS

- Easily accessible cargo
- Minimal time of transport
- Minimal cargo storage volume
- Minimal failure probability
- Minimal maintenance and manpower requirements
- Easily reconfigurable



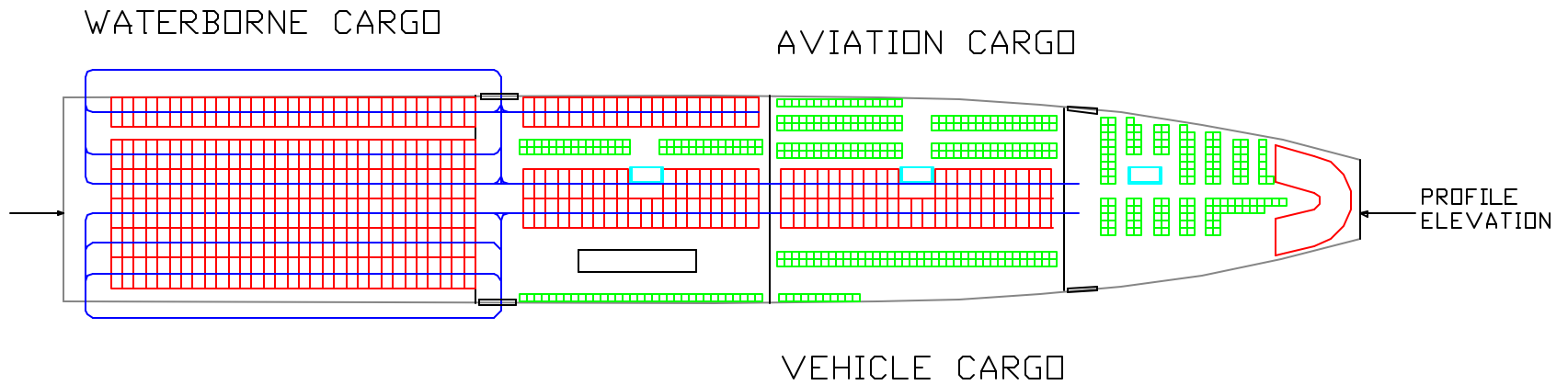
- CONTAINER
- PALLET
- ELEVATOR
- OVERHEAD CRANE

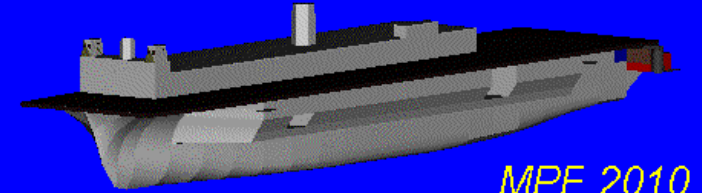
## CARGO DECK

### PROFILE



### PLAN VIEW



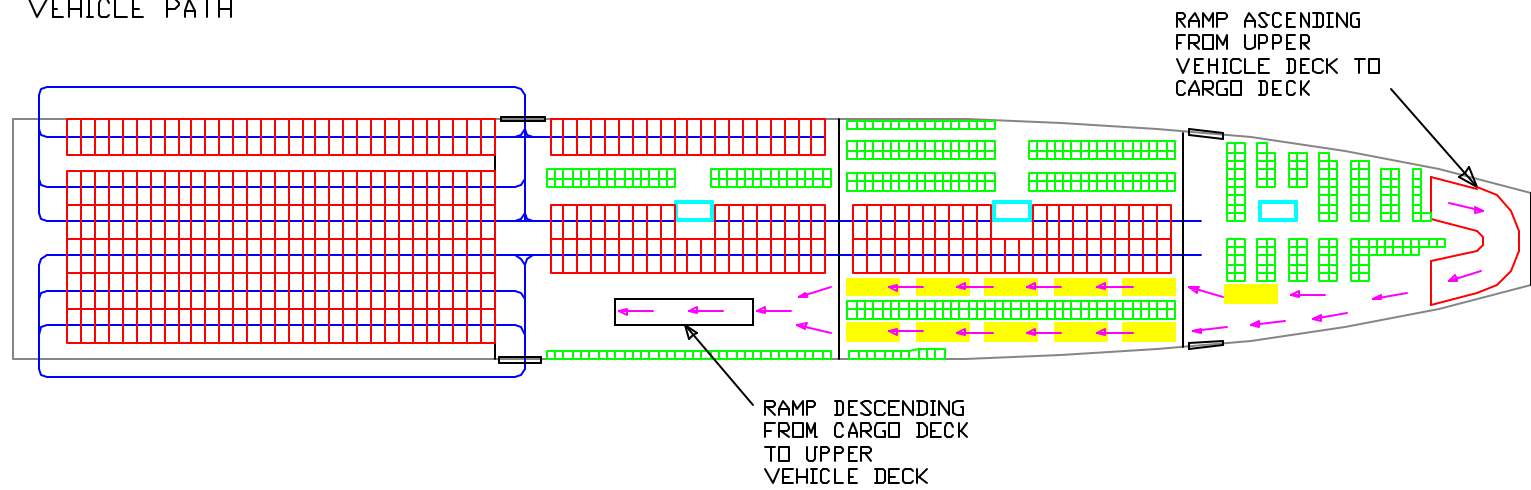


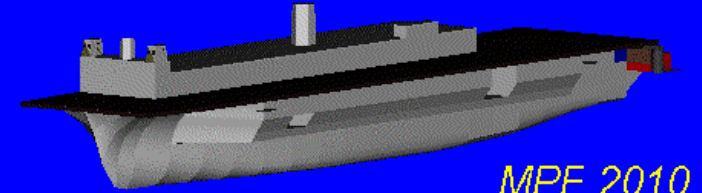
## CARGO DECK VEHICLE LOAD OUT

- CONTAINER
- PALLET
- ELEVATOR
