Huntington Beach Platform Emmy Structural Analysis

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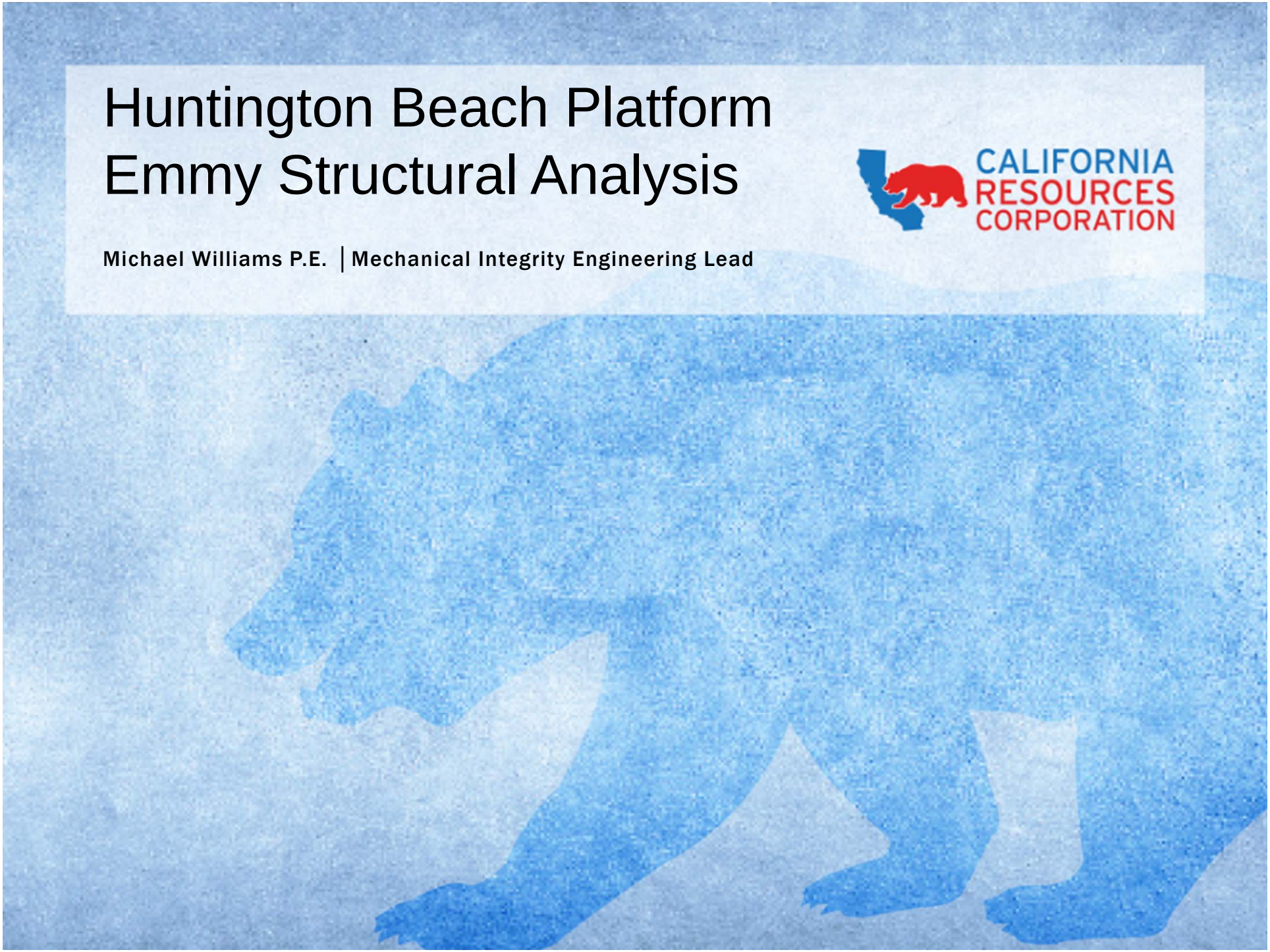


PRESENTATION OUTLINE

- Background and Platform History
- Getting The Most Out of Subsea Inspection
- Developing a Novel Approach
- Results and Path forward

