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The following has been approved for answering queries:

Governor Reagan supports federal backing of a loan to the Lockheed Aircraft Corporation to enable the company to manufacture and sell the 1011 "Tri-Star" airbus.

The governor feels, however, that the loan guarantee should be conditioned upon the feasibility of producing the plane at currently estimated costs, and without any significant delay beyond presently estimated delivery dates.

He also feels that safeguards should be provided to make certain that the loan guarantee cannot be used in any way to improve Lockheed's competitive position over other aerospace firms in relation to other projects.

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Space Shuttle's new era dictates different needs for space launches and retrievals. At the outset of America's space age we were seeking both thrust and reliability. Then, Cape Kennedy afforded the needed boost of an eastward thrust near the Equator and ocean-overflight as a potential safety haven while we improved reliability.

But, the Space Shuttle has different requirements. The Shuttle will have assured thrust-capability, a necessity for several azimuth angles of launch, an emergency ability to abort safely and intact, and the intent of a glide or powered landing at a dry land base. These abilities, and concurrent requirements, prompt the search for an applicable base-site in the continental United States.

California offers a solution.

California's solution is the currently existing, applicable, and complementary facilities inherent in the combined use of the bases at Vandenberg and Edwards. Vandenberg for launch and most retrievals; Edwards for alternate and emergency retrievals.

Thereby, the use of Edwards for flight-testing implies that facilities developed for such testing could be economically phased into follow-on use for retrievals. The proximity of the two bases makes possible an efficient interchange between the two, initially during testing and ultimately during operations, without costly dislocation.

Combined, they resolve most objections found elsewhere, and combined they equal or surpass most isolated and individual advantages claimed elsewhere.

Choice of a launch-retrieval base site should be made on a priority-rated scale ranked by significance to national goals and weighted by value to operations. California endorses a decision evaluated on that criteria. California has the qualifications to justify a decision reached on that basis.

California's qualifications, combining Vandenberg and Edwards:

Strategically essential  
Demonstrated necessity  
Foreign avoidance  
Favorably situated  
Optimum climate  
Existing facilities  
Convenient fuel  
Airfield capability  
Waterborne adaptable  
Accessible manufacturers  
Ascending importance  
Eliminates moth-balling  
Overwater trajectory  
Safety zoned  
Sparsely inhabited  
Casualty avoiding  
Dispersing sonic-boom  
Compatible mating  
Cost efficient  
Skilled manpower  
Receptive economy  
Aerospace compatibility  
Manning capabilities  
Environment conscious  
Cumulatively superior

### Strategically essential

Reportedly, over 93% of America's orbiting space shots are polar. Thereby observing the Earth perpendicularly at every latitude as it rotates below. America's polar shots start from Vandenberg.

Retrograde shots achieve sun-synchronous orbits to view the Earth consistently in sunlight or dark. 133 of America's 136 retrograde shots were fired from Vandenberg.

The majority of shots America evidently deems strategically essential are made from Vandenberg. Prudently, we should assure our strategic obligations first, our less-essential obligations thereafter.

### Demonstrated necessity

Vandenberg's necessity is evident from the decision to develop our capability there even though initiating the Cape Kennedy space site.

Since 1957 the need for a Vandenberg capability has been developed and demonstrated; a necessity not satisfied elsewhere.

### Foreign avoidance

Shots from Vandenberg avoid flight over foreign territory during initial ascent. For Space Shuttle, a California launch site also avoids the booster's return flight over foreign territory.

The problems of having dropped missile parts upon Cuba from Cape Kennedy, the threat of the Cuban missile crisis years later, and the national policy decision to avoid Cuban overflights underscore the shortcomings of Cape Kennedy for polar and some retrograde shots which comprise the bulk of our space azimuth-angle needs. Space Shuttle shots to the south from Cape Kennedy would overfly Cuba and Panama; boosters would be returning over Cuba vulnerability at a 13,000 foot altitude. Such a possibility induces the likelihood of exploitation of our foreign neighbors by our international competitors.

### Favorably situated

Combined or separately, the two California sites are favorably situated. They facilitate strategic needs, offer coastal availability or inland isolation, semi-rural locale but nearby metropolitan requirements, southerly for thrust of Equatorial-nearness yet Western in weather advantages, and convenience to aerospace centers and suppliers.

### Optimum climate

Predictable weather and evenness of climate aid operations. California affords inland desert dryness and a less pervasive coastal humidity than that deteriorating Cape Kennedy facilities. Minimum necessity for protection from weather extremes favors operations.

At Vandenberg thunderstorms occur less than 5 days a year, while thunderstorms at Cape Kennedy average 75 annually. Lightning activity, which is almost unknown at Vandenberg and Edwards, occurs 100 days a year at Cape Kennedy where lightning strikes between 20 and 40 times within a square mile each year.

The modest wind gust level at Vandenberg is tolerable, compared with gusts approaching hurricane velocity at Cape Kennedy.

### Existing facilities

The largest launch area in the western world, Vandenberg maintains 44 launch sites of which 30 are active. With a range ten times the size of Cape Kennedy, the Vandenberg base comprises 100,000 acres traversed by 327 miles of roads, dotted with 3,500 buildings -- 1,400 of which relate to base operations, and 2-1/4 million square feet of which are occupied by missile contractors. Vandenberg represents a construction investment since 1957 of \$2.4 million.

Vandenberg and Edwards admirably satisfy the caveat in site selection: "make maximum use of existing facilities".

The premier landing and testing facility in the Nation exists at Edwards insofar as extensiveness, visibility, unobstructed access and existing facilities. Covering over 300,000 acres, and served by an array of hangars, buildings, shops and laboratories, Edwards maintains an assembly of tracking facilities, houses the Aerospace Research Pilot School and since 1953 has conducted rocket test firings at the \$150 million aggregation of high thrust rocket test stands and research equipment buildings.

#### Convenient fuel

California already has both the natural gas network as well as plant facilities for converting natural gas to liquid hydrogen. California's liquid hydrogen plants can produce more than the 90 tons-per-day the Shuttle will require during its peak operation. California has over three times the liquid hydrogen plant capacity of any other state.

Within 150 miles of either Vandenberg or Edwards, plants can supply by tank truck more than adequate fuel for the Shuttle's initial years.

By contrast, the Cape Kennedy site requires a 740-mile haul by truck or train for most of the liquid hydrogen consumed. One study concluded: the costly alternative is to dismantle one of California's plants and re-construct it in Florida.

A California site also makes unnecessary another alternative, that of an international agreement for converting crude oil to liquid hydrogen in another country for shipment to America, thereby avoiding American import duties on crude oil.

#### Airfield capability

Vandenberg's airfield adjoins a likely Shuttle launch complex. Adequacy is demonstrated by its use for training by commercial pilots of 747 aircraft which approximate the booster in size. Extensive flat land surrounds the strip, making expansion of its 8,000 feet convenient to achieve.



