M/B Project CEIP 81-8

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WEST COAST PLATFORM
DEMAND & SITING
STUDY

Part 1 - Platform Demand

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Part 1 - Platform Demand

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PREFACE

Exxon Corporation and Brown & Root/Wright Schuchart Harbor Co. have proposed platform jacket assembly yard facilities for Humboldt Bay. The facility proposed by Exxon is specific to the need for 3 to 4 steel jackets for use in developing the Santa Ynez Unit oil fields in the Santa Barbara Channel area. The need for the Exxon facility arises due to bridge constraints at the existing Kaiser assembly yards in the San Francisco Bay area where previous jackets have been built. The Brown & Root proposal is intended to be specific to platforms in the Santa Maria Basin.

Due to other federal offshore oil leasing activity and discoveries, the demand for platform jackets on the West Coast likely exceeds that reflected by the specific proposals mentioned above.

Part One of the study reviews the potential additional demand for platform jackets on the West Coast. Platform fabrication and assembly operations and facilities are described, and two possible market regions for a West Coast yard, Southern California and Alaska, are reviewed. Part Two of the study will assess the siting needs that demand may generate, and will review siting alternatives for the combined demand at various locations around Humboldt Bay.

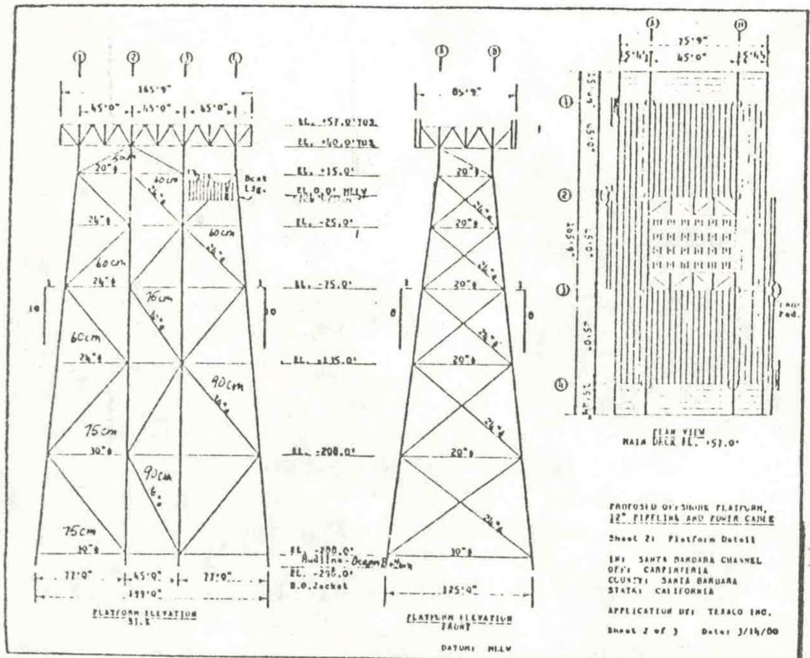
Table of Contents

CHAPTER 1

Once an oil discovery has been made and the size of the discovery has been delineated and determined to be commercially viable, production drilling is done from a fixed platform--a stationary structure that is placed over the field from which numerous individual wells are drilled. Unlike exploratory drilling rigs, production platforms remain in place for the 20 to 30 year life of the field. This section discusses the different types of platforms and the facilities required to build them.

Steel Jacket Platforms

Steel jacket platforms are the most widely used type of platform for offshore production drilling. These are the conventionally designed platforms with a rigid steel latticework base (Fig. 1.1). The latticework base or jacket is assembled on its side and either floated or barged to the oil field (Fig. 1.2). Once on site, the jacket is upended and lowered to the sea bottom. Piles are driven through the inside of the corner members of the frame into the sea bed to secure the jacket base. A derrick barge is then brought alongside and the decks are set. Modules containing the drilling rig, production equipment, support facilities, crew accommodation and a helicopter pad are also set into place. Installation usually takes two to 18 months,



Environmental Criteria

1. Design Criteria

Wave Height	= 45 ft
Wave Period	= 12 sec
Drag Coefficient	= 0.6
Inertia Coefficient	= 1.5
Wind Speed	= 75 kts
Total Current - Surface	= 2 kts
Mid-Depth	= 1.6 kts
Bottom	= 1.3 kts
Total Tide	= 8.5' above MLLW

Design wave data and coefficients are in accordance with API RP 2A. The design wind speed is from Union's Hueneme Field-Plan of Development. The design total current and total tide is from Chevron's Santa Clara Unit-Plan of Development.

2. Operating Criteria

Wave Height	= 30 ft
Wave Period	= 10 sec
Wind Speed	= 50 kts
Drag Coefficient	= 0.6
Inertial Coefficient	= 1.5
Total Current - Surface	= 2 kts
Mid-Depth	= 1.6 kts
Bottom	= 1.3 kts
Total Tide	= 5.3' above MLLW

Figure 1.1 Typical steel jacket platform (Texaco's Platform Habitat)

Source: Ref. No. 37

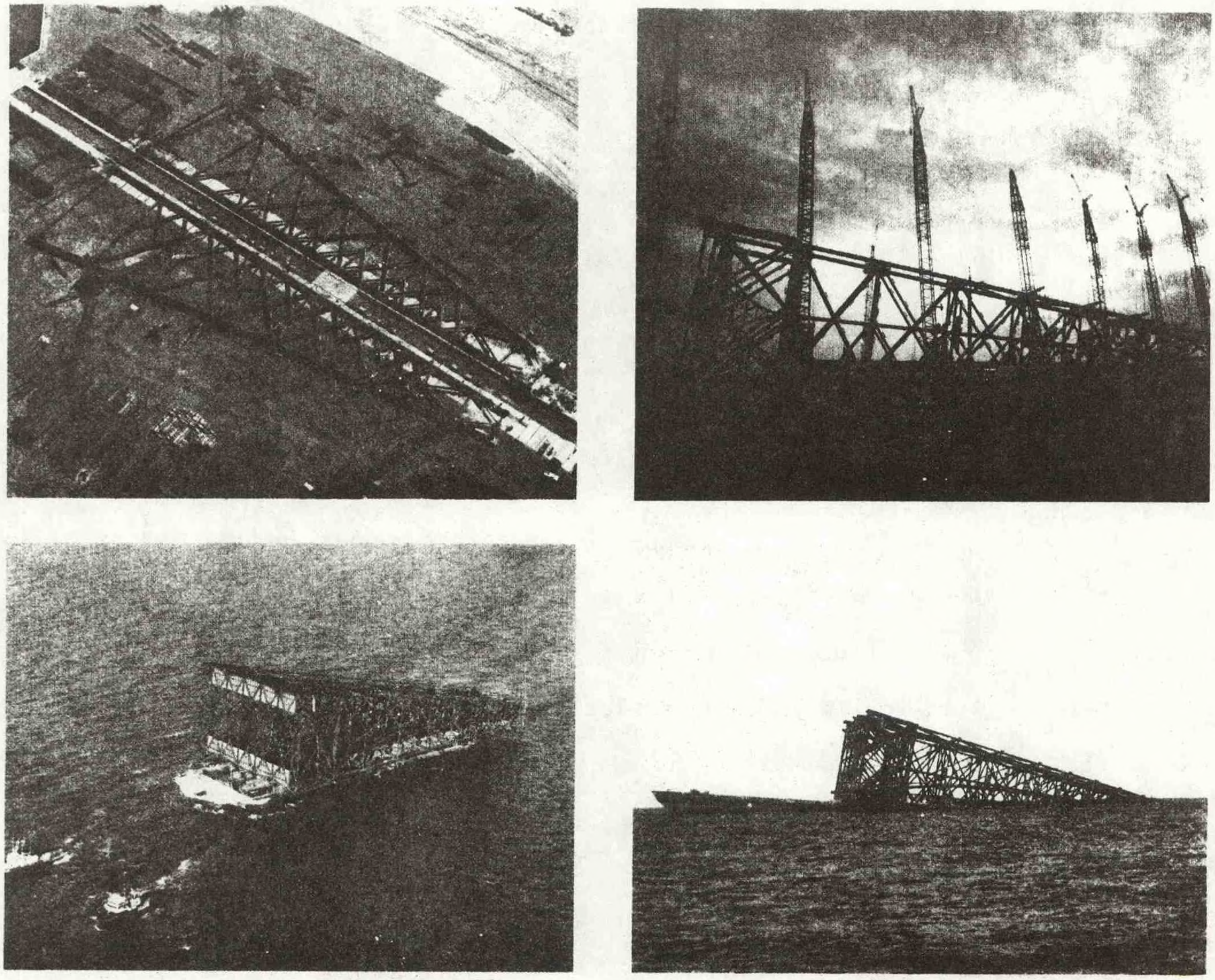


Figure 1.2 Assembly and barging sequence

Source: Ref. No.15

depending on the complexity of the operations, weather, equipment availability, etc.

Every attempt is made to minimize the amount of fabricating and assembling that is done at the offshore drillsite. Sites with deep water and high wind and wave conditions present special challenges. The deeper the water, the larger the platform, and the more ungainly it is to transport in one piece. Large plaforms can be segmented, but then sophisticated coupling systems need to be designed to allow mating of the segments in open water (1).

Platform Hondo's jacket, for example, was transported in two segments to the Santa Barbara Channel. The jacket was built at Kaiser Steel Corporation's shipyard in Oakland, California. The base section of the jacket measured 235 feet by 375 feet at its widest dimension, and when it was towed on the launch barge out of San Francisco Bay, it cleared the Oakland-Bay Bridge by 28 feet and cleared the Golden Gate Bridge by 40 feet. The sections of the Hondo jacket were fitted with hydraulic coupling flanges and stabbing cones mounted on the four external legs to guide the sections during the joining operation. The cost of the Platform Hondo jacket was $80 million. (See Figure 1.3)

Platform Cognac, in the deepest water of any platform (1025 feet) was installed in three sections in the Gulf of Mexico in 1978. An on-the-bottom acoustic transponder array and on-board computer system were used to guide the sections as they were being lowered and mated. (See Figure 1.4)

The base section measured 380 by 400 by 175 feet and weighed 14,000 tons. The mid-section was 282 by 310 by 315 feet high,

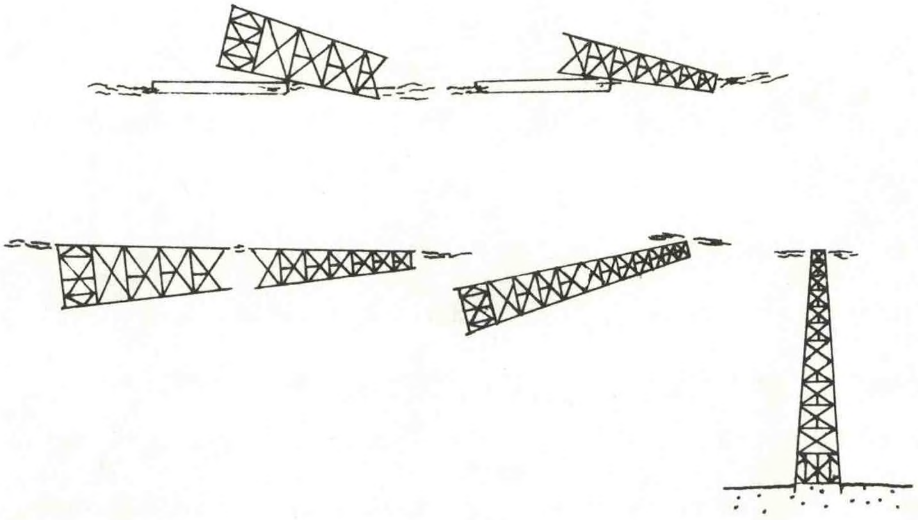


Figure 1.3 Hondo-type installation sequence

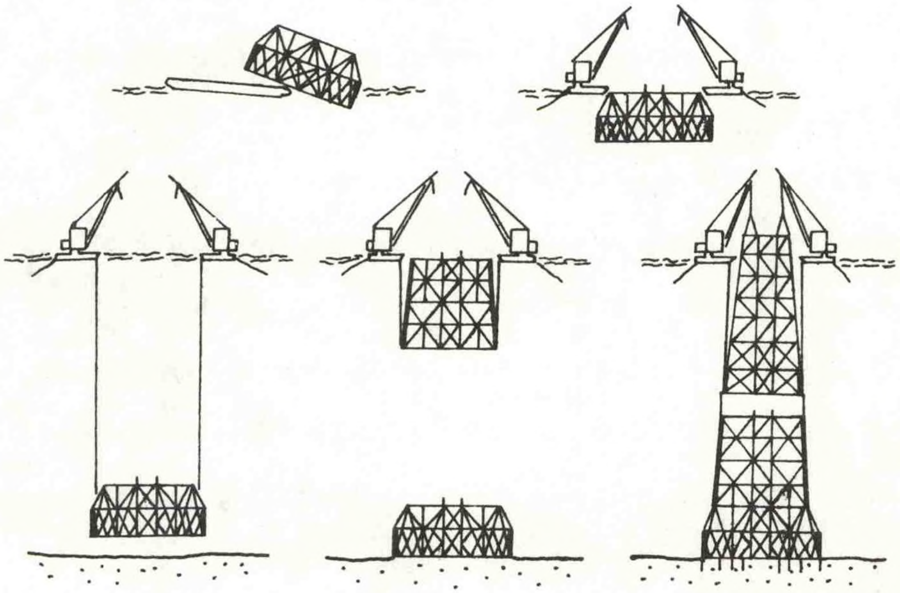
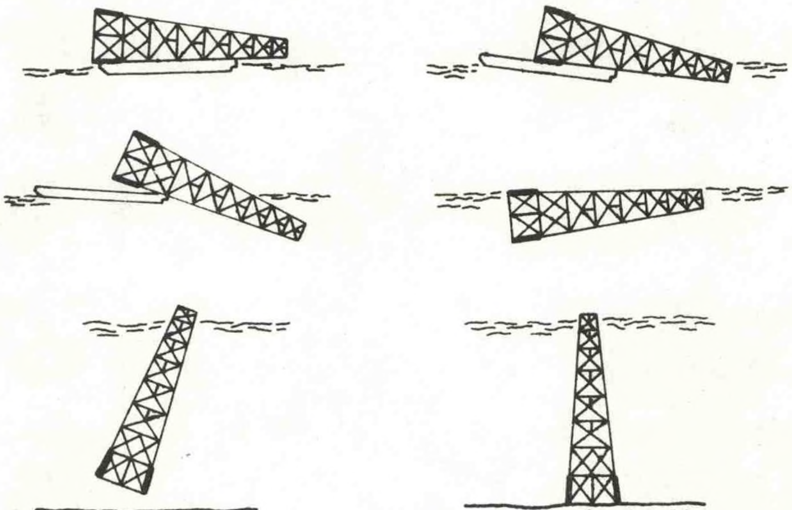
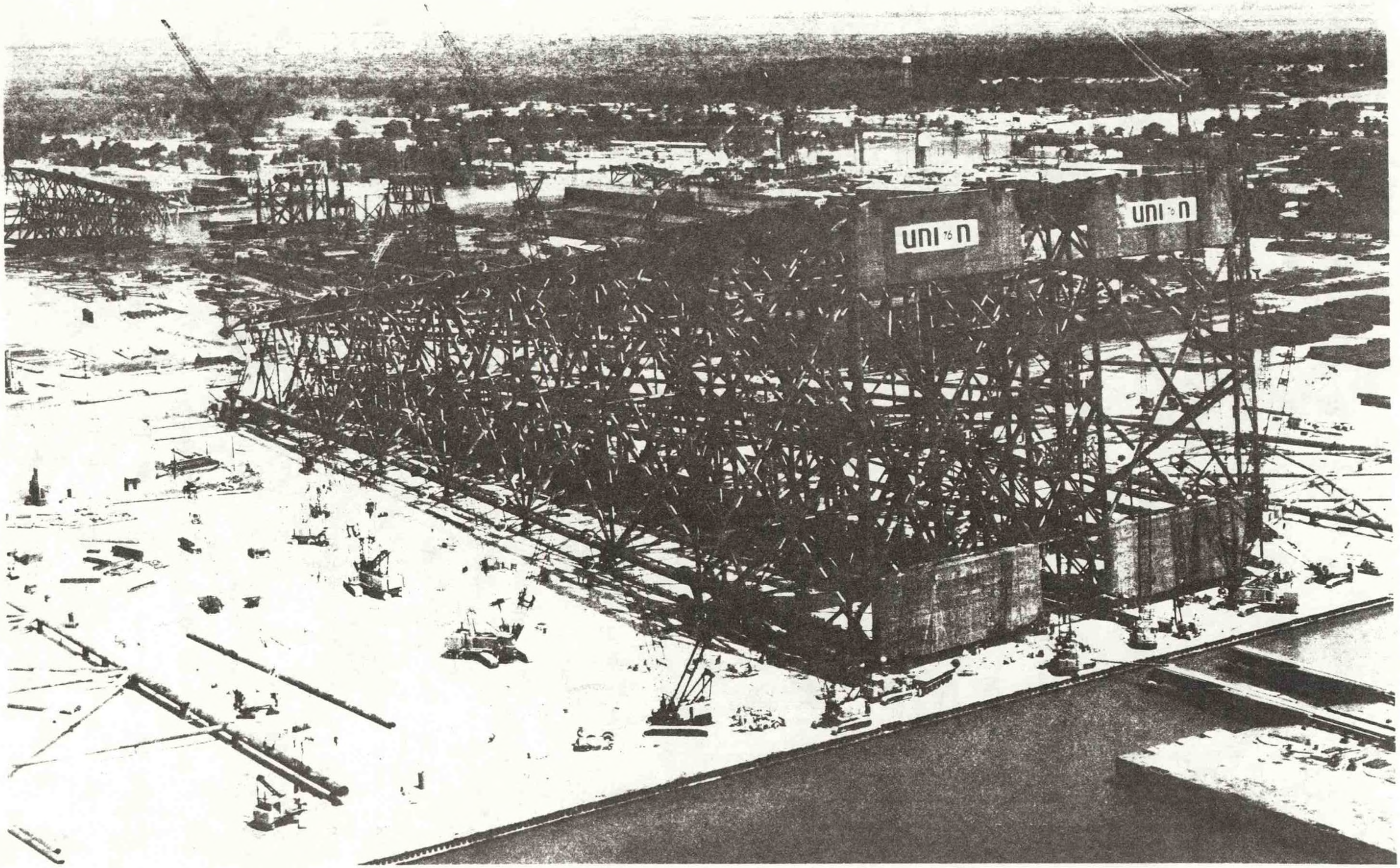


Figure 1.4 Cognac-type installation sequence



Source: Ref. No. 1

Figure 1.5 Cerveza-type installation sequence



Cerveza loadout, McDermott Fabricators

Source: Reference 39

weighing 8,500 tons, and the top section measured 207 by 254 by 530 feet high and weighed 11,000 tons. The total investment for the Platform Cognac installation, including production equipment and pipeline to shore was $750-800 million (2). The cost of the platform,including jacket and decks was $265 million (3).

