

MUELLER RESIGNS head of manned space flight programs to step down Dec. 10

Dr. George E. Mueller, NASA's Associate Administrator for Manned Space Flight, the man who directed the US manned flight program for the past six years, will leave NASA December 10.

He has been responsible for the largest research, development and operational program ever undertaken by man. At its peak, the Apollo Program involved over 400,000 NASA, other government, university and industry personnel.



GEORGE E. MUELLER

Important as his role has been, he has not been a highly visible public figure. This is as Mueller wishes. He says: "when I took this job I made up my mind that, to get it done, I'd remain submerged."

Still, Dr. Mueller has been looking far ahead for the space program, fearing that the assets put together to produce the first lunar landing might be dissipated if the

country did not set itself some new goals. In July he told a press conference in Houston: "It seems quite clear that the planets of the solar system are well within our ability to explore, both manned and unmanned, at the present time."

In speaking before a Senate committee on space, he eloquently championed the cause of the space program. (Selections from this presentation are featured in the "Space Quotes" column, on page 2.)

Commenting on Mueller's retirement, NASA Administrator Dr. Thomas O. Paine said: "We regret that Dr. Mueller has made the decision to return to private life, but recognize that decision comes at a time when the task he accepted is complete and a sound foundation for our future national space program has been established."

Before his years with NASA, Dr. Mueller gained years of management experience working on the Atlas, Titan, Minuteman, and Thor ballistic missile programs, and NASA's Pioneer and Explorer space programs. He had overall responsibility for the design, development, and testing of systems and components basic to the ballistic missile program, the development of the United States' first successful space probe, Pioneer I, for several other space and interplanetary probes, including Explorer VI and Pioneer V, and for the establishment of the first world-wide satellite tracking network—the SPAN network.

No successor to Dr. Mueller has yet been named.

Gilbreath named WSTF Manager

Ken Gilbreath was named Manager, NASA White Sands Test Facility effective Monday, November 10, 1969. He succeeds Martin L. Raines who was reassigned Manager of the Reliability & Quality Assurance Office and Manager for Flight Safety at the Manned Spacecraft Center, Houston, Texas.

Mr. Gilbreath joined NASA White Sands Test Facility in May 1964. His primary responsibilities with NASA have been facility operations and test supervision, laboratories management, and engineering supervision relative to development and verification testing of the Apollo Service Module and Lunar Module propulsion systems. Prior background work experiences include four years in nuclear power plant operation and seven years in the aerospace industry.

"The Other City," an American Cancer Society film, will be shown at the MSC auditorium, Bldg. 1, Dec. 11, at 10:30 p.m.



KENNETH B. GILBREATH

Low tapped for Headquarters post

President Nixon has announced his intention to nominate George M. Low to the office of deputy administrator of NASA. The nomination is, of course, subject to the approval of the Senate.

Since April of 1967 Low has been Manager of the Apollo Spacecraft Program at MSC. Under his leadership, the Apollo spacecraft was made flight-worthy after the fire of January 1967. He originated the plans for



Blasting through the overcast, Conrad, Gordon and Bean ride atop the massive Saturn V. Following separation from the CSM, Gordon photographed the "Intrepid" as it headed for the Ocean of Storms. Back in the Pacific, the trio awaited helicopter transportation to the recovery ship Hornet.

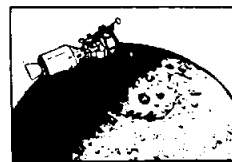
ROUNDUP

NASA MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

VOL. 9 NO. 3

NOVEMBER 28, 1969



Launch to Splash -- "a magnificent crew, a superb performance"

Thus MSC Director Robert R. Gilruth commended the men and machines which made the Apollo 12 flight. The post-recovery press-conference brought together nine major figures associated with the flight for questions from the newsmen, and an opportunity to express their reactions to the events of the past 10 days.

In reviewing the mission, Dr. Gilruth said:

I would just like to express my profound admiration for the magnificent crew that accomplished all the objectives in this our most

difficult mission yet. The Apollo 12 expedition to the lunar surface will vastly increase our knowledge of the moon. They accomplished the point landing that we set out to do, they made the first lunar traverse, they installed a nuclear power generating station for the long-life scientific experiments which they implanted on the lunar surface. They brought back the Surveyor parts that are important to understand how mechanical and electronic equipment weathers in the lunar environment. I am equally proud of the entire Apollo organization. Without the superb launch vehicle that got us on the way to the moon, the command and service module that did all the things it had to do in flawless manner, the LM, the network, the Mission Control Center, and the recovery forces. Without the superb performance of all these people and their equipment, none of these objectives would have been possible. All of us are very

happy and proud of this performance. Thank you.

Naturally, the members of the press inquired about these aspects of the flight which did not go according to plan. Regarding Conrad's comments on the difficulty he encountered at lunar touchdown, Kraft recommended that the de-briefing of the crew be completed before any action be taken, so that the problems might be completely understood. The panel made essentially the same recommendation in response to questions regarding the hand tools used on the lunar surface, and the dust which was noticed in the spacecraft.

Some of the events which might have seemed to be mishaps actually gave the planners confidence for future missions. Conrad's spill, for example, gave reassurance about man's ability to handle himself in adverse circumstances on the lunar surface.

