ROUNDUP

NASA MANNED SPACECRAFT CENTER HOUSTON, TEXAS

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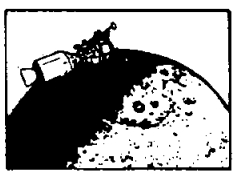


An Apollo 14 core tube sleeve half weighs in at 18.2 grams during pre-flight preparation of one of two sample return containers in the Lunar Receiving Laboratory. Roy Ayers, Brown Root Northorup glove operator (right) and BRN inspector Zachary Shannon check sale reading, which will be subtracted from the weight of the returned container to determine net weight of sample.

Apollo 14 Roll Out Set for Monday at KSC

Preparations are continuing for the January 31, 1971 launch of Apollo 14 with two significant events on schedule for the coming weeks.

Saturn launch vehicle number 509 bearing LM eight and CSM 110 will leave the Vehicle Building at Kennedy Space Center next Monday for the three and one half mile trip to Pad 39.

Along with the roll out, Astronaut Stuart A. Roosa, the Command Module Pilot, will field questions from newsmen at a KSC Press Conference.

One week later the prime lunar landing crew will travel to Flagstaff, Arizona to practice EVA 2; the final of two lunar surface activities scheduled for Apollo 14.

Spacecraft Commander Alan B. Shepard and Edgar D. Mitchell, the lunar module pilot, plan to traverse across a man-made lunar surface which has been configured like the Moon's hilly uplands region north of the rim of Fra Mauro crater.

Astronauts Shepard and Mitchell will pull a two wheeled vehicle as they train to become the first men to leave wheeled tracks on the Moon.

The vehicle has the imposing name of the Modular Equipment Transporter and, of course, an appropiate acronym, MET. The MET was built at MSC by personnel in the Technical Services Division.

This vehicle is needed to lighten the burden because the Apollo 14 crew will be carrying more equipment and will cover greater distances than either of the first three Moon landing crews.

Also participating in the Arizona training, will be the flight controllers at Houston mission control and Roosa, who will be in the CSM simulator at KSC.

Fra Mauro was selected as the landing site by a team of scientists who believe the lunar materials from there were dredged up from deep inside the Moon when a smaller Moon or large meteorite impacted into it four or five billion years ago.

AFGE Meeting

The American Federation of Government Employees Lodge 2284 has scheduled a monthly meeting Novemer 9 at 5 p.m. in the Building 30 auditorium. The public is invited.

AFGE also announces that by mutual agreement between the union and the Manned Spacecraft Center November 24 has been set as an elction day to determine if civil service employees desire exclusive recognition by the AFGE.

Buy Savings Bonds

U. S. Savings Bonds are a good buy. They earn 5½% when held to maturity.

MSC Probable Site for Soviet, US Space Talks

The Manned Spacecraft Center probably will be the site for further technical discussions between American and USSR engineers on possible docking arrangements between spacecraft of the two countries, according to an announcement by Dr. Robert R. Gilruth.

The MSC Director was chairman of an American delegation which traveled to Moscow recently for inital discussions on compatible space docking.

Traveling with Dr. Gilruth were Caldwell C. Johnson, Chief of the Spacecraft Design Office, and Glynn Lunney, Chief of the Flight Director Office. A representative from Headquarters and one from the Marshall Spaceflight Center also attended.

The MSC trio listened to technical presentations by their Soviet counterparts and were shown photographs and drawings of Russian docking mechanisms. They appeared to be similar to the ones used in Apollo Command and Lunar modules, according to Dr. Gilruth.

Skylab 'Chow' to Taste Like Mom's Cooking

When it's chow time on Skylab, astronauts who will spend four to eight weeks in Earth orbit, will have a menu which is as close to 'home-cooking' as modern food technology can make it.

Aerospace doctors and technicians are developing a food system designed to compensate partially for astronauts' long absence from the usual fare of Earthlings and the warmth and delight of home-cooked meals with family and friends.

Dr. Malcolm C. Smith, Chief of Food and Nutrition at the NASA Manned Spacecraft Center said "For the first time, a diet will be provided (for astronauts) which is conventional in appearance, superb in taste and yet satisfies the rigorous nutritional requirements. The food system is so designed that the Skylab crews will have a relatively wide range of selection from a set of conventional food items while still rigidly adhering to the "experimental requirements."

For the first time astronauts will prepare their meals from an assortment of frozen as well as the conventional space foods similar to that carried on manned Gemini and Apollo missions.

Astronauts will 'cook' their own meals on a special food tray now being developed for Skylab. Frozen foods will be stored in a freezer in the Skylab orbital workshop.

In addition to being the most palatable menu carried into space thus far, the Skylab food system is designed to meet the requirements and objectives of an important series of medical investigations. Dr. Smith explained that the medical experiments are profoundly influenced by the nature and amount of food that the astronauts consume.

