

2005 Tulane Engineering Forum

Engineering in a Coastal Environment

June 2, 2006

Oil and Gas Industry Measures for Protecting Infrastructure and Mitigating Hurricane Effects

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What Happened to the Offshore Oil and Gas Industry?

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IVAN

KATRINA

RITA

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➤ **Order of Presentation:**

- **Prior to Ivan, Katrina, and Rita**
- **Impact of Ivan, Katrina, and Rita**
- **Industry Response to Ivan, Katrina, and Rita**

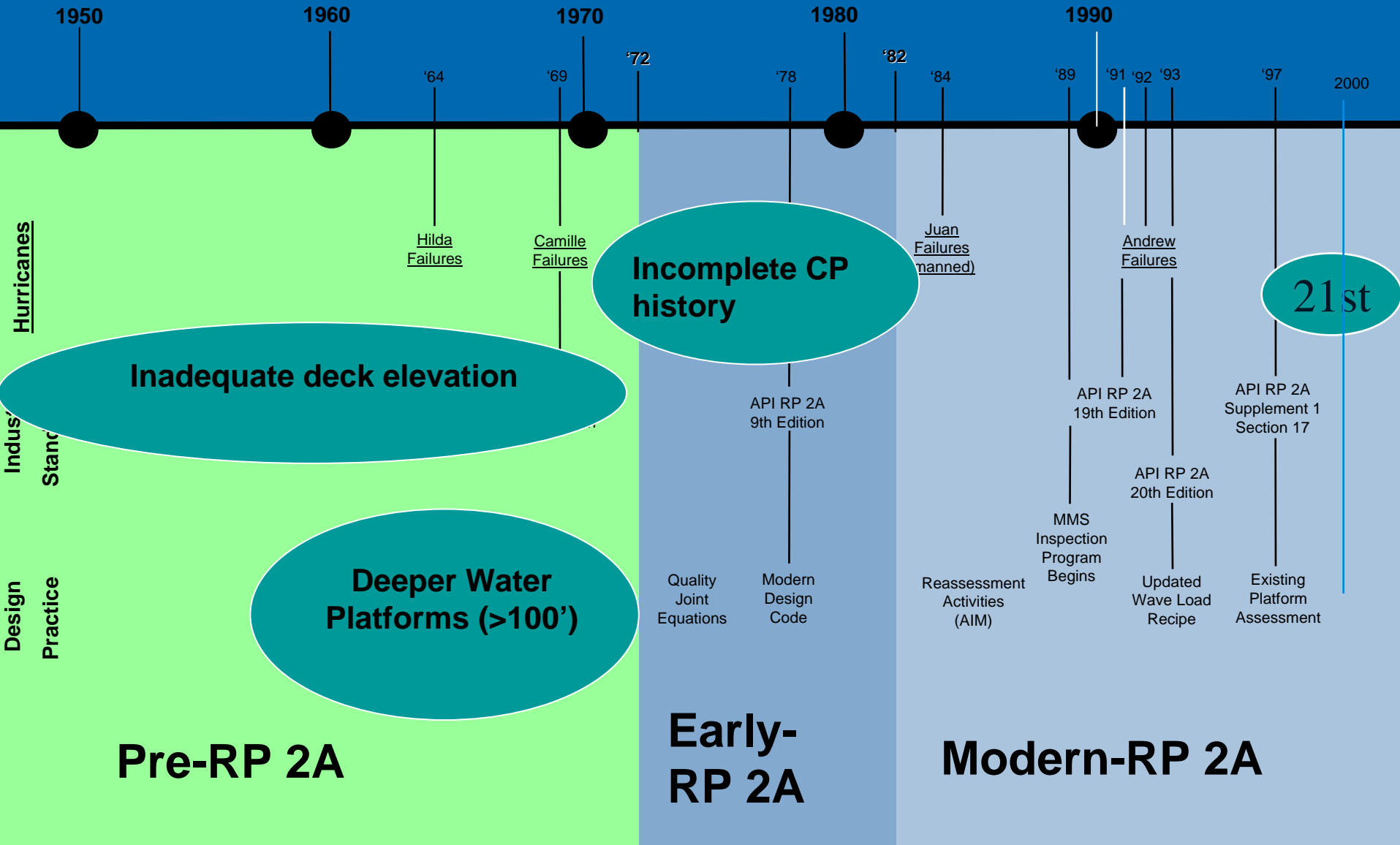
➤ Engineering in a Coastal Environment

Oil and Gas Industry Measures for Protecting Infrastructure and Mitigating Hurricane Effects

