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### Analyzing the Assault and Sustainment Throughput Capabilities of the Maritime Prepositioning Force (Future) Squadron of Ships

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<td>Marine Corps Combat Development Command, Operations Analysis Division, 3300 Russell Road, Quantico, VA 22134</td>
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### SUPPLEMENTARY NOTES


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Analyzing the Assault and Sustainment Throughput Capabilities of the Maritime Prepositioning Force (Future) Squadron of Ships

Adam Martin
Operations Research Analyst
Marine Corps Combat Development Command
Operations Analysis Division
Mission Area Analysis Branch
Quantico, VA
Agenda

✓ Background

• Overall Assumptions
• Surface Assault
• Vertical Assault
• Ship-to-Objective Sustainment
• The "Take Aways"
Purpose

Purpose of study
- MPF(F) Squadron Capabilities Development Document (CDD) lists:
  - Key Performance Parameters for MPF(F) at squadron level, including:
    - Air connector interfaces
    - Surface connector interfaces
  - Threshold capabilities, including:
    - Employ one surface and one vertical BLT in 8-10 hours
    - Sustain the MEB forces ashore from the sea base
- Provide insights to MPF(F) CDD working group and N85
  - Surface assault
  - Vertical assault
  - Vertical ship-to-objective sustainment

Purpose of this brief
- Highlight the results of the study

Can the squadron meet the threshold capabilities?
Focus on issues
- Timelines
- Surface interface points
- Surface assault connectors
- Assault support aircraft
- Operational deck spots
- Ship-to-objective sustainment

Primary Measures of Effectiveness
- Time to complete assaults and sustainment
- Operating hours
MPF(F) Squadron Composition

Squadron composition approved by SECNAV on 24 May 05

MPF(F) Squadron Composition

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<thead>
<tr>
<th>Ship Type</th>
<th>Quantity</th>
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<td>MLP*</td>
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<td>FLO/FLO Technology focused</td>
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* Mobile Landing Platform
UNCLASSIFIED

Agenda

Mission Area Analysis Branch—Analyzing the Future

• Background
✓ Surface Assault
• Vertical Assault
• Ship-to-Objective Sustainment
• The "Take Aways"
Forces Going Ashore - Surface

Mission Area Analysis Branch—Analyzing the Future

**Units**
- 1 – Infantry Battalion
- 1 – Tank Company
- 1 – LAR Company
- 1 – LW155 Battery
- 1 – Combat Engineer Spt Det
- 1 – DS CSS Company
- 1 – LAAD Detachment

**Personnel/Representative Equipment**

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53 LCAC SLEP loads + 18 more
Surface Assault Assumptions

- 25 NM ship-to-shore
- Surface BLT moved to 3 MLP prior to the assault
- Surface BLT launched from 3 MLP
- 18 LCAC SLEP pre-loaded on 3 MLP
- 3 LCAC SLEP in MPF(F) LHD well have pre-boated Mech Co in reserve (not used for assault)
- LCAC SLEP $A_o$: 95% (rounded down)*
- LCAC SLEP speeds of 35 Kts for both ingress and egress
- Significant wave height 3.0 ft (NATO SS 3)
- LCAC SLEP processing time of 67 minutes on MLP**
  - Processing time: Time from entering MLP to exiting MLP
- LCAC SLEP unload time of 15 minutes on beach***

* Approved by N753L on 14Sep05, applies to surge rate for the first day of the surface assault and does not include combat attrition

** LCAC Cargo Loading Operations Onboard Amphibious Well Deck Ships, NAVSEA Panama City, 2002

*** LCAC Data Summary and Analysis, CNA, 1992
Surface Assault Excursions

Mission Area Analysis Branch—Analyzing the Future

- Land DS CSS Co and LAAD Det
- Notional LCAC(X) (N7 NCDP Study, 2005)
  - Payload weight: 279,860 lbs
  - Payload square: 2,611 SqFt
  - 12 LCAC(X) pre-loaded on 3 MLP
  - 2 LCAC(X) in MPF(F) LHD well have pre-boated Mech Co in reserve (not used for assault)
- Improved processing times*
  - LCAC SLEP: From 67 min to 49 min
  - LCAC(X): From 92 min to 65 min
- Vary number of operational connectors