In each of the above cases, the key limiting factor that required the platforms to be installed in sections was lack of a launch barge large enough to transport these platforms in one piece. In 1981 Platform Cerveza was installed in 935 feet of water in a single section. The newly built launch barge Intermac-650 provided the needed launch capacity (to 40,000 tons, 650 feet by 170 feet) to install the platform in a single section. The cost of Platform Cerveza was $90 million, including jacket and decks (4).

Single-piece jackets allow use of traditional installation techniques that have been perfected over the years. Many of the time consuming high technology operations inherent with locating, leveling, and connecting sectionalized jackets are not required. The resulting structure is substantially less expensive (5).

A variety of other factors influence platform design and control the ultimate size of conventional steel jacket platforms. These factors include rolling mill capabilities, lift crane height and weight capacities, launch barge capacities, derrick barge lifting capabilities, and pile driving hammer energies. The rolling mills at deep water fabrication facilities now have the capacity to roll plates into 15 ft. diameters with over 4-inch wall thicknesses. Maximum base widths may be influenced by working height capabilities. Lift cranes can presently lift to about 340 feet (6). The limitation can be circumvented by placing the cranes on towers and rail tracks (See Fig. 1.6). Platforms can be made self-floating to avoid launch barge constraints, but only at the expense of larger legs to provide buoyancy and ocean going stability. The resulting jacket is much heavier and more expensive (Fig. 1.6). Such jackets can weigh on the order of 300,000 tons. At-sea lifting capabilities have been significantly expanded by a new class of semisubmersible derrick barges; such barges can lift 2,000 tons or more, where previously the capacity was limited to the 600-ton range.

These, and other considerations influence the platform design and can dictate where the rolling stock must come from and where it can be assembled.

Fabrication and Assembly Yards for Steel Jackets

The basic operations associated with the manufacture of a steel jacket platform are illustrated in the flow diagram of Figure 1. 7.

While there are certain advantages to having fabrication facilities and assembly areas located together, it is not always feasible to do so. The fabrication facilities require substantial indoor work area as well as outdoor storage area for stockpiling materials. Flat steel plate is received at the fabrication plant site from the foundry. The plates are then burnished and beveled, fed through a rolling mill into tubulars, welded lengthwise, and welded end to end into various size sections of stock. Various

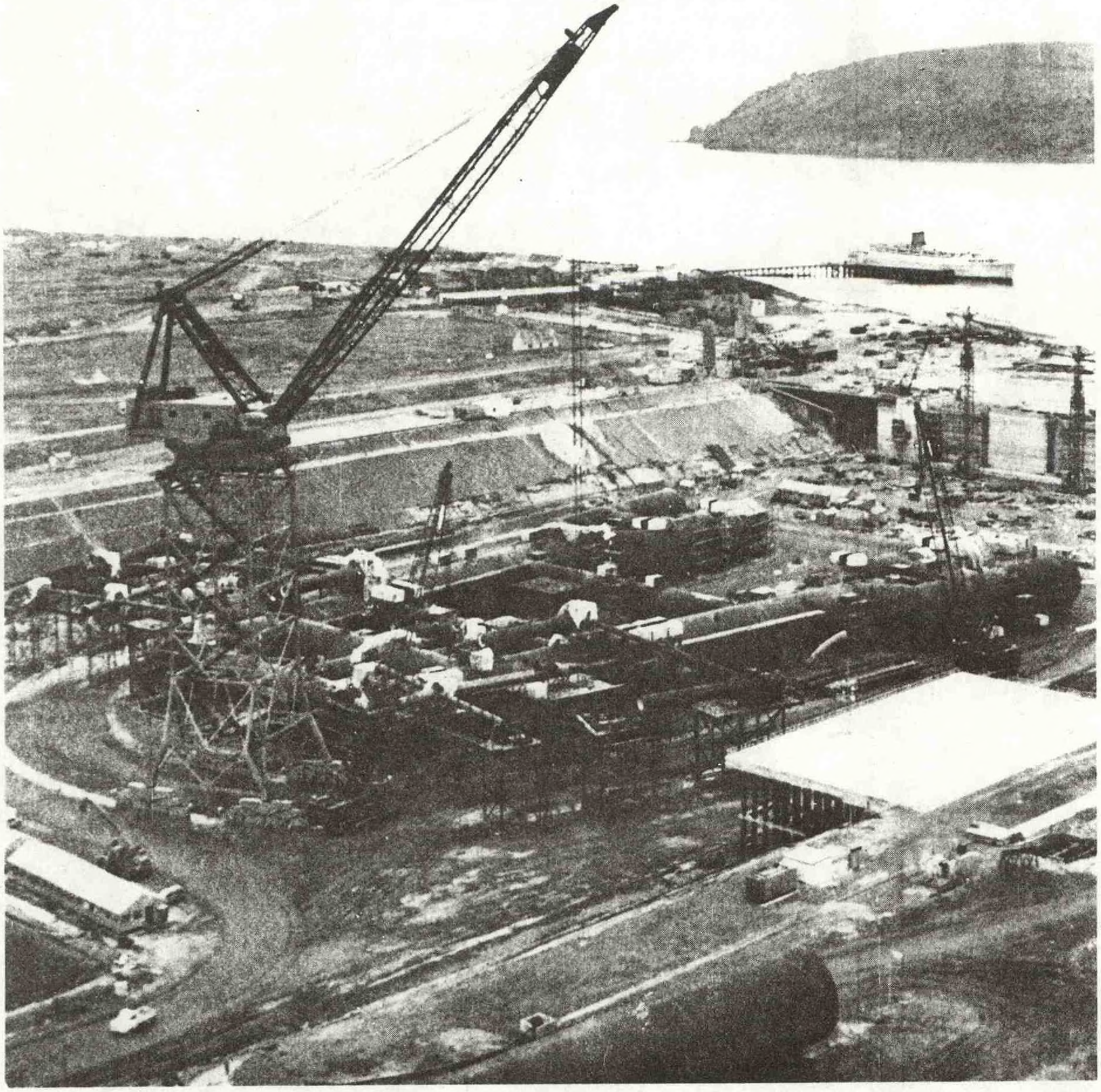


Figure 1.6 Self-floating platform, Brown & Root Fabrication Yard, Scotland

Source: Ref. No. 30

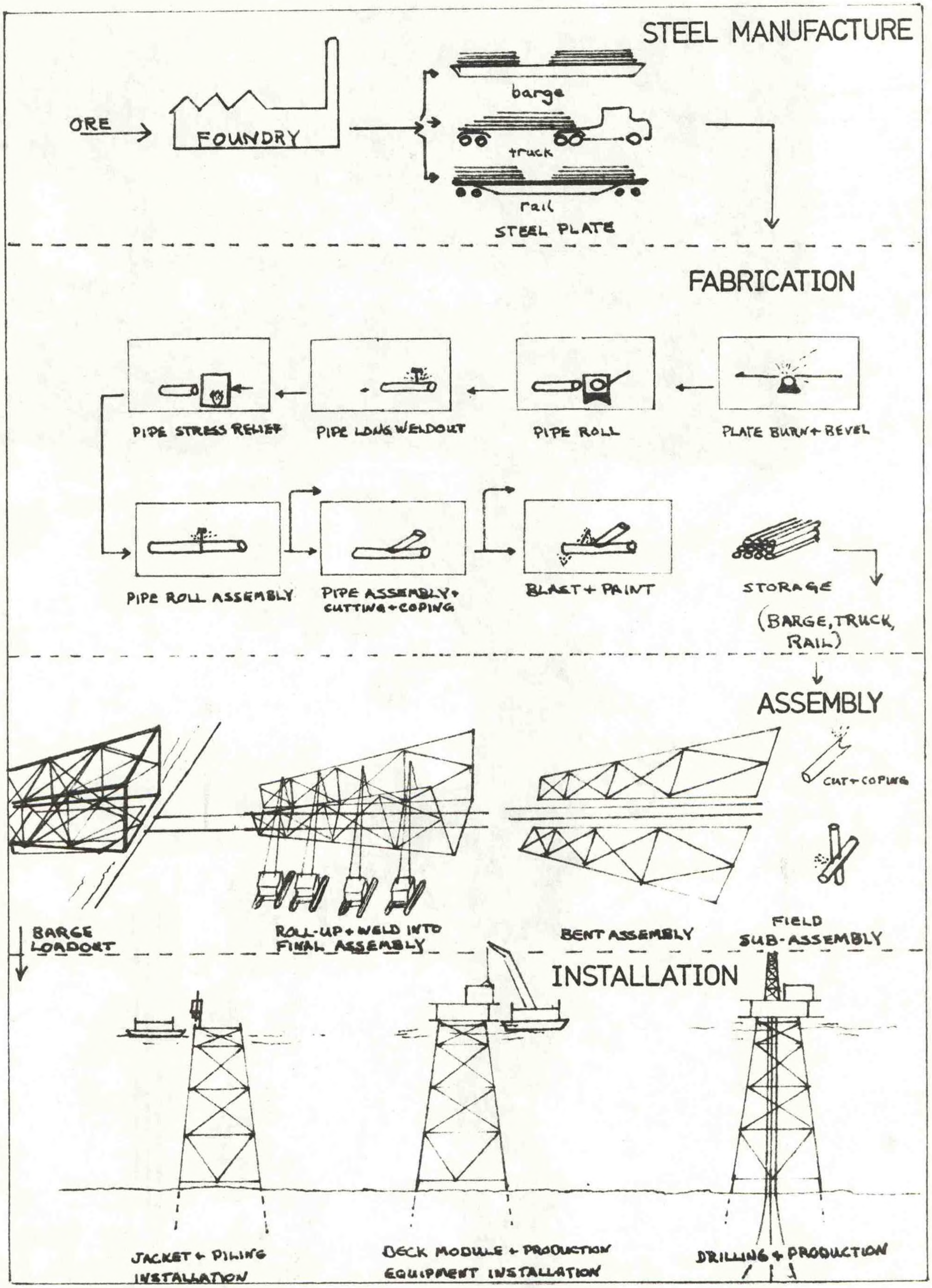
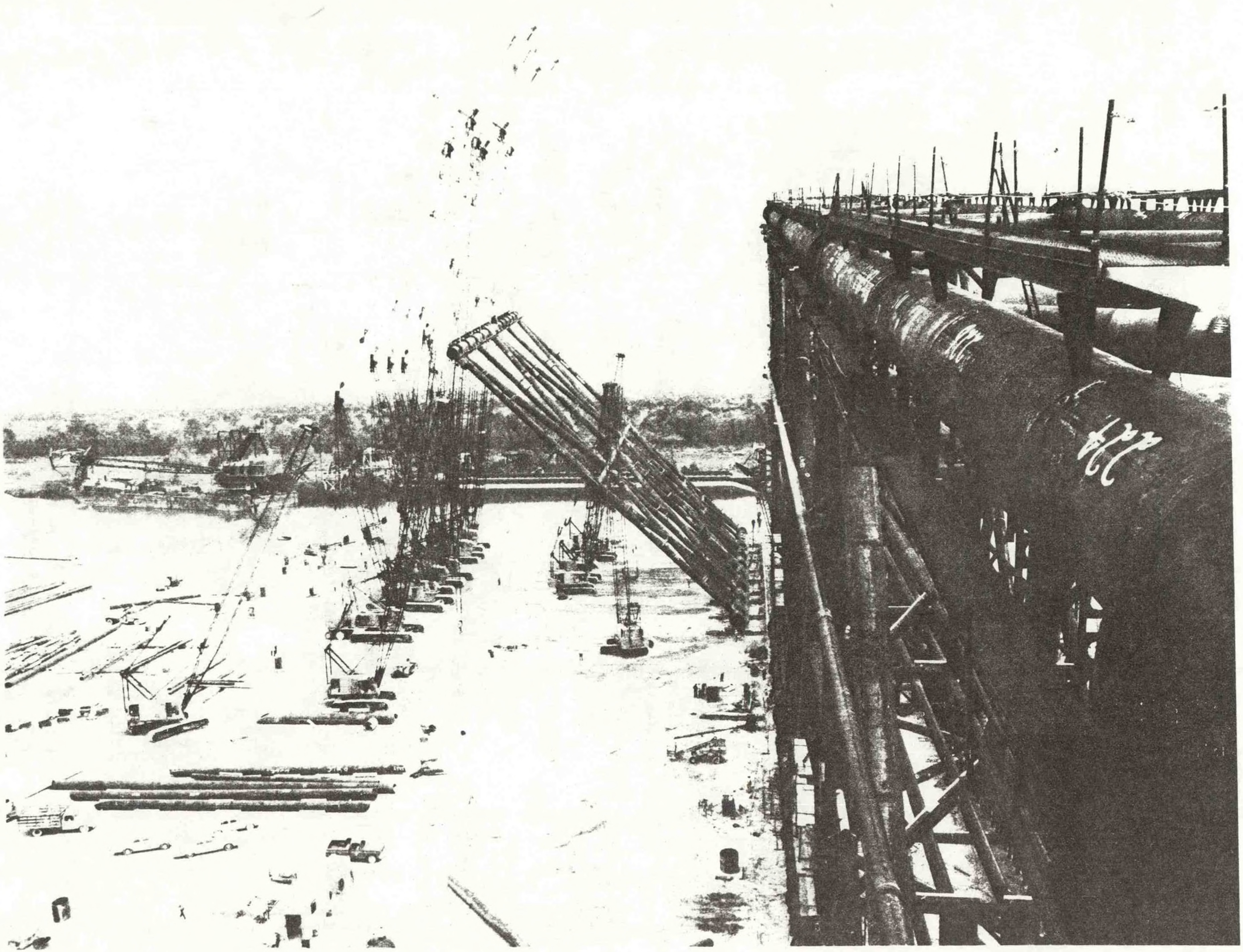


Figure 1.7 Schematic flow diagram of platform fabrication

Source: Modified from Ref. No. 30



Roll up by fleet of crawler cranes

Source: Reference 39

sub-assemblies are also fabricated, particularly those requiring precision or complex workmanship, or which must be passed through a stress-relieving heat treatment furnace after sub-assembly. Initial sandblasting and painting also typically occur at the fabrication plant.

The tubular stock and sub-assemblies are then transported to the assembly area where they are welded together. Cutting and coping (cutting a special contour for mating) can be done either at the fabrication site or the assembly site, depending on the complexity of the operation. Isolated joints that require stress-relieving can be heat treated at the assembly yard.

The tubulars and sub-assemblies are laid out on the ground in pairs of "bents" (sides of the platform jacket) and welded together. Once all components are attached to the bents, they are rolled up into vertical position by cranes, secured with guy wires, and the rest of the framing is welded in place. Eight leg jackets have two pairs of bents, an inner set and an outer set.

The completed jackets are skided on marine ways onto a waiting launch barge. In the case of very large self-buoyant jackets, these are assembled in graving (dry) docks (below sea level work areas protected by flood gates) and floated free by flooding the area (See Fig. 1.6).

If facilities in question also manufacture deck modules and components, then fabrication, assembly, and launch areas must be provided for these operations as well (See Fig. 1.8).