Prior to Ivan, Katrina, and Rita

- 52 Years of Offshore Development
- Increasing Design Wave Return Period
- Reasonably good experience
- API Recommended Practice 2A for Offshore
 - Consequence Based Criteria (new design)
 - Assessment Criteria (existing designs)
 - Life Safety and Environmental Safety

Platform Design History



1950

1960

1970

1980

1990

2000

'64

'69

'72

'78

'82

'84

'89

'91

'92

'93

'97

Hurricanes

Industry Standards

Design Practice

Hilda Failures

Camille Failures

Incomplete CP history

Juan Failures (manned)

Andrew Failures

21st

Inadequate deck elevation

Deeper Water Platforms (>100')

API RP 2A 9th Edition

API RP 2A 19th Edition

API RP 2A Supplement 1 Section 17

API RP 2A 20th Edition

Quality Joint Equations

Modern Design Code

Reassessment Activities (AIM)

MMS Inspection Program Begins

Updated Wave Load Recipe

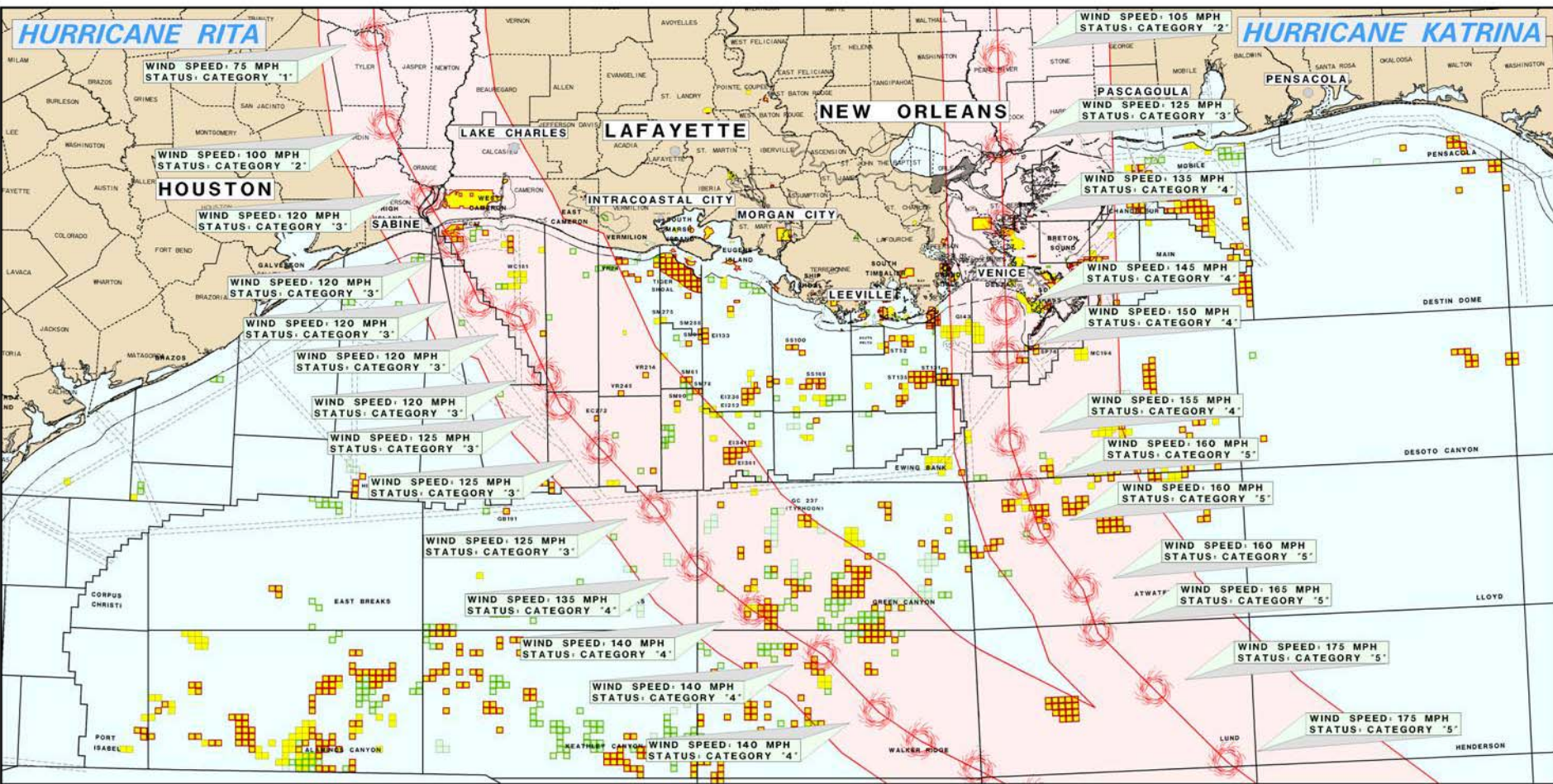
Existing Platform Assessment

Pre-RP 2A

Early-RP 2A

Modern-RP 2A

Hurricanes Katrina & Rita (2005)



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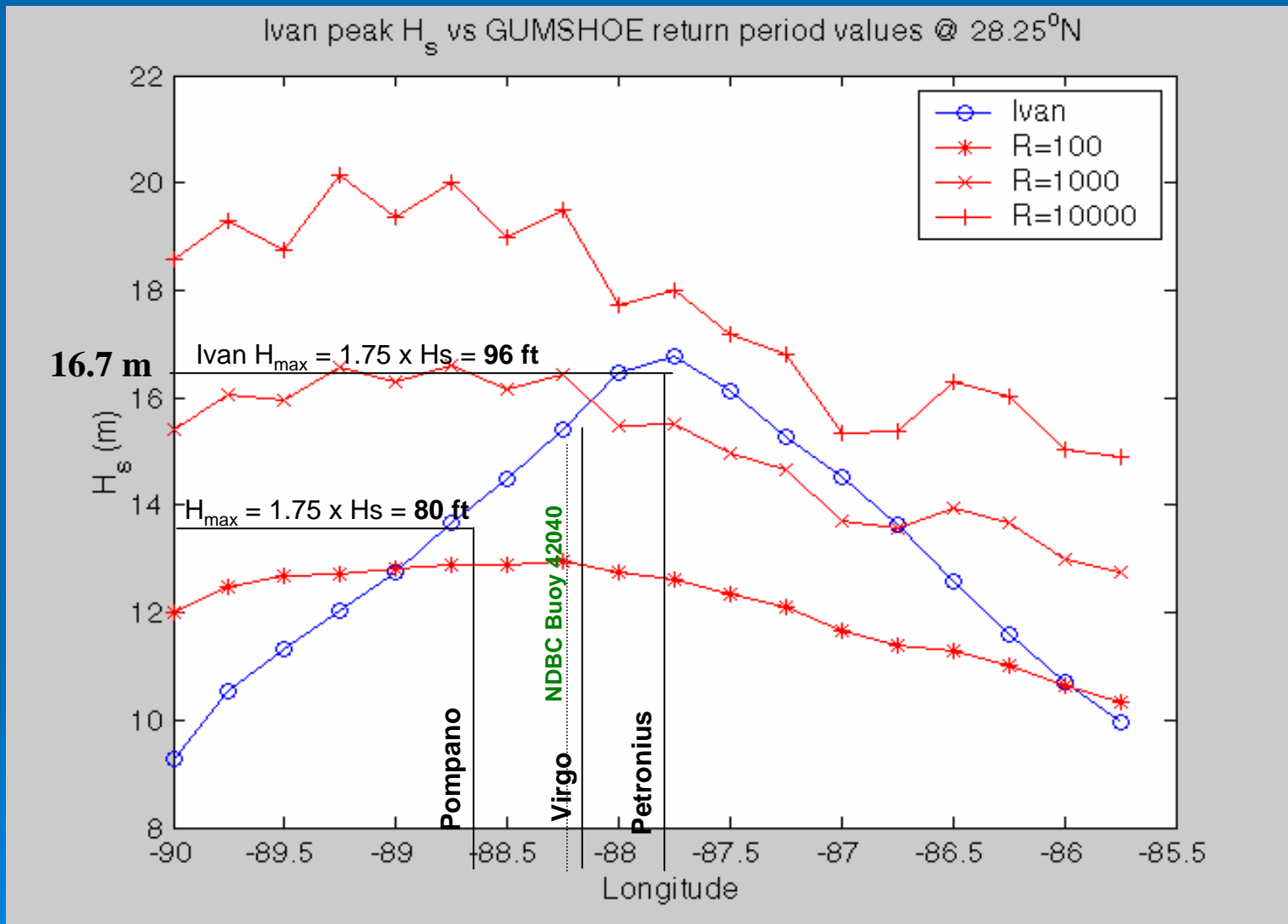
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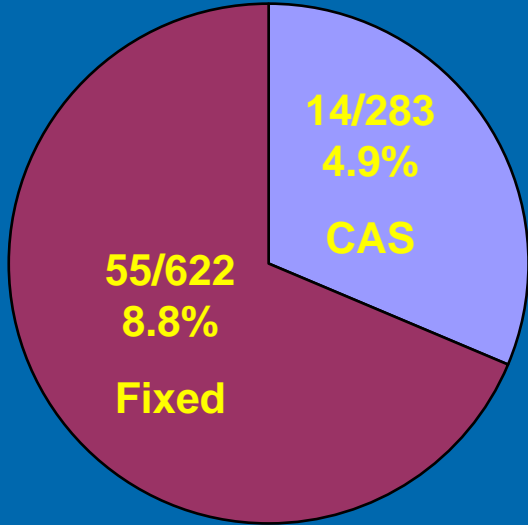
Impact of Ivan, Katrina, and Rita