* Well Deck Throughput Study, NAVSEA Panama City, 2003
**Processing Times Comparison**

*Mission Area Analysis Branch—Analyzing the Future*

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<th>LCAC SLEP</th>
<th>LCAC(X)</th>
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<td>Current Procedures</td>
<td>67 min</td>
<td>92 min</td>
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<tr>
<td>Improved Procedures</td>
<td>49 min</td>
<td>65 min</td>
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</table>

**Current procedures**
- NAVSEA Study 2002
- Identified discrete event steps associated with LCAC SLEP cargo loading ops

**Improved procedures**
- NAVSEA Study 2003
- Dedicated team loading
- Concurrent passenger loading and Foreign Object Damage walk-down
- Load planning software

*LCAC(X) times extrapolated from LCAC data*
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LCAC SLEP Results - BLT w/out DS CSS & LAAD

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Surface Assault Time-To-Complete

Can meet 10-hour threshold for landing surface BLT (w/out DS CSS and LAAD) with:
- Improved SIP processing time
- OR - Use of LCAC SLEP from MPF(F) LHD

Can meet 8-hour objective for landing surface BLT (w/out DS CSS and LAAD) with:
- Improved SIP processing time
- AND - Use of LCAC SLEP from MPF(F) LHD

Base Case -
18 LCAC SLEP (17 Operational), No DS CSS and LAAD, 67 min SIP proc time

14 Jun 07
LCAC SLEP Results - BLT w/ DS CSS & LAAD

Cannot meet 10-hour threshold when landing BLT, DS CSS, and LAAD using LCAC SLEP.

Best case is 11.1 hours, using LCAC SLEP from MPF(F) LHD and improved SIP processing time.
**LCAC(X) Results - BLT w/out DS CSS & LAAD**

Can meet 8-hour objective for landing surface BLT (w/out DS CSS and LAAD) with LCAC(X) and

- Improved SIP processing time
  - OR -
- Use of LCAC(X)s from MPF(F) LHD

![Surface Assault Time-To-Complete](chart)

- **11 Operational LCAC(X)**
- **13 Operational LCAC(X)** (2 from MPF(F) LHD)

*No DS CSS, LAAD*
**LCAC(X) Results - BLT w/ DS CSS & LAAD**

Can meet 10-hour threshold for landing surface BLT, DS CSS, and LAAD with LCAC(X) and

- Improved SIP processing time (without use of LCAC(X) from MPF(F) LHD)

Best case is 8.8 hours, using LCAC(X)s from MPF(F) LHD and improved SIP processing time.

**Surface Assault Time-To-Complete**

- 11 Operational LCAC(X)
- 13 Operational LCAC(X) (2 from MPF(F) LHD)

<table>
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- 11.1
- 10.5
- 9.7
- 8.8
If LCAC(X) night ops crew day is increased to 10 hours, then the average crew day would be under the limit* 

*Given 13 operational LCAC(X) and SIP processing time of 65 minutes
Surface Assault Operating Hours by LCAC(X)

Time-To-Complete: 8.8 hours*
Average Operating Hours: 9.5 hours*

How many of the 13 operational LCAC(X)s operate for more than 10 hours?

Operating Hours by LCAC(X)

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</table>

*Given surface BLT with DS CSS and LAAD, 13 operational LCAC(X) and SIP processing time of 65 minutes
Sensitivity Analysis- # Operational Connectors

TTC - BLT, w/ DSS CS and LAAD

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- 1 for 1 replacement does not fit on current MPF(F) squadron design
- 1 for 2 replacement does not meet timelines
- 2 for 3 replacement meets timelines and will fit on current MPF(F) squadron design

LCAC(X), 65 min SIP
Surface Assault “Take Aways”

Surface Assault w/ LCAC SLEP
- Can meet 8-hour objective for landing surface BLT (w/out DS CSS and LAAD) with
  - Improved Surface Interface Point (SIP) processing time
    - AND -
  - Use of LCACs from MPF(F) LHD
- Cannot meet 10-hour threshold for landing surface BLT, DS CSS, and LAAD