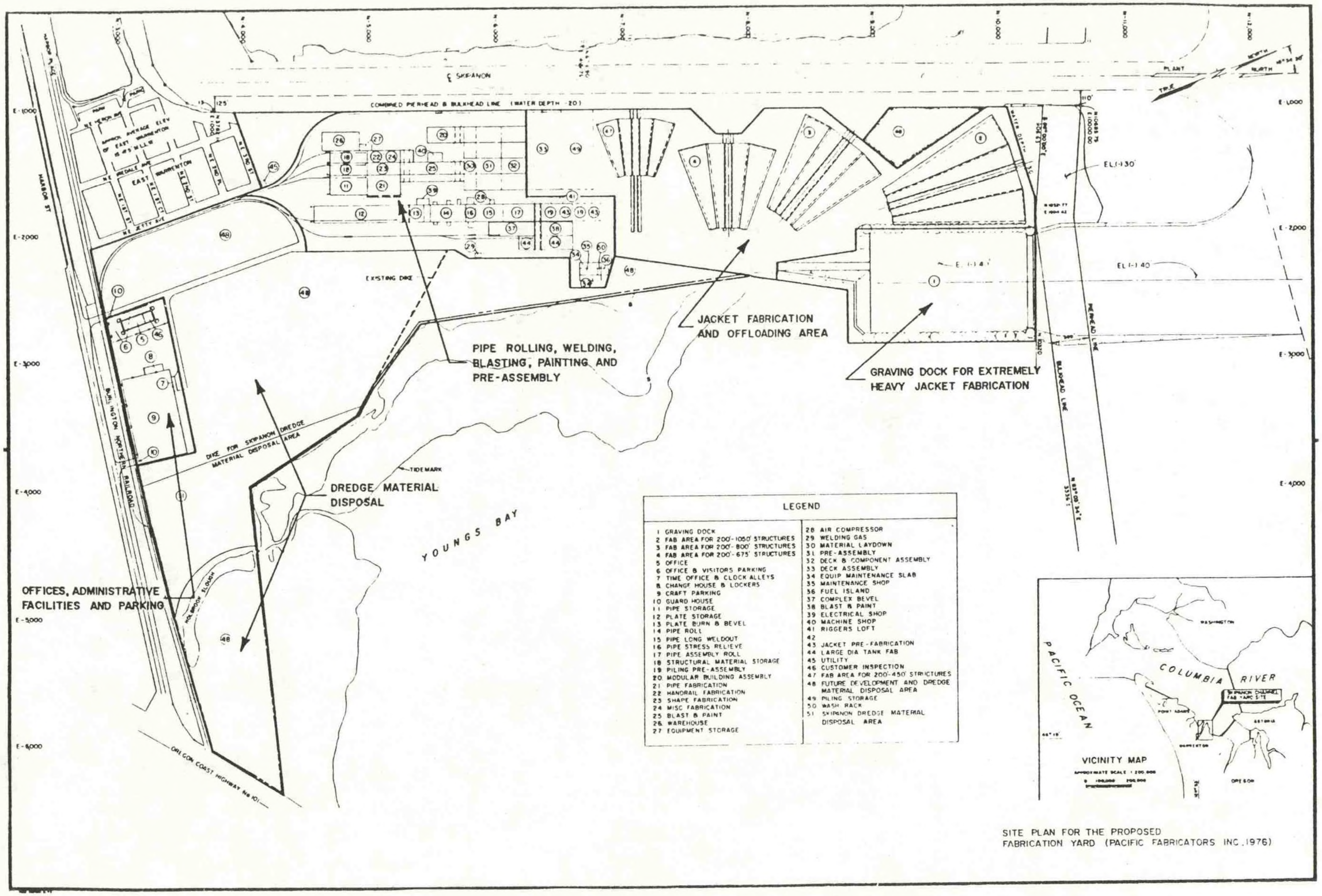


Figure 1.8 Typical platform fabrication yard layout. (Proposed 344 acre Pacific Fabricators (Brown & Root) site near Warrenton, Oregon.) Source: Reference 30

Major Yards

Most of the larger drilling and production platforms fabricated and assembled in the United States are constructed at J. Ray McDermott's Morgan City yard and at Brown & Root's Greens Bayou and Corpus Christi facilities. Avondale Shipyards (Ogden Corp.) and Dupont Fabricators (Raymond Int'l.) also operate fabrication yards in the Gulf of Mexico. The total yearly capacity of these yards is about 275,000 tons of fabricated steel (7). These facilities are combined fabrication and assembly yards, and have areas for fabrication and assembly of decks as well as jackets. The McDermott yard is 1,100 acres and has 8,200 feet of waterfront bulkhead. Kaiser Steel Corporation operates the primary West Coast facilities, which have a rated capacity of 50,000 tons (8). Kaiser operates fabricating plants at Napa and Fontana that support assembly yards in Oakland and Vallejo. Steel is brought to the assembly yards by truck and rail from Fontana, and Napa has facilities for barging parts, in addition to truck and rail access. The Oakland and Vallejo yards have one skidway each. Kaiser also has a small yard in Stockton which makes crew base modules for use on the North Slope, and Sohio leases additional land for the fabrication and assembly of other modular components used at Prudhoe Bay.

Kaiser's main foundry at Fontana has recently announced possible closure due to poor economic conditions "unless the company can find a buyer or partner for the facility" (9). Should the foundry close, Kaiser would seek steel plate on the

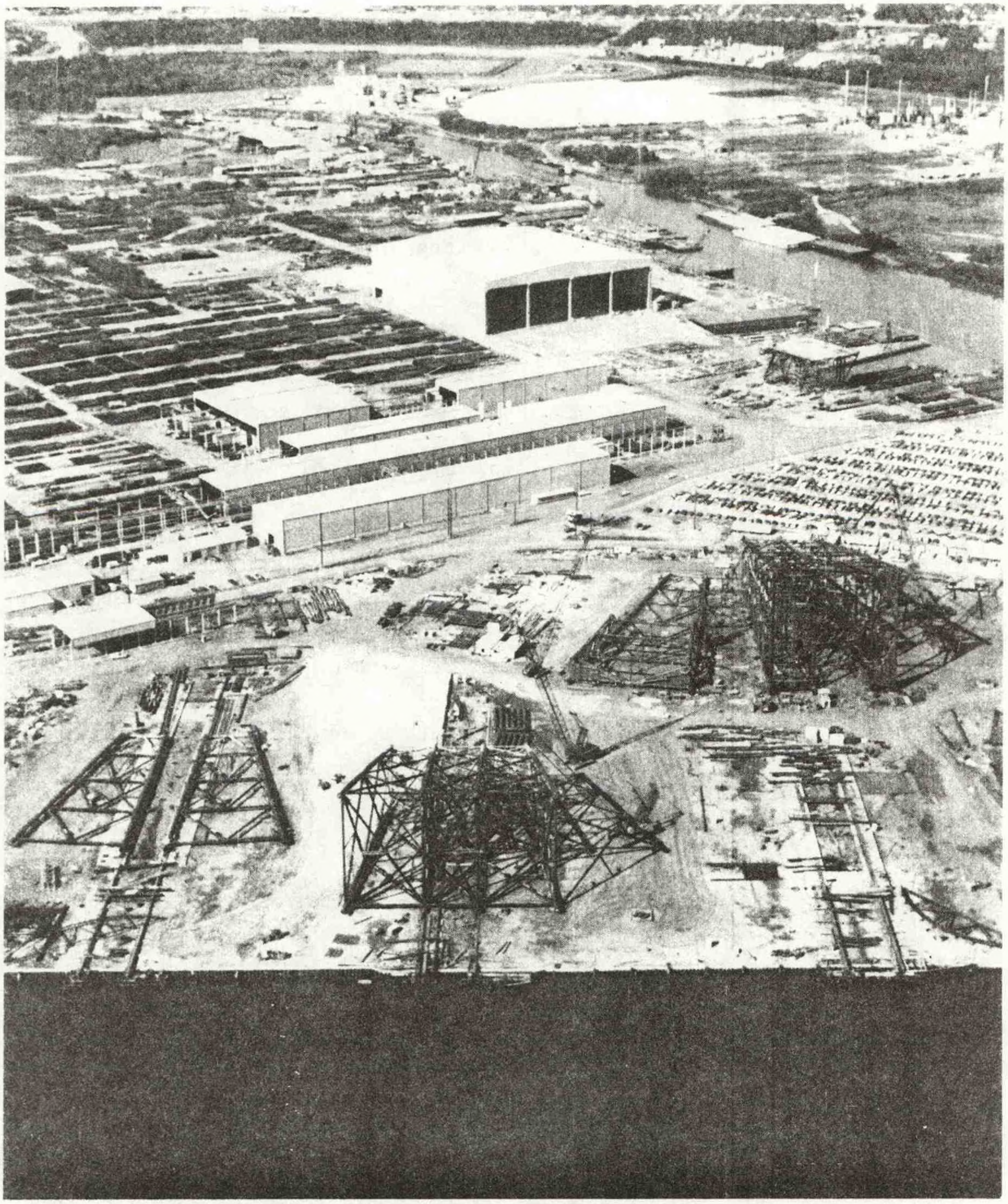


Figure 1.9 Brown & Root Fabrication Yard, Corpus Christi, Texas
Source: Ref. No. 30

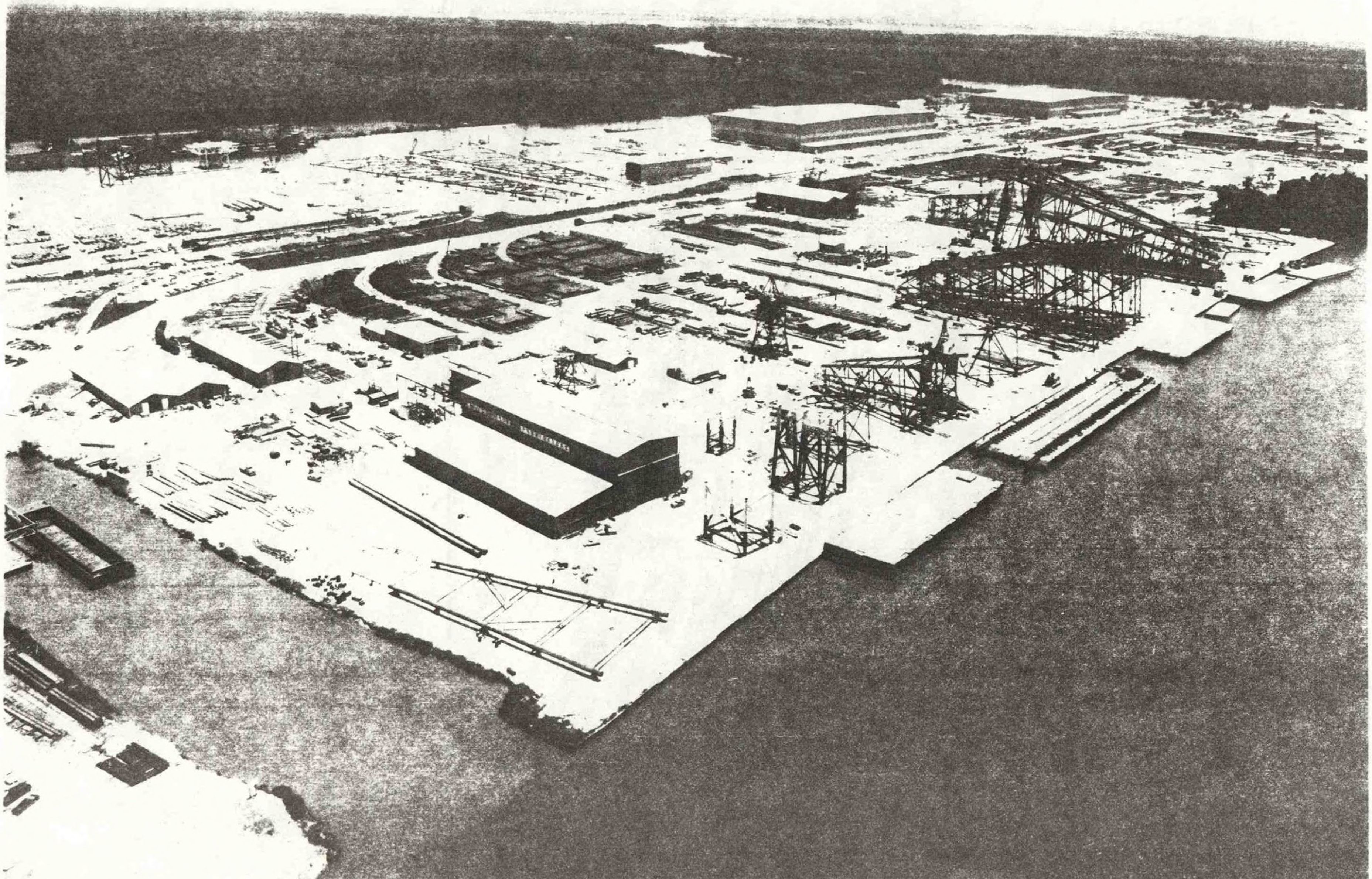


Figure 1.10 McDermott Fabricators (J. Ray McDermott), Morgan City, Louisiana Source: Ref. No. 39

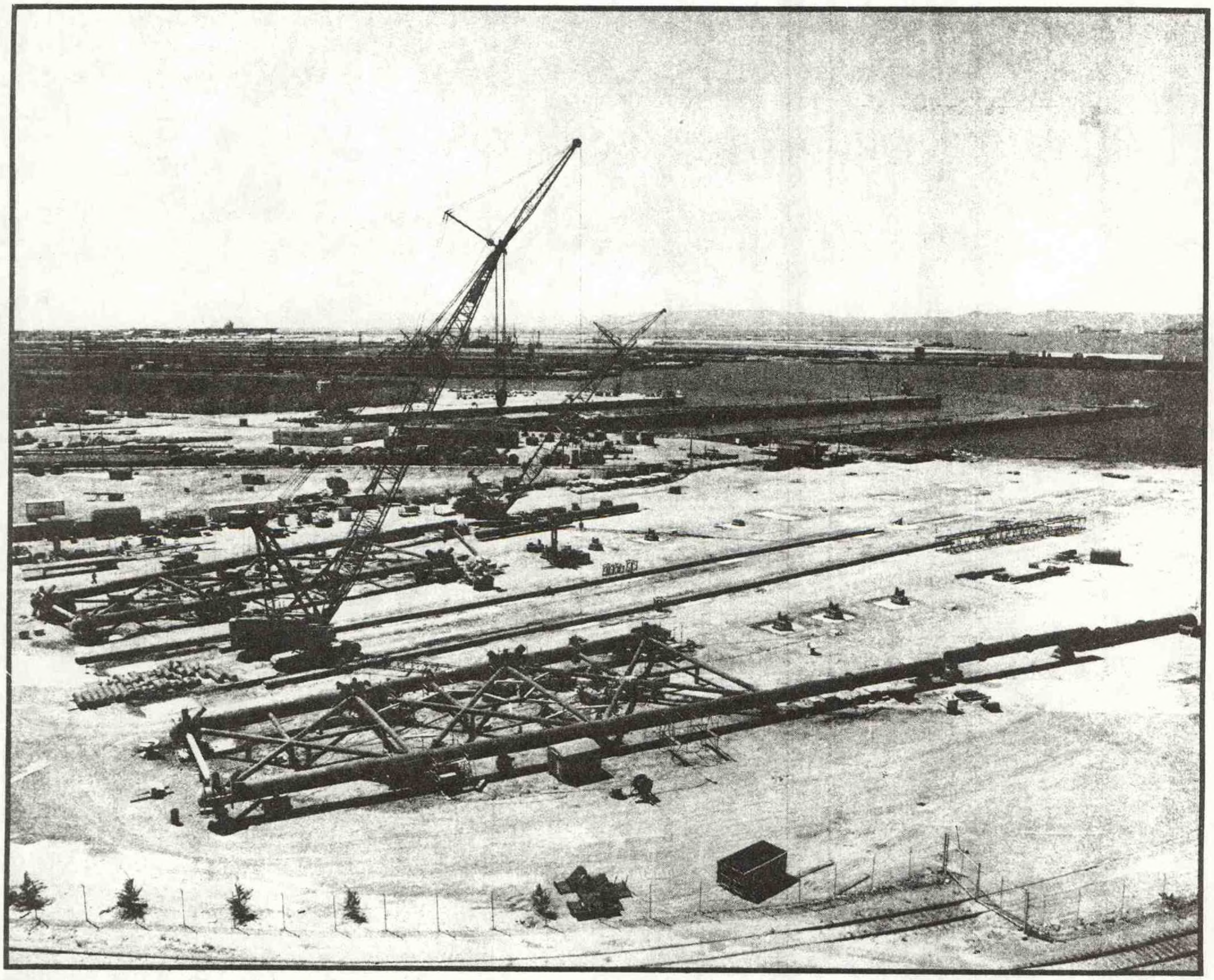


Figure 1.11 Kaiser Assembly Yard, Oakland, California
Source: Ref. No. 49

open market, and continue to operate its fabrication facilities (10). Kaiser is currently seeking permission to establish an assembly yard with two skidways which are not constrained by bridge clearances at Terminal Island in the Port of Los Angeles.

Although the Kaiser portion of the North Slope modular construction operation is small (15 acres, and about 50 employees), the balance of the operation is substantial, with work areas in Oakland, Alameda, Richmond, Vallejo, and Stockton. About 800 employees are involved with construction of these modulars at the various locations. There are also construction facilities in the Seattle area which fabricate and assemble these components.

Bridge and Canal Clearances

The Gulf Coast Yards are constrained by the Panama Canal for any West Coast deliveries. The width of the Panama Canal is the limiting factor, being 110 feet wide. Canal authorities will allow a load width of 106 feet (11). Kaiser's Vallejo yard is constrained by the Richmond-San Rafael Bridge which has a clearance of 185 feet, mean high water. Kaiser's Oakland yard is constrained by the Oakland-Bay Bridge which has a clearance of 217 feet (mhw). Deliveries from both of these yards must also pass under the Golden Gate Bridge, which has a clearance of 232 feet (mhw) (12).

It is difficult to precisely correlate these clearances to sizes of platforms for any given water depth. As previously mentioned, the size of the jacket will vary depending on a variety of factors, including the weight to be supported and the oceanographic conditions at the installation site. The fact that Platform Hondo in 850 feet of water was assembled at the Oakland yard, and Platform Eureka for 699 feet of water is being assembled at the Vallejo yard, give some indication of the size of platform that could be accommodated. Generalizing from this information, however, should only be done with great caution. For instance, for Platform Eureka to clear the Richmond Bridge, the launch barge must be submerged while passing under the bridge. Such an operation adds a degree of risk which may not be acceptable to other clients. If the jacket had been designed with base dimensions just a few feet larger, it would not have been able to be built at the Vallejo yard.

Towing Costs

Towing costs vary depending on the size of the platform to be towed and the availability of the specific equipment required. Costs include barge and tug rental, labor costs, insurance, and barge relocation and modification costs. For small to moderate size platforms (200 to 700 feet), these costs range between $120,000 to $300,000 average cost per day. For the largest platforms (1000 to 1200 feet), they could go as high as $700,000 average cost per day.

Launch barge costs range between $20,000 and $35,000 per day, and will probably be substantially higher for barges in the 40,000+ ton class. Barge mobilization costs, including mobilization (the cost of getting the bargefrom to where it needs to be), rig up (the cost of refitting the barge to accept the specific platform), rig down (removing the refittings), and demobilization (returning the barge) can typically be on order of $6 to $10 million for the West Coast situation, since no barges of this type are normally moored here (53) . Tug costs are also substantial, and vary with the class of tug and number required. Four to six tugs may be required for the larger platforms. Costs range from $3000/day for a 3000 hp tug to $15,000/day for a 9000 hp tug (54). Average towing speed may be expected to be about 6 knots, and possibly as slow as 3 knots for the largest loads. Insurance costs vary with the value of the load and equipment in use.

Japan, at 7,000 miles towing distance from the Santa Barbara Channel, might have a towing cost on the order of $6 to $15 million for small to moderately large platforms, and take 50 days. The largest platforms requiring state of the art barge and tug equipment may cost substantially more, possibly on the order of $30 million. Towing long distances may also result in increased structural requirements for the jacket due to the stresses encountered during towing. This may be particularly true for larger jackets.

