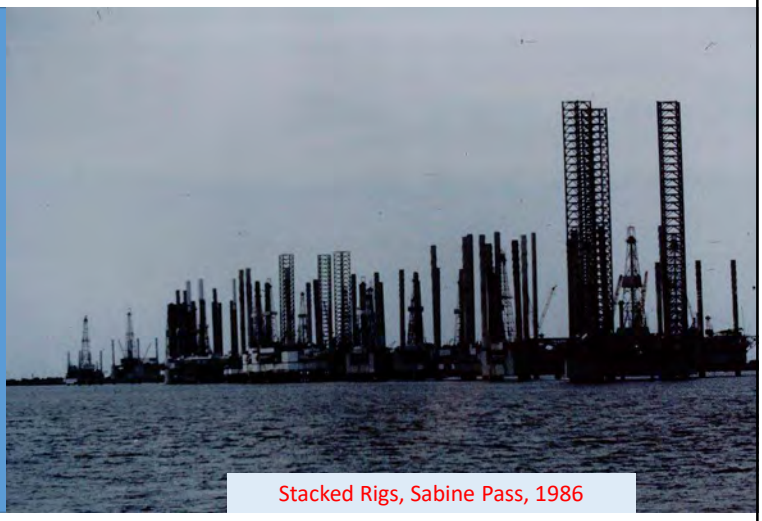
"I'll Drink to those Legs"



Stacked Rigs, Sabine Pass, 1986

John Stiff and Dr. Malcolm Sharples
City, University of London, The Jack-Up Platform 5th – 6th September 2023

I'll Drink to Those Legs!

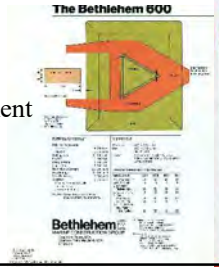
- Captain David Noble
- Born 21st May 1911
- Died 16th July 1980 age 69 – after a VERY long life
- Used to "encourage" people to have a drink to a number of rigs – "To the One-Leg Rig", "To the Two-Leg Rig", "To the ……."
- You get the Picture
- I did NOT have personal experience, but I certainly did have a drink with him
- Malcolm Sharples DID participate in this "Game" with him.

One Leg - Original

Elf Oscillating Tower –
BUT IT'S NOT A JACK-UP

One Leg – Our Version

- Bethlehem 600
- OK, Not Built but ….
- Sharples and I did Design Review of Jim Steele's FULL SET OF **HAND CALCULATIONS** (50 mm thick Binder)
  - Leg Structure
  - Hull Structure
  - Preload System
  - Piping
  - Mat
  - Drilling Equipment
  - Etc.



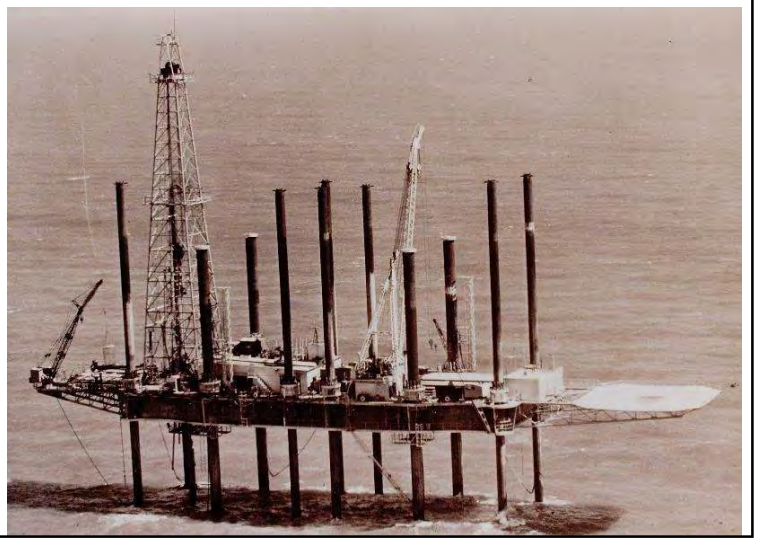
ALSO RAN ….(and built) Arup Concept Elevator (ACE) Platform The first ACE platform, the Hang Tuah , was installed in West Natuna Sea in 2001

Two Legs - Original

- McAlpine Brent C Sea Tank
- Built Ardyne Point, Scotland on WEST coast (1976)
- Towed around Scotland from west coast north of Orkney Islands to Frigg Field