- OVERHEAD CRANE

- LOADING AREA
- VEHICLE PATH

### PLAN VIEW

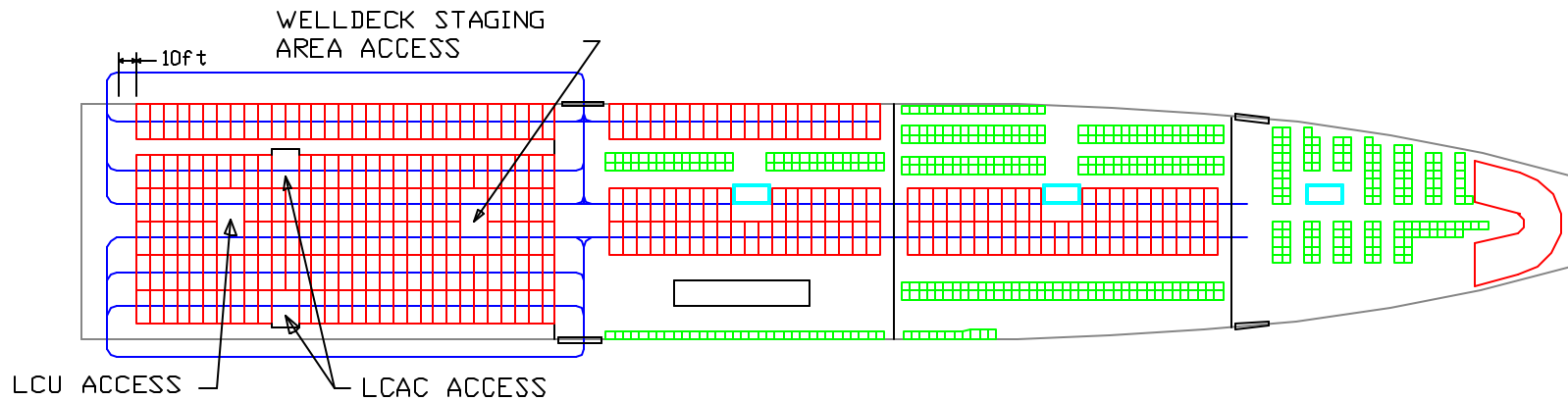


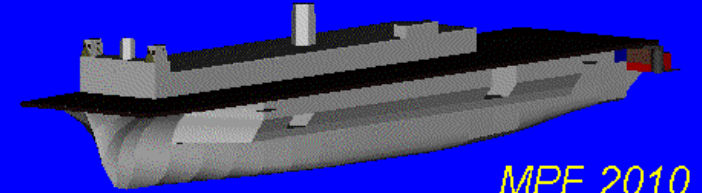


## CARGO DECK WATERBORNE ASSET LOAD OUT

- CONTAINER
- PALLET
- ELEVATOR
- OVERHEAD CRANE

### PLAN VIEW



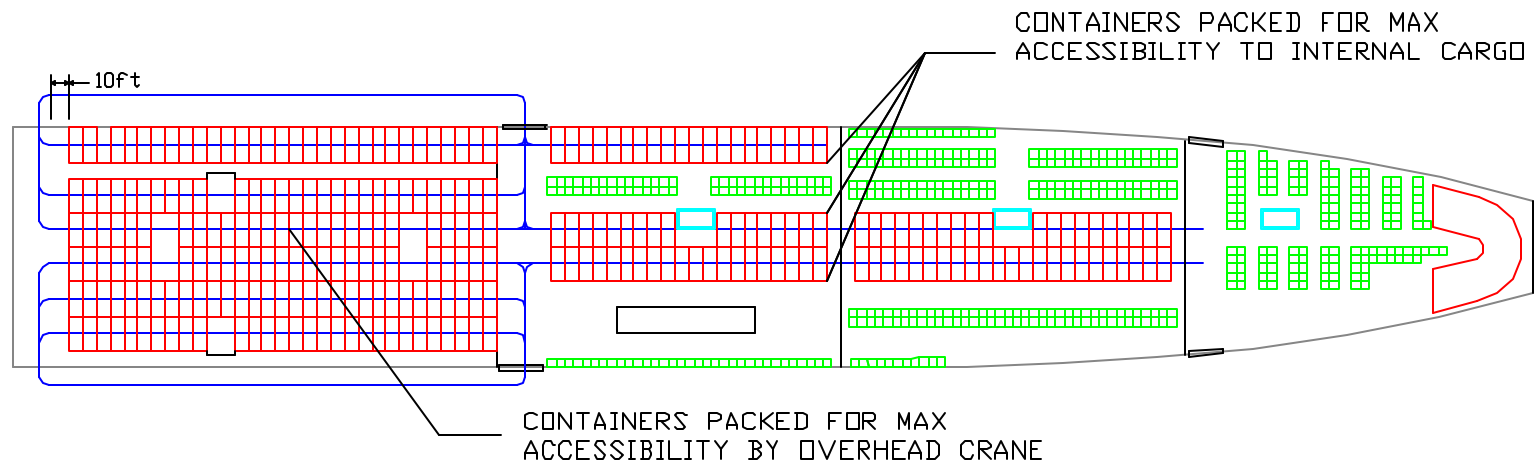


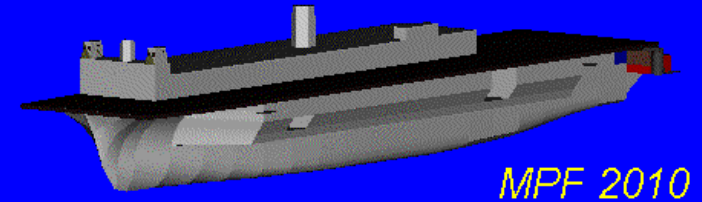
MPF 2010

- CONTAINER
- PALLET
- ELEVATOR
- OVERHEAD CRANE

## CARGO DECK ACCESSIBILITY

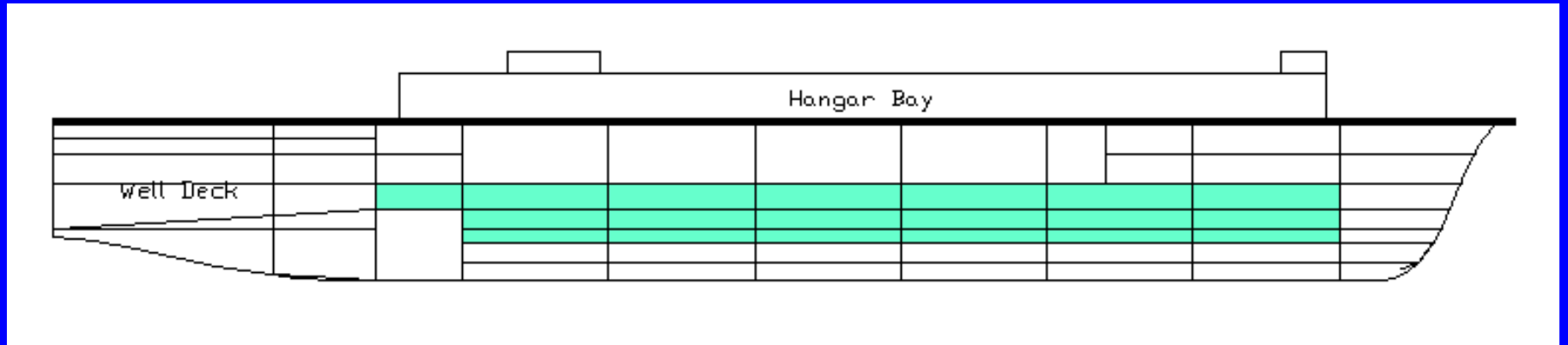
### PLAN VIEW

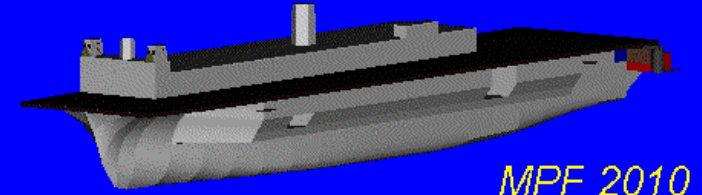