Edwards is one of the Nation's largest landing areas. A 15,000 foot concrete runway adjoins the 44 square mile sun-hardened, wind-smoothed Rogers Dry Lake. In turn, Rogers connects with 27 square miles of Rosamond Dry Lake bed. Seven natural runways criss-cross the 11-mile length of Rogers Dry Lake. The supportive strength of these dry lake beds is equivalent to a three-foot thickness of concrete and can support up to 250 pounds per square inch.

The largest and heaviest of the world's aircraft land here. Three billion dollars worth of aircraft have been saved since 1946 from loss of crash landing by directing them to Edwards.

By contrast, a landing strip adjacent to a Shuttle complex at Cape Kennedy would have to be built at more than \$1,500 a foot.

#### Waterborne adatable

Coastal accessibility makes Vandenberg convenient by boat or barge to all the Pacific aerospace ports from Seattle to San Diego and to shipments from the Gulf Coast.

A sheltered lagoon exists on Vandenberg's 36-mile coastline within a short distance of the intended Shuttle site. Limited dredging could prepare this convenient natural port to receive Shuttle barge shipments. Reportedly, the sand bottom is coarser and less subject to silting and wave action than the Cape Kennedy barge channel.

Over a decade of logistics experience has been perfected at Vandenberg in missile and aerospace shipments by plane, truck, and rail. Shuttle shipments can adapt this knowledge in the handling of large and awkward components.

#### Accessible manufacturers

Convenience to manufacture and assembly is a cost-efficiency criterion in selecting a base site.

Virtually every manufacturer earmarked as a likely participant, including payload and servicing contractors, has a major installation in the nearby California and



Pacific Coast aerospace complex. Most are located within an easy drive of Vandenberg or Edwards, making shipment less time-consuming, servicing convenient, and reducing the costs for rotation of personnel.

All major aircraft builders use Edwards for test purposes; most of those engaged in today's missile hardware business maintain personnel and service facilities at Vandenberg.

#### Ascending importance

Vandenberg's importance and frequency of use will correspondingly increase as the Apollo era ends and as Space Lab is completed.

The diminishing of space work elsewhere, and the four or five year hiatus in manned space flight, increases the reliance on and need for this major remaining site.

The continuing necessity for Vandenberg's capabilities, the steady schedule of operations, a readily accessible work force, and a physical plant maintained in response to current operations increase the legitimacy of Vandenberg's importance.

#### Eliminates moth-balling

Cost savings occur when our space program can avoid incurring the relatively unproductive expense of moth-balling and the follow-on reactivation expenses.

Facilities at Vandenberg and Edwards will continue to be used in a regular schedule of operations and the expense of moth-balling while awaiting the Shuttle era can be avoided. Furthermore, construction at Vandenberg and Edwards could be scheduled when timely and feasible rather than being initiated in the near-future as a means to stretch-out, prolong, and maintain an otherwise declining level of activity.

### Overwater trajectory

Vandenberg's bay-window on the Pacific scans 210° of clean front, from 120° to 330°.

The overwhelming preponderance of our current space shots, both polar and retrograde, capitalize on these overwater trajectories from Vandenberg.

Therefore, if an overwater trajectory is advantageous during the Shuttle's development as well as for frequently used azimuth angles...yet paralleling relatively nearby emergency or alternate landing sites in the continental United States without requiring foreign landing rights...Vandenberg's location combines these favorable factors.

### Safety zoned

Edwards encompasses 300,000 acres; Vandenberg 100,000. This provides an important buffer margin of safety. The nearly vertically rising Shuttle will have reached a 100,000 foot elevation before traversing 20 miles on the ground. Although engineered for intact abort, a catastrophe-prone critical period could occur during the initial rise prior to separation before sufficient altitude is reached for guided landing.

In this interim, a margin of safety is assured for the off-base populace if debris falls within the perimeter of a large land-area base. Narrow or limited-area base sites cannot offer this safety-zone afforded by Vandenberg and Edwards, two of America's largest bases in ground area.

### Sparsely inhabited

Vandenberg and Edwards combine a unique feature: sparsely settled, low-population density nearby, yet easy accessibility to the cosmopolitan advantages of major metropolitan centers.

Both satisfy a preference specified by one study: low-population density for the initial 100-mile downrange along the most likely used azimuth angles.

The desert immediately surrounding Edwards is one of America's least populated areas; Vandenberg is in the heart of a sparsely-settled, primarily rural area. Likely eastward Shuttle corridors pass over lightly inhabited national forest and desert terrain.

#### Casualty avoiding

Edwards and Vandenberg claim at least seven factors that aid in minimizing casualty possibilities: (1) extensive, immediate base-site perimeter; (2) available down-range corridors; (3) overwater corridors for heavily used flight azimuths; (4) low population density for at least the first 100 miles of a corridor; (5) opportunity for the Shuttle to achieve substantial altitude before overflying even moderate-sized population centers; (6) clearly defined landing alternatives, either scheduled or emergency; and (7) consistently reliable weather making advance planning possible.

#### Dispersing sonic-boom

Orbiter sonic booms can be dispersed on return over the Pacific Ocean for all Vandenberg eastward launches; southerly launches can disperse orbiter sonic boom off the Pacific Coast by means of a dog-leg return glide angle. This offshore dispersal of orbiter sonic boom is achievable by practically no other candidate site without the costly establishment of alternative landing sites developed solely for that purpose.

Most orbiter returns to Edwards will also disperse their sonic booms in the sparsely settled desert test range where aircraft sound effects have long been isolated from the public.

Booster flights south from Vandenberg disperse their sonic booms over the Pacific; eastward booster flights effect booms largely within the Edwards test range, national forest or southwest desert country.

Unlike some other candidate sites, California launched Shuttles will subject no other international neighbor to our sonic booms.

#### Compatible mating

Most engineering studies tend to prefer horizontal mating of the booster and orbiter, either during preparation, concurrently with roll-out, or at the launch pad. Some studies advocate lifting booster and orbiter, at the pad, by strong-back and mate at that time.

Cape Kennedy's vertical Vehicle Assembly Building imposes an obligation to examine at length the possibility of vertical mating and crawler-transporter roll-out.

Neither California site, Vandenberg or Edwards, impose the obligation of devising engineering techniques or modifications of the Shuttle to satisfy extensive existing structures. Either method, horizontal or vertical, is thereby adaptable to the California sites, whichever represents priorities of practical engineering and orbiter and booster design.

#### Cost efficient

An array of inherent Vandenberg and Edwards advantages contribute to efficiency and the minimizing of cost, both in initiating as well as long term operating of a Shuttle base.

Strategic need is satisfied without assuming costs of duplication to achieve that capability elsewhere. Test development facilities at Edwards could cost-effectively translate into retrieval base operations serving Vandenberg. Favorable climate has cost advantages. Existing facilities minimize new construction costs. The expense of additional natural gas network system is not needed. Nearby liquid hydrogen plants reduce new plant expense. Existing airfields make construction minimal. Coastal accessibility reduces costs of accommodating larger components. Nearby manufacturers diminish several expenses of accommodation. Vandenberg's continuing operation minimizes otherwise costlier stretch-out elsewhere. Moth-balling expenditures are unnecessary. Manning facilities may reduce new construction costs. Competitively available manpower indicates cost efficiencies.