One of the experiments which is in the area of Nutrition and Musculoskeletal Function includes at least three different investigations which demand precise knowledge of nutrient and mineral intake. One such investigation, Mineral Balance, depends upon the complete and accurate knowledge of everything the crew member consumes and of everything he excretes. Another investigation, Assay of Body Fluids, is also dependent upon close surveillance of certain types of nutrient intakes.

In addition to these inflight experiments there are a number of pre- and post-flight medical experiments which are dependent on a detailed quantitative knowledge of what each crew member consumes throughout his exposure to orbital flight.

The Skylab food system will maintain a caloric level between 2,000 to 2,800 calories. The diet will be baselined to provide at least the minimum dietary allowances of protein, carbohydrate, fat, minerals, and vitamins which are recommended by the National Academy of Science.

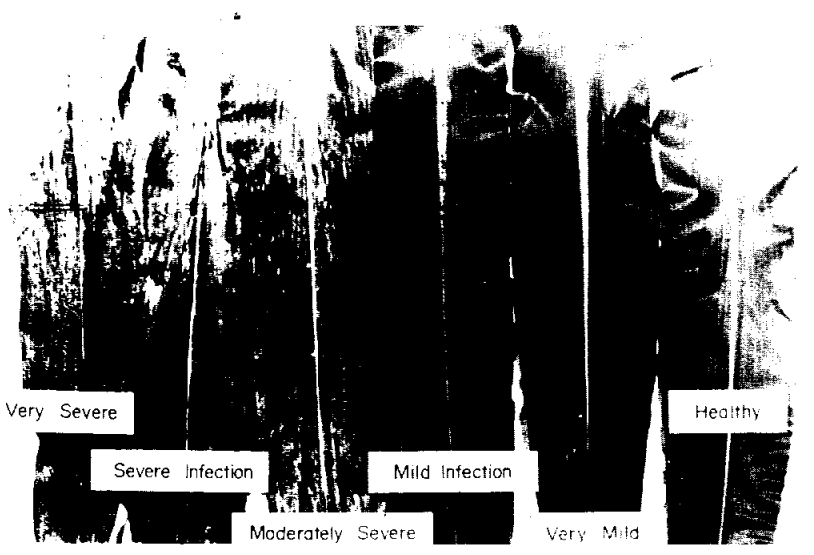
(Continued on page 4)

Miss Connie Stadler, dietician at MSC, holds the food tray proposed for use in Skylab. Packaged food items are placed in the individual compartments and the astronaut heats up his meal by flipping the switches at the front of the tray.

THE ASTRONUTS

courtesy of TRW's gordon a. south

"He's the new center for our interstellar basketball team."



DISEASE DETECTION — NASA, Air Force and Purdue University aircraft cooperated recently in a study of diseased corn in the midwest. Aircraft sensing equipment was able to detect healthy versus diseased crops. Photo shows the extent of infestation of corn as photographed in laboratories at Purdue University.

Airborne Sensing Devises Detect Blight in Indiana Cornfields

A series of aircraft flights at various altitudes to detect corn blight infestation in Indiana with onboard sensing devices have proved successful, National Aeronautics and Space Administration announced today.

During the final weeks of August and in early September, MSC scientists and personnel from Purdue University, Lafayette, Indiana, coordinated a corn blight sensing experiment. Also involved were aircraft from the University of Michigan, Ann Arbor, and the U. S. Air Force.

The test area was between Michigan City and Evansville.

While the cameras aboard the various aircraft, including infrared cameras, turned up significant results, the most precise data came from the multispectral scanner flown by University of Michigan's aircraft.

Combined with ground computer readouts the scanner was able to classify corn as healthy, very mild blight, mild blight, moderately severe blight, and severe.

Although infrared photographs showed little difference between severely damaged cornfields and a maturing normal field, the scanner data, after being run through a computer, could make the dis tinction.

A computer printout clearly identified cornfields and the amount of infestation in them. This was by a digital system from one to five. The system indicated healthy to severely infested corn blight.

In addition, each field was classified according to a code number based on the numerical averages of the field. In some of the same fields blight ranged all the way from mild to severe.

A NEW BREED . . .

Today's Aerospace Engineer Designs With Costs in Mind

A new breed of aerospace engineer — product of a tightening purse string— is making the scene in Downey, California on way out projects like the space shuttle.

Like a cost analyst, he keeps his eye on the final bill, operates an adding machine (in addition to his slide rule), and consults a computer to avoid unnecessary costs as he introduces and test new designs.

The philosophy is being driven home here by Bastian Hello, vice president at North American Rockwell's (NR) Space Division, and general manager of the Space Shuttle program there. The firm is one of two awarded parallel 11-month contracts for preliminary design studies of NASA's two-stage reusable space vehicle of the late 1970's.

"If recent history portends the future, then the manned space budget will constrain expenditures on the Shuttle during the development phase," Hello tells his staff.

We hope to achieve the savings by stressing "cost avoidance," an aerospace term widely used at Space Division, and "commonality," another one already familiar to the aerospace industry, Hello said.