Platform Emmy History

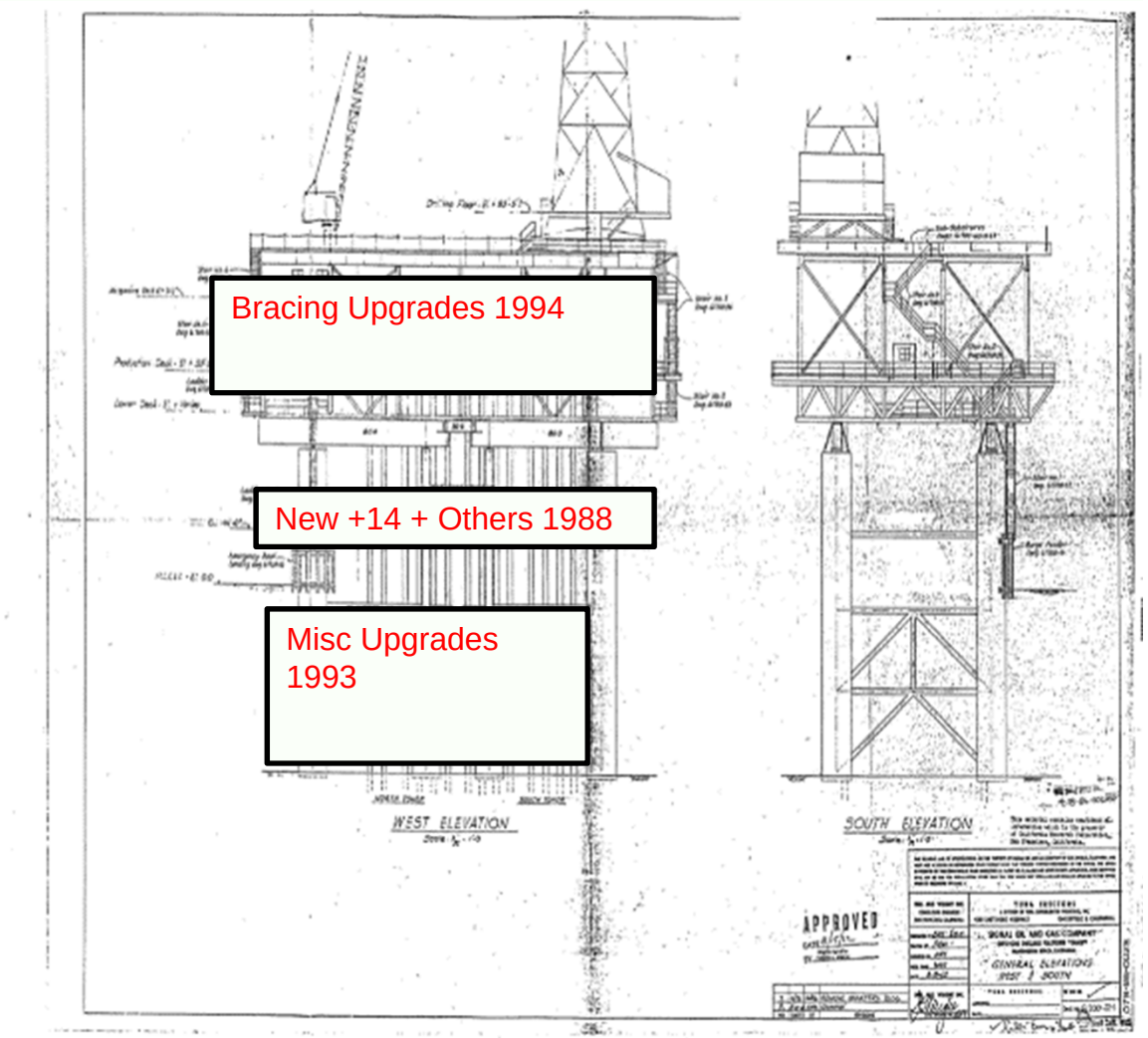
Platform Emmy was built in 1961 by Signal Oil and Gas.

1988 added additional cross member level

Shell/Aera reestablished the baseline 1991-1994

- Extensive inspections and data review
- A baseline structural response model

Structural upgrades to the topsides and other locations were completed during this time.