Tonnages

The size of platforms and capacities of fabricating plants are generally described in terms of tons of finished steel products per year. Size (and therefore tonnages) of platforms vary over a wide range depending on water depth, number of well slots, and amount of ancillary equipment (crew quarters, oil and gas processing and treatment) to be located on the platform.

Tonnage requirements also vary for a given water depth according to stress load factors, wind and wave conditions, seismicity and other geologic stability factors, and ice conditions. Many relatively minor installations in the Gulf of Mexico including well protectors, single-well platforms, and small six-well-or-less platforms, are included in most platform counts. There are about 2700 fixed platforms in federal waters, almost all of which are located in the Gulf of Mexico. About 850 of these are classified as "major" platforms, i.e., having more than 6 wells and processing equipment (13). Off California, there are currently 13 platforms in federal waters, and nine platforms, seven artificial islands, and 39 subsea completions in State waters (14).

A typical 24-well platform for use in 300 feet of water in the Gulf of Mexico would weigh about 6,000 tons. The average tonnage for platforms ordered in 1979 for installation in U.S. waters (almost all in the Gulf of Mexico) was 2,600 tons. The average tonnage of the platforms ordered for use in the North Sea that year were on average nearly ten times as large, or 20,600 tons each (15). Platform Hondo weighed 15,000 tons and the deepest water platform proposed for the Santa Ynez Unit development will probably weigh 60,000 tons. Representative steel requirements for jackets are provided in the following table.

Representative Steel Tonnage Requirements
for Jackets Installed in Various Areas

Area	Average Water Depth	Steel Tonnage Requirements
Gulf of Mexico	100'	2,000 tons
	200'	4,000 tons
	300'	6,000 tons
California/Pacific	200'	6,000 tons
	600'	12,000 tons
Atlantic	300'	7,000 tons
Alaska	200'	15,000 tons
	400'	25,000 tons

OCS Order No. 8

OCS Order No. 8 regulates the design, fabrication, and installation of all platforms installed in federal waters. The Order sets up a "Platform Verification Program" which defines standards for design, fabrication, and installation, and describes the procedures for verifying the structural integrity of platforms. The basic approach of the Program is to utilize a third party "Certified Verification Agent" to assume responsibility, and to do plan and field checks during the various phases of the operations.

Steel or Concrete Gravity Platforms and Other Non-Conventional Platforms

Concrete gravity platforms are a relatively new technology that have certain advantages over steel leg conventional platforms for some specific applications. They are currently in use in the North Sea where water depths, wind and wave conditions, lack of earthquake hazards and distance from shore have made them a feasible approach.

Concrete gravity platforms consist of a hollow concrete base on which one to four concrete towers are slip-formed (see Figure 1.12). The base is built in dry-dock and moved to deep water where the towers are built as the platform is steadily lowered deeper into the water. Once the towers are completed and the deck structure installed, the platform is raised and towed out to the oil field. Because of the immense weight (about 300,000 tons for a typical North Sea platform), they are held in place by gravity and no pilings are required to anchor these platforms to the seabed. They can be installed in two or three months.

Steel gravity structures for both exploratory and production drilling have been conceptually designed for use in Alaskan waters. These structures are designed with load-bearing characteristics to meet the unique set of harsh environmental conditions occurring in Alaskan waters. The hostile conditions and remoteness of the Alaskan sea ice areas such as the Beaufort Sea favor the use of gravity structures that can be pre-assembled at a construction site in temperate water, towed to location, and installed quickly with all or most of the production facilities

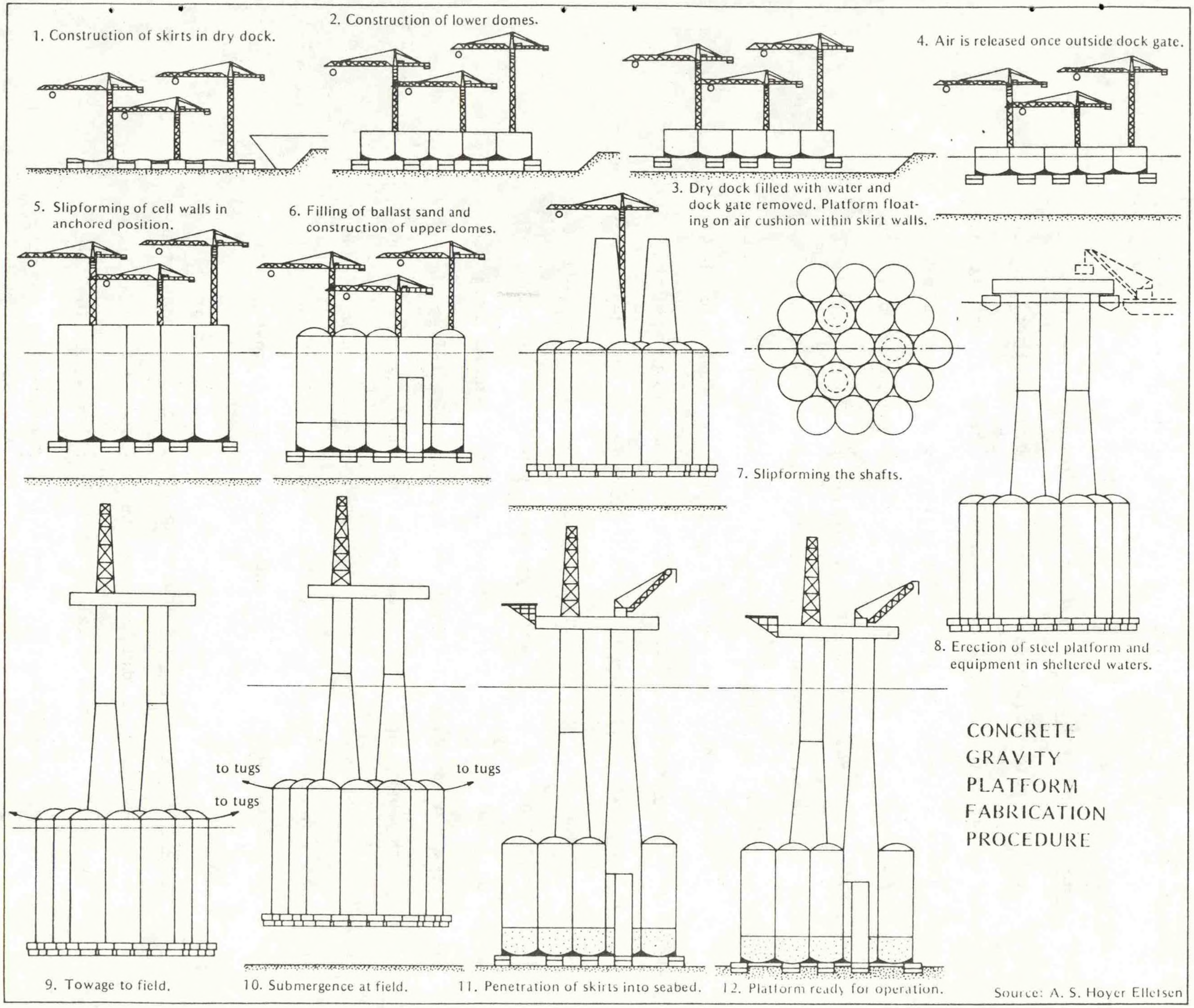


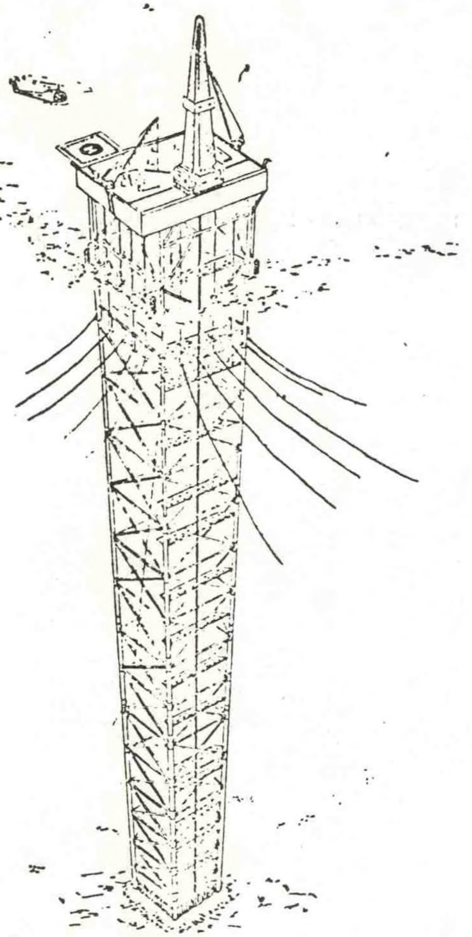
Figure 1.12 Source: Ref. No. 26

already in place. A further discussion of various types of platforms to be used in different Alaskan regions is contained in Chapter 2.

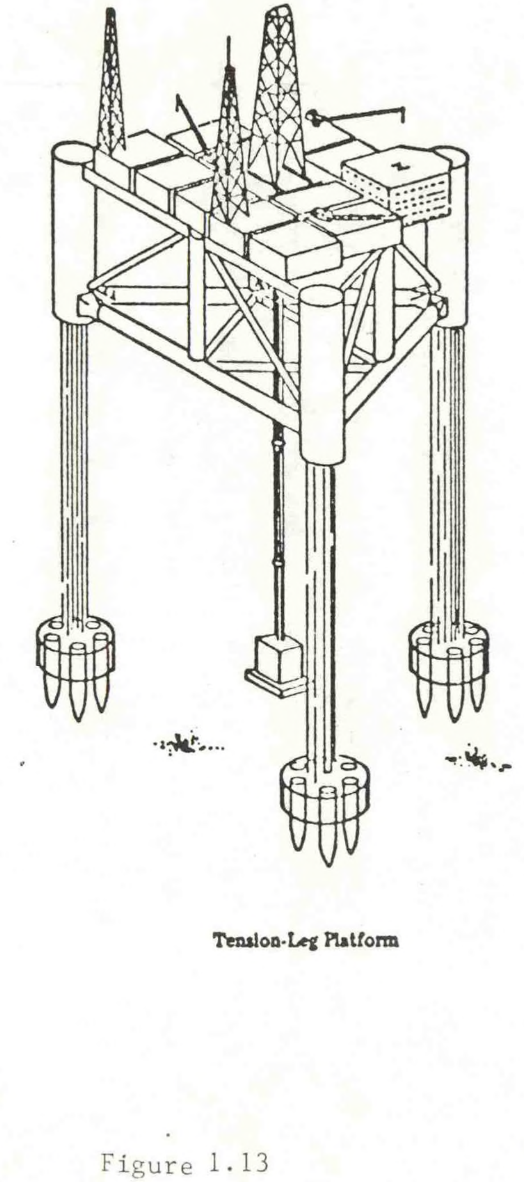
Tension-leg platforms differ significantly from both the steel and concrete platforms. The structure supporting the modules and drilling rigs floats rather than sits on the seabed. Anchor lines attached to the seabed hold the platform in place. The tension-leg platform design has not yet been used in production, although a small prototype has been tested in California waters. Because of the similarity between tension-leg platforms and semi-submersible mobile exploratory drilling rigs, it is expected that these platforms could be manufactured at existing shipyards specializing in mobile rig assembly.

Guyed tower platforms are another design concept for deepwater use. They consist of a relatively narrow steel lattice tower founded on the seabed and supported by an extensive array of cables or guys anchored to the seabed at some distance from the tower base. Guyed tower platforms are less suitable in regions of strong earthquakes, and have recently fallen into disfavor on the West Coast because of the extensive space requirements of the anchoring system which may conflict with commercial trawl fisheries. Exxon is presently installing a 1000 foot tower in the Gulf of Mexico.

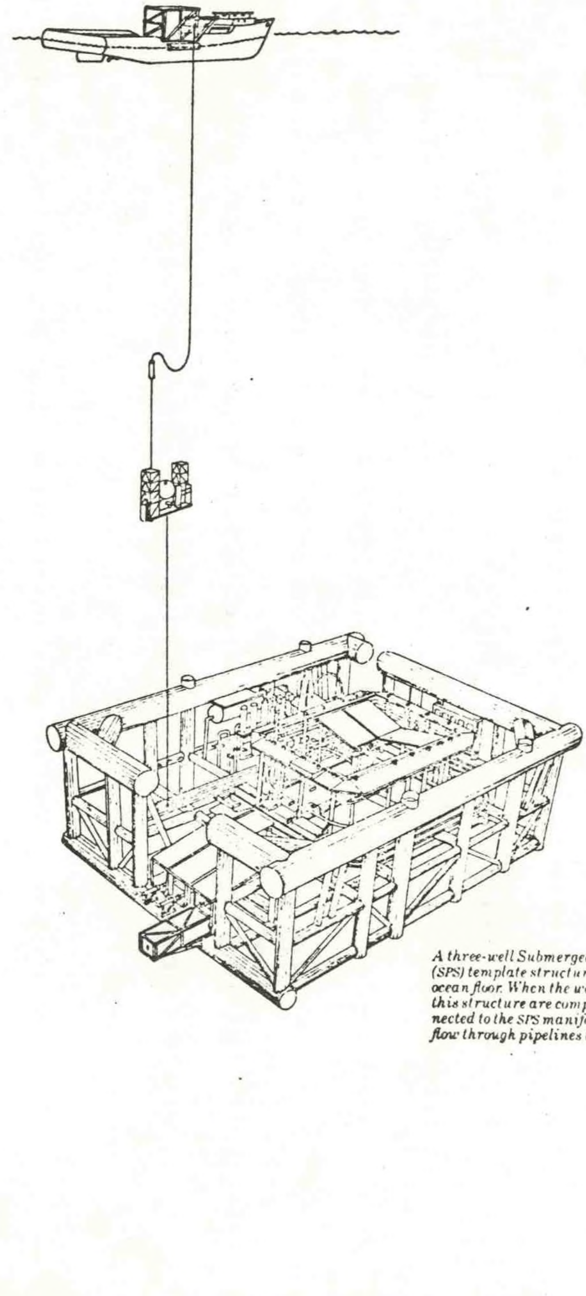
Subsea Production Systems are ocean floor drilling templates for which an exploration drilling rig can be used to drill the production wells. Satellite wells can be drilled with flowlines running back into the production template. The oil and gas is



Guyed Tower



Tension-Leg Platform

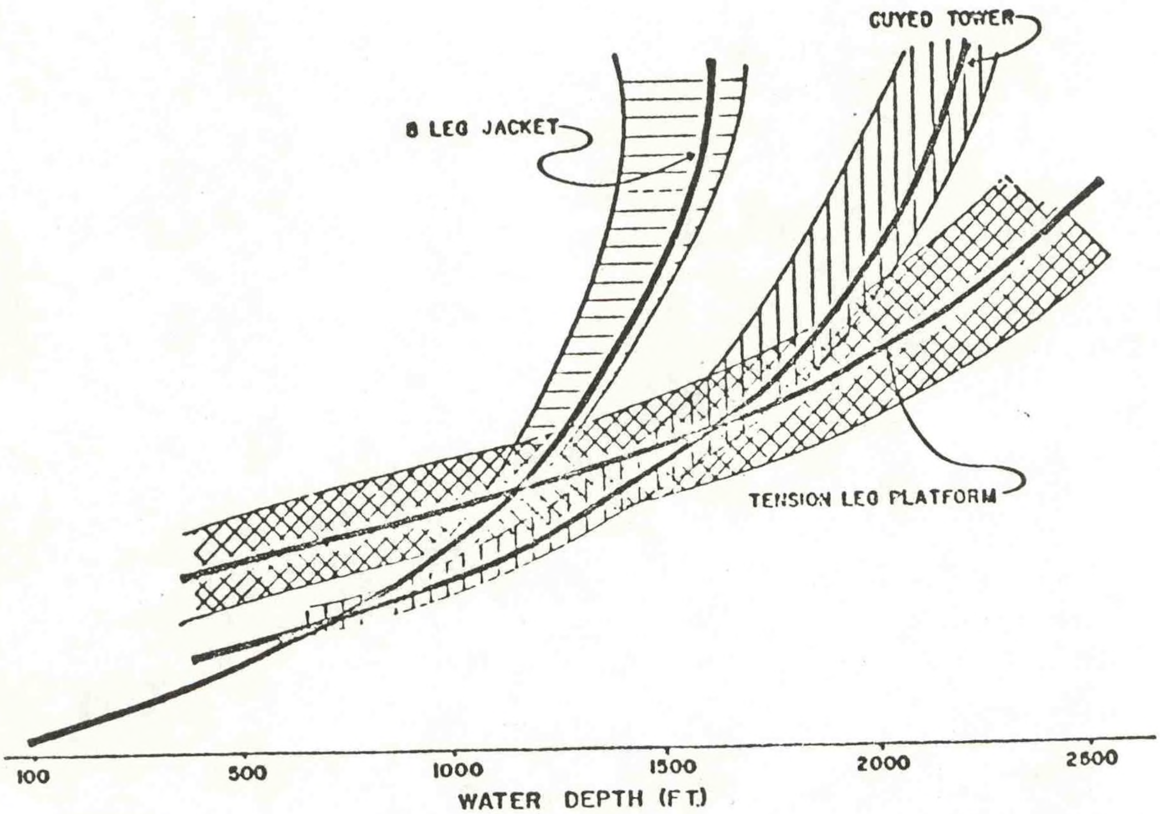


A three-well Submerged Production System (SPS) template structure to be secured on the ocean floor. When the wells drilled through this structure are completed, they will be connected to the SPS manifold, and the oil will flow through pipelines to the shore.

Figure 1.13

then carried up through a riser system to a floating production and storage vessel. Work-over and maintenance costs are high on subsea completions, so they are typically not used when conventional systems are available. Subsea production systems are anticipated for use in waters to 3000 meters. The key design consideration for such deep water production systems tends to be engineering the riser to be able to support its own weight. Most design concepts include some buoyance compensation device to help support the column.

Use of the non-conventional deepwater platform designs such as the tension-leg and guyed tower has been delayed in favor of extending use of conventional steel platforms to deeper waters, a development made possible by recent advances in launch barge and pile driving hammer sizes previously mentioned. Figure 1.14 shows representative cost cross-over curves for three types of platforms. Although the curves are at this point somewhat out of date (a 1979 source) because of the recent advances mentioned above, the figure is illustrative of the cost trade-offs that industry looks at in making the production technology choice.