Surface Assault w/ Notional LCAC(X)
- Can meet 10-hour threshold for landing surface BLT, DS CSS, and LAAD with
  - Improved SIP processing time
Mission Area Analysis Branch—Analyzing the Future

Agenda

• Background
• Surface Assault
✓ Vertical Assault
• Ship-to-Objective Sustainment
• The "Take Aways"
**Forces Going Ashore - Vertical**

**Units**
- 1 – Infantry Battalion
- 1 – EFSS Battery
- 2 – Combat Engineer Platoons

**Personnel/Representative Equipment**

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156 MV-22-equivalent loads + 49 more
Vertical Assault Assumptions

- 110 NM ship-to-objective
- Vertical BLT launched from 2 MPF(F) LHA(R) and 1 MPF(F) LHD
- 124 KIAS for external load speed*
- 15° C, no wind, LZs at sea level
- Assault support aircraft from MEB ACE in MPF(F) squadron
  - 48 MV-22
  - 20 CH-53K
- Aircraft availability
  - CH-53K MCR: 80% (WG Guidance- DC AVN)
  - MV-22 MCR: 82% (ORD Threshold)
  - 14% (5) MV-22s held out for CASEVAC and other missions (III MEF Planning Factors)
- Without aerial refueling
- No additional armor on vehicles
- 6 Operating Spots per MPF(F) LHA(R) and MPF(F) LHD

* 124 KIAS is the weighted average of speeds specified in FM10-450 for loads carried in the assault
Vertical Assault Excursions

- Land DS CSS and LAAD Det
- Vary temperature from 15° C to 35° C
- Add MAK to HMMWVs
- Vary number of operational deck spots per MPF(F) LHD/MPF(F) LHA(R)
Impact of Temperature / Armor

No DS CSS, LAAD; 15°C; No MAK

- CH-53K Required: 7%
- MV-22 Preferred: 40%
- Either Aircraft: 53%

No DS CSS, LAAD; 35°C; No MAK

- CH-53K Required: 60%
- MV-22 Preferred: 40%

No DS CSS, LAAD; 15°C; MAK

- CH-53K Required: 60%
- MV-22 Preferred: 40%
Vertical STOM Results

Without MAK Armor

At 15° C, greatest impact is 38% increase

At 35° C, greatest impact is 5% increase

# Internal / refueling spots

All cases still near or below 8-hour objective
**Vertical STOM Results**

At 15°C, greatest impact is 8% increase

At 35°C, greatest impact is 7% increase

All cases still below 10-hour threshold
There are gaps in the activity on the ships.
As the number of operational spots decreases, the gaps can no longer absorb aircraft and the time must shift to the right.

2 refueling/internal spots
No DS CSS, LAAD
No MAK, 15° C
Vertical Assault “Take Aways”

- **Vertical Assault**
  - **Can** meet 8-hour objective for landing vertical BLT (w/out DS CSS and LAAD)
    - With Marine Armor Kit (MAK) armored HMMWV at 35° C
  - **Can** meet 8-hour objective for landing vertical BLT, DS CSS and LAAD
    - Without MAK armored HMMWV at 15° C
  - **Can** meet 10-hour threshold for landing vertical BLT, DS CSS and LAAD
    - With MAK armored HMMWV at 35° C
• Background
• Surface Assault
• Vertical Assault

✓ Ship-to-Objective Sustainment

• The "Take Aways"
Entire Sea Based Maneuver Element (SBME) ashore (3 BLTs, Arty Bn, RLT HQ, DS CSS Bn, etc.)

Forces go ashore with prescribed load for initial assault
- BA + 1 DOA (assault rate) for ammo
- 1 DOS for all other supplies

Sustainment planning factors
- Infantry-heavy threat
- Assault rate of consumption

All units positioned 110 NM from Sea Base

Ships providing SBME sustainment vary by class of supply
- 2 LMSR: Water
- 2 MPF(F) LHA(R)/MPF(F) LHD: Fuel
- 2 T-AKE: Dry goods and ammo
Aviation ship operations are staggered in order to provide continuous 24-hr availability of assault support aircraft and flight decks.