Original 1961 Construction Drawing

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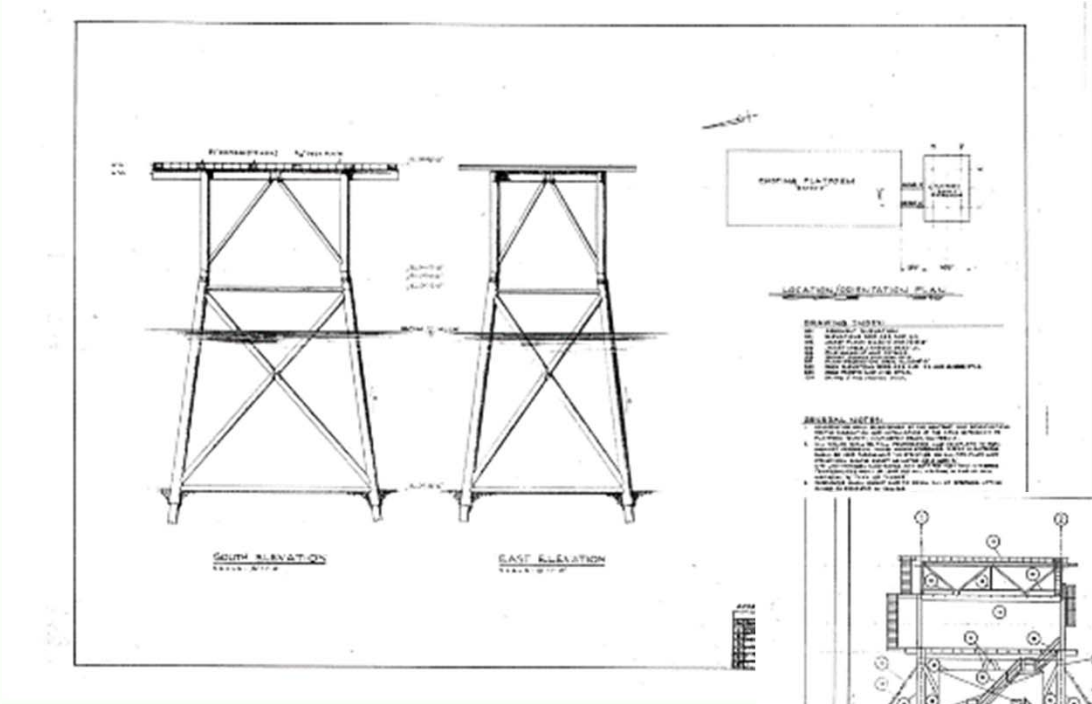
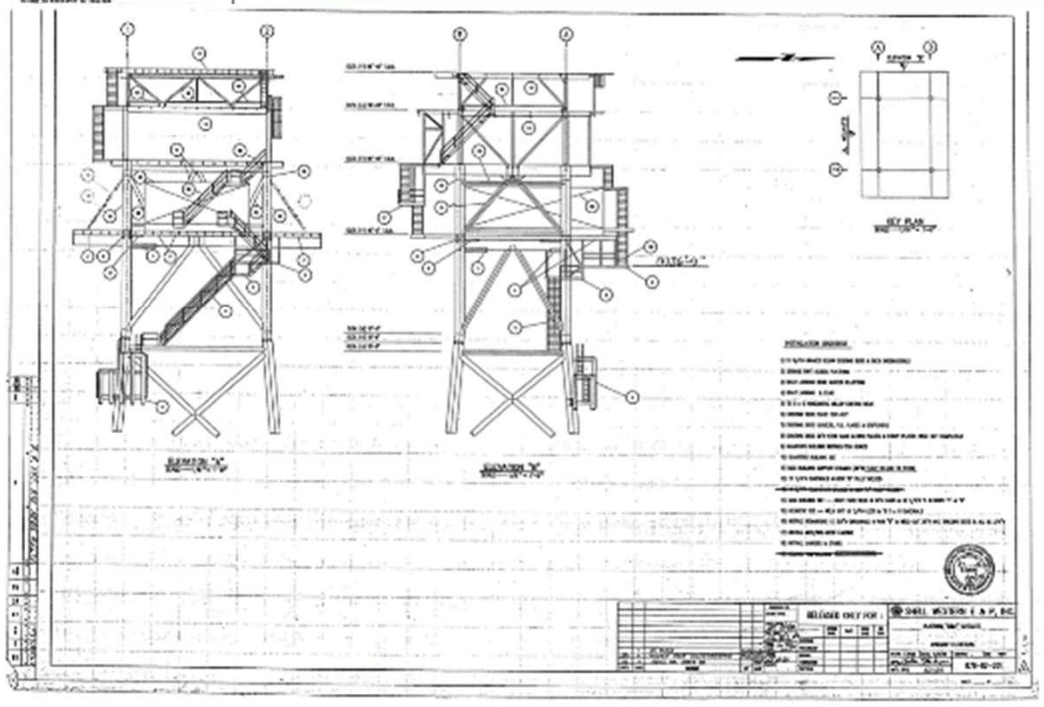
PLATFORM EMMY SATELLITE PLATFORM