* DESIGN, FABRICATION AND INSTALLATION COST, EXCLUDING TOP SIDE EQUIPMENT AND FACILITIES.

Figure 1.14

1979 Cost curves for three platform technologies. Recent advances in launch barge and pile-driving hammer sizes have reduced costs and extended the practical depths for conventional 8-leg steel jackets.

Source: Reference No.2

CHAPTER 2

Potential West Coast Platform Demand

Any estimates projecting numbers of platforms that would be required to develop offshore oil resources will be **highly speculative**. About the best that can be hoped for is a characterization of the potential demand with explanation of the factors which introduce the uncertainities into any estimates. Uncertainity is increased by attempting to look at deep water platform demand which extends past the limits of present conventional platform technology. A subtle engineering innovation may dramatically alter the expected platform configurations beyond a certain water depth, and hence, alter the site required to construct such platforms.

The firmest requirements for new platforms are those which relate to oil and gas fields that have been discovered and delineated, and for which development and production plans have been filed. Even then, as noted below for Exxon's Santa Ynez Unit, uncertainities remain. Platform estimates based on leased acreage, oil and gas resource estimates, lease sale offerings, and five year scheduling offerings become progressively less reliable. U.S. Interior Department lease sale and five-year schedule documents have been consistently overly optimistic in estimating the timing of platform installation. It must be kept in mind, however, that these documents are prepared for impact purposes rather than estimating firm demand.

This study reviews the potential demand for platforms generated by leasing activities in two areas - southern California and Alaska. Current levels of activities in these two areas indicate that the southern California area will generate most of the near term need for platform installations, whereas Alaska's need is more speculative because recent exploratory efforts have failed to make commercial discoveries.

SOUTHERN CALIFORNIA REGION

Figures 2.1 and 2.2 display the current and proposed platforms in the southern California region. Discoveries in the Santa Maria Basin have also triggered platform proposals which are currently being filed. (Santa Maria Basin is technically in the Interior Department's central California planning region, but for purposes of this study it will be considered part of the southern California area). There are currently 13 platforms in federal waters and 16 platforms and artificial islands in state waters. In addition, there are 39 subsea completions in State waters. To date, 1.8 billion barrels of oil and 1.2 trillion cubic feet of gas have been produced from State offshore waters and 0.2 billion barrels of oil and 0.1 trillion cubic feet of gas from federal waters (16). There are an estimated 450 million barrels and 787 million barrels of oil yet to be produced (reserves) from existing state and federal fields respectively (17). In addition, there

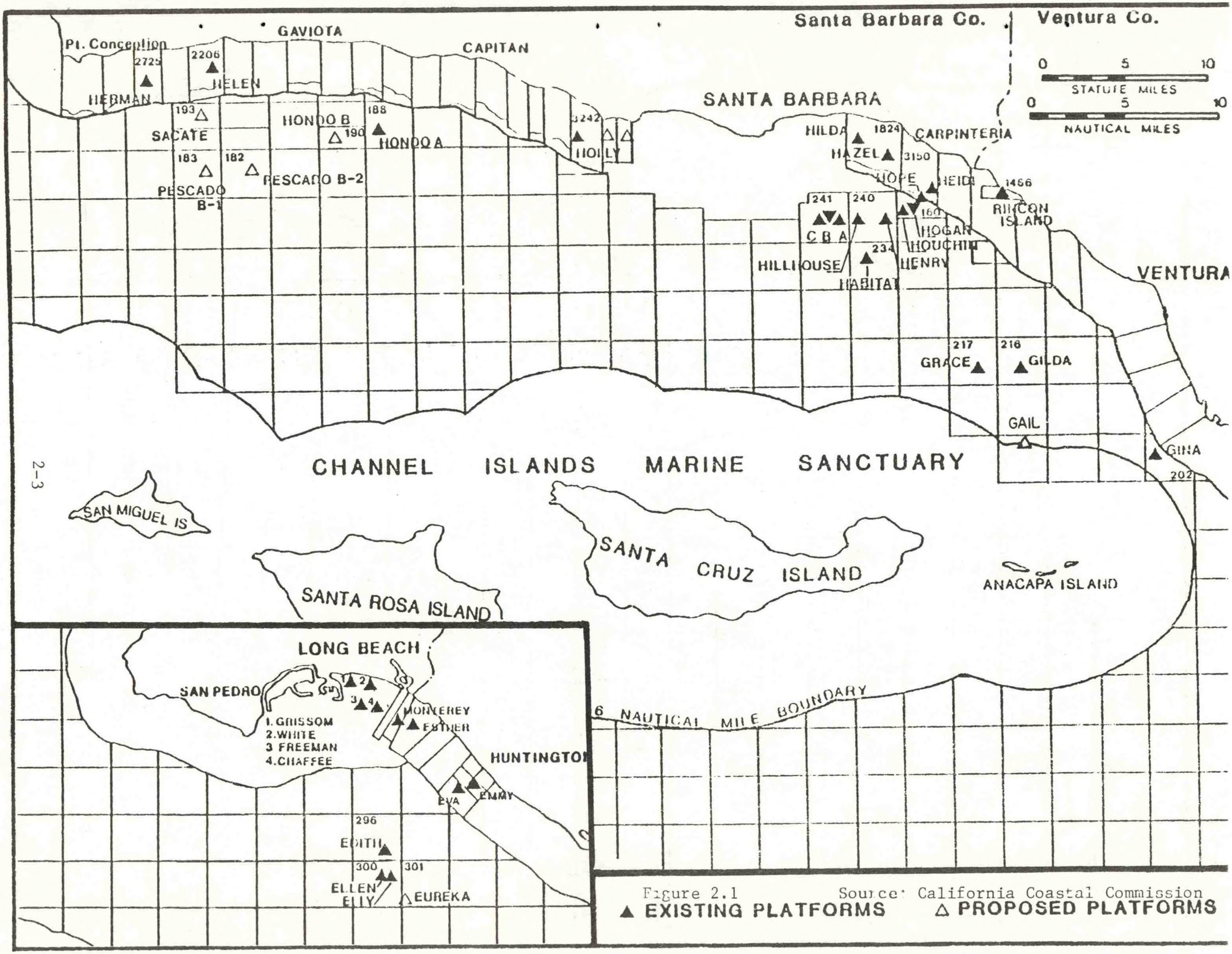


Figure 2.1 Source: California Coastal Commission

▲ EXISTING PLATFORMS △ PROPOSED PLATFORMS

SANTA MARIA BASIN

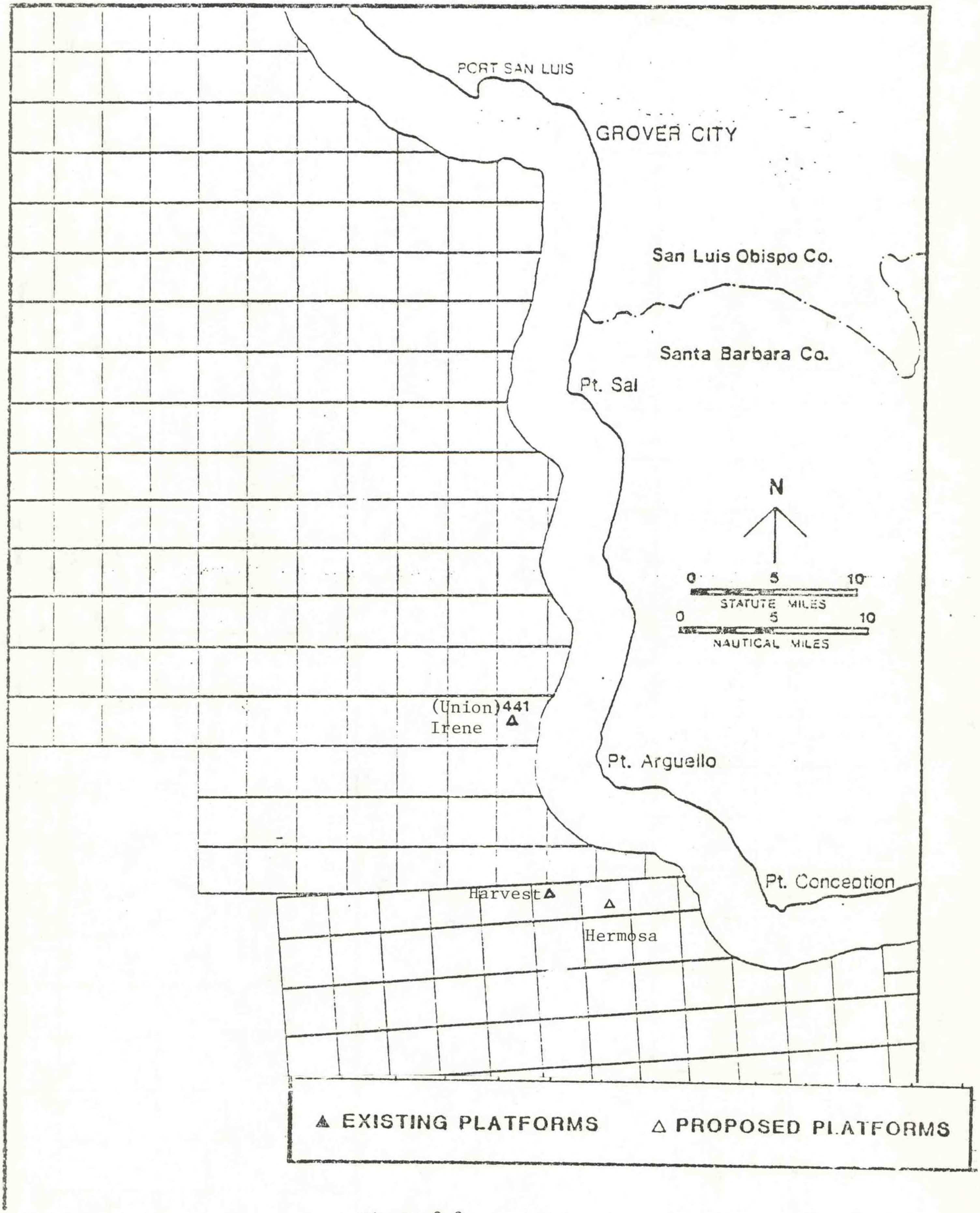


Figure 2.2

are an estimated 3.1 billion barrels of undiscovered recoverable oil in state and federal waters in Southern and Central (Santa Maria) California (18). Of these 3.1 billion barrels, 1.9 billion are expected to occur in water depths over 200 meters (650 feet) (19). See Figure 2.3.

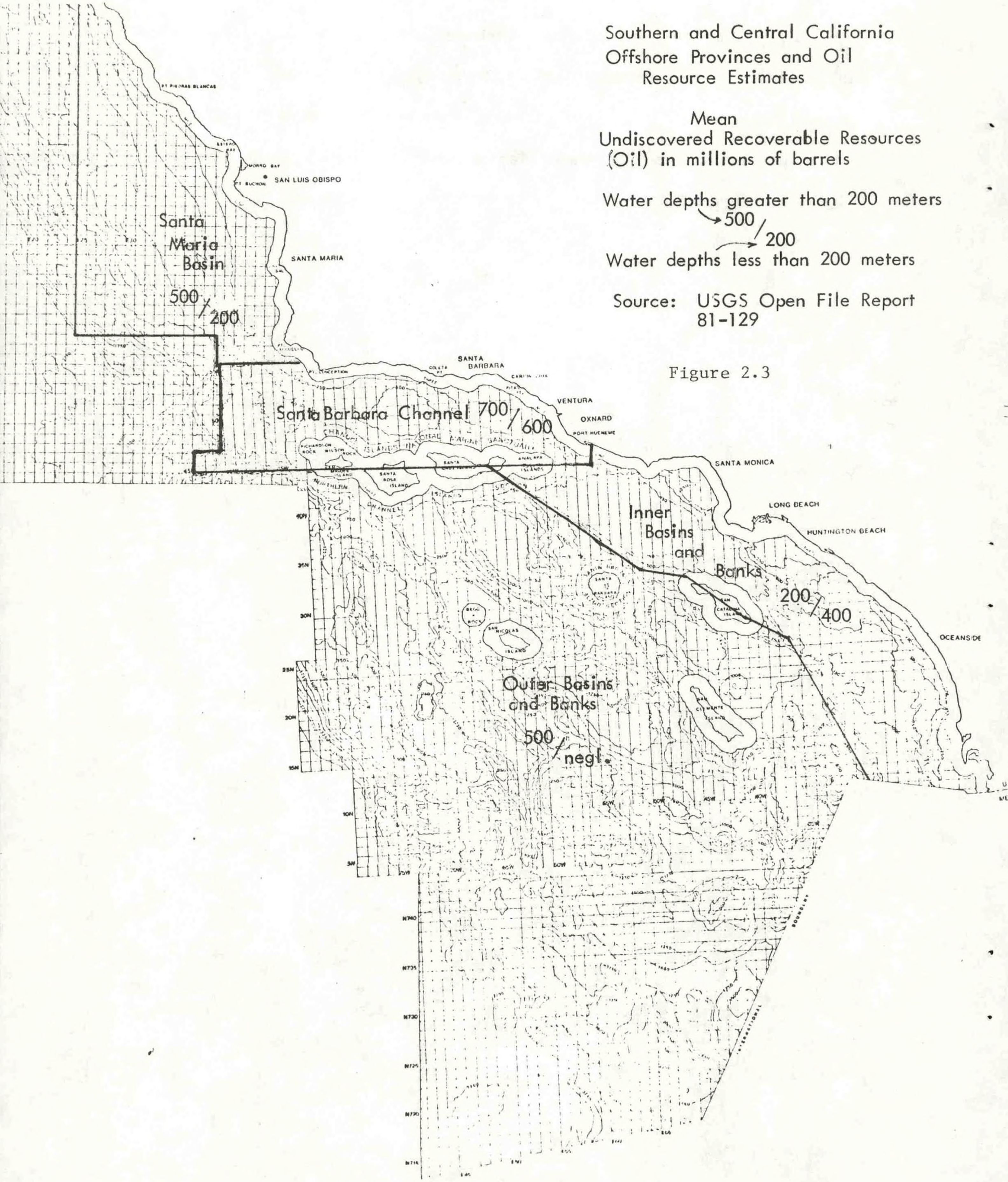

Southern and Central California
Offshore Provinces and Oil
Resource Estimates
Mean
Undiscovered Recoverable Resources
(Oil) in millions of barrels
Water depths greater than 200 meters
500/200
Water depths less than 200 meters
Source: USGS Open File Report 81-129
SAN LUIS OBISPO
SANTA MARIA
Santa Maria Basin
500/200
SANTA BARBARA
VENTURA
OXNARD
PORT HUENEME
Santa Barbara Channel 700/600
SANTA MONICA
LONG BEACH
HUNTINGTON BEACH
Inner Basins and Banks
200/400
OCEANSIDE
Outer Basins and Banks
500/negl.

Figure 2.3

The Interior Department in its most recent Five-Year Schedule Environmental Statement (January '82-December '86) estimated numbers of platforms for a variety of alternatives and assumptions. Under the assumption that all resources contained in each planning area would be developed, the total number of platforms required to develop the resources in the central and northern California and southern California planning areas was estimated at 51 and 108 respectively (Fig. 2.4). (Approximately 30 of the 51 platforms estimated for the central and northern California areas would be required in the Santa Maria Basin, based on a breakdown of Lease Sale #53 estimates). These figures provide a rough approximation of the ultimate number of platforms required off the California coast. If one assumes that the resource will be developed by the year 2050, for instance, 2.3 platforms per year would be required (20). These estimates do, however, include sanctuary and other areas that historically have not been open to lease activity, and thus the likelyhood of realizing these estimates is quite low.

Under a slightly different assumption that a certain portion of each planning area would be offered for lease, but that all that is offered is developed, (see pages 39 and 47 of ref. #21 for assumptions), Interior Department estimated that 74 platforms would be required in southern California and 34 platforms would be required for central and northern California (Fig. 2.5). Under this scenario it was estimated that these platforms would be installed between the years 1986 and 1998, a rate of 12 per year

Planning Area	Number of Wells		No. of Platforms	Pipelines (miles)	Exploration Wells		Platforms Set		Platform Production Wells Drilled	
	Exploratory	Development/ Production			First	Last	First	Last	First	Last
Diapir Field	60	1,600	40	1,000	1983	1998	1988	2000	1989	2008
Barrow Arch	30	560	14	350	1985	2001	1991	2003	1992	2011
Hope Basin	7	60	3	225	1986	1994	1989	1996	1990	2001
Norton Basin	20	140	6	450	1983	1995	1986	1997	1987	2002
Navarin Basin	30	346	14	1,050	1985	1998	1988	2000	1989	2005
St. Matthew Hall	5	0	0	0	1987	1992	---	---	---	---
St. George Basin	28	300	12	900	1984	1995	1987	1997	1988	2002
No. Aleutian Basin	20	125	5	375	1984	1996	1987	1998	1988	2003
Shumagin	10	72	3	225	1987	1997	1990	1999	1991	2004
Kodiak	12	196	8	600	1987	1997	1990	1999	1991	2004
Cook Inlet	4	80	3	36	1987	1997	1990	1999	1991	2004
Gulf of Alaska	3	196	8	400	1987	1997	1990	1999	1991	2004
Central & No. Calif.	40	1,275	51	1,275	1984	1993	1988	1995	1989	2000
So. California	210	2,710	108	2,160	1983	1991	1987	1993	1988	1998
Gulf of Mexico	7,844	13,718	1,143	2,286	1983	1998	1985	2000	1985	2002
So. Atlantic	146	990	40	200*	1984	1995	1988	1997	1989	2002
Mid-Atlantic	245	2,391	96	2,400	1984	1995	1988	1997	1989	2002
North Atlantic	88	764	31	775	1983	1993	1988	1995	1989	2000

* gathering lines only

Figure 2.4 Interior Department Development Estimates Assuming Complete Development of All Recoverable Resources. Source: Reference 20

(21). Interior Department considered this scenario "very unlikely", and suggested the figures were another approximation of ultimate number needed most appropriately used without respect to time of installation.