The response to a question about the knowledge gained from the mission (scientific and engineering) tied together the feelings associated with this flight: the returns from the flight, it was said, make us "jubilant and puzzled, and that is the way the scientist wants it to be."



Pouring rain didn't stop 120 winners in the 1969 Youth Science Congress from watching the Apollo 12 launch with President Nixon. The group of 22 from the MSC area was seated immediately around the President. All 22 paid their own way to join Nixon, who is shown here with Ronald L. Siebler, one of the MSC area winners.

WSTF Awards

Ten NASA employees and four contractor firms and Government agencies received special NASA awards at a recent White Sands Test Facility ceremony. The awards were in recognition of the individual and company participation in extensive Apollo propulsion system test programs conducted at the facility.

Kenneth B. Gilbreath and Rob R. Tillett were presented the NASA Certificate of Commendation. Gilbreath, who became WSTF Manager effective November 10, 1969, also received the Group Achievement Award for the NASA White Sands Test Facility.

NASA Superior Achievement Awards were presented to: Archie R. Beckett, Edwin J. Burke, L. Maurice Clelland, John F. Day, Michael J. Hamilton, Kenneth R. Haynes, Benjamin C. Ingels, Jr., and Edwin W. Sievers, Jr.

ROUNDUP

NASA MANNED SPACECRAFT CENTER HOUSTON, TEXAS

The **Roundup** is an official publication of the National Aeronautics and Space Administration Manned Spacecraft Center, Houston, Texas, and is published every other Friday by the Public Affairs Office for MSC employees.

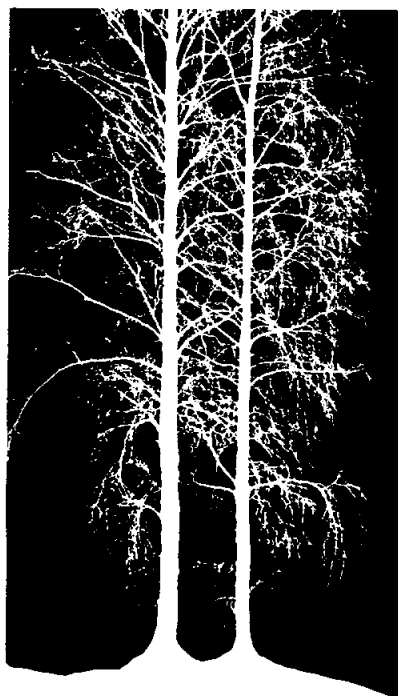
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Space Quotes

If a country can stay the course of a peaceful decade-long program to land men on the moon and return them safely to Earth, who can say that nation cannot solve its other problems?

Our space program . . . has widened out horizons, permeated our economy, inspired invention, stimulated productivity and served as a yardstick by which we can measure precision and reliability.

Solutions to the problems of our times depend upon the continued creation of new wealth to maintain the growth of our economy. The space program does this by upgrading people, creating new regional and industrial capabilities and fostering the introduction of thousands of new products, new processes and new ways of doing things—more effectively, more reliably and at lower cost . . . The adventure and the fact of space flight enrich and improve our national growth and will, I believe, eventually affect every facet of our life on Earth.



Lost: Santa suit

Lost: Santa Claus uniform! Will the person who borrowed the Santa Claus uniform last year please return to Ed Stelly, Bldg. 15, Room 120, ext. 3378.

Announcements

TRYOUTS FOR "DOG SUIT"—Open tryouts for Pasadena Little Theatre's production of "The Man in the Dog Suit" will be held at the theatre on Sunday, December 7th at 2:30 and 7:30 pm and again on the 8th at 7:30 pm. Four women and six men are needed for the cast of this hilarious comedy which will be presented in February 1970. Call Bill Simmons at x 5371 or 649-2558.

MOON ROCKS—Dr. Donald A. Flory will discuss the preliminary results of chemical analysis of Apollo 11 lunar soil samples Wednesday, Dec. 3, at the King's Inn. A social hour and dinner will precede his address. Reservations should be made (\$4 each) before Tuesday. Call Steve Jacobs at x 4564, Charles Nagle at x 4176 or Dan Supkis at x 4336.

*To spare the tree...
 Let's trim the branches,
 Tra la la la la,
 la la la la!!*

Your COST REDUCTION CREW

EAA Bulletins

Final MSC/EAA Flag Football standings

Division I		DIVISION II	
Tigers	10-0	Roaches	7-3
FCSD	7-3	TANG	6-4
FCD	4-5	747th AF	4-5
USCG	0-10	2578th AF	1-9

In the league championship game, the **Roaches** upset the favored **Tigers** by a 16-6 score. Led by Phil Shannahan, Ivan Johnson and Martin Alexander, the entire **Roaches** defensive team played an inspired game. Offensively, the **Roaches** scored first on a 20-yard delay pass over the middle from Harry Kolkrurst to Al Wylie. After the **Tigers** scored on a 30-yard pass from Bill Whatley to Gid Weber the **Roaches** iced the game when Lee Norbraten intercepted a lateral pass on a punt return and raced 25-yards for the final score. Larry Radcliff and Gid Weber played outstanding games in a losing cause for the Tigers, who had won the last three MSC Flag Football Championships.