MPF 2010

# VEHICLE DECKS

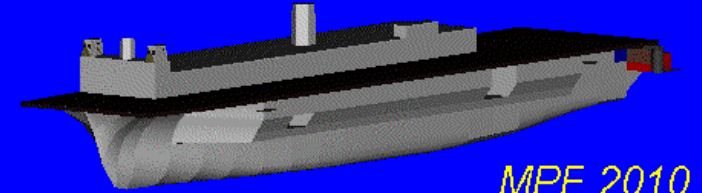




## VEHICLE DECK GOALS

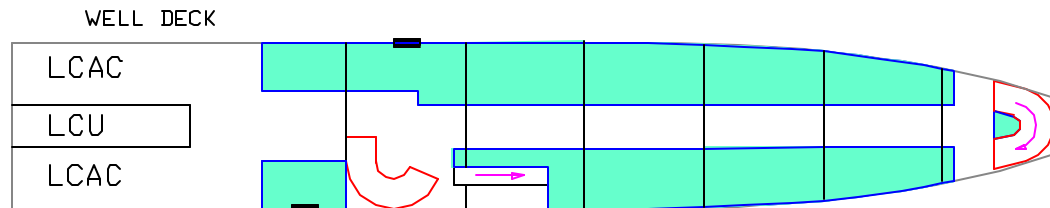
- Easily accessible vehicles
- Minimal vehicle storage volume
- Vehicles have direct access to offload points
- Easily reconfigurable



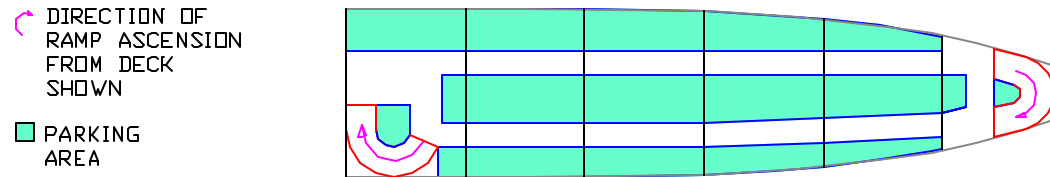


## VEHICLE DECKS PLAN VIEWS

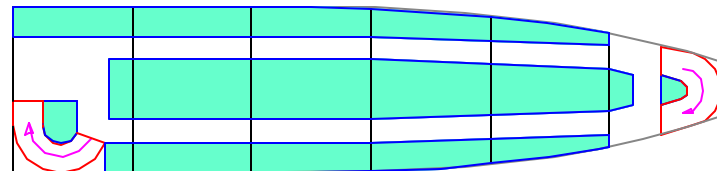
UPPER DECK  
(18 FT HIGH)

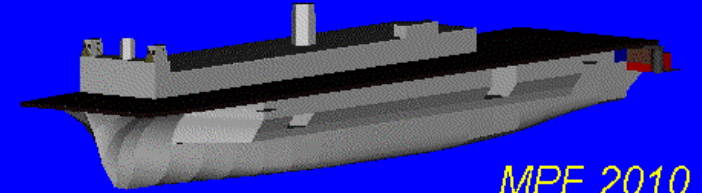


MIDDLE DECK  
(13 FT HIGH)



LOWER DECK  
(10 FT HIGH)





