Unsteady Fluid Dynamic Loads

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SYMPOSIA DISCUSSION

REFERENCE AND/OR TITLE OF THE PAPER: Keynote Address #1

DISCUSSOR’S NAME: C. Ciray
AUTHOR’S NAME: P. Genalis

QUESTION:
Can you elaborate on ship based heavy lift aircraft? Should the aircraft carrier be much bigger than the present ones?

AUTHOR’S REPLY:
No – C-120 size aircraft carriers, about 1000 foot deck, but need to eliminate carrier island.

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<th>13. SUPPLEMENTARY NOTES</th>
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<tr>
<td>See also ADM201978, Flow-Induced Unsteady Loads and the Impact on Military Applications (Charges instables induites par ecoulement et impact sur les applications militaires)., The original document contains color images.</td>
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Unsteady Fluid Dynamic Loads

Dr. Paris Genalis
National Defense University
April 25, 2005
Unsteady Fluid Dynamic Loads

Objective

• To provide a perspective on the overall strength of research, development and design capabilities that currently exist in the U.S. regarding Naval Architecture - and how the impact of the work each of you is doing in unsteady load prediction influences those capabilities
Influencing Factors

• Academic Stream of Input
• Commercial Environment
• Security Environment
Academic Stream of Input

• INFO – NANO – BIO
  – Great emphasis at notable U.S. universities
  – Promise of actively fermenting research
  – Attracts talent (students, faculty researchers) based on excitement, growth, funding, and promise of high salaries

• Little emphasis placed on “MACRO”
Academic Stream of Input

• MACRO
  – Where all “Info – Nano – Bio” find application
  – Defense and commerce still rely on platforms
    • they have shapes, motion, structure of modern materials, operate in an environment that imposes loads
  – Very challenging problems
    • Require all capability developed in these other disciplines, and then some
    • Challenge other disciplines with new problem formulation and ways to look at problems

• Every bit as exciting
Academic Stream of Input

• MACRO
  – BUT WE HAVE NOT DONE A GOOD JOB OF CONVEYING THIS FACT TO PEOPLE OUTSIDE OUR COMMUNITY
  – Guilty of drifting to the abstract and away from the realities of design
  – Decoupling from the customer never pays off.
  – Need to take remedial action
    • Attract talent – takes effort, time
    • Work with customer – develop design tools
The New Commercial Environment

- U.S. shipbuilding business has not been commercially competitive. (Strong in military ship domain)
- International shipbuilding has seen a boom in fast ship designs – ferries with advanced hull shapes.
  - Usually coastal restrictions apply, somewhat easing the demand for advanced load predictions
- Aircraft business enjoys robust international competition (Boeing and Airbus)
  - Loads come from one fluid – no free surface complications
The New Security Environment

- US is increasingly recognizing 4 security constructs
  - Traditional (strategic advantage)
  - Irregular
  - Disruptive
  - Catastrophic
- The latter 3 are NOT “lesser included cases”
New Security Environment

• Defense Science Board studies
  – Carrier of the future
  – Seabasing
  – Mobility
• Mobility Requirements Study
  – QDR 2005
• All identified need for new aircraft and ships
New Security Environment

• Require new kinds of platforms (in addition to traditional ones)
  – More (cheaper), smaller, faster, netted ships
    • Advanced hull forms (similar to commercial, inspired by..., )
    • Steel may be too heavy
    • Need to be open-ocean capable
    • Finite life vs. economic replacement
    • Load prediction is key
  – Ship-based heavy lift aircraft
The Challenge – Staying close to the customer

• Reliable, accurate load estimates needed for design

• Today – accurate probably means many hours of computing (Navier Stokes solvers necessary); potential flow solutions are quick but not up to task for ship life prediction.

• Always – designers need quick turn around of analysis results; many iterations
The Challenge – ONR Response

• National Naval Responsibility – Naval Engineering program
  – Emphasis on design tools of all kinds - broader than just load prediction
  – Level of sophistication of tools can (must?) be transparent to user (also open to other researchers)

• New program on exploring the limits of numerical power of highly parallel machines in load prediction