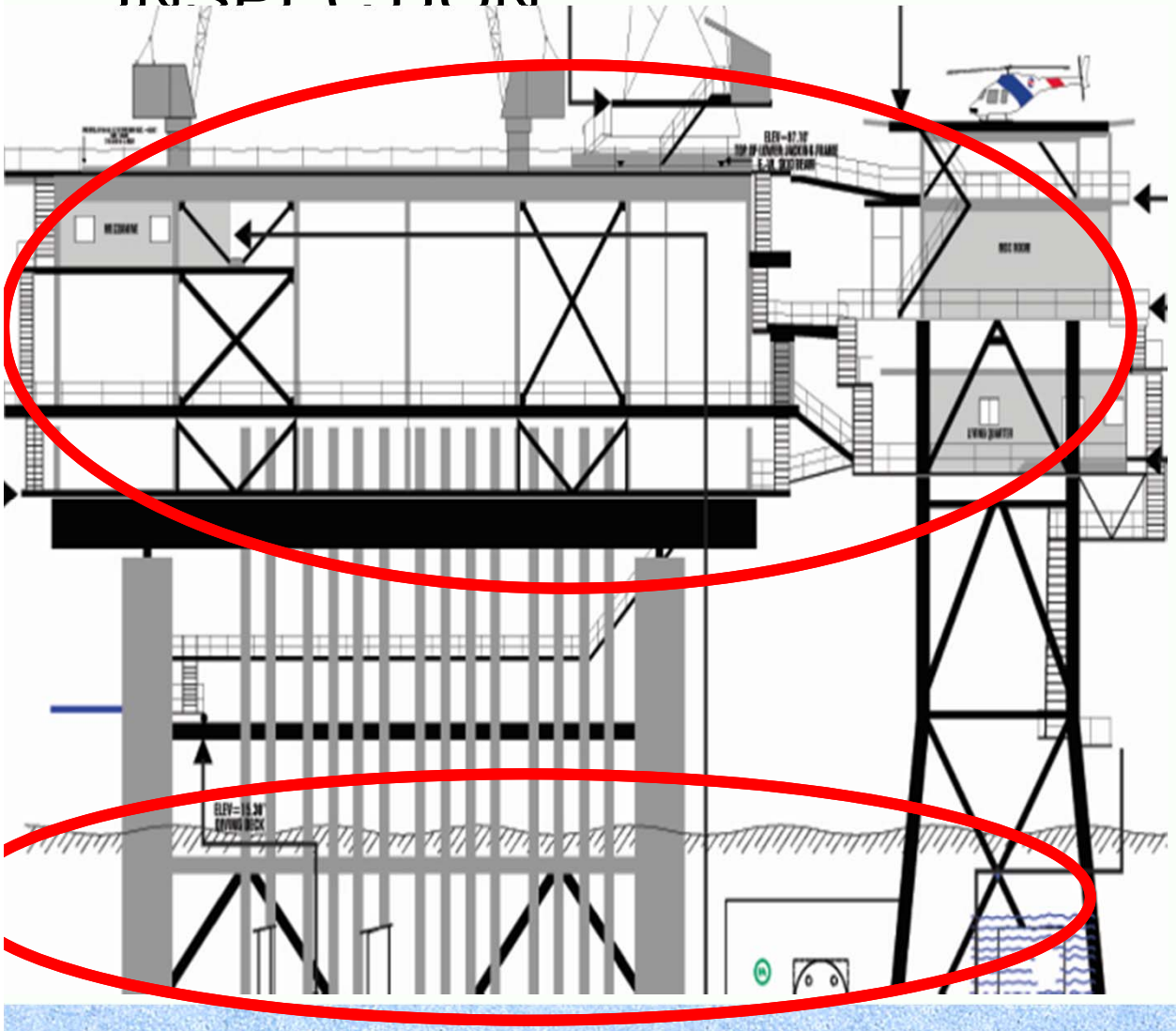


1980

1989



GETTING THE MOST OUT OF SUBSEA INSPECTION

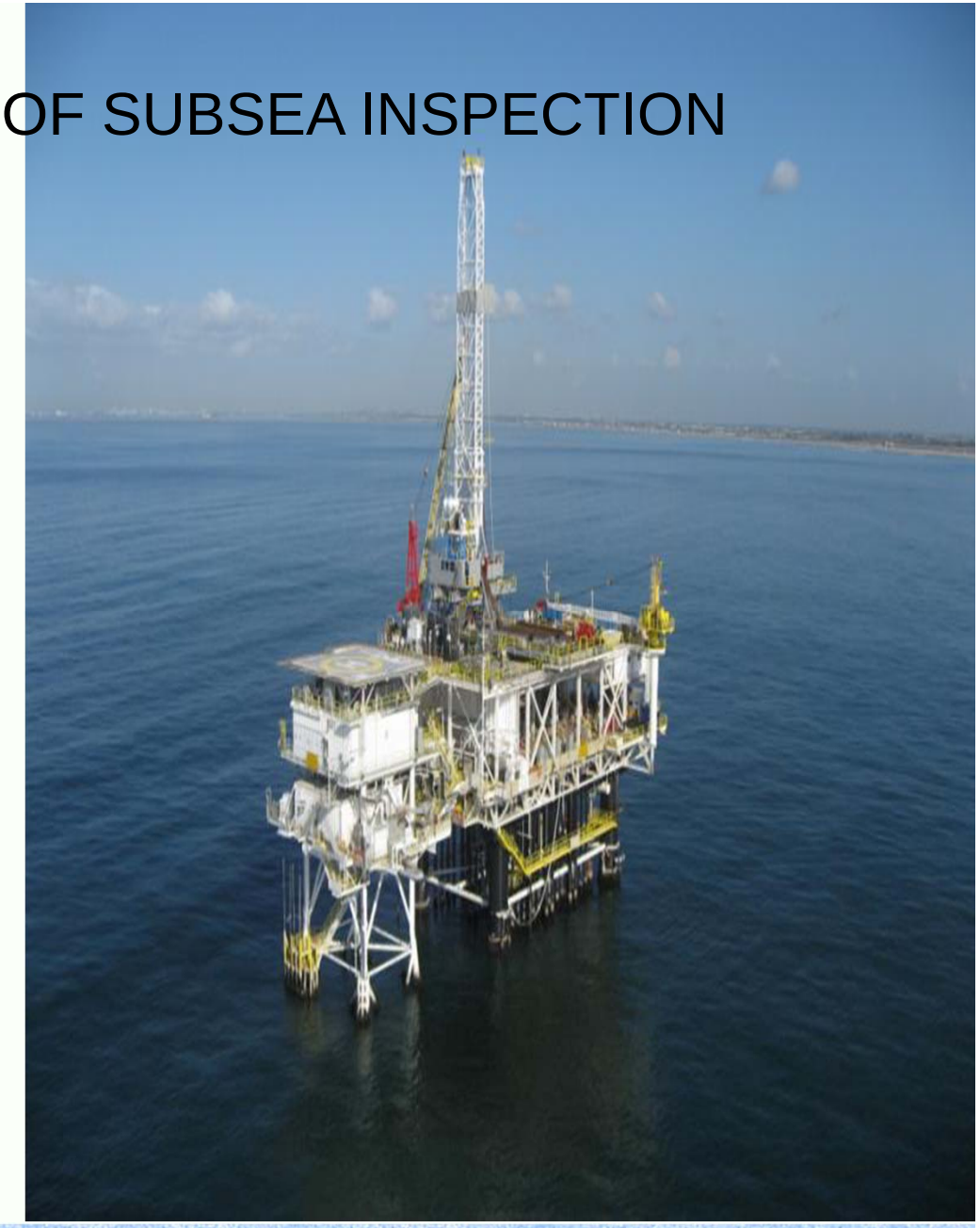


- Level I: Topsides survey

- Level II: General underwater visual inspection
- Level III: Underwater Visual inspection of pre-selected areas
- Level IV: Underwater non-destructive examination of pre-selected areas

GETTING THE MOST OUT OF SUBSEA INSPECTION

- Platform Emmy is required to have the Level II, III & IV inspections on a 5 year cycle.
- Engineering evaluation requires detailed understanding of the past findings, inspection history, and structural analyses in order to choose the correct joints and inspection techniques
- Platform Emmy has 5000+ pages of historical analysis documentation mostly in narrative form.



GETTING THE MOST OUT OF SUBSEA INSPECTION

- Documentation arranged by year or data type, not joint or member
- Work completed across several decades by different contractors
- How can we choose the most efficient program and choose the right joints/members?

AQUEOS

Weld Mag Particle Survey #4

Job Number: 13-013
Date: 05/28/13
Inspection Level: API Level IV

Structure Name	Area	Block	Name	Operator
Pit Emmy	PRC	425	Huntington Beach	Oxy