Ivan	2000yr. r.p. event	95' waves
Katrina	1000yr. r.p. event	83' waves
Rita	1000yr. r.p. event	83' waves

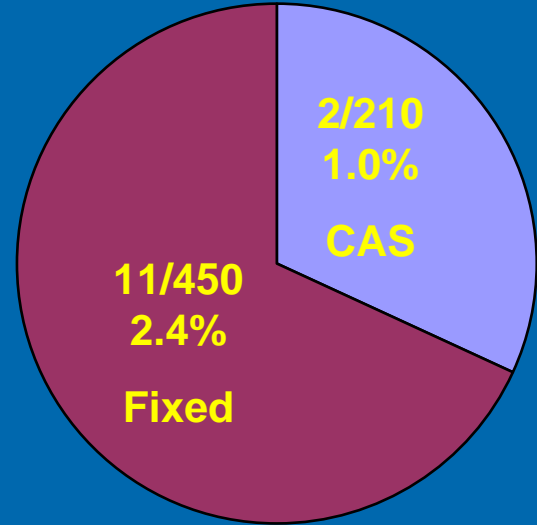
IVAN – HINDCAST DATA



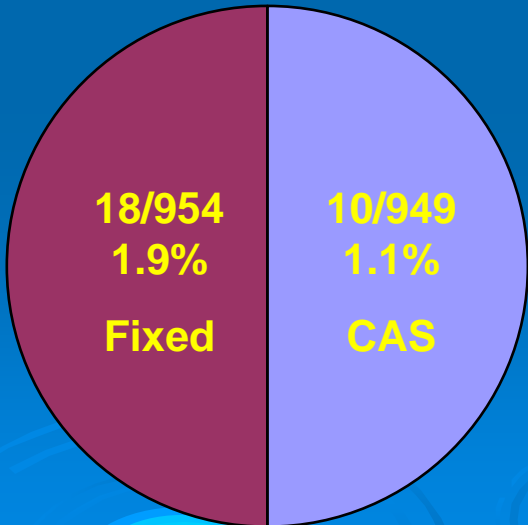
Platform Performance Fixed and Caissons



Pre-RP 2A



Early-RP 2A



Modern-RP 2A

3468 Platforms East of NTL Line
110 Platforms Destroyed

Data as of 10/18/2005

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Impact of Ivan, Katrina, and Rita

Platforms Destroyed	120
Platforms Damaged	73
Oil & Gas Wells Toppled	600
Pipelines Interrupted	641
MODU's floating free	19
Jack-ups Damaged	20

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Impact of Ivan, Katrina, and Rita

**** NO LIVES LOST ****

**** MINIMAL POLLUTION ****

****100 yr. Design Criteria worked well****

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Impact of Ivan, Katrina, and Rita

Platforms Destroyed	\$\$\$\$\$\$\$\$\$\$
Platforms Damaged	\$\$\$\$\$\$\$\$\$\$
Oil & Gas Wells Toppled	\$\$\$\$\$\$\$\$\$\$
Pipelines Interrupted	\$\$\$\$\$\$\$\$\$\$
MODU's floating free	\$\$\$\$\$\$\$\$\$\$
Jack-ups Damaged	\$\$\$\$\$\$\$\$\$\$