Object of commonality, explains Hello, is to save money by making use of the same design and invention between two or more hardware, aircraft or space program development efforts.

A number of sophisticated aircraft now being developed, for instance the Air Force B-1 bomber and other supersonic craft, offer hardware opportunities for common development. Some of these items are airborne computers, flight controls, landing gear, air breathing engines and crew equipment.

From the Apollo command and service modules, it may be possible to use components and assemblies such as plumbing and valves from the environmental control system's cooling equipment, plus crew couches, sextants and telescopes.

The Shuttle's two stages are being designed to use similar main rocket engine chambers where the oxygen and hydrogen propellants are ignited to provide thrust when the engines are fired.

Although the orbiter and booster stages' structural design differs, the same material and fabrication processes for each will prove to be money savers.

Contracting with the same suppliers of such items as power components, mounts, meters and other instrumentation for both stages is expected to hold down costs, as would the use of common computer languages, compilers, programming agencies and ground facilities.

Cost avoidance stresses continued use of a specially-educated computer—an IBM digital 360-85 —which spares engineers the tedius tasks of reptitive analysis and allows them the time to check, challenge and improve hundreds of concepts.

The computer solved more than 30,000 design problems in fractions of a minute, "telling" engineers, among other things, that the best piggyback position for the orbiter was to place its nose in line with the booster's. Thus, the craft will have the least amount of wind resistance or stressloads during flight.

The same workload would have taken hundreds of engineers months to resolve. It already has saved more than $100,000 in Shuttle design.

"We must put ourselves in the place of a man buying or building a house," says Hello. "He knows what he can afford and if he plans well, he will know what he will spend on that house. He obviously does not want to spend a nickel more."

Bogart to Speak To Fiscal Groups On November 17

Lt. Gen. Frank A. Bogart, USAF (Ret), Associate Director, Manned Spacecraft Center, will address a joint meeting of the National Contract Management Association and the Federal Government Accountants Association. The meeting will be held November 17 at The Airport Hotel, 7777 Airport Blvd.

General Bogart has had a distinguished career in the U. S. Army and U. S. Air Force. A graduate of the United States Military Academy, Command and General Staff School, and the National War College, he has held numerous positions of significant responsibility both in the U. S. Air Force and NASA.

Most recently prior to his Air Force retirement, General Bogart performed duties as director of Budget, U. S. Air Force Headquarters, Director of Plans and Programs - Air Material Command, Director of Supply, Headquarters - Air Material Command and Comptroller, U. S. Air Force

After joining NASA in 1964 General Bogart served in various positions including Deputy Associate Administrator for Manned Space Flight (Management), NASA Headquarters and his present position, Associate Director of MSC. In this position, he is responsible for management of MSC's nontechnical affairs and acts for the Director in much of the day-to-day general management of the Center in the areas of budget, procurement, manpower, and supporting services.

Airglow Studies Underway at White Sands

Two small rockets, carrying experiments to study the infrared airglow at 50 miles altitude, will be launched for the Manned Spacecraft Center from the U. S. Army White Sands Missile Range during the first two weeks of November.

Purpose of the twin launches is to provide a firm basis for scientific studies of the atmosphere from either Space Station or Shuttle. Plans are being considered to conduct similar airglow experiments from Space Station or Shuttle.

The airglow is a dim luminosity produced by chemical reactions among atmospheric gases. The airglow can be seen near the horizon on clear nights and is clearly visible to astronauts in orbit who view the glowing layer edge-on.

The experiment payloads weigh about 110 pounds each and will be launched by Nike-Cajun two stage-rocket. The Nike-Cajun, a solid propellant rocket is 21 feet tall and its two stages have a total thrust of 51,000 pounds.

Sustained Superior Performer

Bobby J. Wood of the White Sands Test Facility, and a resident of Las Cruces, New Mexico, received a Sustained Superior Performance Award from Martin L. Raines, Manager, Reliability and Quality Assurance Office. The award was presented to Wood while hospitalized at the Texas Medical Center in Houston.

Roundup Swap-Shop

(Deadline for Swap-Shop classified ad is Thursday of the week preceding **Roundup** publication date. Ads are limited to MSC civil service employees and assigned military personel. Maximum length is 15 words, including name, office code and home telephone number. Send ads in writing to **Roundup** Editor, AP3)

LOST

Lost at Ellington. Man's wrist watch with wedding ring and class ring attached. Reward. Faust x-3946

REAL ESTATE

For rent 2 B/R studio duplex, central air and heat, water paid, nice yard, adults only, no pets, Webb 932-3816 or Heflin 932-4488.

For sale Spanish brick 3-2-2, fenced, central air and heat, all electric, equity, 6% $143.00. Brock, League City 932-5292.

All-brick Olde English home, 2 spacious bedrooms, one luxurious Roman bath, log burning fireplace, Clear Lake City, Call 488-3751.