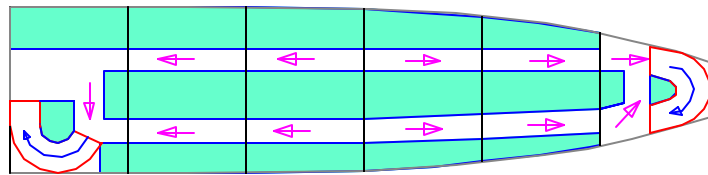
MPF 2010

## VEHICLE DECKS FLOW PATHS

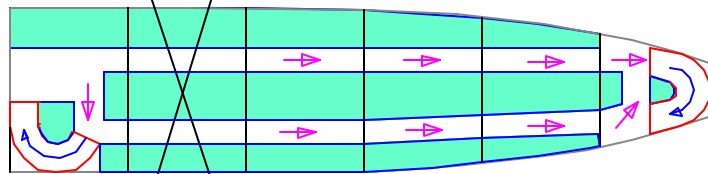
→ DIRECTION OF TRAFFIC FLOW

↪ DIRECTION OF RAMP ASCENSION FROM CURRENT DECK TO DECK ABOVE

ALL VEHICLES UP

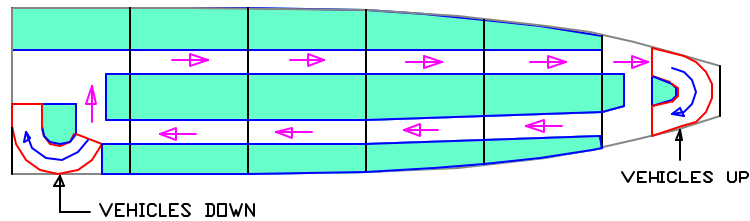


ALL VEHICLES UP



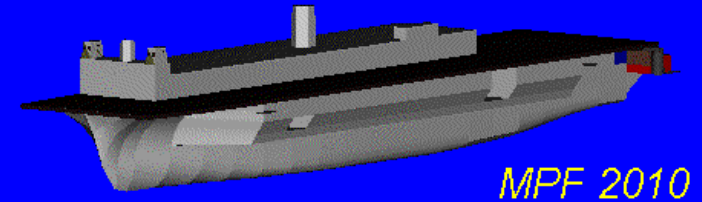
BATTLE DAMAGE

VEHICLES BOTH UP AND DOWN



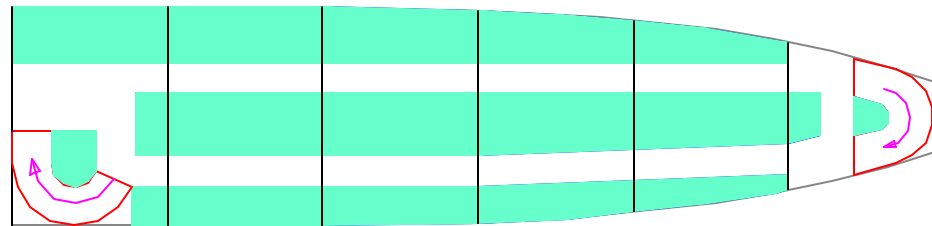
VEHICLES DOWN

VEHICLES UP

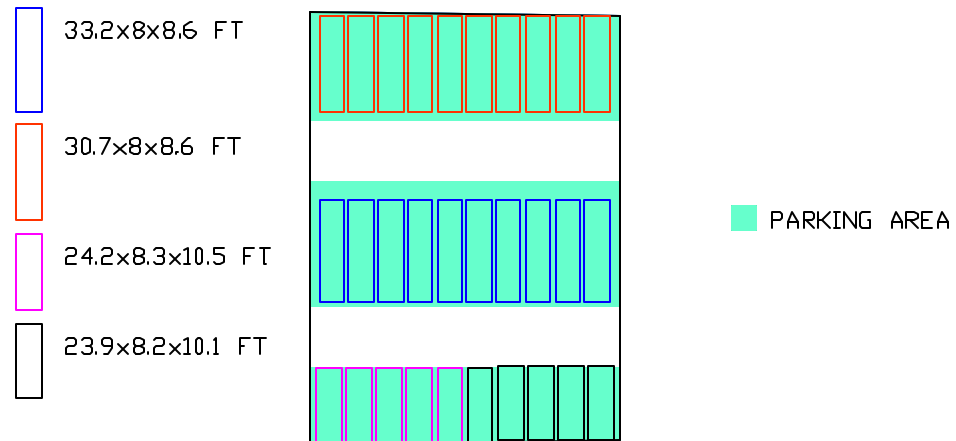


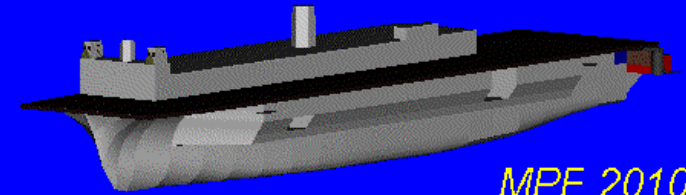
## 13 FT HIGH VEHICLE DECK PLAN VIEWS

↻ DIRECTION OF RAMP  
ASCENSION FROM DECK  
SHOWN



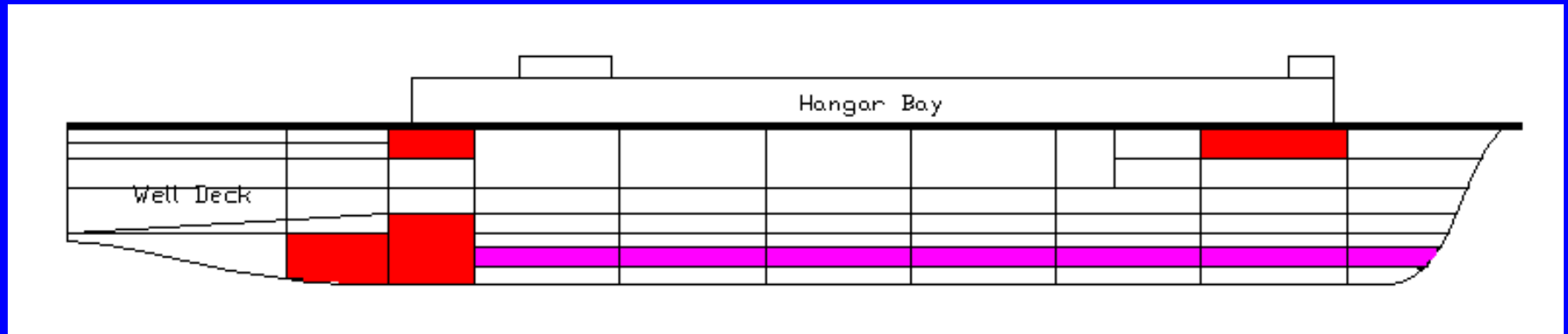
EXPANDED VIEW

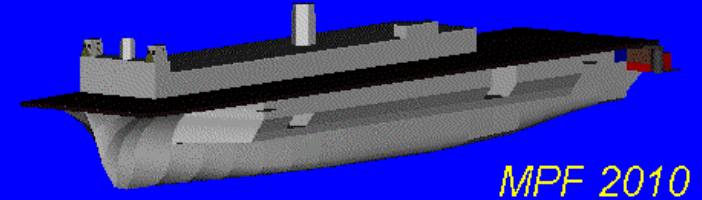




MPF 2010

# PROPULSION SYSTEMS

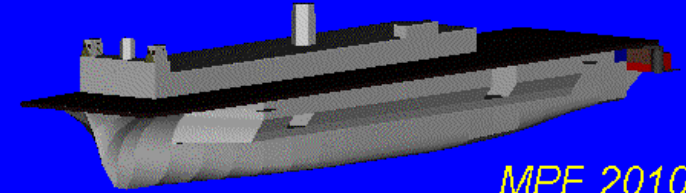




## ELECTRICAL PROPULSION

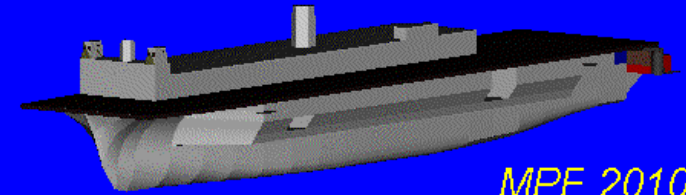
- Diesel Engines (4)
  - Colt Pielstick
  - 15,000 HP
- Generator
  - 6600V 60 Hz 3 phase
  - 11 MW

- Gas Turbine Engines (3)
  - LM5000
  - 39,100 HP
- Generator
  - 6600V 60 Hz 3 phase
  - 23.3 MW