\$\$\$\$\$\$\$\$\$\$ = Inspect, repair-remove-replace, lost production

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➤ Industry Response to Ivan, Katrina, and Rita

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- **API - Hurricane Evaluation and Assessment Team - HEAT**
 - **Charged with evaluating and assessing design criteria for Suite of API Offshore Recommended Practice**

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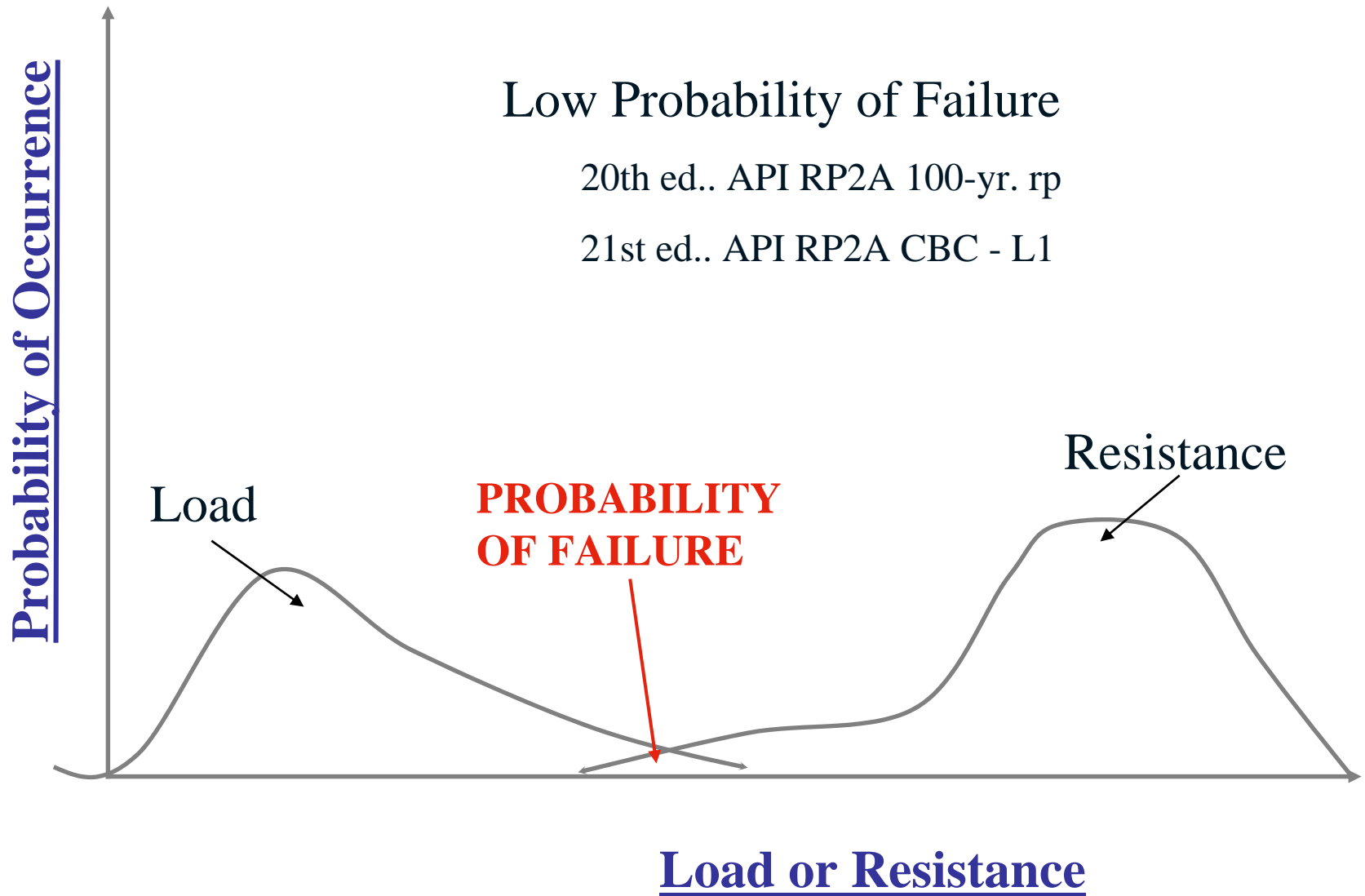
➤ API HEAT Work Groups