4-2-2 brick, Sagemont, detached garage, large fenced-in backyard, reduced equity. Chassay 487-2940.

WANTED

Two used white walls 6.95x14 or 7.35x14 tires, must be good. Brock 932-5292.

Window air conditioner, three-fourths ton cooling and 5 KW heating capability. Jacobs 744-9924.

To rent: garage or other suitable structure for use during reconstruction of antique car. Simmonds 877-1188.

22 rifle, bolt action, repeater, with reasonably good barrel. Kaigler 877-4731.

Share expenses to Florida via Beechcraft Bonanza. Two seats available leaving November 25 returning November 29. Hanisch 932-6484.

PETS

AKC Cocker Spaniel puppies, champion blood line, six weeks old. Johnson x5018 or LaMarque WE 5-6218.

Adorable AKC Miniature Schanuzer puppies, nine weeks old, shots, wormed, Tyler x3088 or Alvin 585-5948.

Small red AKC Dachshund puppies, registered litter, two months old, Christmas Day, reserve now. Carlin 667-3000

Six free puppies, mother long hair Terrier and Beag e, need a good home, good around children, Janney, 488-0658.

MISCELLANEOUS

3-rd seat for 70 International Travel-all, black with seat belts, new condition, $65. Bent 944-3688.

69 Johnson 20hp ob motor, excellent condition, recent tune-up cost $500, sell for $335. Horton 877-4102.

Daisy BB gun like new, cost $15.00 sell for $9. Horton 877-4102.

14-ft Cuachita boat DW model, good condition, eight year guarantee, cost $160. Horton 877-4102.

Cimatti 160cc, 5,000 miles, two helmets and shop manual, superb condition, $260. Hagood x2385.

Two Goodyear belted polyglas white wall tires, Size H78-14, used 4,000 miles, 50 Supkis 877-2967.

Set of six swivel Bourbon Barrel chairs, oak, black diamond tufted naugahyde, excellent condition, $75. each, Spann 877-2150.

Early American love seat, green, one year old, $60. Bishop 932-5161.

Head 6' skiis, bindings, poles, $100; ladies size 6½ Henke buckle boots, $50. Clancy x3361.

Ladies high heel pointed shoes, size 8AAA and 8AAAA, seven pair in various colors, good condition, $2 per pair. Pope 932-5134.

Custom trailer hitch for early VW, $7. Brock 932-5292.

Heath Bonnie Bike, 5hp Briggs Stratton engine, like new, $165. Lucas 482-3592.

Den furniture, ranch style, sofa, easy chair, three tables, $125. Vang x2918.

Royce-Union exercise bike $25. Glover 955-4863.

69 Travel Trailer, 20 ft., tandem axle, self contained, air, excellent condition, $2,750. Lucas 482-3592.

Citizen band radio for base or mobile $50. Gillis, 471-0695 after 4:30.

110 volt room air conditioner, used three months, $90. Jacobsen 487-0792.

Two 7.35x14 Goodrich Custom Long miler tires, whitewalls, excellent condition, used two months, $10 each Rippey 877-1895.

Aloe vera plants, 50¢ to $1. bowling ball, bag and shoes. Lines x5018.

12x60 foot mobile home, unfurnished, carpets, drapes, central air and heat, three bedroom. Cobaugh 534-2730.

Ladies wrist watch, Seiko, white gold, new $35. Moser 877-3048.

Gerbil cage with exercise wheel and water bottle, $3. Moser 877-3048.

JGR, 1964-70, will sell by volume or copy. Snyder x5367.

Kenmore portable automatic dishwasher, excellent condition, guaranteed for nine months, $95, light blue nylon looped carpet and pad 15x17 feet, used nine months, like new $95. Bartosh 488-6052.

Argus automatice slide projector with 12 slide magazines and spare 300 watt lamp 25. Hervig x2634 or 488-0239.

Double bed, Sears-opedic box springs, foam mattress, walnut veneer bookcase headboard $50. Mallary 482-7081.

Membership in Clear Lake Country Club, $100 plus transfer fee, Braun 488-0020.

25 inch Magnavox color TV, console, excellent condition, about two years old $300; Zenith stereo AM-FM changer console $200. Petrash 534-2605.

Large wooden shelf, finished, 4 feet high, 8 feet long, 2 feet wide, ideal for playroom or garage, 20. Buckel 591-3208 nights or weekends.

Camper cover, fits pick-up short wheel base, lined wide bed, Ford or Dodge, Cost $250 sell for $175. Horn 487-0371.

Large mobile home 10x55 foot, three bedroom, $2,250 excellent for home or lake lot. Wright 944-5624.

Six foot aluminum Christmas tree, good condition, $5. Elaine 488-3433.

Bassinet, mesh play pen and Strolee stroller, all for $30. Will sell separately, Westbrook, x2581 or 723-9594.