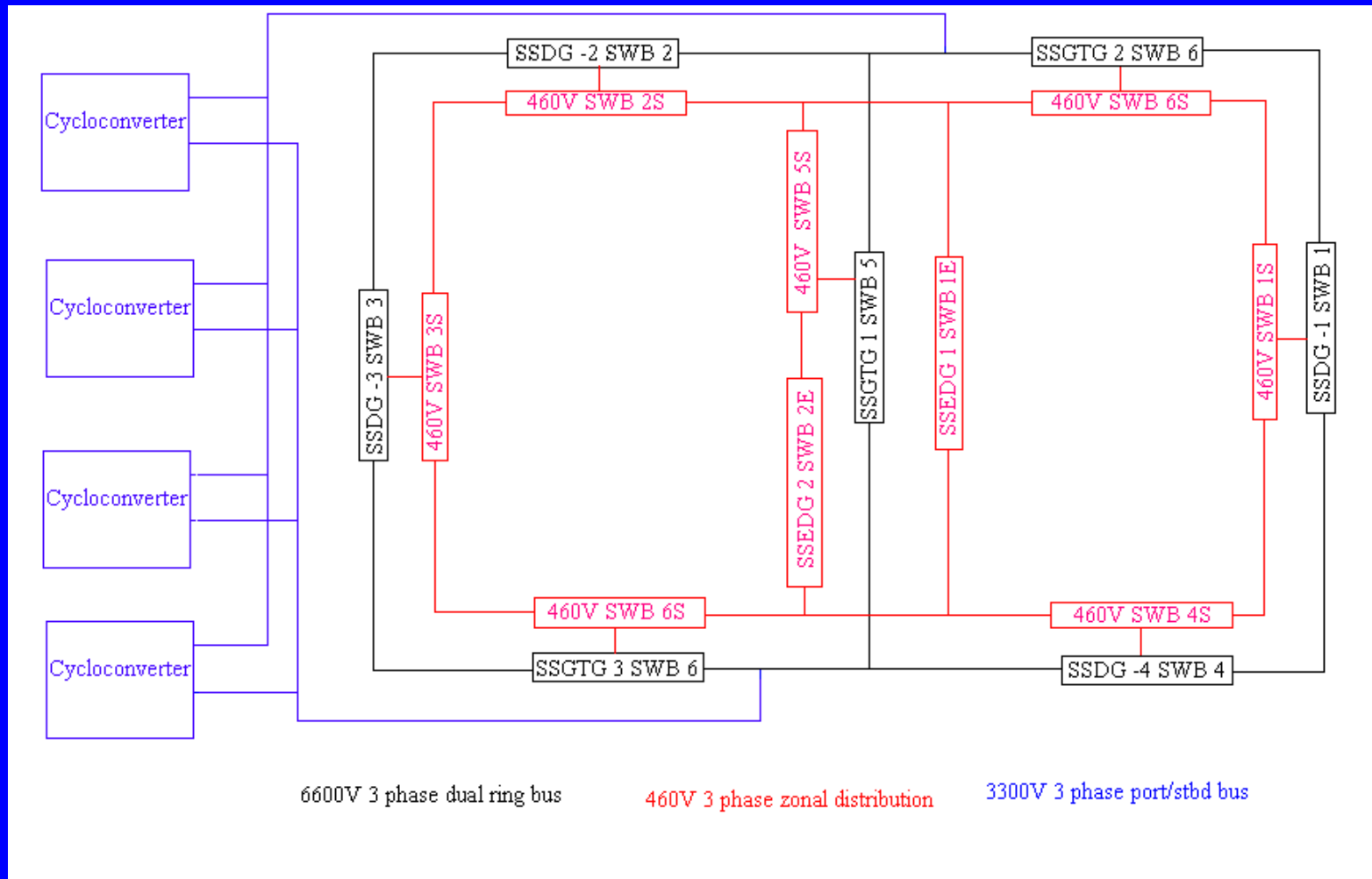


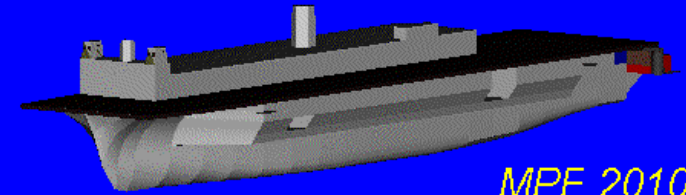
## ELECTRICAL PROPULSION (Cont'd)

- Cycloconverter (4)
  - 12 pulse
  - 3300 V
  - 0-24 Hz
- Motor (2/shaft)
  - 6 phase 20 pole rotor
  - 59,000 HP
  - 0-144 RPM
- Inport/Emergency Diesel Engines (2)
  - Two 3608 Caterpillar
  - 3100 HP
- Generator
  - 460V 60 Hz 3 phase
  - 2500 kW










## ELECTRICAL DISTRIBUTION





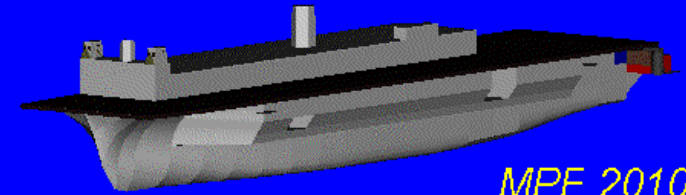
## AUXILIARIES



- |   |                        |   |                    |   |               |   |              |
|---|------------------------|---|--------------------|---|---------------|---|--------------|
|  | Fire and Flushing Pump |  | JP-5 Service Pump  |  | Transfer Pump |  | Reefer Plant |
|  | Potable Water Pump     |  | JP-5 Transfer Pump |  | A/C Plant     |   |              |