Location					Inspector (1)	Inspector (2)	MT Performed?	DVD Number
	B3 -23 HD TO	C3.5	-23					
	B3 NODE				Barr		YES	MAG 01

Member Diameter	12"	Weld Geometry	Flat	Overall Condition	Fair	Estimated Loss of Definition	0-25%	General Corrosion	MUC

W,N or M	Clock	Comment: (Defect, L x W x D, additional details)
W,N & M	12:00	Slight Loss of weld definition. MUC throughout.
M	12:30	Hole like indication in toe of weld 1/8" diameter
W,N & M	1:00	Slight Loss of weld definition. MUC throughout.
W	2:00	Flat weld
N & M	3:30	LUC to MUC throughout.
W,N & M	6:00	Slight Loss of weld definition, 3 Stringer Cap pass, Flat weld.
W,N & M	6:30	Slight Loss of weld definition, 3 Stringer Cap pass, Flat weld.
W,N & M	7:00	Slight Loss of weld definition, 3 Stringer Cap pass, Flat weld.
W,N & M	9:30	Slight Loss of weld definition. MUC throughout.
W,N & M	10:00	Slight Loss of weld definition. MUC throughout.
W,N & M	11:00	Slight Loss of weld definition. MUC throughout.

Photo/Sketch:

Comments

1. No previous inspection report
2. Hole type indication in toe of weld 1/8" diameter

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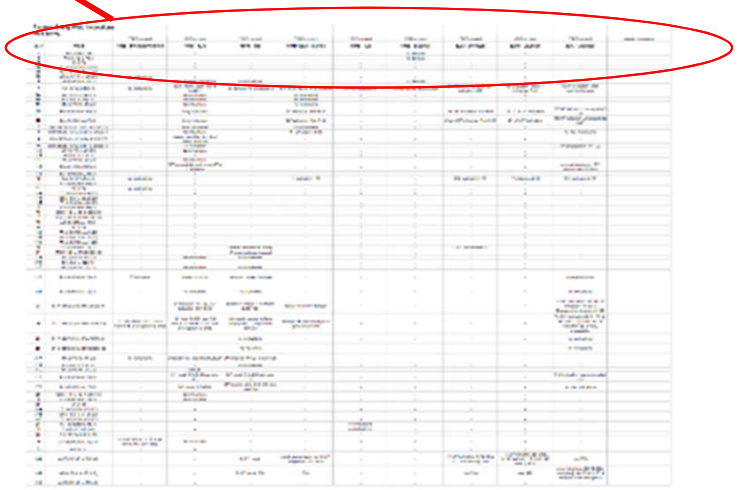
A NOVEL APPROACH