AUTOS

67 VW, good condition, new battery, 36,000 miles, $950. Akin 941-1631 after 4 p.m.

63 Porsche 356B coupe, Pirelli tires, AM-FM, new paint, clean $2,400. Provenzano x4321 or 591-4589 after 5 and weekends.

61 Bug-Eye Sprite, good top, runs wells, spare generator, $300, no dicker, Trout x5361 or 944-3959.

66 Simca, 4-dr, 32 mpg, good cheap transportation, $395. Lindemuth, 482-1086.

69 GMC Sierra Grande pickup, 396 CID, auto transmission, air, all accessories, Bailey 534-5468.

62 rebuilt 101 Hp Opel engine, complete to transmission, $12. Brock 932-5292.

55 MG-TF 1500 Classic design, new upholstery, body good, no engine or transmission. $350. Hagood x2385.

International Harvester step van, runs well, $150. Hodge 591-2152.

70 Ambassador 360 SST sedan, power, air, velour upholstery, low mileage, warranty, take up payments. Jacobsen 487-0792.

67 Riviera full power and air, stereo FM, sacrifice at $1895 Oczkowski 926-8994.

69 VW sedan, diamond blue, $1450 Coler MI9-8521 after 5.

Triumph TR-250, 6 cylinder, yellow convertible, black top, AM-FM, luggage rack, mag wheel covers, red stripe Michelin radials, sharp, $2,000 Davis x3271.

69 Chevelle, Rally sport, equipped, four speed, 350 cu in Humphrey 643-3870.

67 Chevelle, SS396, air, vinyl top, extras, low mileage, $1675. Carson 946-0319.

68 VW Camper, excellent condition, air, radio, 70 engine, good tire, $2,200. Parker 877-2665.

63 Buick, excellent condition, good work car, $350, Harris, 877-2651 after 5.

69 VW, 11,000 miles, excellent condition, under warranty, Gearhart, 488-6016.

32 MGJ2, original engine, cycle fenders, 19 inch wheels, Myers, 488-0810 after 5.

68 Mercedes, 250S, 4 dr sedan, Ivory color, auto transmission and air, excellent condition, low mileage, Metz 534-4771.

66 Olds 98 four door hardtop sedan, power and air, immaculate Sharma x5156.

64 Gran Prix, excellent condition, air, must sell, Snyder 488-1540.

65 Chevrolet, Bel-Air station wagon, good condition, radio, heater, auto transmission, great work car, $695. Hamner 877-4903.

65 Olds 442 Holiday, automatic, factory, air, one owner, $695. Collier x5536 or 433-1045

67 Ford Country Sedan air, power steering, radio, 32,000 miles, clean. Davis 946-2503.

66 Opel Kadett, Station Wagon, air, excellent condition $850, Sampsel 471-0172.

63 Chevrolet Impala, 4-door hard top, original owner, excellent condition, 69,000 miles Hargrave 488-3385.

Irving Alexander (left) receives congratulations from William M. Bland, Jr., Deputy Manager, R&QA Office, after passing the American Society for Quality Control Certification exam; a rigorous six-hour test covering all aspects of quality control. In addition to textbook exercises, the society requires a minimum of eight years of experience in one or more branches of quality control or degree work in science or engineering.

60 YEARS OF SERVICE

Edward F. Mitros, of the Flight Operations Directorate, recently completed 30 years of service with the federal government. A resident of League City, he is active in civic and church affairs.

Marcus D. Garner, Flight Operations Directorate, also a 30-year civil service employee. During Apollo missions he is in charge of a shift of Communications Controllers. Garner lives in Houston.

MSC Employee To Direct Theatre Group

ASPO Division's Dave Goldenbaum and Mrs. Jo Simmons, wife of William H. Simmons, Power and Propulsion Division, are MSC headliner contributions to the upcoming Pasadena Little Theatre production of "Angel Street."

Goldenbaum, well known to local amateur theater goers, has assumed the task of director. Mrs. Simmons will play the leading lady role of Mrs. Manningham in this Victorian mellodrama which portrays the efforts of a man to drive his wife insane.

Opening night performance is November 13—that's next Friday—with the production scheduled for subsequent Fridays and Saturdays through December 5.

During the eight years that Goldenbaum has been in the MSC area, he has been active in the theater and arts. Dave is past president and board member of the Clear Creek Country Theatre in League City, and he has directed a number of plays for that group.

He came to MSC from the Langley Research Center where he also was active in little theater work. His previous directing experience included motion pictures and historical pageants.

"This is where the gaslight flickers," says MSC's David Goldenbaum to Mrs. Jo Simmons at an early rehearsal of the Pasadena Little Theatre's production of "Angel Street." The play opens on November 13.

Final Golf Tourney Set

The ninth and final tournament of the MSC Golf Association will be held at El Dorado Country Club Nov. 11, 1970. Tee time starts at 10 a.m.

Dick Hart, tournament chairman, requests league members send their applications in no later than Nov. 6.