VOLUNTEERS NEEDED FOR ANNUAL PARTY

The seventh annual Children's Christmas Party will be held on Saturday, December 13, 1969 from 1:00 to 3:00 p.m. in the MSC Auditorium. All children ages 2 through 8 are invited. There will be TV's "NONO the Clown" and two cartoon films. Santa Claus and his helpers will distribute gifts and favors to the children. Tickets are 50c each with a limited supply of 700 (350 girls—350 boys). For tickets contact your EAA representative. All of you interested in helping in this event, please contact Martha Caballero, ext. 2421.

Your Job in Focus

President signs Bill to increase daily travel allowance

The President has signed into law a bill increasing from \$16 to \$25 the maximum per diem travel allowance of Government employees.

The new law also increases from \$30 to \$40 the maximum actual expense allowance for

Bloodmobile visit

The MSC Blood Bank has scheduled the Blood Services of Houston bloodmobile to visit building 8 at MSC on the following dates: Tuesday, Dec. 2, and Thursday, Dec. 4.

Bloodmobile hours are from 9 am to 3 pm.

Employees interested in participating in the MSC Blood Deposit Program should make an appointment by telephoning either Les Wynn, x5293, or Barbara Freeman, x3296. If you already have a blood type Identification Card please bring it with you to have it updated. Otherwise a new one must be issued.

In Gratitude

I never before knew how inadequate the words "Thank You" could be.

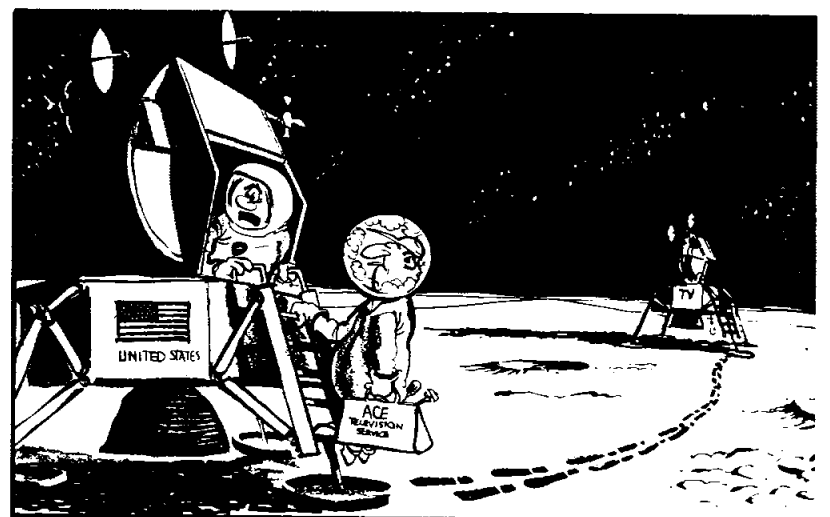
I am certain that no one has ever received more support or loving kindness from people than I have received from you during a very difficult time.

Mildred W. Cascaden

40 Yrs Service

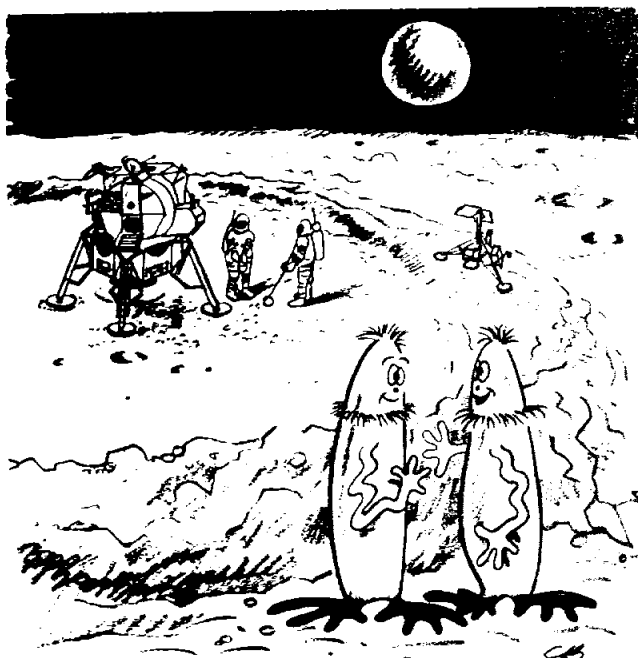


Vernon E. (Bud) Powell, of the Public Affairs Office was awarded a diamond-embellished memento to mark his 40th year of service with the government. Bud was under the doctor's care when the pin was presented, but he hopes to return to his place at MSC soon.



"It's the TV repair man...!"

Courtesy The Sun, Melbourne, Australia



THEY'RE TAKING ALL THE ROCKS WE BROUGHT FROM EARTH LAST YEAR!

"Chemical evolution & the origin of life" to be topic of scientific colloquium

Dr. Cyril Ponnameruma, Chief of the Chemical Evolution Branch of the Exobiology Division at the Ames Research Center will visit MSC on December 2 to speak at the MSC Scientific Colloquium Series.

Dr. Ponnameruma will speak at 3 pm in the Building 1 auditorium. His lecture will deal with the evidence which lends support

to the hypothesis of chemical evolution.

Dr. Ponnameruma's professional career has been varied, including Visiting Professor to the Indian Atomic Energy Commission, to the University of Nijmegen in The Netherlands, and to the Faculty of Sciences, University of Paris. He is currently a Principal Investigator for lunar sample analysis.