- Qualitative data is analyzed using summary maps
  - Visually represent what has been inspected to show the distribution of inspection data point
  - Anomaly patterns can emerge as a function of orientation and platform geometry
- Quantitative data is analyzed using a database and scoring algorithm
  - Anomaly size, Propagation, Stress ratio, Inspection history, Corrosion
  - Several thousand data points are catalogued and entered into the database
  - All data is converted from narrative to measurable fields

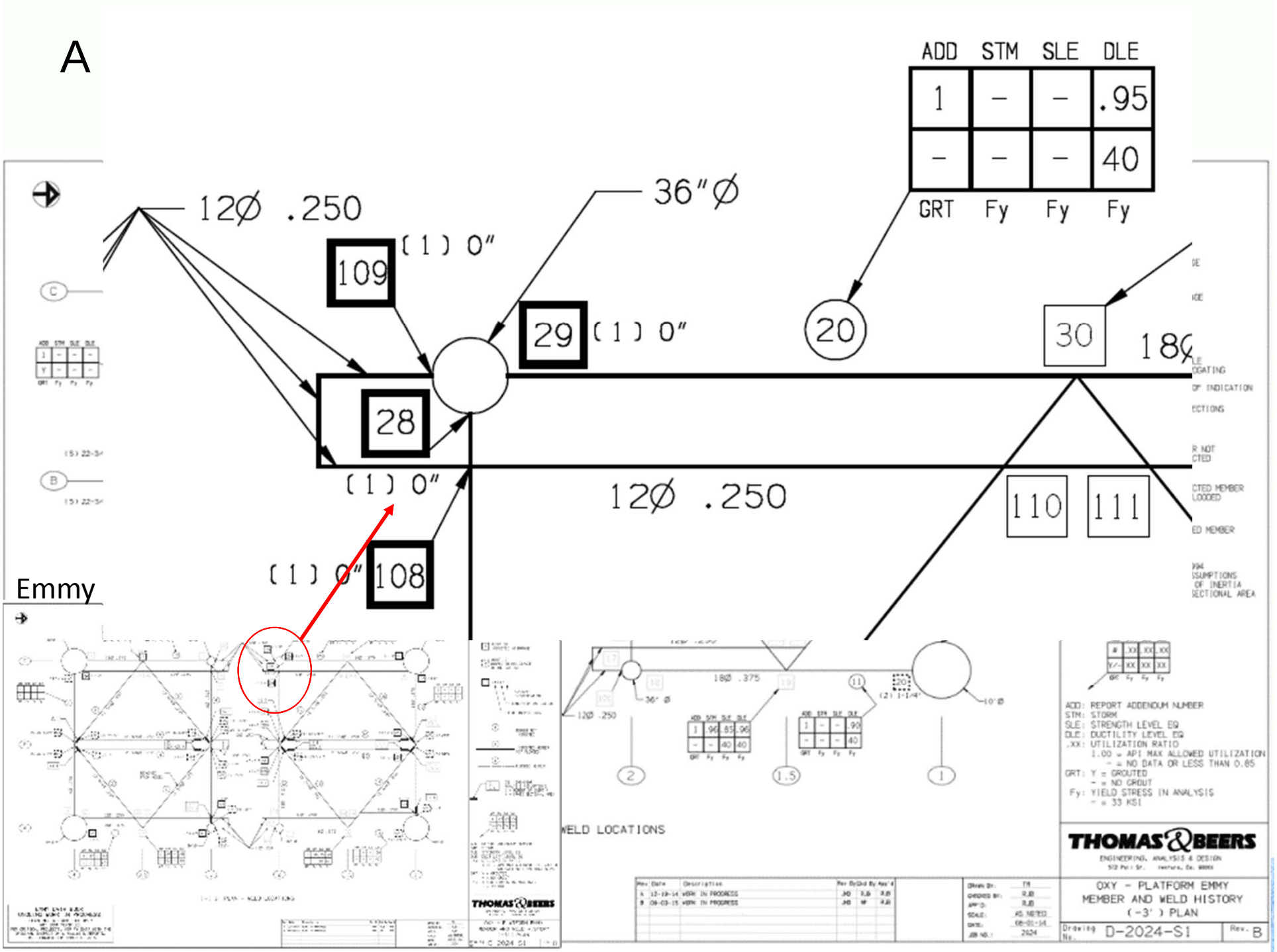
A NOVEL APPROACH: MEMBER HISTORY

.#	Weld	YR/Comment 1985 - Phillips/Aminoil	YR/Comment 1987 - IDS	YR/Comment 1990 - IDS	YR/Comment 1991/1992 - Martek	YR/Comment 1993 - IDS	YR/Comment 1995 - Ecomar	YR/Comment 2003- Divecon	YR/Comment 2008 - Divecon	YR/Comment 2013 - Aqueos
	A4(-3) HZ to B4	-	-	-	-	-	no damage	-	-	-
	A4(-3) HZ to A3.5	-	-	-	-	-	no damage	-	-	-
	A3.5(-3)	-	-	-	-	-	-	-	-	-
A	A3.5(-3) VD to A4(-23)	-	-	-	-	-	-	-	-	-
B	A3.5(-3) V to A3.5(-23)	-	-	-	-	-	-	-	-	-

Weld History Spreadsheet



A


ADD STM SLE DLE
1 - - .95
- - - 40
GRT Fy Fy Fy
12Ø .250
36"Ø
109
(1) 0"
29
(1) 0"
20
30
28
(1) 0"
12Ø .250
110
111
(1) 0"
108
Emmy
WELD LOCATIONS
THOMAS & BEERS
OXY - PLATFORM EMMY
MEMBER AND WELD HISTORY
(-3') PLAN
Drawing No. D-2024-S1
Rev. B