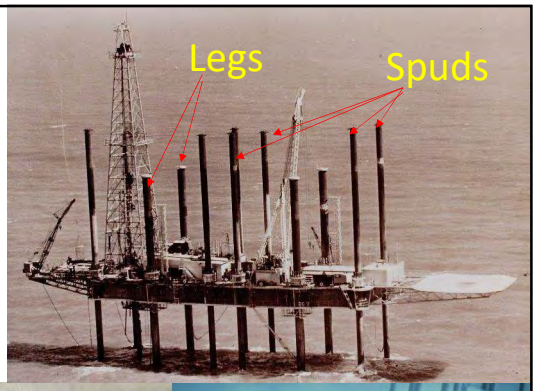
Two Legs – Our Version

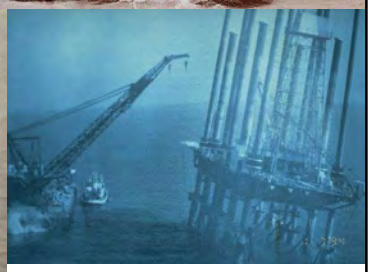
- **USE YOUR IMAGINATION!!!**
- **OK, Maybe needs an explanation???**



Two Legs – Our Version

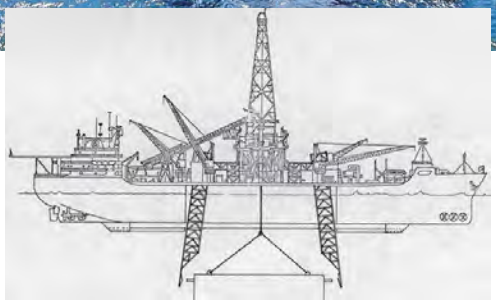
- Mr. Gus
- Self Erecting Platform – Airgap was fixed
- Built as TWO Units (Tender and Drilling)
- Each unit had 4 SPUDS (through the mat) and
- **2 LEGS (connected to the mat)**
- Bethlehem Hull 1, built Beaumont 1955
- BAD problems as two units
- "Glued" the two parts together
- Capsized 1957 coming off location
- Mat Supported, Gripper Jacking System
- Non-Buoyant Hull
- Towed on Mat





Two Legs – Alternative Two "Leg" Ship

- It had Two Legs and they Jacked Up & Down – so it counts??????
- LeTourneau "Docking Legs" and Jacking Motors
- The CIA Funded "Project Azorian" or "Jennifer Project"
- "Hughes Glomar Explorer"
- Global Marine and Howard Hughes
- "Manganese Nuggets on the seafloor"
- 1968 sinking Russian Submarine in 16,000' water ~1,000 miles NW of Hawaii
- Operation in 1974 partially successful

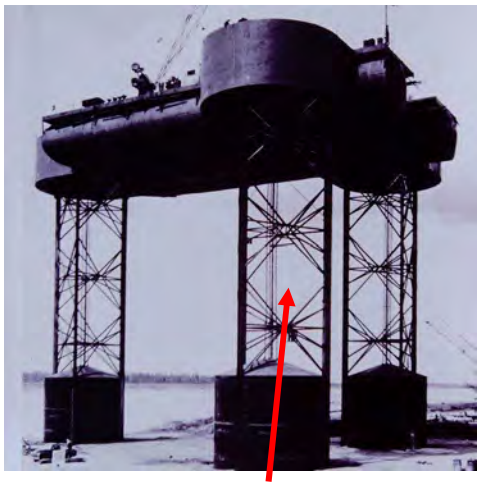


Two and a HALF Legs – Our Version

- Glomar Labrador 1
- North Sea
- 23rd June 1988
- Hit by Irving Forest

- N. B. Irving Forest sank in January 1990 in N. Atlantic

Three Legs (Lots of choices)

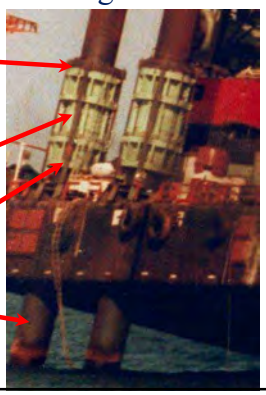


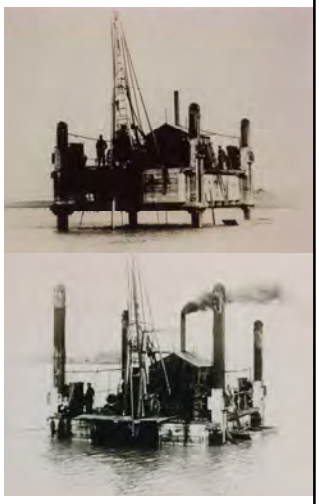
- Note the "missing" Horizontal Brace quickly added after jacking trials