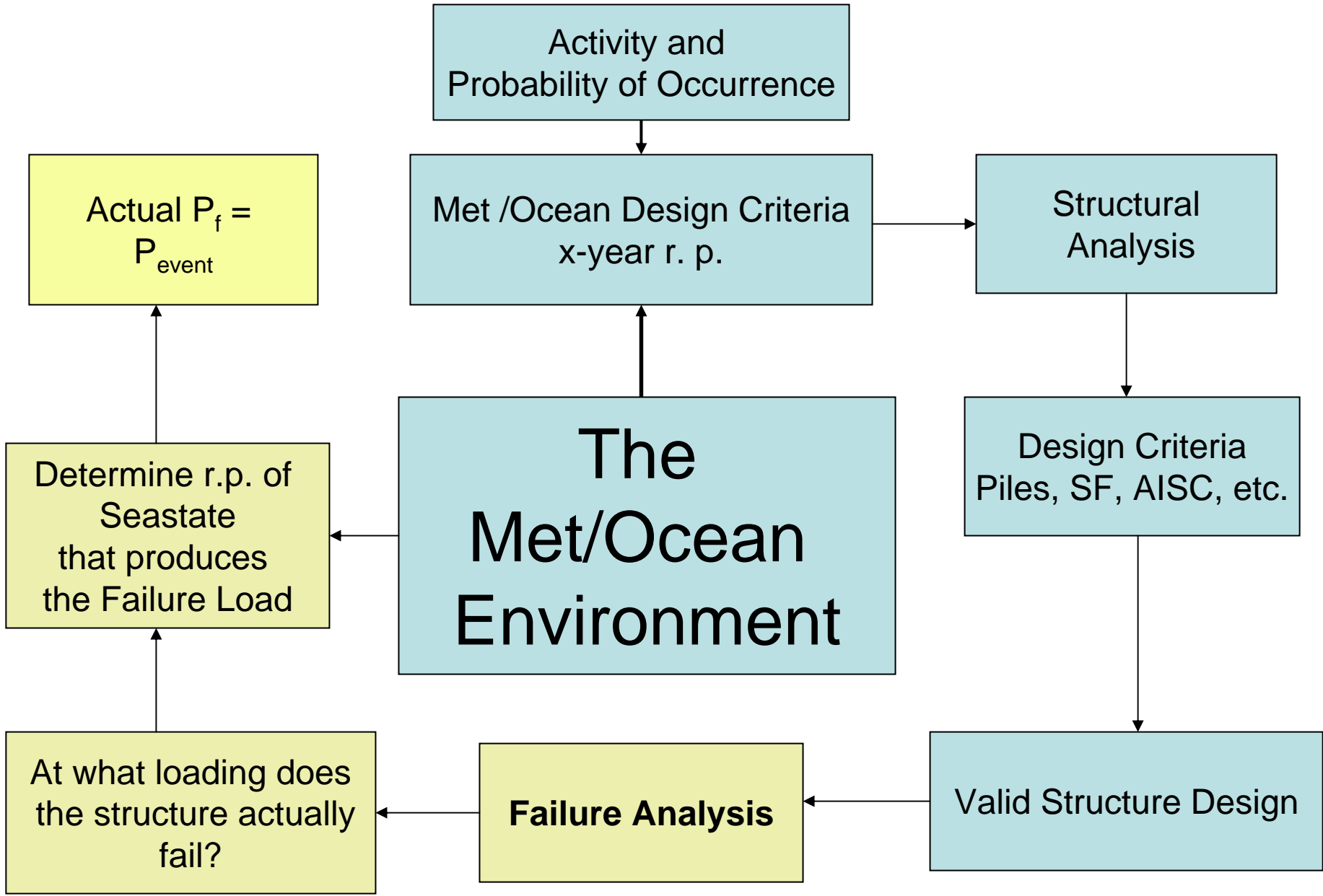
- WG1 – MetOcean
- WG2 – Data Gathering
- WG3 - Assessment/Analyses
- WG4 - Topsides Integrity
- WG5 – Information Dissemination

Low Probability of Failure

20th ed.. API RP2A 100-yr. rp

21st ed.. API RP2A CBC - L1





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➤ **Interim Guidelines for 2006 Hurricane Season**

- API RP 95J - - Jack-up
- API PR 95F - - Floating Drill rigs
- API Bulletin TD - - Topsides Equipment Tie-downs

OOC, API, IADC