1-2 aviation ships operating during vertical ship-to-objective sustainment window

- Flight windows are 12 hours
  - 10 hours available for actual flying
  - 2 hours for spotting/re-spotting

- Aircraft availability
  - CH-53K MCR: 80% (WG Guidance- DC AVN)
  - MV-22 MCR: 82% (ORD Threshold)
  - 4 MV-22s held out for CASEVAC and other missions

Assume 2 options for assault support lift coverage
Assault Support Lift Coverage - Option 1

MPF(F) LHD available through the period of darkness - 6 MV-22 and 16 CH-53K

MPF(F) LHA(R) -1 - 18 x MV-22 + 4 x CH-53K

MPF(F) LHA(R) -2 available if sustainment time-to-complete exceeds 7 hours - 24 MV-22
### Assault Support Lift Coverage - Option 1

#### Best and Worst Case

**Mission Area Analysis Branch—Analyzing the Future**

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**MPF(F) LHD - 6 x MV-22 + 16 x CH-53K**

- **FLIGHT WINDOW 2000 – 0600**

**MPF(F) LHA(R) –1 - 18 x MV-22 + 4 x CH-53K**

- **FLIGHT WINDOW**

**MPF(F) LHA(R) –2 - 24 x MV-22**

- **FLIGHT WINDOW**

**AIRCRAFT AVAILABLE FOR SUSTAINMENT PER HOUR MV-22**

- 18

**AIRCRAFT AVAILABLE FOR SUSTAINMENT PER HOUR CH-53K**

- 4

**Best case for ship-to-objective sustainment**

**Worst case for ship-to-objective sustainment**

14 Jun 07
## Assault Support Lift Coverage - Option 2

### MPF(F) LHD available for duration of sustainment window - 12 MV-22 and 12 CH-53K

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<th>RESPOP</th>
<th>Flight Window</th>
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### MPF(F) LHA(R)-1 available for 3 hours of sustainment window - 18 MV-22 and 4 CH-53K

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### MPF(F) LHA(R)-2 available if sustainment time-to-complete exceeds 7 hours - 18 MV-22 and 4 CH-53K

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Assault Support Lift Coverage - Option 2
Best and Worst Case

Start re-supply
Best Case

Start re-supply
Worst Case

MPF(F) LHD - 12 x MV-22 + 12 x CH-53K

MPF(F) LHA(R) –1 - 18 x MV-22 + 4 x CH-53K

MPF(F) LHA(R) –2 - 18 x MV-22 + 4 x CH-53K

AIRCRAFT AVAILABLE FOR SUSTAINMENT PER HOUR MV-22

AIRCRAFT AVAILABLE FOR SUSTAINMENT PER HOUR CH-53K

Best case for ship-to-objective sustainment

Worst case for ship-to-objective sustainment

14 Jun 07
Ship-to-Objective Sustainment Updates

Sustainment calculations were modified during the course of this analysis due to:

● New, emerging containers
  - JMIC (Joint Modular Intermodal Container) for dry goods and ammo replaces cargo nets
  - GERS (Ground Expedient Refueling System) for fuel replaces other refueling systems

● New planning factors for ammunition consumption
  - Includes composite threat
    - Infantry/armor heavy threats no longer used
Impact of New Planning Factors for Ammunition

Due to changes in ammo requirements, the daily sustainment requirement of the SBME has increased from 583 to 733 short tons - a 26% increase.

Daily sustainment requirements assuming composite threat and assault rate of consumption
**Impact of New, Emerging Containers**

**Mission Area Analysis Branch—Analyzing the Future**

Concept: Vertical resupply via external lift. Loads configured for MV-22, with CH-53Ks lifting three loads.