MSC Bowling Standings

JIMMY WARREN MEMORIAL LEAGUE

Team	Won	Lost
Achievers	24	16
Bit Pickers	24	16
Fabricators	23	17
Mixers	23	17
Pin Pounders	21	19
Alley Oops	21	19
Strikers	19½	20½
Blitzers	19	21
Real Timers	18	22
Roadrunners	16	24
Hexes	16	24
Chokers	15½	24½

Aero Club Plans Ground School for Student Flyers

The Aero Club, an EAA sponsored organization, will begin ground school soon if there is sufficient interest from MSC personnel.

The ground school is held for student pilots and includes basic courses in navigation, weather, fundamental flight theory and federal flying regulations.

The course runs approximately 10 weeks, with the frequency of classes left to the discretion of the students. Course fee is $20 which is applied to the purchase of books and other required materials.

Classes will be held in Room 520 of Building 2 after 5 p.m.

Interested students may contact Maurice Brooks, a licensed ground school and flight instructor, at x2566.

The MSC Aero Club currently has four aircraft including a Cessna 150 and a 172. Recently the organization moved its base of operations to Hobby Airport.

NASA Pilot Wins Handball Tournament

Jerry Cobb, a test pilot for NASA, captured the 1970 East End YMCA Open Handball Championship by defeating top seeded L. B. "Tiger" Jones. The finals match, was an hour-and-a-quarter see-saw battle marked by Cobb's steady position game and bullet-like service, and by Jones' incredible fist kills.

Cobb's victory by scores of 21-17, 12-21, 21-17, came in his first tournament effort, although he maintains "top flight" status at the Manned Spacecraft Center's in competition with astronauts and other NASA personnel. By contrast, "Tiger" Jones, who has been playing and teaching handball for over 40 years, has participated in numerous tournaments.

In advancing to the finals, both Cobb and Jones defeated Boeing Company engineers assigned to MSC. Cobb beat Rod Zieger 21-9, 21-7, while Jones eliminated Emile Unverzagt.

THE TUG

Versatile, Practical; Program for the 70's

Few government programs are based on the type of long-range planning which characterizes U.S. space ventures. The NASA's programs are responsive both to the opportunities opened by the new technology developed during past decades and to the financial limitations imposed by this nation's many competing needs. And yet the space program for the 1970's promises to be rewarding, especially in the hitherto lightly investigated field of unmanned planetary exploration.

Probes to Venus and Mars have produced much new information, but even these gains will be dwarfed when man-made spacecratt bearing cameras and other instruments arrive in the neig ıborhoods of Mercury, Jupiter, Saturn, Uranus, Neptune and Pluto.

Along with the prospect of exciting probes into the far reaches of the solar system, there is a development effort aimed at delving into the secrets of planet Earth; this oasis on which we live. Reconnaissance activities via satellite have enormous potential for aiding farmers, for forestry, for exploration of the seas, and in the search for oil and new minerals. And the presence of a reusable space Shuttle will affect the economics of space—both in its costs and in returning dividends. In addition a permanent manned orbiting space station will unlock new secrets for science.

To complement these new programs there is the need for a fleet of vehicles with extensive transfer and maneuvering capability. This need can be achieved most effectively by a reusable Space Tug; a system which will be based and maintained in space.

The Tug is one of the new flight articles identified for support of missions in the document submitted to the President in 1969. The report is called "The Post-Apollo Space Program: Directions for the Future," Space Task Group Report to the President dated September, 1969.

As conceived by Manned Spacecratt Center designers, the Tug can either be manned or unmanned. Working out of the Engineering and Development Directorate, the team is headed by Andre J. Meyer, manager, of the Lunar Exploration Project Office; an employee of NASA and its predecessor for 27 years.

Project engineer is Marion D. Kitchens.

The Tug could be comprised of four modules. These may operate independently or with other flight systems: example, a space station. Thus, with this record of innovative accomplishments, the MSC has initiated a $250,000 study with the North American Rockwell Corporation, Space Division, Seal Beach, California.

Directions to the contractor emphasize: (1) Mission interface (2) Requirements (3) Operations, (4) New technology implications.

Four modules combine to make up a Tug. They have been identified as: (1.) the Crew module (2.) Cargo module (3.) Electronics, also called an Intelligence module (4) Propulsion module.

Autonomy is a design objective; ground support is to be at a minimum, and the system can be left quiescent in space for as long as 180 days. The study calls for tug reactivation to be completed within two hours and be flown by but one space pilot. It is planned that a Commander and crew will be transferred to the orbiting Tug from a Shuttle.

Under present study plans, each Tug might be used up to ten times merely by refueling and replacing consumables. For major refurbishing the Tug will be returned to Earth—probably in the bay of Shuttle.