- R. G. Letourneau designed "**Scorpion**"
- First MODERN Jack-Up
- Delivered 2nd November 1955
- Zapata/George H. W. Bush
- 3 Legs, 3 Chords / Leg
- Electric Jacking System
- Spudcans
- "Sale or Return"

A Little Digression – Why the First "MODERN" Jack-Up

- Plenty of previous Jack-ups
- Even Mobile Offshore Drilling Jack-Ups (See Offshore 51 to follow)
- Older Jack-Ups had LOTS of legs
- Old jacks had limited Grip and Oomph (technically speaking)
- LeTourneau managed to get lots of lift through electric motors

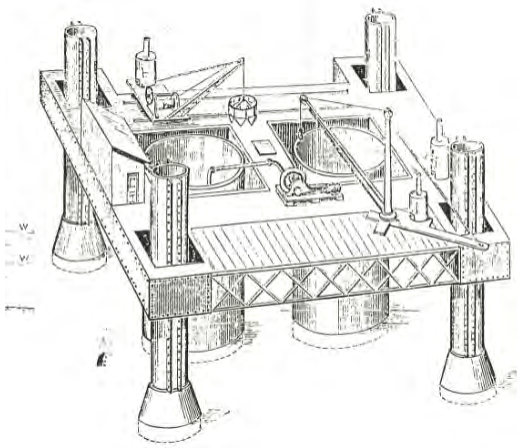




Port Weller Harbour Drilling Jack-Up used winches to raise the hull (1914)

Four Legs (lots)

Courtesy of Dr. Richard Stonor



- First real Jack-up (1884)
- Four built (?mass produced?)
- Own Power Supply
- Proper Jacking System - Hydraulic, not Rack and Pinion (but certainly not Manual!)
- Used to Install Foundations for New Tay Bridge

But I think we need some “Honourable Mentions”

- Mr. Gus II
- Bethlehem Hull 2 delivered 1957
- Bethlehem hydraulic jacking system - effective (but leg pin holes - bad)
- Operating after 2000 – but an ignominious end
- One of the first MAJOR papers on Jack-up design (SNAME 1957)

Engineering Problems Related to the Design of Offshore Mobile Platforms

By E. C. Rechtin,[1] Member, J. E. Steele,[2] Associate Member, and R. E. Scales,[3] Visitor

The authors outline the problem of ascertaining the forces acting upon mobile drilling platforms operating in the Gulf of Mexico. Limitations of space have made it impossible to consider the many other problems of design, such as stability, structural details, logistics and drilling techniques, for example. The forces generated by wind and waves are uncertain, owing to the many uncontrollable variations in weather and local geography. An attempt, however, has been made to bring together and to develop workable theories which have been generally accepted at the present time. The ultimate resistance to these tremendous forces must be developed by the underwater soil. The Gulf of Mexico has very extensive areas where the geophysical surveys have shown probabilities of oil deposits, but the soil itself is of extremely variable nature. Predictions of the soil behavior at any particular location can only be made in the most general way and soil borings are necessary to develop any quantitative data. Some outstanding examples of failure of existing platforms have been given, which serve to emphasize the authors' contention that this is but an interim report, and that much is still to be done to arrive at a complete solution of the problem of resisting the unpredictable forces of wind and wave, when utilizing unknown soils as foundations for drilling platforms.

Introduction

Naval architecture has always had to draw upon the contributions of other fields of engineering to complete its concepts. With the advent of the mobile drilling platform for petroleum or other prospecting in waters over the continental shelves of the world this reliance has extended into many hitherto remote professions. In addition to the usual staff of structural, mechanical and electrical engineers; the specialists on galleys, painting, floor covering, insulation and joiner work; the experts on heating, ventilation and air conditioning, we now have to enlist the advice and co-operation of a new group. This consists of such esoteric professions as petroleum engineers, oceanographers, meteorologists, geologists, soils and foundation engineers, statistical mathematicians and just plain crystal ball gazers.

It may seem to many that the design of this type of equipment is something confined to a small group of visionary specialists haunting the Gulf Coast, but even a quick study of the map of the world showing potential offshore production areas, Fig. 1, will demonstrate how world-wide this problem may become. There will be little, if any, standardization possible, as the controlling factors and conditions of water depth, soils, weather, climate and logistics vary all over the world, between such extremes as Alaska and the Persian Gulf.