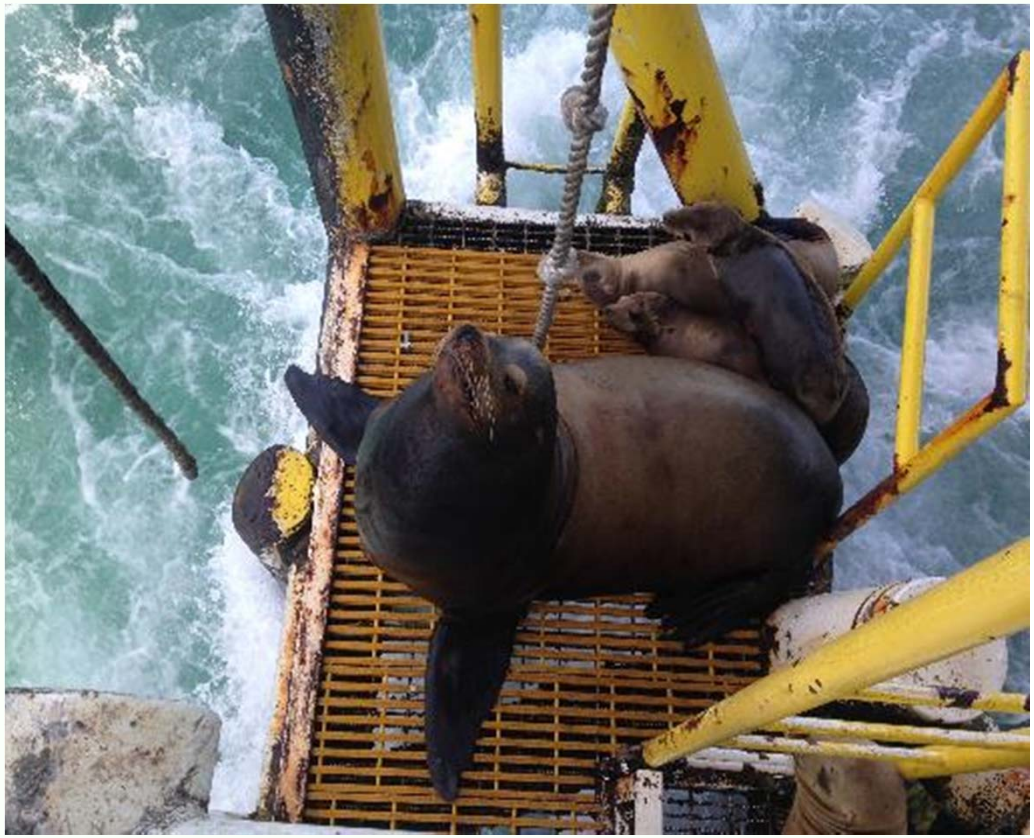
A NOVEL APPROACH: QUANTITATIVE ANALYSIS

I.D.	Diameter (in.)	Elevation (ft)	Inspected?	#	Last Inspected	Indication Size (in.)	Percent Remaining	Assumed Moment of Inertia	Assumed Area	Location of Indictation (Clock)	Status	Status Rank	Orientation	Orientation Rank	Storm	DLE	SLE	Comments (Latest)	1	2	3	4	5	6	7	8
Elevation (ft)			Inspected?	#	Last Inspected	Indication Size (in.)	Percent Remaining	Assumed Moment of Inertia	Assumed Area	Location of Indictation (Clock)	Status	Status Rank	Orientation	Orientation Rank	Storm	DLE	SLE	Comments (Latest)								
				1	2	3					4		5		6	7										
-3			N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	H_z	1	0	0	0	-								
5	18	-3	Y	9	2013	12	78.8%	100.0%	100.0%	12:00	P	3	H_z	1	0	0	0	12:00 restricted access	1	11	6.4	30	5	0	0	
6A	18	-3	Y	2	1992	0	100.0%	100.0%	100.0%	-	-	0	V_D	3	0	0	0	No indications	8	15	0	0	15	0	0	
6B	18	-3	Y	2	1992	0	100.0%	100.0%	100.0%	-	-	0	V	3	0	0	0	No indications	8	15	0	0	15	0	0	
6C	18	-3	Y	2	1992	0	100.0%	100.0%	100.0%	-	-	0	V_D	3	0	0	0	No indications	8	15	0	0	15	0	0	
6D	18	-3	Y	5	2013	22.75	59.8%	100.0%	100.0%	4-8:00	P	3	H_D	2	0	0	0	22 3/4" indication, propogated 3 1/4"	5	11	12	30	10	0	0	
6E	18	-3	Y	5	2013	22.75	59.8%	100.0%	100.0%	3-8:00	P	3	H_D	2	0	0	0	22 3/4" indication, propogated 3 1/4"	5	11	12	30	10	0	0	
7	12.75	-3	Y	2	1992	0	100.0%	1.0%	100.0%	-	-	0	H_D	2	0	0	0	Short indication	8	15	0	0	10	0	0	
8	12.75	-3	Y	3	2013	4.5	88.8%	1.0%	100.0%	5-6:00	P	3	H_D	2	0	0	0	No new indications	7	11	3.4	0	10	0	0	
9	12.75	-3	Y	1	1987	0	100.0%	1.0%	100.0%	-	-	0	H_D	2	0	0	0	Missing section, bent in the area, repaired	9	16	0	0	10	0	0	
10	12.75	-3	Y	2	2013	14.25	64.4%	1.0%	100.0%	10-2:00	P	3	H_D	2	0	0	0	14 1/4" indication, propogated 3 1/4"	5	11	12	30	10	0	0	
11A	18	-3	Y	1	1987	0	100.0%	100.0%	100.0%	-	-	0	V	3	0	0	0	No indications	8	15	0	0	15	0	0	
11B	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	V_D	3	0	0	0	No indications	8	15	0	0	15	0	0	
11C	18	-3	Y	1	1987	0	100.0%	100.0%	100.0%	-	-	0	V	3	0	0	0	No indications	8	15	0	0	15	0	0	
11D	18	-3	Y	2	2013	19.5	65.5%	100.0%	100.0%	6-8:00	P	3	H_D	2	0	0	0	22 3/4" indication, propogated 3 1/4"	5	11	12	30	10	0	0	
11E	18	-3	Y	1	1987	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	Short indication	8	15	0	0	10	0	0	