All MSC and contractor employees are cordially invited to attend.

Co-Op of month



Lawrence D. Kissinger
Cleveland State Univ.
CSD

In his assignment to the Environmental Control Systems Branch of CSD, Larry has provided the branch's primary chemical engineering support. In his work in the area of advanced subsystems for the removal and reduction of CO₂, he conducts trade-off evaluations, design studies, and performance analyses. He establishes test requirements, and evaluates test data. His initiative in acquiring necessary skills from an available consultant and his subsequent use of these skills have made him a valuable and productive engineer.



The Apollo Applications Program Office presented Cost Reduction Awards to 7 men within the Directorate last month. One went to Percy S. Miglicco, whose suggestion to delete a particular item of hardware from program requirements saved the government an estimated \$1.5 million.

Other suggestions came from Richard E. Hall and Merle J. Denny, Preston H. Allen and Horace E. Whitacre, Thomas P. Larkin, and Clifford J. Hall. These suggestions represent cost savings which range in value from \$26,00 to \$850,000.

Like to sing?

The Houston chapter of the SPEBSQSA (Society for the Preservation and Encouragement of Barbershop Quartet Singing in America) copped all the first place trophies in the Southwestern District Quartet and Chorus Contest held the weekend of November 1 in Austin. Their first place trophy entitles the "Houston Tidelanders" chorus to compete in the International Contest to be held in Atlantic City next June.

Also planned for this coming year is the annual show in Jones Hall. The chapter meets every Monday night. Any men interest-

Graduate courses

A variety of courses in communications, mathematics, engineering, astronomy, physics, and the humanities will be offered at the Clear Lake Graduate Center of the University of Houston this spring.

New applicants to the Graduate School must submit an application to the Dean by December 15.

Forms and further information may be obtained from the MSC Employee Development Branch at x 7311.

ed in singing with them? Call Lloyd Erickson, x5421.

Roundup Swap-Shop

[Deadline for Swap-Shop classified ad is the Thursday preceding Roundup publication date. Ads received after the deadline will be run in the next following issue. Ads are limited to MSC civil service employees and assigned military personnel. Maximum length is 15 words, including name, office code and home telephone number. Send ads in writing to Roundup Editor, AP3.]

REAL ESTATE

10 acres, \$400/acre & up, Wimberly area, views, woods, deer, easy terms, Davis 877-1155
4-2-2 brick, lg den, formal dining, central A/H, Sagemont, by owner, \$2000 equity, \$21,950 total, Born, 487-2614

2 lots, 70'x170' each, excellent bass fishing resort near Guy, Texas, \$800 each, Remini, x 5271

3-2-2 Nassau Bay Colonial, fenced, corner, formal living and dining, paneled den, fireplace, custom draped, carpeted, 5 $\frac{1}{2}$ %, Bell, 591-2340

176 acres, cabin, barn, 2 wells, river frontage, East Texas pines, minerals, will accept trade, Nickerson, x 2001

6 acres, creek frontage, excellent deer hunting adjacent to 5,000 acres open hunting, \$2250, Nickerson, x 2001

HOME FURNISHINGS

Traditional sofa, 88", 2-cushion, light green excellent condition, \$75; 2 walnut end tables, Italian Provincial, \$20 each; 1 coffee table, \$15; 2 matching lamps, \$10 each, all in very good condition, Brenton, x4372

Couch, curved 4-cushion blue/green color, 9' long, Salyer, x2805 or 877-1351

Rattan dinette set with 4 chairs, excellent, \$125, Bednarczyk, 591-4184 after 5 pm.

Matching Krohler Mr & Mrs curved back lounge chairs & ottomans, excellent cond, \$75 each, Blackshear, 946-8312

AUTOMOBILES

French-built motorbike with helmet, \$65, Booker, 488-3668

68 Corvette coupe, 4-speed, air, power steering, postraction, low mileage, one owner, Samonski, 877-4795

64 Studebaker Hawk, 4-speed, disc brakes, power steering, radio, good condition, \$400, Gibson, x 3686

65VW bug, radio, heater, excellent condition, \$850, Streit, x 2658 or 482-1559

68 Pontiac Lemans, 2-dr hdtip, vinyl top, V-8, ai, power, good tires, \$2195, Hanisch, 926-8994

68 Chevelle SS 396, vinyl roof, air, stereo, mags, new tires, \$2295, Oczkowski, x5595 or 926-8994

66 Mustang, power, air, 41,000 miles, clean, \$1350, Taylor, 591-3653 after 5 pm

62 Pontiac Star Chief, 4-dr sedan, power, automatic, air, \$295, Jezewski, 488-5342

66 Pontiac Catalina wagon, R/H, A/C, power, 2 seat, \$1400 Kohrs, M15-0478

63 GMC pickup & camper, camper insulated, paneled, tile floor, custom cushions, lined drapes, sleeps 4, \$895, 534-5048, McCullough

67 Falcon STM only 6,000 miles, will sell at book value (\$1100) to settle estate, Remini, x 5271

64 VW, clean, radio, 44,000 miles, one owner, Taylor, x 5100 or 944-5818

59 Olds 98, Holiday sedan, air, power, electric windows, seat, antenna, rebuilt motor and transmission, very clean, \$375, Welner, x 2738