#### Aerospace compatibility

Historically, California is an accustomed partner in the development of flight. Californians are attuned to aerospace activity, accept it as natural to modern life, are agreeable to its presence, industry is attuned to its requirements, and the economy is conscious of its practices.

California's level of understanding and sophistication about aerospace makes it an accepting environment for the establishment of a Shuttle base.

#### Manning capabilities

The Manned Orbiting Laboratory with its allied training, launch, housing and servicing facilities exists at Vandenberg. The base has been brought to the threshold of manned space flight as a natural adjunct to its unmanned capabilities. This readiness could phase into Shuttle use.

Edwards has extensive experience at studying and adapting the talents of man to the capabilities of advanced aircraft. Both sites could easily serve Shuttle's manned requirements.

### Environment conscious

All site candidates should be studied for their likely effect on man and nature, their respect for land use, their impingement upon other needs, and their effect on natural terrain.

Vandenberg has witnessed several generations of use, yet has maintained a pleasant accommodation with nature, preservation of most of the natural terrain and phenomenon, and has had a minimum of unsightly nearby commercial exploitation. Local residents are aware of continuing this responsibility toward the total environment.

Edwards, a highly isolated location with very little plant and animal life, has nevertheless made only the slightest alteration on the vastness and stark outline of the California desert. Shuttle activity at Edwards is unlikely to induce any appreciable change in the environment. Edwards' vast size, on the other hand, offers an opportunity to continue preservation of this unique segment of American terrain.

### Skilled manpower

Numerically, the total of California's experience aerospace manpower is over twice that of nearly all other major site-contending states combined.

In duration, California's aerospace manpower experience is frequently two generations in depth and often over three decades in length.

The size of the working populace, 7-1/2% to 8% of which are now unemployed.....the majority being aerospace.....indicates a larger total unemployed aerospace populace than any other state or combination thereof.

For Shuttle base staffing this implies: (1) cost advantage of competitive availability; (2) many applicants per opening thereby making selection for quality more likely; (3) a work force already residing in an area of pre-determined preference; (4) less necessity for costly inducements to relocate at isolated locations; and (5) unlikely need for extensive education to upgrade the work force.

#### Receptive economy

California's extensive and highly diversified economy could absorb the infusion of Shuttle-related activity without shock of dislocation. On the contrary, even the placement of nearly all Shuttle-related work in California would not equal or offset the larger loss of aerospace work which California has suffered in recent years.

Unlike isolated or rural Shuttle base candidate sites in other states, a study concluded that location of the Shuttle base at Vandenberg would only moderately effect the nearby local economy by maintaining the same modest rate of growth experience during the past ten or fifteen years.

California's gross national product is equivalent to that of the world's seventh largest nation, ranking in between that of the United Kingdom and Italy. The scope of California's economy, the size of populace and area, make it equivalent to a major American region than the limited and conventional interpretation of a state.



Cumulatively superior

In total, the reasons for California Shuttle-site suitability are numerous. In importance of contribution toward satisfying Shuttle needs, the reasons are influential. In necessity, the reasons are logical.

The foregoing has scanned the more obvious qualifications. Each is worthy of greater investigation. Each will reveal an increasing number of justifications for establishment of a Shuttle base in California; justifications which compare favorably with other candidates, justifications which cumulatively endorse California, and justifications which continue an already established importance of California sites for space endeavors.

*Aerospace* 41

# California Space Shuttle Task Force

April 15, 1971

ROBERT H. VOLK  
CHAIRMAN

JAMES A. COOK  
EXECUTIVE DIRECTOR

Attached is a tentative compilation of financial and contract implications for California of the Space Shuttle:

Probable manufacturing income through short-range of 1970's.

Possible launch/retrieval base income as a follow-on economic leveler, 1970's, 80's and on.

Current status of major shuttle contracts.

Composition of shuttle contractor "teams".

# POTENTIAL CALIFORNIA INCOME FROM MANUFACTURING AND BASE OPERATIONS - SPACE SHUTTLE

## SPACE SHUTTLE INITIAL EXPENDITURES

\$8.5 Billion likely RDT&E expenditures for booster and orbiter through 1972-1979 time period, peaking about 1975-1976.  
(Estimates as high as \$9.6 Billion, as low as \$6.4 Billion)

\$4 Billion of that probably for the orbiter.

\$3 Billion of the total RDT&E effort could probably be obtained by California prime and sub-contractors through either of the team efforts by North American Rockwell or McDonnell-Douglas; assuming assembly in California, flight test at Edwards AFB.

\$600,000 engine expenditures (Estimates as high as \$1 Billion) 1972-1979 time period.

Almost entire expenditure could be obtained by California through the proposals of either Aerojet Liquid Rocket Corp. or Rocketdyne.

## BASE INITIAL AND CONTINUING OPERATIONS EXPENDITURES

### Base modification/construction

\$400 Million tentatively earmarked for investment in base construction. Effort currently to reduce that expenditure by utilizing existing facilities. Late 1973 into initial 1977 time period.

Nearly entire amount could be obtained for a Vandenberg/Edwards combination minus existing applicable facilities.

### Flight operations

\$67.5 to \$75 Million yearly in 1977-78 time period, rising to \$270 Million - \$300 Million, annually, in the early 1980's and throughout decade.

Payload costs provide additional income (Nearby preparation, assembly, repair, possibly manufacture)

1970's base expenditures: approx. \$650 Million plus payload.  
1980's base expenditures: almost \$3 Billion plus payload, and on into 1990's

Nearly entire amount could be obtained for a Vandenberg/Edwards combination

## MANUFACTURING AND LAUNCH/RETRIEVAL BASE OPERATIONS

### For California:

Manufacturing and base start-up could provide \$4 Billion in the 1970's

Base operations could provide an economic leveler after manufacturing of \$3 Billion per decade thereafter.

## STATUS OF SPACE SHUTTLE CONTRACTS

### PHASE A. Initial Space Shuttle studies

#### Launch & vehicle reentry studies

Amount: \$450,000 each  
Time : Jan 31 to Sept 30, 1969

Who : Convair Division, General Dynamics Corp.  
Lockheed Corp.  
North American Rockwell Corp.  
McDonnell-Douglas Corp.

#### Additional Phase A. Alternate designs

<u>Who</u>	<u>Amount</u>	<u>T i m e</u>
Lockheed	\$1 Million	June 30, '70 - May 31, '71
Chrysler	\$1 Million	June 30, '70 - May 31, '71
Grumman	\$4 Million	July 6, '70 - June 6, '71

### PHASE B. (Research on facilities, logistics, advanced technology requirements. Ends with selection of single project concept.)