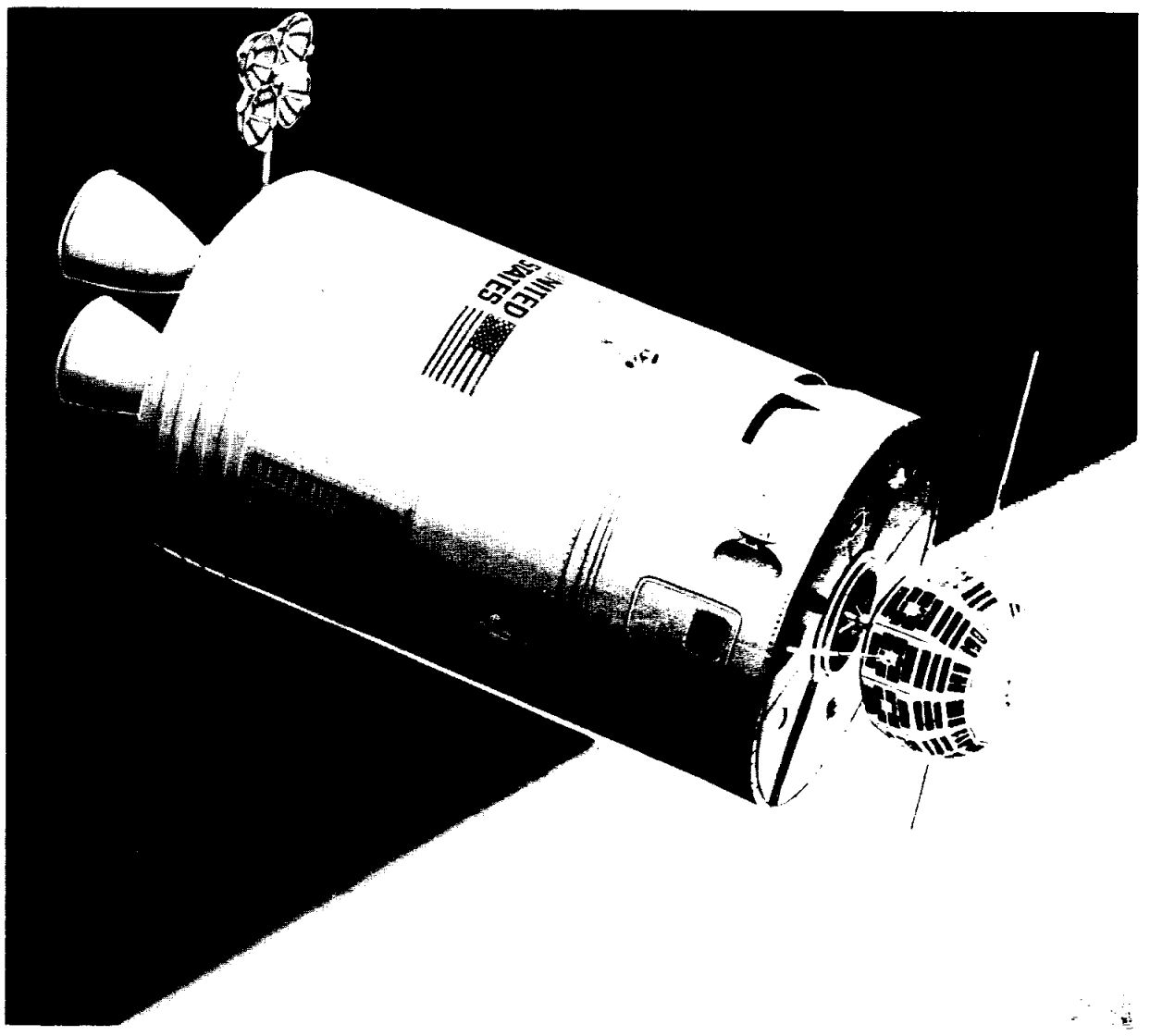
Size of the Tug will vary depending upon its missions; however, a baseline vehicle will be 15 feet in diameter and several stories tall—the "Skinny Albert" of outer space.

The Crew compartment will contain the flight station, and it also will serve as the living quarters for three or more personnel. In addition the Crew module will be equipped with an airlock for EVA. Primary power will come from a liquid oxygen/liquid hydrogen (LOX/LH_2) system. Current state-of-the-art engines are acceptable. The contractor will—at NASA request — study advance systems using other power sources.

The Tug may operate in the following flight regimes: (1.) Earth orbital. (.2) Lunar orbit or lunar surface. (3) Unmanned planetary.

Potential Earth-related missions include: (1) The transfer of space station modules to a new altitude or inclination. (2.) The placement, inspection, serving and retrieval of unmanned satellites. (.3) The transfer, rendezvous and docking of fuel containers brought up from Earth via Shuttle. (4.) Space rescue.

Potential lunar-related missions include: (1) The placement servicing and inspection of unmanned satellites. (2.) Supply and support lunar orbitting space station. (3.) The transfer of fuel containers. (4.) Personnel rescue. (5.) The Tug can be modified to become a base on the Moon's surface. External payloads of up to 70,000 pounds might be landed on the Moon using a Tug.