12	10	-3	Y	5	2013	1	96.8%	100.0%	100.0%	2:00	P	3	H_D	2	0	0	0	3/4" indication 2:00	5	11	1	30	5	0	0	
13	10	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	-	10	21	0	0	10	0	0	
14	12.75	-3	Y	1	1987	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	No indications	9	16	0	0	10	0	0	
14A	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	V	3	0	0	0	No indications	8	15	0	0	15	0	0	
14B	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	10-2:00	P	3	H_D	2	0	0	0	No new indications, 3/4" propogated at 10 2:00	5	11	12	30	10	0	0	
14C	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	-	10	21	0	0	10	0	0	
15	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	-	10	21	0	0	10	0	0	
16	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	-	10	21	0	0	10	0	0	
17	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	-	10	21	0	0	10	0	0	
18	18	-3	N	0	*1963*	0	100.0%	100.0%	100.0%	-	-	0	H_D	2	0	0	0	-	10	21	0	0	10	0	0	

Scoring algorithm

RESULTS AND PATH FORWARD

- Created an evergreen process to quantitatively and qualitatively maintain Platform Emmy's Structural Inspection Program
- Continue vetting the program through CRC and Thomas and Beers collaborative team
- Complete inspections and feed data back into algorithm for next planning cycle



BACKUP

ABSTRACT VERSION

Platform Emmy is located a little over a mile off the coast of Huntington Beach. The platform has changed ownership several times since its construction in 1961, and each owner has aggressively maintained a preventative maintenance program on the structure. This maintenance history has resulted in a massive compendium of structural data that must be reviewed and evaluated in order to perform the most effective API RP 2A Level III and Level IV inspections.

The platform structural analysis project compiled the large data set and developed a database to perform a rigorous quantitative and qualitative analysis of the platform condition. This data was used to develop a prioritization matrix for inspection and was translated into structural summary drawings to give a visual representation of the collected data. The overall project has allowed for more intuitive inspection planning, more cost effective deployment of resources, and most importantly greater reduction in risk by prioritizing joints for subsea inspection.