#### Engine design, preliminary vehicle design.

Amount: \$6 Million each  
Time : June 12, '70 - May 12, '71

Who : Aerojet-General Corp., Div. of General Tire &  
Rubber  
Rocketdyne Division, North American Rockwell Corp.  
Pratt & Whitney Aircraft, Div. of United Aircraft

#### Vehicle design studies

Amount: \$10.8 Million each

<u>Who</u>	<u>T i m e</u>
McDonnell-Douglas Corp.	June 19, '70 - May 19, '71
North American Rockwell	June 30, '70 - May 31, '71

Conclusion Phase B studies: NASA reopens competition for vehicle construction to other corporate teams.

### PHASE C. Contractors develop exact design specifications.

### PHASE D. Hardware is fabricated and tested.

SPACE SHUTTLE, PHASE B CONTRACTOR "TEAMS"

Subject to possible reorganization and reallocation at conclusion of Phase B studies (June 1971) and selection of single vehicle construction team.

MCDONNELL-DOUGLAS TEAM

McDonnell Douglas Space Systems Center	(St. Louis, Missouri) (Huntington Beach, Cal. however major mfg. work likely in St. Louis, Mo. and Michaud, La.)
Martin Marietta Corp. Denver Division (possible follow-on to Titan work done in Colorado)	(Baltimore, Maryland) (Denver, Colorado)
TRW, Inc. Systems Group	(Cleveland, Ohio, & Los Angeles) (Redondo Beach, Ca.)
Raytheon Co.	(Lexington, Mass.)
Sperry Rand Corp.	(Lexington, Mass.)
Norden Div., United Aircraft Corp.	(Norwalk, Conn.)
Pan American Base operations	(New York, N.Y.) (Coco Beach, Florida)
Societe Nationale Industrielle Aerospatiale	(France)
Hawker-Siddeley-Aviation, Inc.	(England)
ERNO-Raumfahrttechnik, GMBH	(Germany)

NORTH AMERICAN TEAM

North American Rockwell Space Division -Program & system integration -Orbiter development	(Pittsburgh, Penna.) (Downey, Cal. & Seal Beach, Cal.)
General Dynamics Convair Aerospace Division -Booster development	(New York, N.Y.) (San Diego, Ca., however, mfg. likely at Michaud, La.)
IBM -Data management, installation at site	(Gaithersburg, Maryland)

NORTH AMERICAN TEAM (cont'd)

Honeywell	(Minneapolis, Minnesota)
-Vehicle stabilization & control at site	
American Airlines	(New York, N.Y. & Tulsa, Okla.)
-Aircraft-type maintenance and operations at site	
British Aircraft Corp.	(England)
Messerschmitt, Boelkow & Blohm	(Germany)

GRUMMAN-BOEING TEAM

Grumman Aerospace Corp.	(Bethpage, N.Y. & possibility of final assembly at Michaud, Louisiana)
-Systems manager	
-Orbiter	
Boeing	(Seattle, Wash., however major mfg. work likely at Wichita, Kansas, and Michaud, La.)
-Booster	
-Operations	
Aerojet General	(El Monte, California)
-Cryogenic tankage	(Fullerton, California)
Avco Systems Division	(Wilmington, Mass.)
-Thermal protection systems	
General Electric	(Schenectady, N.Y.)
-Avionics	(Philadelphia, Pa.)
-some protection materials work	
Northrop	(Los Angeles, Cal.)
-Orbiter technology	(Hawthorne, Cal.)
Eastern Airlines	(New York, N.Y.)
-Operations	
-Maintenance	
Avions Marcel Dassault	(France)
-Thermal protection subsystems	
-Insulation subsystems	
Dornier	(Germany)
-Subsystems technology	

ENGINE

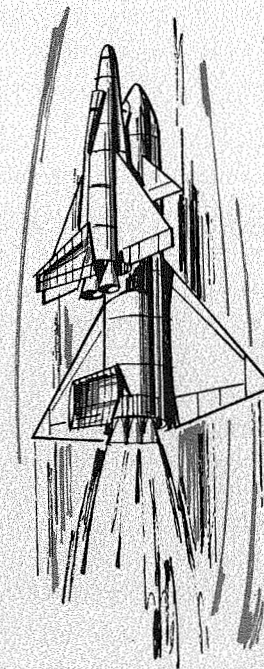
Pratt & Whitney Aircraft	(Hartford, Conn. for turbo machinery)
Florida Research & Development Center	(West Palm Beach, Fla. for manufacture and assembly)
Aerojet Liquid Rocket Corp.	(Sacramento, Cal.)
Rocketdyne, North American Rockwell	(Canoga Park, Cal.)





**CALIFORNIA**  
**the ideal solution**  
**to the search for**  
**Space Shuttle**  
**launch & retrieval base**  
**as well as for**  
**flight testing**





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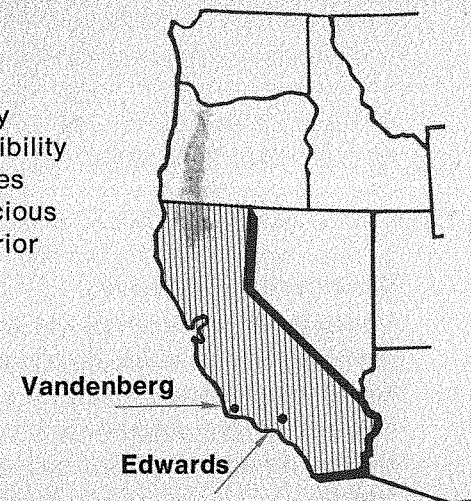
Combined, they resolve most objections found elsewhere, and combined they equal or surpass most isolated and individual advantages claimed elsewhere.

For several years of conventional missile operations, Cape Kennedy as well as Vandenberg have admirably served our missile needs. New needs stimulate a reevaluation. Comparisons and questions on the following pages are tempered with respect and appreciation for the contributions made thus far to space exploration by the site and people of Cape Kennedy. Historically, the Cape is unquestioned. However, new needs require questioning of old assumptions.

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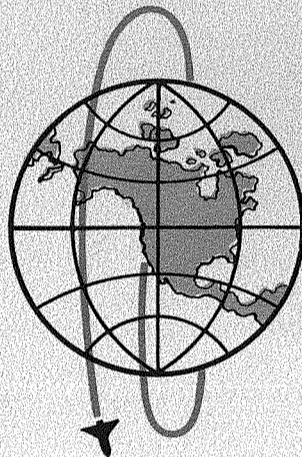


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### Demonstrated necessity

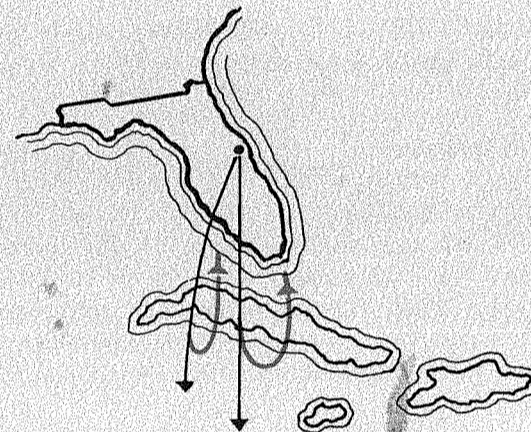
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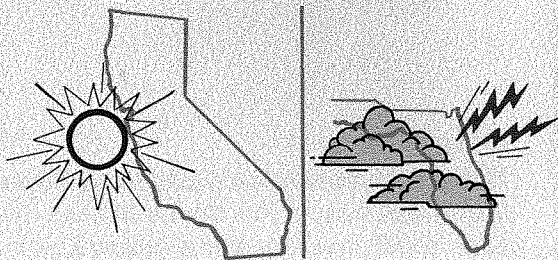
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The modest wind gust level at Vandenberg is tolerable, compared with gusts approaching hurricane velocity at Cape Kennedy.