Interior Department's "best guess" estimate in their Five-Year Schedule documents estimate that 37 platforms would be installed in southern California and 19 in central and northern California between the years 1986-1998 (Fig. 2.6). This would result in a rate of installation of 4.6 platforms per year. Under the previous Administration's Schedule (June, 1980), a total of 30 platforms would be required in the two California planning areas over a period of 10 years, a rate of 3 per year (Fig. 2.7).

It should be noted that in expressing the rate of demand as a simple average distributed evenly over a given number of years, some accuracy in the scenario is being forfeited. The demand is actually expected to be a curve, with peak activity occurring slightly before the mid-point of the given period, as indicated by the dates in the charts.

The platforms that have been installed to date in the southern California area have been installed at a rate of about one per year, with peaks of activity during the mid to late 1960's and again during the late 70's and early 80's. In the years from 1964 through 1969, nine platforms and five artificial islands were installed. During 1979 through 1981, seven platforms were installed. From 1970 through 1978, two platforms were installed. The Santa Barbara oil spill in 1969 and subsequent drilling bans influenced the timing of installations during the '70's. See Figure 2.8.

Planning Area	Number of Wells		Number of Platforms	Number of Oil Spills				Exploratory Wells			Platforms			Devlpmt/Prod. Wells		
	Exploratory	Development/ Production		Production 1K bbls	Production 10K bbls	Transportation 1K bbls	Transportation 10K bbls	First	Most Intense	Last	First	Most Intense	Last	First	Most Intense	Last
North Atlantic	633	2443	98	3.2	1.3	12.8	6.8	1984	1984-87	1997	1990	1991-93	2003	1991	1991-94	2008
Mid Atlantic	470	1878	75	2.1	.9	8.6	4.6	1984	1985-87	1993	1990	1991-93	1999	1991	1991-94	2004
South Atlantic	277	762	30	.9	.4	4.4	2.6	1984	1986-88	1995	1987	1989-90	1998	1988	1989-91	2000
E.G.of Mexico	370	555	22	1	.4	2.4	1.4	1982	1984-86	1997	1985	1987-89	2000	1986	1988-90	2002
C.G.of Mexico	12176	6880	573	2.56	1.04	5.9	1.5	1982	1983-85	1998	1983	1985-87	2001	1983	1986-88	2003
W.G.of Mexico	7924	3845	320	1.2	.5	2.7	.7	1982	1983-85	1998	1983	1985-87	2001	1983	1986-88	2003
S.California	506	1840	74	1.4	.6	5.1	2.5	1983	1985-88	1996	1986	1989-90	1998	1987	1990	2000
C&N California	176	845	34	.7	.3	2.9	1.6	1984	1986-87	1995	1987	1988-89	1997	1987	1989-90	1999
G.of Alaska	12	106	3	.4	.2	2.0	.9	1986	1987-90	1996	1990	1993	1998	1991	1994	2001
Kodiak	24	110	4	.4	.2	2.1	.9	1986	1987-90	1996	1990	1993	1998	1991	1994	2001
Cook Inlet	7	18	1	.1	.0	.3	.1	1986	1987-90	1996	1990	1993	1998	1991	1994	2001
Shumagin	13	36	1	.1	.1	.7	.3	1986	1987-90	1996	1990	1993	1998	1991	1994	2001
N.Aleutian Basin	29	90	3	.7	.3	1.7	.7	1984	1987	1994	1987	1989	1991	1988	1989-90	1994
St. George Basin	40	142	4	.6	.2	2.7	1.2	1984	1986-87	1996	1987	1987-91	1991	1988	1990	1994
Navarin Basin	51	228	7	.9	.4	4.3	1.9	1985	1987-90	1997	1988	1990	1990	1989	1993	2002
Norton Basin	29	54	3	.2	.1	1.0	.4	1984	1986-88	1994	1988	1990	1993	1989	1989-90	1996
Hope Basin *	10	14	1	.1	.02	.3	.1	1986	1988	1990	1990	1990	1990	1991	1991-92	1992
Barrow Arch *	45	188	5	.7	.3	3.5	1.5	1986	1989-91	1996	1988	1990	1997	1989	1994-98	2007
Diapir Field *	94	554	14	2.2	.9	5.0	1.3	1984	1986-88	1997	1986	1989-91	1998	1987	1992-96	2008
OCS Totals **	22,870	19,99[illegible]	1251	17	7	60	27									

* Includes only the portion of the planning area in water depths 0-100 meters.

** OCS totals must be calculated from total OCS resource estimates and are not column totals.

Figure 2.5 Interior Department Development Estimates Assuming Development of All Resources Within Postulated Leased Acreage of Each Planning Area. Source: Reference 21

Planning Area	Number of Wells: Exploratory	Number of Wells: Development/ Production	Number of Platforms	Number of Oil Spills: Production 1K bbls	Production 10K bbls	Transportation 1K bbls	Transportation 10K bbls	Exploratory Wells: First	Most Intense	Last	Platforms: First	Most Intense	Last	Devlpmt/Prod. Wells: First	Most Intense	Last
North Atlantic(#52)	28	123	5	.2	.1	1.1	.7	1983	1984-86	1992	1986	1988	1994	1987	1988-89	1996
North Atlantic (new)	134	698	28	1.3	.5	5.1	2.7	1985	1986-88	1996	1991	1993-95	2002	1992	1994-97	2007
Mid Atlantic	118	564	23	.6	.3	2.6	1.4	1984	1985-87	1993	1990	1991-93	1999	1991	1991-94	2004
South Atlantic	72	267	11	.3	.1	1.6	.9	1984	1986-88	1995	1987	1989-90	1997	1988	1989-91	1999
E.G.of Mexico	136	272	11	.4	.2	1.1	.6	1982	1984-86	1997	1985	1987-89	2000	1986	1988-90	2002
C.G.of Mexico	410	926	77	.3	.13	.7	.2	1982	1983-85	1997	1983	1985-87	1999	1983	1986-88	2001
W.G.of Mexico	225	437	36	.12	.1	.3	.1	1982	1983-85	1997	1983	1985-87	1999	1983	1986-88	2001
S.California	211	920	37	.7	.3	2.6	1.3	1983	1985-88	1996	1986	1989-90	1998	1987	1990	2000
C&N California	90	465	19	.4	.2	1.6	.9	1984	1986-87	1995	1987	1988-89	1997	1987	1989-90	1999
S. Alaska(Sale Area)	7	26	1	.1	.04	.5	.2	1986	1987	1991	1991	1991	1991	1992	1992-95	1995
N. Aleutian Basin	14	54	2	.2	.1	1.0	.4	1984	1987	1992	1987	1987	1991	1988	1992	1994
St. George Basin	19	78	3	.3	.1	1.5	.6	1984	1986-87	1994	1987	1987-91	1991	1988	1989-90	1994
Navarin Basin	18	114	3	.5	.2	2.2	.9	1985	1988-89	1993	1988	1988	1995	1989	1984	1998
Norton Basin	21	41	3	.2	.1	.8	.3	1984	1986-88	1994	1988	1988	1993	1989	1989-90	1996
Hope Basin *	6	9	1	.1	.02	.2	.1	1986	1988	1990	1990	1990	1990	1991	1991-92	1992
Barrow Arch *	8	47	1	.2	.1	.9	.4	1986	1989	1996	1990	1990	1990	1991	1991-2000	2000
Diapir Field *	45	332	8	1.3	.5	3.0	.8	1984	1986-88	1997	1986	1989-90	1998	1987	1994-96	2008
OCS-Wide **	1562	5152	261	6.5	2.7	24.1	11.2									

* Includes only the portion of the planning area in water depths of 0-100 meters.
** OCS totals must be calculated from total OCS resource estimates and are not column totals.

Figure 2.6 Interior Department "Best Guess" Development Estimates Under Current Five-Year Schedule (Area-Wide Offerings).
Source: Reference 21

Planning Area	Number of Wells		Number of Platforms	Number of Oil Spills				Exploratory Wells			Platforms			Devlpmt/Prod.Wells		
	Exploratory	Development/ Production		Production 1K bbls	Production 10K bbls	Transportation 1K bbls	Transportation 10K bbls	First	Most Intense	Last	First	Most Intense	Last	First	Most Intense	Last
North Atlantic	28	123	5	.2	.1	.9	.5	1983	1984-86	1992	1989	1991	1997	1990	1991-92	2002
Mid Atlantic	90	422	17	.5	.2	1.9	1.0	1984	1985-87	1993	1990	1991-93	1999	1991	1991-94	2004
Blake Plateau	36	119	5	.1	.1	.7	.4	1985	1987-88	1994	1988	1990-91	1996	1981	1990-92	1998
South Atlantic	18	32	1	.1	.02	.2	.1	1985	1985-86	1989	1988	1988	1988	1989	1989-90	1990
E.G.of Mexico	98	196	8	.03	.01	.1	.04	1982	1984-86	1996	1985	1987-89	1999	1986	1988-90	2001
C&WG.of Mexico	411	869	72	.3	.12	.7	.2	1982	1983-85	1996	1983	1985-87	1998	1983	1986-88	2000
S.California	52	236	9	.2	.1	.7	.22	1983	1985-87	1994	1986	1989-90	1996	1987	1990	1998
Santa Barbara	78	314	13	.23	.1	.8	.4	1983	1985-87	1994	1986	1989-90	1996	1987	1990	1998
C&N California	36	191	8	.6	.1	.6	.4	1984	1985-86	1993	1987	1988-89	1995	1988	1989-90	1997
N.Aleutian Shelf	8	36	1	.1	.1	.7	.3	1984	1986	1992	1987	1987	1987	1988	1988-90	1990
St. George Basin	8	36	1	.1	.1	.7	.3	1984	1985-86	1989	1988	1988	1988	1989	1989-91	1991
Navar Basin	11	44	2	.2	.1	.8	.4	1986	1988-89	1984	1989	1991	1994	1990	1995	1997
Norton Sound	9	27	1	.1	.04	.5	.2	1984	1986	1992	1988	1988	1988	1989	1989-90	1991
Hope Basin	6	9	1	.04	.02	.2	.1	1986	1988	1990	1990	1990	1990	1991	1991-92	1992
Chukchi Sea *	8	38	1	.2	.1	.7	.3	1986	1989	1996	1990	1990	1993	1991	1991-2000	2003
Beaufort Sea *	22	166	4	.7	.3	1.5	.4	1984	1986-88	1994	1986	1986-95	1995	1987	1992-99	2005
OCS Totals	921	2706	147	3.3	1.4	9.9	4.1									

* Includes only the portion of the planning area in water depths of 0-100 meters.
** OCS totals must be calculated from total OCS resource estimates and are not column totals.

Figure 2.7 Interior Department Estimated Development Under Previous Five-Year Schedule (Andrus). Source: Reference 21

Chronology of California
Platform Installations

Installation Date	Platform/ Island	Operator	Water Depth	Field/Unit
1954	Monterey Island	Exxon	42'	Belmont Offshore
1958	Rincon Island	Norris Oil Co.*	45'	Rincon
"	Hazel	SoCal(Chevron)	100'	Summerland Offshore
1960	Hilda	SoCal "	106'	" "
"	Helen	Texaco	95'	Cuarta Offshore
1963	Emmy	Aminoil	41'	Huntington Beach
"	Herman	Texaco	85'	Conception Offshore
1964	Eva	Union	58'	Huntington Beach
"	Esther(Island)	SoCal(Chevron)	35'	Belmont Offshore
"	Grissom "	Long Beach	35'-40'	Wilmington
"	White "	" "	"	"
"	Freeman "	" "	"	"
"	Chaffee "	" "	"	"
1965	Hope	SoCal(Chevron)	140'	Carpinteria (State)
1966	Heidi	SoCal "	128'	" "
1967	Hogan	Phillips	154'	Carpinteria (federal)
1968	Houchin	"	150'	" "
"	Union A	Union	188'	Dos Cuadras
"	Union B	Union	188'	" "
1969	Hillhouse	Sun	190'	" "
1976	Hondo A	Exxon	842'	Hondo/Santa Ynez
1977	Union C	Union	193'	Dos Cuadras
1979	Grace	Chevron	318'	Santa Clara
"	Henry	Sun	291'	Carpinteria (federal)
1980	Ellen	Shell	265'	Beta
"	Elly	"	255'	"
"	Gina	Union	95'	Hueneme
1981	Gilda	Union	210'	Santa Clara
1983	Edith	Chevron	161'	Beta

Source: References 50, 51

*formerly Arco operated this island.

The following sections provide a more detailed review of activities in the State tidelands and Federal OCS California areas:

California Tidelands

Twenty-three fields in the Santa Barbara channel and Los Angeles Basin have been developed beginning in 1868 with the Summerland field, and 17 fields are still active. Total tidelands production peaked in the late 1960's, and will decline in the future. Several fields in the Channel are still developing, but these will be offset by the continued decline of the majority of the tideland oil fields in the Channel and Los Angeles basin (22).

There are four other areas in the Channel tidelands where new production might be achieved. These include the Point Arguello to Pt. Conception area, the Pt. Conception to Goleta Pt. area, the Rincon area, and the Pierpont prospect south of Ventura. The Rincon area could be explored from Norris Oil Co.'s (previously Arco's) existing artificial island, and a discovery could likely be developed from the island without an additional platform. The Pierpont prospect (State lease PRC 3314.1) is being explored and could require a platform should a commercial discovery be made. There is a considerable amount of exploratory activity in the Pt. Conception to Goleta Pt. area. Arco has made recent discoveries on state leases 308 and 309 between Coal Oil and Goleta Points. Arco plans construction of two drilling platforms each with an adjacent production platform connected by a catwalk.

The platforms will be located in about 220 feet of water. Other drilling to the west near Gaviota, Cuarta, and Pt. Conception could result in additional finds. Somewhere in the neighborhood of 3 to 6 platforms might be required should such finds be made.

The State Lands Commission has recently decided to offer the area from Pt. Conception to Pt. Arguello, immediately inshore from the large Pt. Arguello/Hueso field discoveries in federal waters. The area has been divided into eight tracts, thought to contain between 63-274 million barrels of oil and attendant gas, with a mean estimate of 153 million barrels. Six platforms are expected to be required to develop the predicted resource. Water depths range to about 325 feet, with an average depth of about 160 feet over the mid-point of the postulated structures.

Southern California OCS

Beta Field

The field is located in San Pedro Bay, nine miles offshore from Huntington Beach. The field area is large, with water depths ranging from 220 to 1,000 feet. Shell and Chevron are the operators. Shell has installed Platforms Elly and Ellen in 256 and 266 feet of water respectively. Platform Elly is a production support platform with no well slots. In addition to the two existing platforms, Chevron is currently installing Platform Edith on Lease OCS-P 0296, in the northern portion of the Beta Field, and Shell is planning to install Platform Eureka on OSC-P0301 seaward from Ellen and Elly. Edith will be in a water depth of 160 feet, and Eureka will be in 699 feet of water. Shell's Platform Eureka is having its jacket assembled by Kaiser Steel and its deck modules fabricated by J. Ray McDermott in Morgan City Louisiana (23).

Chevron has had a Plan of Exploration approved on OCS-P 0306, which is further seaward of proposed Platform Eureka, with water depths of 1,000-plus feet.

Hueneme Offshore Field

The Hueneme Offshore Field is a relatively small field on two tracts (OCS-P 0202, 0203) at the eastern edge of the Santa Barbara Channel, which in part are within the Channel Islands Marine Sanctuary. Union installed Platform Gina in 95 feet of water in

1981. Production began in 1982 and ultimate oil recovery is estimated at 9.53 million barrels. A Plan of Exploration has been approved for lease OCS-P 0202. In addition, Union proposed further exploration on lease OCS-P 0203, but the Plan of Exploration has been deemed not consistent by the Coastal Commission during consistency review, and Union has appealed the decision before NOAA.

Pitas Point Unit

A discovery well was drilled in 1968 on lease OCS-P 0234, but no development occurred as a result of that oil find. In 1979, a gas discovery resulted in the installation of Platform Habitat. The platform's jacket was constructed at Nippon Steel's Wakamatsu Japan yard. The $80 million, 8-leg 24-slot structure is in 302 feet of water, and is the first platform in the Federal portion of the Santa Barbara Channel to handle gas only. Three or four well slots on the platform are reserved for exploratory drilling of the adjacent lease OCS-P 0233. Texaco is operator of the unit.

Santa Rosa Unit

The unit is currently composed of three tracts (originally it was composed of six tracts; three were relinquished) in the eastern portion of the Santa Barbara Channel, with water depths ranging from 600 feet to 1300 feet. Exxon, the operator of the unit, made a discovery in 1978, but was granted a request to temporarily suspend operations in 1983, and as yet has not filed any production plan.

Santa Ynez Unit

The Santa Ynez Unit, which contains the Hondo, Sacate, Pescado, and Government Point Oil fields, is believed to contain more oil and gas than any other unit in the Channel, and may only be rivaled by the recent Point Arguello discovery off Point Conception. Exxon, the unit operator, and U.S.G.S. have each estimated the total oil in place in the unit at 3-5 billion barrels. U.S.G.S., using a recovery factor of 22-34%, has estimated that 730-1,100 million barrels could be produced from the unit. The Oil and Gas Journal (January 31, 1977) estimated that 1,000 million barrels might be produced from this unit. Exxon's own estimates, using a 10-15% recovery factor, is that 300-500 million barrels could ultimately be produced (24).

Such divergence in estimates highlight the uncertainties inherent in OCS facilities planning. In the case of Santa Ynez, part of the uncertainty stems from the fact that the main reservoir rock is fractured Monterey shale, which, even after delineation, is difficult to predict. Another factor is the depth of the water. With depths ranging to 1400 feet, production technology is pressed to its limits and cost factors are very high. The tendency is to estimate and design more conservatively. Also the technology is changing. It was originally thought that non-conventional production technology such as compliant towers or subsea production systems would be required to develop the deep water of the Hondo and Pescado fields. It has now become feasible, however, to utilize conventional steel jacket platforms for the development of these fields. Recent advances in rolling mill capabilities, launch barge capacities, and pile driving hammer energies have extend conventional steel jacket technology to deeper waters than previously projected (See Chapter 1).