**155 Ammo**
- 4 x JMIC (8,375 lbs)
- cube out before max weight
- Use of JMIC: decrease of 800 lbs of ammo per load compared to cargo nets

**Other Ammo**
- 4 x JMIC (8,447 lbs)
- cube out before max weight
- Use of JMIC: decrease of 2,126 lbs of ammo per load compared to cargo nets

**Other Supplies**
- 8 x JMIC (6,519 lbs)
- cube out before max weight
- Use of JMIC: decrease of 1,825 lbs of supplies per load compared to cargo nets

**Fuel**
- 1 x 10K Cargo Net with 6 155 gal GERS (7,585 lbs) at LZs w/ trucks
- Use of 155 gal GERS: decrease of 1,836 lbs of fuel per load compared to 300 gal EFS
- 2 x 10K Cargo Net with 36 28 gal GERS (9,201 lbs) at LZs w/o trucks
- Use of 28 gal GERS: no change

**Water**
- 2 x 500 gal drum (8,967 lbs)
**Impact of New Ammo Planning Factors and Packaging**

The change in ammo requirements account for 39 of 41 additional MV-22 equivalent loads (2 for adjusted fuel calculations).

The use of new and emerging containers account for 38 additional MV-22 equivalent loads.

Changes in ammo requirements and containers have increased the number of MV-22 sustainment loads for the SBME by 53%.

### Daily Sustainment Requirement by Unit

<table>
<thead>
<tr>
<th>Containers:</th>
<th>Ammo Planning Factor:</th>
<th>Water</th>
<th>155 ammo</th>
<th>Other ammo</th>
<th>Fuel</th>
<th>Other supplies</th>
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<tr>
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<td>New</td>
<td>227</td>
<td>39</td>
<td>42</td>
<td>81</td>
<td>38</td>
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</table>

187% increase in # ammo loads
**Ship-To-Objective Sustainment Results**


**New ammo planning factors: Draft MCO-8010 (2006):**

- 733 total short tons of sustainment (assault rate/composite);
- 470 total short tons of sustainment (sustained rate/composite)

Source of sustainment:
- 2 LMSR – Water;
- 1-2 MPF(F) LHA(R)/MPF(F) LHD – Fuel;
- 2 T-AKE – Dry goods

14 Jun 07
Ship-to-Objective Sustainment “Take Aways”

- **Vertical ship-to-objective sustainment**
  - Impact of changes in MCO-8010 and packaging containers:
    - 53% increase in number of MV-22 equivalent loads required to sustain SBME
    - Time to sustain the entire SBME at assault rate extends beyond a period of darkness
    - SBME can be re-supplied at sustained rate in a period of darkness
  - Schedule mission during period that maximizes assault support capabilities
    - CH-53K is critical for delivery of sustainment ashore
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Agenda

Mission Area Analysis Branch—Analyzing the Future

• Overall Assumptions
• Surface Assault
• Vertical Assault
• Ship-to-Objective Sustainment
✓ The “Take Aways”
The “Take Aways”

● Surface Assault w/ LCAC SLEP
  ■ Can meet 8-hour objective for landing surface BLT (w/out DS CSS and LAAD) with
    ◆ Improved Surface Interface Point (SIP) processing time
    -AND-
    ◆ Use of LCACs from MPF(F) LHD
  ■ Cannot meet 10-hour threshold for landing surface BLT, DS CSS, and LAAD

● Surface Assault w/ Notional LCAC(X)
  ■ Can meet 10-hour threshold for landing surface BLT, DS CSS, and LAAD with
    ◆ Improved SIP processing time
The “Take Aways” (cont’d)

Vertical Assault

- **Can** meet 8-hour objective for landing vertical BLT (w/out DS CSS and LAAD)
  - With Marine Armor Kit (MAK) armored HMMWV at 35° C

- **Can** meet 8-hour objective for landing vertical BLT, DS CSS and LAAD
  - Without MAK armored HMMWV at 15° C

- **Can** meet 10-hour threshold for landing vertical BLT, DS CSS and LAAD
  - With MAK armored HMMWV at 35° C
The “Take Aways” (cont’d)

- **Vertical ship-to-objective sustainment**
  - Impact of changes in MCO-8010 and packaging containers:
    - 53% increase in number of MV-22 equivalent loads required to sustain SBME
    - Time to sustain the entire SBME at assault rate extends beyond a period of darkness
    - SBME can be re-supplied at sustained rate in a period of darkness
  - Schedule mission during period that maximizes assault support capabilities
    - CH-53K is critical for delivery of sustainment ashore
Questions?