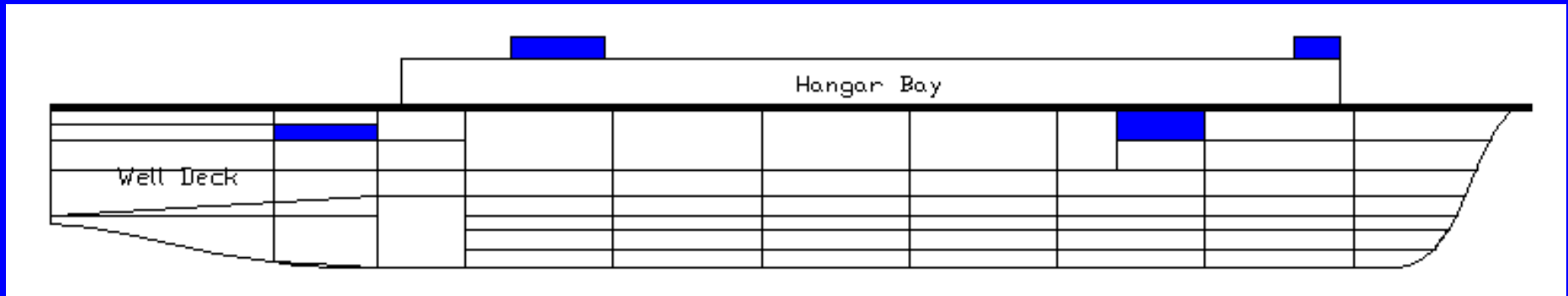
15 ft Deck (7th deck)

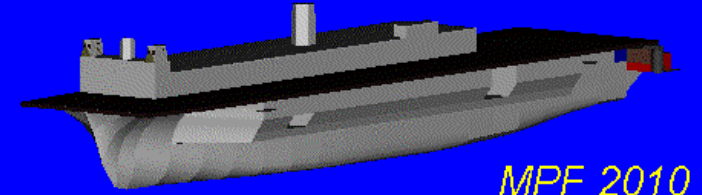




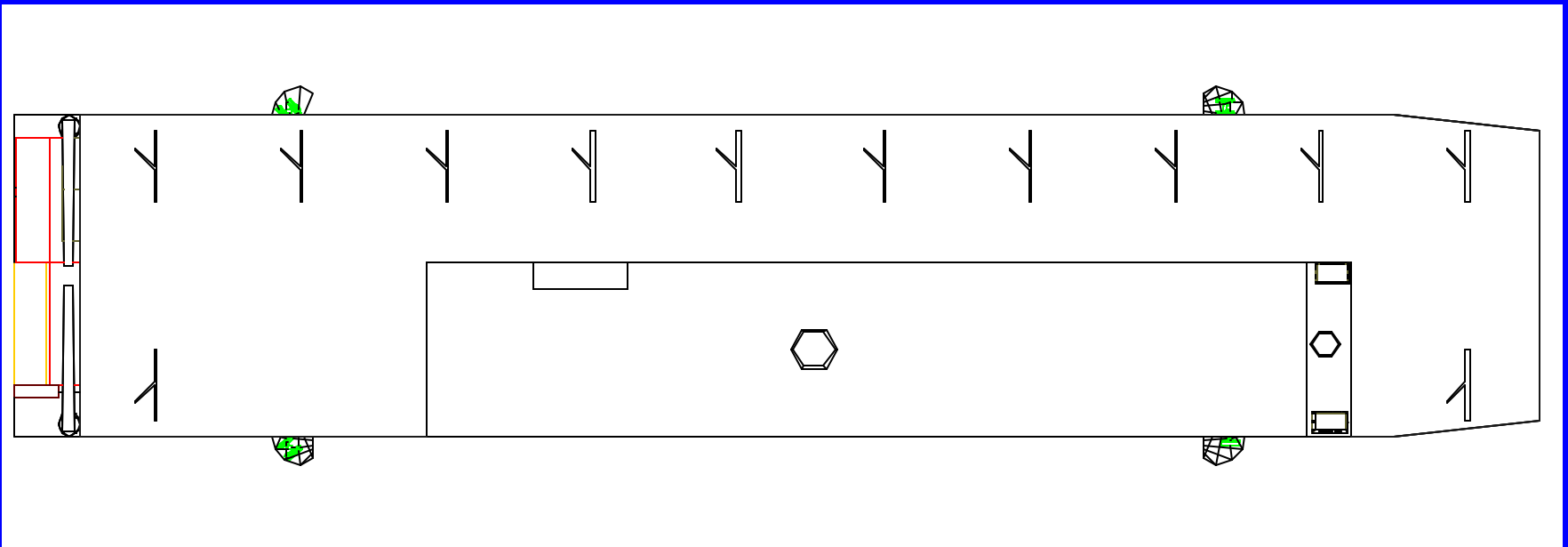
MPF 2010

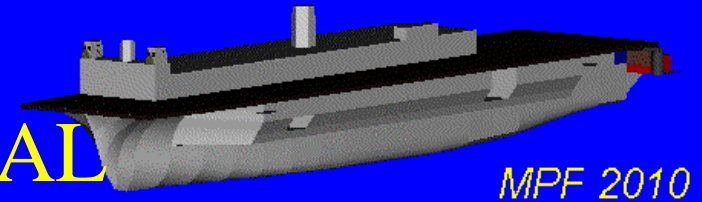
# COMMAND AND CONTROL & COMBAT SYSTEMS





# SELF DEFENSE SYSTEMS





MPF 2010

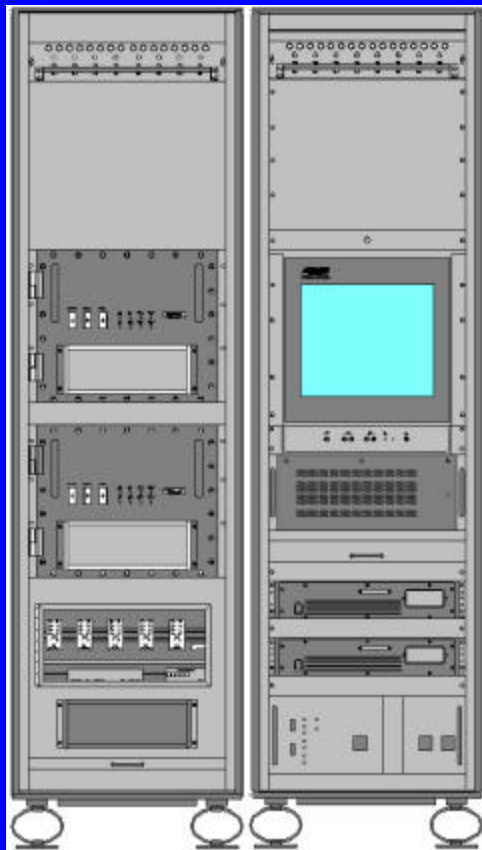
# WHAT IS AUTOMATED DIGITAL NETWORK SYSTEM?