Three to four new platforms are planned for the Santa Ynez Unit. One additional platform would be used in the Hondo field in 1200 feet of water (Hondo B), one or two platforms in the Pescado field at either 1075 feet or 1025 and 1140 feet, and in the 620 feet in the Sacate field. Discovery wells have been drilled in the Government Point and Abalone prospects in the western area of the Unit, but further evaluation is required to determine commerciality.

Point Arguello/Hueso Field

Chevron drilled a well in November, 1980, that hit what is thought to be one of the largest finds since Prudhoe Bay in Alaska.Although the Point Arguello/Hueso field is not expected to be as large as the 9.6 billion barrel Prudhoe bay field, it may be as large as one billion barrels, possibly larger. Chevron estimates their share of recoverable oil in the new field to be 100-300 million barrels of oil, and estimates two to six platforms would be required to develop the finds. Water depths of the structure as presently delineated range between 350-1220 feet. Texaco drilled a discovery well on lease OCS-P 0315, due west of Chevron's. Texaco is beginning design work on a platform with a peak production capacity of 50,000 barrels for its Hueso field discovery. Although Texaco has not released reserve estimates, such a production peak indicates that the field is probably at least 150 million barrels. These discoveries have touched off speculation that only the tip of the iceberg has been discovered and that the three billion barrel potential estimated for the Santa Maria Basin by U.S.G.S. to have 5% probability may be realized (25).

ALASKA

Alaska is in an earlier stage of development than the southern California offshore area. Currently the only offshore production is in the Cook Inlet in state waters. The production is the result of discoveries in the early 1960's, and currently there are 14 platforms producing oil and gas from the State-leased areas of Upper Cook Inlet (See Fig. 2-9). The Cook Inlet is part of the Gulf of Alaska subregion, where five of the six Alaska OCS lease sales have been held to date. The other sale was held in the Beaufort Sea area (currently referred to as the Diapir Field planning area by the Interior Department) in the Arctic subregion. Figure 2-10 displays the Alaska subregions and planning areas.

The large Prudhoe Bay oil field (9.6 billion barrels) is primarily onshore adjacent to the Beaufort Sea. Production of the field is currently limited to onshore, although the delineation of the producing area extends offshore into Prudhoe Bay (Fig. 2-11).

Interior Department estimates of expected number of platforms are presented in Figures 2-4, 2-5, 2-6, 2-7 on pages 2-4 through 2-8. However, based on a review of the literature on the platform technologies expected to be used in the various Alaska subregions, it appears that only the Gulf of Alaska and, perhaps the southern portion of the Bering Sea subregion has the potential to exert a demand for fixed steel leg platforms. Other regions farther to the north with heavier ice conditions are expected to utilize gravel islands for shallow water (maximum of 40-60 feet) production and steel or concrete gravity platforms for deeper

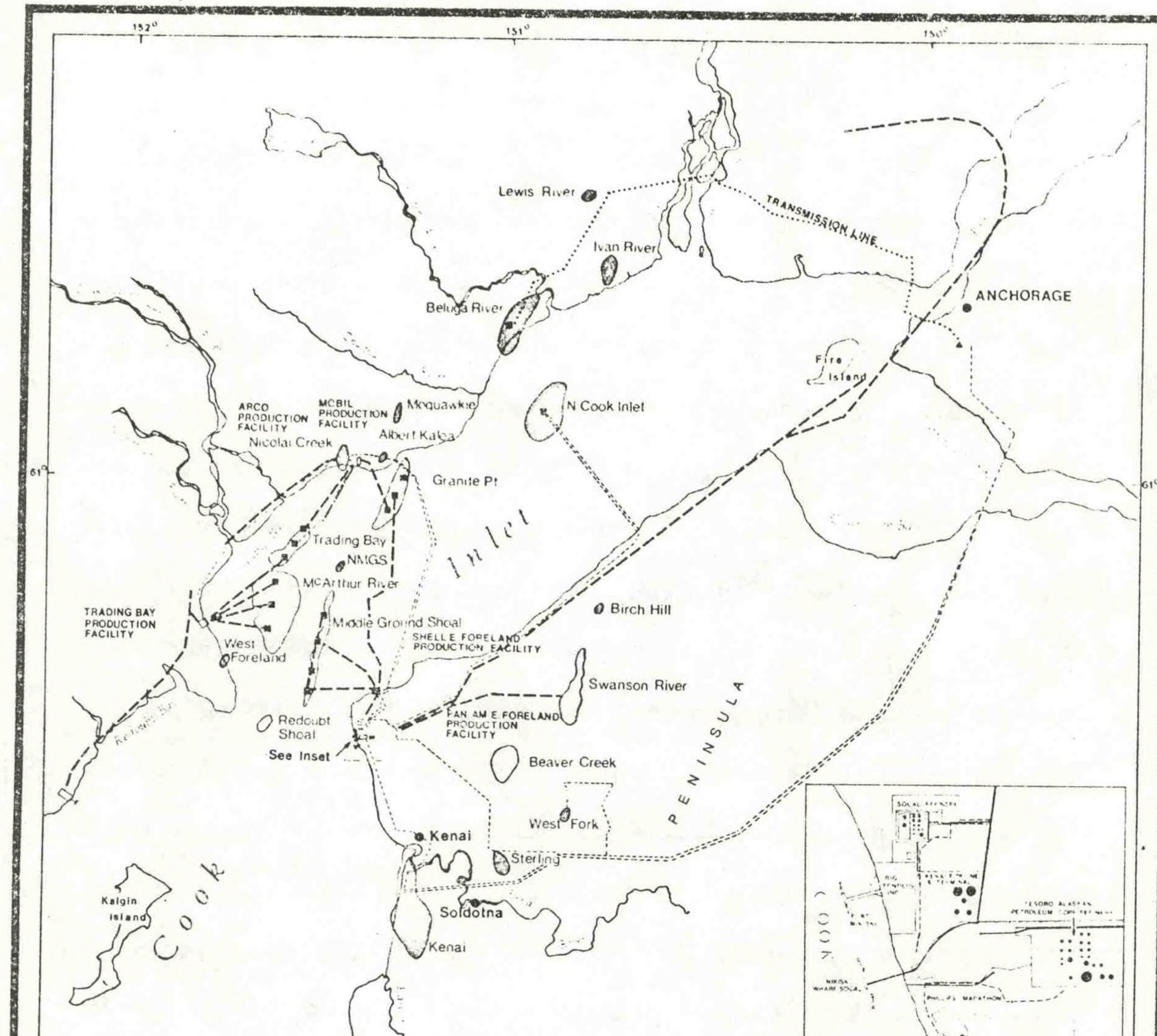


Figure 2.9 Location of fields and facilities in the Cook Inlet area.

Source: 35

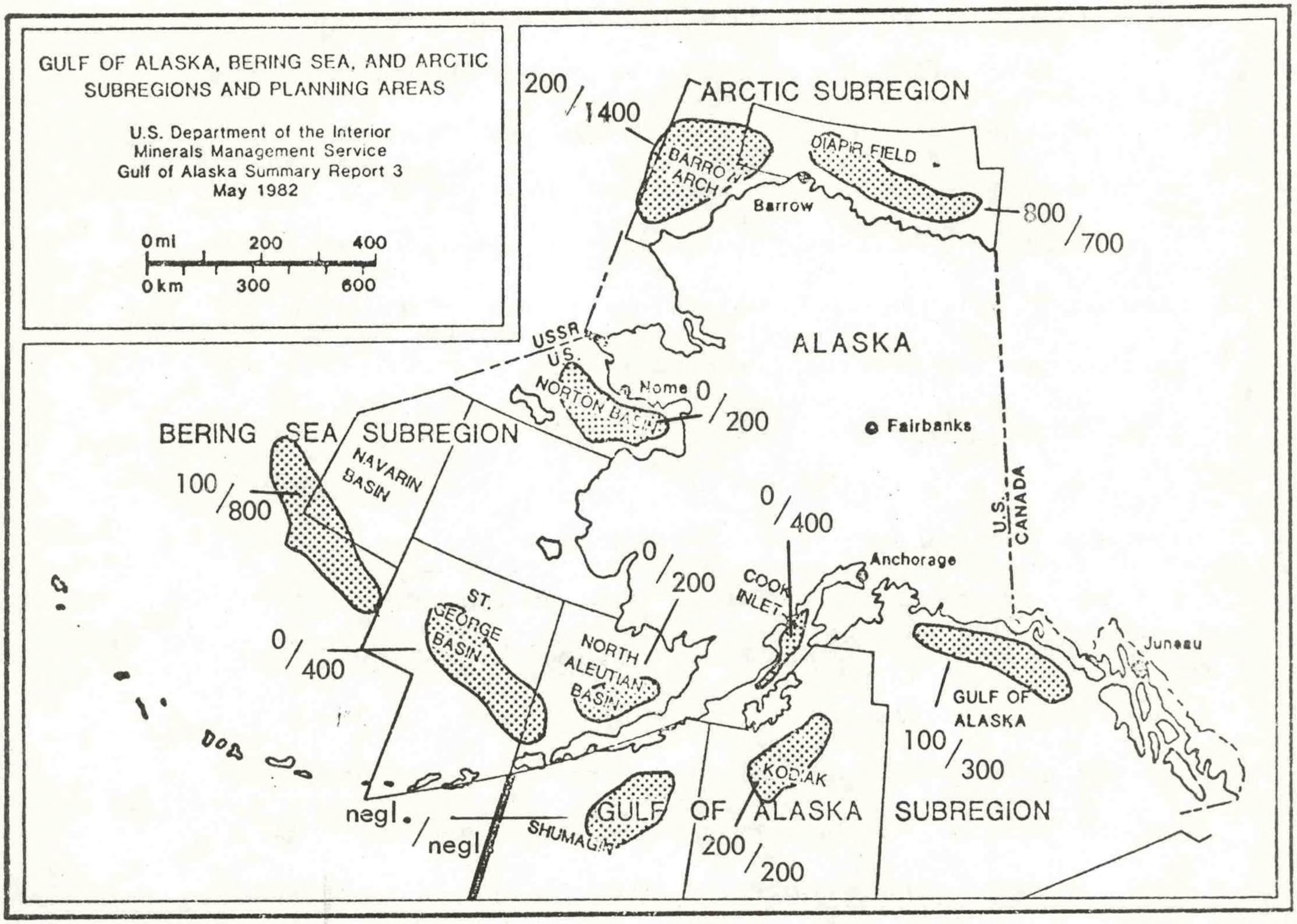


Figure 2.10 Alaska Planning Areas, Subregions, and Mean USGS Resource Estimates, greater than 200 meters/ less than 200 meters

Source Reference 35, and USGS OFR 81-129 water production. However, since there is currently no production in these areas, such information must be regarded as tentative and may be subject to change in the future. The most significant potential land use demand for West Coast ports likely to result from Alaskan oil and gas development is not associated with platform fabrication and assembly but rather from modular construction for production support of North Slope development.

Cook Inlet-Gulf of Alaska

The 14 platforms installed in the Upper Cook Inlet between 1964 and 1968 are uniquely designed for their specific location, and are substantially different from conventional eight-leg platforms used in the Gulf of Mexico and southern California. The Cook Inlet platforms were built with one, three, or four large diameter caisson-like legs used to support the drilling decks. All the wells are drilled through the legs. The design is a result of considering a number of rather severe environmental conditions: sea ice on a seasonal basis, tides to 30 feet, earthquakes, and currents to 8 knots. The large diameter legs reduce the drag effects of the ice and currents, and allow well stems and other riser equipment to be in a protected enclosure to avoid ice build up. The Upper Cook Inlet platforms, the deepest of which is in 130 feet of water, are considered to be rather small when compared to those anticipated to be used in the OCS portion of the Gulf of Alaska area (26). While fixed steel platforms similar to those in Upper Cook Inlet would be one possible platform technology for the Gulf of Alaska OCS, one must consider that the full range of available platform technologies, including steel and concrete gravity platforms, and self-floating steel-legged structures, would be utilized, depending on how the various environmental conditions and production needs apply to the given situation. It might be expected that the resulting mix of platform technologies used in the Gulf of Alaska OCS would be similar to the mix used in the North Sea, with the addition of the special design considerations to cope with seasonal ice and seismic activity.

Due to lack of discoveries in recent exploratory efforts, interest in the Gulf of Alaska area has slacked off and U.S.G.S. has downgraded it's oil and gas estimates (see Figure 2.10). Substantial potential still exists for the area, but until a commercial discovery is made, a firm demand estimate is not possible. It should be noted, however, that because one of the platform technologies that could be used is the very large self-buoyant steel platforms of the 200,000-300,000 ton class, a commercial discovery in this area could cause a dramatic rise in the required tonnage of steel fabricated on the West Coast.

Arctic-Bering Sea

Substantial exploration has occurred in the Beaufort Sea (Diapir Field) area, both in Canadian and U.S. waters. Efforts in Canadian waters have preceded drilling efforts in the U.S. portion. To date, there is no production in the area; however, some significant oil shows are are currently undergoing evaluation as a result of the Joint State of Alaska/U.S. Interior Department Lease Sale held in 1979, and previously held State

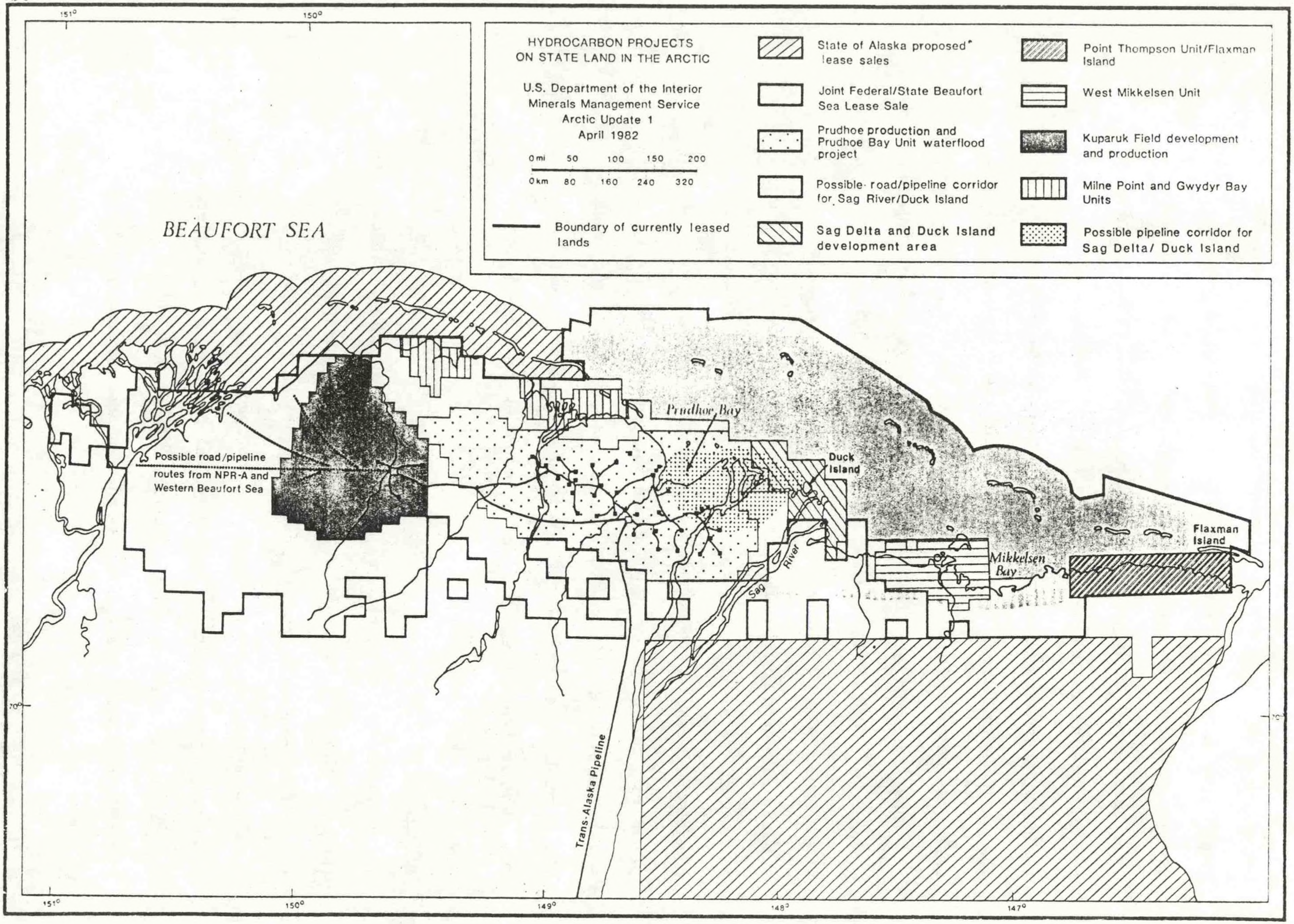


Figure 2.11 Alaska North Slope Development Activity Source: Reference 34

sales, and Sohio has filed plans to develop the Sag River/Duck Island area.

Exploratory drilling has been conducted from three types of temporary islands: dredged sand islands, gravel islands, and ice islands. Seventeen islands were utilized in the Canadian Beaufort Sea for exploratory drilling through 1979 in water depthsranging from 4 to 63 feet. Most were constructed in the summer by dredging. Others were constructed in winter by trucking gravel out to the site and dumping it through a hole in the ice. The gravel islands are considered to be less impacting than the dredged type of island. In 1977, Union Oil first utilized an ice island in 9 feet of water. Union grounded the ice onto the sea floor bottom by successive flooding and thickening of a round section of ice cut away from the ice pack. The island had been completed by January 20, and the rig was brought out and completed the drilling operation by mid-April. By early July the island had completely disappeared (27).

Gravel islands are the anticipated production technology for waters to a maximum of 60 feet. Sohio's preliminary plan of development for the nearshore Sag River/Duck Island area calls for four gravel islands. Steel or concrete gravity platforms are currently the technology anticipated for deeper waters. The hostile environment and remoteness of the sea ice areas favor the use of gravity structures that can be preassembled at a construction site in temperate waters, towed to location, and installed quickly with all or most of the production facilities already in place. Cone-type steel gravity structures would be a prime candidate for production platforms in the Hope, Norton, and St. Matthew-Hall basins out to 200 feet, with manmade islands being applicable for the shallow water portions of those basins. In the southern part of the Bering Sea where there is less ice, more conventional platform designs become practical. The pile-founded caisson structures similar to the Cook Inlet platforms can probably be designed for the relatively shallow water areas such as Bristol Bay. For the deep water St. George and Navarin Basins, with water depths ranging between 300-365 feet, gravity structures similar to the Con-Deep type used in the North Sea appear to be likely candidates (28).