### Existing facilities

The largest launch area in the western world, Vandenberg maintains 44 launch sites of which 30 are active. With a range ten times the size of Cape Kennedy, the Vandenberg base comprises 100,000 acres traversed by 327 miles of roads, dotted with 3,500 buildings—1,400 of which relate to base operations, and 2¼ million square feet of which are occupied by missile contractors. Vandenberg represents a construction investment since 1957 of \$2.4 billion.

Vandenberg and Edwards admirably satisfy the caveat in site selection: "make maximum use of existing facilities."

The premier landing and testing facility in the Nation exists at Edwards insofar as extensiveness, visibility, unobstructed access and existing facilities. Covering over 300,000 acres, and served by an array of hangars, buildings, shops and laboratories, Edwards maintains an assembly of tracking facilities, houses the Aerospace Research Pilot School and since 1953 has conducted rocket test firings at the \$150 million aggregation of high thrust rocket test stands and research equipment buildings.

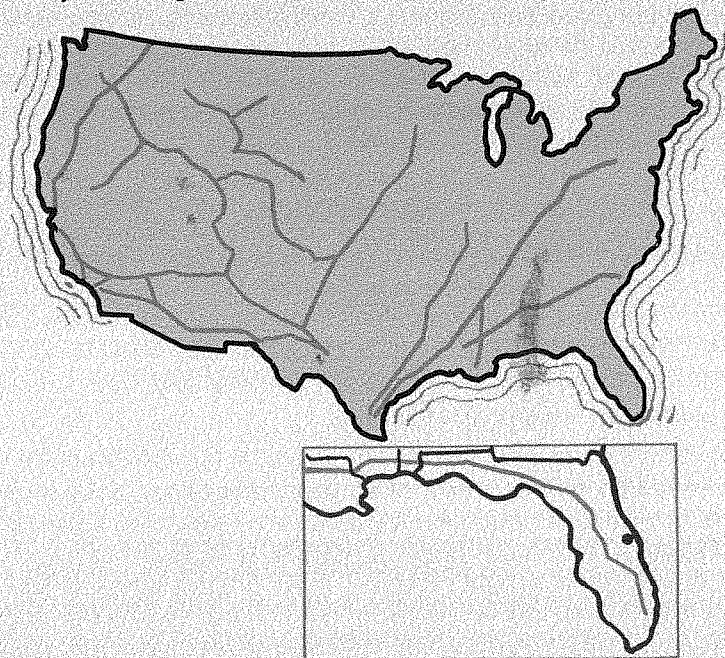
### Convenient fuel

California already has both the natural gas network as well as plant facilities for converting natural gas to liquid hydrogen. California's liquid hydrogen plants can produce more than the 90 tons-per-day the Shuttle will require during its peak operation. California has over three times the liquid hydrogen plant capacity of any other state.

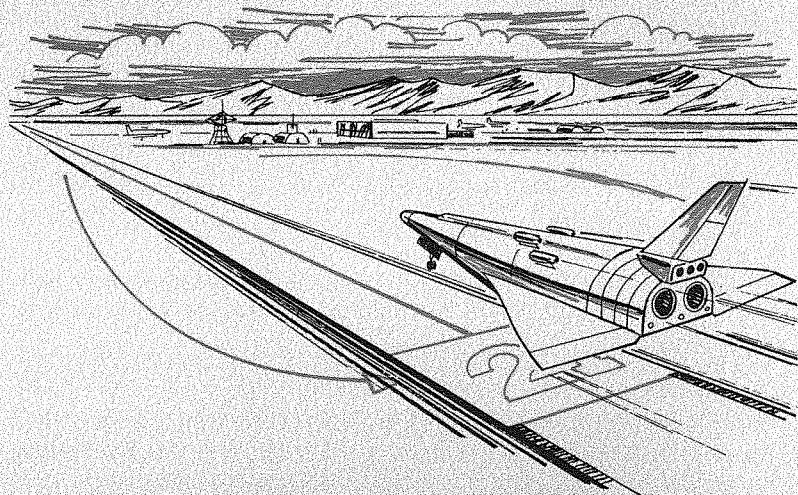
Within 150 miles of either Vandenberg or Edwards, plants can supply by tank truck more than adequate fuel for the Shuttle's initial years.

By contrast, the Cape Kennedy site requires a 740-mile haul by truck or train for most of the liquid hydrogen consumed. One study concluded: the costly alternative is to dismantle one of California's plants and reconstruct it in Florida.

A California site also makes unnecessary another alternative, that of an international agreement for converting crude oil to liquid hydrogen in another country for shipment to America, thereby avoiding American import duties on crude oil.





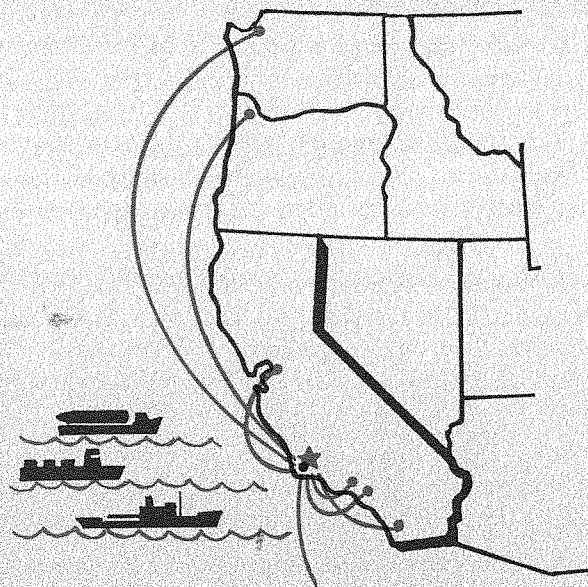


#### **Airfield capability**

Vandenberg's airfield adjoins a likely Shuttle launch complex. Adequacy is demonstrated by its use for training by commercial pilots of 747 aircraft which approximate the booster in size. Extensive flat land surrounds the strip, making expansion of its 8,000 feet convenient to achieve.