This paper is an attempt to set forth these governing conditions in a limited sense, outlining those that obtain in the Gulf of Mexico and to describe some of the results achieved following one particular engineering concept.

When our company began the study some years ago of the problem of mobile-platform construction, the potential demand was apparent, but the lack of engineering information and precedent was

[1] General Manager, Shipbuilding Division, Bethlehem Steel Company, Gulf District (Deceased).

[2] Chief of Design, Shipbuilding Division, Bethlehem Steel Company, Beaumont Yard, Beaumont, Texas.

[3] Engineer, Shipbuilding Division, Bethlehem Steel Company, Beaumont Yard, Beaumont, Texas.

Presented at the Annual Meeting, New York, N. Y., November 14-15, 1957, of The Society of Naval Architects and Marine Engineers.

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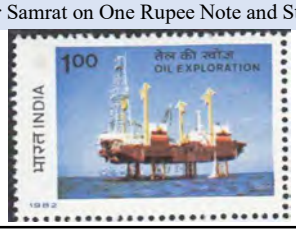
And some “Honourable Oddities”

- Transworld Rig 60 (1971)
- Jack-Up Submersible

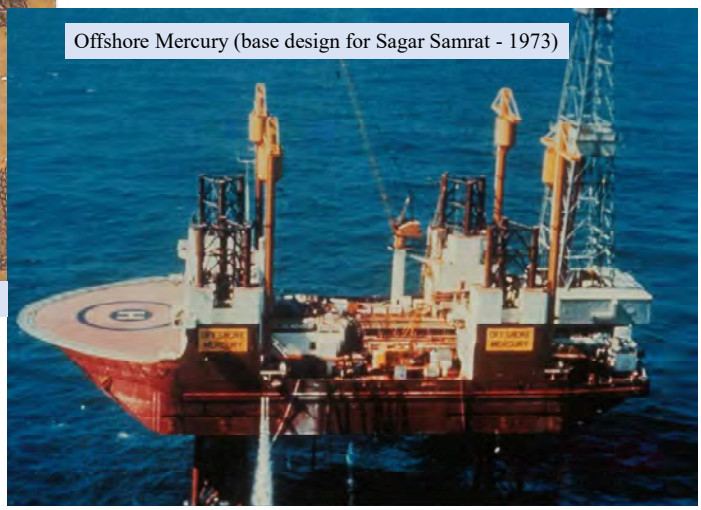
- Transworld Rig 61 (1970) – (my personal favourite)
- Jack-Up Semi-Submersible

Honourable Heartfelt

Sagar Samrat on One Rupee Note and Stamp



Offshore Mercury (base design for Sagar Samrat - 1973)



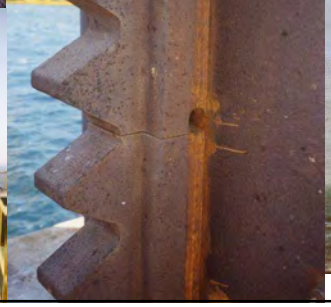
Five Legs

- Isle de France
- IHC Gusto design
- Built 1965
- Scrapped 1989

Six Legs

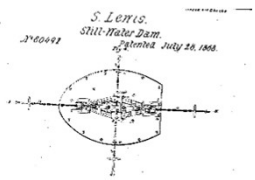
- Transocean1
- First Jack-Up specifically designed for North Sea Operations (1965)
- Tubular legs with 2 racks

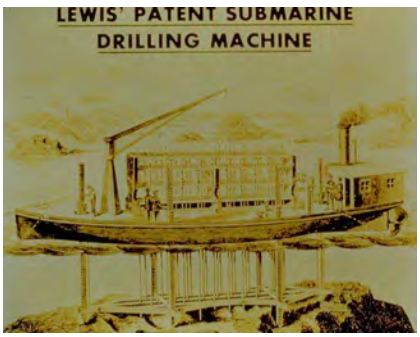


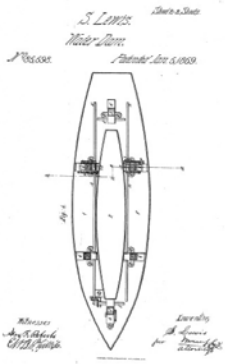



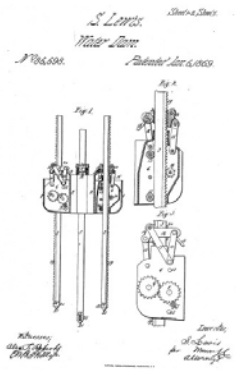

NOT a Valid Six Leg Jack-Up

- The "Lewis" Jack-Up Patented 1869
  - Never built
  - Not really practical – Hand Crank Jacks
  - Designed for removal of "Hell Gate" Rock in New York