## MISSION

Provide seamless and secure connectivity for voice, video and data applications afloat and pierside through automated network and RF resource management

## ENABLES IT21

IP/ATM Services for UNCLAS, SECRET and SI LANs  
Video Teleconferencing (VTC)  
Battle Force Email  
Web Services (NIPRNet, SIPRNet, JWICS)  
Common Operational Picture (COP)  
Tactical Messaging  
Defense Messaging System(DMS)  
File Transfer Services



VME Chassis

Monitor

VME Chassis

SCSI Expansion Chassis

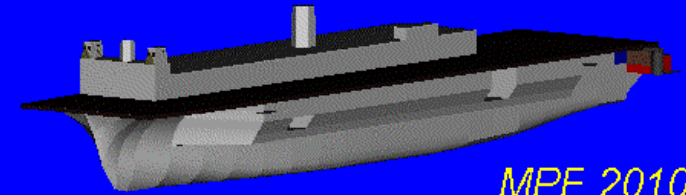
Router

HP 712

HP 712

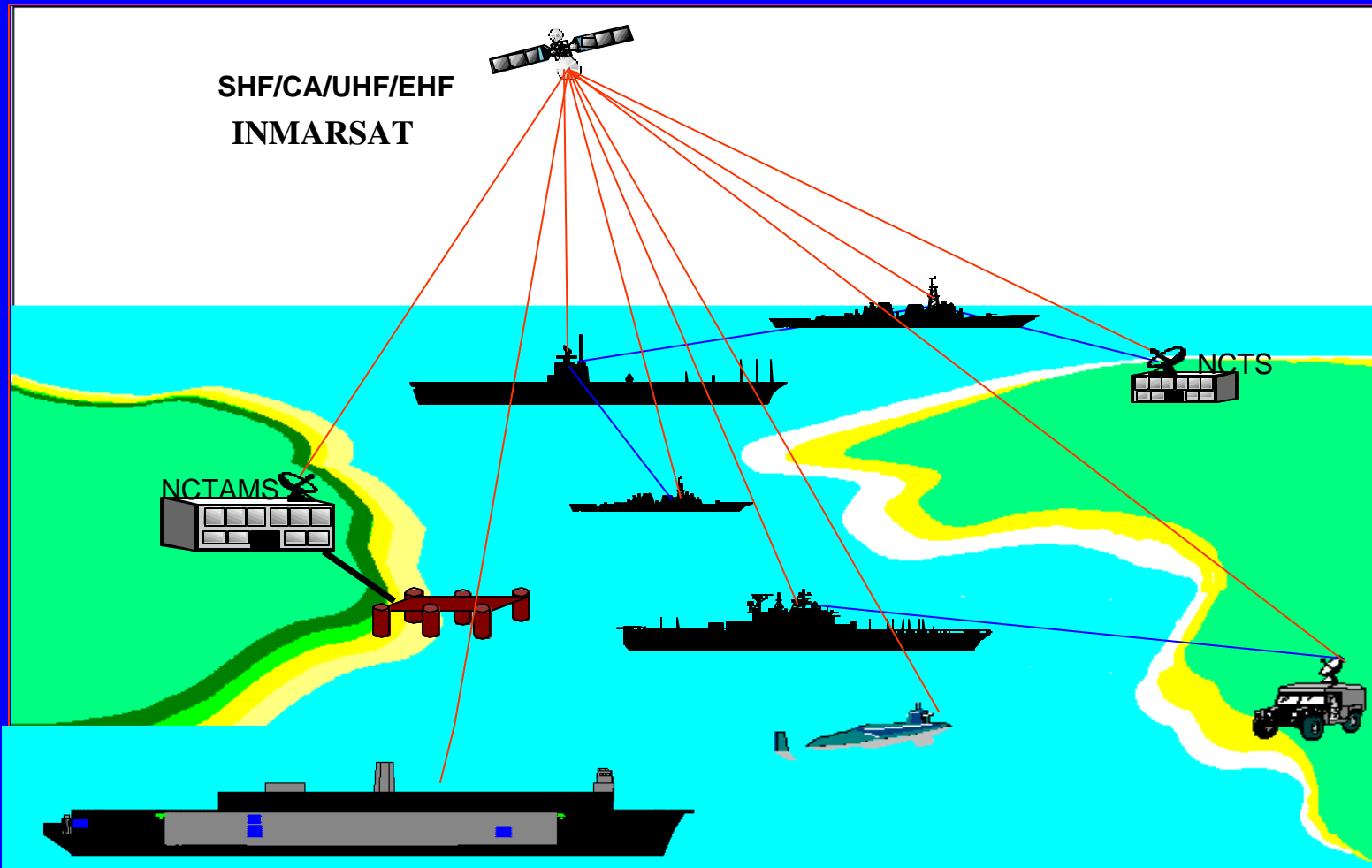
MUPS

**ADNS 2.0/2.1 Configuration**

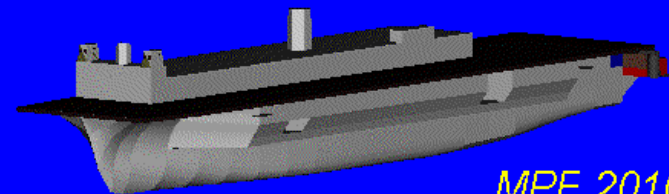


MPF 2010

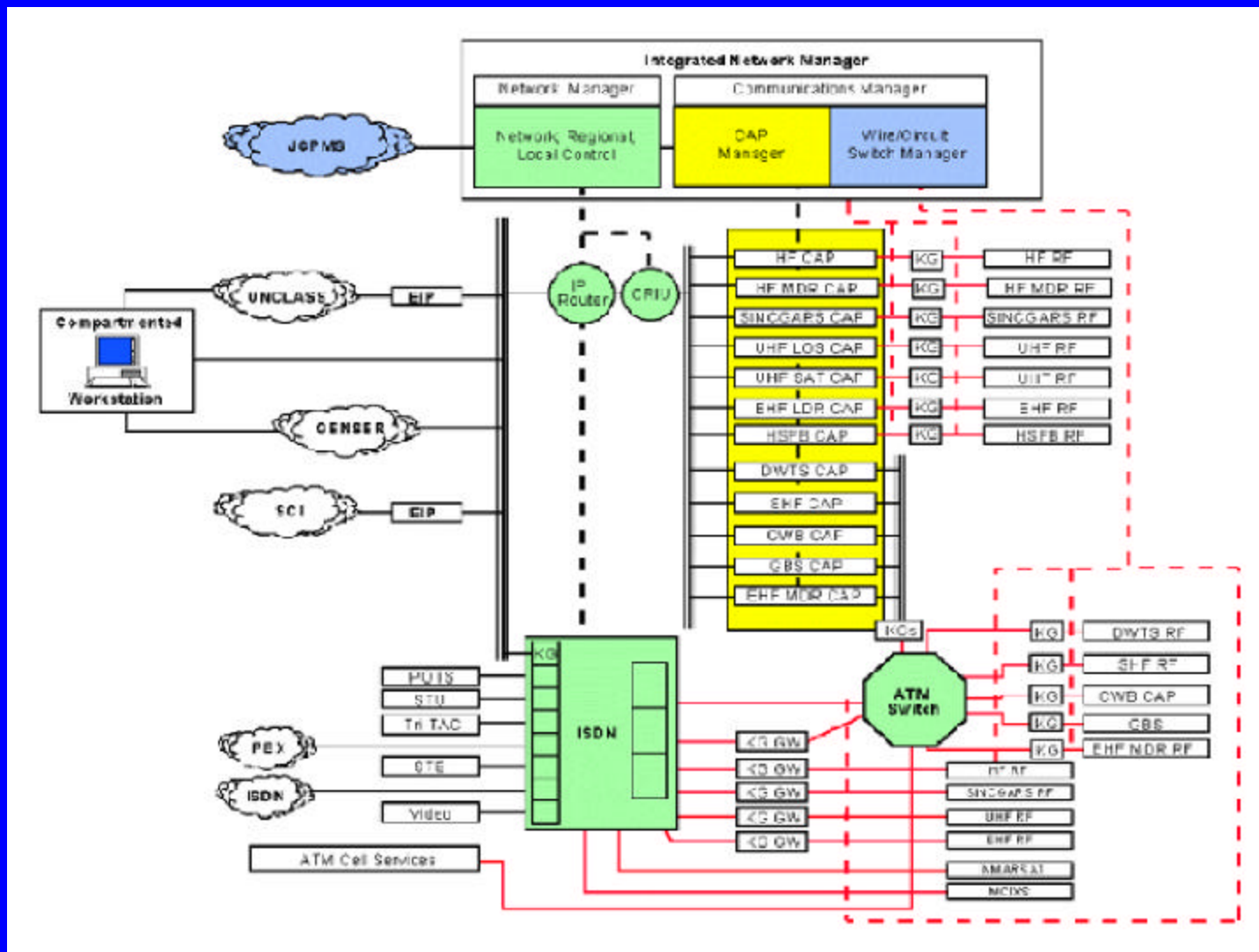
# ADNS CONOPS

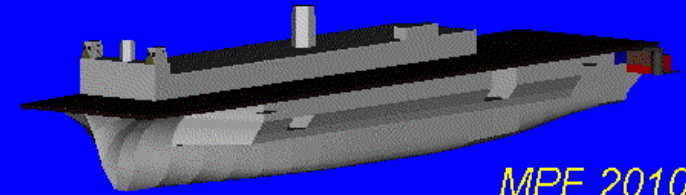


## ADNS ARCHITECTURE



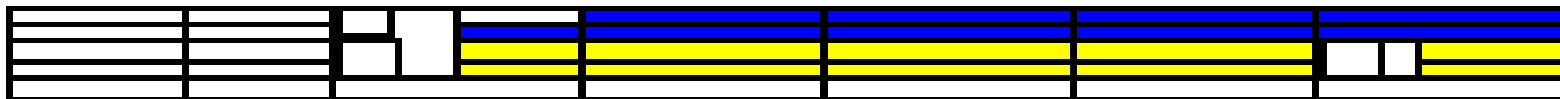
MPF 2010






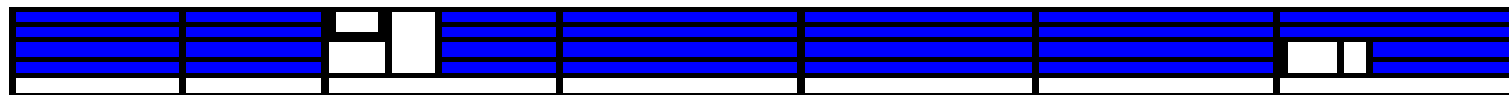