THE TUG—a highly versatile multi-use vehicle under study at the Manned Spacecraft Center. The vehicle shown in this art concept is retrieving an Earth orbiting satellite. Other uses of the Tug during Earth operations might include rescue of disabled craft and the transport of payloads from one altitude to another.

Potential unmanned planetary missions include: (1.) The assembly of modules for planetary missions. (2.) The transfer of unmanned payloads to suitable altitudes and inclination for interplanetary injection.

North American Rockwell is requested to study missions and operations arriving at representative configurations and flights. Cost effectiveness also will come under exhaustive consideration.

Skylab—

(Continued From Page 1)

More than 70 different items are now under consideration for use during Skylab missions. The final selection will be made by each crew member.

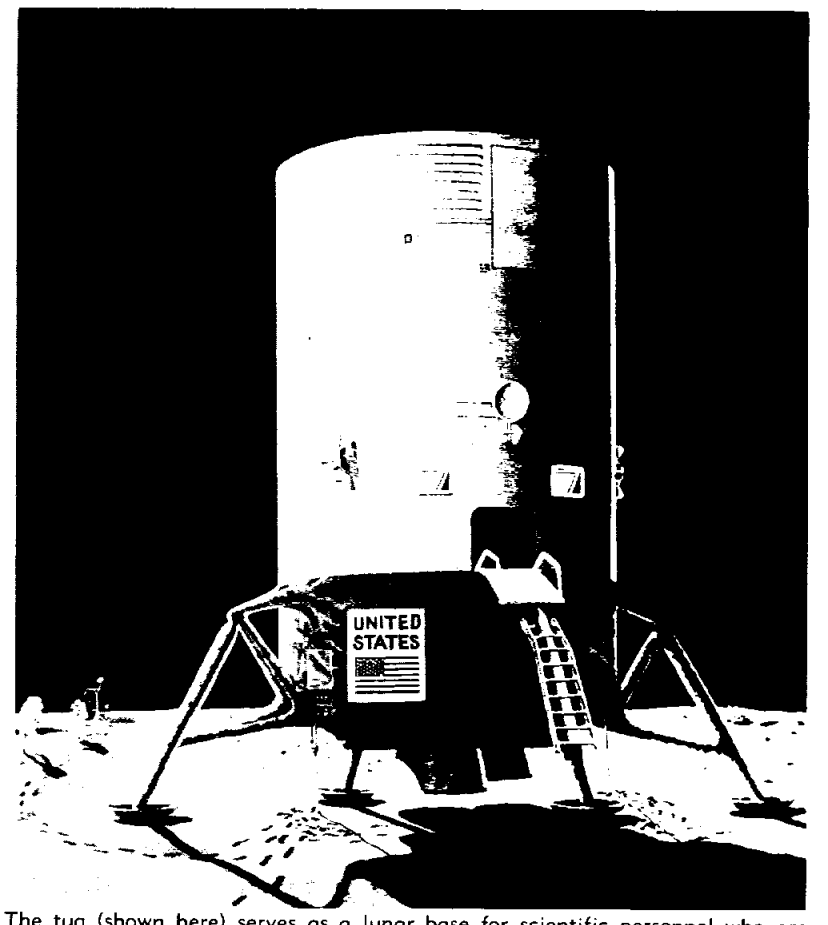
The Skylab menu will consist of the following food types:

Dehydrated—ready to eat dehydratable foods such as cream of tomato soup, scrambled eggs, salmon salad, beverages and deserts.

Intermediate Moisture — precooked, thermally stablized or fresh food with moisture content partially reduced such as dry roasted peanuts, cookies, and bacon wafers.

Wetpack—precooked, or thermally stablized food with approximately 30 to 95 percent moisture content such as turkey and gravy, meat balls with sauce and chili without beans.

Frozen — precooked, thermally stablized or fresh foods stowed below minus 10° to retard spoilage such as prime rib of beef, filet mignon, shrimp cocktail and lobster Newburg.



The tug (shown here) serves as a lunar base for scientific personnel who are conducting exploration of the Moon.

All food and water for the three manned Skylab missions—one 28 day mission and two 56-day missions—will be stowed aboard the Orbital Workshop which will be launched by the Saturn V. Dr. Smith estimates approximately 2,000 lbs of food and about 6,000 lbs. of water will be required for the three manned missions.

The food tray will measure about 13½ x 15" by 4½" thick. There will be a Skylab tray for each crewmember, carried aboard the OWS when it is launched from Cape Kennedy. The tray has individual recessed compartments into which the canned food item is placed for heating.

At meal time the crew member selects his meal—filet mignon, a vegetable, beverage and desert—from food compartment. He places the items to be warmed in the food tray and then flips the warmer switch and presto he has a three course meal.

Dr. Smith said "We have every expectation that the Skylab food system will provide the most palatable food that has ever been taken into space, and will at the same time support the most rigidly defined metabolic experiment ever conducted on man in space."