CONCEPTUAL STUDY
OF
ARTICULATED STABLE OCEAN PLATFORM

FINAL REPORT
PART II
(VOLUME III)

CONTRACT NO. N00167-95-C-0113
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PREPARED FOR

CARDEROCK DIVISION
NAVAL SURFACE WARFARE CENTER

Prepared by
McDermott Engineering Houston, L.L.C.
801 N. Eldridge Street
Houston, Texas 77079

MEH Project 44271

May 6, 1997

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**16. SUPPLEMENTARY NOTATION**


**17. COSATI CODES**

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<th>FIELD</th>
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**18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)**

- Articulated stable ocean platform
- ASOP, floating production
- Offshore oil storage

**19. ABSTRACT (Continue on reverse if necessary and identify by block number)**

A conceptual study has been completed to evaluate the feasibility of a new concept of a floating storage platform - the Articulated Stable Ocean Platform (ASOP). The unique aspects of the ASOP is the articulation of the stabilize buoys which were introduced for the purposes of reducing wave load and overall vessel motion. The ASOP was designed to have a fuel storage capability of 1 million barrels and to support a topside up to 12,000 kips in total weight. The fuel storage tanks were designed in such a way that the draft of the platform would remain unchanged at any loading condition without adjusting the ballast. This greatly simplified the operations and allowed the platform to continue other activities while loading and off-loading.
The study shows that the ASOP has adequate stability and satisfies the stability requirement of the certifying authorities. Both numerical analysis and model test showed that the ASOP offers exceptional motion response characteristics in all its degrees of freedom. In terms of platform motion response, the ASOP is capable of operating in more severe weather conditions than a conventional surface vessel type platform. A seven body (six buoys and the hull) coupled motion analysis in ocean environment was performed and results in general agreed with the model test. However, both numerical analysis and model tests showed that the articulated buoys have no clear advantage over fixed buoys in the global motion of the ASOP. The reduction of forces by using articulation did not significantly improve the motion of the platform. Furthermore, the analysis and model test showed that compared to the fixed buoy case, using articulations increased the slow drift motions of the ASOP in random waves. The study also indicated that the introduction of articulations complicated the hydrostatic stability of the platform. Damaged stability was the governing factor in determination of the size of the articulated buoys. In conclusion, this conceptual study indicated that the fuel storage ASOP is a viable concept. Its large storage capability and exceptional motion characteristics allow many applications both in civil and military purpose.
Preliminary Report No. OMB-95-214-1

MODEL STUDIES
OF
ARTICULATED STABLE
OCEAN PLATFORM

VOLUME III

JUNE 1996

PREPARED FOR
McDERMOTT ENGINEERING HOUSTON
801 N. ELDRIDGE STREET
HOUSTON, TEXAS 77218

PREPARED BY
OFFSHORE MODEL BASIN
578 ENTERPRISE STREET
ESCONDIDO, CALIFORNIA 92029
APPENDIX I

FILTERED TIME HISTORY PLOTS

PART 1 OF 2
Unfiltered Time History

Filtered Low Pass Time History

Filtered High Pass Time History
Unfiltered Time History

Filtered Low Pass Time History

Filtered High Pass Time History

Page 1
Unfiltered Time History

Prototype Seconds

Filtered Low Pass Time History

Prototype Seconds

Filtered High Pass Time History

Prototype Seconds
Unfiltered Time History

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Prototype Seconds

Filtered Low Pass Time History

Prototype Seconds

Filtered High Pass Time History

Prototype Seconds
TEST A551 - BUOY 1 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A551 - PT SURGE

Unfiltered Time History

Filtered Low Frequency Time History

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Page 1
TEST A551 - PT HEAVE

Unfiltered Time History

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TEST A552 - BUOY 2 TENSION

Unfiltered Time History

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Page 1
Test A552 - PT HEAVE

Unfiltered Time History

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Filtered High Frequency Time History
TEST A553 - BUOY 2 TENSION

Unfiltered Time History

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TEST A553 - PT SURGE

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Unfiltered Time History

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TEST A554 - BUOY 2 TENSION

Unfiltered Time History

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TEST A554 - PT SURGE

Unfiltered Time History

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TEST A554 - PT HEAVE

Unfiltered Time History

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TEST A555 - BUOY 1 TENSION

Unfiltered Time History

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TEST A555 - BUOY 2 TENSION

Unfiltered Time History

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TEST A556B - BUOY 1 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
TEST A556B - BUOY 2 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
TEST A556B - PITCH

DEGREES

Time (sec)
0 500 1000

DEGREES

Time (sec)
0 500 1000

DEGREES

Time (sec)
0 500 1000

Page 1
TEST A556B - PITCH

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
TEST A557 - BUOY 2 TENSION

Graph 1: KIPS vs Time (0-1000)

Graph 2: KIPS vs Time (0-1000)

Graph 3: KIPS vs Time (0-1000)

Graph 4: KIPS vs Time (0-1000)
TEST A557 - PT SURGE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
Unfiltered Time History

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TEST A585 - PITCH

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 1
TEST A585 - PT SURGE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 1
TEST A586 - PT SURGE

- Chart 1
- Chart 2
- Chart 3

Page 3
Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A587 - PT SURGE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A593 - BUOY 2 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A593 - PITCH

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A594 - PT SURGE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A595 - BUOY 2 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A595 - PT HEAVE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A596 - BUOY 1 TENSION

Unfiltered Time History

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Unfiltered Time History

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TEST A598 - BUOY 1 TENSION

Graphs showing tension measurements over time.

Page 1
TEST A598 - BUOY 1 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
TEST A598 - PITCH

DEGREES

0 500 1000

DEGREES

0 500 1000

DEGREES

0 500 1000

Page 1
Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
TEST A598 - PT HEAVE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
Unfiltered Time History

Prototype Seconds

Filtered Low Frequency Time History

Prototype Seconds

Filtered High Frequency Time History

Prototype Seconds

Page 2
TEST A599 - BUOY 1 TENSION

Diagram of tension values over a time period.
TEST A599 - BUOY 1 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

Page 2
TEST A599 - PT HEAVE

3000  3500  4000

3000  3500  4000

3000  3500  4000

Page 3
TEST A603 - PT HEAVE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A605 - ML_1 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
Unfiltered Time History

Prototype Seconds

Filtered Low Frequency Time History

Prototype Seconds

Filtered High Frequency Time History

Prototype Seconds
TEST A606 - PT HEAVE

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A607 - BUOY 1 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History
TEST A608 - BUOY 1 TENSION
TEST A609 - ML_1 TENSION

Unfiltered Time History

Filtered Low Frequency Time History

Filtered High Frequency Time History

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