## HABITABILITY


### Starboard Sponsons

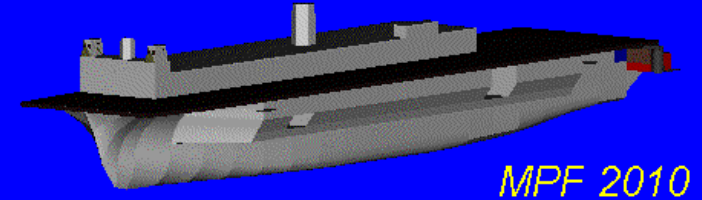


-  Hospital
-  Berthing

### Port Sponsons

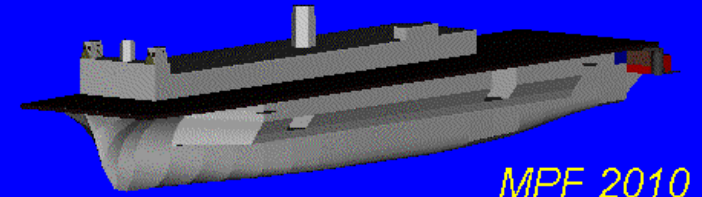


-  Berthing



## MANNING

- 45 MSC personnel
- 107 permanent party military personnel
- 4248 Accommodations for MEF(FWD) personnel

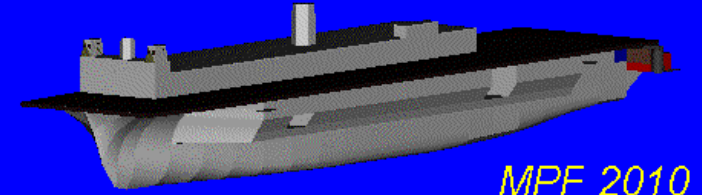


MPF 2010

## MPF 2010 AND BEYOND SHIPS...

- Fully support the Marine Corps Doctrine of Operational Maneuver from the Sea and Ship to Objective Maneuver
- Are prestaged with all cargo and equipment necessary to fully support a deployed MEF (FWD) for 30 days of combat operations
- Can indefinitely support MEF (FWD) combat operations by functioning as conduits for resupply
- Provide the MEF(FWD) Commander with maximum operational flexibility due to commonality of ship design
- Provide battlespace information dominance to the warrior through the implementation of a Littoral Region Area Network





*MPF 2010*

# QUESTIONS