Edwards is one of the Nation's largest landing areas. A 15,000-foot concrete runway adjoins the 44 square mile sun-hardened, wind-smoothed Rogers Dry Lake. In turn, Rogers connects with 27 square miles of Rosamond Dry Lake bed. Seven natural runways criss-cross the 11-mile length of Rogers Dry Lake. The supportive strength of these dry lake beds is equivalent to a three-foot thickness of concrete and can support up to 250 pounds per square inch.

The largest and heaviest of the world's aircraft land here. Three billion dollars worth of aircraft have been saved since 1946 from loss of crash landing by directing them to Edwards. By contrast, a landing strip adjacent to a Shuttle complex at Cape Kennedy would have to be built at more than \$1,500 a foot.



#### **Waterborne adaptable**

Coastal accessibility makes Vandenberg convenient by boat or barge to all the Pacific aerospace ports from Seattle to San Diego and to shipments from the Gulf Coast.

A sheltered lagoon exists on Vandenberg's 36-mile coastline within a short distance of the intended Shuttle site. Limited dredging could prepare this convenient natural port to receive Shuttle barge shipments. Reportedly, the sand bottom is coarser and less subject to silting and wave action than the Cape Kennedy barge channel.

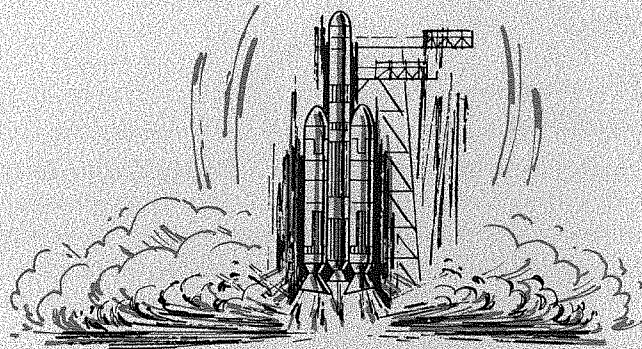
Over a decade of logistics experience has been perfected at Vandenberg in missile and aerospace shipments by plane, truck, and rail. Shuttle shipments can adapt this knowledge in the handling of large and awkward components.

### Accessible manufacturers

Convenience to manufacture and assembly is a cost-efficiency criterion in selecting a base site.

Virtually every manufacturer earmarked as a likely participant, including payload and servicing contractors, has a major installation in the nearby California and Pacific Coast aerospace complex. Most are located within an easy drive of Vandenberg or Edwards, making shipment less time-consuming, servicing convenient, and reducing the costs for rotation of personnel.

All major aircraft builders use Edwards for test purposes; most of those engaged in today's missile hardware business maintain personnel and service facilities at Vandenberg.



### Ascending importance

Vandenberg's importance and frequency of use will correspondingly increase as the Apollo era ends and as Space Lab is completed.

The diminishing of space work elsewhere, and the four or five year hiatus in manned space flight, increases the reliance on and need for this major remaining site.

The continuing necessity for Vandenberg's capabilities, the steady schedule of operations, a readily accessible work force, and a physical plant maintained in response to current operations increase the legitimacy of Vandenberg's importance.

### Eliminates moth-balling

Cost savings occur when our space program can avoid incurring the relatively unproductive expense of moth-balling and the follow-on reactivation expenses.

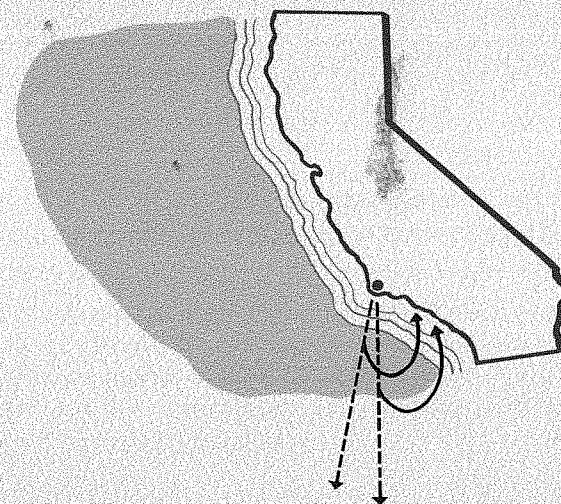
Facilities at Vandenberg and Edwards will continue to be used in a regular schedule of operations and the expense of moth-balling while awaiting the Shuttle era can be avoided. Furthermore, construction at Vandenberg and Edwards could be scheduled when timely and feasible rather than being initiated in the near-future as a means to stretch-out, prolong, and maintain an otherwise declining level of activity.

### Overwater trajectory

Vandenberg's bay-window on the Pacific scans 210° of ocean front, from 120° to 330°.

The overwhelming preponderance of our current space shots, both polar and retrograde, capitalize on these overwater trajectories from Vandenberg.

Therefore, if an overwater trajectory is advantageous during the Shuttle's development as well as for frequently used azimuth angles... yet paralleling relatively nearby emergency or alternate landing sites in the continental United States without requiring foreign landing rights... Vandenberg's location combines these favorable factors.





### Dual usefulness

Both services, NASA and Defense, can and do perform missions at Vandenberg. Conversely, Cape Kennedy has a diminishing usefulness for defense missions, primarily including the peaceful yet prudent observational flights.

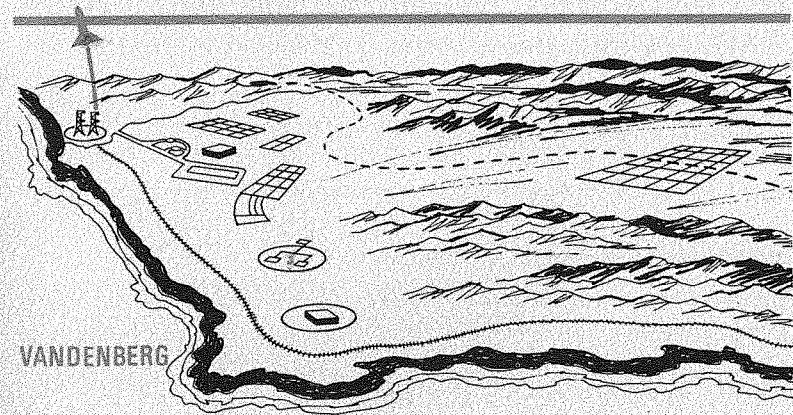
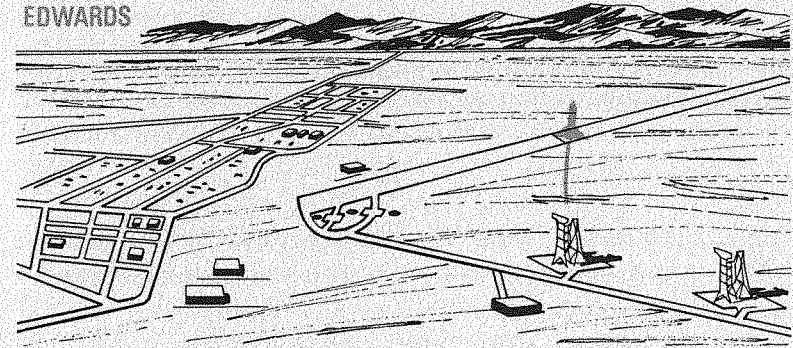
Cost-conscious site selection urges the choice of a single California location suitable for both services rather than the luxury of two, new, separate Shuttle bases created simultaneously for each of two services.