Gravel islands for exploratory drilling tend to be expensive, and the increasing amount of activity on the North Slope has taxed sand and gravel supplies and led Interior Department to initiate lease offerings for sand and gravel mining. Because of the cost and constraints, alternatives to gravel islands are being developed and may replace islands for exploratory use. The configurations of the various drilling rig designs being considered may lend themselves to assembly at a platform assembly yard, but at this point it is difficult to predict precise assembly site requirements.

components in the Arctic, a demand presently exists for modular components to support drilling, crew quarters, and production equipment. Demand for these units, to support both offshore and onshore production, will very likely increase as North Slope petroleum areas are developed. This demand will most likely be met by Japanese firms in absence of expanded West Coast capacity.

SUMMARY & DISCUSSION

Currently off California there are 11 platforms that are firmly proposed, and another 6 to 9 which are anticipated to be needed to produce fields already discovered. See Figure 2.12. Installation for these platforms is scheduled or expected to occur over the next 6 to 8 years. In addition to this fairly firm demand, exploratory efforts, particularly in the Santa Maria Basin, will very likely yield several additional commercial finds during the next two years. More precise delineation of the Pt. Arguello area fields and reevaluation of recovery factors for these fields may lead to additional platforms being required for this area. Resumption of drilling on State leases, as well as exploration in the Beta, Santa Clara, Hueneme, & Santa Rosa Units may also yield discoveries within the next two years. Lease Sales #73 and #80, and the State Pt. Conception Lease Sale will also add potential demand which will begin to be exerted within the next four years. Estimates on the total number of additional platforms to fully develop the oil and gas of the region range from between 30 to 138, with best guess estimates predicting about 50 to 60 to be installed between now and the turn of the Century.

Predicting the ultimate number of platforms to be installed in the future might best be expressed by referring to them as a probability distribution curve. The lowest estimates will have the highest probability of being realized and the highest numbers will have the lowest probability of being totally achieved. The numbers at the mid-point of the curve will be the mean probability numbers and will generally correspond to the average or best guess

Proposed Platforms

California

Installation Date	Platform Name	Operator	Water Depth	Unit/ (field)
1984	Eureka	Shell	699'	Beta
1985	Hermosa	Chevron	605'	Pt. Arguello
"	Hueso(Harvest)	Texaco	788'	Hueso
1986	Gail	Chevron	740'	Santa Clara (Sockeye)
"	(unnamed)	Arco	220'	Coal Oil Point
"	"	"	"	" "
"	"	"	"	" "
"	"	"	"	" "
1987	Hondo B	Exxon	1200'	Santa Ynez (Hondo)
1988	Pescado A*	Exxon	1075'	Santa Ynez (Pescado)
1989	Sacate	Exxon	620'	Santa Ynez (Sacate)

Additional Anticipated

Platforms

1985	(planned)	Union	260'-300'	POCS Lease #441
1987	(probable)	"	" "	" " "
1989	(possible)	"	" "	" " "
1986	(probable)	Chevron		Point Arguello
1988	(possible)	"		" "
(89-92)	(possible)	"		
"	(possible)	"		
(88-92)	(probable)	Texaco		Hueso
"	(possible)	"		"

*Alternative option for the development of the Pescado field includes two platforms, Pescado B1 & B2, at 1025' and 1140' respectively. Approximate installation date of B1 is 1992 or 1998; for B2, 1988.

Source: 42, 48, 46, 43

Figure 2.12

estimates. In applying this scheme to the California situation, the estimates that have a 95% probability of being realized are probably between 10 to 20. This number takes into account all the various uncertainties associated with projecting into the future such as war, major oil spills and other events that may alter current trends, and technology changes. The mean probability numbers seem to range somewhere between 40 to 60 platforms, and the numbers that seem to have a 5% chance or less of occurring are those above 120 or so.

Estimating shear numbers for purposes of land use demand may, however, be somewhat aside the point. Perhaps the most relevant numbers are those that indicate the timing of the demand. These figures indicate relatively high peaks in platform demand at around the end of the decade, in the range of 5 to 10 installations per year. While this pace is rapid relative to California's past experience, it does not seem unrealistic considering that over 100 platforms per year have been installed in the Gulf of Mexico for the last several years.

Possibly not more than three Plans of Development could be generated, reviewed, and processed in any given year of the California OCS. This assessment is based upon a variety of factors and conditions affecting the California situation, including pattern of lease ownership, limitations on administrative, managerial, and engineering manpower capabilities, as well as present regulatory capabilities. (MMS however, has indicated that they would review and process as many Plans of Development as recieved in a year.) It should be noted, however, that Plans of Development often address more than one platform, and that installation plans for subsequent platforms to a given field can be substantially less complex and time comsuming than the first. Chevron's Pt. Arguello Production Plan, for instance, at present includes only one specific platform (Hermosa), but Hermosa is being planned to accept production from three additional platforms. Arco's Coal Oil Point Project in State waters consists of two pairs of platforms, each pair consisting of a drilling platform and an adjacent processing platform.

One important point relative to land use that seems to be lacking from previous planning documents discussing this issue is that there is a significant difference between simple assembly yards and integrated fabrication yards. Assembly yards are typically much smaller facilities, ranging between 20 to 300 acres in size. Integrated yards that include both fabrication and assembly tend to be substantially larger, ranging from 300 to 1500 acres.

From the standpoint of land use demand, the timing of construction and installation of each individual jacket is the most critical element. The size of each jacket is also an important factor. Figure 2.13 lists the anticipated platforms with construction and installation times approximated. The accuracy of the approximations varies substantially because of the various planning stages each of the projects is in, and the varying degrees of complexity associated with each project. Thus the listing should be considered both approximate and tentative. Nevertheless, it is useful in illustrating assembly yard usage

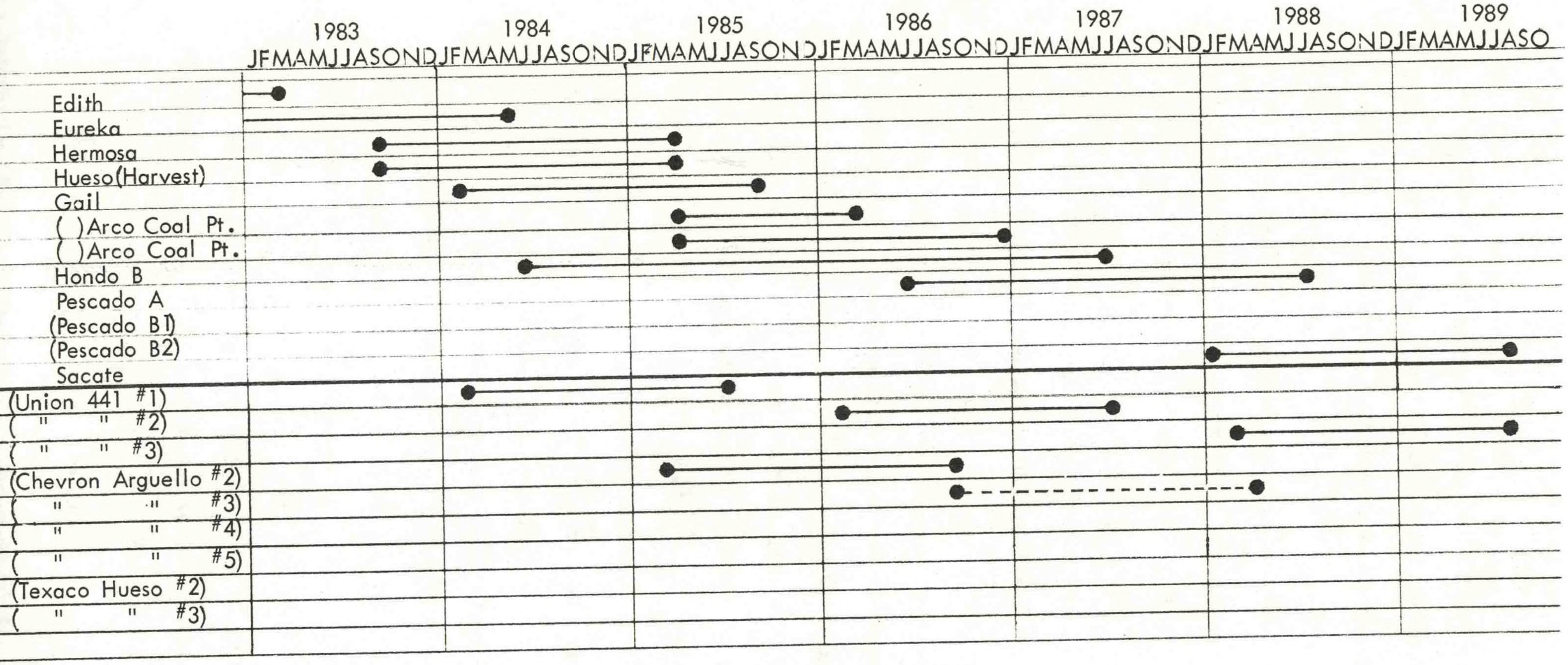


Figure 2.13 Tentative Construction and Installation Schedule for Proposed and Anticipated Platforms. (For each platform, first dot indicates start of jacket construction, second dot indicates loadout.) See text notes.

Sources: 42, 48, 46, 43, 41, 51

over the next few years. It indicates that for most of the period covered, at least five platforms will be under construction at any given time. Any new discoveries over the next four years will add to the list during the time period covered.

Based on near term demand, approximately 5 to 8 skidways will be needed over the next six to eight years, assuming all are to be built in the United States. New commercial discoveries would add to this total. This rate will likely continue through the mid 1990's, with a downturn coming near the turn of the century.

With respect to the assumption concerning whether or not the platforms would be built in the United States, it appears that West Coast yards can be fully competitive with Gulf Coast and foreign yards for moderate to large platforms, but they would be at a slight competitive disadvantage for smaller platforms that would have cheaper tow costs. Since there is currently only one fabricator on the West Coast, a second fabricator may add to the total competitive advantage of West Coast yards.

The Alaska situation with respect to demand is dominated by uncertainty. No firm demand for steel jackets can be projected based on the present situation; however, a commercial find in the Gulf of Alaska could cause a dramatic rise in the West Coast platform tonnages required per year because of the very heavy jackets that could be used in that region. A 1976 marketing survey predicted a rise from the present 50,000 ton capacity requirement to a 250,000 ton requirement per year based on an assumed Gulf of Alaska commercial find (29). Although other Alaska offshore regions are less likely to exert a demand for fixed steel platforms than the Gulf of Alaska, all planning regions should be watched closely for the type of platform that is chosen to develop the find. Demand for on-shore modules used for drilling support bases will continue to be exerted by North Slope development activities and the high likelyhood of additional discoveries in that region. The demand for these modulars appears to offer a significant fabrication and assembly opportunity and may exert a land use demand at West Coast ports.

Notes and References

1. Will, Stephen A., ASCE, "Construction of Offshore Platforms", in Journal of the Construction Division, Proceedings of the American Society of Civil Engineers, Vol. 108, No. CO4, December, 1982.

2. Dunn, F. P., "Deepwater Drilling and Production Platforms in Non-Arctic Areas", in OCS Frontier Technology Proceedings, December 6, 1979, National Academy of Sciences, Marine Board Assembly of Engineering, Washington, D.C 1980, p. 25.

3. Oil and Gas Journal, April 30, 1979.

4. Stafford Menard, McDermott Fabrications, J. Ray McDermott & Co., Inc., Morgan City, Louisiana, personal communication, 6/13/83.

5. Op. cit. #1, p. 515.

6. Op. cit. #4.

7. Freedman, J.R., and Miller, K.S., U.S. Marine Construction Survey 1976-1985, Smith Barney, Harris Upham & Co., March, 1977., p. 14.

8. Ibid, p. 14. Also, personal communication with Richard W. Holt, Kaiser Steel Corporation, Napa, CA, 6/83, indicated a capacity of 4,000 tons/month; current operations are at the 1,400-1,500 ton/month level, with flexibility to increase fabrication capacity to meet demand.

9. Times-Standard news item, March 8, 1983.

10. Iver Thomas, Kaiser Steel Corporation, Napa, California, personal communication, 6/14/83.

11. Op. cit. #4.

12. Wayne C. Till, Chief, Bridge Section, Twelfth U.S. Coast Guard District. Alameda, CA, personal communication. See also Bridges Over Navigable Waters of the United States, Part 4, Pacific Coast. Coast Guard publication No. CG 425-4, October 30, 1975, and data sheets of amendments.

13. Department of Energy, Federal Leasing and OCS Energy Production Goals, 6/79. DOE/RA-0037, p. 196, gave 1977 estimate of 2255 total platforms, 604 of which were major. This was updated by op. cit. #4.

14. Department of the Interior, Minerals management Service, Pacific OCS Region, Draft Environmental Impact Statement, OCS Sale No. 73, p. 4-69.

15. Ocean Industry, October, 1979, P. 64.

16. California Division of Oil & Gas, 67th Annual Report, 1981, p. 73, and Preliminary Estimates of 1982.

17. Ibid, plus Roger, Golden, and Halpren, Inc., Pacific Summary Report 2, USGS Open File Report 82-21, p. 16.

18. USGS Open File Report 81-192, Estimates of Undiscovered Recoverable Resource of Conventionally Producible Oil and Gas in the United States, A Summary, pp. 8,10. Published in Draft Supplement to the Final Environmental Statement, Proposed Five-Year OCS Oil and Gas Lease Sale Schedule, January 1982-December, 1986, 1981.

19. Ibid.

20. U.S. Department of the Interior, Bureau of Land Management, Draft Supplement to the Final Environmental Statement, Proposed Five-Year OCS Oil & Gas Lease Sale Schedule, January 1982-December 1986, p. 14.

21. U.S. Department of the Interior, Bureau of Land Mangement, Final Supplement to the Final Environmental Statement. Proposed Five-Year OCS Oil & Gas Lease Sales Schedule, January 1982-December 1986. pp. 30-86.

22. State of California, Office of Planning & Research, Offshore Oil & Gas Development: Southern California, October, 1977. p. 680.

23. Op. cit. #17, Rogers et. al.

24. Op. cit. #22, p. 665.

25. Resource estimate is from Reference #18 (op. cit), pp. 8, 10. The 3 billion barrel figure comes from adding the 5% figure for less than 200 meter water depth (0.8 billion) with the 5% figure for greater than 200 meters water depth (2.2 billion) for the Santa Maria Basin. When resource estimates are added like this, the resulting probability that both figures will be realized is somewhat lower than 5%, as per USGS discussions on Monte Carlo aggregation techniques. For references on speculation on the size of possible funds see San Francisco Chronicle, 11/18/82, p. 1, and New York Times, 11/15/82, p. 1.

26. Alaska Department of Community and Regional Affairs, Planning for Offshore Oil Development: Gulf of Alaska OCS Handbook, 1978, p. 11.

27. Jahns, Hans O., "Arctic Platforms", in op. cit. #2.

28. Ibid.

29. Op. cit. #7.

Additional References

30. U.S. Army Corps of Engineers, Portland District, Draft Environmental Impact Statement, Construction and Operation of Pacific Fabricator's Steel Structure Fabrication Yard at Warrenton, Oregon, December, 1977.

31. U.S. Army Corps of Engineers, Seattle District, Environmental Impact Statement-Final, Port of Grays Harbor/Kaiser Steel Corporation, July, 1976.

32. Rogers, Golden, and Halpern, Inc., Alaska Index, U.S. Geological Survey Open-File Report 82-18, 1982.

33. Rogers, Golden and Halpern, Inc., Arctic Summary Report, USGS Open-File Report (81-621, 1981.

34. Rogers, Golden and Halpern, Inc. Update 1, Arctic Summary Report, May, 1982, USGS Open-File Report 82-19.

35. Rogers, Golden and Halpern, Inc. Gulf of Alaska and Lower Cook Inlet Summary Report 3, USGS Open-File Report 82-20, June, 1982.

36. U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Environmental Planning for Offshore Oil and Gas, Volumes I-V, March, 1978.

37. Chambers Consultants and Planners, Final Environmental Assessment/Environmental Impact Report for Natural Gas Platform "Habitat" and Pipeline, Pitas Point Unit, Texaco, Inc., April, 1981.

38. Exxon Corportation, "The offshore search for oil and gas", second edition, 8/75.

39. McDermott Fabricators, "McDermott Fabricators, Morgan City", (brochure), 1982.

40. Texaco, Inc., Pitas Point Unit Development and Production Plan, September, 1979.

41. Chevron U.S.A. Inc., Development and Production Plan, Point Arguello Field, December, 1982.

42. Rogers, Golden and Halpern, Inc., Pacific Summary Report, December, 1982.

43. John Shalz, Arco Oil and Gas, Bakersfield, CA, personal communication.

44. Tom Dunaway, Pacific OCS Office, personal communicatons.

45. Mari Gottdiener, California Coastal Commission, personal

communications.

46. Greg Moon, Union Oil, Goleta, CA, personal communication.

47. Gerry Turner, Oxy Petroleum, Bakersfield, CA.

48. Steve Craig, OCS Coordination, Department of Ecology, State of Washington, Olympia, personal communication.

49. Los Angeles Harbor Department, Draft Environmental Impact Report for Kaiser Steel Corporation Terminal Island Marine Assembly Yard, Port of Los Angeles, California, June, 1983.

50. State of California, Resources Agency, The Offshore Petroleum Resource, 1971.

51. Interior Department Data Sheet, "Platform Information", Pacific OCS Region, December, 1981.

52. D.S. Moore, Chevron USA, Concord, CA., personal communication.

53. Richard Holt, Kaiser Steel Corporation, Napa, CA., personal communication.

54. Al Zurawski, Crowley Maritime Corporation, San Francisco, CA., personal communication.