61 VW bug, radio, excellent condition, \$395, Albon, x3057 or 471-2665

63 VW Karmann Ghia convertible, radio, heater, vinyl top, 2 yr old, Cohen, x3578

58 Sears "Cushman" motor scooter, good condition, with hard-hat, \$60 or trade for small outboard motor, Brendle, x5221 or 488-5085

66 VW, radio, sunroof, clean and in good condition, \$950, Lonsberry, x 7621 or 488-0627

Honda 305 Super Hawk motorcycle, only 1250 miles, crashbars, luggage rack, \$495, Coan, 488-1028

Honda Mini-trail, less than 1 year old, good condition, \$195, Lillipop, x3111

68 Honda 350 Scrambler, good condition, good tires, \$595, 471-0112 (LaPorte) after 6 pm.

66 Pontiac Catalina, 4-dr sedan, air, r/h, whitewalls, \$1200, Smith, x2716

69 VW bug, 5700 miles, white with red interior, \$1800; 69 VW bus, 14,000 miles, white with red interior, \$2500, Bonafas, HUS-2643

66 Honda motorcycle 590, excellent condition, helmet, face shield, \$150, Kelly, x7211 or HUS-3034

PETS

Free pup, half beagle, cute, black and tan, loves kids, 3 mo. old, Rodman 932-2897

Adorable Beagle pups, AKC registered, tri-colored, small breed, shots, available Dec. 5, will discuss holding for Christmas, \$25, Mal-lary, x 2191 or 482-7081.

Myna bird with cage, \$35, Coler, M19-8521
Four cute sealpoint Siamese kittens, 2 male, 2 female, 7 weeks old, \$15 each, Brandenberger, 482-7883

Black-and-white puppies, ideal children's

Christmas gift, \$5, Boyd, x 4313 or 471-0249 (La Porte)

MISCELLANEOUS

Jungle gym, playground quality, 6 $\frac{1}{2}$ ' high, 3/4" galvanized pipe, welded construction, Bargain at \$25, Samonski, 877-4795

8' custom-built stereo component cabinet, built-in receptacles for KLH-6 speakers or others of same size; walnut formica, excellent condition, new: \$400, sell: \$150, Bednarczyk, 591-4184 after 5 pm.

Sailboat, "West Wight Potter", 14', cabin, 2 bunks, fully equipped trailer, \$1000, Cree, 487-1158

Social membership Clear Lake Country Club, save \$75, Johnson, 591-3541

Clarinet, beginners instrument seldom used, list \$140, yours for \$40, Johnson, 591-3541

Movie camera, Argus Super 8 model 822 Showmaster, loaded/automatic features, flood light and remote control cable, \$65, Largent, 946-4075 or x 4761

35mm SLR, Mamiya 500 DTL, 50 mm F:2 lens, spot and averaging BTL metering system, with case, 18 mo old, \$125, Waltz, 591-2286.

New mexican guitar, \$30, Pouzar, HUS-2935

Vacuum sweeper, canister type, G.E., like new, but needs hose, \$8, Rodman, 932-2897

18' fiberglass racing & skit boat with trailer, 500 hp/427 cu. in., excellent condition, Oczkowski, 926-8994

Women's golf clubs, McGregor irons, 2,5,7, and putter + 2 and 3 woods, also canvas bag, all for \$15, Samfield, HUS-4005

Toys and games for children, including 2 pairs of boxing gloves, electric football game, baseball glove, etc., Stamfield, HUS-4005

24" deluxe gas range, copper-tone, used 6 months, like new, 591-3531 after 5:30, Mendenhall

Muntz auto stereo tape player, model C-50, \$30, Bauch, 591-3382

35 mm SLR Mamiya scora, through the lens light meter, auto or manual operation, excellent condition, \$75, Miller, 932-5973

600 x 16 tires & tubes, two mud, one passenger tread, \$10 each, Prince, M19-7852 or x 3871.

Westinghouse TV, \$30; child's table & chairs, \$4, Firetruck, wagon, trike, \$12; Wonder Horse, \$15; clock radio, \$10; Platform rocker, \$5, 3-piece lawn set, \$15, other misc. items, Bell, 591-2340.

Discover the joy of open-cockpit flying; aerobatic instruction in the incomparable Starman biplane, D. Grow, 944-9152
Hoover washing machine, spin drying, portable, one year old, \$90, J. Kempf, x 2141 or 932-5440.

Camping trailer, Apache "Eagle", sleeps 4, foam mattresses, 4-ply tires, excellent condition, \$600, Guadiano, RE4-2711

7.75 x 15 blackwall tires, Fed-Mart "Strato-Flite", 30-month, 4-ply nylon, brand new, \$17 each, Guadiano, RE4-2711

16' Lone Star aluminum boat, Johnson 35 hp motor, Gator tilt trailer, \$350; Two boy, one girl 26" bicycles, \$10 and \$15; Kenmore automatic washer, \$20, Stullken, x 3501 or 877-4108

16' glass boat with trailer, 35 or 75 hp Evinrude, HUS-7870

Deer lease, 1200 acres, near Bryan, camp house, doe permits, river frontage, Savoy, 443-1360.