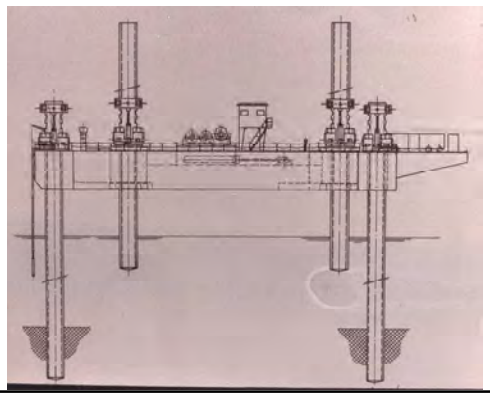


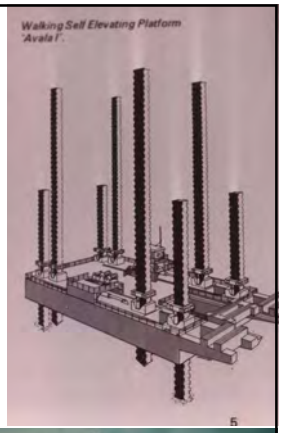
Seven Legs?

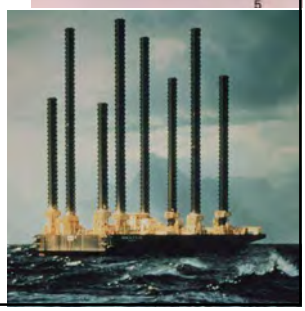
- **IF** one was part of this game, one suspects the participants may have been having a problem focusing
- Sorry, nothing suggested

Eight Legs

- Avala 1
- IHC Gusto design - 1978
- WALKING JACK-UP
- Designed for pier construction

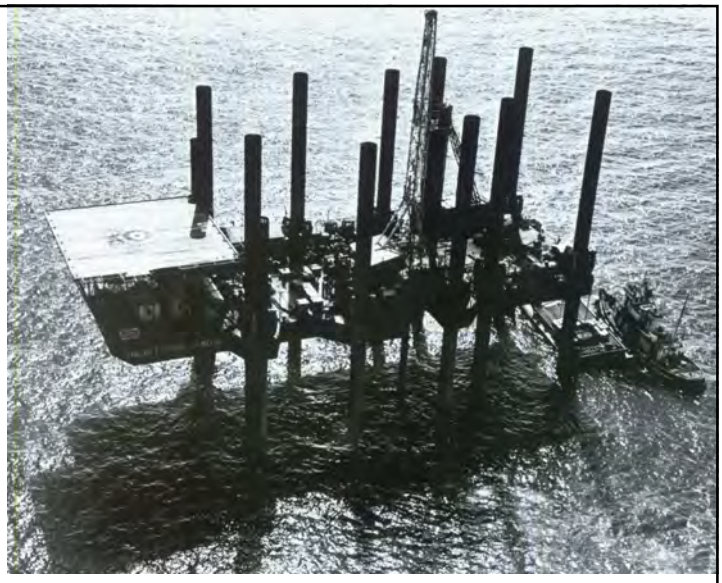






Ten Legs

- Offshore Rig 51
- **First Mobile Offshore Drilling Jack-Up (1954)**
- DeLong Jacking system – 6' OD legs



Twelve Legs

You will note I am out of order – as will become apparent in a moment

- Mr. Louie
- Designed by Emile Brinkmann. Delivered in 1959
- First Well in German North Sea (1964 – Mr. Cap drilled first well in UK North Sea the same year)

Eleven Legs

OK, a bit of a Cheat

- Mr. Louie was NOTORIOUS for breaking legs, hence the "11-Legged Rig"

Fourteen Legs

- Offshore Rig 52
- Built 1955
- Two separate units welded together
- Retired 1980

More than 14 legs Legs

- San Marco (with Santa Rita – ex Scarabeo LeTourneau hull 9 (1958) as control platform)
- Built 1957, DeLong jack-up, 22 legs (but may be only 18)
- Italian Space Agency Rocket Launch Platform, Malindi, Kenya (named for Professor Luigi Broglio)
- 27 launches between 1964 and 1988
- Inactive but possible use by Russians