### Performance advantages

Dog-leg maneuvers to attain orbits are costly in fuel-weight. Southerly and polar orbits lack the eastward earth rotation for added thrust. Therefore, dog-leg maneuvers are least desirable in achieving such orbits. In evaluating site trade-offs, California locations require no dog-leg maneuvers for southerly orbits as does Cape Kennedy.

Higher elevations, such as Edwards' 2,302 feet elevation, consume less fuel to exit the drag of earth's atmosphere and could accommodate an additional 2,300 pound payload. Edwards qualifies if high elevation inland launch sites are preferred over coastal locations.

EDWARDS



### Safety zoned

Edwards encompasses 300,000 acres; Vandenberg 100,000. This provides an important buffer margin of safety. The nearly vertically rising Shuttle will have reached a 100,000-foot elevation before traversing 20 miles on the ground. Although engineered for intact abort, a catastrophe-prone critical period could occur during the initial rise prior to separation before sufficient altitude is reached for guided landing.

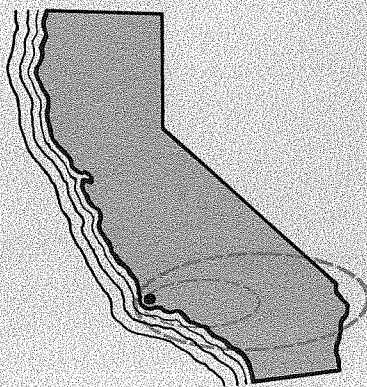
In this interim, a margin of safety is assured for the off-base populace if debris falls within the perimeter of a large land-area base. Narrow or limited-area base sites cannot offer this safety-zone afforded by Vandenberg and Edwards, two of America's largest bases in ground area.

### Sparsely inhabited

Vandenberg and Edwards combine a unique feature: sparsely settled, low-population density nearby, yet easy accessibility to the cosmopolitan advantages of major metropolitan centers.

Both satisfy a preference specified by one study: low-population density for the initial 100-mile downrange along the most likely used azimuth angles.

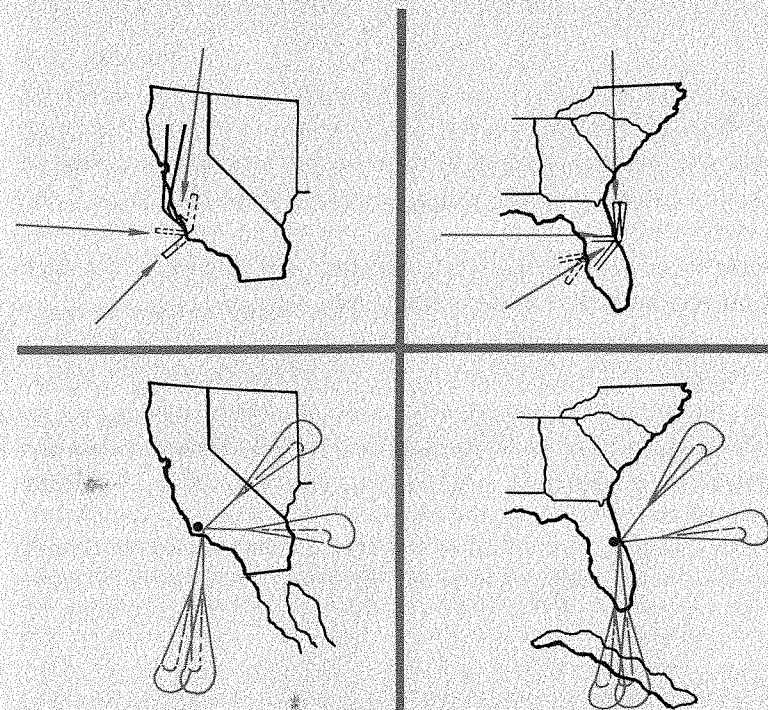
The desert immediately surrounding Edwards is one of America's least populated areas; Vandenberg is in the heart of a sparsely-settled, primarily rural area. Likely eastward Shuttle corridors pass over lightly inhabited national forests and desert terrain.



### Casualty avoiding

Edwards and Vandenberg claim at least seven factors that aid in minimizing casualty possibilities:

1. extensive and protective base-site perimeter
2. available down-range corridors
3. overwater corridors for heavily used flight azimuths
4. low population density for at least the first 100 miles of a corridor
5. opportunity for the Shuttle to achieve substantial altitude before overflying even moderate-sized population centers
6. clearly defined landing alternatives, either scheduled or emergency
7. consistently reliable weather making advance planning possible



### Dispersing sonic-boom

Orbiter sonic booms can be dispersed on return over the Pacific Ocean for all Vandenberg eastward launches; southerly launches can disperse orbiter sonic boom off the Pacific Coast by means of a dog-leg return glide angle. This offshore dispersal of orbiter sonic boom is achievable by practically no other candidate site without the costly establishment of alternative landing sites developed solely for that purpose.

Most orbiter returns to Edwards will also disperse their sonic booms in the sparsely settled desert test range where aircraft sound effects have long been isolated from the public.

Booster flights south from Vandenberg disperse their sonic booms over the Pacific; eastward booster flights effect booms largely within the Edwards test range, national forest or south-west desert country.

Unlike some other candidate sites, California launched Shuttles will subject no other international neighbor to our sonic booms.



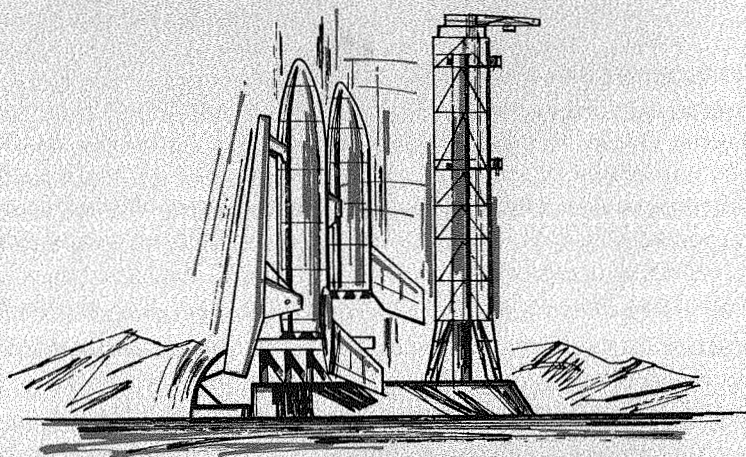
### Compatible mating

Most engineering studies tend to prefer horizontal roll-out of the booster and orbiter with mating at the launch pad, if not in advance.

Some studies advocate lifting booster and orbiter, at the pad, by strong-back and mate at that time.