Collection of mono LP albums, mostly mood music and big band, all good, most excellent condition, 50¢ each, cheaper by the dozen, Musgrove, 488-3966

Mink stole, arcturus shade, cost \$800, sacrifice for \$300, Bednarczyk, 591-4184 after 5 pm

8 mm movie camera (old timer) \$15, Brownie 310 projector, cost \$60 in 1965, asking \$35, excellent condition, Harris, 944-2131

Sewmor portable sewing machine, with attachments, excellent condition, \$200 new, sacrifice for \$85, Hendrickson, 946-7415

357 magnum Ruger Blackhawk single-six revolver, like new, \$70, Woodcock, x 2261 or 649-4562 after 6 pm.

Classical guitar, outstanding tone for an unusually low price, \$40, Gorman, x 4826 or 649-4872.

12" portable Philco TV, b&w, like new, \$50, Goodrick, x2291 or 645-4343

Aircraft propeller from C-150, ideal for airboat or can be clipped and used for home-built, \$30, Steele, 488-0522

25' Cris Craft cabin cruiser, hull & motor in perfect condition, also 14' Lone Star aluminum, 15 hp Evinrude, trailer, all for \$1,500, Fancher, x7356, 2613 NASA Rd. 1

New Hanksraft facial sauna, used once, \$15; new black nylon bathroom carpet, 7x4 $\frac{1}{2}$ ', \$10, Cubley, 488-2248

File, 4 drawers, full suspension, heavy duty,

lock bar, \$35, Coan, 488-1028

Baia standard 8mm action movie editor, 6" viewing screen, built-in splicer, excellent condition, \$12.50; Lafayette cds exposure meter, reflex viewfinder, dual sensitivity ranges, variable acceptance angle, very good, \$7.50, 488-3966

Office typewriter, \$40; carved spanish mirrors, choice decorator type, \$40 for pair, M19-2569

Sony tape deck, model TC-255, perfect condition, used very little, \$115, Woodcock, x 2261 or 649-4562 after 6 pm.

Will fly you anywhere for costs in Bonanza Cessna 172 Comanche, M. von Ehrenfried, 591-4163

Large ceiling fan, 4 wood blades, 4 $\frac{1}{2}$ ' blade arc, excellent condition; 3-ton capacity chain puller (come-along) CM model "B", retail \$180, like new, \$80, Hill, 471-4305.

Ruger .367 Mag pistol; 8' flat boat; Zebco rod & reel; drafting table; Mossberg auto. with scope, 22 cal.; Winchester Canadian Centennial 30-30; 7-mm Mauser; Marlin 12 ga. bolt action; bowie knife, Green, x 2476

Lafayette slide rule; set metric wrenches; executive chair; 68 gas range; K & E slide rule, Green, x 2476

Mercury Super 25, 4 cyl., electric start, good condition, \$100; hardly used Polaroid Swinger camera with case, \$12, Lines, x 1332

Lowrey organ, duplicate keyboard, bass pedals, cost \$900 new, sacrifice for \$385; also 30,40,60 power telescope, \$17.50, Peder-sen, 474-2123

Yoga students for beginners class, fully qualified instructor; exercise for health and figure, Johnson, 591-3541

Spinet piano, used, good condition, Johnson, 591-3541

Early American braided rugs, chest type freezer, gas room heater, several straight-back wooden chairs, Briggs, 946-5849, after 5 pm.

Driver to share car pool from Pasadena-Briarcliff Apts. area, Bldg 12, 8-4:30, Freeman, 944-9622

Aircraft frame & engine parts for home-built, + small to medium size vise and power saw, 591-4163

Heavy-duty winch, 2-speed, minimum capacity 100' 3/8" line, manual or 110 volt, Hill, 471-4305

Re-useable Shuttle is planned for late 70's

Question: How do you build very large, very efficient manned vehicles which can be launched into earth orbit within a 2-hour period from an un-fueled state, function in space, and routinely return to the launch site for economical refill and reuse?

The design currently most favored to meet these requirements space machines.

The aerodynamic design chosen to answer this question will become the Space Shuttle—America's next generation of manned is a vehicle which is part rocket, part orbiting spacecraft, and part airplane.

The shuttle will incorporate the principles of aeronautics with the principles of astronautics — from the Wright Brothers to the blunt wingless vehicles of Mercury, Gemini, and Apollo.

The resultant vehicle will be designed to be completely reusable. It will be employed as a taxi to transport men and supplies to the near-Earth orbiting space stations planned for the late 70's. It would be launched from Earth like a rocket, enter synchronous Earth orbit with the Space Station, transfer men and material, then return to Earth. It could land at most commercial airports. For the sake of rapid turn-around, however, it would return to the site of its launch.

One major configuration concept now under investigation is that presented by Maxime A. Faget, MSC's Director of Engineering and Development at last month's AIAA meeting in California.

As currently envisioned, the shuttle proposed by Dr. Faget would be composed of 2 completely reusable stages. Each stage would be not only a high-performance rocket but also an efficient entry vehicle and airplane. Both would look much like

subsonic air planes. The 225' booster (first stage) and orbiter (second stage) would be attached in a piggyback arrangement weighing 2.5 million pounds at launch. With the oxygen tanks located in the forward portions of each craft, this configuration provides a very favorable forward center of gravity and contributes to making the combination aerodynamically stable.

The booster would operate for a comparatively short time. Immediately after staging, the booster would re-enter the atmosphere, decelerate to subsonic flight, and return to the launch site some 300 nautical miles away.

The orbiter, having been carried to the fringe of space, would ignite its rocket engine and continue to an altitude of about 300 miles, where the space station would be located. After unloading supplies or experiments its two pilots would return the craft to its landing spot or any other 10,000' long runway, if required. Alternatively, the orbiter would have a self-sustaining lifetime of 7 days for independent orbital operation.

Novel re-entry

The key maneuver is the re-entry technique. It is necessary to minimize heating, while slowing the vehicle for subsonic flight. Faget's proposed 60° "angle of attack" would have the plane re-enter on its belly, so that only the flat bottom would be directly exposed to the airflow. Only this area, therefore, would require major thermal protection. The high drag ratio developed shortens the duration of the heat pulse, and also makes it unnecessary to fold the wings. Another attractive "plus" for this method is that forces of only about 2g are produced during re-entry — a force which most healthy passengers otherwise qualified for space could easily withstand. This would permit scientific and technical specialists to become active participants of the space program without having to undergo the rigorous training of an astronaut.

At 40,000' the nose would be pushed down and a transition

would be made to horizontal subsonic flight, the turbojets cut in, and the vehicle readied for a normal airport approach and landing.

Flexible operation

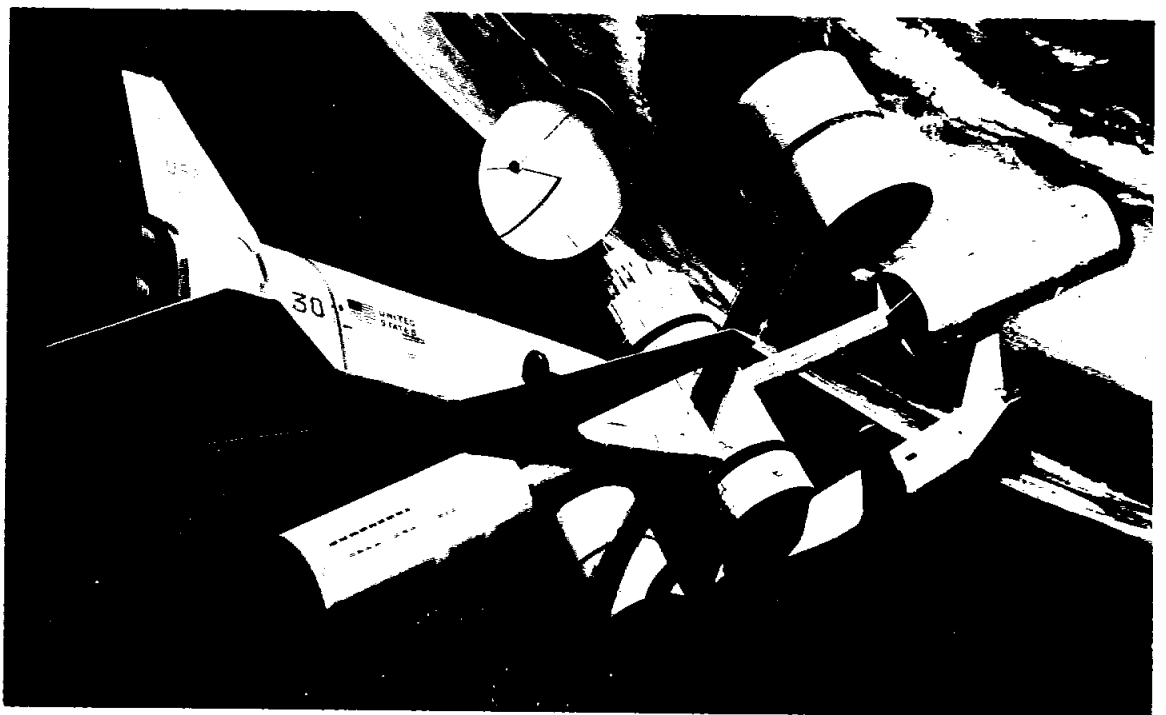
Such a vehicle could perform not only logistic support, but could be a launcher for a variety of satellites, a retriever of damaged satellites, a special mission craft for manned orbital observations of up to 1 month, a vehicle for various military missions, and a carrier for the launching of spacecraft into higher energy missions.

Initially, however, the shuttle would be used primarily for logistic support of the space station. The fact that the shuttle craft will be reusable is expected to reduce payload costs from present levels of about \$1000/lb to the vicinity of \$100/lb, and eventually to even as low as \$10/lb.

A fleet of 5 vehicles, each with a cargo volume comparable to that of the passenger compartment of a 707 jet is the current goal.

Technology gaps

Five technological areas have presented obvious problems: (1) the need for very efficient lightweight structures capable of withstanding a minimum of 100 reuses, (2) a thermo-protection system for temperatures ranging from 3000°F on the leading edges, to 1500°-2000° on the underbody. Metallic super-alloys are being developed to act as a radiative heat protection. At MSC



Science fiction? No, this artist's concept depicting space shuttle orbiters docked to an Earth orbiting space base reflects current thinking on one possible configuration. It could be available for use by the late 1970's.

work is progressing with the use of a hardened, compacted external insulation of quartz fibers on the fuselage and under-wing areas, titanium on upper surfaces. Also under consideration are columbium, tantalum, and nickel chrome. (3) propulsion systems using liquid hydrogen and liquid oxygen on both vehicles, with a capability of a wide range of throttleability, (4) the RCS propulsion, and (5) the configuration itself.