Cape Kennedy's vertical Vehicle Assembly Building imposes an obligation there to examine at length the possibility of vertical mating and crawler-transporter roll-out.

Neither California site, Vandenberg or Edwards, impose the obligation of devising engineering techniques or modifications of the Shuttle to satisfy extensive existing structures. Either method, horizontal or vertical, is thereby adaptable to the California sites, whichever represents priorities of practical engineering and preferred design for orbiter and booster.



### Cost efficient

An array of inherent Vandenberg and Edwards advantages contribute to efficiency and the minimizing of cost, both in initiating as well as long term operating of a Shuttle base.

- Strategic need is satisfied without assuming costs of duplication to achieve that capability elsewhere
- Test development facilities at Edwards could cost-effectively translate into retrieval base operations serving Vandenberg
- Favorable climate has cost advantages
- Existing facilities minimize new construction costs
- The expense of additional natural gas network system is not needed
- Nearby liquid hydrogen and oxygen plants reduce new plant expense
- Existing airfields make construction minimal
- Coastal accessibility reduces costs of accommodating larger components
- Nearby manufacturers diminish several expenses of accommodation
- Vandenberg's continuing operation minimizes otherwise costlier stretch-out elsewhere
- Moth-balling expenditures are unnecessary
- Manning facilities may reduce new construction costs
- Competitively available manpower indicates cost efficiencies

An estimated \$287 million is required to convert Cape Kennedy to Shuttle use, not including correspondingly higher costs of operation. Yet this site would not be universally useful for the Shuttle. On the other hand, that figure represents about two-thirds of the cost for converting California sites to more widely useful Shuttle missions where many operational costs would be less expensive.

### Skilled manpower

Numerically, the total of California's experienced aerospace manpower is over twice that of nearly all other major site-contending states combined.

In duration, California's aerospace manpower experience is frequently two generations in depth and often over three decades in length.

The size of the working populace, 7½ % to 8% of which are now unemployed...the majority being aerospace, among which 14% are unemployed...indicates a larger total unemployed aerospace populace than any other state or combination thereof.

For Shuttle base staffing this implies:

1. Cost advantage of competitive availability
2. Many applicants per opening thereby making selection for quality more likely
3. A work force already residing in an area of predetermined preference
4. Less necessity for costly inducements to relocate at isolated locations
5. Unlikely need for extensive education to upgrade the work force

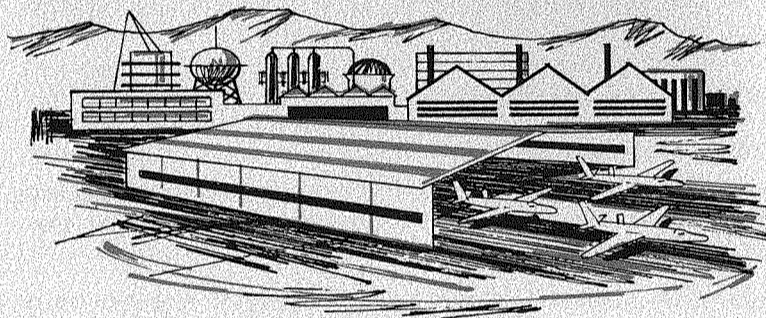


### Receptive economy

California's extensive and highly diversified economy could absorb the infusion of Shuttle-related activity without shock of dislocation. On the contrary, even the placement of nearly all Shuttle-related work in California would not equal or offset the larger loss of aerospace work which California has suffered in recent years.

Unlike isolated or rural Shuttle base candidate sites in other states, a study concluded that location of the Shuttle base at Vandenberg would only moderately affect the nearby local economy by maintaining the same modest rate of growth experienced during the past ten or fifteen years.

California's gross national product is equivalent to that of the world's seventh largest nation, ranking in between that of the United Kingdom and Italy. The scope of California's economy, the size of populace and area, make it equivalent to a major American region than the limited and conventional interpretation of a state.



### Aerospace compatibility

Historically, California is an accustomed partner in the development of flight. Californians are attuned to aerospace activity, accept it as natural to modern life, are agreeable to its presence, industry is attuned to its requirements, and the economy is conscious of its practices.

California's level of understanding and sophistication about aerospace makes it an accepting environment for the establishment of a Shuttle base.

### Manning capabilities

The Manned Orbiting Laboratory with its allied training, launch, housing and servicing facilities exists at Vandenberg. The base has been brought to the threshold of manned space flight as a natural adjunct to its unmanned capabilities. This readiness could phase into Shuttle use.

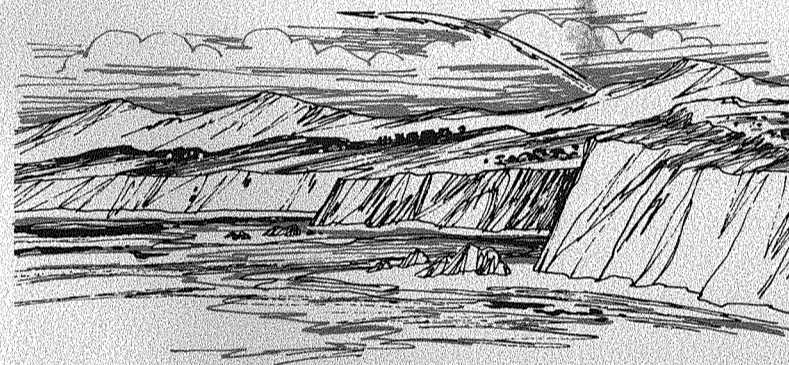
Edwards has extensive experience at studying and adapting the talents of man to the capabilities of advanced aircraft. Both sites could easily serve Shuttle's manned requirements.

### Environment conscious

All site candidates should be studied for their likely effect on man and nature, their respect for land use, their impingement upon other needs, and their effect on natural terrain.

Vandenberg has witnessed several generations of use, yet has maintained a pleasant accommodation with nature, preservation of most of the natural terrain and phenomenon, and has had a minimum of unsightly nearby commercial exploitation. Local residents are aware of continuing this responsibility toward the total environment.

Edwards, a highly isolated location with very little plant and animal life, has nevertheless made only the slightest alteration on the vastness and stark outline of the California desert. Shuttle activity at Edwards is unlikely to induce any appreciable change in the environment. Edwards' vast size, on the other hand, offers an opportunity to continue preservation of this unique segment of American terrain.

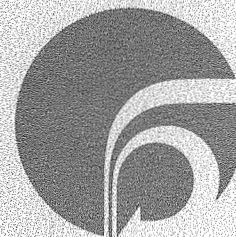




**Cumulatively superior**

*In total, the reasons for California Shuttle-site suitability are numerous. In importance of contribution toward satisfying Shuttle needs, the reasons are influential. In necessity, the reasons are logical.*

*The foregoing has scanned the more obvious qualifications. Each is worthy of greater investigation. Each will reveal an increasing number of justifications for establishment of a Shuttle base in California; justifications which compare favorably with other candidates, justifications which cumulatively endorse California, and justifications which continue an already established importance of California sites for space endeavors.*



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