Requires trade-off

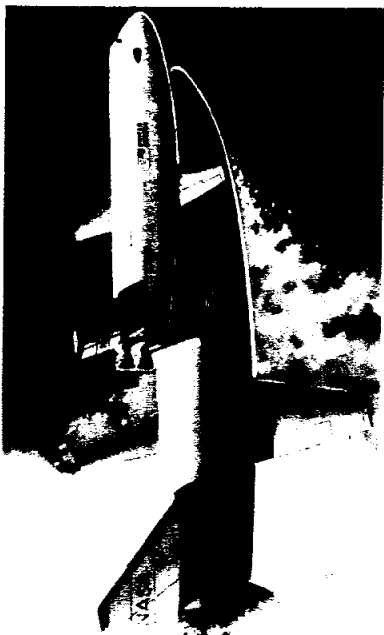
The Faget concept has a limitation in that the high angle of attack does not allow for much crossrange maneuvering during entry at hypersonic speeds. The DOD feels that an ability to move laterally during entry is desirable so that landings can be made at locations some distance to the side of the normal entry path. This capability, which improves mission flexibility is obtained by sacrificing a large portion of the payload for the additional thermal protection material which would be required.

Another concept being considered is a swing-wing design. Its proponents say that it would be a more maneuverable craft, and would require less thermal shielding on the wings. It would, however, introduce complex problems and added weight for hinges and retractor mechanisms.

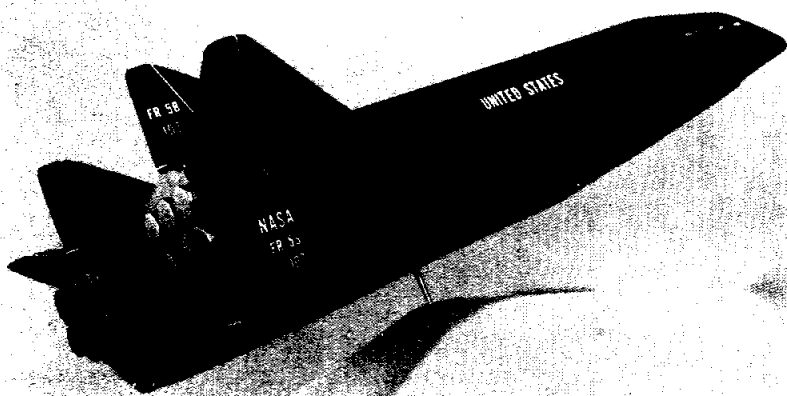
A third concept utilizes the Delta-shaped re-entry vehicle of the "lifting-body" type. This type would have a higher crossrange ability than would the Faget concept.

Still another proposal is to use a twin fuselage first stage, with a stubby-winged second stage nestled in between, the combination weighing some 4½ million pounds at launch.

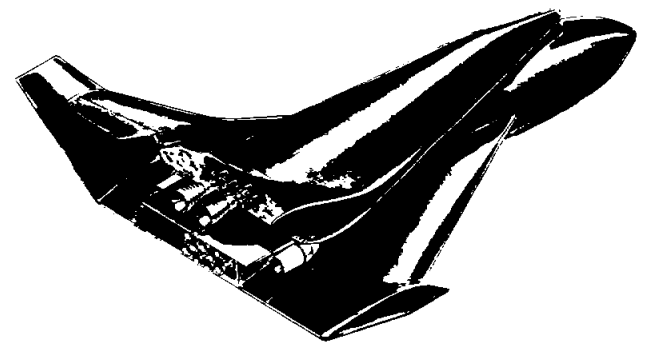
Bidding for prime study contracts on the shuttle program which is estimated to develop into a \$7-10 billion program, are North American Rockwell, Lockheed/Boeing (in cooperation), McDonnell-Douglas, General Dynamics Corporation, and the Martin Marietta Corporation.



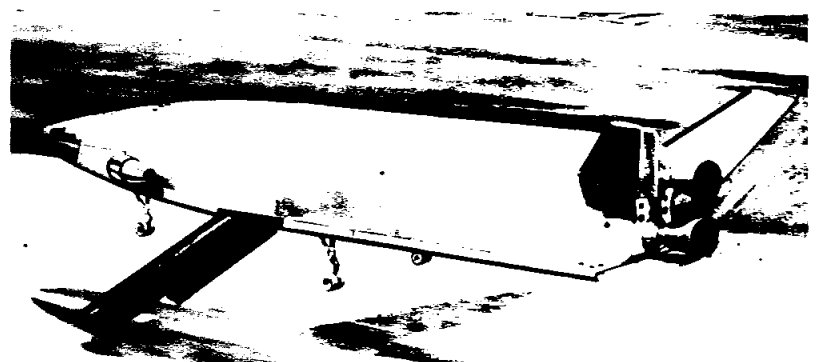
Piggyback configuration is another competitor for the Space Shuttle prime contract.



This three-unit craft by Martin-Marietta tucks the orbiter in between two giant boosters.



Delta-shaped configuration of the "lifting body" type is the Lockheed/Boeing entry.



General Dynamics' entry looks remarkably like a conventional airplane.